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MARK 7 ARTERION™ Injection System

Service Manual

**Mark 7 Arterion™
Injection System**

CE 0086

3027921 Rev. F



MEDRAD
Interventional®

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:

Power Unit Serial Number:
Also System Serial Number

Injector Head Serial Number:

Display Serial Number:

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MEDRAD

**Mark 7 Arterion™ Injection
System**

Service Manual



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1 Introduction

This manual applies to the *Mark 7 Arterion Injection System*.

Read all of the information contained in this manual. Understanding this information will assist in operating the *Mark 7 Arterion Injection System* in a safe manner.

1.1 Important Safety Information

▲ IMPORTANT SAFETY NOTICE ▲

This device is intended to be used by medical professionals with adequate training and experience in cardiac catheterization procedures and techniques.

This device is intended to be used by medical professionals with adequate training and experience in cardiac catheterization procedures and techniques

1.2 Purpose

This manual is intended to provide instructions for servicing the *Mark 7 Arterion Injection System* (herein referred to as “the injection system” safely and accurately. It is intended for those qualified to service the injection system, whether they be MEDRAD Service Personnel, Laboratory Service Technicians, or MEDRAD Authorized Dealers.

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.

For instructions on operating this equipment and associated warnings and cautions please reference the operation manual

1.3 Contraindications

This device is not intended to be used for chemotherapy and is not intended to administer fluids other than intravascular contrast agents and common flushing solutions.

1.4 Certifications

This device is equipped to operate at 100-240 VAC, 50/60 Hz, and is designed to comply with EN 60601-1 / IEC 60601-1 Second/Third Edition and EN 60601-1-2/IEC 60601-1-2 Third edition.

1.5 Safety Certifications

The MEDRAD *Mark 7 Arterion Injection System* complies with the requirements of CAN/CSA-C22.2 No. 0-M91 - General Requirements - Canadian Electrical Code, Part II CAN/CSA-C22.2 No. 601.1-M90 - Medical Electrical Equipment Part I: General Requirements for Safety UL 60601-1 - Medical Electrical Equipment IEC/CSA 601-1 - Medical Electrical Equipment Part 1: General Requirements for Safety, CAN/CSA-C22.2 No. 60601-1-08 Medical Electrical Equipment - Part 1: General Requirements for basic safety and essential performance, ANSI/AAMI ES60601-1:2005 Medical electrical equipment, Part 1: General requirements for basic safety and essential performance.

1.6 EMC Certifications

The MEDRAD *Mark 7 Arterion Injection System* complies with the requirements of:

EN 60601-1-2:2007 Medical Electrical Equipment-Part 1: General Requirements for Safety, Amendment No. 2. Collateral Standard: Electromagnetic Compatibility Requirements and Tests

EN 55011:2009/A1:2010 Limits and methods of measurement of radio disturbance, characteristics of industrial, scientific and medical radio frequency equipment

EN 61000-3-2:2006/A2:2009 edition - Electromagnetic Compatibility - Part 3: Testing and measurement techniques - Section 2: Harmonic current emissions test

EN 61000-3-3:2008 edition - Electromagnetic Compatibility - Part 3: Testing and measurement techniques - Section 3: Voltage fluctuation and flickers test

EN 61000-4-2:2009 edition - Electromagnetic Compatibility - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test

EN 61000-4-3 /A2:2010 edition - Electromagnetic Compatibility - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test

EN 61000-4-4:2004/A1:2010 edition - Electromagnetic Compatibility - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient / Burst immunity test

EN 61000-4-5:2006 edition - Electromagnetic Compatibility - Part 4: Testing and measurement techniques - Section 5: Surge immunity test

EN 61000-4-6:2009 edition edition - Electromagnetic Compatibility - Part 4: Testing and measurement techniques - Section 6: Conducted immunity test

EN 61000-4-8:2010 edition - Electromagnetic Compatibility - Part 4: Testing and measurement techniques - Section 8: Power frequency magnetic field immunity test

EN 61000-4-11:2004 edition - Electromagnetic Compatibility - Part 4: Testing and measurement techniques - Section 11: Voltage dips and interruptions immunity test.

1.7 Additional Information Regarding Compliance to IEC 60601-1-2/2007

This section is intended to reflect conformance to IEC-60601-1-2 / 2007 3rd Edition.

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

NOTICE
<p>Electro-Mechanical Hazard-Equipment Damage may result.</p> <ul style="list-style-type: none">• 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 it's operation manual comply with the requirements of electromagnetic emissions and immunity standards IEC-60601-1-2 / 2007 3rd edition.• Injector may disarm or fail to operate when exposed to high magnetic fields. Portable and mobile RF communications equipment can affect the injector.• 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.

Table 1 - 1: Recommended separation distances between portable and mobile RF communications equipment and the injector

<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</p>
--

Table 1 - 1: 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		
	150 KHz to 80 MHz $d = \left[\frac{3.5}{V_1} \right] \sqrt{p}$	80 MHz to 800 MHz $d = \left[\frac{3.5}{E_1} \right] \sqrt{p}$	800 MHz to 2.5 GHz $d = \left[\frac{7}{E_1} \right] \sqrt{p}$
0.1	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:

Table 1 - 2: Guidance and manufacturer's declaration - electromagnetic emissions

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.		
Emission 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	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.
	Class A	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Table 1 - 3: 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
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% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5 sec	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% 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.			

Table 1 - 4: 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
			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.

Table 1 - 4: Guidance and manufacturer's declaration - electromagnetic immunity

			Recommended Separation Distance
Conducted RF IEC-61000-4-6	3 V _{rms} 150 kHz to 80 MHz	3 V _{rms}	$d = 1.17\sqrt{p}$
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 800 MHz to 2.5 GHz $d = 2.33\sqrt{p}$ 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: <div style="text-align: center;">  </div>
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.			
<p>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.</p> <p>b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.</p>			

1.8 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.

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 Mark 7 Arterion Injection System must be certified according to EN 60601-1 / IEC 60601-1 standard. Furthermore, all configurations shall comply with system standard EN 60601-1-1/IEC 60601-1-1 Second Edition and EN 60601-1/IEC 60601-1 Third Edition. Anyone who connects additional equipment to the signal input or output part configures a

medical system and is therefore responsible that the system complies with the requirements of the standard EN 60601-1-1/IEC 60601-1-1 Second Edition and EN 60601-1/IEC 60601-1 Third Edition. 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.

1.9 Restricted Sale

Rx Only - Federal law restricts this device to sale by or on the order of a (licensed healthcare practitioner.

1.10 Trademarks

MEDRAD, FluiDot, and MEDRAD *Mark 7 Arterion Injection System* are trademarks of MEDRAD, INC. Other trademarks which appear in this manual are the property of their respective companies.

2 Symbols and Icons

The symbols and icons discussed in the sections below describe the requirements to which the *Mark 7 Arterion Injection System* conforms, how warnings are displayed in manual, and the icons used on the equipment and equipment packaging.

2.1 Notified Body



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

2.2 Regulatory Classifications



Type Cardial Floating (CF) Defibrillation-Proof applied part as defined by IEC 60417-2.



Indicates that this device conforms to CSA requirements.

IPX1

IPX1 Code that specifies the degree of protection against vertically falling water drops (IEC 60529).



Indicates separate collection for Electrical and Electronic Equipment per Directive 2002/96/EC .

2.3 Warnings



Indicates dangerous voltage.



Indicates a pinch or crush hazard.



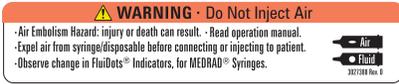
Attention, consult accompanying instructions.



Indicates hot surface. Item can be hot and should not be touched without taking care.



Pushing Prohibited. Do not push at or above this point on the Injector.



Air Warning Label

- Air Embolism Hazard: injury or death can result.
- Read operation manual.
- Expel air from syringe/disposable before connecting or injecting to patient.
- Observe change in FluidDots® Indicators, for MEDRAD® Syringes.



Table Mount Warning

Patient or operator injury could occur if all knobs are not properly tightened. Ensure that all knobs are securely tightened before use. Do not overtighten.

Warning

Indicates that the information is a warning. Warnings advise of circumstances that could result in serious injury or death to the patient or operator. Read and understand the warnings before operating the injection system.

Caution

Indicates that the information is a caution. Cautions advise of circumstances that could result in minor or moderate injury to the patient or operator. Read and understand the cautions before operating the injection system.

Notice

Indicates that the information is a notice. Notices advise of circumstances that could result in damage to the device. Read and understand the notices before operating the injection system.

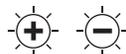
Note

Indicates that the information that follows is additional important information or a tip that will help recover from an error or point to related information within the manual.

2.4 Buttons and Icons

The buttons on the Display Control Unit (DCU), Injector Head, and Power Unit allow operators to access functions on the injector system. The icons used on the DCU, Injector Head, and Power Unit notify operators about system processes and identify connection ports.

2.4.1 Display Control Unit Buttons and Icons



The Display Control Unit brightness controls.



Purged Air Confirmation icon - indicates that the operator has confirmed that all air has been purged.



Indicates that Display Control Unit is locked because someone is accessing another Display Control Unit or the Injector Head controls.



The On/Off Switch.



P21

The hand switch connection location found on the back of the Display Control Unit.

P28

The Power Unit cable connection location found on the back of the Display Control Unit.



Indicates that an Imaging System Interface (ISI) is enabled and functioning properly. This symbol is also used throughout the manual to indicate ISI specific steps.



Operators use the **End Case** button to end the injection for a patient case, to retract the syringe plunger, to clear the Total Contrast number, and to create a record of the case.



Injection Indicator displays during an injection.

2.4.2 Injector Head Buttons and Icons



The **Enable** button activates the **Fill Strip** and **Auto-Fill** button.

LOC

Displays in Volume Remaining LED on the Injector Head when an operator is accessing the Display Control Unit.



The **Fill Strip** allows operators to retract and advance the piston from the Injector Head.



The Auto-Fill button fills the syringe with a user defined contrast volume and at a user defined speed.



Identifies the Volume Remaining LED.



Identifies rotation direction on the manual knob for manually moving the piston. Clockwise is forward movement.



The Syringe Heat Maintainer connection location.



Future expansion port.

J31

Future expansion port. (Hand Controller)

J32

Identifies the Service Port.

2.4.3 Power Unit Icons



Power Unit On/Off switch.



Indicates Alternating Current and identifies the Power Unit power cord connection.



Identifies a connection for Display Control Unit1. The Power Unit has two connection points.



Identifies a connection for Display Control Unit2. The Power Unit has two connection points.



Identifies the hand switch or foot switch connection.



Identifies the Equipotential connection.



Identifies the Earth Ground point (this terminal is meant for supplementary grounding please contact MEDRAD prior to using this terminal)



Identifies an Injector Head connection. The Power Unit has two connection points.



Identifies the Imaging System Interface connection.



Identifies the CAN connection.

J11

Identifies the service port.

NOTE: Used by MEDRAD Service or MEDRAD trained personnel.

J12

Future expansion port.

J13

Future expansion port.

J14

Future expansion port.

3 System Warnings, Precautions, and Notices

3.1 Warnings

⚠ WARNING
<p>Air Embolism Hazard - Serious patient injury or death may result.</p> <ul style="list-style-type: none">• Inspect pressure jacket and replace when signs of damage are evident.• Use only accessories and options provided by MEDRAD which are designed specifically for the injection system.• Injector head shall be mounted on Articulating Arm.• Inspect system and do not use when signs of damage are evident.
<p>Electric Shock Hazard - Serious patient and/ or worker injury or death may result.</p> <ul style="list-style-type: none">• The system should be opened and serviced by MEDRAD Service or MEDRAD trained service personnel.• Use only power cord approved for use on Mark 7 Arterion.• For U.S installations, equipment shall only be connected to Hospital Grade or Hospital Only outlets.• Disconnect the system from line power before cleaning or attempting to perform any maintenance or repairs.• Avoid contact with pins.• Ensure that connector covers are in place or cables are connected.

3.2 Cautions

⚠ CAUTION
<p>Electric Shock Hazard - Minor or moderate patient and/ or worker injury may result.</p> <ul style="list-style-type: none">• Verify that the voltage and frequency marked on the serial tag on the Power Unit matches the voltage and frequency of the electrical outlet.• Do not use extension cord or power adaptor with the system.
<p>Mechanical Hazard - Minor or moderate patient and/ or worker injury may result.</p> <ul style="list-style-type: none">• Do not use injector head handle to move injector system.• Do not use the cabling or syringe to position injector system.• Do not use system in the presence of flammable or combustible gases or other agents.• Turn off power system and disconnect patient when system malfunction occurs.• Follow installation procedures including use of proper screws and plugging all unused holes.• Move Articulating Arm to upper position prior to removing head.• Do not mount DCU to Articulating Arm.• Ensure that the retention knob is secure when mounting the head.• Do not create a trip hazard when installing cable bracket.• Do not create a trip hazard when routing cables.

3.3 Notices

NOTICE
<p>Mechanical Hazard - Equipment Damage may result.</p> <ul style="list-style-type: none">• Do not hang items on the Display Control Unit or Wall Mounting Bracket.• Do not oil the friction plate on the Wall Mount Bracket.

NOTICE

Electro-Mechanical Hazard - Equipment damage may result.

- Do not use tools to over tighten connections or to assist in the removal of disposables.
- Do not roll pedestal over cables.
- Regular preventive maintenance is recommended to ensure that the system stays calibrated and functions properly. Refer to maintenance section of this manual or contact MEDRAD for additional information.
- Allow the injector to stabilize at room temperature before use.
- Follow Electrostatic Discharge (ESD) protection practices.
- Disconnect the power cord before removing or replacing PC boards.
- Do not apply voltage to ISI connector.
- Provide only a switch closure if the injector is being started by an external start connection.
- Do not block Power Unit vents.
- Installation clearance should be a minimum of 3 to 5 inches (8 to 13 cm).
- Before installing the Table Mount, ensure the table rail can withstand a minimum vertical static load of 18 kg (40 lbs.) Refer to the table manufacturer documentation for weight load information.
- Do not over tighten Table Mount knob.
- Do not force the Table Mount onto the table rail.
- Loosen Table Mount knob prior to removal of components.

4 Cleaning and Maintenance

⚠ WARNING

Cross Contamination Hazard - Serious patient and/or worker injury or death may result.

- Do not contact disposables with cleaning agent during cleaning.
- Do not conduct cleaning process during injection procedure.

NOTICE

Electro-Mechanical Hazard - Equipment Damage may result.

- Disconnect power before cleaning.
- Use a wipe or dampened cloth for cleaning.
- Do not soak or immerse components.
- Do not use strong cleaning agents.
- Perform routine cleaning and maintenance.
- Remove power when connecting or disconnecting cables.
- Do not clean the syringe.

This chapter identifies the proper methods for cleaning the injection system, the recommended maintenance schedule, and an operational checkout of the injection system.

The injection system must be properly maintained to ensure it is in peak operating condition. The individual maintenance schedule depends upon how your injection system is used, the type of procedures performed, and frequency of use.

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

NOTE: MEDRAD Service will make available for purchase upon request:

- Service and schematic manuals that will assist qualified technicians to repair components classified as repairable.
- On-site consulting services.

4.1 Daily

⚠ CAUTION

Mechanical Hazard - Minor or moderate patient and/or worker injury may result.

- Do not use an autoclave to sterilize the Pressure Jacket.
- Refer to Pressure Jacket cleaning instructions.

The following procedures are recommended for daily cleaning and inspection of all components on the injection system. If any defects are detected, either repair the system, or call the local MEDRAD office or the local authorized dealer for service. Do not use the system until the problem is corrected.

4.1.1 Cleaning the Injector Head, Syringe Heat Maintainer, Pressure Jacket, Piston, Syringe Interface, and Table Bracket

Clean the product by wiping with a cloth dampened with warm water.

Disinfect components, except Pressure Jacket, with:

- Germicidal Disposable Wipe, or
- Bleach Wipe, for isolation patients

1. Do not remove any covers or disassemble the injector.
2. Remove the Syringe Heat Maintainer.
3. Clean the Syringe Heat Maintainer with a dampened cloth using soap and water.
4. Remove the Pressure Jacket.

5. Clean the Pressure Jacket with a soft cloth or a paper towel dampened with a cleaning solution to remove contrast media and other contamination.

Some cleaning agents react with the plastic material and may cause structural degradation. MEDRAD recommends that the Pressure Jacket be washed in a solution of warm tap water (35° – 45° C) and mild non-abrasive detergent (neutral grade low pH, enzymatic cleaner), and then rinsed thoroughly and dried with a soft towel.

A solution of dish washing detergent and water is compatible with the Pressure Jacket. If a germicidal cleaning agent is desired, contact the germicide manufacturer to check the recommended dilution and compatibility with polycarbonates. If the solution is acceptable, follow the manufacturer's directions exactly. Do not clean the Pressure Jacket with an automatic dishwasher. The Pressure Jacket is not dishwasher safe. Do not leave the Pressure Jacket in germicide for extended periods of time.

Do not expose the Pressure Jacket to fluorocarbons (such as Freon), or other solvents (acetone, benzol, carbon tetrachloride, MEK, MIBK, toluol, trichlor, and triclene). Gasses used to pressurize aerosol cans can be damaging to the Pressure Jacket. Therefore, do not use aerosols in or around the Pressure Jacket.

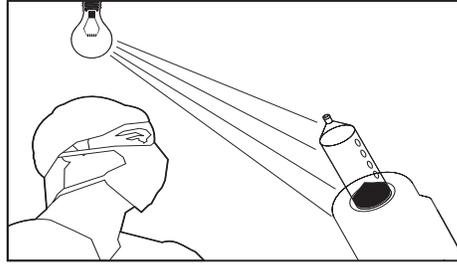
6. Fully advance the piston
7. Turn off the system at the Power Unit.
8. Clean the piston.
9. Clean the inner area of the syringe interface.
10. Clean the Drop Front. The drop front cone should pivot freely back and forth. If it does not, it may be contaminated with contrast.
11. Clean the Injector Head case.
12. Re-install the clean Pressure Jacket.
13. Re-install the clean Syringe Heat Maintainer.
14. Clean any spilled contrast media from the Table Bracket and table rail to assure free movement of the bracket along the rail.

4.1.2 Inspecting the Injector Head

- Inspect the housing for any damage or cracks that could allow fluid to leak inside, or weaken the structural integrity of the unit.
- 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.
- Ensure that all mounting bolts and screws are secure.
- Inspect for contrast media build-up in the syringe interface area, including the Syringe Heat Maintainer and the Pressure Jacket. Follow the cleaning guidelines outlined in this chapter.
- Inspect the pivot points to ensure they move freely.
- Inspect the Injector Head Controls for damage or excessive wear.

4.1.3 Inspecting the Pressure Jacket

Prior to each procedure, inspect the Pressure Jacket for signs of deterioration or fatigue by looking through it with light shining through the Pressure Jacket. MEDRAD recommends replacing the Pressure Jacket if defects are found during daily inspection.



Rotate the Pressure Jacket while looking through it to view all areas. This includes the front edges and the entire cylindrical surface.

A Pressure Jacket should be rejected for cracks, crazing, scratches (if a fingernail can catch on the scratch), and opacity. These conditions indicate that the Pressure Jacket has been weakened and may fracture during a high pressure injection. The Pressure Jacket should NOT BE USED if any of these conditions exist.

Cracks are usually the result of a sharp impact (such as from dropping). A crack may appear simply as a line, usually originating at the radius or edge and may also appear in conjunction with crazing.

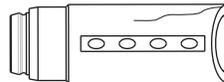


Figure 4 - 1: Cracks

Stress Cracks may appear after the Pressure Jacket has been subjected to a number of pressure cycles. These tiny cracks appear around the front area of the Pressure Jacket, and usually form a pattern around the jacket's circumference. Stress cracks are easiest to see while rotating the Pressure Jacket in front of a light source.

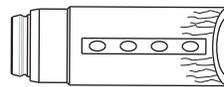


Figure 4 - 2: Stress Cracks

Crazing can occur when non-compatible cleaning solutions or solvents are used on the Pressure Jacket. Crazing can also occur when the Pressure Jacket has reached the end of its expected life. Crazing appears as small lines that interfere with the transparency of the Pressure Jacket. Crazing usually appears localized to a point of impact or fatigue.

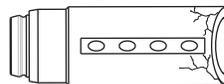


Figure 4 - 3: Crazing

Scratches result from objects striking or scraping the inside or outside surface of the Pressure Jacket. Scratches may occur when the Pressure Jacket is improperly handled. Check depth of scratches by pulling your finger across the scratch, perpendicular to the surface. If your fingernail catches on a scratch, the Pressure Jacket should NOT BE USED.

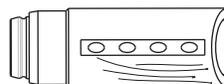


Figure 4 - 4: Scratches

Normally the Pressure Jacket is transparent, enabling you to clearly see through the barrel.

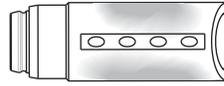


Figure 4 - 5: Opacity

4.1.4 Inspecting the Heat Maintainer

- Inspect the Heat Maintainer for cracks. MEDRAD recommends replacing the Heat Maintainer if cracks are found during inspection.

4.1.5 Inspecting the Display Control Unit

- Inspect the cable connected to the Display Control Unit.
 - Look for cuts, cracks, or worn spots, or other obvious damage.
 - Ensure that the connector is properly seated and fastened securely.
- Inspect the housing for any damage or cracks that could allow fluid to leak inside, or weaken the structural integrity of the unit.

4.1.6 Inspecting the Table Mount Bracket

- Inspect the Clamp knob to ensure that it is tightened.
- Inspect the Injector Head knob to ensure it is tight and the Injector Head fits securely in the Table Bracket.
- Inspect for broken or damaged parts.
- Check the vertical motion of the Table Bracket. If the gas spring is not functioning properly, do not use the bracket.

4.1.7 Inspecting the Pedestal

- Inspect the base, column, casters and handle for cracks and other defects that could weaken the structure
- Ensure all mounting bolts and screws are secure.
- Ensure that the casters roll smoothly with no binding or scraping.
- Ensure all locking mechanisms on the casters are functional.

4.1.8 Inspecting the Power Unit

- Inspect the cables connected to the Power Unit.
 - Look for cuts, cracks, or worn spots, or other obvious damage.
 - Ensure that the connectors are properly seated.
- Inspect the housing for any damage or cracks that could allow fluid to leak inside, or weaken the structural integrity of the unit.
- Ensure that the air vents are not clogged.

4.2 Monthly

Once a month, the entire system should be thoroughly inspected and cleaned, and an Operation Checkout should be performed using the procedures outlined in “14.2.3 Performing an Operational Checkout”.

4.2.1 Cleaning the Display Control Unit, Pedestal, Power Unit, and Table Bracket

NOTICE

Electro-Mechanical Hazard - Equipment Damage may result.

- Remove power when connecting or disconnecting cables.
- Do not spray cleaning solutions directly onto the DCU touch screen.

Clean the product by wiping with a cloth dampened with warm water.

Disinfect components, except Pressure Jacket, with:

- a germicidal wipe, or
- a bleach wipe, for isolation patients

Turn off the system at the Power Unit. Clean the Display Control Unit, Pedestal, and Power Unit.

Remove the table bracket from the rail and clean off accumulated contrast media using soapy water and dry thoroughly.

4.2.2 Inspecting and Cleaning the Internal Air Filter (Power Unit)

1. Turn off the system at the Power Unit.
2. Remove the two screws shown in the drawing below.

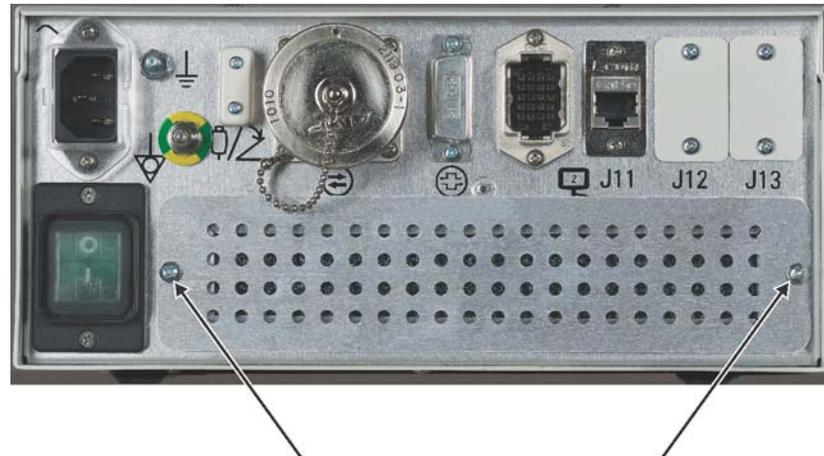


Figure 4 - 6: Power Unit Air Filter

3. Pull out the air filter.
4. Vacuum or rinse the air filter with water and thoroughly dry before installing.
5. Replace the clean air filter (Note the direction of arrow for air flow - air should flow into the unit).
6. Replace the two screws.

NOTE: Inspect the internal air filter monthly and clean at least once per year (this can be done more frequently as needed).

4.2.3 Performing an Operational Checkout

⚠ WARNING

Equipment Malfunction Hazard - Serious patient and/or worker injury or death may result.

- Do not use the injection system if any problems are detected during the operational checkout.

A basic functional checkout of the injection system should be included as part of monthly maintenance. Verify proper operation of the injection system to help detect any problems that may not be noticed in day-to-day operation. The following procedure represents a suggested series of activities which encompasses typical operation of the system. Read the following procedure carefully before beginning the checkout. If problems are detected or any step fails this checkout, contact your MEDRAD Service Representative.

An empty Syringe is required to perform this checkout.

1. Plug in the injection system.
2. Press the **Main Power Switch** on the Power Unit, and press the **On/Off Switch** on the Display Control Unit. All power switches should illuminate green.

- a. Ensure that the system passes self-test with no error messages. When self-test completes, a safety screen displays.
 - b. Press **Continue** to acknowledge the safety information and proceed to the Home tab.
 - c. Ensure that the **Home** tab displays.
3. Press the brightness controls to ensure that the controls vary the display brightness without completely obscuring information at either extreme. Adjust to a suitable brightness.
4. Use the handle and the back of the Injector Head (but not the Manual Knob) to rotate the Injector Head to the Purge position (upright).
 - a. Ensure that the Volume Remaining display on the Injector Head (orange digits) is active and is properly oriented.
 - b. Ensure that the Flow Rate, Volume, and Pressure Limit are not active.
5. Use the handle and the back of the Injector Head (but not the Manual Knob) to the Inject position (downward).
 - a. Ensure that the Volume Remaining display inverts.
 - b. Ensure that the Flow Rate, Volume, and Pressure Limit display and are properly oriented.
6. Insert an empty syringe into the syringe interface.
 - a. Completely close the drop front.
 - b. Ensure that the Volume Remaining icon on the Injector Head illuminates.
7. Press the Forward and Reverse on the **Fill Strip**.
 - a. Ensure the piston does not move.
8. Press the Enable button.
 - a. Ensure the green indicator near the enable key illuminates.
 - b. Ensure the green indicator goes out after approximately five seconds.
9. Press the Enable button, and press Forward on the Fill Strip within five seconds.
 - a. Ensure that the piston extends.
 - b. Vary the position of your finger on the Fill Strip to ensure the piston load speed varies.
 - c. Ensure that the Volume Remaining display on the head decreases.
10. Press the Enable button, and press Reverse on the Fill Strip within five seconds.
 - a. Ensure that the piston retracts.
 - b. Vary the position of your finger on the Fill Strip to ensure the piston load speed varies.
 - c. Ensure that the Volume Remaining display on the head increases.
 - d. Retract the piston to its rear limit. The Volume Remaining should read “150mL”.
11. From the **Home** tab, enter a protocol with the following parameters:
 - Volume** - 20 ml
 - Flow Rate** - 10 ml/s
 - Pressure Limit** - 500 PSI
 - a. Ensure the Injector Head displays these value.
12. Select **Arm Single** to Arm the injector.
 - a. Ensure that the display indicates that the injector is in the Armed state.
 - b. Ensure that the Armed light on the injector head is on solid.
13. Using the hand switch or foot switch, initiate an injection.
 - a. Ensure that the Display Control Unit display indicates that the injector is in the “Injecting” state and the Armed light on the injector head flashes.
 - b. Confirm that the injection completes in approximately two seconds.
 - c. Ensure that the Armed light on the Injector Head goes out.
 - d. When the injection is complete, release the switch.
 - e. Ensure the Actuals window on the Display Control Unit indicates that 20 ml volume was delivered at a rate of 10 ml/s.
14. From the Display Control Unit touch screen, change the Volume to 50mL.

- a. Select **Arm Single** to arm the injector.
 - b. Use the hand switch or foot switch to initiate an injection.
 - c. Release it within two seconds.
 - d. Ensure the injection stops and disarms.
 - e. Ensure a “Premature Termination” message displays in the Sentinel window.
15. Retract the piston to its rear limit.
 - a. Select either **Arm Single** or **Arm Multiple** to arm the injector.
 - b. Open the drop front.
 - c. Ensure that the system disarms.
 - d. Close the drop front.
 16. Select either **Arm Single** or **Arm Multiple** to arm the injector.
 - a. Press the **Disarm** button on the Display Control Unit.
 - b. Ensure the system disarms.
 17. Select either **Arm Single** or **Arm Multiple** to arm the injector.
 - a. Press any button on the Injector Head.
 - b. Ensure the system disarms.
 18. Select either **Arm Single** or **Arm Multiple** to arm the injector.
 - a. Use the handle and the back of the Injector Head (but not the Manual Knob) to rotate the Injector Head to the Purge position (upright).
 - b. Ensure the system disarms and cannot be re-armed unless the head is rotated back to the Injection position.
 19. If a Syringe Heat Maintainer is connected to the Injector Head, ensure that it is warm to the touch.
 - a. Ensure the over-temperature message is not displayed in Sentinel window.
 20. Enable ISI and check for errors.
 21. Power down the system and remove the syringe and dispose of it properly.

4.3 Annually

MEDRAD offers Preventative Maintenance Programs. These annual programs greatly assist in maintaining accuracy and reliability, and can also extend the life of the system. Contact your local MEDRAD office or your local authorized dealer for further information. See Chapter 1 “Information” for address, telephone, fax and website information.

4.3.1 Injection System Calibration

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

4.3.2 Checking Leakage

To ensure safe operation of the *Mark 7 Arterion Injection System*, an electrical earth leakage check must be part of regular maintenance.

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

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

Manufacturer	Model
Bio-Tek Instruments, Inc.	Model 601 PRO
Bender	Unimet 1000 ST

Mark 7 Arterion Injection System

Manufacturer	Model
Bapco	IEC601L
NeTech	LGK 601

1. With power applied, and the line at normal, leakage should be less than 300 micro amps.
2. With power applied and the line reversed, leakage should be less than 300 micro amps.
3. Disconnect the leakage test device.

5 Troubleshooting

5.1 System Malfunction Codes

Conditions can occur which will prevent the injection system from being armed, or interrupt an injection that is in progress. These conditions may be operator induced or caused by a system malfunction. The system displays Error Codes to inform the operator of these conditions.

5.2 General Troubleshooting Guidelines

NOTICE
<p>Electro-Mechanical Hazard - Equipment damage may result.</p> <ul style="list-style-type: none">• Follow Electrostatic Discharge (ESD) protection practices.• Disconnect the power cord before removing or replacing PC boards.

Consider the following guidelines before troubleshooting any condition. These guidelines may help in quickly resolving the condition. Try the simpler things first.

- Remove the power cord from the power source for one minute, then reapply power. The condition could be intermittent, or caused by a voltage transient. If the condition persists, continue troubleshooting.
- To verify the existence of a condition, try to recreate the problem. Follow the Checkout Procedure outlined in this manual for proper/improper operation of the system Refer to “Performing an Operational Checkout” on page 4 - 17.
- 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. Refer to “Information” on page 1 - 1 for address, phone, and Fax information.

5.3 System Messages

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

5.3.1 Type 1 Messages

Type 1 messages provide information regarding the current system status, and clear automatically. These messages typically display in the Sentinel window.

5.3.2 Type 2 Messages

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

5.3.3 Type 3 Messages

⚠ WARNING
Electric Shock Hazard - Serious patient and/ or worker injury or death may result. <ul style="list-style-type: none">• Perform calibration when specific components listed in “Disassembly/Assembly & Replacement Parts” are replaced in the system.

⚠ CAUTION
Mechanical Hazard - Minor or moderate patient and/or worker injury may result. <ul style="list-style-type: none">• Remove power and disconnect patient when system malfunction occurs.

Type 3 messages are system malfunction messages which require power to be removed from the system. Type three messages are accompanied by three beeps. 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.

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. For further assistance, contact MEDRAD Service or an authorized dealer.

NOTE: Before replacing any parts, cycle power to the system. This initiates a system self-test. If this does not correct the problem, replacement of serviceable components as needed may be required.

5.4 White Screen System Lock Up Condition

A blank white screen indicates a faulty or inoperative Single Board Computer (SBC) in the Display Control Unit (DCU)

5.5 Error Codes

CAL **Calibration**

Errors with a prefix of CAL mean that the system has found an error with the system calibration values. They may be missing or corrupt.

- Calibrate system.
- Replace the Servo/CPU Card and perform calibration.

HDC **Head Display Card**

Errors with a prefix of HDC indicate a problem with the Head Display card.

- Check all connections.
- Replace the Head Display card.

HOVER **Switch Card**

Errors with a prefix of HOVER indicate that the system has found a problem with the head interface card or the associated circuitry.

- Ensure that the head cable is seated properly.
- Replace the Signal Management card.
- Replace the Servo/CPU card.

HUB **Ethernet Hub**

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

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

MOTA Motor A

Errors with a prefix of MOTA indicate a problem with the motor or the associated circuitry.

- Ensure the connection to Motor Drive card is fully seated.
- Replace Motor.
- Replace Motor Drive Card.

POTA Pot A

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

- Ensure the connector is fully seated on the interface card.
- Realign potentiometer.
- Replace potentiometer.
- Replace Signal Management Card.
- Replace the Servo/CPU card.

POWR Motor Drive Card

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

- Verify power supply voltages are at the Power Drive card.
- Ensure that connectors are fully seated.
- Replace the Motor Drive card.
- 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 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 either a condition that must be corrected, or an electrical transient that disrupted the system.

- Replace the Servo/CPU card.
- If the condition persists, call MEDRAD Factory Service.

SYRSENA Syringe Sensor A

Errors with a prefix of SYRSENA indicate a problem with the syringe sensor or associated circuitry.

- Ensure no syringe is present during self test.
- Ensure the connector between the Syringe sensor and the Signal Management Card is fully seated.
- Replace the Syringe Sensor Switch.
- Replace the Signal Management Card.
- Replace the CPU/Servo Card.

SW Software Problem

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

- Contact MEDRAD to reload software.
- Replace the SBC card.
- 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 either a condition that must be corrected, or an electrical transient that disrupted the system.

- Contact MEDRAD to reload software.

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.
- Recalibrate the Touch Screen.
- Ensure ribbon cable for the Touch Screen to the SBC is fully connected.
- Replace the Touch screen.
- Replace the SBC card.

UOM Unintended Motion

Errors with a prefix of UOM indicate that unintended motion was detected.

- Cycle power and verify if issue goes away.
- Contact MEDRAD, INC.

VOL Over Volume Injection

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

- Ensure potentiometer is fully seated into gears.
- Replace potentiometer.
- Replace the motor.
- Replace the Servo/CPU card.

6 Theory of Operation

The system consists of three basic parts:

- Display Control Unit
- Power Unit
- Injector Head

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

This section explains basic circuit block diagrams of each of the sub-systems. A block diagram of each primary component is followed by a functional block description for each of the sub-systems.

- "System Interconnect"
- "DCU"
- "Power Unit"
- "Head"
- "Head Display/Armed Light Card"
- "ISI"

6.1 Pressure Limiting

The purpose of the programmed pressure limit is to protect the patient, the catheter, and any disposable device attached to the injector.

As a general rule, set pressure limit no higher than the max pressure rating of the weakest component in the fluid path (tubing, stopcocks, connectors, catheters).

Max pressure rating examples:

- Tubing - 1200 psi
- Stopcock - 1050 psi
- Catheter - 12000 psi

In this case, set the pressure limit no higher than 1050 psi because anything higher could potentially cause the stopcock to fail.

How Pressure is affected:

Factors	Effects on Pressure	
	Decrease	Increase
Viscosity	Low	High
Tubing Length	Short	Long
Catheter ID	Large	Small

Consider the above factors when setting pressure limit to achieve the desired injection flow rate. Proper pressure limit setting optimizes the angiographic images.

The injector applies the minimum pressure needed to achieve the programmed flow rate. If the pressure from the injector exceeds the programmed pressure limit, the system cannot achieve the flow rate and a Sentinel message displays.

Pressure information can be found in the **History** tab.

6.2 System Response to Occlusions

When injecting and a stall condition or occlusion occurs (flow rate less than 10% of programmed rate) or at a very high pressure, a disarm will result. An occlusion lasting more than one second for mL/s or five seconds for mL/m will result in the injection being automatically terminated.

6.3 Injection Protection

The following means are provided to protect against over and under injections:

An on-screen indication of insufficient volume is provided whenever the total volume programmed to be delivered is greater than the amount of fluid in the syringe.

The system monitors injections to detect over rate or over volume conditions due to system faults. The delivered volume is also monitored against the total programmed volume for the injection.

Once the system has disarmed, a tone will sound and a disarm message displays on the Display Control Unit screen.

When any fault condition is detected, the injection will stop.

6.4 System Interconnect

The System Block Diagram and Diagram Description sections show how the DCU, Injector Head, Power Unit, and how some accessories, such as the handswitch and footswitch, interconnect with in the system.

6.4.1 System Block Diagram

The System Block diagram is separated into three figures for the:

- Power Unit - Figure 6 - 1: System Interconnect - Power Unit
- DCUs - Figure 6 - 2: System Interconnect - DCUs
- Head Assembly - Figure 6 - 3: System Interconnect - Head Assembly

Table 6 - 1: ARTERION POWER UNIT PC CARD INTERCONNECT GUIDE

Cable Pt. No.	From Board / Connector	To Board / Connector	Function
3011596	ISI P 404 or P403	External Case	ISI output / Input
	ISI P401	Power Management P107	Power and Comm
	Power Management P107	ISI P401	Power and Comm
3026399	Power Management P113	Power supply Aux	Supply control
3026400	Power Management P101 / 103	Power supply	48V
3026401	Power Management P102 / 104	Power Supply	15V
3026402	Power Management P108	Ethernet switch card Power	Ethernet switch power
3026391	Power Management P111	Ethernet switch card port 1 and Output to case	DCU 1 interface
3026391	Power Management P112	Ethernet switch card port 2 and Output to case	DCU 2 interface
3026390	Power Management P105	Head cable	48 V to head
3026390	Power Management P106	Head Cable	15 V to head
3026390	Power Management P110	Head cable	Hand / Ft switch to head
	Power Management P109	External Case	Hand / Ft switch input
3026402	Ethernet Switch Power	Power Management P108	Ethernet switch power
3026391	Ethernet Switch Port A	Power Management P111	DCU 1 interface
3026391	Ethernet Switch Port B	Power Management P112	DCU 2 interface
3004346	Ethernet Switch Port C	Service connector case	Service input
3026390	Ethernet Switch Port D	Head cable (SBC 1)	Communication to head sax/cpu servo port
3026390	Ethernet Switch Port E	Head Cable (SRV 2)	Communication to head service port

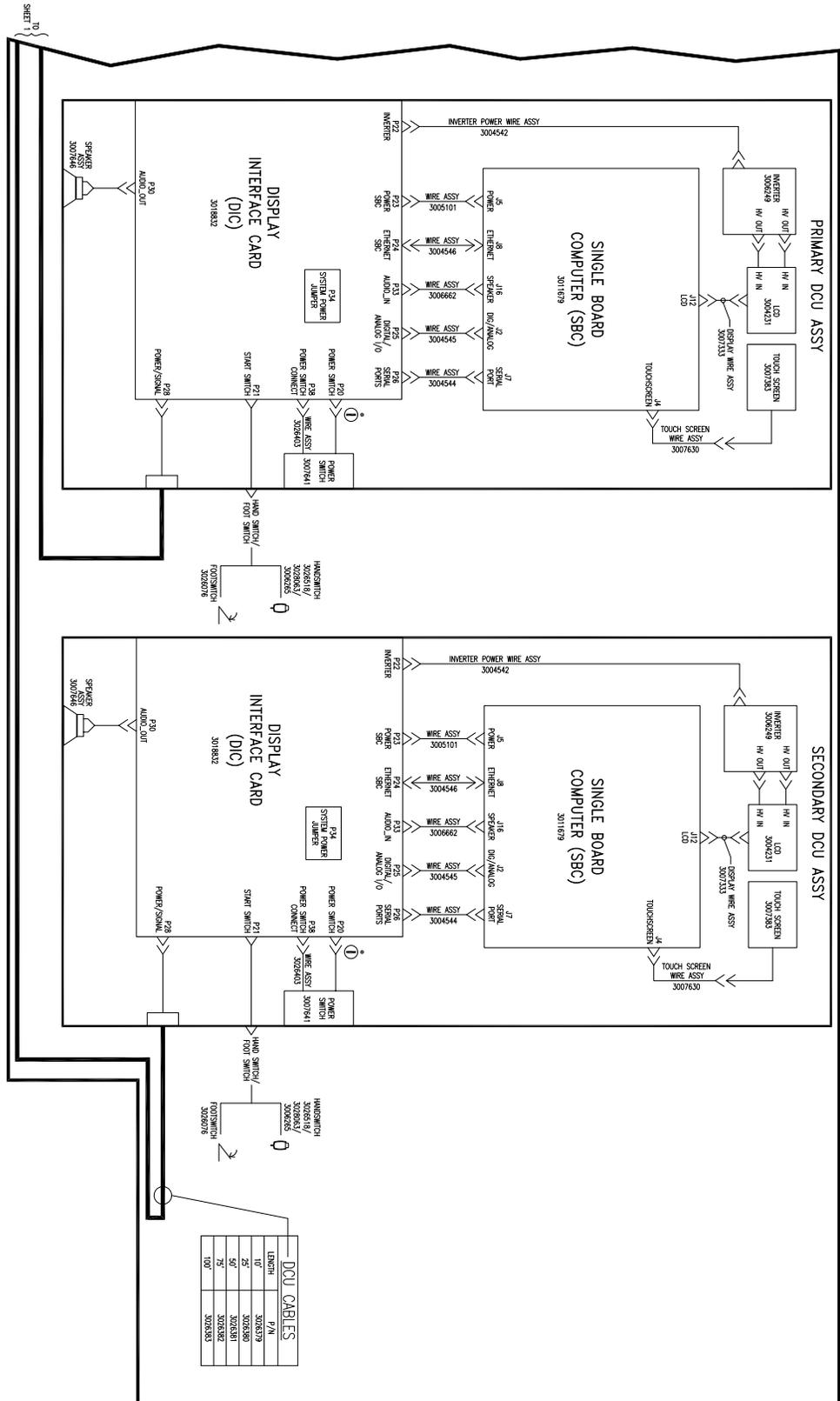


Figure 6 - 2: System Interconnect - DCUs

Table 6 - 2: ARTERION DISPLAY PC CARD INTERCONNECT GUIDE

Cable Pt. No.	From Board / Connector	To Board / Connector	Function
3004545	Display interface card P22	Inverter card	Inverter Power
3005101	Display interface card P23	SBC J5	SBC power
3004545	Display interface card P24	SBC J8	Ethernet
3006662	Display interface card P33	SBC J16	Speaker
3004545	Display interface card P25	SBC J2	Dig Analog I/O
3004544	Display interface card P26	SBC J7	Serial Port
Part of switch	Display interface card P20	Power switch	Pwr switch contacts
3026403	Display interface card P34	Power switch	Pwr switch jumper
	Display interface card P21	External Case	Start switch
	Display interface card P28	External Case	Power and signal
	Display interface card P30	Speaker	Audio Out
3005101	SBC J5	Display interface card P23	SBC power
3004545	SBC J8	Display interface card P24	Ethernet
3006662	SBC J16	Display interface card P33	Speaker
3004545	SBC J2	Display interface card P25	Dig Analog I/O
3004544	SBC J7	Display interface card P26	Serial Port
3007630	SBC J4	Touchscreen	Touchscreen signals
3007333	SBC J12	LCD	LCD signals

Table 6 - 3: ARTERION HEAD PC CARD INTERCONNECT GUIDE

Cable Pt. No.	From (Board / Connector)	To (Board / Connector)	Function
3026498	Signal Management P 204	Servo / CPU J4	5V
3026499	Signal Management P 205	Servo / CPU J5	I/O signals
3026500	Signal Management P 203	Servo / CPU J3	Display signals
3026501	Signal Management P 206	Servo / CPU J6	I/O signals
3026504	Signal Management P 225	EIC J 920	Air Det & Hand controller
3026505	Signal Management P 227/P278/P 279	EIC J 970	Heat & Cal
3026508	Signal Management P 223	Head Position J 623	Position Sensor
3026509	Signal Management P 224	Motor Drive J 324	Temp Sensor
3026510	Signal Management P 221	Motor Drive J 321	48 V
3026511	Signal Management P 228	Drop Front & Syringe Pres	Sensors
3026513	Signal Management P 251	Head Display J 551	Power & Com
3026542	Signal Management P 222	Potentiometer	Piston Position
	Signal Management P 211	Head Cable	Power and Com
3026385	Motor Drive P 331	Head (Part of the cable)	48V
3026502	Motor Drive P 301	Servo / CPU J1	Motor
3026503	Motor Drive P 332	Motor	Motor Power Phase A
3026503	Motor Drive P 333	Motor	Motor Power Phase B
3026503	Motor Drive P 334	Motor	Motor Power Phase C
3026509	Motor Drive P 324	Signal Management J224	Temp Sensor
3026510	Motor Drive P 321	Signal Management J221	48V
Mtr Asy	Motor Drive P 335	Motor	Encoder
3026498	Servo/CPU P4	Signal Management J 204	5 V
3026499	Servo/CPU P5	Signal Management J 205	I/O signals
3026500	Servo/CPU P3	Signal Management J 203	Display signals
3026501	Servo/CPU P6	Signal Management J 206	I/O signals
3026502	Servo/CPU P1	Motor Drive J 301	Motor Signal
3026504	External Interface Card P 920	Signal Management P225	Air Detect & Hand Contr
3026505	External Interface Card P 970	Signal Management P279, P278, P227	Heater, Cal signal
3027642	External Interface Card P 904	External Case Air Detect Port	Air Detect
3027643	External Interface Card P 902	External Case Heat Maintainer Port	Heat Maintainer
	External Interface Card P 32	External Case Service & Cal	Service & Cal
	External Interface Card P 901	Head cable	Ethernet lines
	External Interface Card P 903	External Case Hand Controller	Hand Controller
3026508	Head Position J 623	Signal Management P 223	Position Sensor

6.4.2 System Block Diagram Description

The System Block Diagram covers how the Power Unit, DCU, Injector Head, and accessories interconnect with one another. Sections below show specific diagrams for the Power Unit, DCU, and Injector Head.

6.4.2.1 Power Unit

The Power Unit contains the power supplies for the other parts of the System. It provides the external interface between the System and the outside world.

6.4.2.2 DCU

The DCU serves three main functions.

Display - All functions of the System are displayed on the DCU. This includes Operating values, Warnings and Cautions, and Error messages.

Input - When information is to be placed into the System, the selected value is entered on the face of the DCU.

Monitor - The DCU monitors the safety, and functionality of the System.

6.4.2.3 Injector Head

The Head provides the power to load the syringe and inject the contrast into the patient.

The head features a display of Volume Remaining in the syringe, as well as programmed parameters for the current protocol.

6.4.2.4 Accessories

The accessories listed in this section are listed on the System Block Diagram.

6.4.2.4.1 Extension Cables

Extension cables are available for DCU, Head Power / Communications in 15, 50, 65, and 90 foot lengths.

- DCU: 10 ft, 25 ft, 50 ft, 75 ft, 100 ft
- Head: 15 ft, 40 ft, 65 ft, 90 ft

6.4.2.4.2 Foot Switch

A Foot Switch can be added to start and stop injections with the foot.

6.4.2.4.3 Hand Switch

The handswitch can start and stop injections.

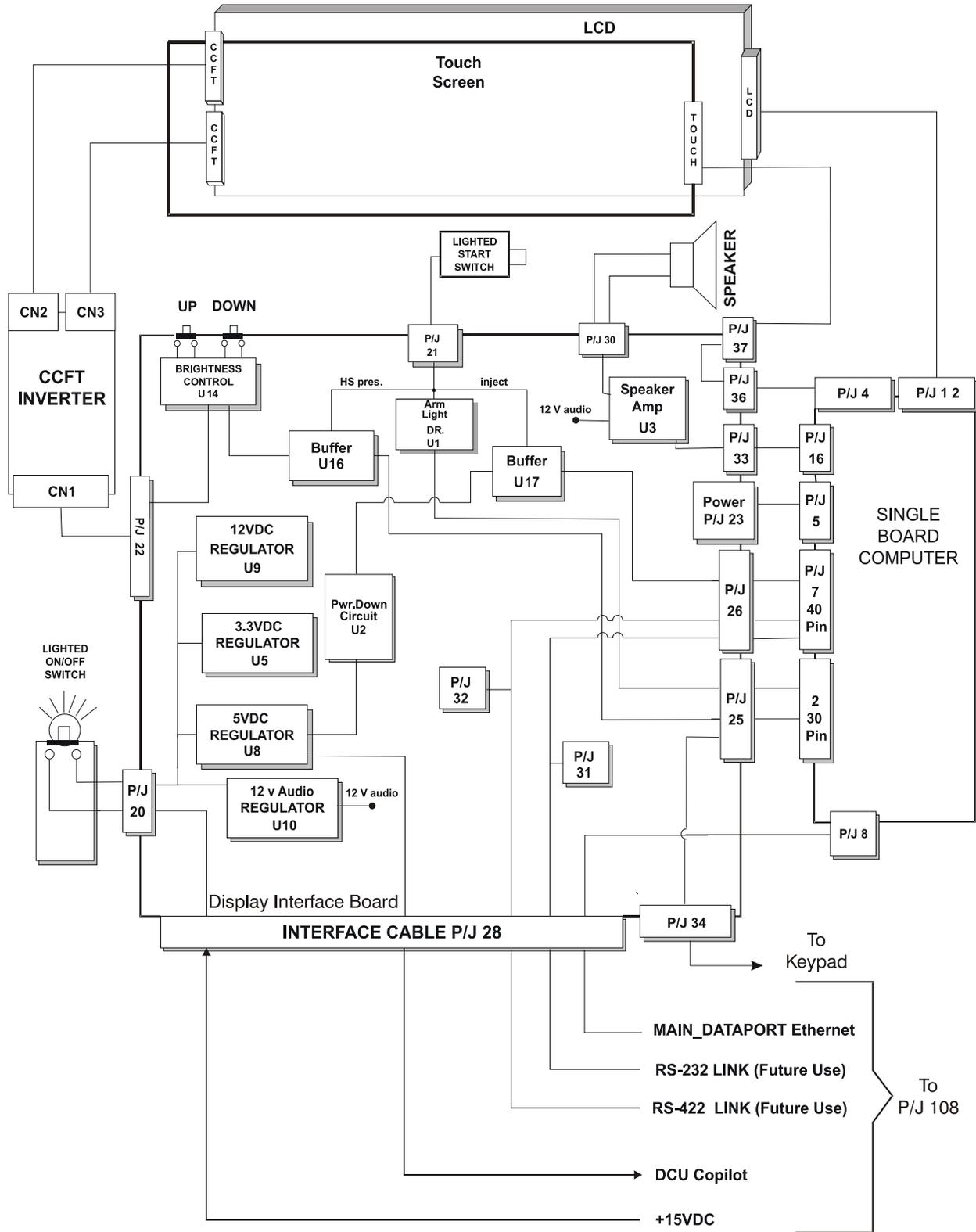
6.4.2.4.4 Syringe Heat Maintainer

Temperature of the syringe is maintained at approximately 35°C.

6.5 DCU

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.

6.5.1 DCU Block Diagram



6.5.2 DCU Block Diagram Description

6.5.2.1 Brightness Control

Two buttons controlling the brightness of the DCU screen by varying the CCFT voltage. The SBC monitors this voltage. 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.

6.5.2.2 Single Board Computer (SBC)

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

- Ethernet Interface: 10Base T
- Power Management
- LCD Panel Interface
- Non-Volatile (NV) RAM
- Real Time Clock

6.5.2.3 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.

6.5.2.4 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.

6.5.2.5 +5VDC Regulator

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

6.5.2.6 +3.3VDC Regulator

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

6.5.2.7 +12VDC Audio Regulator

The +15 VDC power supply feeds power to a regulator providing a +12 VDC power level to supply power to the audio amplifier.

6.5.2.8 Audio 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.

6.5.2.9 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.

6.5.2.10 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.

6.5.2.11 Touch Screen

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

6.5.2.12 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.

6.5.2.13 On/Off Switch

The on/off switch provides the means to active/deactivate the system. The Global_Enable signal is switched through a lighted switch. The light is run off of +5VDC.

6.5.2.14 DCU Copilot

This signal enables and disables the +5VDC regulator on the Power Management Card.

6.5.2.15 Power Down Circuit and Indicator

This circuit provides an early warning to the processor when the +15VDC supply rail decays to +12.8VDC.

6.5.2.16 Arm Light Drive

This circuit provides the drive voltage to illuminate the arm light on the handswitch. The drive voltage is controlled by the SBC.

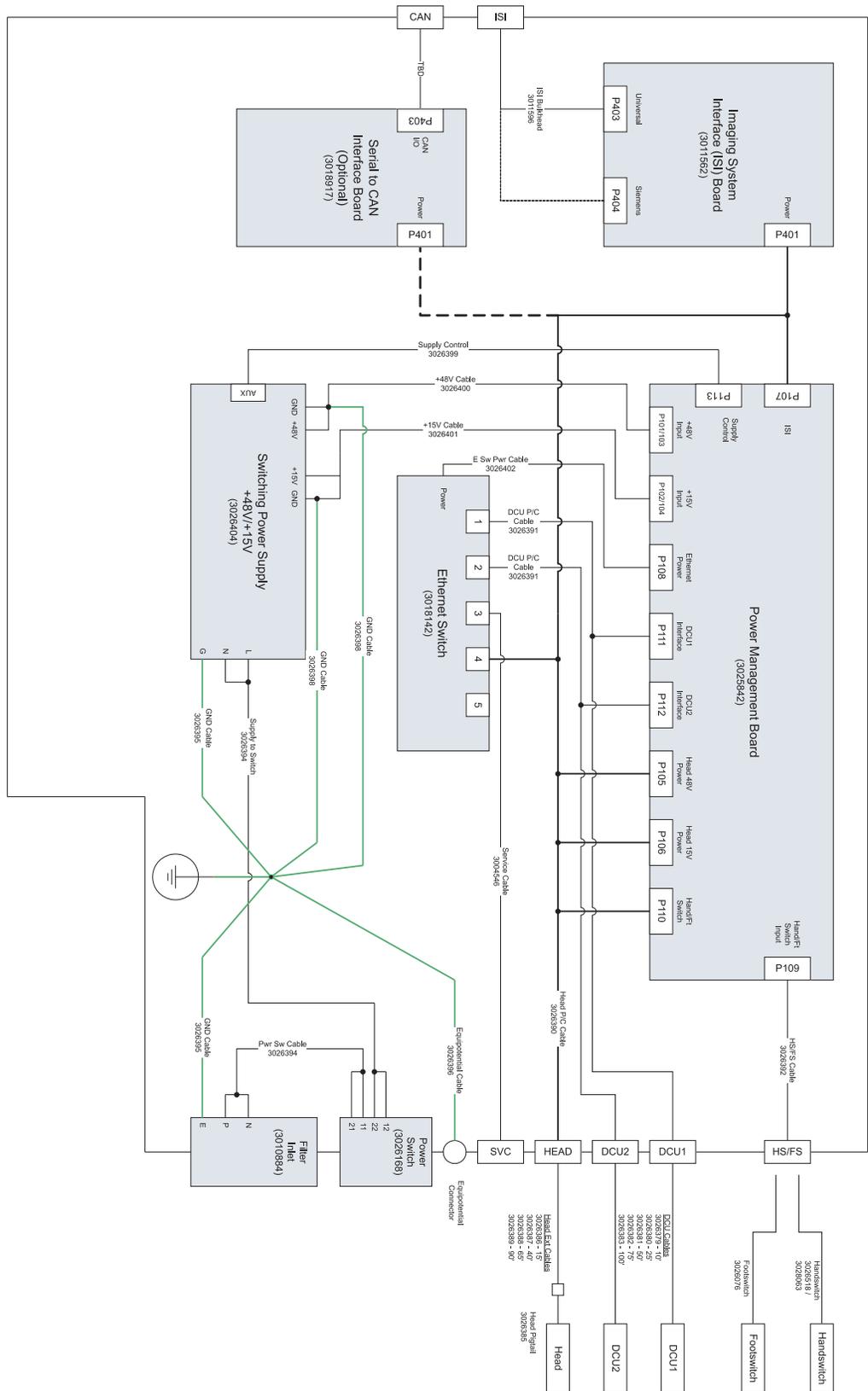
6.5.2.17 DCU Interface Board

All connectors and switches are terminated here.

6.6 Power Unit

The Power Unit for the *Mark 7 Arterion Injection System* supplies power to the Injector Head and the DCU, and, as the main communications hub, provides system communications to all connected components.

6.6.1 Power Unit Block Diagram



6.6.2 Power Unit Block Diagram Description

Will update with more info from DF-110571 when that info is available.

6.6.2.1 Power Supply Activation

Used to activate the system. When the DCU power switch is activated, the main power supplies are activated.

6.6.2.2 Main Power Supply

48VDC and 15VDC - Provides 48VDC to the Head and 15VDC to the Power Unit, DCU, and Head.

6.6.2.3 Ethernet Switch 5VDC Power

Powers the Ethernet Switch.

6.6.2.4 Ethernet Switch

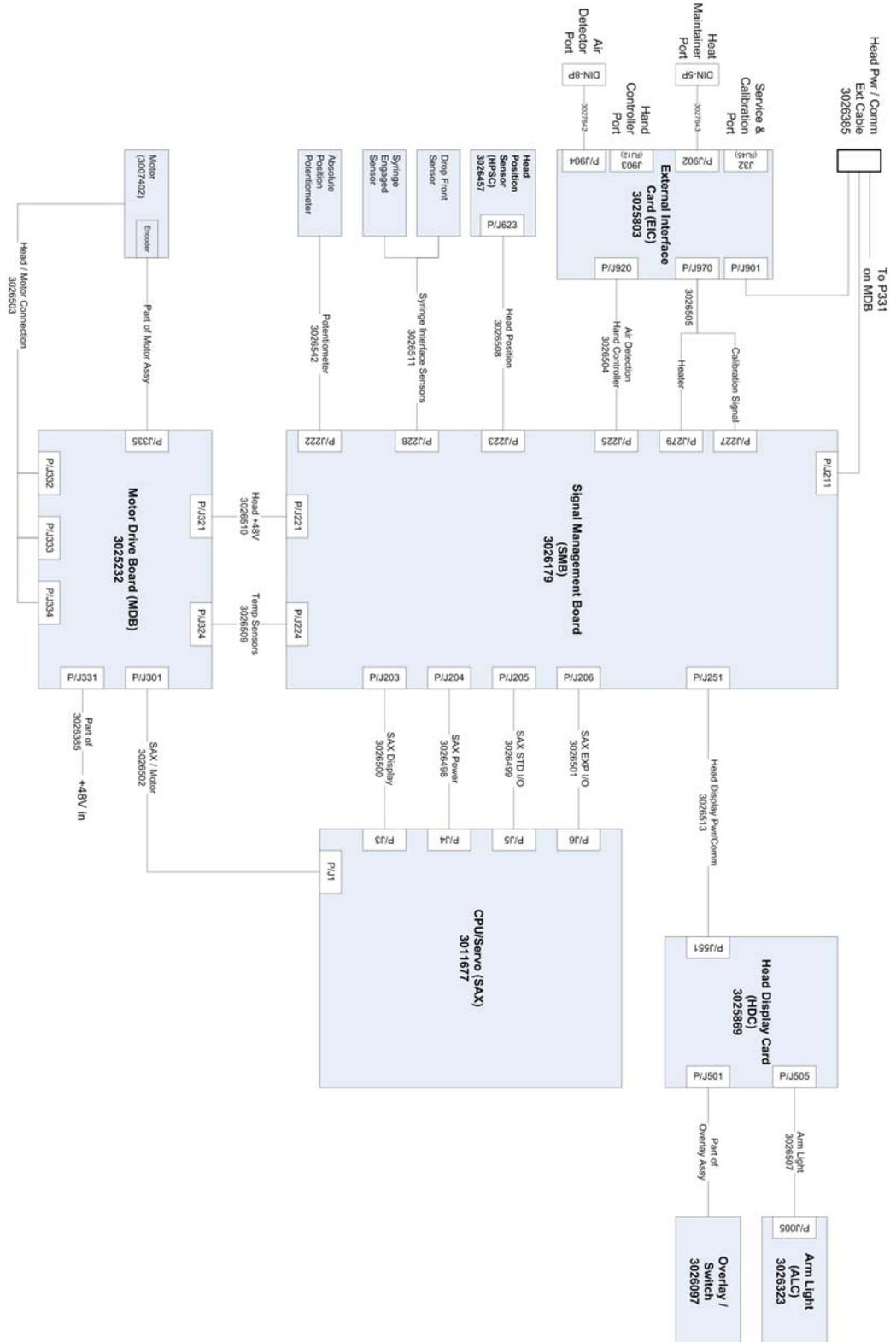
Connection point for all Ethernet communications.

6.6.2.5 Power Management Card

System power and communication dissemination.

6.7 Head

6.7.1 Head Overview Block Diagram



6.7.2 Head Overview Block Diagram Description

6.7.2.1 Signal Management Board

An interface between internal components of the head and the power unit.

- Power and communications from the Power Unit.
- Routes power to the motor drive board, CPU/Servo card, and the head display card.
- Communication interface between the CPU/Servo Card the Head Display Card, and the Single Board Computer (in the DCU).
- Reads the potentiometer for piston position.
- Status of the syringe and drop arm position.
- External Interfaces Card
- Provides isolation and filtering for accessories that connect to the head including the hand-controller and the heat maintainer.

6.7.2.2 Drop Arm Sensor

The Drop Arm Sensor is digital; Low - Drop Arm Up (Closed); High - Drop Arm Down (Open).

6.7.2.3 Syringe Present Sensor

The Sensor is digital; Low - Syringe is Present (Closed); High - No Syringe (Open).

6.7.2.4 Armed Light

Bank of LEDs used to indicate Arm and Inject status to the user. The signal driving the arm lights on the injector head originates on the Head Display Card.

6.7.2.5 Potentiometer

Provides absolute piston positioning information.

6.7.2.6 Motor Drive Card

Takes data from the CPU/Servo board and develops drive signals for the 3-phase Motor assembly.

6.7.2.7 Servo/CPU

Contains a microprocessor that manages card power, data, footswitch control, motor drive, network communications.

6.7.2.8 Head Display Card

The head display card provides a user interface to the head. It's functions include:

- Communication to and from the CPU/Servo card via the signal management card
- Display of information to the user such as volume remaining, volume selected, flow rate selected, and pressure limit selected.
- Processes piston movement and loading control input from the membrane switch.

6.7.2.9 Motor Assembly

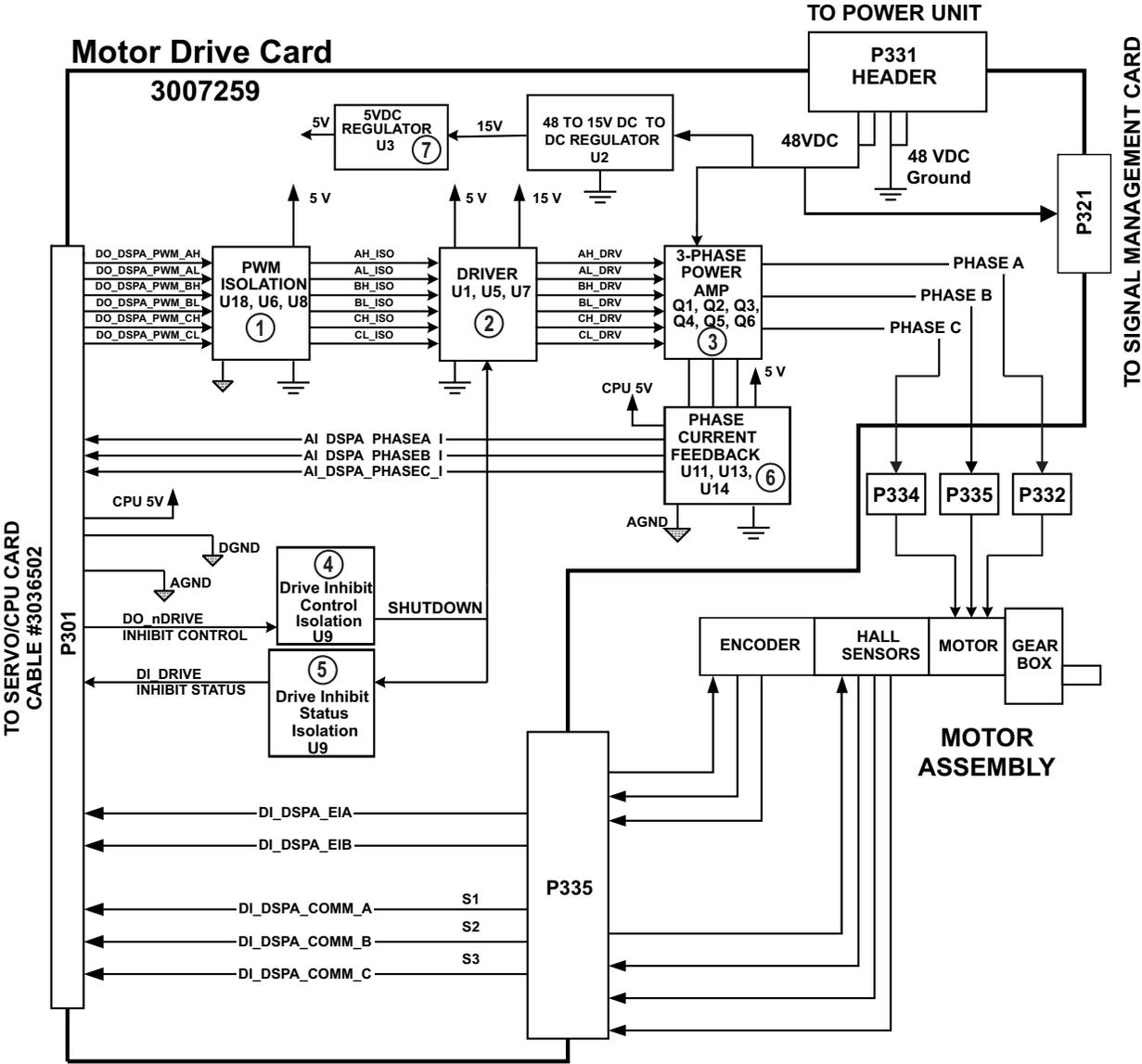
Contains the 3-phase servo motor driven by the Motor Drive Card. Contains an optical incremental encoder for accurate position, direction and rate determination.

6.7.2.10 Drive Train

Contains the gears to move the piston.

6.7.3 Head Motor Drive Block Diagram

Motor drive card takes data from the cpu/servo board and develops drive signals for the motor assembly.

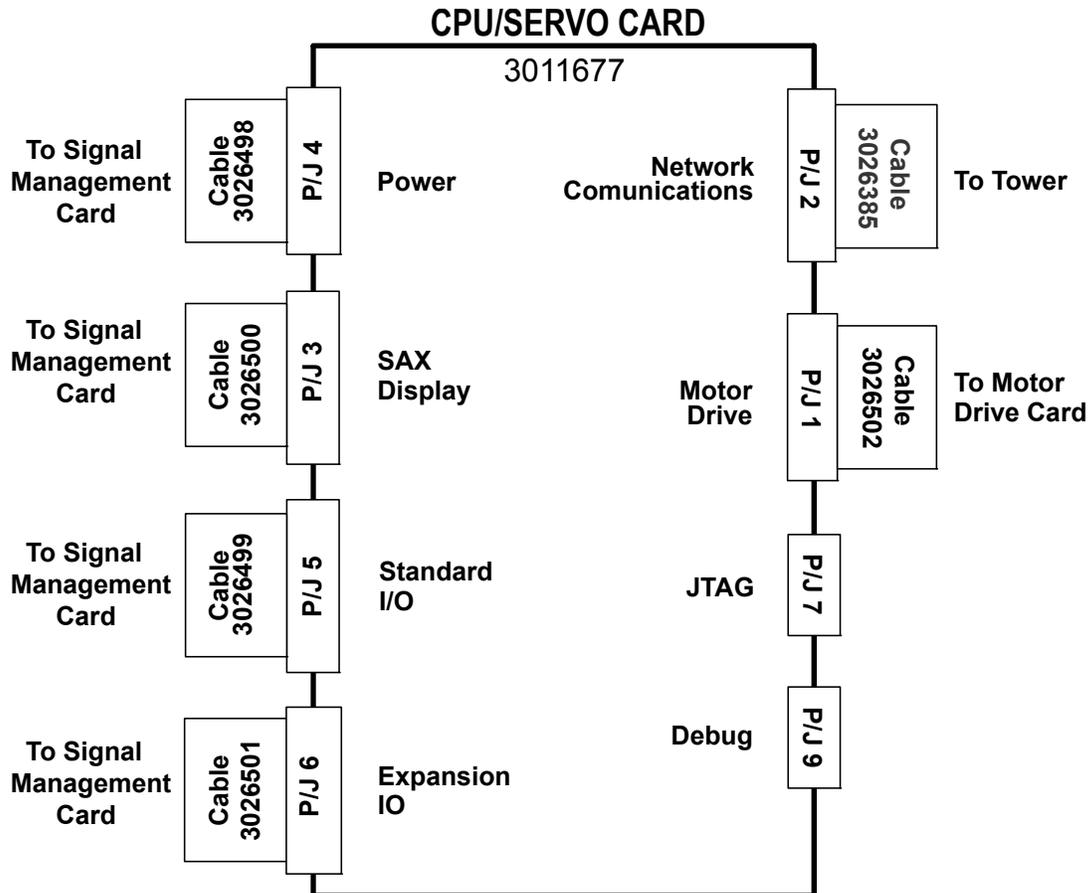


6.7.4 Head Motor Drive Block Diagram Description

1. **PWM Isolation** - Provides electrical isolation of the Pulse Width Modulation (PWM) switching signals for the syringe. These signals are generated on the Servo/CPU Card and are used to control the power amplifier current to the motor.
2. **Driver** - Drives the 3-phase power amplifier.
3. **Power Amplifier** - Drives the servo motor.
4. **Drive Inhibit Control** - Provides shutdown control of the driver, which disables the Power Amplifier.
5. **Drive Inhibit Status** - Feedback to the Servo/CPU card giving status of the Drive Inhibit signal.

6. **Bridge Current Test Feedback** - Measuring, isolating and filtering Power Amplifier bridge voltage.
7. **5 VDC Regulator** - 5 VDC power to the servo motor.

6.7.5 Head Servo/CPU Block Diagram

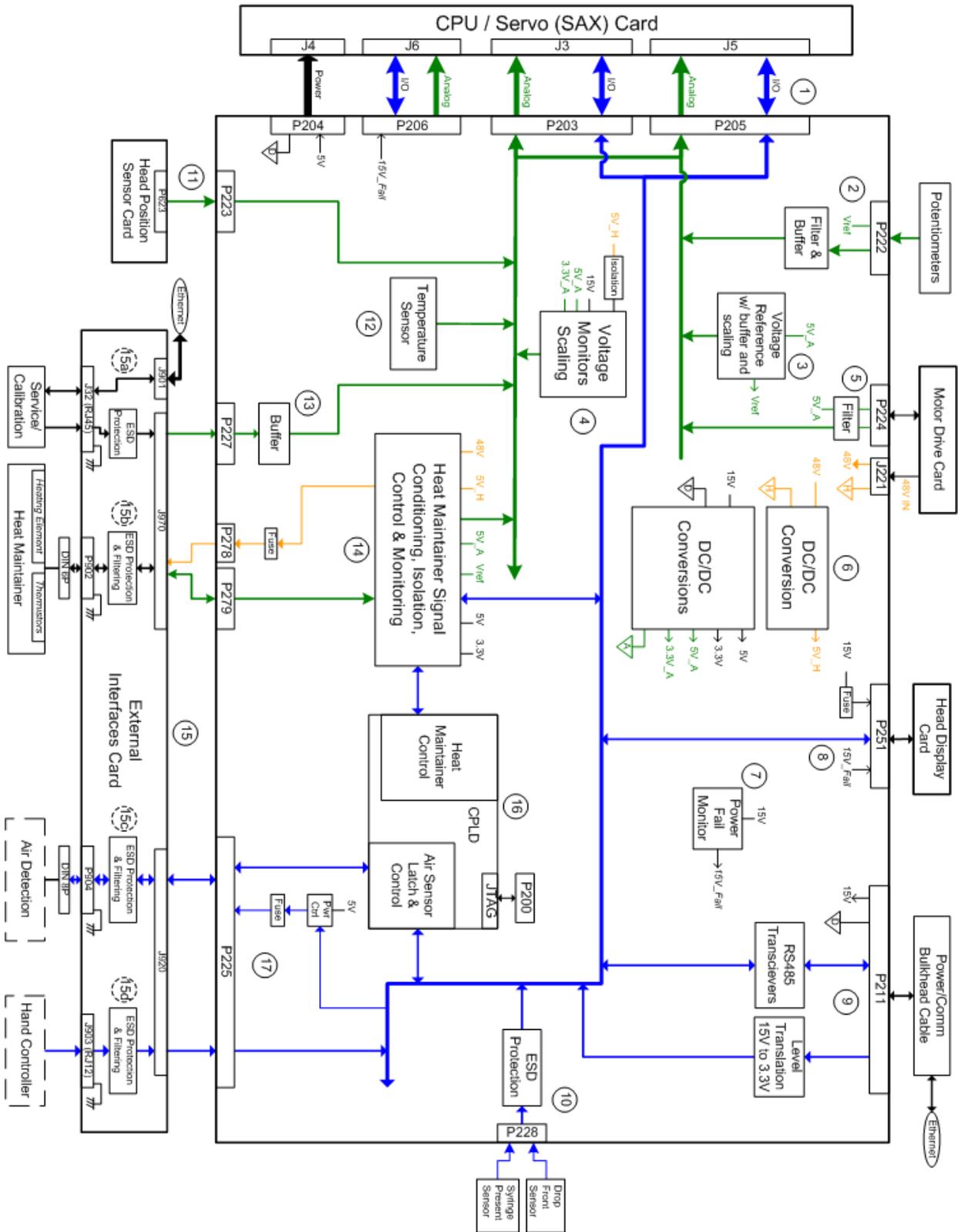


6.7.6 Head Servo/CPU Block Diagram Description

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

- Card power management.
- Data management I/O - two ports.
- Network communications in conjunction with the Tower.
- Motor Drive control.
- JTAG - programming port - not used.
- Display (via Signal Management).

6.7.7 Head Signal Management Block Diagram



6.7.8 Head Signal Management Block Diagram Description

The Signal Management Card (SMC) provides the interconnection between the Single Axis (SAX) processor card and the various interface components within the Mark 7 Injector Head. The simplified block diagram above provides details on the various sections of the board.

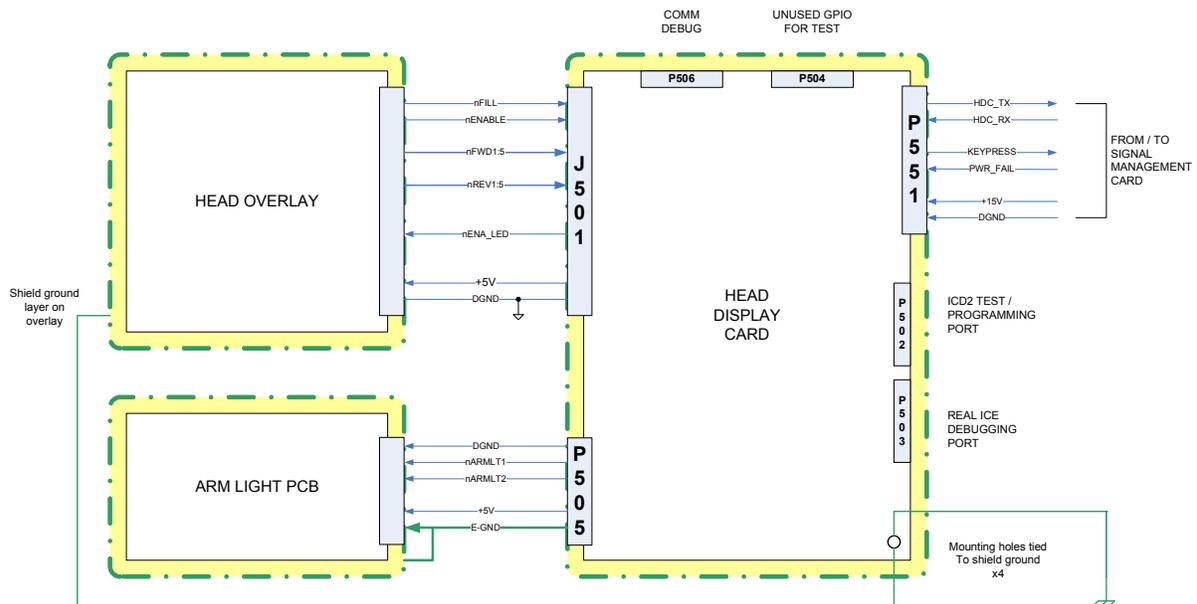
1. Four connectors provide the direct interface between the SAX card and the SMC. These connections are a mix of analog and digital signals as well as the supply of power to the SAX card.
2. A dual precision potentiometer within the head provides an absolute position indication of the Head's piston. A reference voltage is applied to the potentiometer and the signals from the potentiometers are filtered and buffered and then sent as analog signals to the SAX card.
3. An analog reference voltage of 4.096V is generated on the SMC card and is used in various analog circuits on the card. In addition, the signal is scaled down and provided to the SAX card for monitoring.
4. The various voltages present or generated on the SMC card are scaled and provided to the SAX card for monitoring of the integrity of the system.
5. The Motor Drive Card (MDC) has two connections to the SMC card. One connector provides filtered analog power to two temperature sensors on the MDC and receives back the temperature sensor analog signals, then filters them before providing them to the SAX card. The other connector provides the 48V power to the SMC card for voltage monitoring and for power to the Syringe Heat Maintainer.
6. DC/DC converters create the other voltages needed within the system from the 48V and 15V supply voltages.
 - The 48V supply is converted to a 5V supply, referenced to HGND. (All HGND portions are kept isolated from remaining circuits for improved noise immunity.)
 - The 15V supply is converted to 5V, which is then also converted to 3.3V; both of which have separate filtering to create analog 5V and 3.3V sources.
7. The 15V supply is monitored for a drop or drops in voltage which indicate a power fail condition. The digital Power Fail signal generated is provided directly to the processors on the SAX card and the Head Display Card.
8. A connector is present to provide fused 15V power to the Head Display Card as well as interface signals to and from the SAX card.
9. A connector is present to accept the power and signals from the main Bulkhead Cable. The 15V supply for the Head is connected here, as well as the SAX card connection for RS485 communications and the level translated Handswitch/Footswitch signals from within the system.
10. Signals from sensors for the Drop Front Position and Syringe Present are connected to the SMC and include ESD protection before they are supplied to the SAX card.
11. A connector for Head Position Sensor Card provides the analog signal to the SAX card. The Head Position Sensor card consists simply of a rotary potentiometer which varies its output as the Head rotates, thus providing an electrical representation of the position of the Head.
12. A temperature sensor provides an analog signal representing the temperature of the SMC to the SAX card for system monitoring.
13. A connector receives the analog calibration signal from the External Interfaces Card, buffers it, and provides it to the SAX card.
14. The Heat Maintainer interface is through two connectors to the External Interfaces Card, and includes switched and fused 48V power, heat maintainer presence detection, redundant analog temperature signal conditioning, and redundant temperature threshold monitor circuits. The analog temperature signals as well as the digital threshold signals are supplied to the SAX card. The digital threshold signals and presence signals are presented to the Heat Main-

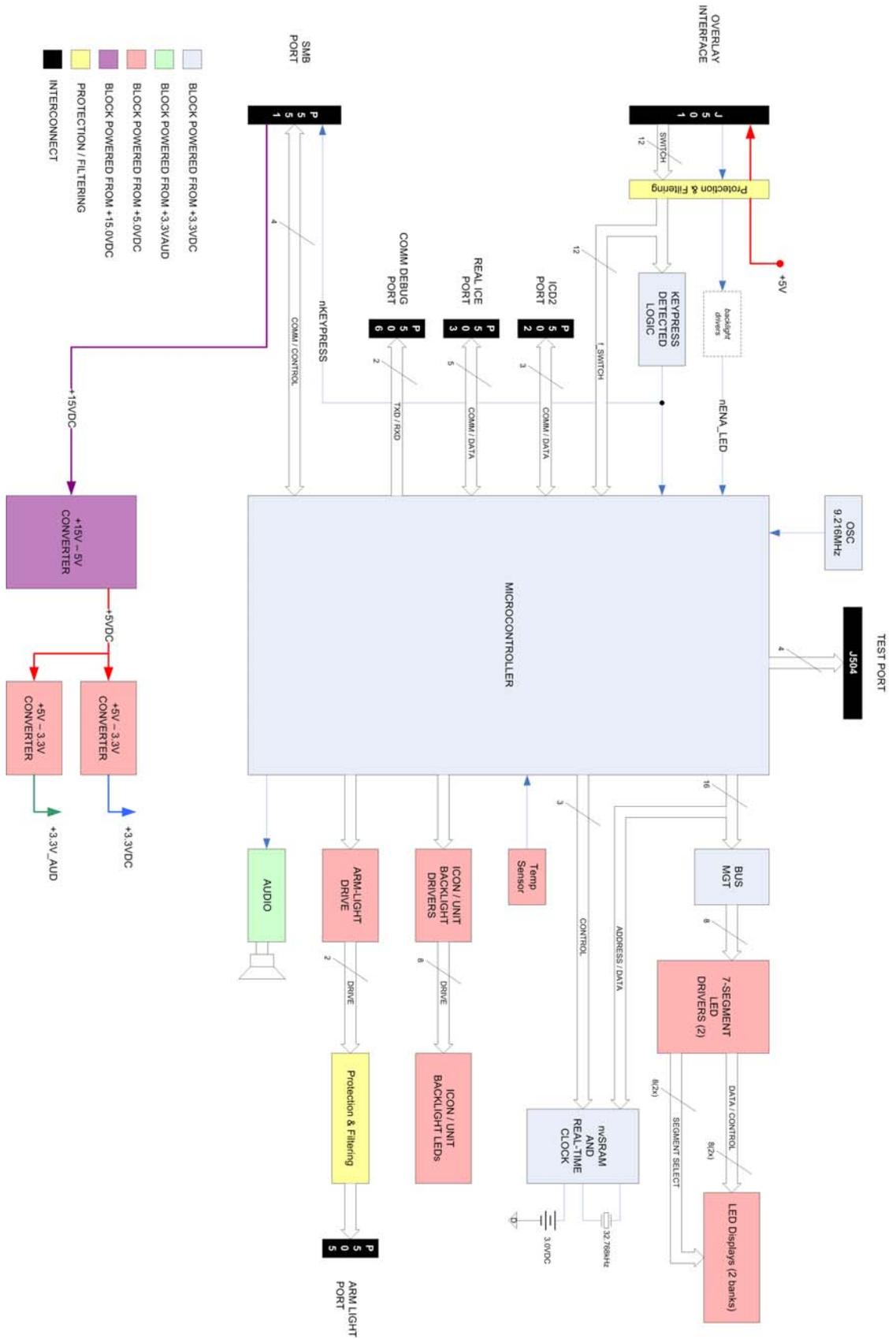
tainer Controller within the CPLD, which in turn provides the drive signal for control of the amount of heat generated.

15. The External Interfaces Card (EIC) provides ESD protection and filtering for the various signals from devices outside of the Head before connecting to the SMC. The addition of this board allows for better shunting of potential noise sources away from the system components as well as helps to simplify cabling and servicing. The four interfaces on the EIC are:
 - a. The RJ45 Service and Calibration port allows for connection of Service SWIFT to the Head and also includes the simultaneous connection of the calibration device. ESD protection is provided on the calibration signal. The Ethernet connection simply passes straight through the EIC and provides attachment to the bulkhead cable.
 - b. The Heat Maintainer signals have ESD protection and filtering as they pass through the EIC. A wiring harness connects the panel mounted 6-pin DIN connector for the Heat Maintainer to the EIC.
 - c. The future Air Detector signals have ESD protection and filtering as they pass through the EIC. A wiring harness connects the panel mounted 8-pin DIN connector for the Air Detector to the EIC.
 - d. (Future Item) The RJ11 connector provides the direct interface to the Hand Controller. The Hand Controller signals have ESD protection and filtering as they pass through the EIC.
16. The CPLD contains the logic for controlling the Heat Maintainer and Air Detection interfaces.
17. (Future Item) The Air Detection and Hand Controller interfaces are connected to the External Interfaces Card and then provided to the CPLD and SAX card. The power to the Air Detector is fused and controlled by the SAX card.

6.8 Head Display/Armed Light Card

6.8.1 Head Display/Armed Light Card Block Diagram





6.8.2 Head Display/Armed Light Card Block Diagram Description

6.8.2.1 Power Supply

The Head Display Card (HDC) is supplied +15VDC from the Signal Management Card. From this voltage a +5V and two +3.3V sources are derived.

+5VDC is derived from the 15V supply using a switching voltage regulator primarily used for efficiency and current capabilities. The +5V will drive common anodes of seven segment LEDs, discrete LEDs and supply power to the seven segment drivers. The switching regulator component is capable of supplying up to 3.5A max, but the +5V supply in this circuit is only designed to provide 1.5A.

The +3.3V is derived from the +5V using a Low Dropout (LDO) regulator. The +3.3V supplies power to all of the logic devices on the board with the exception of the seven segment drivers. The 3.3V supply is capable of providing up to 700mA.

The +3.3V_AUD is derived from the +5V using a Low Dropout (LDO) regulator. The +3.3V_AUD supplies power to the audio transducer only. The +3.3V_AUD supply is capable of providing up to 200mA, although the maximum load on the regulator from the transducer will be 110mA.

6.8.2.2 Microcontroller

The Microcontroller is a Microchip PIC18F87J11 general purpose 8-bit microcontroller.

This particular PIC device has an 80 pin TQFP package, features 128K of program flash memory, 3904 bytes of internal system RAM and operates over a voltage range of 2-3.6VDC

The PIC is clocked with an external 9.216MHz oscillator, chosen primarily for parts reuse with existing designs and minimal baud error with the UART.

The PIC peripherals used in this design are the extended memory interface, the UART, A/D Converter and a PWM output.

This design utilizes this particular PIC devices External Memory Interface function, in which the nvRAM / RTC memory and 7-segment LED displays are interfaced using traditional parallel data / addressing.

The board will be equipped with ports to program and debug the PIC from the In-Circuit Debugger (ICD2/3) or the In-Circuit Emulator (RealICE).

6.8.2.3 Bus Management

Control of the address and data bus is provided by a 16-bit D-type latch which latches the address on command from the controller.

Additional latches provide control for data to the seven segment display drivers.

Combinational logic is used to generate the write enables for the seven-segment drivers, which also make use of the data bus.

6.8.2.4 Seven Segment LED's

Three orange seven segment displays (HDSM-431L) are chosen for this design to indicate Volume Remaining. The quantity will be displayed as a three digit quantity with no decimal point.

Three blue seven segment LED displays (HDSM-431B) represent the programmed volume. The quantity will be displayed as a three digit quantity with no decimal point.

Three blue seven segment LED displays (HDSM-431B) represent Flow Rate Selected. The Flow Rate selected will be displayed as a three digit quantity with a decimal point indicating one decimal place.

Four blue seven segment LED displays (HDSM-431B) represent Pressure Limit Selected. The pressure will be displayed as a four digit quantity with no decimal point.

6.8.2.5 Seven Segment LED Driver

The driver for the seven segment LED displays will be an Intersil ICM7228. This device can drive up to eight seven segment displays providing the proper scan rates. The data is fed to the drivers 8-bits at a time. Because there are 13 seven segment LED displays in use, two ICM7228s will be used on this board.

6.8.2.6 Icon Unit Backlight LEDs/Drivers

Backlights are directly driven from the PIC with the assistance of IRF7303 N-channel MOSFETs.

All of the backlights are white Lite-On LTW-150TK chip LEDs featuring a typical luminous intensity of 260mcd when driven at 20mA.

6.8.2.7 Armed Light LEDs/Drivers

The arm lights are driven from one IO line on the processor; ARM_IND. The ARM_IND output drives two FETs which feed 19 LEDs on the Arm Light board.

Two IRF7303 MOSFETs are used to distribute the current load between the LEDs

The arm lights are low profile, right angle LEDs with moderate brightness mounted on the arm light PCB and arranged to provide a uniform light through a lens near the rear of the injector head. 16 bright, cool-white, LEDs are used for this purpose. The Arm light gives a visual indication of the injectors armed / injecting status and is consistent with the operation of ProVis (Flashing for **Armed** and solid for **Injecting**).

6.8.2.8 NVRAM and Real-Time Clock

The Real time clock and NVRAM device are combined in a Cypress CY14B256KA. This device is placed for potential future non-volatile data storage. The device is operated at +3.3V and comes in a 48-pin SSOP package.

The Real Time Clock is used as a communication heartbeat between the HDC and SAX.

The real time clock is backed up by a 3V Lithium Coin Cell which can provide approximately 15 years of storage before requiring replacement.

6.8.2.9 Audio Circuit

The audio circuit consists of an audio transducer and a switching MOSFET to properly drive it. The circuit provides a maximum output of 85dBa at 10cm with a resonant frequency of 2700Hz, and a reduced output at other frequencies.

6.8.2.10 Programming and Debugging interface (P502-503)

Two ports allow for interfacing the Microchip ICD2 and the Real ICE to the PIC processor for programming and debugging the device.

6.8.2.11 Signal Management Board Port (P551)

The signal management port provides power from the signal management card and communications to the SAX card via the Signal Management Board. Each signal / power connection is twisted with ground to reduce noise and improve signal integrity.

6.8.2.12 Key Press Detected Logic

The Key press Detected Logic is used to detect any key press on the overlay. This is a safety measure for disarming the system by a key press. The nKEYPRESS signal is sent to the SMC to alert the CPU/ Servo, and is also applied to the PIC microcontroller as an interrupt for early detection of key presses.

6.8.2.13 Membrane Switch Interface (P501)

The membrane switch interface provides the I/O for switch inputs from the loading switches; forward and reverse, and the enable, and fill keys. The Enable Indicator is embedded in the membrane switch. The lines leading to and from the overlay are protected from ESD by 3.3V transient protectors and from EMI emissions by a common mode choke.

6.9 ISI

6.9.1 ISI Basic Functionality

The MEDRAD *Mark 7 Arterion* ISI supports the following functions on the Injector as depicted in the figure below.

- Allows the Injector to be Disarmed when Armed or Injecting.
- Prevents the Injector from being Armed.
- Allows the Injector to be Started from an Imaging System input when the Injector is in an armed state.
- Allows the Injector Hand Controller and Footswitch to be disabled from directly initiating a contrast injection

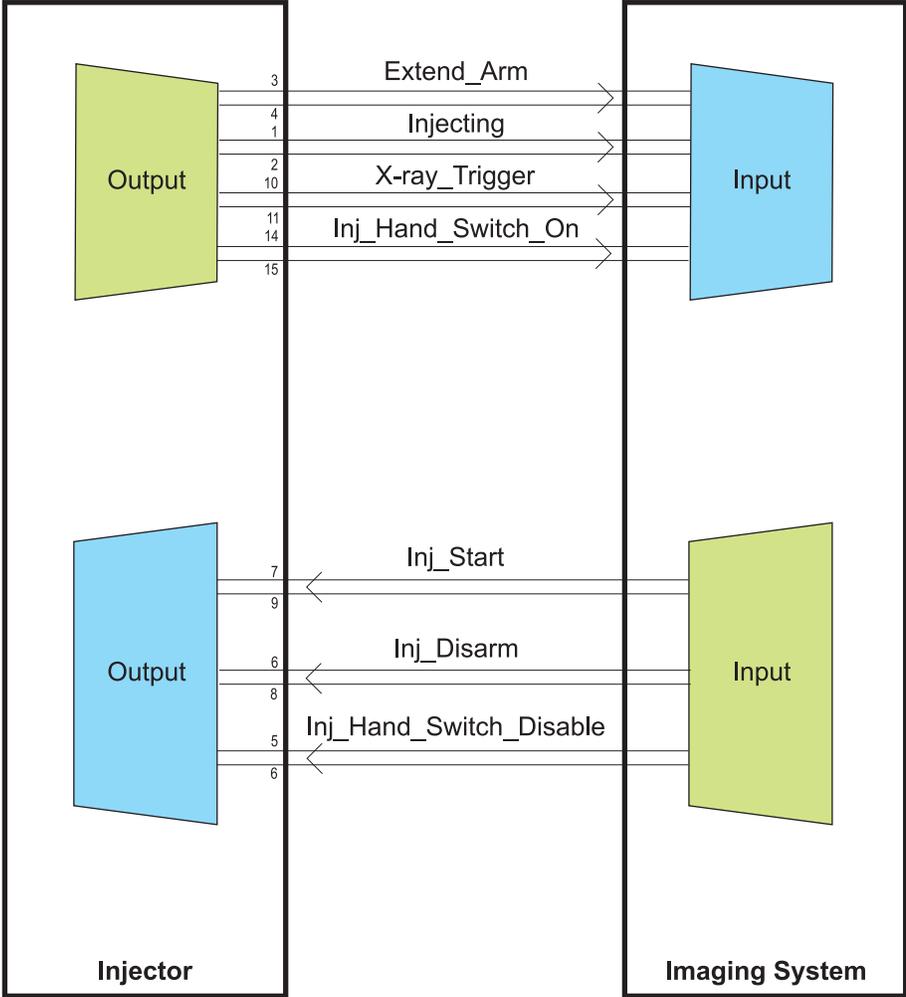


Figure 6 - 4: ISI Basic Functionality Diagram

MEDRAD Mark 7 Arterion Injection System ISI operates as illustrated below:

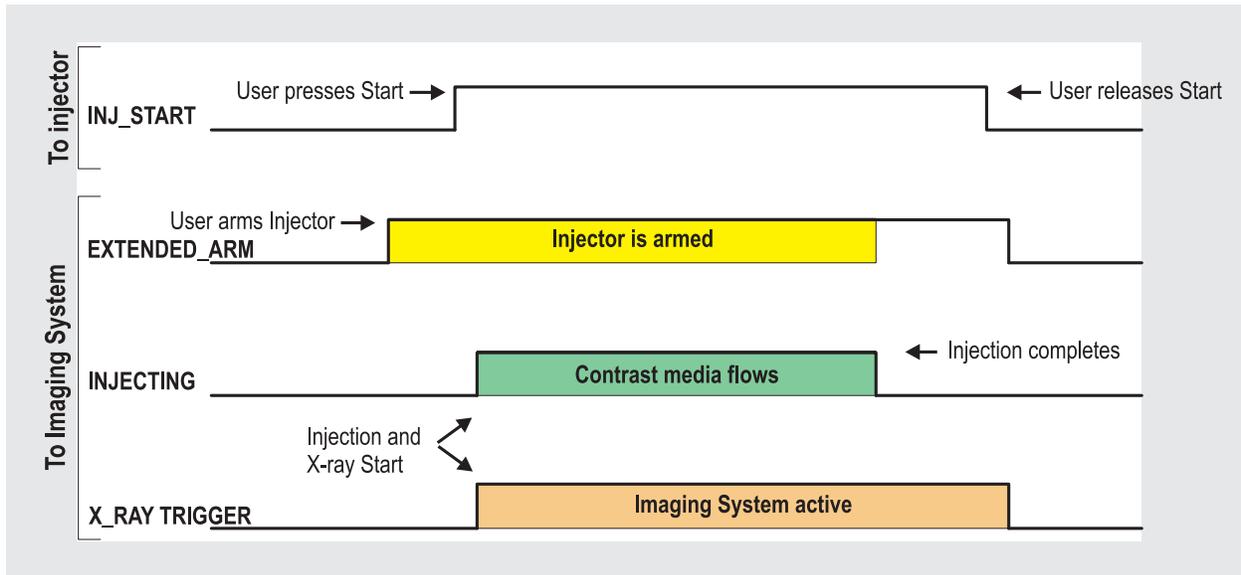


Figure 6 - 5: Typical ISI Implementation and Timing (No Delay)

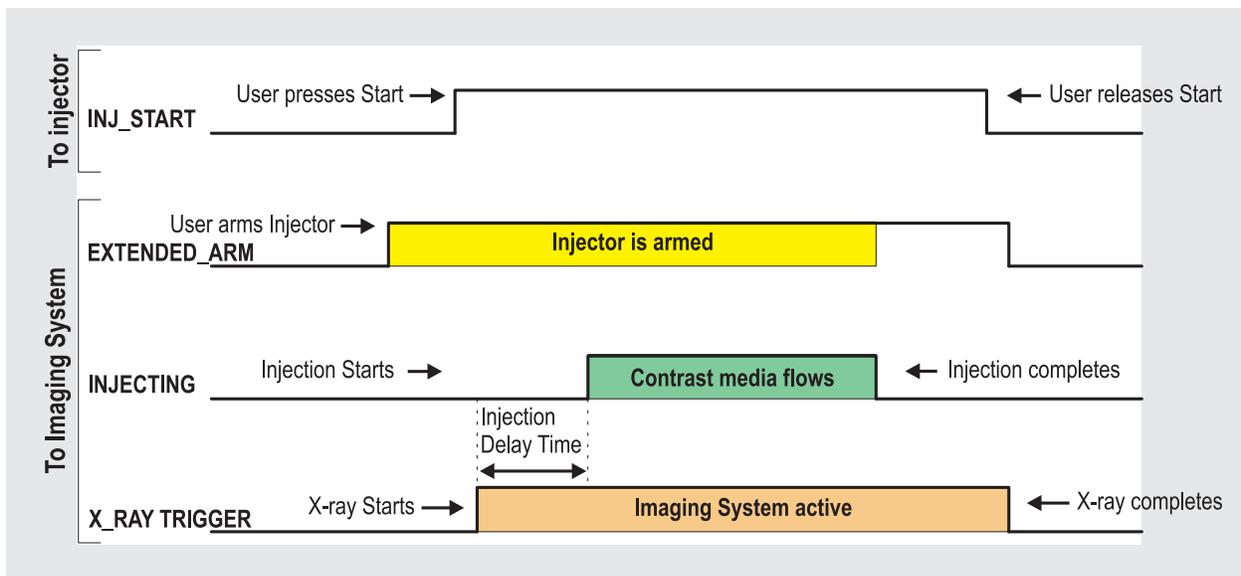


Figure 6 - 6: Typical ISI Implementation and Timing (Injector Delay)

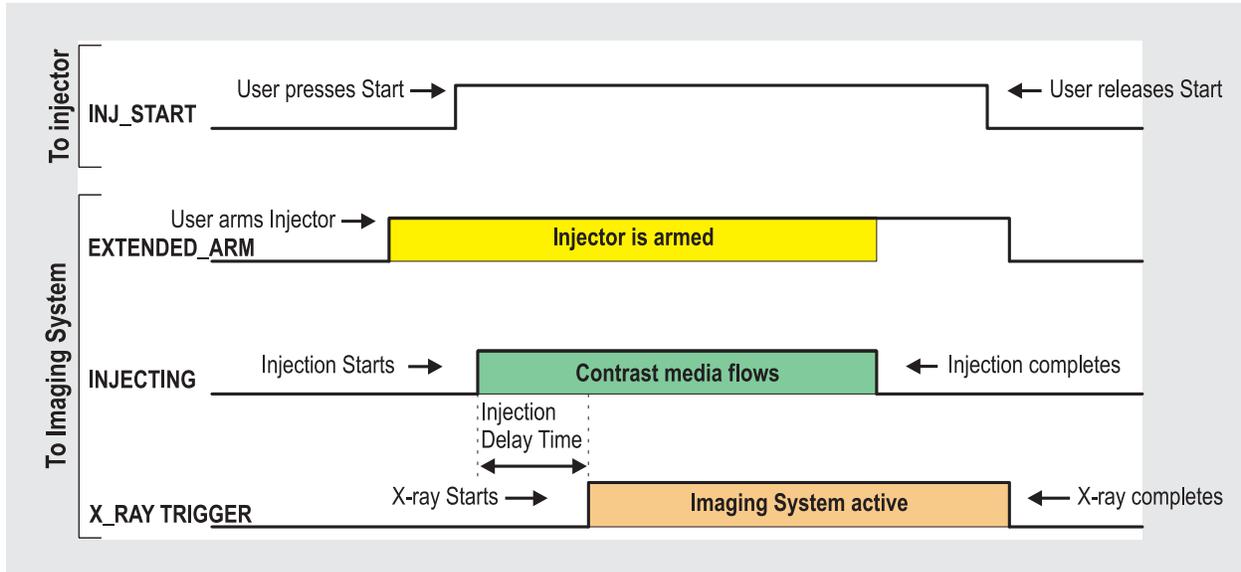


Figure 6 - 7: Typical ISI Implementation and Timing (X-ray Delay)

6.9.2 ISI Technical Specifications

See "ISI Technical Specifications" on page 9 - 120.

6.9.3 ISI Block Diagram

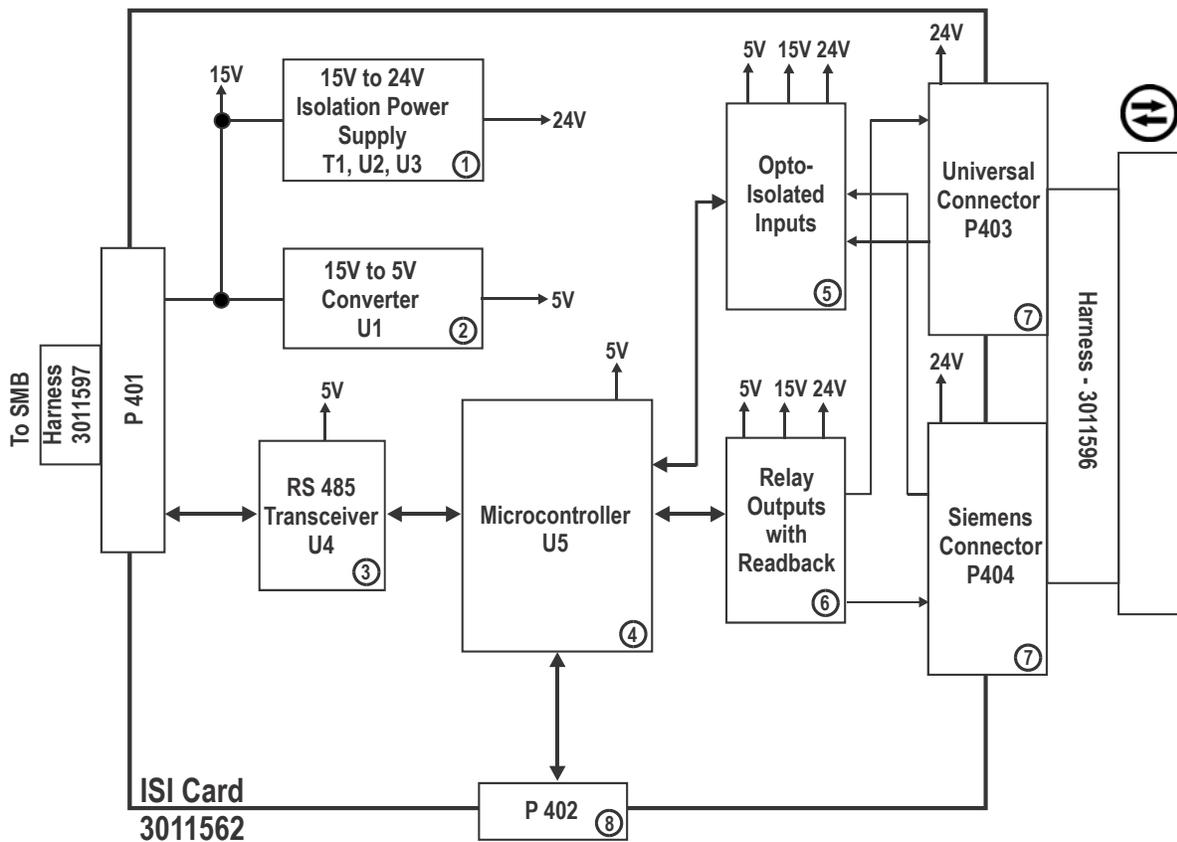
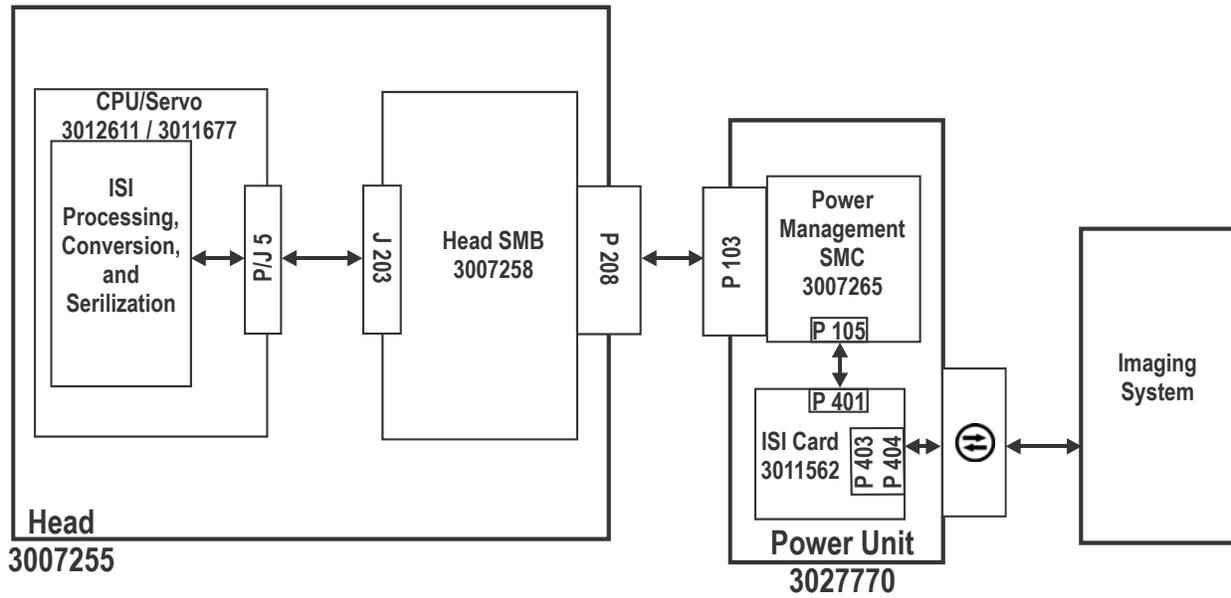


Figure 6 - 8: ISI Block Diagram

6.9.4 ISI Block Diagram Description

6.9.4.1 15 to 24 VDC Isolated DC to DC Converter

24 VDC for the interface on the Imaging System. To maintain electrical segregation, an isolated converter is used and includes a short circuit protection feature.

6.9.4.2 15 to 5 V DC Linear Converter

5 VDC supply for the microcontroller and RS485 transceiver.

6.9.4.3 RS-485 Transceiver

External interface: 2-wire, differential, bidirectional, half-duplex RS-485 signals. The digital transmit and receive signals are converted by this block to RS-485 transmission levels. Direction of transceiver is set by the microcontroller.

6.9.4.4 4 - Microcontroller

Receives data from RS-485 transceiver, isolated input signals from the Imaging System and transmits data to RS-485 transceiver and drivers for relay outputs. The microcontroller provides the control of the ISI interface and provides the status of the inputs in these messages.

6.9.4.5 Opto-Isolated Inputs

Inputs are isolated control signals from Imaging system. Output are control signals converted to 5 VDC levels.

Isolation is needed so that the noise from the Imaging System is not coupled into the electronics of the MEDRAD *Mark 7 Arterion Injection System*.

6.9.4.6 Relay Outputs with Readback

Control and status input signals from the microcontroller.

Isolated output contacts to the Imaging System. Relay contacts through opto-isolators for verification.

Relays provide the isolation for the control and status signals sent to the Imaging System.

6.9.4.7 Universal / Siemens Connectors

Control input signals from Imaging System, referenced to the isolated 24V supply.

Relay output contacts to the Imaging System representing control and status signals.

The ISI cable assembly is configured for the appropriate Imaging System.

6.9.4.8 Programming Port

Interface to program the Microcontroller.

6.9.5 ISI Wiring Diagrams and Pinouts

6.9.5.1 ISI Universal Connector Wiring Diagram

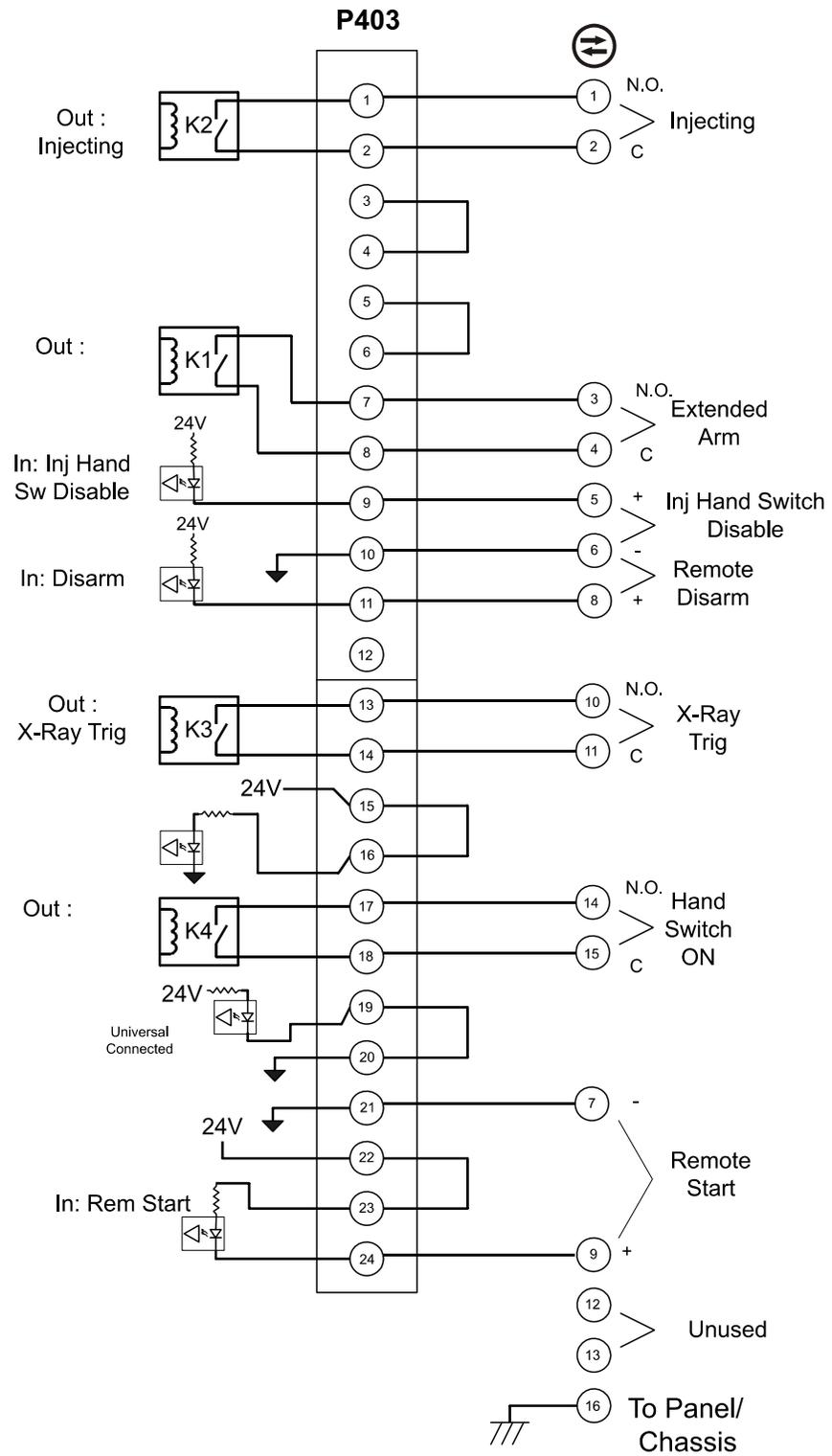


Figure 6 - 9: Universal Connector

6.9.5.2 ISI Siemens Connector Wiring Diagram

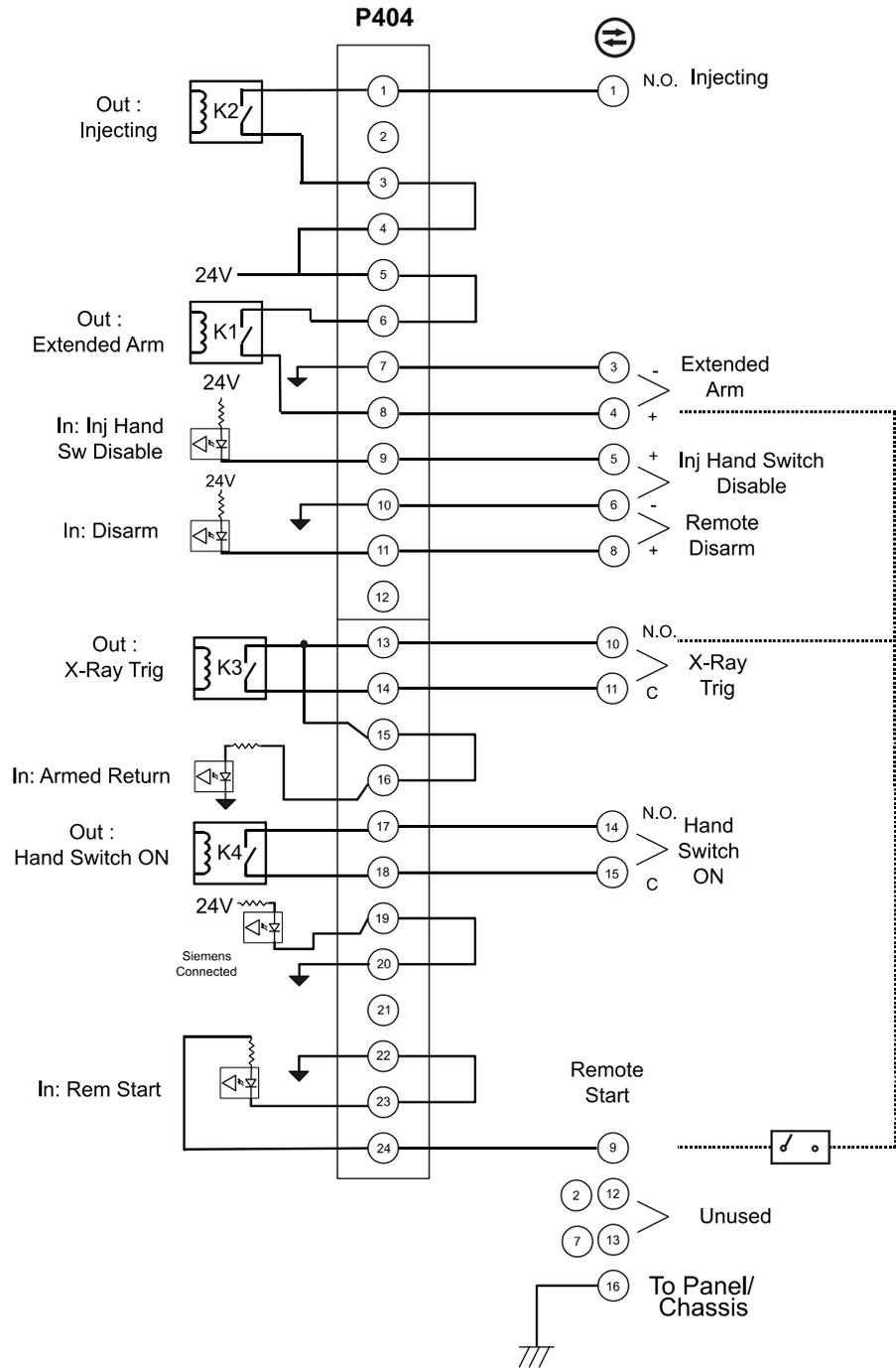


Figure 6 - 10: Siemens Connector

6.9.5.3 ISI Cable Pinout - Universal

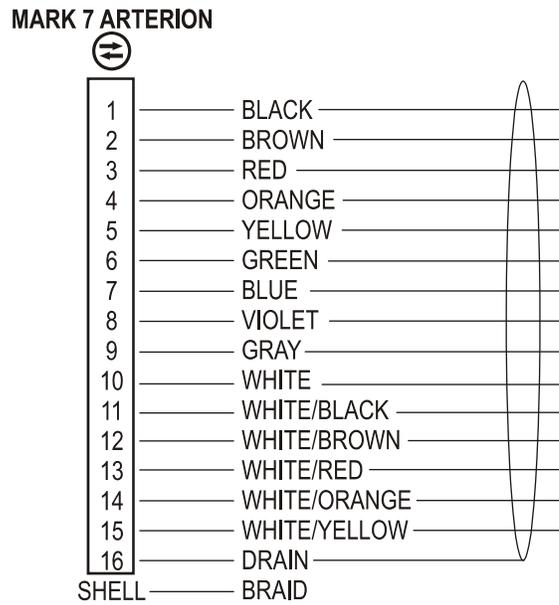


Figure 6 - 11: Universal ISI Cable (XMC 906i) - For use with Toshiba and Shimadzu

6.9.5.4 ISI Cable Pinout - Siemens

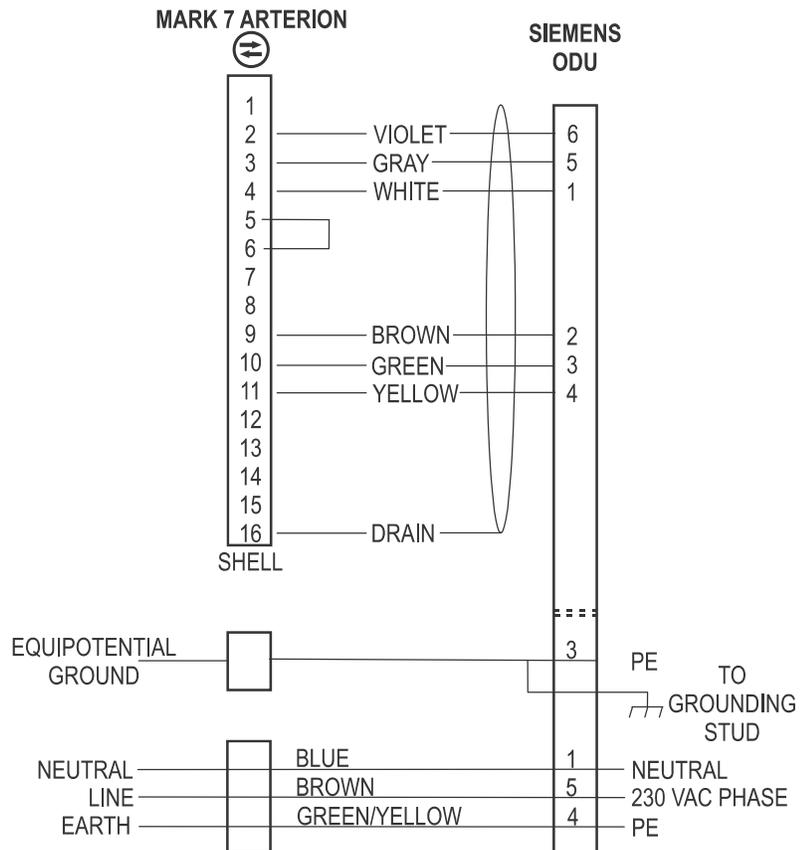


Figure 6 - 12: Siemens ISI Cable (XMC 977A)

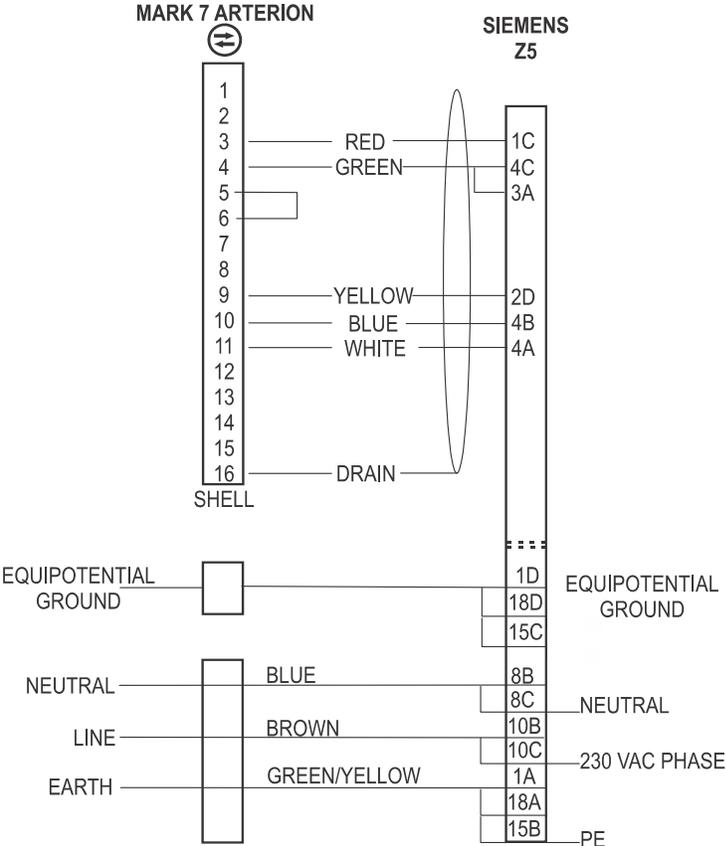


Figure 6 - 13: Siemens ISI Cable (XMC 970)

NOTE: Replace internal ISI Cable 3011596 with 3016360.

6.9.5.5 ISI Cable Pinout - Philips

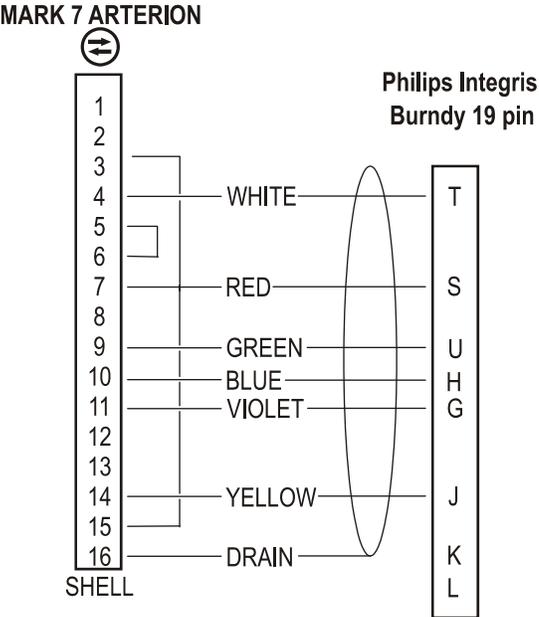


Figure 6 - 14: Philips Integris ISI Cable - Table Connection (XMC 925A)

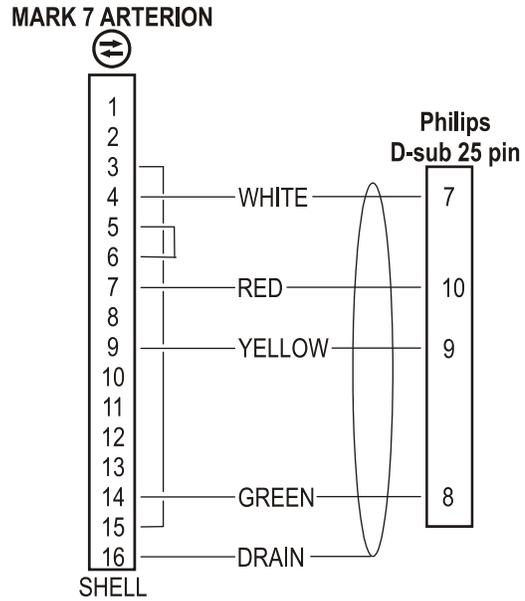


Figure 6 - 15: Philips Integris ISI Cable - Remote Power Unit (XMC 945S and XMC 945 40)

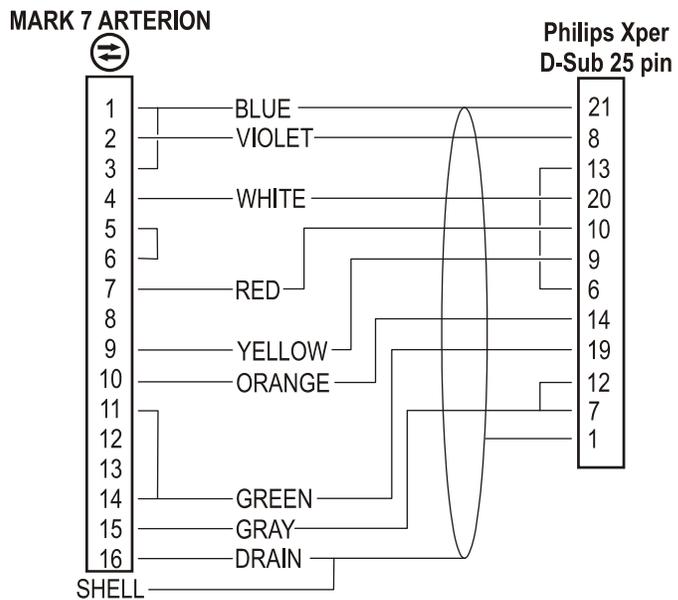


Figure 6 - 16: Philips Allura Xper ISI Cable - Remote Power Unit (XMC 947R)

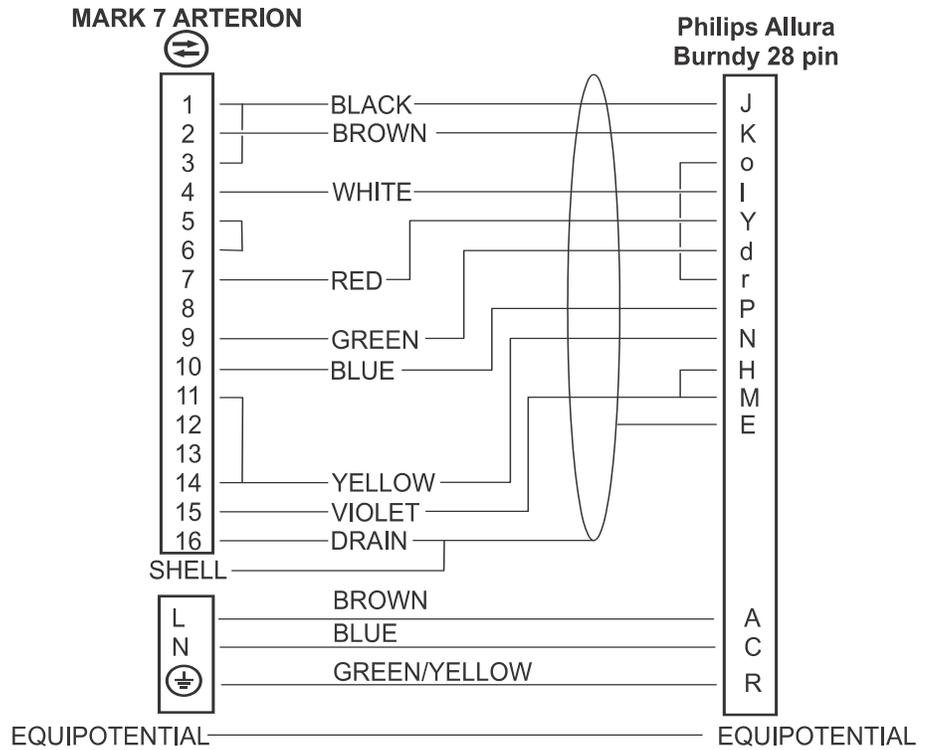


Figure 6 - 17: Philips Allura Xper ISI Cable - Table Connection (XMC 927A)

6.9.5.6 ISI Cable Pinout - GE OEC

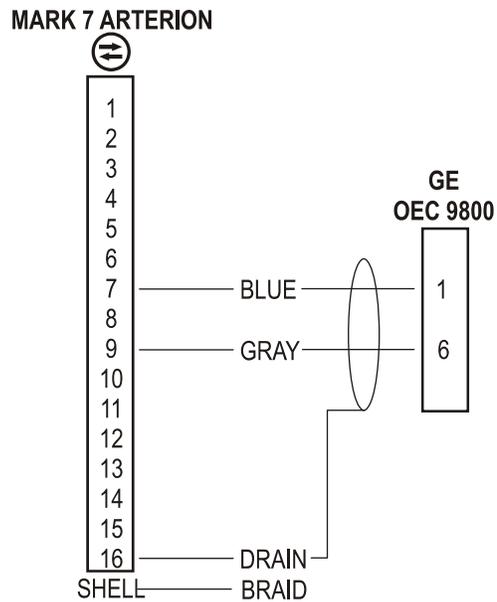


Figure 6 - 18: GE OEC ISI Cable

6.9.5.7 ISI Cable Pinout - GE

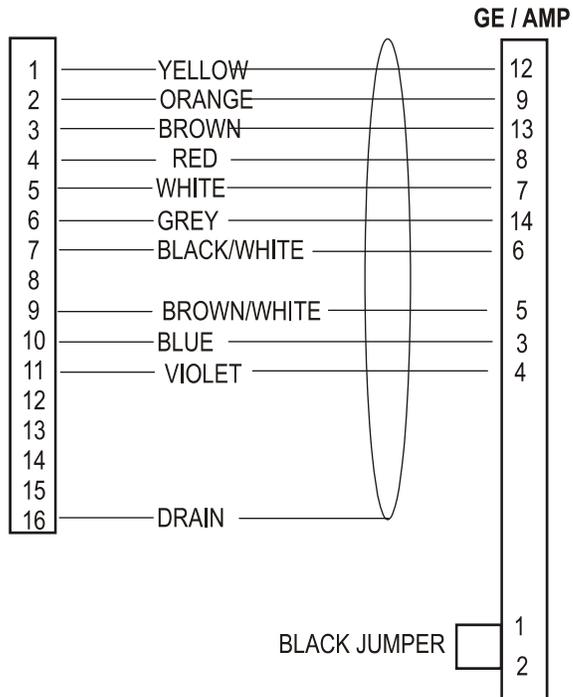


Figure 6 - 19: GE ISI Cable - Remote Power Unit (XMC 917A)

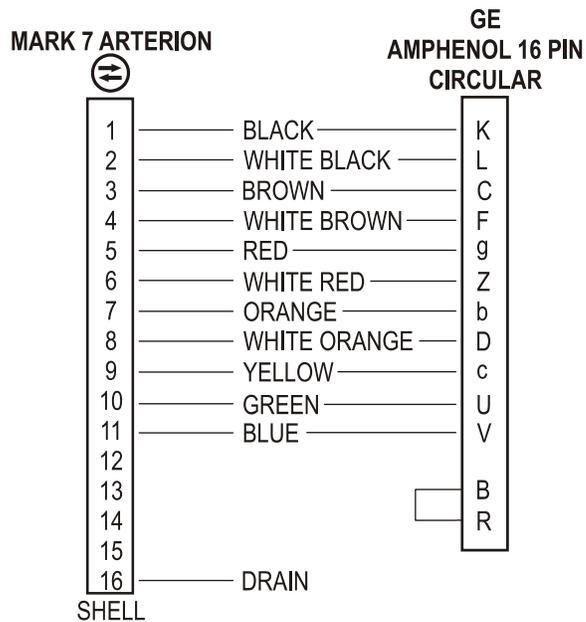


Figure 6 - 20: GE ISI Cable - Table Connection (XMC 915R)

7 Disassembly/Assembly

⚠ WARNING

Electric Shock Hazard - Serious patient and/ or worker injury or death may result.

- Perform calibration when specific components listed below are replaced in the system.

NOTICE

Mechanical Hazard - Minor or moderate patient and/or worker injury may result.

- Ensure all gaskets are properly seated and not damaged upon re-assembly.

NOTE: Electronic assemblies contain potentially hazardous materials. Dispose of system components or accessories properly. Follow all local regulations for the recycling or disposal of electronic assemblies, or contact MEDRAD Service for assistance.

When troubleshooting the MEDRAD *Mark 7 Arterion 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 Diagram and Parts List, specifying components that may require replacement. To order replacement parts, contact MEDRAD Service, or your authorized MEDRAD dealer.

This chapter shows disassembly and assembly for the following sub-assemblies:

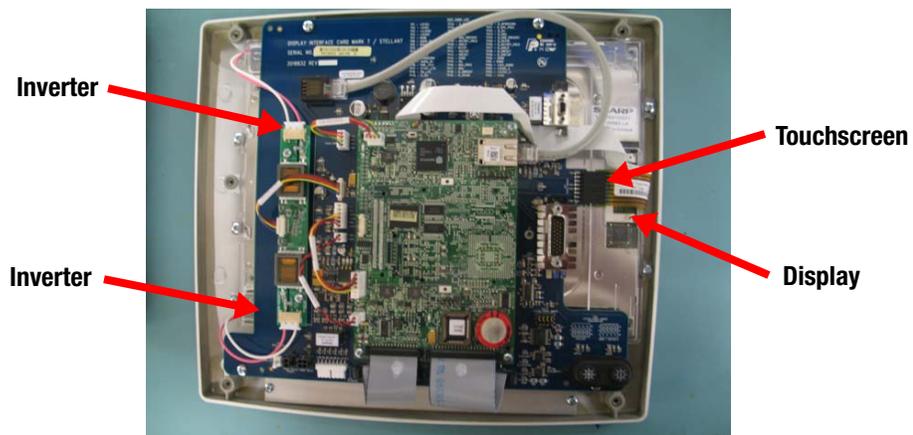
- "Display Control Unit"
- "Head"
- "Power Unit"

7.1 Display Control Unit

7.1.1 Touch Screen 3031224

To remove old touch screen:

1. Disconnect power cable and start switch (or start switch connector cover) from back of display.
2. Remove the four screws that secure the back cover on.
3. Carefully lift up the back cover. The power cable remains attached to the cover.
4. Disconnect the two power switch connectors and speaker connector from the board.
5. Lift rear cover off.
6. Remove touch screen cable.
7. Remove the white cable going from CPU card to display at the display. Cable will not be able to be removed until the display cover is removed.
8. Remove CCFT inverter connectors (pink and white wires).



9. Remove the four screws securing the interface card, and fold the card to side with white connector.
10. Remove the eight screws securing the clear plastic display cover and lift off the display cover.
11. Remove copper tape from the display to cover, leaving it attached to cover.
12. Lift out the display.
13. Lift out the touch screen.

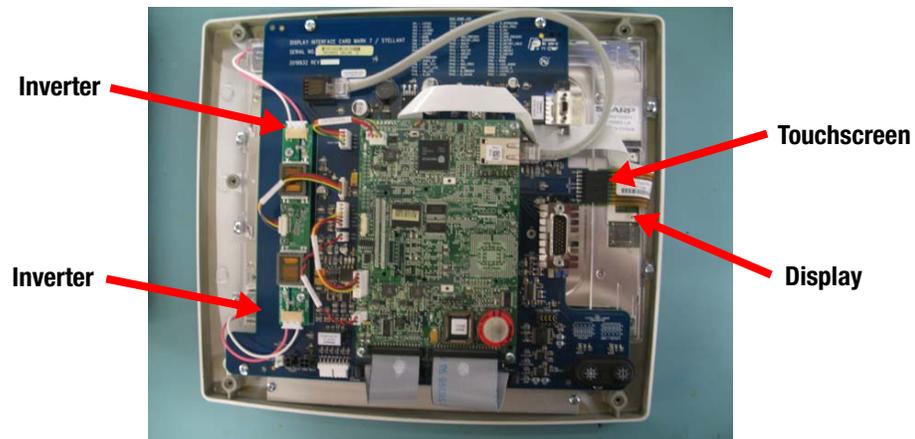
To install new touch screen:

1. Ensure the new touch screen is clean before installing.
2. Set touch screen into the cover. Ensure it lays flat (the metal tabs on the connector face upwards and the label faces down).
3. Set the display into cover. Ensure it lays flat.
4. Install the white connector to display.
5. Install the copper tape back onto display.
6. Install the display cover over the display, and secure it with eight screws.
7. Install interface card into assembly, and secure it with four screws.
8. Attach the two connectors from the display to the inverter card.
9. Install the touch screen cable to interface card.
10. Connect the two power switch connectors and speaker connector from rear cover to board.
11. Install the cover, and secure it with four screws.
12. Reconnect any removed cables or covers.

7.1.2 LCD Display 3004231

To remove old LCD display:

1. Disconnect display power cable and start switch (or start switch connector cover) from back of display.
2. Remove the four screws that secure the back cover on.
3. Carefully lift up the back cover. The power cable remains attached to the cover.
4. Disconnect the two power switch connectors and speaker connectors from the board.
5. Lift off the rear cover.
6. Remove the touch screen cable.
7. Remove the white cable going from the SBC card to display at the display. The cable will not be able to be removed until the display cover is removed.
8. Remove the inverter connectors.



9. Remove the four screws securing the interface card, and fold the card to side with white connector.
10. Remove the eight screws securing the clear plastic display cover and lift off the display cover.
11. Remove copper tape from the display to cover, leaving it attached to cover.
12. Lift out the display.

To replace LCD display:

1. Ensure the new display is clean before installing.
2. Set display into cover. Ensure it sits flat.
3. Install the white connector to display.
4. Install the copper tape back onto display.
5. Install the display cover over the display, and secure it with eight screws.
6. Install the interface card into assembly, and secure with four screws.
7. Attach two connectors from the display to the inverter card.
8. Install the touch screen cable to the interface card.
9. Connect the two power switch connectors and speaker connector from rear the cover to the board.
10. Install the cover, and secure it with four screws.
11. Reconnect any removed cables or covers.

7.1.3 DCU Interface Card 3018832

To remove old DCU Interface card:

1. Disconnect the display power cable and start switch (or start switch connector cover) from the back of the display.
2. Remove the four screws that secure the back cover on.
3. Carefully lift up the back cover. The power cable remains attached to the cover.
4. Disconnect the two power switch connectors and speaker connector from the board.
5. Lift off the rear cover.
6. Remove the touch screen cable.
7. Remove the cables going to SBC card on the interface card (leave it connected to SBC card).



8. Remove the four screws that secure the SBC card.
9. Carefully lift up the card and disconnect ribbon cable attached to the back of card.
10. Remove the two screws securing the inverter card, and then remove the card.
11. Remove the five screws securing the card, and remove the card.

To install new Interface card:

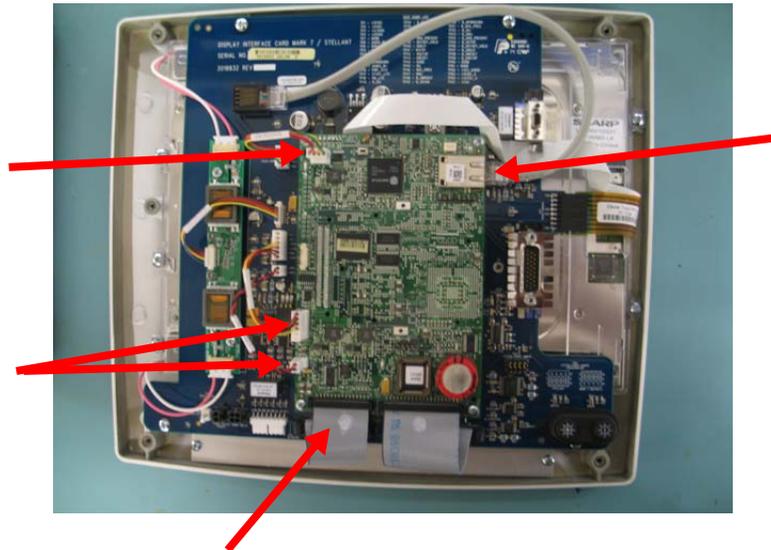
1. Set the switch on the new card to *Mark 7 Arterion* configuration.
2. Install the new interface card into the assembly, and secure it with five screws.
3. Install the Inverter card removed from the previous card onto the new card, and secure it with two screws.
4. Attach the three connectors to the inverter card.
5. Install the white cable to the connector on the rear of the CPU card.
6. Set the card onto the display interface card, and secure it with the four screws.
7. Install the connectors removed (two ribbon cables, an Ethernet cable, and three connectors) from the CPU card.
8. Connect the two power switch connectors and speaker connector from the rear cover to the board.
9. Install the cover, and secure it with four screws.
10. Reconnect any removed cables or covers.

7.1.4 SBC Card 3011679

NOTE: This card contains software that must be matched with other parts of the unit. Do not replace the card unless you have the ability to load software.

To remove old CPU Card:

1. Disconnect the display power cable and start switch (or start switch connector cover) from the back of display.
2. Remove the four screws that secure the back cover on.
3. Carefully lift up the back cover. The power cable remains attached to the cover.
4. Disconnect the two power switch connectors and speaker connector from the board.
5. Remove the rear cover.
6. Disconnect the two ribbon cables, the Ethernet cable, and three connectors from the CPU card.



7. Remove the four screws that secure the CPU card.
8. Carefully lift up the card, and disconnect the ribbon cable attached to back of card.

To install new CPU Card:

1. Install the white cable to the connector on the rear of the card.

2. Set the card onto the display interface card, and secure it with the four screws
3. Install the connectors removed (the two ribbon cables, the Ethernet cable, and the three connectors) from the CPU card.
4. Connect the power switch connectors (2) and speaker connectors from the rear cover to the board.
5. Install the cover, and secure it with the four screws.
6. Reconnect any removed cables or covers.

7.1.5 CCFT Inverter Card 3006249

To remove old inverter card:

1. Disconnect the display power cable and start switch (or start switch connector cover) from the back of the display.
2. Remove the screws that secure the back cover on.
3. Carefully lift up the back cover. The power cable remains attached to the cover.
4. Disconnect the two power switch connectors and speaker connector from the board.
5. Lift off the rear cover.
6. Disconnect the three connectors from the inverter card
7. Remove the two screws securing the cards, and remove the cards.

To install new Inverter card:

1. Install the new inverter card, and secure it with the two screws.
2. Install the three connectors.



3. Connect the two power switch connectors and speaker connector from rear cover to board.
4. Install the cover, and secure it with the four screws.
5. Reconnect any cables removed.

7.1.6 Speaker 3007656

To remove old speaker:

1. Disconnect the display power cable and start switch (or start switch connector cover) from the back of the display.
2. Remove the screws that secure the back cover on.
3. Carefully lift up the back cover. The power cable remains attached to the cover.
4. Disconnect the two power switch connectors and speaker connector from the board.
5. Lift off the rear cover.
6. Remove the two screws securing the speaker bracket.
7. Lift the speaker out of the cover.

To install new speaker:

1. Set the new speaker into the cover with wires facing the power switch.
2. Install the speaker bracket, and secure it with the two screws.

3. Connect the two power switch connectors and speaker connector from the rear cover to the board.
4. Install the cover, and secure it with the four screws.
5. Reconnect any removed cables or covers.

7.1.7 Power Switch 3007641

To remove old power switch:

1. Disconnect display power cable and start switch (or start switch connector cover) from back of display
2. Remove four screws that secure the back on
3. Carefully lift back cover up. Cover is still secured with cable
4. Disconnect two power switch connectors and speaker connector from board
5. Lift rear cover off.
6. Slide power switch out of cover.
7. Remove the yellow wire from the old switch

To install new power switch:

1. Install yellow wire removed from old switch onto the new switch
2. Slide new power switch into cover with door opening downward.
3. Connect two power switch connectors and speaker connector from rear cover to board.
4. Install cover and secure with four screws.
5. Reconnect any cables removed.

7.2 Head

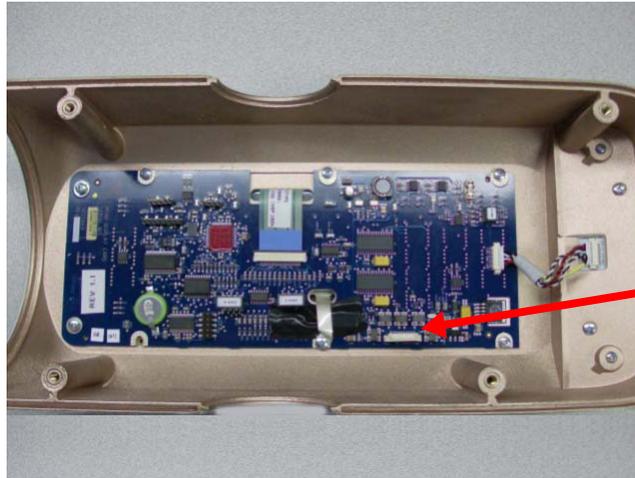
7.2.1 Top Head Cover 3026093

To remove old head cover:

1. Remove the four screws from the bottom cover.



2. Unplug the cable running to the head display card.



3. Lift off the cover.

NOTE: If you are replacing the head cover order the following parts. They cannot be reused from the existing cover.

- Top overlay 3026097
- Gaskets 3028048 and 3028044

To install new head cover:

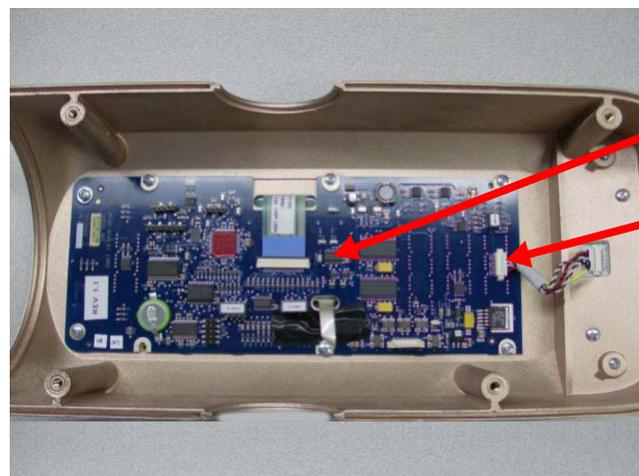
1. Install the cable from the top cover to the head display card.
2. Set the cover onto the head. Ensure that no wires are pinched.
3. Secure cover with the four screws previously removed.

7.2.2 Head Display Card 3025869

To remove head display card:

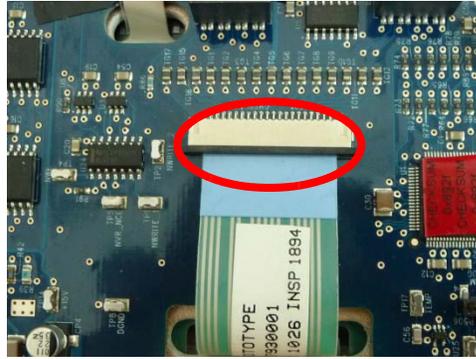
1. Remove the top head cover
2. Remove the arm light connector.
3. Remove the overlay connector. Slide the lock away from connector, and then, slide the cable out.

NOTE: be careful not to pull the lock out too far. The lock can break off of the connector body if too much force is applied.

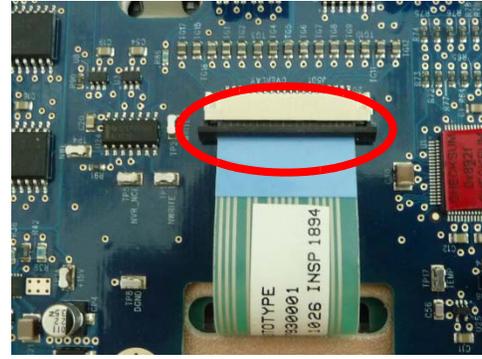


**Overlay
Connector**

**Arm Light
Connector**



Locked



Unlocked

4. Remove the eight screws securing the card to the cover.
5. Lift out the card.

To install head display card:

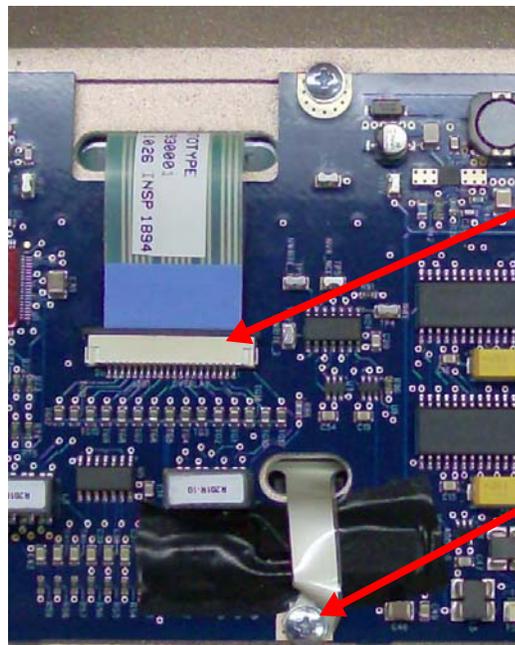
1. Feed Ground strap cable through the card. Install and secure the card with eight screws. Ensure the ground tab from the overlay is under the mounting screw.
2. Install the arm light connector.
3. Insert the overlay connector, and slide the locker into place to lock the connector.
4. Install the top covers.

7.2.3 Top Overlay 3026097

To remove the top overlay:

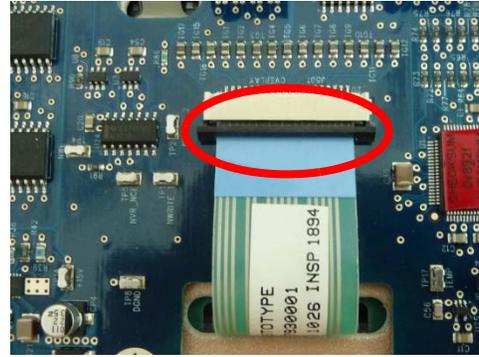
1. Remove the top head cover.
2. Remove the overlay connector. Slide the lock away from connector, and then, slide the cable out.

NOTE: be careful not to pull the lock out too far. The lock can break off of the connector body if too much force is applied.





Locked



Unlocked

3. Remove the screw holding the ground tab.
4. Peel off the overlay from the top of the cover.

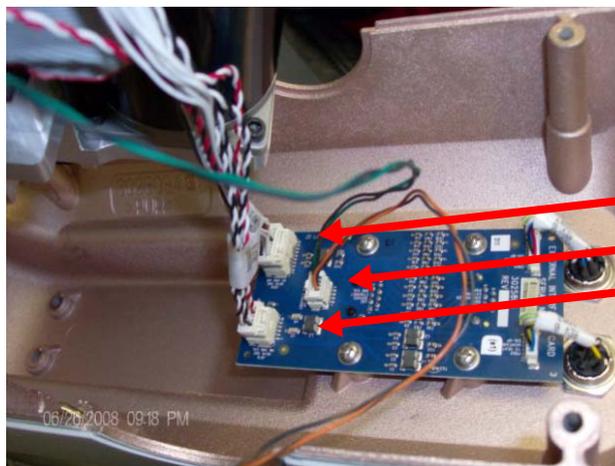
To install the top overlay:

1. Clean the cover of any residue from the old overlay.
2. Feed the ribbon connector through the top cover.
3. Remove the backing from the new overlay.
4. Feed the ground strap cable through the cover before securing the overlay.
5. Insert the overlay connector, and slide the locker into place to lock the connector.
6. Secure the ground strap with the screw.
7. Install the top cover.

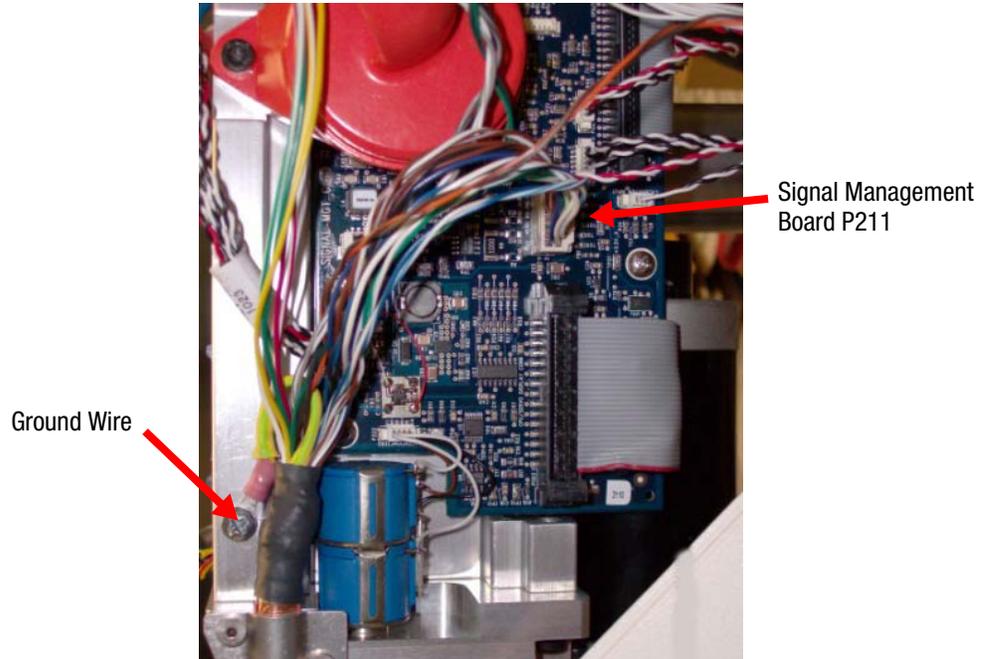
7.2.4 Bottom Head Cover 3026094

To remove bottom head cover:

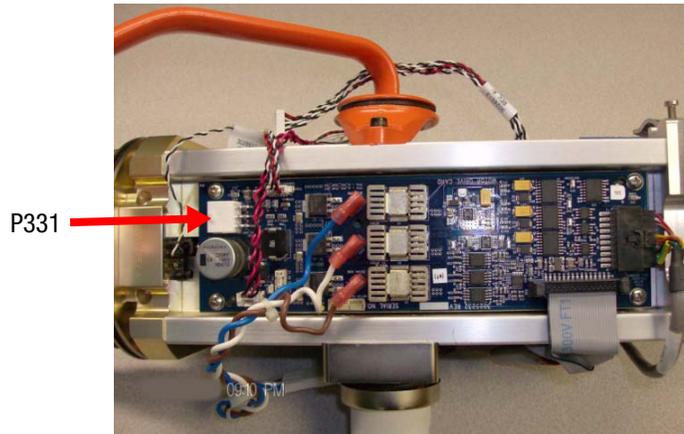
1. Remove the top cover.
2. Slide off the manual knob.
3. Remove the two screws from the bottom cover.
4. Tilt the cover down, and remove the three connectors from the external interface card.



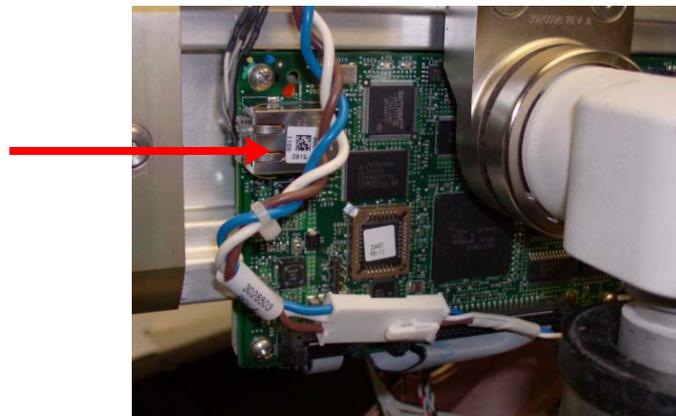
5. Remove the Ground wire.



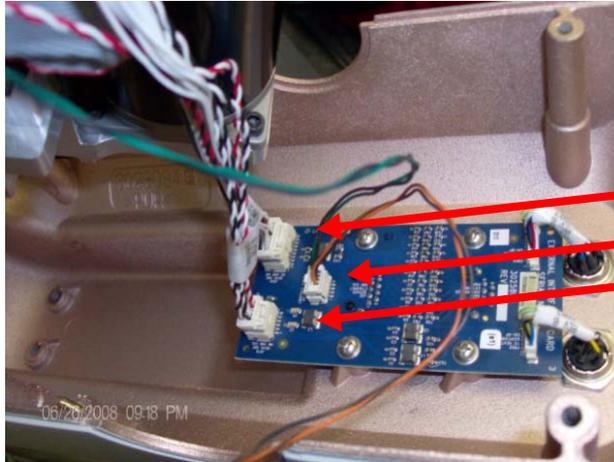
6. Disconnect the connector to the signal management card.
7. Remove the connector from the Motor Drive card.



8. Remove the Ethernet cable from the Servo CPU card.



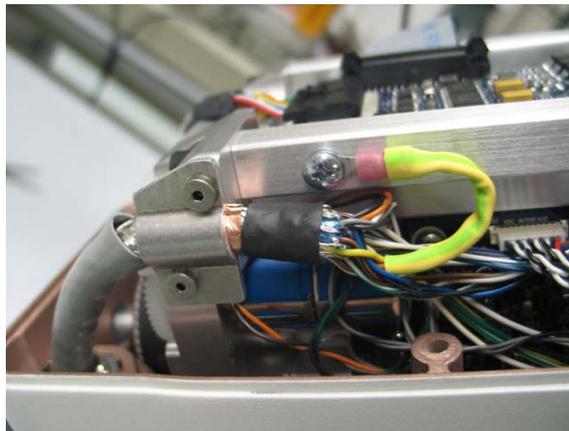
9. Tilt the cover down, and remove the three connectors from the external interface card.



10. Remove the two screws holding the head cable clamp to the rear plate 5/64 hex key.
11. Lift off the cover and cable.

To install bottom head cover:

1. Position the head cover so that the head cable can be secured to the rear plate.



2. Secure the head cable to the rear plate with the cable clamp over the exposed copper tape on the cable.
3. Route the wires under the handle, and connect the three connectors to external interface card.
4. Route the Ethernet connector wires under the handle, and connect it to the Servo CPU card.
5. Route the wires under the handle, and connect P331 connector to power card.

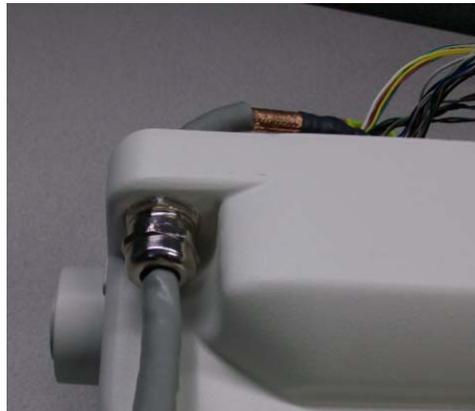


6. Connect the P211 connector to the signal management card.
7. Attach the ground wire to frame.
8. Seat the head cover onto head. Verify that no wires are being pinched.
9. Secure the cover with two screws.
10. Install the manual knob.

7.2.5 Head Cable 3026385

To remove head cable:

1. Remove the bottom cover.
2. With a 7/8 open-end wrench or tool P/N 3031378, loosen the top nut holding the cable strain relief to cover.



3. Once nut is off of the inside cover, slide the cable out of the cover.

To install head cable:

1. Remove the nut from the new cable.
2. Slide the cable into the cover.
3. Replace the nut onto the cable, and seat it into the bottom cover.



4. Rotate the cable to secure the nut. Tighten the nut with 7/8 wrench.
5. Install the top and bottom covers.

7.2.6 Drop Front Boot 3008379

To remove the drop front boot:

1. Remove the top and bottom covers.
2. Use a 1/8 hex key to remove the two screws securing the handle to the front plate.
3. Use a 5/32 hex key to remove the screw securing the handle to side of the head.
4. Remove the handle.
5. Use a 1/8 hex key to remove the two screws on the bottom of the drop front.
6. Use a 1/8 hex key to remove the two screws securing the arms into the front plate.
7. Lift off the drop front arms and the metal ring.
8. Slide the arms out of the metal ring.
9. Pull the old boot out of the metal ring.

To install the drop front boot:

1. Slide the new boot into metal ring. Ensure that it fully seats into the plate.
2. Carefully slide the arms through the boot.
3. Slide the arms and the metal plate onto head, and secure them with the two screws securing the arms.
4. Secure the two bottom screws into the metal plate.
5. Set the handle onto the front plate, and secure the handle with two screws. Apply Loctite® 242 to the screws.
6. Secure the screw holding the handle to the side of head. Apply Loctite 242 to the screw.
7. Install the top and bottom covers.

7.2.7 Drop Front 3026577

To remove drop front:

1. Remove the top and bottom covers.
2. Use a 1/8 hex key to remove the two screws securing the handle to the front plate.
3. Use a 5/32 hex key to remove the screw securing the handle to side of the head.
4. Remove the handle.
5. Use a 1/8 hex key to remove the two screws on the bottom of the drop front.

6. Use a 1/8 hex key to remove the two screws securing the arms into the front plate.
7. Lift off the drop front arms and the metal ring.
8. Remove the drop front and syringe sensor switch.
9. Use a 3/16 hex key to remove the four bolts securing the front plate to the frame.
10. Slide the front plate off of the piston.

To install drop front:

1. The new drop front comes with a front plate attached to metal ring.
2. Remove the four screws holding the metal ring to front plate, and slide the metal ring forward onto arms.
3. Install the front plate onto the piston, and secure it onto the head with the four bolts.
4. Slide the metal plate back against the front plate.
5. Secure the two bottom screws onto metal plate.
6. Set the handle onto the front plate, and secure the handle. Apply Loctite 242 to the screws.
7. Install the screw holding the handle to the side of the head. Apply Loctite 242 to the screws.
8. Install the drop front and the syringe sensor switch.
9. Install the top and bottom covers.

7.2.8 Front Piston Seal 3010951

To remove front piston seal:

1. Remove the drop front.
2. Note the orientation of the front seal in the plate; then, carefully pry seal from the front plate.

To install front piston seal:

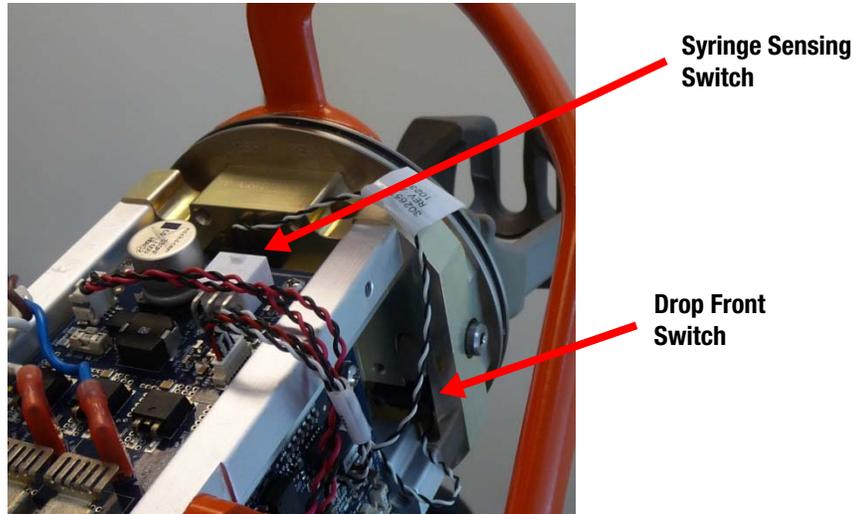
1. Clean the piston rod before installing the new seal.
2. Place the new seal into the groove on the front plate. Orient as noted above.
3. Install the front plate onto the piston rod.
4. Secure the front plate with four bolts.
5. Install the front plate arms and the metal ring.
6. Install the top and bottom covers.

7.2.9 Drop Front Switch and Syringe Sensor Switch 3026511

NOTE: The switches come as a set.

To remove drop front switch and syringe sensor switch:

1. Remove the top and bottom covers.



2. Remove the four screws holding the interface card, and slide the card back to gain access to the switch.
3. Use a 3/32 hex key to remove the screw holding the drop front switch into the front plate.
4. Remove the four screws securing the power card, and slide the card back to gain access to the switch.
5. Use a 3/32 hex key to remove the screw securing the syringe sensing switch onto front plate.
6. Lift out the switches.
7. Disconnect the cable from the interface card.

To install drop front switch and syringe sensor switch:

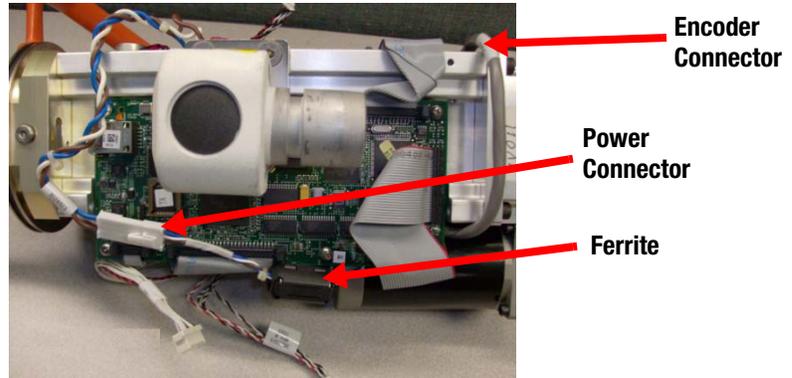
1. Thread the screw into the new drop front switch and into front plate.
2. Rotate switch until it fully seats into the front plate.
3. Secure the screw.
4. Thread the screw into the new syringe sensor switch and into front plate.
5. Rotate switch until it fully seats into the front plate.
6. Secure the screw.
7. Connect the cable to the interface card.
8. Secure the screws onto the power card and the interface card.
9. Install the top and bottom covers.

7.2.10 Motor 3007402

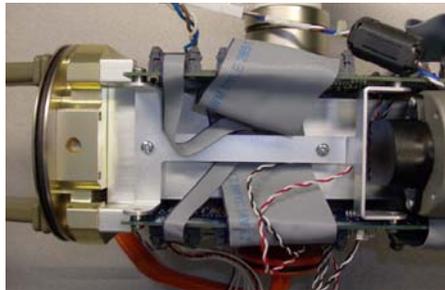
NOTE: This part requires electronic pressure calibration after replacement. Do not replace this card unless you have the ability to recalibrate the head.

To remove the motor:

1. Remove top and bottom covers.
2. Disconnect Power connector going to motor.



3. Remove ferrite from motor wires for use on new motor.
4. Disconnect Encoder connector on Power card.
5. Slide belt off large gear.
6. Remove six screws holding board support and remove support.



7. Remove four screws holding motor to rear plate 9/64 hex key.
8. Lift motor out.

To install the motor:

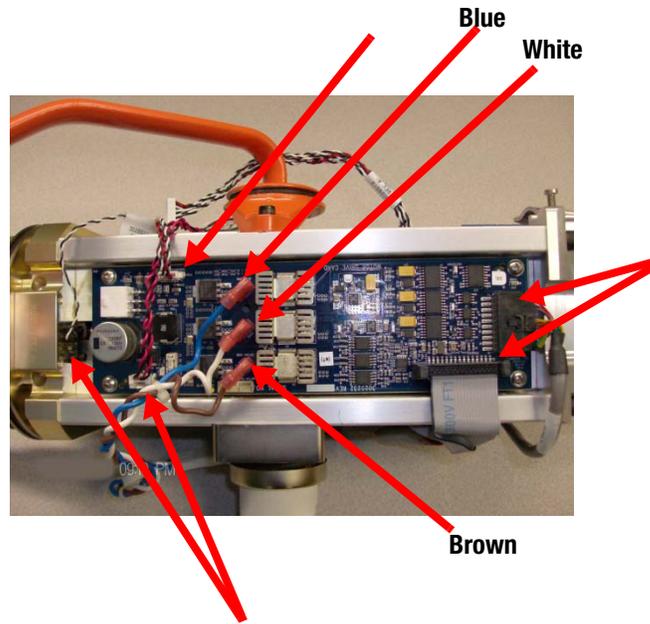
1. Install motor into rear frame with cables facing toward ball screw and away from handle.
2. Make sure motor is fully seated to rear plate. Secure with four screws.
3. Install belt onto small gear and then big gear.
4. Install board support as shown above, wire cables run under support. Secure with two screws without lock washers.
5. Install four other screws.
6. Connect encoder wires to power card.
7. Connect power connector.
8. Install ferrite onto power wires.
9. Install top and bottom covers.
10. Electrically recalibrate Pressure.

7.2.11 Motor Drive Card 3025232

NOTE: This card requires electronic pressure calibration after replacement. Do not replace this card unless you have the ability to recalibrate the head.

To remove the motor drive card:

1. Remove top cover.
2. Disconnect eight connectors from card.



3. Remove four screws.
4. Lift card out.

To install the power card:

1. Install card and secure with four screws.
2. Install eight connectors (wire colors noted above).
3. Install top cover.
4. Electrically Recalibrate Pressure.

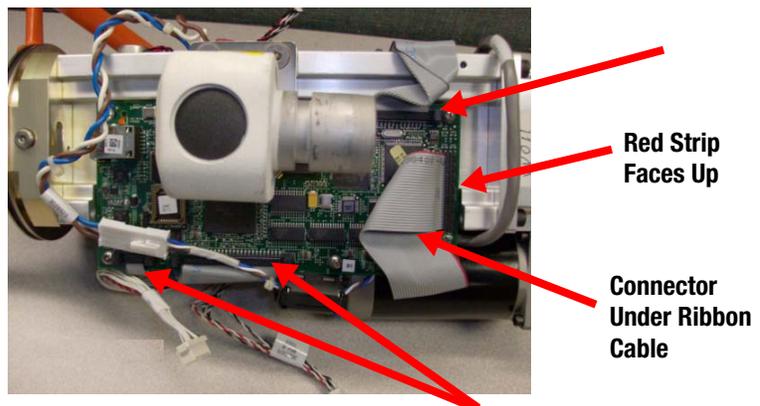
7.2.12 Servo CPU 3011677

NOTE: This card contains software that must be matched with other parts of the unit. Do not replace card unless you have the ability to correct software mismatches.

NOTE: This card contains electronic calibration values for the head. Do not replace this card unless you have the ability to recalibrate the head.

To remove Servo CPU:

1. Remove top and bottom covers.
2. Disconnect five ribbon cable.
3. Remove four screws holding card.



4. Remove card.

To install Servo CPU:

1. Install card and secure with four screws.
2. Install five ribbon cables.
3. Install top and bottom covers.
4. Electrically Recalibrate Head.

7.2.13 External Interface Card 3025803

To remove External Interface Card:

1. Remove top and bottom covers.
2. Disconnect two connectors.



3. Remove four screws securing card and remove card.
4. Remove gasket.

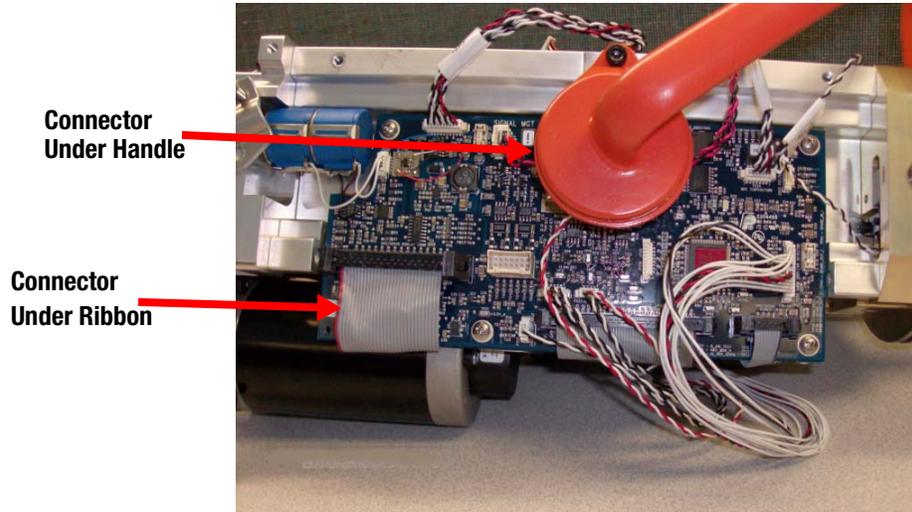
To install External Interface card:

1. Install gasket from old card onto new card.
2. Install card into bottom cover and secure with four screws.
3. Install two connectors.
4. Install top and bottom covers.

7.2.14 Signal Management Interface Card 3026179

To remove Signal Management Interface card:

1. Remove top and bottom covers.
2. Disconnect fourteen connectors.



3. Remove four screws.
4. Lift card out.

To install Signal Management Interface card:

1. Install new card and secure with four screws.
2. Install all fourteen connectors to card.
3. Install top and bottom covers.

7.2.15 Position Sensor 3026457

NOTE: This card requires electronic calibration after replacement. Do not replace this card unless you have the ability to recalibrate the head.

To remove the position sensor:

1. Remove top and bottom covers.
2. Set head on flat surface.



3. Remove two bolt holding pivot knuckle to head frame (5/32 hex key).
4. Slowly lift knuckle away from head. There is still a cable attached to the assembly.
5. Disconnect cable from position sensor card.
6. Remove screw securing card and lift card off.

To install the position sensor:

1. Rotate sensor on new card to match "D" location in shaft.
2. Set card onto shaft and alignment hole.
3. Secure with screw.
4. Connect cable to position card.

5. Set assembly onto frame and secure with two screws (loctite screws with loctite 242).
6. Install top and bottom covers.
7. Electrically Recalibrate position sensor.

7.2.16 Pot 3026512

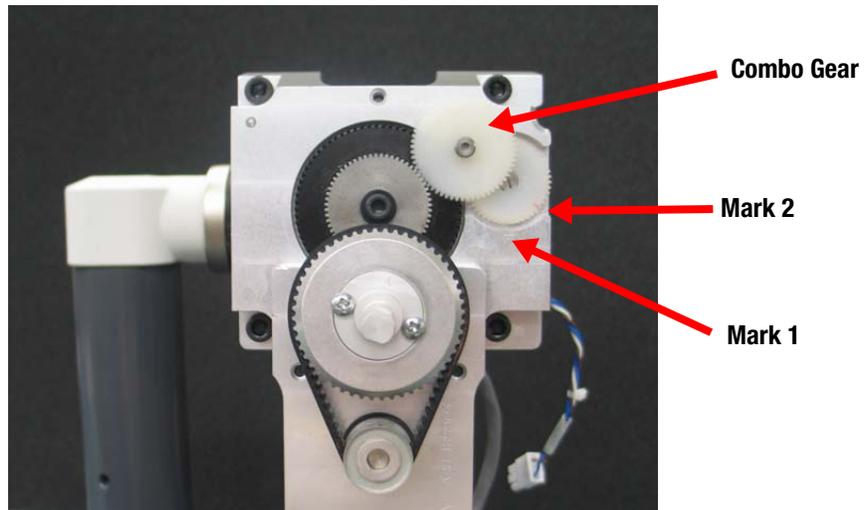
NOTE: This part requires electronic calibration after replacement. Do not replace this card unless you have the ability to recalibrate the head.

To remove Pot:

1. Remove top and bottom head covers.
2. Remove pot connector from interface card.
3. Remove four screws securing interface card.
4. Remove combo gear from rear plate (5/64 hex key).
5. Remove gear from pot.
6. Remove nut holding pot (½ nut driver).
7. Slide pot out of rear plate. You will need to slide the interface card forward to make clearance for the pot.

To install Pot:

1. Install new pot into rear plate with terminals facing down.
2. Secure with nut.
3. Rotate the pot fully clockwise.
4. Install gear onto pot shaft.
5. Mark gear to match mark on rear plate. Rotate gear to second mark on rear plate.



6. Ensure ball screw is rotated to rear stop position.
7. Install combo gear and secure with screw.
8. Install interface card with four screws removed.
9. Connect pot connector to interface card.
10. Install top and bottom covers.
11. Electrically recalibrate Pot.

7.2.17 Arm Light Card 3026323

To remove arming light card:

1. Remove top head cover.
2. Remove arm light connector from arm light board.
3. Remove two screws securing arm lens and remove lens and gasket.
4. Remove two screws securing arm light card.
5. Lift card off.

To install arming light card:

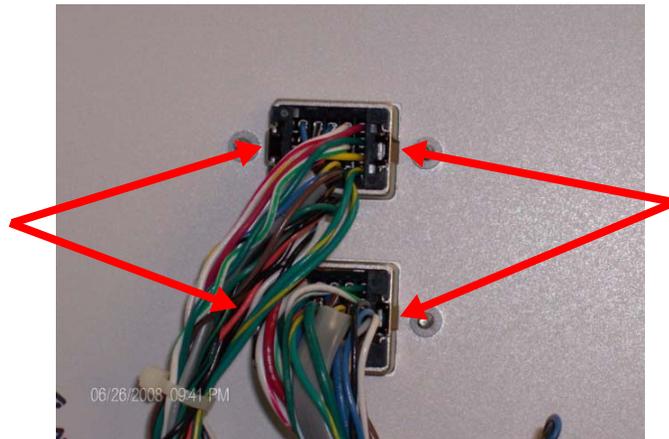
1. Install new arm light card and secure with two screws (shorter screws).
2. Install arm light gasket and arm lens. Secure with two screws. Insure gasket seats under lens.
3. Connect cable to arm light card.
4. Install top cover.

7.3 Power Unit

7.3.1 Cover 3027770

To remove cover:

1. Remove any cables attached to module.
2. Remove the fourteen screws securing the external perimeter of the cover (not connector screws).
3. Carefully lift the cover up.
4. To remove connectors from the back side of connectors push in tabs and slide connector out. The frame remains in the cover.



5. Remove cover.

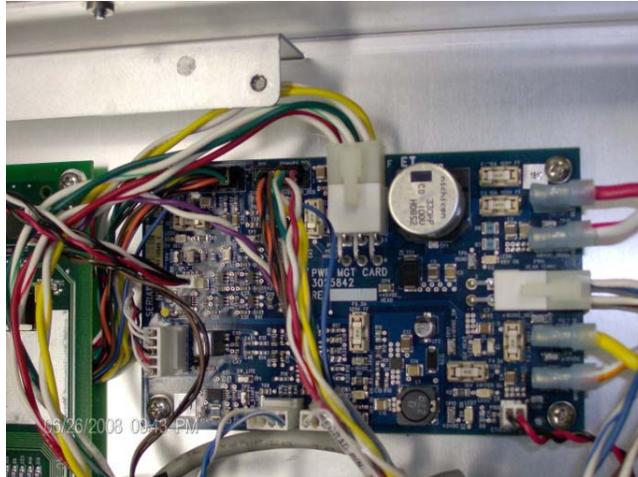
To install cover:

1. Install connectors into connector bodies in top cover. They are keyed to be installed one way. Push till they snap into place.
2. Install cover and secure with fourteen screws previously removed.

7.3.2 Power Management Card 3025842

To remove power management card:

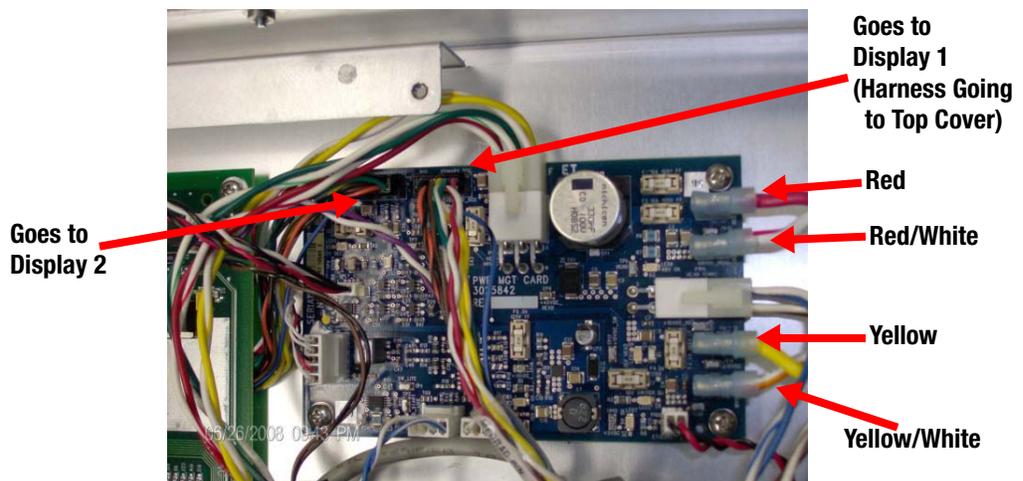
1. Remove cover.
2. Remove all fourteen connectors from the card.



3. Remove four screws and lift card out.

To install power management card:

1. Set card into module and secure with four screws.
2. Install fourteen connectors.



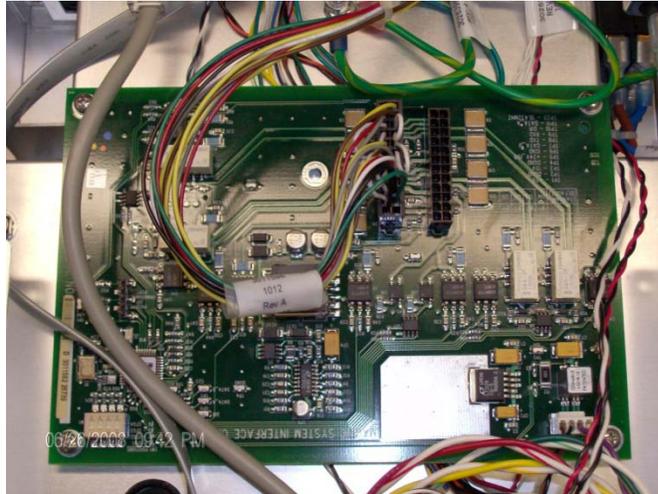
3. Install top cover.

NOTE: There is a spare connector in the unit with a blue and black wires attached to it. This is for future use.

7.3.3 ISI card 3011562

To remove ISI card:

1. Remove cover.
2. Remove power connector and output connectors from card. Note connector placement of output cable.



3. Remove four screws and lift card out.

To install ISI card:

1. Set card into module and secure with four screws.
2. Install Power connector and output connector as were previously installed.
3. Install top cover.

7.3.4 Ethernet Switch Card 3018142

To remove ethernet switch card:

1. Remove cover.
2. Remove five Ethernet cables and power connector from card.



This cable is from J11 and must be installed in this port on this card.

3. Remove four screws and lift card out.

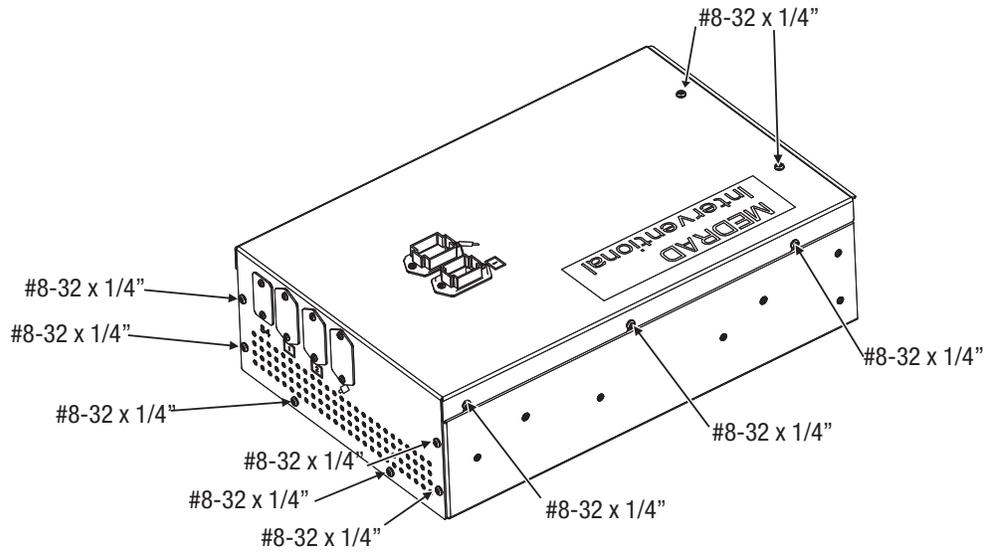
To install ethernet switch card:

1. Set card into module and secure with four screws.

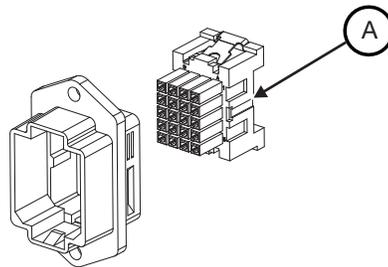
2. Install five Ethernet cables and power connector from card. Note that the cable going to J11 must be installed into port 3.
3. Install top cover.

7.3.5 Change Connector Placement

1. Disconnect the A/C Inlet plug from the Power Unit.
2. Remove the three screws from each side, two screws from the top, and six screws from the back of the Power Unit. Retain screws. All screws are #8-32 X 1/4".



3. Lift and tilt the top of the Power Unit.
NOTE: Do not lift the top of the Power Unit too high to avoid disconnecting other wires in the Power Unit.
4. Press the two metal clips (A) on the side of the Display Control Unit 1 connector and Injector Head housing to disconnect the housing from the shell.

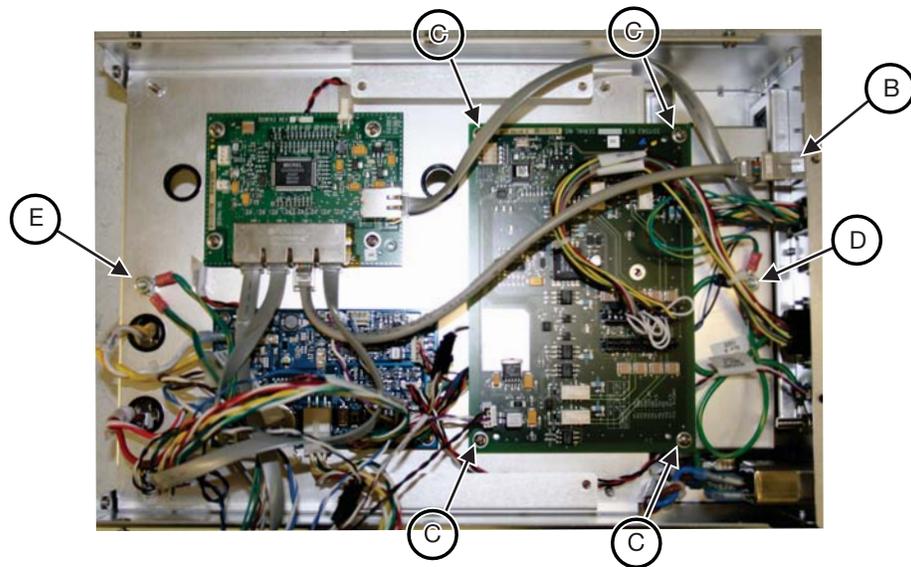


5. Remove the two screws for each of the shells. Retain the screws.
6. Lift the shells out of the top of the Power Unit.
7. Remove the port covers for Display Control Unit 1 and the Injector Head from the back plate of the Power Unit.
8. Place the port covers removed in step 7 over the empty ports on the top of the Power Unit. Use the screws removed in step 7.
9. Insert the shells into the corresponding holes in the back of the Power Unit.
NOTE: The smaller shell goes into the Display Control Unit 1 hole and the larger shell goes into the Injector Head hole.
10. Use the screws removed in step 5 to secure the shells into the holes.

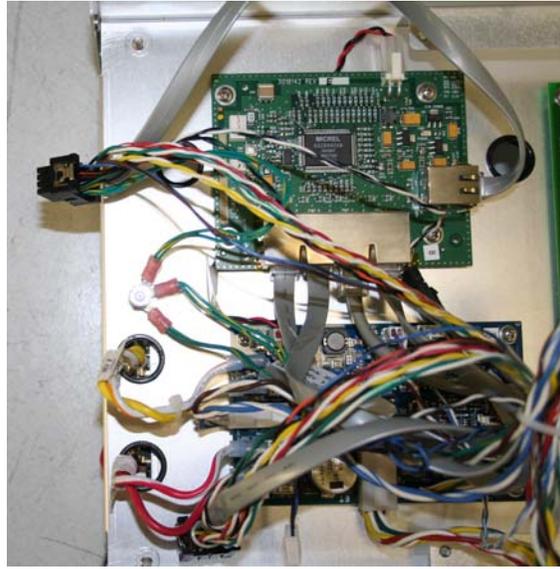
11. If relocating Display Control Unit 2 proceed to the Optional Steps. Otherwise proceed to step 12.

Optional Steps - Relocating Display Control Unit 2

- I. Press the two metal clips on the side of the Display Control Unit 2 connector housing to disconnect the housing from the shell.
- II. Remove the two screws for the Display Control Unit 2 shell on the front of the Power Unit. Retain the screws.
- III. Lift the shell out of the back of the Power Unit.
- IV. Remove the port cover for Display Control Unit 2 from the front of the Power Unit.
- V. Secure the port cover removed in step IV over the empty port on the front of the Power Use the screws removed in step IV.
- VI. Insert the shells into the Display Control Unit 2 hole in the back of the Power Unit.
- VII. Use the screws removed in step II to secure the shells into the holes.



- VIII. Disconnect cable from the back of the Service Port (B).
- IX. Remove the four screws from the ISI Card (C). Retain the screws.
- X. Remove the nut from the ground screw (D). Retain the nut.
- XI. Lift the ground wire for the Display Control Unit 2 connector off of the ground screw.
- XII. Replace the ground screw nut (D) removed in step X.
- XIII. Gently lift the ISI card and reroute the Display Control Unit 2 connector so that no longer sits under the ISI card.
- XIV. Replace the ISI card and secure it with the four screws (C) removed in step IX.
- XV. Plug the cable removed in step VIII into the back of the Service Port.
- XVI. Remove the nut from the ground screw (E). Retain the nut.
- XVII. Place the ground wire for the Display Control Unit 2 connector onto the ground screw.
- XVIII. Replace the ground screw nut (E) removed in step XVI.



XIX. Align the grooves on the Display Control Unit 2 connector with the corresponding notches on the Display Control Unit 2 shell.

XX. Snap the Display Control Unit 2 connector into place.

End Optional Steps

12. Align the grooves on the Display Control Unit 1 connector with the corresponding notches on the Display Control Unit 1 shell.

NOTE: The smaller connector is Display Control Unit 1.

13. Snap the Display Control Unit 1 connector into place.

14. Repeat steps **12** and **13** for the Injector Head connector.

15. Replace the top of the Power Unit onto the base.

16. Secure the six side screws, two top screws, and six back screws removed in step **2**.

7.3.6 Air Filter 3028075

To remove filter:

1. Remove and retain two screws securing filter cover plate and remove plate.



2. Remove the filter.

To install filter:

1. Install filter as shown in the image below for correct air flow. (cross hash facing inward).

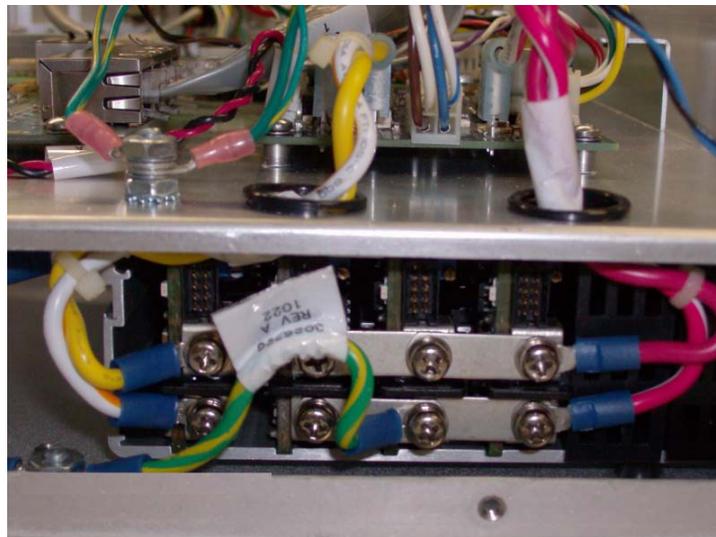


2. Install cover plate and secure with two screws removed in step 1.

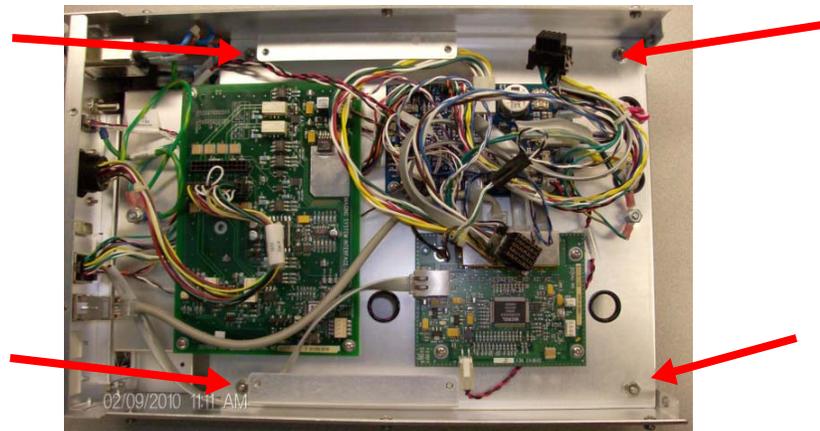
7.3.7 Power Supply 3026404

To remove power supply:

1. Remove the Power Unit Cover.
2. Remove the screws securing the five wires to the rear of the power supply.



3. Slide four of the wires removed from power supply through holes in plate. The green yellow wire does not go through a hole in the plate.
4. Remove four screws that secure the power supply from bottom cover.
5. Remove four nuts (11/32) securing the mounting plate.



6. Lift up on plate and pull towards the front of the case with the wires to the front connectors still attached.

7. Unplug AC power inlet from front of power supply and power sense connector.

NOTE: If the power sense connector cannot be removed, remove other end of the wire from Power card and then remove from power supply once out of module.



8. Remove power supply.

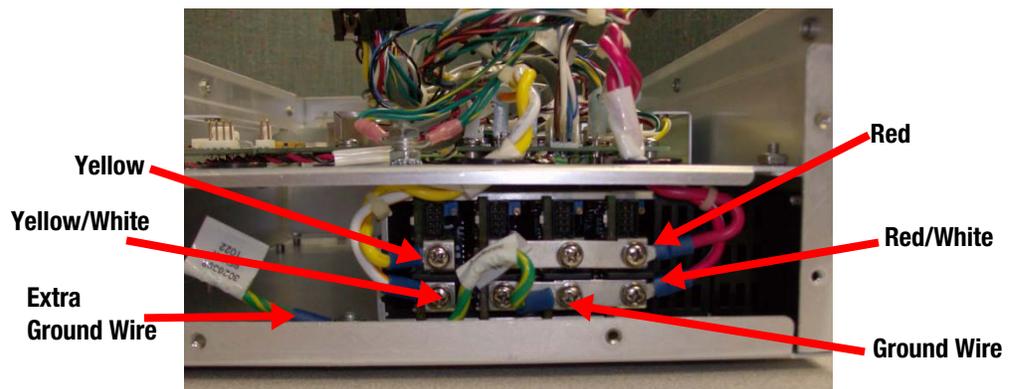
To install power supply:

1. Mount the power supply to the bottom cover with the four screws removed in step 4.
2. Attach the Power Sense Cable so that the red wire is oriented as shown in the above image.

NOTE: It is physically possible to attach the Power Sense Cable in either orientation. Make certain that the cable is installed correctly before proceeding to the next step.

3. Install AC power inlet to front of power supply and power sense connector.
4. Secure plate onto studs with four nuts.
5. Route five wires back through holes in plate and secure with screws to power supply.

NOTE: Do not attach extra ground wire.

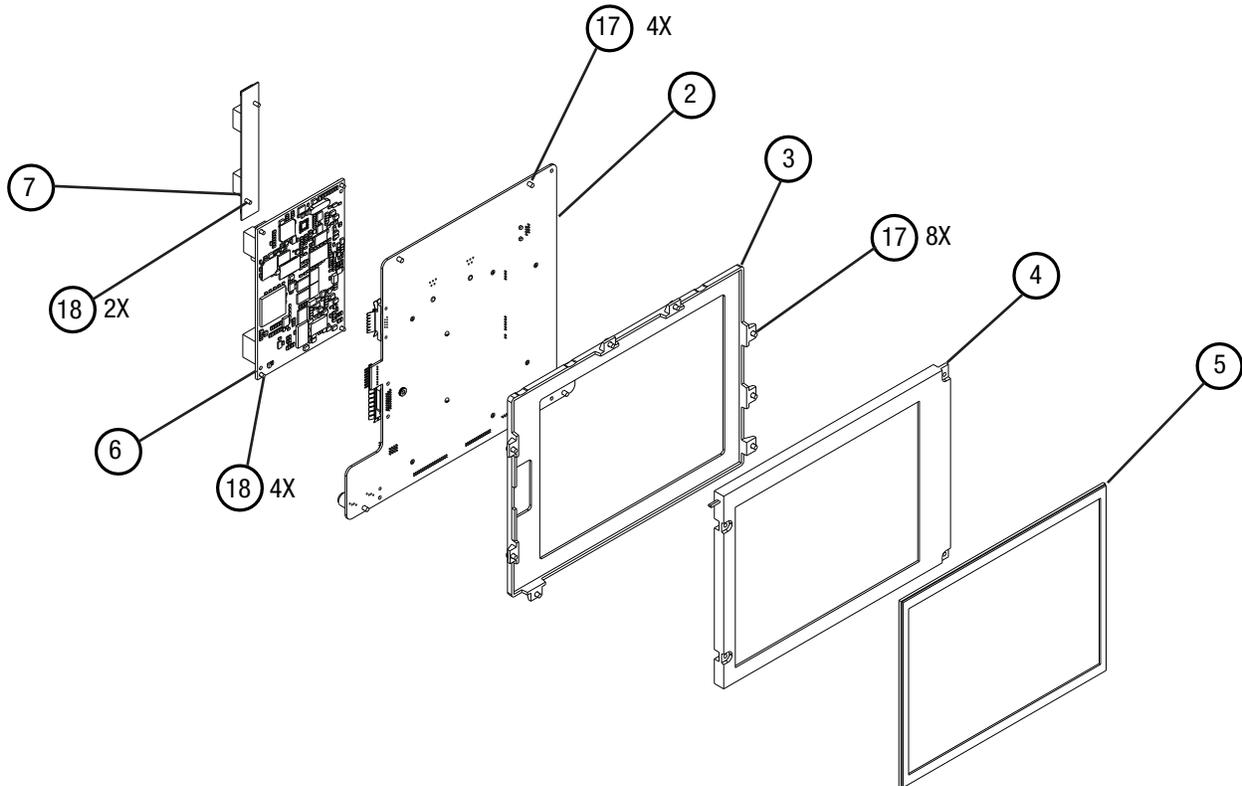


6. Reinstall cover.

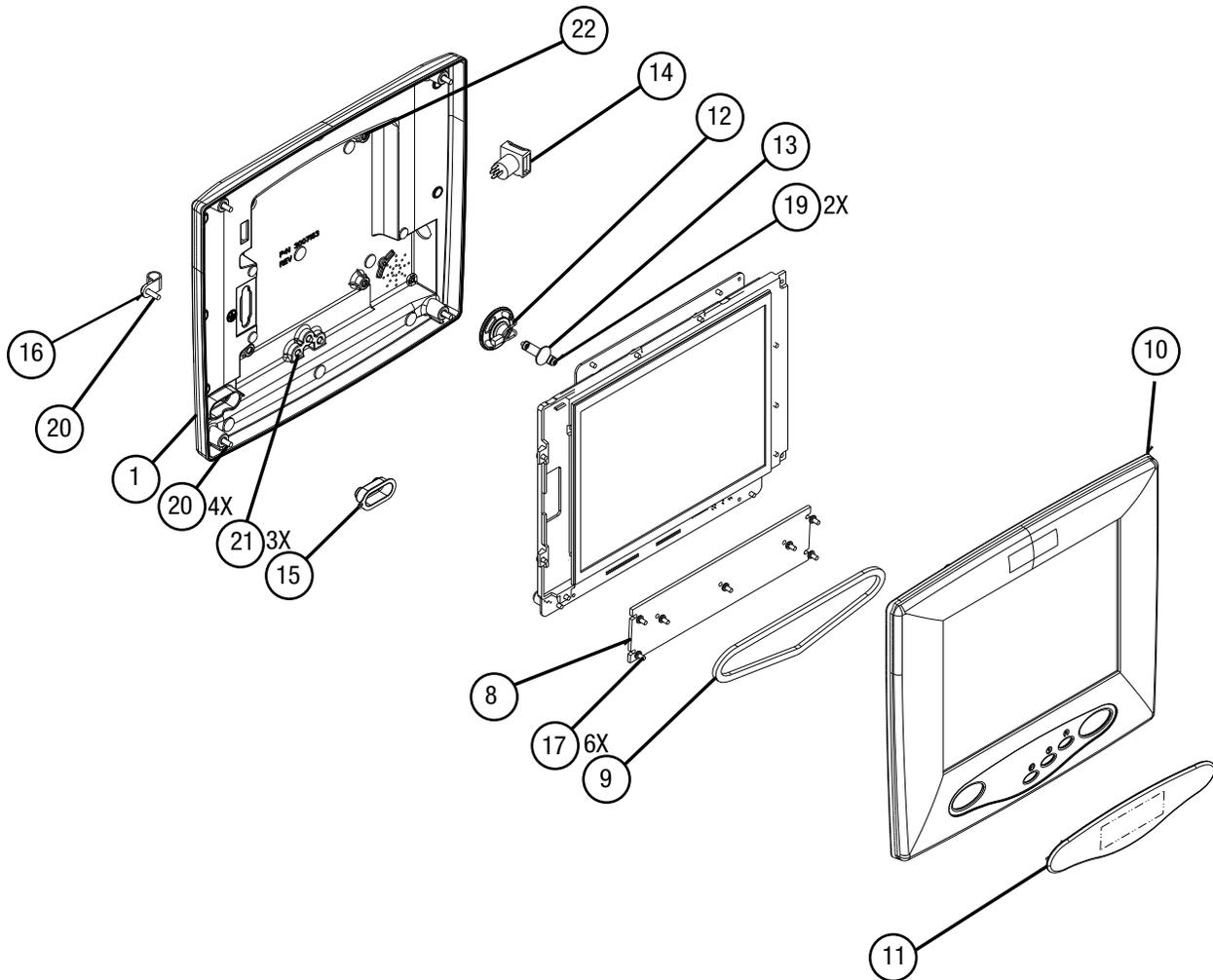
8 Replacement Parts

- Display Control Unit Assembly Drawings and Bill of Material
- Injector Head Assembly Drawings and Bill of Material
- Power Unit Assembly Drawings and Bill of Material
- Pedestal Assembly Drawing and Bill of Material

8.1 Display Control Unit Assembly Drawings and Bill of Material



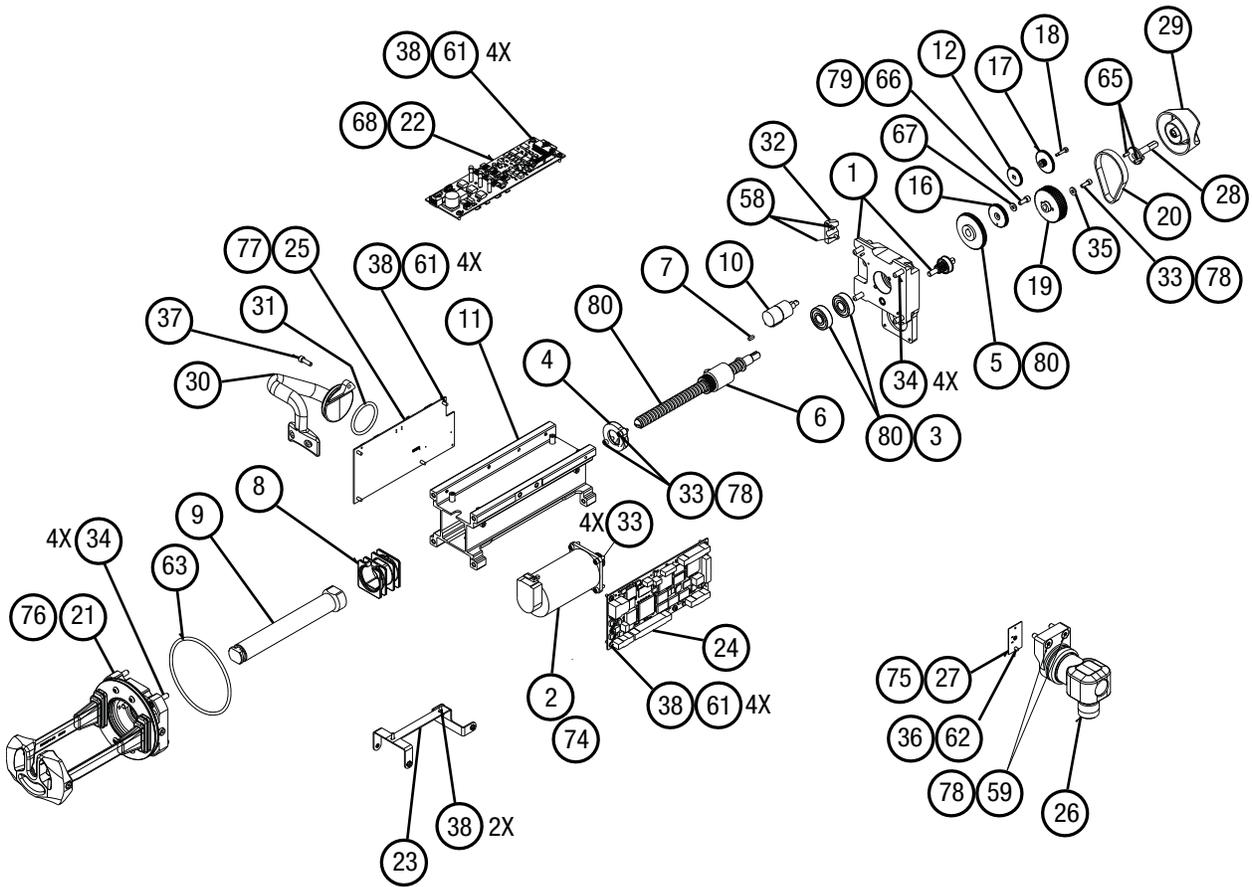
Mark 7 Arterion Injection System

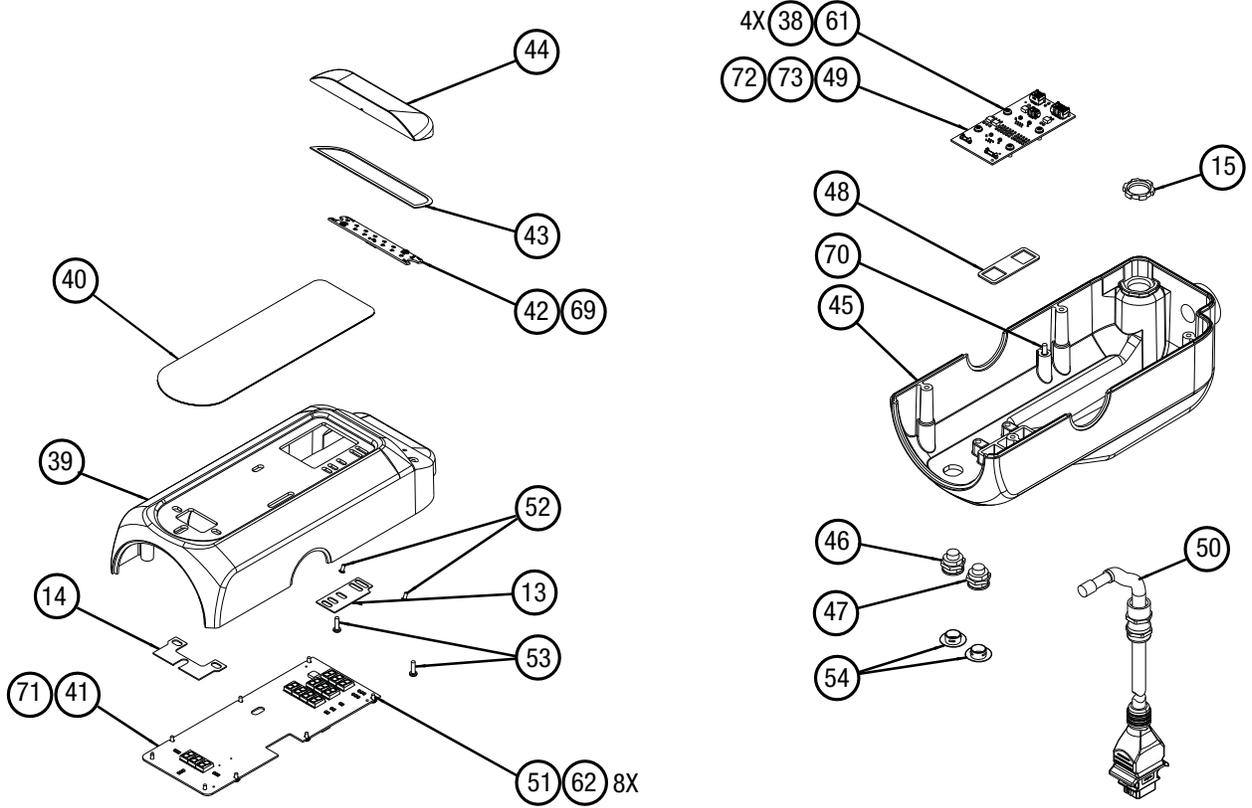


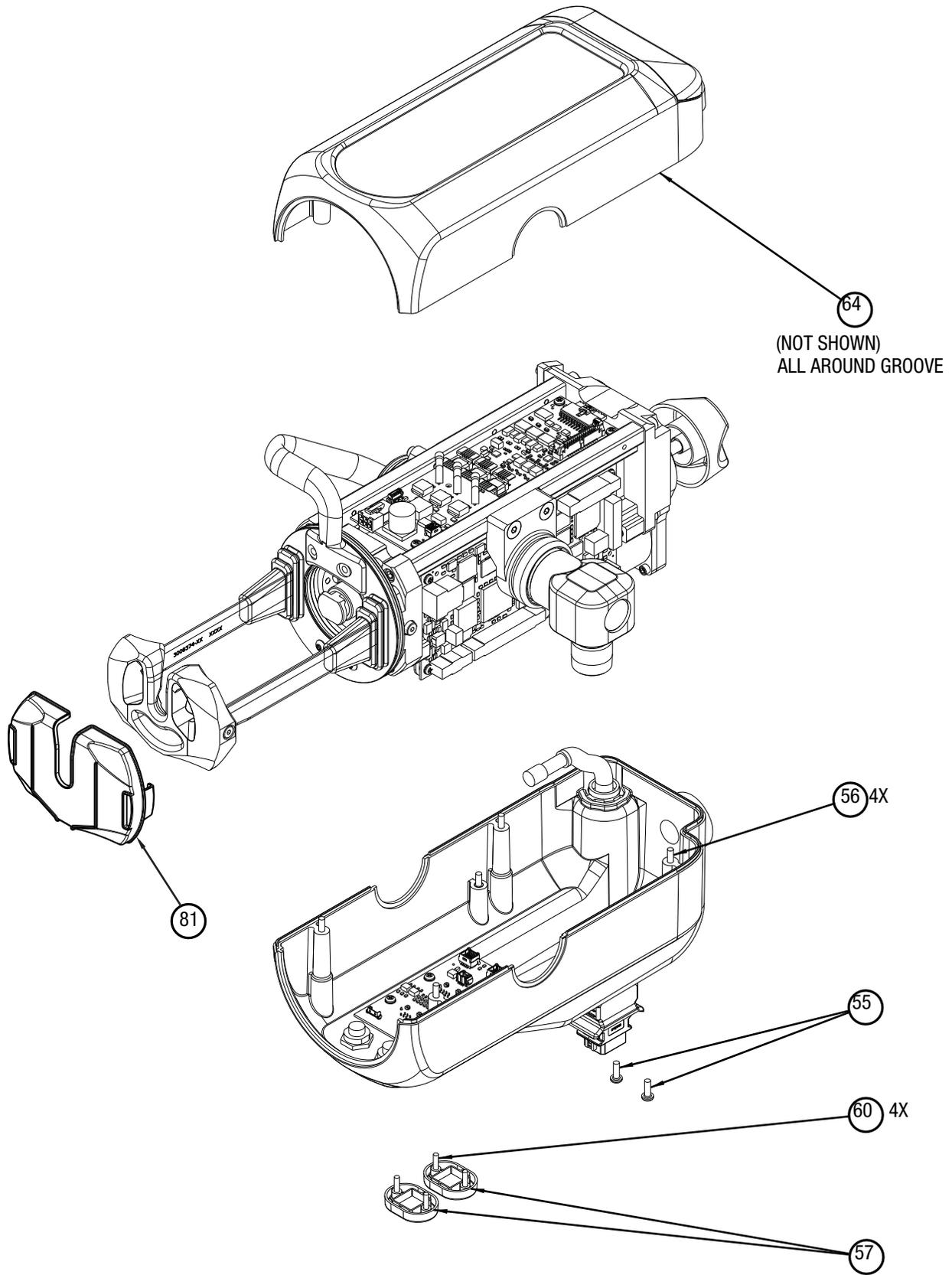
Item	Description	Part Number	QTY	MATL
1	ENCLOSURE, DISPLAY, FLATSCREEN	3029074	1	MAG
2	ASSY, PCB, DISPLAY INTERFACE, MARK 7 / STELLANT	3018832	1	
3	BRACKET, LCD	3007411	1	LEXAN
4	DISPLAY, LCD, COLOR, TFT, SHARP	3004231	1	
5	TOUCHSCREEN, DISPLAY, FLATSCREEN	3031224	1	
6	PCB, GRAPHICS, STELLANT, PHOENIX	3011679	1	
7	INVERTER, CCFT, + 12V, ADJUSTABLE	3006249	1	
8	BACKING PLATE, BEZE	3026674	1	AL
9	GASKET, BACKING PLATE, BEZEL	3026673	1	SILICONE
10	BEZEL, DISPLAY, FLATSCREEN	3029091	1	MAG

Item	Description	Part Number	QTY	MATL
11	COVER, BEZEL, DISPLAY	3026672	1	PC/ABS
12	ASSEMBLY, CABLE, SPEAKER, DISPLAY	3007646	1	
13	RETAINER, BRACKET, DISPLAY, SPEAKER	3008892	1	AL
14	ASSEMBLY, CABLE, POWER SWITCH, W/LED	3007641	1	
15	SWITCH BOOT, BRIGHTNESS SWITCH, DCU	3005273	1	RUBBER
16	CLAMP,NYLON,HEAVY DUTY,3/8X1/2	3008313	1	NYLON
17	SCREW, MACH, PAN HD, PH ZP, 6-32 X 1/4	602-0632-140	18	ZP
18	SCREW,MACH,PNH,PHL,ZP,4-40X1/4	602-0440-140	6	ZP
19	SCREW,MACH,PNH,PHL,ZP,6-32X1/8	602-0632-180	2	ZP
20	SCREW,MACH,PNH,PHL,ZP,8-32X5/8	602-0832-580	5	ZP
21	SCREW,MACH,PNH,PHL,ZP,8-32X1/2	602-0832-120	3	ZP
22	SCREW,MACH,FLH,PHL,ZP,8-32X3/8	603-0832-380	3	ZP

8.2 Injector Head Assembly Drawings and Bill of Material







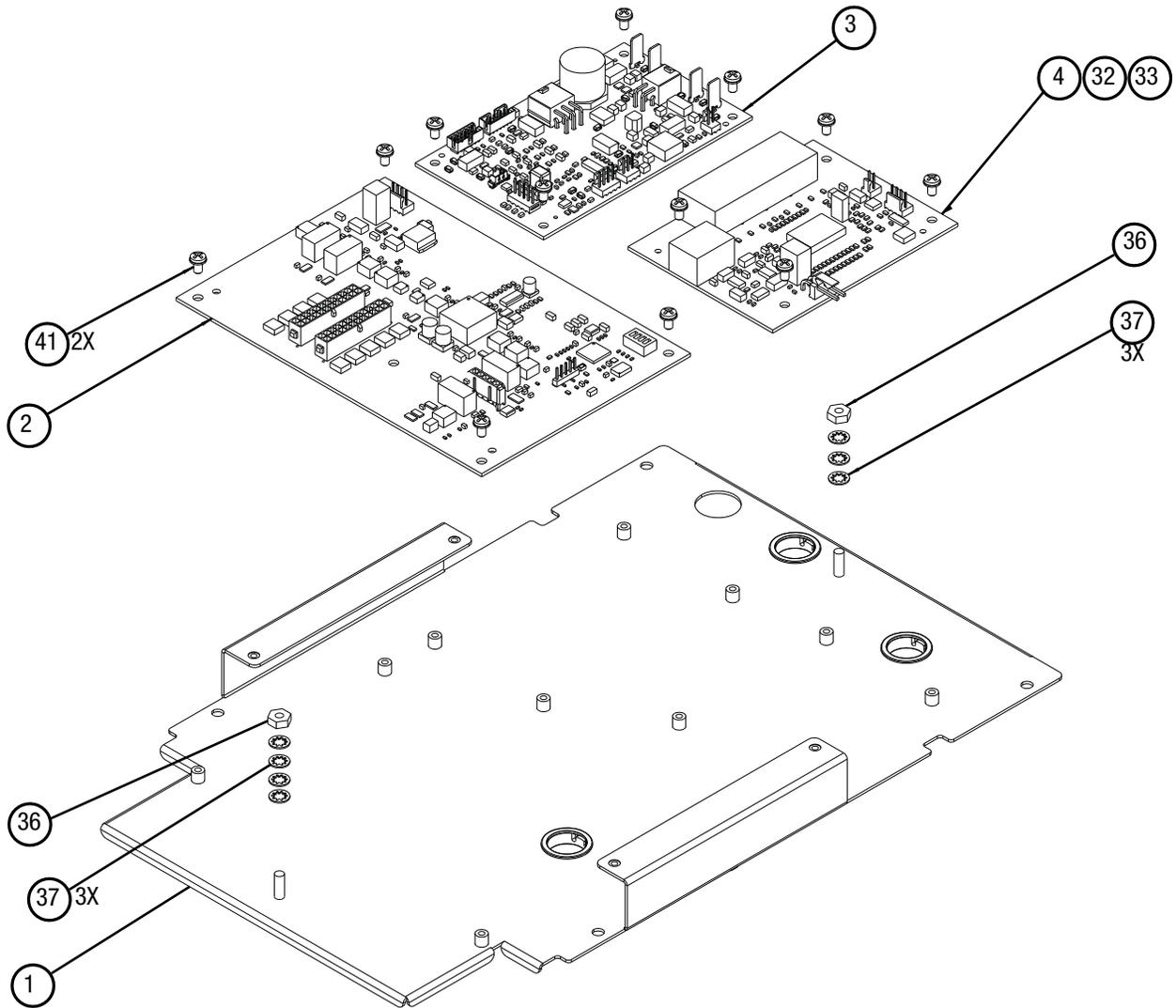
Item	Description	Part Number	MFR Number	MFR Name	QTY
1	ASSY,REAR PLATE,WITH JACKSHAFT,NOVA	3026572			1
2	MOTOR, NEMA 23 BRUSHLESS DC SERVO	3007402			1
3	BBRG. 32MM	3027582	6201 2RSJEM	SKF	2
4	RETAINER. BEARING	3007403			1
5	GEAR, HELIX	3008096			1
6	ASSY, BALLSCREW	3007410			1
7	KEY STOCK	3011282			1
8	PLATE. ANTI-ROTATION. MOLDED	3026573			1
9	PISTON, HEAD	3008212			1
10	ASSY. WA. HEAD. POTENTIOMETER	3026512			1
11	ASSY. SUPERSTRUCTURE. HEAD	3026100			1
12	GEAR. 48 TEETH. POTENTIOMETER	403002877			1
13	GASKET. LIGHT CHANNEL. INJECT UNITS	3028044			1
14	GASKET. LIGHT CHANNEL. FILL UNITS	3028045			1
15	CLAMP.CABLE.BRASS.NICKLE PLATE, .50	3029264			1
16	GEAR, DRIVE, POTENTIOMETER	3007409			1
17	GEAR, IDLER	3007408			1
18	SHOULDER BOLT, .125 OD X .500 LONG	301129			1
19	PULLEY, 52 TEETH	3026575			1
20	BELT, DRIVE, MOTOR	3007406			1
21	ASSEMBLY, DROP FRONT, NOVA	3026577			1
22	ASSY, PCB, MOTOR DRIVE, NOVA	3025232			1
23	CARRIAGE, BRACKET, PCB MOUNTING	3026580			1
24	ASSY,PCB,CPU SERVO,STELLANT SAX,PHOENIX,LF	3011677			1
25	ASSY, PCB, SIG MGT, NOVA	3026179			1
26	ASSEMBLY, PIVOT	3027485			1
27	ASSY, PCB, HD POSN SNSR, NOVA	3026457			1
28	ADAPTER, KNOB, MANUAL ASPIRATION	3026101			1
29	ASSY, KNOB, MANUAL ASPIRATION	3026571			1
30	HANDLE, INJECTOR HEAD	3026574			1

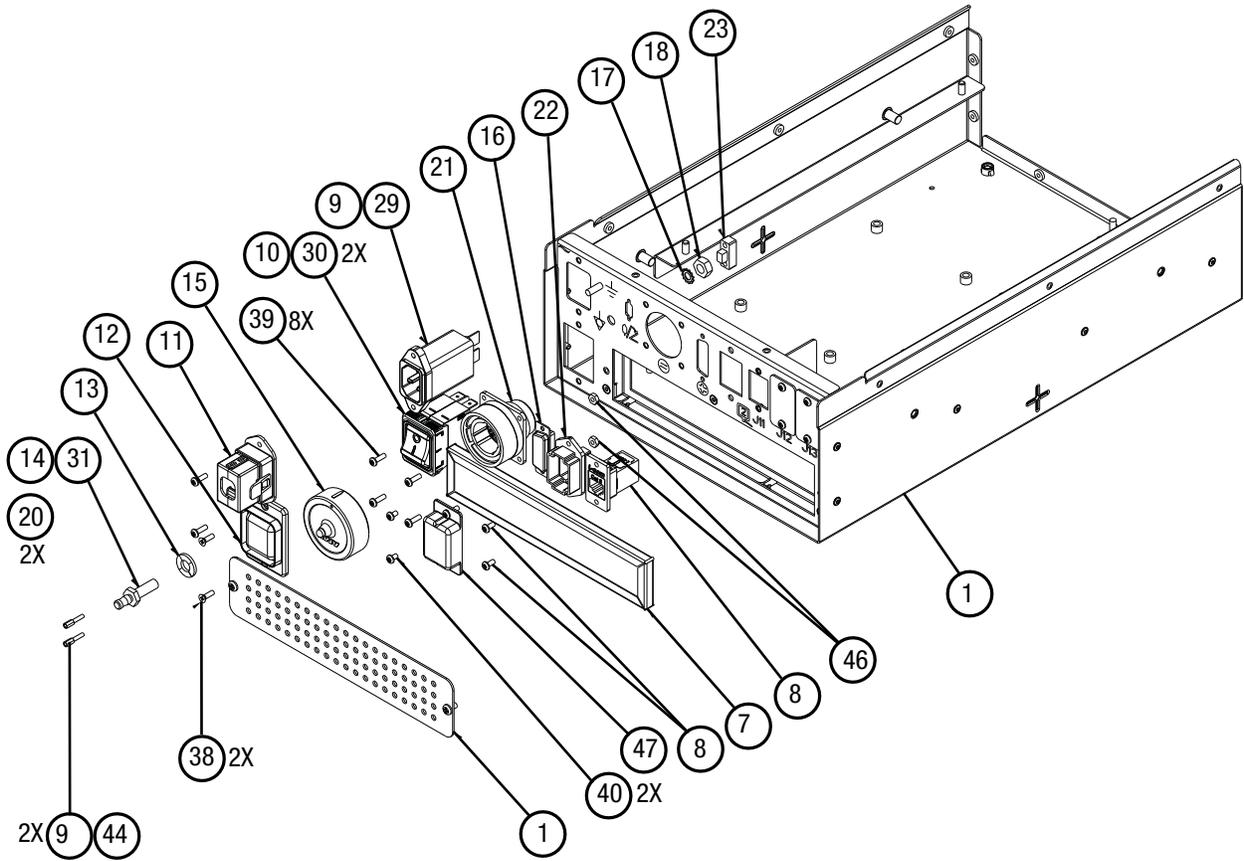
Mark 7 Arterion Injection System

Item	Description	Part Number	MFR Number	MFR Name	QTY
31	GASKET, PIVOT, HEAD	3027295			1
32	CLAMP, CABLE, POWER	3027426			1
33	SCREW,MACH,SKTCAP,HEX,8-32X1/2,BO	614-0832-500			7
34	SCREW,MACH,SKTCAP,HEX,BO,1/4-20X1	614-1420-100			8
35	WASHER, .438 OD X .188 ID X .063 THK	3011421			1
36	SCREW,MACH,PNH,PHL,SST18-8,6-32X1/4	3006128			1
37	SCREW,MACH,SKTCAP,HEX,BO,10-24X5/8				1
38	SCREW,MACH,PNH,PHL,SST,6-32X3/8,YEL HD	3005960			18
39	ENCLOSURE, TOP	3026093			1
40	ASSEMBLY, HEAD, OVERLAY	3026097			1
41	ASSY, PCB, HEAD DSPL	3025869			1
42	ASSY, PCB, ARMLIGHT, NOVA	3026323			1
43	GASKET, ARM LIGHT LENS	3027543			1
44	LENS, ARM LIGHT	3026095			1
45	ENCLOSURE, BOTTOM	3026094			1
46	ASSY,WA,HEAT MAINTAINER TO EIC	3027643			1
47	ASSY,WA,AIR DETECTOR TO EIC	3027642			1
48	GASKET, SILICONE, EXTERNAL INTERFACE, HEAD	3027584			1
49	ASSY, PCB, EXTERNAL INTERFACE, NOVA	3028503			1
50	HEAD PIGTAIL, MARK 7 ARTERION	3026385			1
51	SCREW,MACH,PNH,PHL,SST18-8,4-40X1/4	3009880			8
52	SCREW,MACH,BTNHD,HEX,BO,4-40X1/4	614-0440-140			2
53	SCREW,MACH,PNH,PHL,BO,6-32X1/2	3008623			2
54	CAP,COVER,BLACK,.29 X.558,FIT 5/8	3029077			2
55	SCREW,MACH,PNH,PHL,ZP,8-32X1/2	602-0832-120			2
56	SCREW,MACH,PNH,PHL,ZP,8-32X2	3011293			4
57	COVER, RJ45, PLASTIC	3006335			2
58	SCREW,MACH,SKTCAP,LOW,HEX,8-32X1/2,SST				2
59	SCREW,MACH,SKTFLH,HEX,1/4-20X1-1/8,SST				2
60	SCREW,MACH,FLH,PHL,SST18-8,6-32X3/4	3006049			4
61	WASHER,ITL,ZP,#6	605-0006-000			16

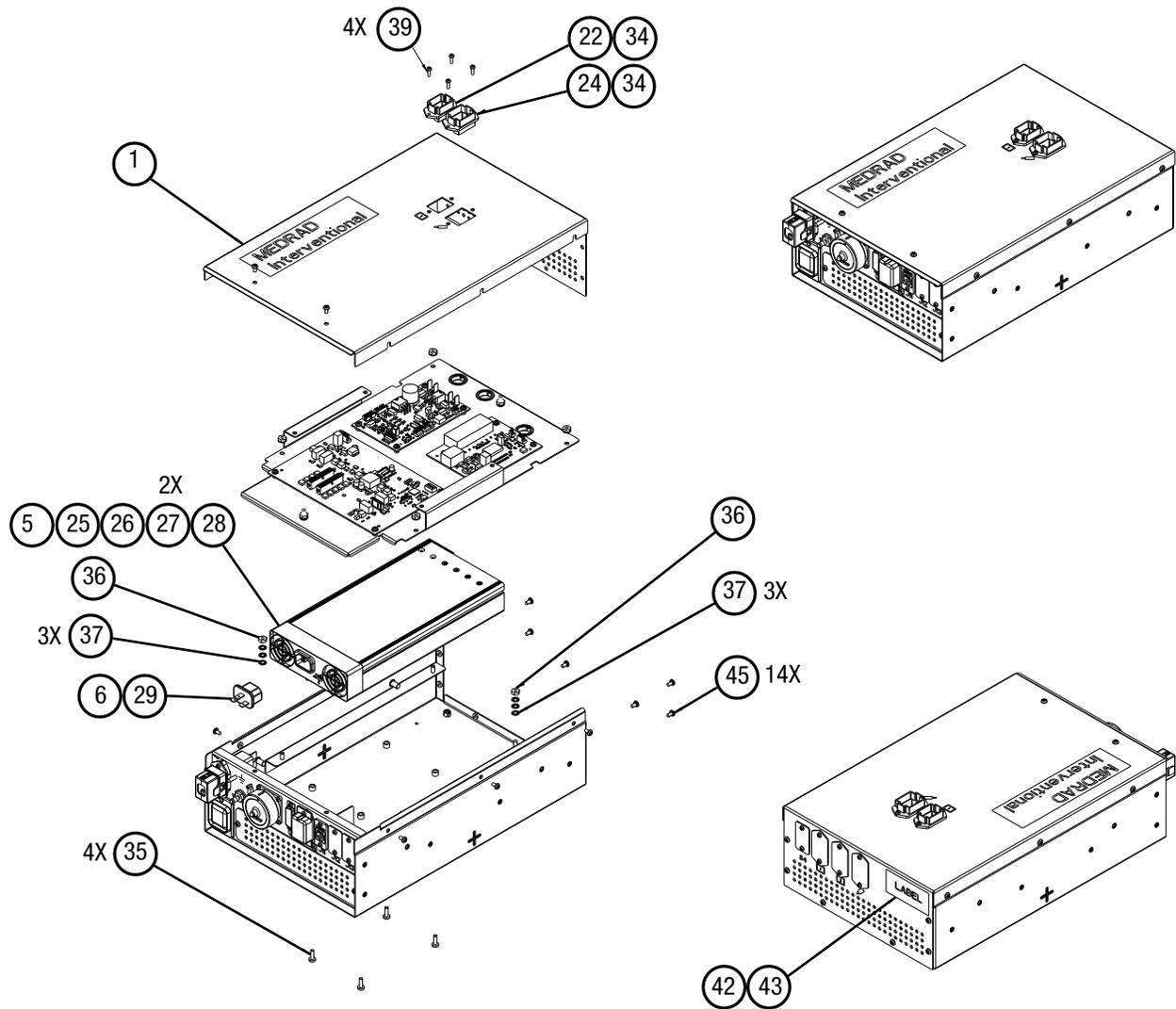
Item	Description	Part Number	MFR Number	MFR Name	QTY
62	WASHER,ITL,ZP,#4	605-0004-000			9
63	GASKET, FRONT LOAD	3011011			1
64	GASKET,.062 ODX.050 ID TUBING,SIL,NI/C,EMI	3007724			AR
65	SCREW,MACH,SKTCAP,HEX,SST,6-32X1/2	3011294			2
66	SCREW,MACH,SKTCAP,HEX,SST,10-32X1/2	3011722			1
67	WASHER, FLAT, #8, 7/16 OD, 5/64 THICK	3011421			1
68	ASSY, WA, HEAD, 48V POWER	3026510			1
69	ASSY, WA, HEAD, ARM LIGHT	3026507			1
70	ASSY, WA, HEAD, CABLE GROUND	3026506			1
71	ASSY, WA, HEAD, DISPLAY POWER/COMM	3026513			1
72	ASSY, WA, HEAD, HC AND AIR DETECTOR	3026504			1
73	ASSY, WA, HEAD, HM AND CAL	3026505			1
74	ASSY, WA, HEAD, MOTOR CONNECTION	3026503			1
75	ASSY, WA, HEAD, POSITION SENSING	3026508			1
76	ASSY, WA, HEAD, SYRINGE/DROP FRONT SWITCHES	3026511			1
77	ASSY, WA, HEAD, TEMP SENSORS	3026509			1
78	LOCTITE 242	702-2420-500			AR
79	LOCTITE 2440	3015812			AR
80	SUPERLUBE	3000603			AR
81	DROP FRONT COVER	3031173			1

8.3 Power Unit Assembly Drawings and Bill of Material





Mark 7 Arterion Injection System



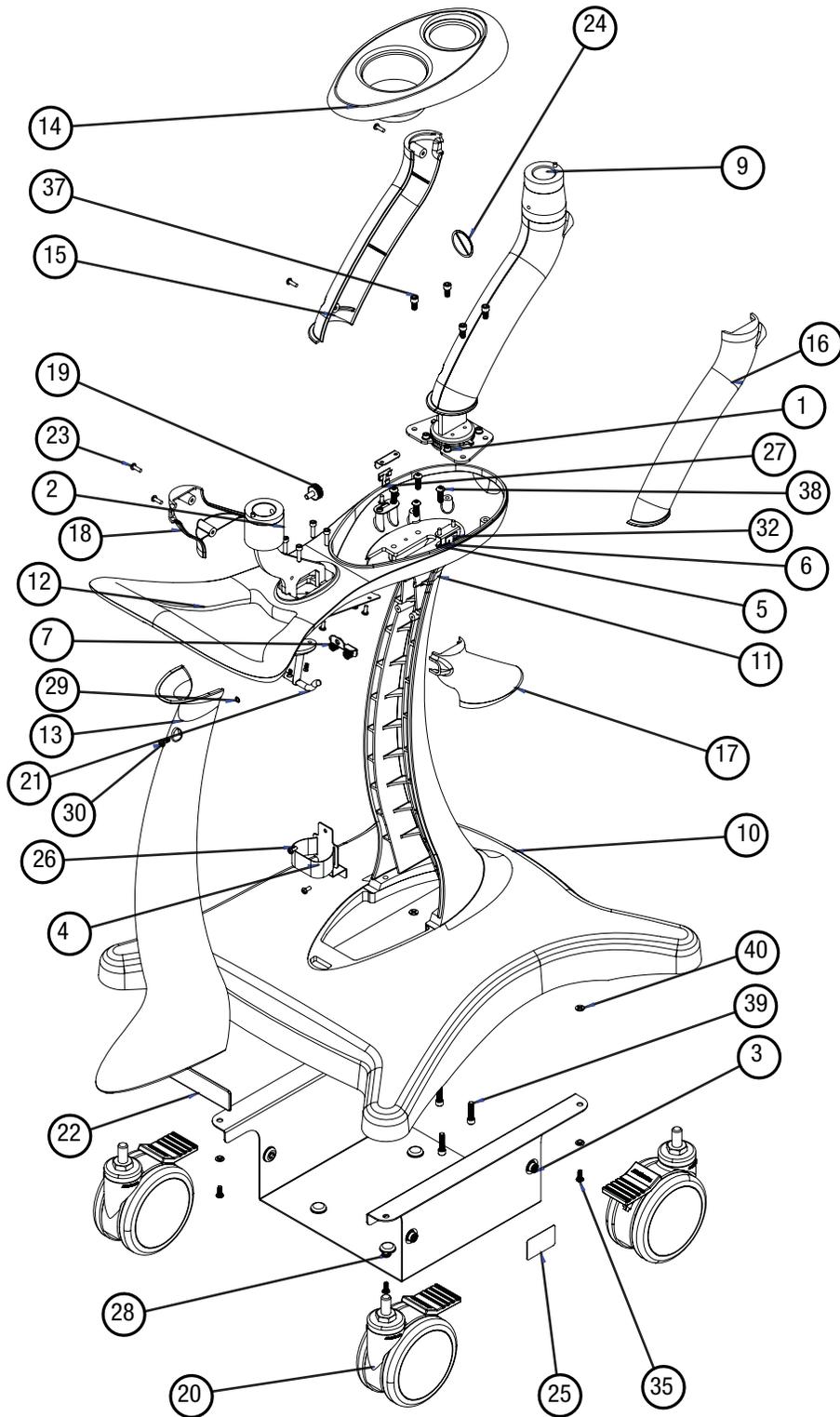
Item	Description	Part Number	QTY
1	ASSEMBLY, HOUSING, PSU	3027770	1
2	ASSEMBLY, PCB, IMAGING SYSTEM INTERFACE (ISI), TOWER	3011562	1
3	ASSY, PCB, PWR MGT, NOVA	3025842	1
4	ASSEMBLY, PCB, ETHERNET SWITCH, STELLANT	3018142	1
5	POWER SUPPLY, SWITCHING, 48V/17A, 15V/10A	3026404	1
6	MOUNTING CLIP, POWER SUPPLY, AC INLET	3026517	1
7	AIR FILTER, NON EMI, POWER SUPPLY	3028075	1
8	L-COM, CAT6, ETHERNET CONNECTOR	3026170	1
9	FILTER, IEC, INLET 15A	3010884	1

Item	Description	Part Number	QTY
10	POWER SWITCH, MAIN, 12A	3026168	1
11	CLAMP, AC CORD RETENTION	3026515	1
12	COVER, MAIN POWER SWITCH	3026169	1
13	WASHER, COLOR CODE, GRN/YEL #14.5010	528-1450-001	1
14	PLUG, BRASS, #04-0057	528-4057-001	1
15	COVER, METAL, W/CHAIN, CON, 211903-1AMP	512-2119-301	1
16	CAP, CONNECTOR, 15 PIN	3008631	1
17	WASHER, LOCK, SERRATED, #08.0704	528-8704-001	1
18	NUT, #08-0501	528-8501-001	1
19	JACKPOST, HEX, 2-56	3028273	2
20	WASHER, #4 SPLIT-LOCK, 316 SS	3006012	2
21	WA, ISI, BULKHEAD	3011596	1
22	DCU HARNESS ASSY, MARK 7 ARTERION	3026391	2
23	ASSY, WA, POWER UNIT, HAND/FOOT SWITCH	3026392	1
24	HEAD HARNESS BREAKOUT, MARK 7 ARTERION	3026390	1
25	ASSY, WA, POWER UNIT, PS 48V OUT	3026400	1
26	ASSY, WA, POWER UNIT, PS 15V OUT	3026401	1
27	ASSY, WA, POWER UNIT, PS OUT TO PE STUD	3026398	2
28	ASSY, WA, POWER UNIT, PS AUX	3026399	1
29	ASSY,WA, POWER UNIT, AC/PS IN TO PE STUD	3026395	2
30	ASSY, WA, POWER UNIT, CKT BRK SW, PS	3026394	2
31	ASSY,WA,POWER UNIT,EQUIPOT IN TO PE STUD	3026396	1
32	ASSY,WA, POWER UNIT, ETHERNET SW, POWER	3026402	1
33	ASSY, CABLE, ETHERNET, 1.0 F	3004546	1
34	TIE, CABLE, 5.6" LG, PLT1.5M, PANDUIT	715-0096-003	2
35	SCREW, PNHD, PH, ZP, M4X12	3028637	4
36	HEX NUT, ZP, 8-32	3028636	4
37	WASHER, LOCK, INTERNAL, ZP #8	605-0008-000	13
38	SCREW, PHIL, FLAT HD, 4-40 X 3/8" 18-8 SS	3006096	2
39	SCREW, 4-40X3/8, PAN HD, PH, 18-8 SS	3009892	12
40	SCREW, MACH, PNH, PHL, ZP, 4-40X3/16	602-0440-316	2

Mark 7 Arterion Injection System

Item	Description	Part Number	QTY
41	SCREW, 6-32X1/4, LOCK WASHER, INTERNAL	3028277	12
42	LABEL,SERIAL,ASSY,PWR UNIT,MARK 7 ARTERION	3027539	1
43	ALCOHOL, ISOPROPYL, >/= 99%	3011156	A/R
44	ADHESIVE, LOCTITE 242	720-2420-000	A/R
45	CREW,MACH,PNH,PHL,ZP,6-32X1/4	602-0632-140	14
46	NUT,MACH,HEX,ZP,4-40	604-0440-140	2
47	COVER, COMPACT ROBOT CONN REC, 20 CKT	3030692	1

8.4 Pedestal Assembly Drawing and Bill of Material



Mark 7 Arterion Injection System

Item	Description	MEDRAD P/N	QTY
1	MAST, UPPER, WELDMNT	3030082	1
2	WELDMENT, POST, DCU	3030083	1
3	CRADLE, PSU, MARK 7 ARTERN	3030081	1
4	BRACKET, VELCRO, CABLE MNGMNT	3030084	1
5	BRACKET, SPRING CLIP RECIEVER	3030086	2
6	BRACKET, SPRING CLIP	3030087	2
7	BRACKET, COVER BRACKET, NOVA	3030088	1
8	COVER, BOTTOM, HANDLE	3030089	1
9	SLEEVE, UPPER MAST	N/A	1
10	BASE, ZINC, MARK 7	N/A	1
11	COLUMN, CASTING, MARK 7	N/A	1
12	COLLAR, HANDLE, MARK 7	N/A	1
13	COVER, COLUMN, MARK 7	3029912	1
14	COVER, COLLAR, MARK 7	3029911	1
15	COVER, UPPER MAST, LEFT, MARK 7	3029903	1
16	COVER, UPPER MAST, RIGHT, MARK 7	3029904	1
17	COVER, DCU, LEFT	3029905	1
18	COVER, DCU, RIGHT	3029906	1
19	THUMBSCREW, 1/4-20 X 1/2, MC 91185A398	3030090	1
20	CASTER, DUAL 5" LOCK	3029907	4
21	HOOK, UNDER SHELF	3030091	1
22	LABEL, BASE, MEDRAD	3029908	1
23	KMA-350 BUSHING	3028586	1
24	LABEL, PUSHING PROHIBITED	3028507	1
25	LABEL, SERIAL STICKER	N/A	1
26	VELCRO, SELF GRIP, 1"	3029910	1
27	CLIP, TINNERMAN, TRIM, D98826-051M-255	3030093	2
28	WASHER, SHOULDER, NYLON, #10	649-2746-750	4
29	RETAINER, NYLON PUSH-ON	3030095	1
30	SCREW, FAST LEAD	3030096	1

Item	Description	MEDRAD P/N	QTY
31	SCREW,6-32X3/8,PFH,Z	3030097	2
32	#8-32 UNF X 3/8 PPHMS	3001643	14
33	#8-32 UNF X 1/2 PPHMS	3013166	4
34	#8-32 X 1/2 SOCKET SET SCREW CUP POINT	3030098	1
35	SCREW, 10-32 X 1/2" PPHMS ZINC	3003161	4
36	SHCS #10-32 UNF X 7/8	3030099	4
37	SCREW, 1/4-20X1/2 ,SHCS,Z	3030100	4
38	SCREW, 1/4-20 X 750" BSHCS ZINC	3030101	4
39	SCREW, 1/4-20X1.0 ,SHCS,Z	3030102	4
40	WASHER, NYLON RETAINER, #10	3030103	4

9 Specifications

This chapter provides specifications for the *Mark 7 Arterion Injection System* and its components.

This chapter lists:

- "System Technical Specifications"
- "High Pressure Connector Tubing Specifications"
- "System Component Weight and Dimensions"
- "Mounting Components Weight and Dimensions"
- "ISI Technical Specifications"
- "Environmental Specifications"

9.1 System Technical Specifications

9.1.1 Input Power Requirements

100-240 VAC

50/60 Hz

1200 VA

9.1.2 Technical Specifications

Table 9 - 1: System Technical Specs

Flow Rate:	0.1-45.0 ml/s in 0.1 ml increments
	0.1-59.9 ml/m in 0.1 ml increments
Volume:	1-150 in 1 ml increments
Pressure Limit (150 ml syringe):	100-1200 psi in 1 psi increments
	689-8273 kPa in 1 kPa increments
Rise Time:	0.0-9.9 seconds in 0.1 increments
Delay Time:	0.0-99.9 seconds in 0.1 increments
Fill Speed:	1-20 mL/s
Fill Volume:	1-150 ml
Syringe Size:	150 ml
Syringe Heat Maintainer:	37°C +/- 2°C (98.6°F +/- 3.8°F)
Protocol Memory:	40 Protocols
Injection History Memory	50 Injections

9.2 High Pressure Connector Tubing Specifications

The injection system was designed to use the MEDRAD *Mark 7 Arterion* Syringe. Tubing should meet the following specifications to operate in a safe and effective manner.

- Disposable tubing shall be rated to a minimum of 1200 psi
- Disposable tubing shall have a minimum internal diameter of .070" with a maximum length of 72".

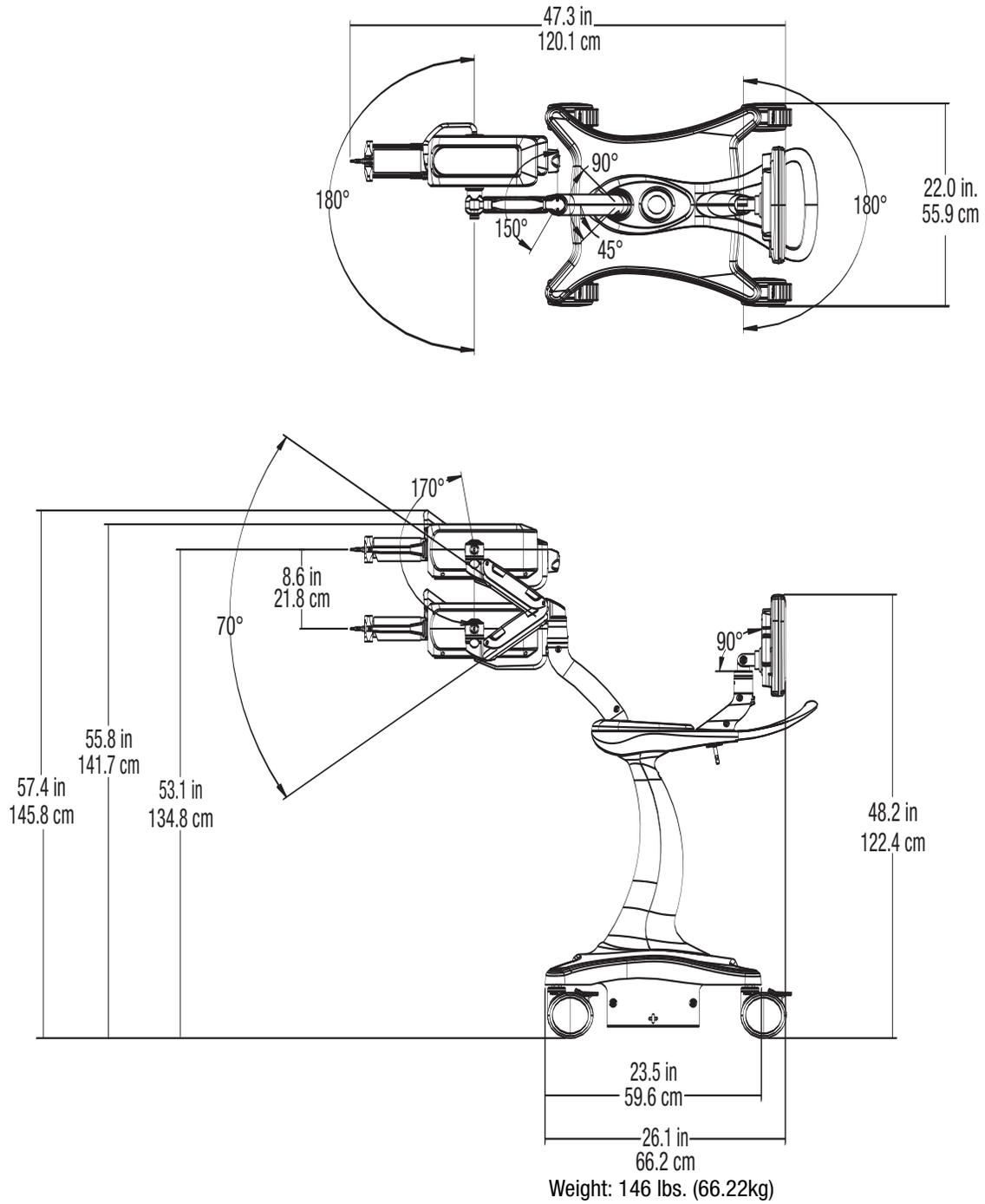
Both parameters are needed to establish a maximum pressure drop across the tubing set. The parameters enable the Injector to achieve the programmed flow rates to ensure proper opacification of targeted anatomy.

- Syringe interface luer shall be a standard female luer as defined in:
 - ISO 594-1:1986
 - ISO 594-2: 1998
 - BS EN20594-1:1994/ISO 594-1:1986 Incorporating Amendment No. 1 to BS 3930-1:1987
- Catheter interface luer shall be a standard male luer as defined in:
 - ISO 594-1:1986
 - ISO 594-2: 1998
 - BS EN20594-1:1994/ISO 594-1:1986 Incorporating Amendment No. 1 to BS 3930-1:1987.
- Disposable tubing shall be made from a clear polymeric material that allows for proper visualization of fluid path to ensure all air has been adequately purged with fluid before connection to a patient.

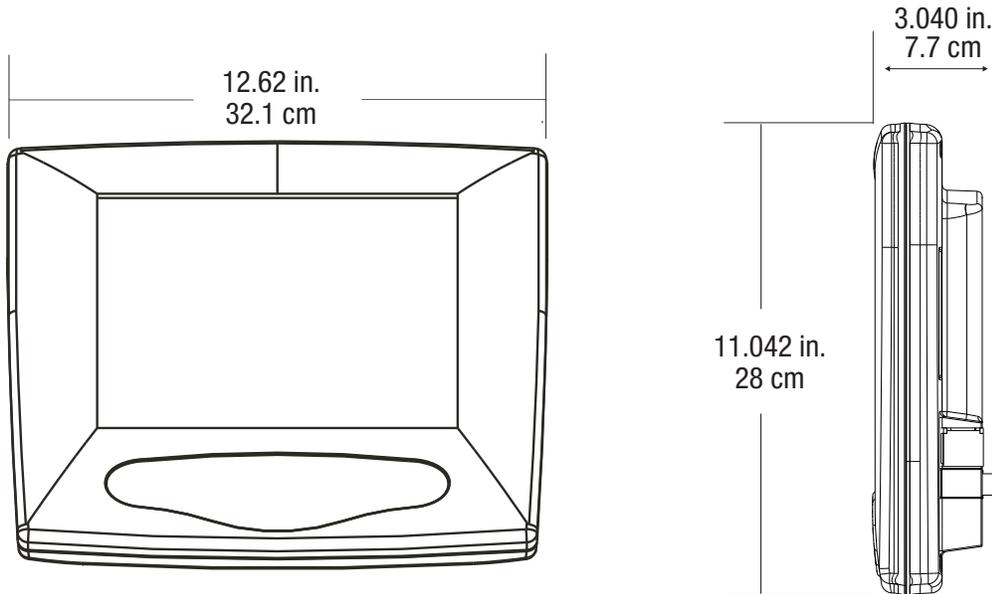
9.3 System Component Weight and Dimensions

NOTE: All listed weights and dimensions are approximate.

9.3.1 Pedestal System Weight and Dimensions

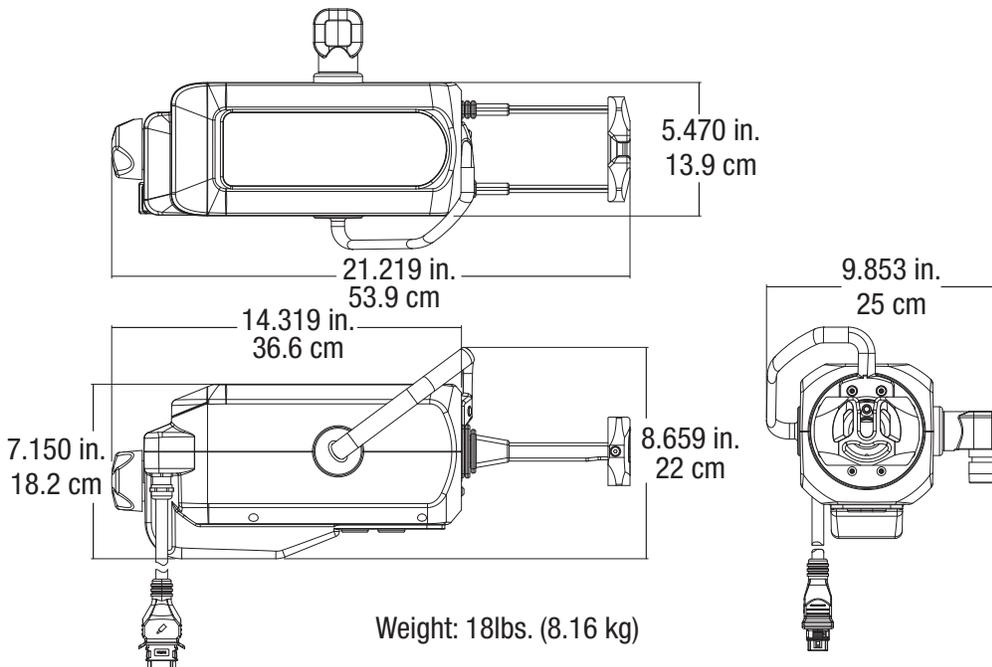


9.3.2 Display Control Unit Weight and Dimensions



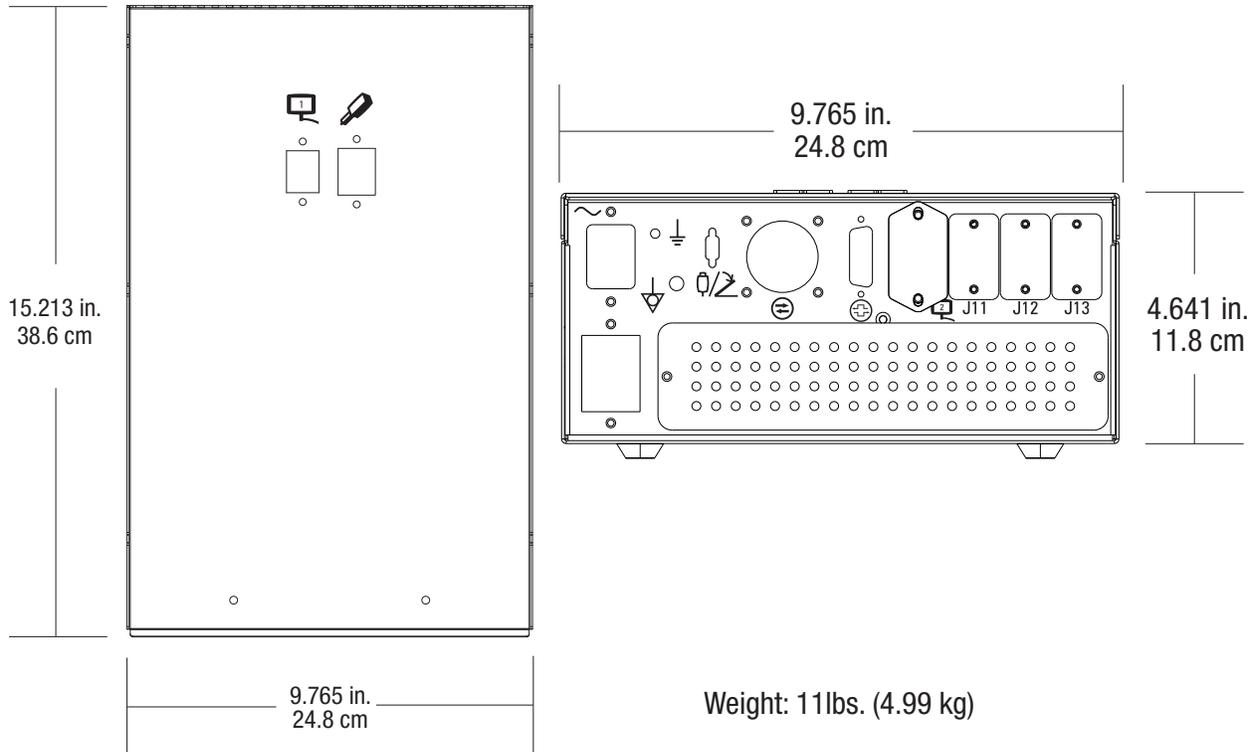
Weight: 7lbs. (3.18 kg)

9.3.3 Injector Head Weight and Dimensions



Weight: 18lbs. (8.16 kg)

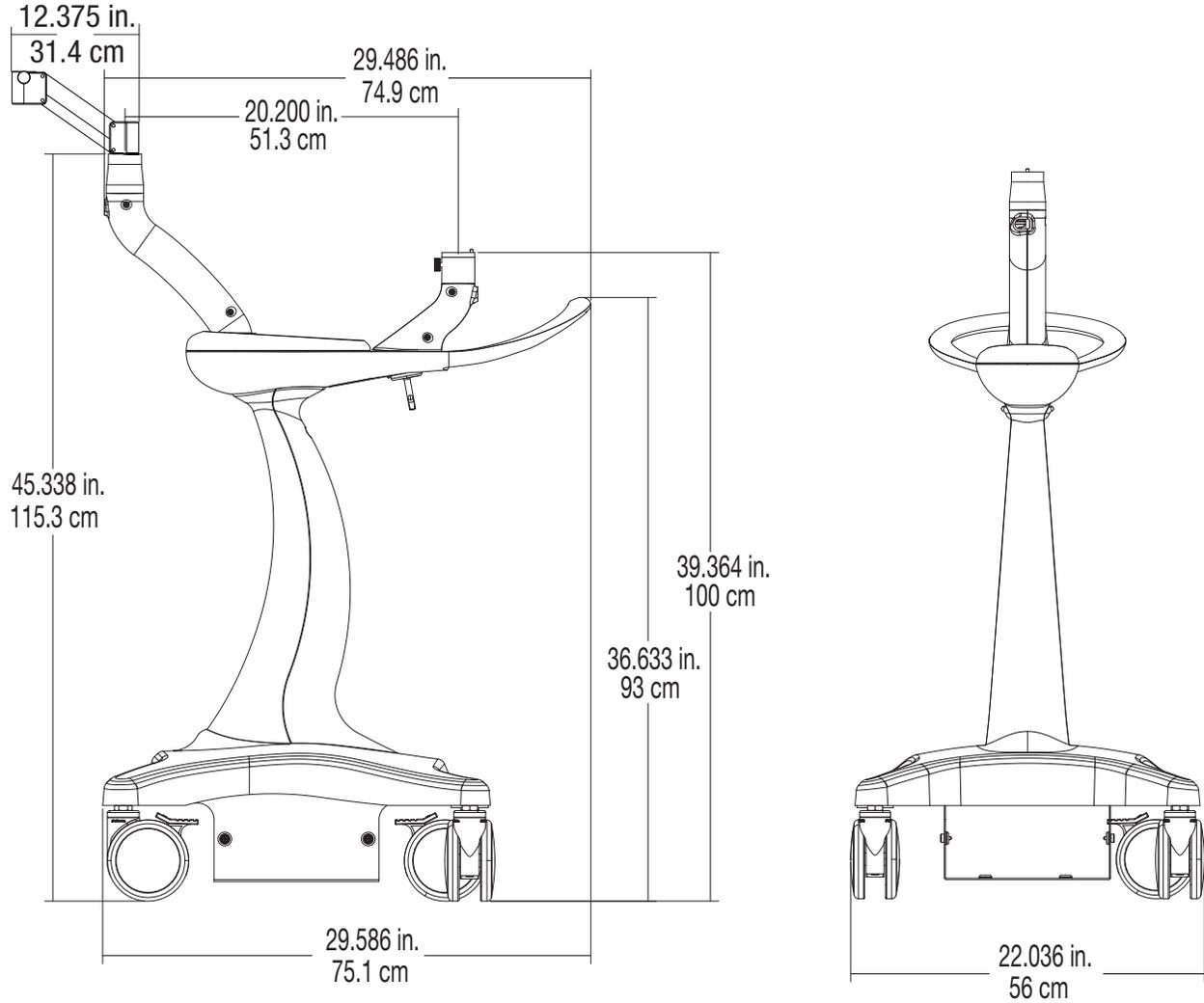
9.3.4 Power Unit Weight and Dimensions



9.4 Mounting Components Weight and Dimensions

NOTE: All listed weights and dimensions are approximate.

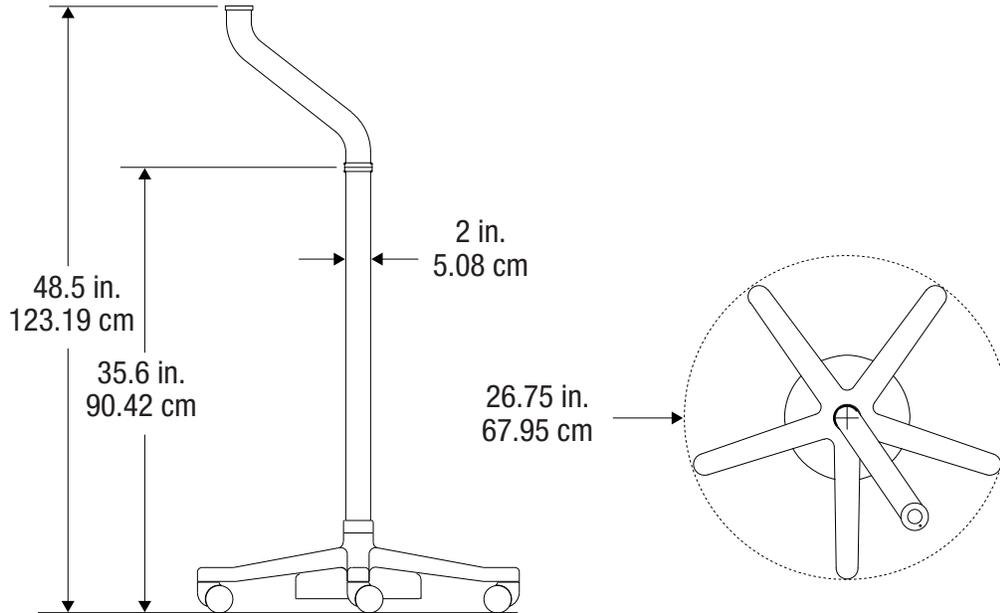
9.4.1 Pedestal Mount Weight and Dimensions



Weight*: 100lbs. (45.35 kg)

*Pedestal weight is total weight of the pedestal and does not include the Injector Head, Display Control Unit, or Power Unit weights.

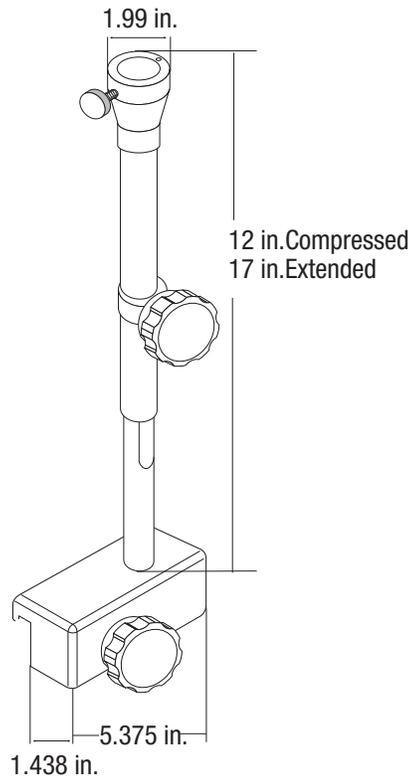
9.4.2 Head Stand Weight and Dimensions



Weight*: 100lbs. (45.35 kg)

*Stand weight is total weight of the stand and does not include the Injector Head weight.

9.4.3 Adjustable Table Mount (KMA 350) Weight and Dimensions



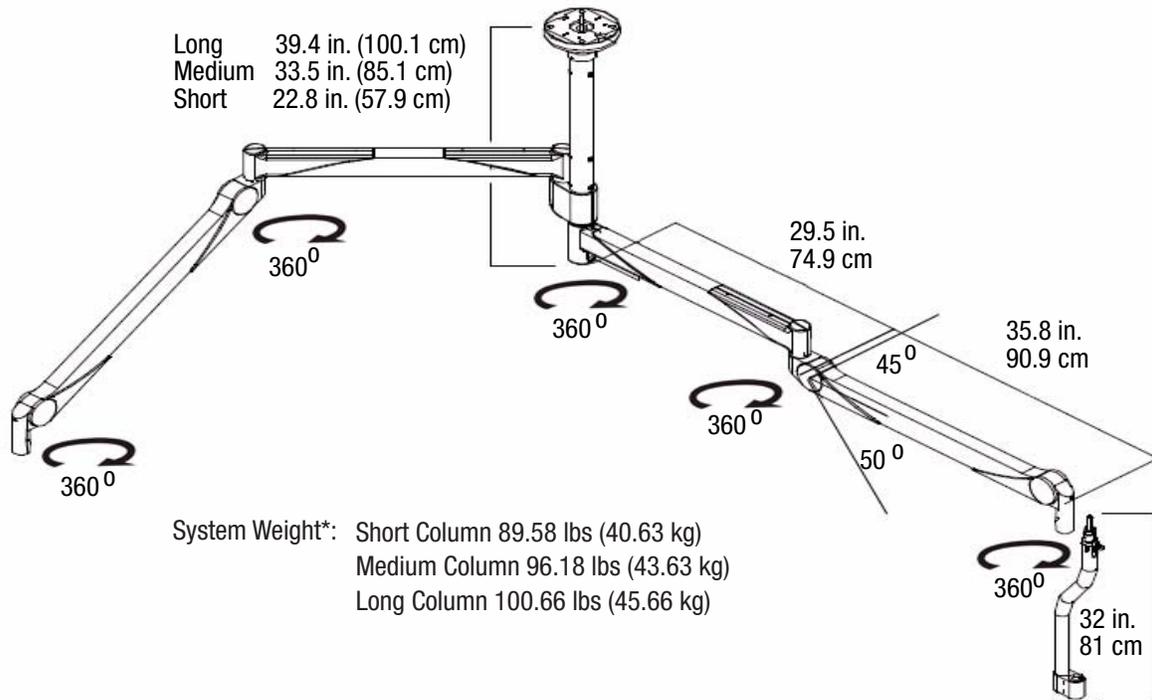
Weight*: 5.4 lbs

*Table Mount weight is total weight of the table mount and does not include the Injector Head weight.

9.4.4 OCS Mount Weight and Dimensions

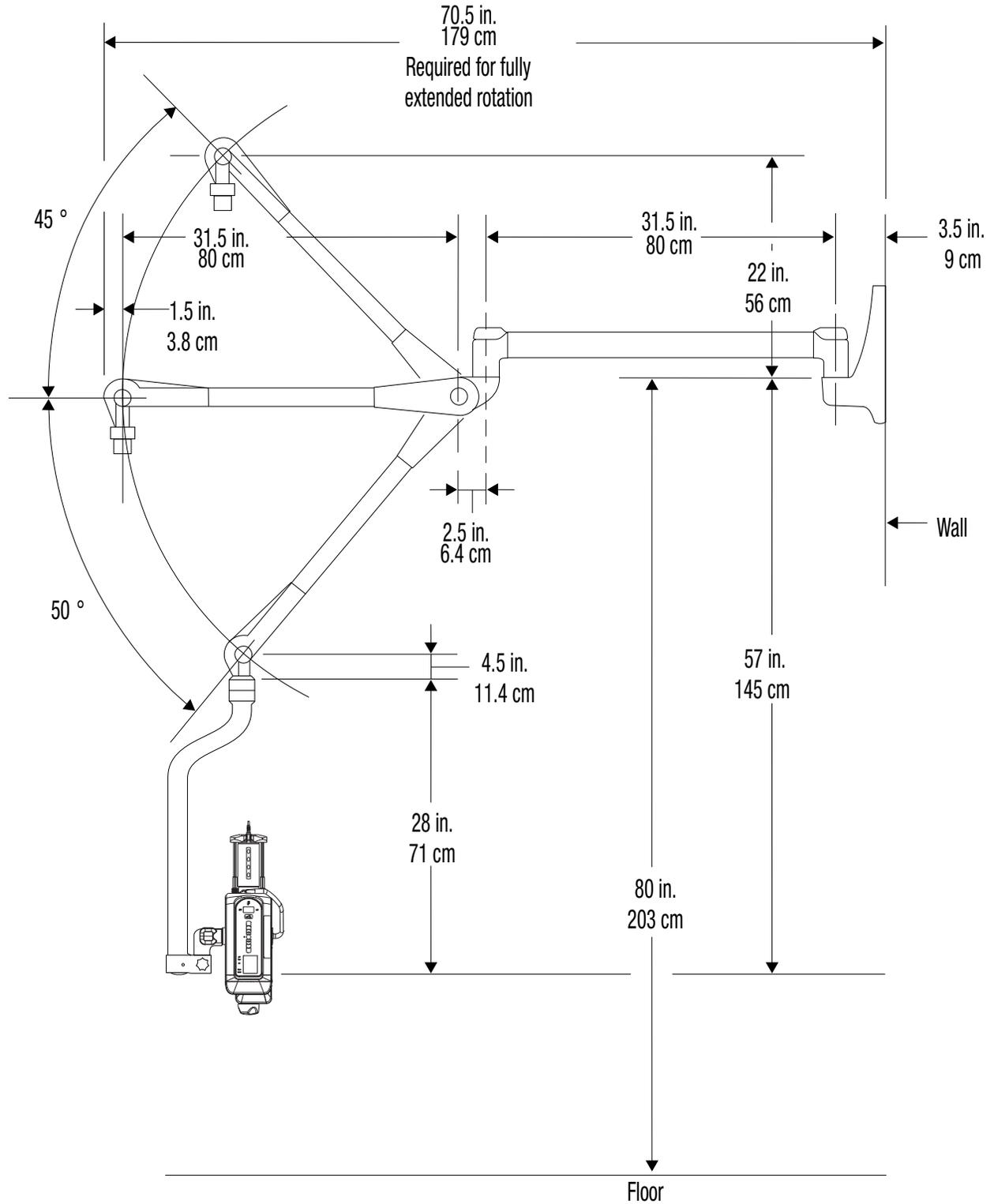
The Overhead Counterpoise Systems can be mounted directly to the ceiling, on a ceiling trolley mount, or a wall mount.

9.4.4.1 Ceiling Mount Weight and Dimensions



*System weight is total weight of OCS system and does not include Injector Head weight.

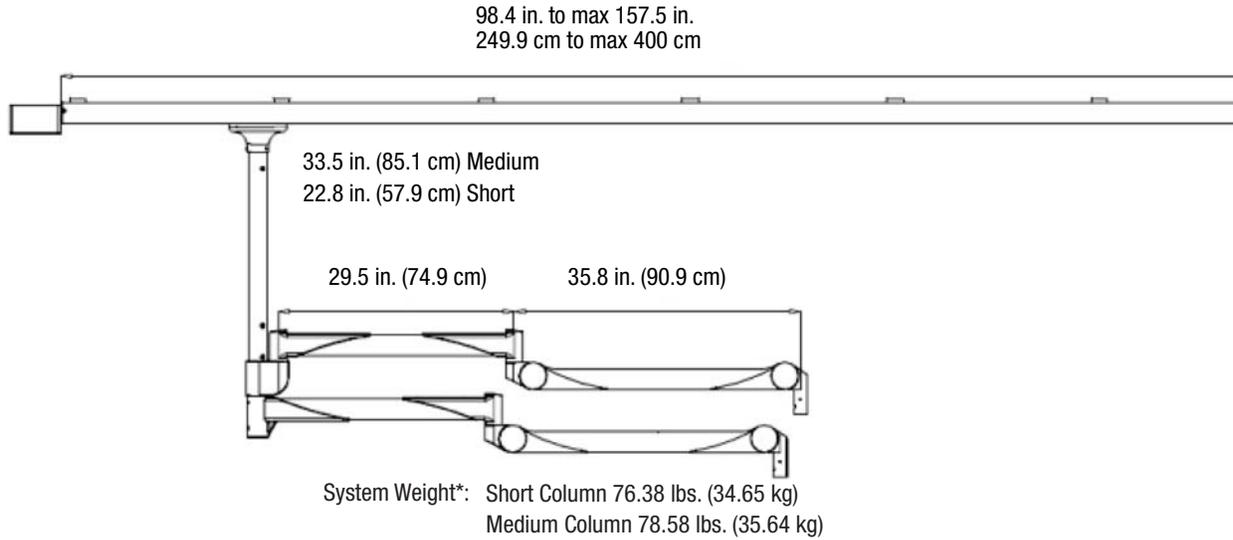
9.4.4.2 Wall Mount Weight and Dimensions



System Weight*: 43.28 lbs (19.63 kg)

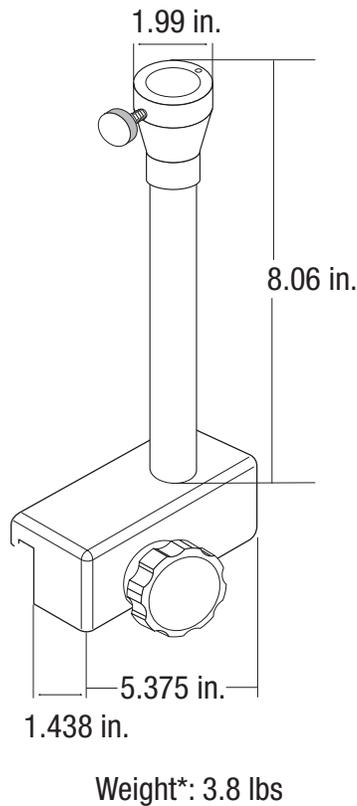
*System weight is total weight of OCS system and does not include Injector Head weight.

9.4.4.3 Trolley Mount Weight and Dimensions



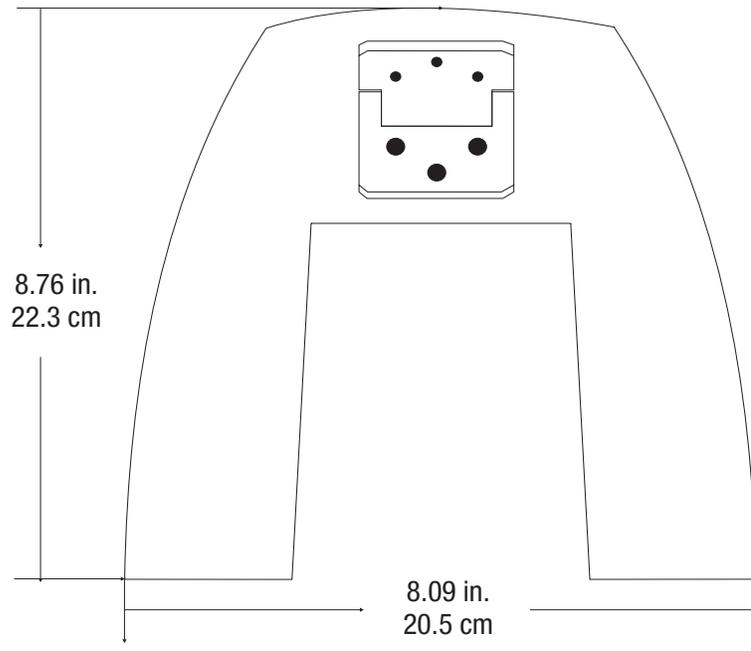
*System weight is total weight of OCS system and does not include Injector Head weight.

9.4.5 Fixed Table Mount Weight and Dimensions



*Table Mount weight is total weight of the table mount and does not include the Display Control Unit weight.

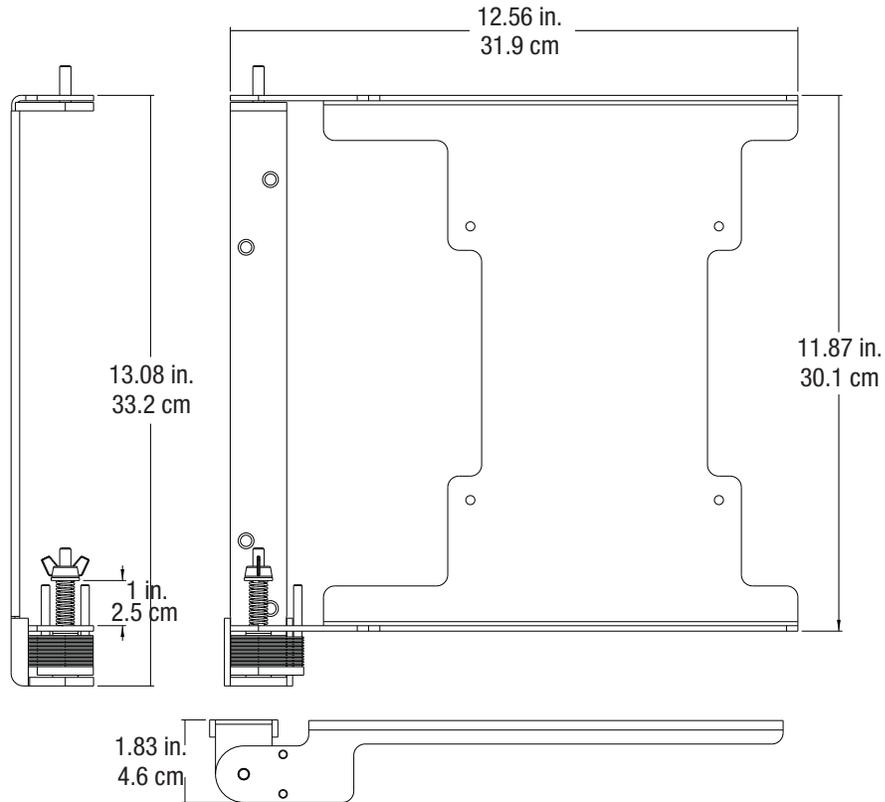
9.4.6 Display Control Unit Desk Stand Mount Weight and Dimensions



Weight*: 2.6 lbs. (1.17kg)

*Desk stand weight is total weight of the desk stand and does not include the Display Control Unit weight.

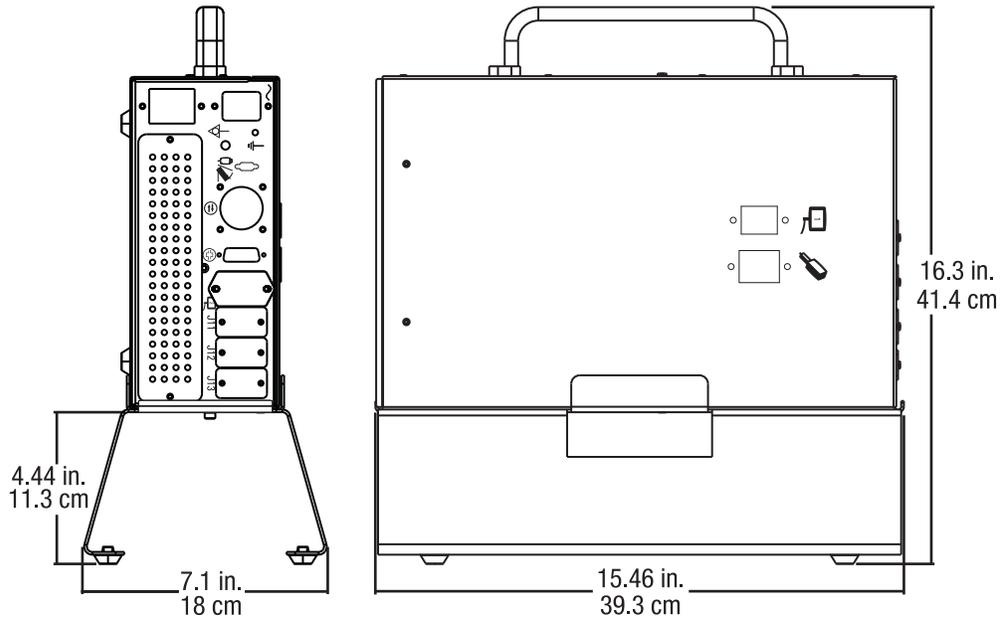
9.4.7 Display Control Unit Wall Mount Weight and Dimensions



Weight*: 4.4 lbs (1.99kg)

*Wall Mount weight is total weight of the wall mount and does not include the Display Control Unit weight.

9.4.8 Power Unit Floor Mount Weight and Dimensions



Weight*: 2.2 lbs (1 kg)

*Weight does not include the Power Unit weight.

9.5 ISI Technical Specifications

This section outlines the *Mark 7 Arterion* specifications for the output signals and input signals for the ISI, and shows pinouts for legacy ISI connector, universal cable, and Siemens cable.

9.5.1 ISI Output Specifications

The tables below list the output signals and the relay contact outputs for the *Mark 7 Arterion* ISI.

Table 9 - 2: Output Signals

Signal Name	Description
Extended_Arm	<p>This signal is a pair of relay contacts output from the Injector. When active, it indicates that the Injector is in an armed state and is ready to accept the start input from the Imaging System. This signal operates as an Extended Arm; it becomes active with the arming of the Injector and remains active after an injection until the signal that initiated the injection (e.g. INJ_START signal from the Imaging System) is deactivated.</p> <p>NOTE: The Injector still disarms at the completion of the injection; only this ISI armed signal is extended.</p>
Injecting	<p>This signal is a pair of relay contacts output from the Injector. It indicates that the piston on the Injector is in motion.</p>

Table 9 - 2: Output Signals

Signal Name	Description
X-Ray Trigger	This signal is a pair of relay contacts output from the Injector. When the Injector X-ray delay has expired, this signal becomes active and notifies the Imaging System to start the X-ray. Like the Extended Arm signal, the X-RAY_TRIGGER signal remains active until the signal initiating the injection (e.g. INJ_START signal from the Imaging System) is deactivated.
Inj_Hand_Switch_On	This signal is a pair of relay contacts output from the Injector. When the INJ_HAND_SWITCH_DISABLE input is active and the Injector is armed, this signal indicates when the Injector hand switch (contrast activation only) or foot switch is in an “on” position; otherwise, this signal is inactive.

Table 9 - 3: Relay Contact Outputs

2A @ 28VDC or 0.5A @ 125VAC

9.5.2 ISI Input Specifications

The *Mark 7 Arterion* ISI is activated by a contact closure at the imaging system, and it is powered by internal 24VDC isolated supply with short circuit protection at the *Mark 7 Arterion* Injector.

The tables below list the output signals and the Opto-isolated Input requirements.

Table 9 - 4: ISI Input Signals

Signal Name	Description
Inj_Start	This signal is an input to the Injector and is generated by the Imaging System. Once the Injector is armed and the EXTENDED_ARM signal is active, activating this signal enables the Injector to start. Deactivating this signal during an injection will abort any injection in progress and disarm the Injector.
Inj_Disarm	This signal is an input to the Injector and is generated by the Imaging System. This signal must be inactive to allow the Injector to be armed. When the Injector is armed or is injecting, activating this signal will disarm the Injector and abort any injection in progress.
Inj_Hand_Switch_Disable	This signal is an input to the Injector and is generated by the Imaging System. This signal must be inactive to allow the Injector hand switch and foot switch to function normally when in ISI mode. When this signal is active, the Injector hand switch (contrast activation only) and foot switch are disabled from directly starting the Injector and the Injector can only be started from a remote INJ_START control.

Table 9 - 5: Opto-isolated Inputs Requirements

10mA at 24VDC (nominal), 15mA at 30VDC (maximum).

9.5.3 ISI Connector Specifications

The figures below show the pinouts for the Legacy ISI connector, ISI Universal cable, and ISI Siemens cable. Table 9 - 6 on page 9 - 122 provides a brief description of each pin in the Legacy ISI Connector.

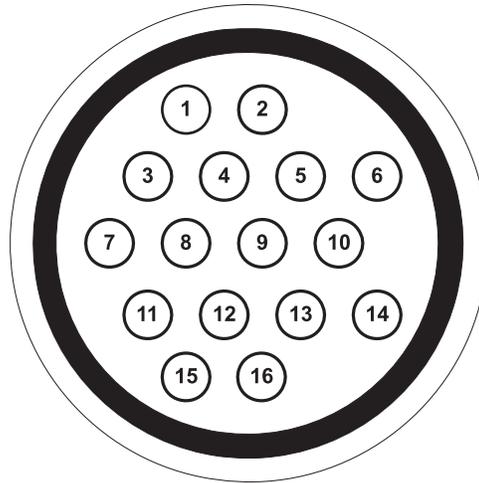


Figure 9 - 1: ISI Legacy Connector (View Into Injector Connector)

- | | |
|------------------------|-------------------------------|
| 1 - Injecting N/O | 2 - Injecting N/O |
| 3 - Extended_Arm N/O | 4 - Extended_Arm N/O |
| 5 - Handswitch Disable | 6 - ISO_GND |
| 7 - Remote Start | 8 - Remote Disarm |
| 9 - Remote Start | 10 - X-Ray Trigger N/O |
| 11 - X-Ray Trigger N/O | 12 - Gate Out (unused) |
| 13 - Gate Out (unused) | 14 - Handswitch On N/O |
| 15 - Handswitch On N/O | 16 - AC Ground - cable shield |

Table 9 - 6: ISI Legacy Connector Signals

Signal	Description
Injecting	Output signal to Imaging System that shorts pins 1 and 2 together when the system is injecting. When not injecting, pins 1 and 2 are open.
Extended_Arm	Output signal to Imaging System that shorts pins 3 and 4 together when the system is armed. When not armed, pins 3 to 4 are open.
Handswitch Disable	Input signal from Imaging System; when pins 5 and 6 are shorted, the injector hand switch and/or foot switch is disabled from directly initiating an injection. When open, the injector hand switch and/or foot switch functions normally.
Remote Start	Input signal from Imaging System; when pins 7 and 9 are shorted, the injector is commanded to start the injection.

Table 9 - 6: ISI Legacy Connector Signals

Signal	Description
Remote Disarm	Input signal from Imaging System; when pins 8 and 6 are shorted, the injector is commanded to disarm.
X-Ray Trigger	Output signal to Imaging System that shorts pins 10 and 11 together when active.
Gate Out	Output signal to Imaging System that shorts pins 12 and 13 together based on an ECG R-wave signal. This signal will not be used in the <i>Mark 7 Arterion</i> design and is only presented for informational purposes.
Handswitch closed	Output signal to Imaging System that shorts pins 14 and 15 together as an indication that the <i>Mark 7 Arterion</i> hand switch or foot switch is pressed.

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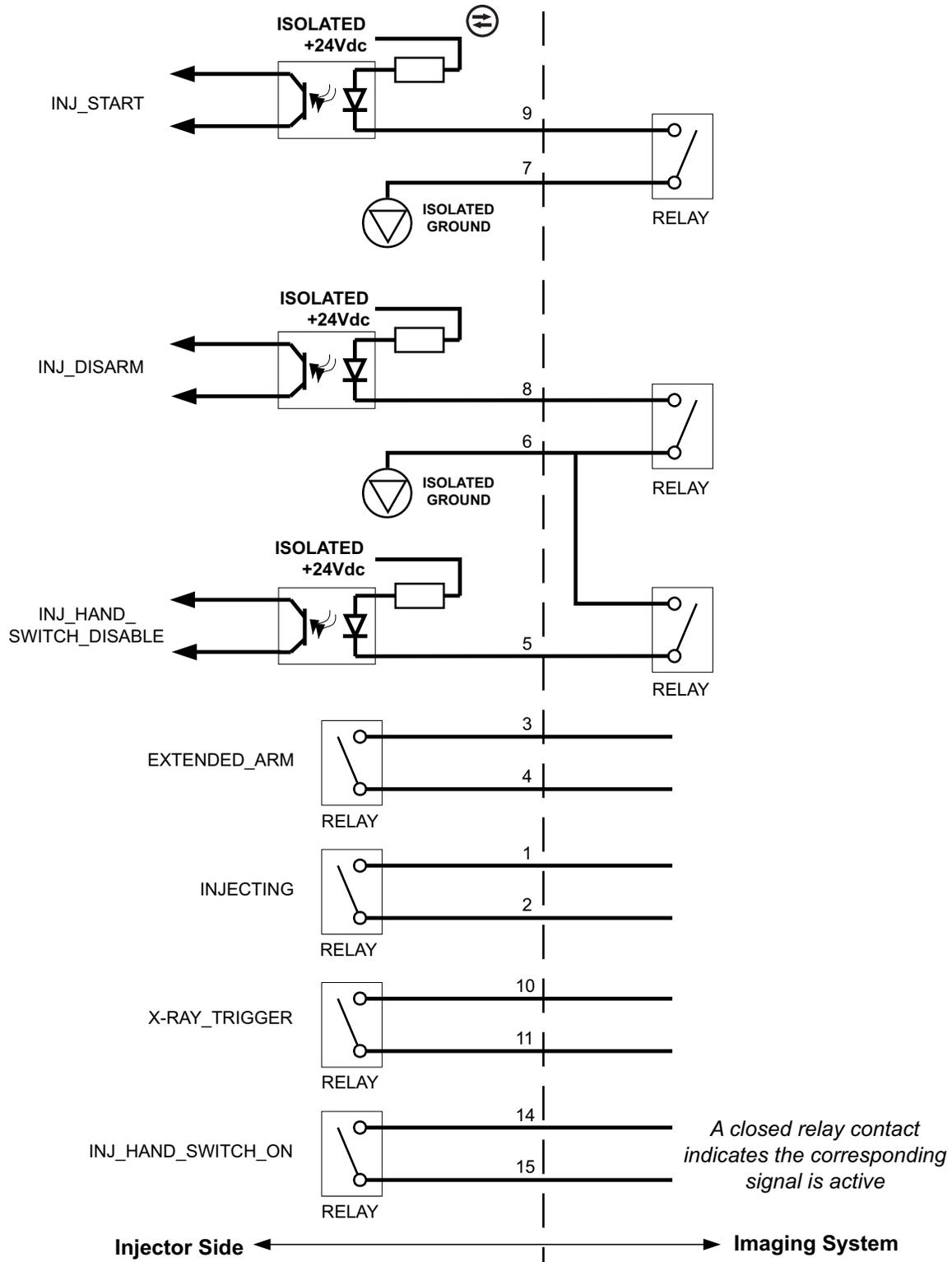


Figure 9 - 2: ISI Universal Cable

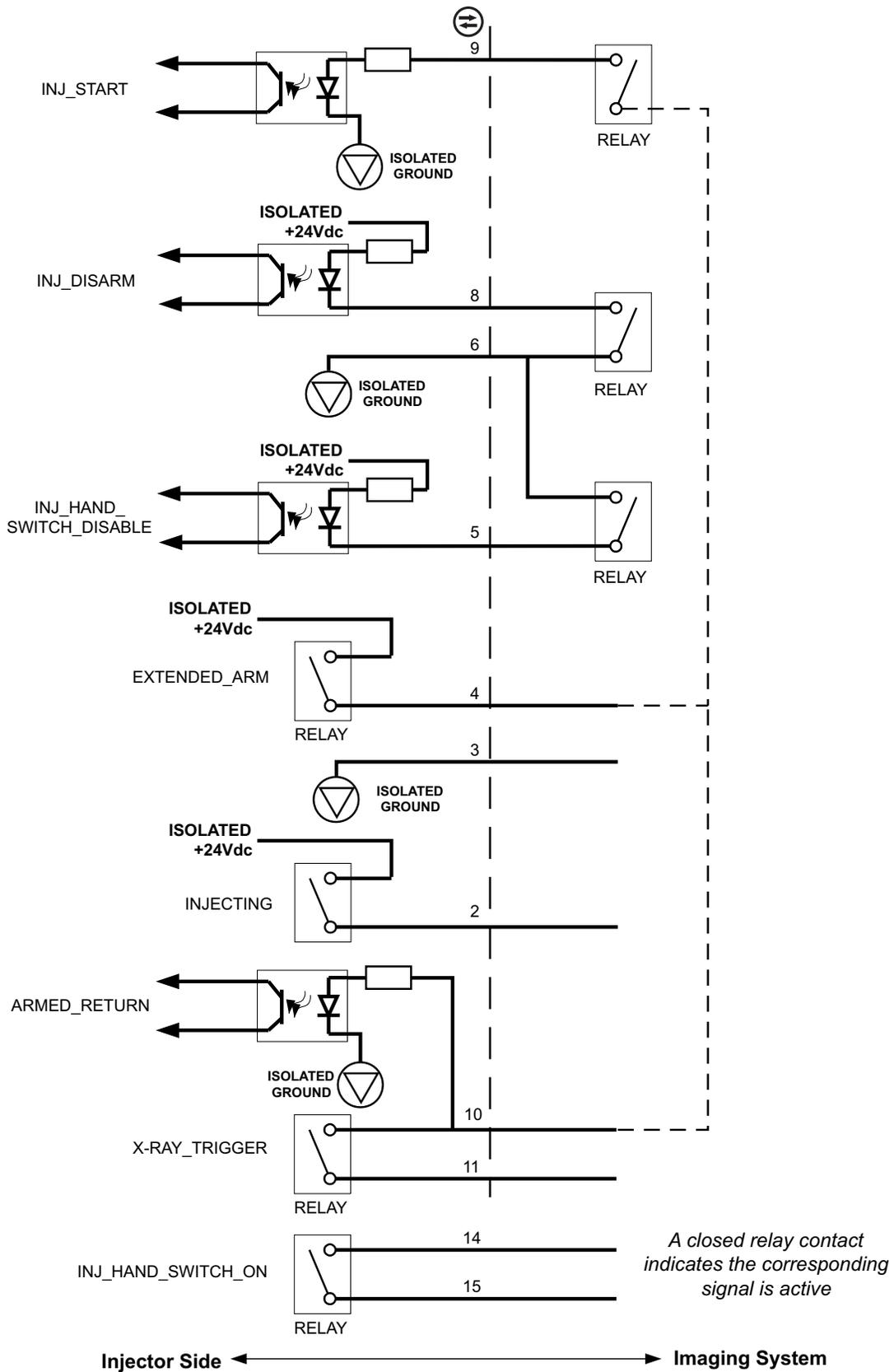


Figure 9 - 3: ISI Siemens

9.6 Fuses

Table 9 - 7: FUSES - POWER MANAGEMENT CARD (3025842)

Fuse	Value	P/N	Purpose	LED
F1 and F2	10A	3026106	48 Volt input	L6
F3	5A	3026320	15 V to head	L1
F4	3A	3013256	15V for Ethernet Switch	L7*
F5	3A	3013256	ISI /Can 15 Volts	L3
F6	3A	3013256	15 V Primary DCU	L4
F7	3A	3013256	15 V Secondary DCU	L5

*L7 shows the 5V actual output to the switch. The 5V is generated from the 15V shown by L2

Table 9 - 8: FUSES - MOTOR DRIVE CARD

Fuse	Value	P/N	Purpose	LED
F1	2A	3013606	48 V to Signal management card	L1

Table 9 - 9: FUSES - HEAD DISPLAY CARD (3025869)

Fuse	Value	P/N	Purpose	LED
F1	1A	3016255	5V arm light	None*

*Indirectly indicated by LED on Arm Light Card.

Table 9 - 10: 15

Fuse	Value	P/N	Purpose	LED
F1	1A	3016255	15V To head display card	None*
F2	.75A	3013605	48 V to heater	None
F3	.125A	3030037	5V to air sensor	None

*Indirectly indicated by LED 15 on the Head Display Card.

9.7 Environmental Specifications

9.7.1 Operating

The system may not meet all performance specifications if operated outside the following conditions.

Temperature: +10°C to +40° C (+50°F to +104°F)

Humidity: 20% to 90% R.H.

Air Pressure: 69 kPa to 106 kPa after it has stabilized to within the operating pressure ranges.

9.7.2 Non-Operating: (Transportation and Storage)

Temperature:	-20°C to 60°C (-4°F to +140°F)
Humidity:	5% to 100% R.H., non-condensing
Air Pressure:	57 kPa to 106 kPa after it has stabilized to ambient conditions.

9.7.3 EMI/RFI

The injector system is classified as Group 1, Class B equipment per the requirements of EN 60601-1-2. Accessories provided by MEDRAD will also comply with this standard.

9.7.4 Equipment Classification

Type of protection against electrical shock: Class 1.

Degree of protection against electrical shock: Type CF Defibrillation-proof applied part.

Degree of protection against ingress of water: IPX1.

Degree of safety of application in the presence of a flammable anaesthetic mixture with air or with oxygen or nitrous oxide: Equipment is not suitable for use in the presence of a flammable anaesthetic mixture with air or with oxygen or with nitrous oxide.

Mode of operation: Continuous.

9.7.5 Class I Product

A product that is provided with a reliable protective earth (PE) such that all accessible metal parts cannot become live in the event of a failure of basic insulation and therefore will provide protection against electric shock in the case of failure of basic insulation.

9.7.6 Type CF Defibrillation-proof Applied Part

The Injection System is Type CF Defibrillation-proof as the System may be utilized in a situation when the applied part is connected to the patient while defibrillation is applied. During the discharge of a cardiac defibrillator to a patient connected to the Defibrillation-proof applied part, hazardous energies do not appear on the enclosures, signal input and output parts.

9.7.7 IPX1

IEC 60529 classification of degree of protection (IP Code) provided by enclosures of electrical equipment against ingress of vertically dripping water with harmful effects.

9.7.8 Continuous Mode of Operation

Operation under normal load for an unlimited period, without the specified limits of temperature being exceeded.

9.7.9 EU Directive

The MEDRAD *Mark 7 Arterion Injection System* complies with the essential requirements of the Medical Device Directive 93/42/EEC and bears the CE Mark to show conformity with the provisions of this Directive.

10 Options and Accessories

The sections below list catalog numbers for:

- "Mark 7 Arterion System Mount Options"
- "Mark 7 Arterion Accessory Devices and Kits"
- "Mark 7 Arterion Cords and Cables"
- "OCS Mounting Systems"
- "OEM Imaging System Interface Cables"

10.1 Mark 7 Arterion System Mount Options

10.1.1 Injector Head Mount Options

Description	Catalog Number	Material Number
Mark 7 Arterion Pedestal	ART 700 PEDA	3026048
Adjustable Table Mount	KMA 350	3002745
Free Standing Pedestal on Wheels	KMA 320RT	3003108

10.1.2 Power Unit Mount Options

Description	Catalog Number	Material Number
Mark 7 Arterion Pedestal	ART 700 PED	3026048
Floor Mount	ART 700 F PSU	3029071

10.1.3 Display Control Unit Mount Options

Description	Catalog Number	Material Number
Mark 7 Arterion Pedestal	ART 700 PED	3026048
Adjustable Table Mount Kit (includes adjustable table mount and display mount fulcrum)	ART 700 DCU TM A	N/A
Fixed Table Mount Kit (includes fixed table mount and display mount fulcrum)	ART 700 DCU TM	N/A
Display Mount Fulcrum	ART 700 DCU FMK	3027294
Desk Stand Kit	ART 700 DCU DM	3027648
Wall Mount	ART 700 DCU WM	3027434

10.1.4 Cable Brackets

Description	Catalog Number	Material Number
Floor Cable Bracket	ART 700 CB F	3026675

Mark 7 Arterion Injection System

Description	Catalog Number	Material Number
Table Cable Bracket	ART 700 CB T	3026676

10.2 Mark 7 Arterion Accessory Devices and Kits

10.2.1 Switches

Description	Catalog Number	Material Number
Foot switch 25 ft. (Optional)	ART 700 FS	3026076
Hand switch 6 ft. (Standard)	ART 700 HS6	3026518
Hand switch 12 ft. (Optional)	ART 700 HS12	3028063
Hand switch Mount Kit	ART 700 HSM	3031093

10.2.2 Accessory Devices and Kits

Description	Catalog Number	Material Number
Syringe Heat Maintainer	ART 700 HM	3026680
Dual Display Option (Does not include Mounting.)	ART 700 2DCU	3030114
Pressure Jacket	ART 700 PJ150	3031684

10.3 Mark 7 Arterion Cords and Cables

10.3.1 Power Cords

Description	Catalog Number	Material Number
Power Cord - North America and Japan - Standard Length	ART 700 PC110V	3011249
Power Cord - North America and Japan - 20 ft. (6.096 m)	ART 700 PP	3015600
Power Cord - International	ART 700 PC220V	3012541
Power Cord - China	ART 700 PCCHINA	3016106
Power Cord - Brazil	AVA 500 PCBRAZIL	3029078

10.3.2 Head Power and Communication Extension Cables

Description	Catalog Number	Material Number
Cable Head Power - 15 ft. (4.5 m)	ART 700 HC 15	3033233
Cable Head Power - 40 ft. (12 m)	ART 700 HC 40	3026387
Cable Head Power - 65 ft. (20 m)	ART 700 HC 65	3026388

Description	Catalog Number	Material Number
Cable Head Power - 90 ft. (27 m)	ART 700 HC 90	3026389

10.3.3 Display Cables

Description	Catalog Number	Material Number
Cable Display - 10 ft. (3 m)	ART 700 DC 10	3026379
Cable Display - 25 ft. (7.5 m)	ART 700 DC 25	3026380
Cable Display - 50 ft. (15 m)	ART 700 DC 50	3026381
Cable Display - 75 ft. (23 m)	ART 700 DC 75	3026382
Cable Display - 100 ft. (30.5 m)	ART 700 DC 100	3026383

10.4 OCS Mounting Systems

10.4.1 Stationary Ceiling Mount

Description	Catalog Number	Material Number
Portegra - Stationary Ceiling Mount - 22.8 in. (58 cm) Post	OCS CEIL 58-P	3016424
Portegra - Stationary Ceiling Mount - 33.5 in. (85 cm) Post	OCS CEIL 85-P	3016426
Portegra - Stationary Ceiling Mount - 39.4 in. (100 cm) Post	OCS CEIL 100-P	3016423

10.4.2 Mobile Ceiling Mount

Description	Catalog Number	Material Number
Portegra 2 - Track Ceiling Mount - 22.8 in. (58 cm) Post	OCS Track 58-P	3016427
Portegra 2 Track Ceiling Mount - 33.5 in, (85 cm) Post	OCS Track 85-P	3016425

10.4.3 Wall Mount

Description	Catalog Number	Material Number
Portegra 2 - Wall mount - 33.5 in. (85 cm) Post	OCS Wall-P	3016482

10.4.4 Ceiling Mount Plate

Description	Catalog Number	Material Number
Portegra 2 - Ceiling Mount Plate	OCA Plate Ceil	3016436

10.5 OEM Imaging System Interface Cables

10.5.1 General Electric

Description	Catalog Number	Material Number
GE Advantx, 15 ft. (4.5 m) ISI Signals Only	XMC 915R	3009001
GE Innova, 15 ft. (4.5 m) ISI Signals Only	XMC 915R	3009001
GE/OEC, 25 ft. (8 m) ISI Signals Only	XMC 990R	3007511
GE Advantx, 20 ft. (6 m) Remote Power Unit, ISI Signals Only	XMC 917A	3007511
GE Innova, 20 ft. (6 m) Remote Power Unit, ISI Signals Only	XMC 917A	3016024

10.5.2 Phillips

Description	Catalog Number	Material Number
Multidiagnostic (MD), 15 ft. (4.5 m) ISI Equipotential	XMC 925A	3012643
Integris (Including Integris Allura), 15 ft. (4.5 m) ISI Equipotential	XMC 925A	3012643
XPER, 15 ft. (4.5 m) ISI Power Equipotential	XMC 927A	3012644
MultiDiagnostic (MD) and Integris, ISI Signals Only, Remote Power Unit	XMC 945-S	XMC 945-S
Multidiagnostic (MD) and Integris, ISI Signals Only, Remote Power Unit	XMC 945 40	3008776
XPER, 80 ft. (24 m) ISI Signals, Remote Power Unit	XMC 947R	3009602

10.5.3 Siemens

Description	Catalog Number	Material Number
Axiom Artis, 16.5 ft. (5 m) ISI, Power, Equipotential	XMC 977A	3012642
Multistar, Angiostar 13 ft. (4 m) ISI, Power, Equipotential	XMC 970A with 3016360	3016359

10.5.4 Universal Imaging System Interface Cables

Description	Catalog Number	Material Number
Universal Synchronization Cable, 25 ft. (8 m)	XMC 906I	XMC 906I
Universal Synchronization Cable, 50 ft. (15 m)	XMC 906 50I	XMC 906 50I
Universal Synchronization Cable, 75 ft. (23 m)	XMC 906 75I	XMC 906 75I
Universal Synchronization Cable, 100 ft. (31 m)	XMC 906 100I	XMC 906 100I

10.5.5 Equipotential Cables

Description	Catalog Number	Material Number
Equipotential Cable, 16.4 ft. (5 m)	N/A	78101-15-AC-26
Equipotential Cable, 19.7 ft. (6 m)	GE EP TABL	3018481