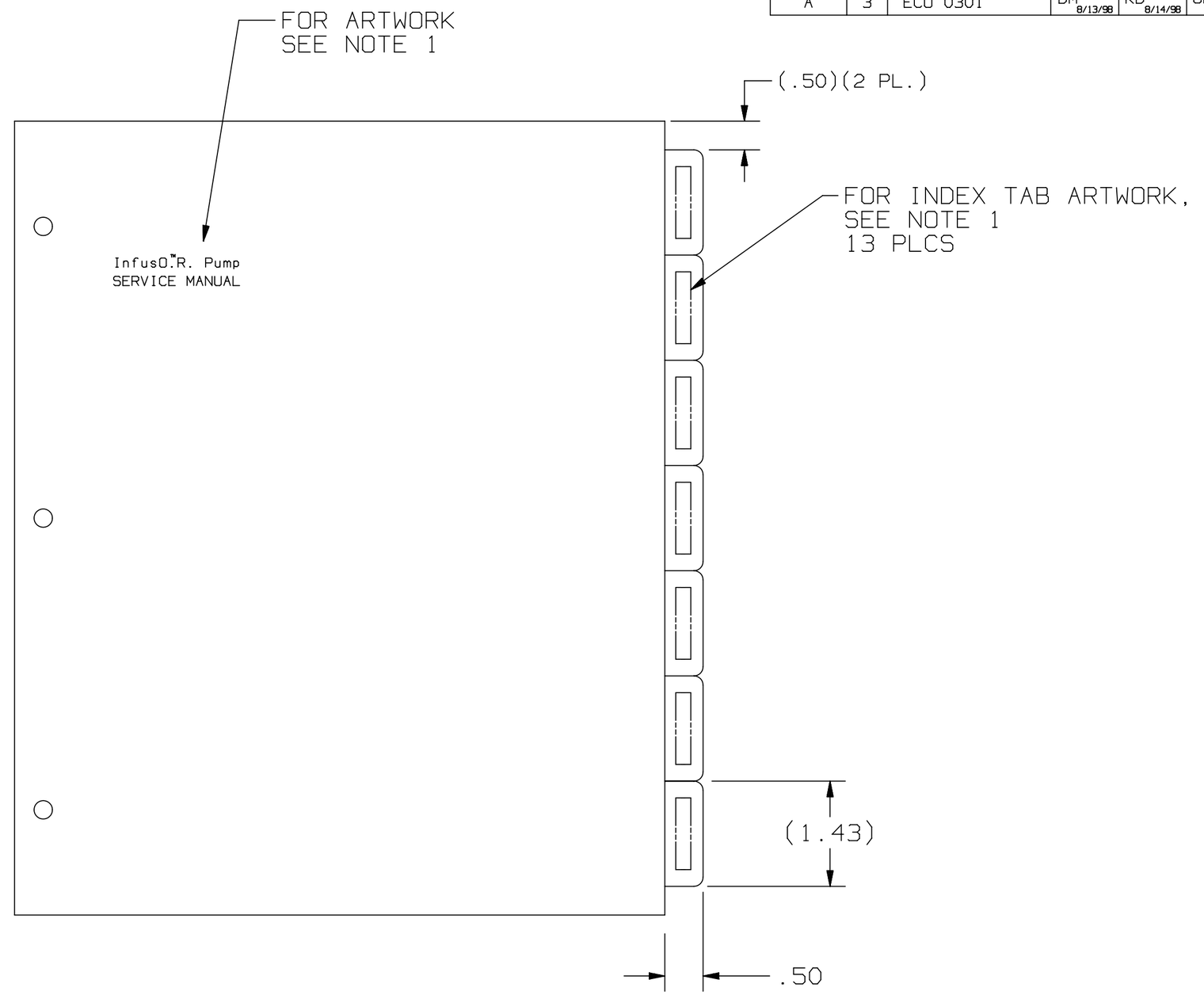
ARTWORK REV.	REV	REVISION RECORD	DR / DATE	CK. / DATE	APP. / DATE
0	0	NDR 433	BZ 08/08/91	LM 08/08/91	JS 08/09/91
1	1	ECO 7480	GT 12/18/91	BZ 12/20/91	DM 12/20/91
2	2	ECO 8204	REM 1/28/94	BZ 3/8/94	BK 3/9/94
A	3	ECO 0301	DM 8/13/98	KD 8/14/98	GB 8/21/98

TABLE -A-	
SINGLE-SIDED PAGES	DOUBLE-SIDED PAGES
COVER PAGE	iii THRU A7-2
REG. FORM	
i	
ii	



2. MATERIAL:

2.1. MANUAL PAGES:
8-1/2 x 11-80 LB OFFSET WHITE PAPER WITH 3 HOLES.
ALL TEXT AND GRAPHICS BLACK.
35 DOUBLE SIDED PRINTED PAGES AND 4 SINGLE SIDED PAGES PER TABLE -A-.

2.2. TABS:
80lb COVER WHITE DIVIDER WITH 13 INDEX TABS.
BLACK TAB TEXT CENTRALLY LOCATED ON TAB.
EACH TAB TO BE DOUBLE-SIDE PRINTED.
TAB MUST BE LAMINATED CLEAR MYLAR BOTH SIDES.
TAB DIE CUT TO INDUSTRY STANDARDS.
TABS TO BE INSERTED IN FRONT OF EACH APPROPRIATE SECTION.

2.3. MANUAL PAGES TO BE INSERTED INTO APPROPRIATELY SIZED SEALED POLY BAG(S).

1. FOR SHEETS 2 THRU 76, SEE ARTWORK FILE LOCATION -A-.

NOTES:

ITEM	SIZE	PART No.	REV	DESCRIPTION
1	S	5158113	REF	QII MANUAL OPERATOR'S

UNLESS OTHERWISE SPECIFIED TOLERANCES ON:

DECIMALS		ANGLES
.XX ±.12	.XXX ±	±

DO NOT SCALE DRAWING
REMOVE BURRS AND SHARP EDGES TO APPROX. .005 R

SQ. & PAR. ____ IN PER IN
CONCENTRICITY ____ TIR
SURFACE FINISH ____ RMS
MACH. FIL.APPROX. .005 R

		DATE
DRAWN	R. ZAREMBA	AUG 8, 1991
CHECKED	L. MARKS	AUG 8, 1991
R & D	J. SKAKOON	08/09/91
M.E.	M. MENDEZ	08/08/91
Q.A./RA.	P. OHANIAN	08/08/91
M.C.	R. BROWN	08/08/91
MFG.	L. MATULSKY	08/08/91
SER.	P. MOVSESIAN	08/08/91
MKT.	C. FAY	08/08/91

Baxter
ORIGINATING OFFICE
MEDICATION DELIVERY

TITLE
MANUAL PAGES SERVICE
InfusO.R.

SIZE	DRAWING NUMBER	REVISION
C	5371159	3

SCALE	FIRST USED ON	LOC	SHEET OF
NONE	5371160		1 76

InfusO.R. ™Pump
SERVICE MANUAL

Baxter Healthcare Corporation
Deerfield, IL 60015 USA

REORDER NO. 5371160

5371159 RA 2/98

InfusO.R.™ Pump
SERVICE MANUAL REGISTRATION FORM

In order to provide up-to-date service information to our customers, Baxter's Andover Service Center has instituted a Service Manual Maintenance Program. This program will provide updates, addenda and service bulletins on a periodic basis to registered users. Participation in this program is recommended for all users who will be using this manual to perform routine maintenance and repairs on the *InfusO.R.*™ Pump.

To register, you **MUST** fill out and return this registration form. A separate registration form must be completed for each manual in your facility.

PART NUMBER: 5371160

NAME: _____

FACILITY: _____

ADDRESS: _____

CITY, STATE, ZIP: _____

PHONE: _____

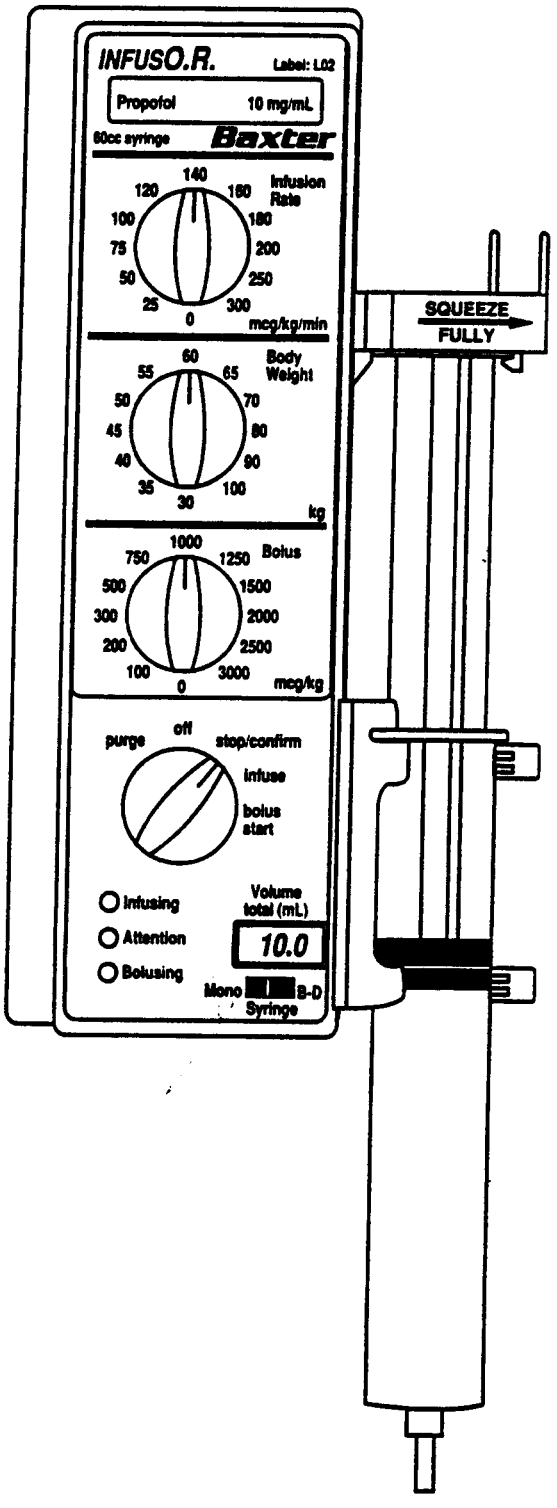
E-MAIL ADDRESS: _____

DATE RECEIVED: _____

RETURN FORM TO: BAXTER HEALTHCARE CORPORATION
SERVICE MANUAL REGISTRATION
ANDOVER SERVICE CENTER
200 BULFINCH DRIVE
ANDOVER, MA 01810

5371159 RA 2/98

INFUSO.R.™ PUMP



NOTICE

NOTICE: READ THIS BEFORE ATTEMPTING TO SERVICE PUMP

This manual has been developed to help you troubleshoot and service the InfusO.R. Pump.

Be sure to read this manual and become familiar with its contents before attempting any disassembly or repair of the pump.

The InfusO.R. Pump should only be serviced by a Certified Biomedical Equipment Technician (CBMET).

CAUTION: The InfusO.R. Pump contains static sensitive electronic devices. DO NOT attempt disassembly without proper personnel and work station grounding apparatus. DAMAGE MAY RESULT.

TOOLS AND EQUIPMENT REQUIRED

The Troubleshooting and Repair Section contains a list of the tools and equipment necessary to repair and maintain the InfusO.R. Pump. No repair should be attempted unless the necessary equipment is available.

TABLE OF CONTENTS

			PAGE
1.0	**INTRODUCTION**		1-1
	1.1	General	1-1
	1.2	Field Repair Constraints	1-1
	1.3	Factory Service/Assistance	1-1
2.0	**THEORY OF OPERATION**		2-1
	2.1	Mechanical Assemblies	2-1
		2.1.1 Front Case	2-1
		2.1.2 Rear Case	2-1
		2.1.3 Pusher Block	2-2
		2.1.4 Syringe Holder	2-2
		2.1.5 Drive Mechanism	2-3
	2.2	Electronic Circuits	2-4
		2.2.1 Microprocessor Circuit	2-4
		2.2.2 Motor Drive Circuit	2-5
		2.2.3 Power Supply Circuit	2-5
		2.2.4 Low Battery Detection Circuit	2-6
		2.2.5 Primary Encoder Detector Circuit	2-6
		2.2.6 Hall Sensor Circuit	2-7
		2.2.7 Status Input Circuit	2-7
		2.2.8 LED Drive Circuit	2-8
		2.2.9 External Timer Circuit	2-9
		2.2.10 LCD Driver Circuit	2-9
3.0	**DISASSEMBLY/ASSEMBLY**		3-1
	3.1	General	3-1
	3.2	Disassembly/Assembly Sequence	3-1
	3.3	Disassembly/Assembly Instructions	3-2
	3.4	Mechanism Reassembly	3-3
	3.5	Syringe Block Alignment	3-4
	3.6	End of Syringe Adjustment	3-5
4.0	**TROUBLESHOOTING AND REPAIR**		4-1
	4.1	Tools and Equipment	4-1
	4.2	Board Exchange	4-1
	4.3	Troubleshooting Tips	4-1
	4.4	Troubleshooting Chart	4-2

CONTENTS (CONTINUED):

5.0	**ROUTINE MAINTENANCE**		5-1
	5.1	General	5-1
	5.2	Cleaning and Disinfecting	5-1
	5.3	Lubrication	5-1
6.0	**FUNCTIONAL TEST**		6-1
	6.1	Pusher Block	6-1
	6.2	Syringe Holder	6-1
	6.3	End of Syringe Alarm	6-1
	6.4	Occlusion Alarm	6-1
	6.5	Input Switches	6-2
	6.6	Accuracy Check using a Burette and Timer	6-3
	6.7	Accuracy Check using a Linear Displacement Gauge	6-5

APPENDICES:

1.0	Schematics and Wiring Diagram	A1-1
2.0	Circuit Board Assembly Drawings	A2-1
3.0	Parts List/Diagrams	A3-1
4.0	Product Updates	A4-1
5.0	Manual Revision Notices	A5-1
6.0	Repair History	A6-1
7.0	Operator's Manual	REF

1.0 INTRODUCTION

1.1 GENERAL

This Manual provides technical and service information necessary to maintain satisfactory operation of the InfusO.R. Pump.

The contents are summarized as follows:

1. Set up and inspection
2. Routine maintenance and functional tests
3. Troubleshooting and repair

Baxter Healthcare Corporation provides a one-year limited warranty for each InfusO.R. Pump. If a pump requires warranty service, call Baxter Healthcare Corporation for repair. Unauthorized repairing of a pump before the warranty has elapsed voids the warranty.

1.2 FIELD REPAIR CONSTRAINTS

Pumps no longer under warranty can be repaired by the customer within the following constraints:

1. Customer assumes responsibility for repair.
2. Only components included in the parts list are used to make the repair.
3. Components from the mechanism must not be removed during the repair procedure unless those components are specified in the parts list.
4. Each repaired unit passes the InfusO.R. Pump functional test before it is returned to use.

Call Baxter Healthcare Corporation Service Department to order components necessary to complete the repair.

1.3 FACTORY SERVICE/ASSISTANCE

If factory service is desired, pumps may be returned to Baxter Healthcare Corporation for repair. A charge will be incurred for material and labor costs.

To expedite repairs, call for a return authorization number before shipping any pump to Baxter Healthcare Corporation.

TECHNICAL ASSISTANCE, SERVICE AND REPAIR:

FOR TECHNICAL ASSISTANCE, PARTS ORDERING AND SERVICE RETURN AUTHORIZATION, CONTACT THE BAXTER HEALTHCARE CORPORATION SERVICE CENTER.

PARTS AND SERVICE RELATED BUSINESS:
800-343-0366

TECHNICAL REPAIR ASSISTANCE HOTLINE:
800-634-4602

THIS PAGE INTENTIONALLY BLANK

2.0 THEORY OF OPERATION

2.1 Mechanical Assemblies

The mechanical assemblies of the InfusO.R. Pump are contained within the pump cases and provide two basic functions: Component housing and fluid delivery when a syringe is placed in the pump. For convenience, the assemblies are divided into the following subunits:

2.1.1 Front Case
2.1.2 Rear Case
2.1.3 Pusher Block
2.1.4 Syringe Holder
2.1.5 Drive Mechanism

A description of each subunit follows.

2.1.1 Front Case

The front case includes the pump front cover, the battery door, the battery spring, the switchboard assembly, the hall effect subassembly, the pump LCD and the Syringe Manufacturer Selection switch. The assembly is contained within a high impact ABS case that provides drip proof fluid protection. The assembly holds the batteries and drive mechanism in conjunction with the rear case assembly. It is connected to the rear case assembly by four self-tapping screws located in the pump rear cover.

The batteries are placed in series in the pump in a channel created by the two pump case assemblies. A battery spring provides contact with the negative terminal of the batteries when four C-cells have been placed in the battery compartment. The battery door connects to the batteries' positive terminal. The battery spring and door are both connected to the microprocessor board assembly to provide power to the pump electronics.

The user input switches for pump operation are mounted directly onto the switchboard subassembly. The syringe selection switch and LCD are mounted in the front case cover and attach via cables to the switchboard. The front label contains a thin metal shield for attachment of the pump smart labels. The front label also helps to seal the case cover for fluid protection.

2.1.2 Rear Case

The rear case includes the pump rear cover and the pole clamp bracket. The rear case cover is also made of high impact ABS. It provides a travel guide for the battery door in conjunction with the front case half. The battery door slides open in this guide to allow insertion and removal of the C-cell batteries.

2.1.2 Rear Case (Continued)

The pole clamp bracket is made of nylon and is attached to the rear case half with two self-tapping screws. Its dovetail shape is designed to interlock with the pole clamp. An extension from the bracket helps to secure the pump to an IV pole when the locking pole clamp is used.

2.1.3 Pusher Block

The Pusher Block subassembly connects to the pump drive mechanism and extends outside of the pump case through the drive mechanism channel located on the right side of the pump. The Pusher Block has a main support and finger lever that are squeezed to allow free travel of the subassembly along the drive mechanism. A latch on the lever provides positive connection to the plunger of a syringe placed in the pump.

Squeezing the lever causes it to slide within the pusher block until it encounters a brass rod cap. The lever then retracts the plunger rod as it is squeezed further. This retracts a half-nut that rides on the drive mechanism leadscrew which mechanically decouples the leadscrew from the pusher block subassembly. When the lever is released, a spring forces the half-nut back to its coupled position thus engaging the leadscrew. Another spring returns the lever until it captures the syringe plunger flange or lacking one, until it stops within the pusher block.

Within the case halves, the pusher block subassembly has an actuator screw attached to it that will actuate the pump end of syringe alarm system. The screw location is calibrated in the factory to ensure proper alarm actuation position.

2.1.4 Syringe Holder

The Syringe Holder subassembly also connects to the drive mechanism and is located outside of the pump case in line with the pusher block subassembly. The syringe holder accepts the barrel of either 20 cc or 60 cc syringes used with the pump. It connects to the drive mechanism via two self-tapping screws located beneath the syringe loading label.

The Syringe Holder has a base, a rotating syringe clip and a stainless steel pivot arm with a return spring. The base has a groove for locating and seating the syringe barrel flange. The syringe clip rotates on the pin to allow insertion of the syringe barrel. The return spring forces the syringe clip against the syringe barrel to firmly hold the syringe in place with the syringe holder base.

2.1.5 Drive Mechanism

The drive mechanism assembly is held within the pump case halves and includes the pump's DC motor, the pusher block subassembly, the leadscrew assembly, the syringe holder assembly and the end of syringe and occlusion alarm actuation systems. The mechanism has two aluminum pillow blocks and two stainless steel guide rods for its main support. The DC motor fastens to one pillow block and is coupled to the leadscrew through gears. The leadscrew runs parallel with the guide rods and is held in place by bearings mounted in each pillow block. The guide rods also fasten to the pillow blocks and provide a travel guide for the pusher block subassembly.

The middle pillow block holds the end of syringe switch. The actuator screw attached to the pusher block subassembly aligns with the switch and actuates it when the pusher block has travelled to the end of syringe location. The guide rods extend through the middle pillow block and support the occlusion alarm actuator block. The syringe holder subassembly attaches to the occlusion actuator block which is held in position by a spring and two preload collars. When the force on the syringe holder due to pressure in the fluid delivery system overcomes the actuator spring force, the occlusion actuator block begins to move and actuates the occlusion switch located on the microprocessor board assembly. The switch and actuator block are calibrated in the factory to assure actuation at the proper position. When the pressure in the fluid system is released, the spring returns the actuator block back to its normal position.

The pump microprocessor board assembly is mounted to the middle pillow block via two machine screws and a dowel pin which helps to minimize free travel of the assembly once the occlusion system has been calibrated.

2.2 Electronic Circuits

The logic and control circuits for the InfusO.R. Pump are distributed over three circuit boards. These three circuit boards are the microprocessor board assembly, the switchboard, and the hall sensor board. For explanatory purposes, the circuits have been divided into the following subunits:

- 2.2.1 Microprocessor Circuit
- 2.2.2 Motor Drive Circuit
- 2.2.3 Power Supply Circuit
- 2.2.4 Low Battery Detection Circuit
- 2.2.5 Primary Encoder Circuit
- 2.2.6 Hall Sensor Circuit
- 2.2.7 Status Input Circuit
- 2.2.8 LED Driver Circuit
- 2.2.9 External Timer Circuit
- 2.2.10 LCD Driver Circuit

A description of the operation of each of these subunits follows.

2.2.1 Microprocessor Circuit

The microprocessor is responsible for control of the pump. It contains all PROM and RAM used for pump operation. The Hitachi HD63705VOP microprocessor is a low power 8 bit microprocessing unit (MPU) which contains a central processing core, internal clock functions, 4K bytes of programmable read only memory (PROM), 172 bytes of random access memory (RAM), and 31 input/output pins. It interfaces with and controls all other circuit subunits described in this theory of operation section. In addition, it also provides a series of pump status checks periodically during pump operation. These check the end of syringe switch, secondary encoder circuit, the Syringe Selector switch, and the pump audio alarm indicator.

The end of syringe switch is connected to microprocessor input U1-29. The input is normally held low by a pulldown resistor. When the syringe is near empty, switch S6 is closed by the actuator on the pusher block which drives U1-29 high. This indicates an end of syringe condition to the microprocessor.

The secondary encoder circuit consists of a reed switch and a disc magnet that rotates with the pump leadscrew. The reed switch output is connected to U1-25 which is driven high when the reed switch is closed and pulled low when the switch is open. Each closure of the reed switch signals the microprocessor to compare the primary encoder counts from the electro-optical encoder with a reference value. Capacitor C24 provides switch debounce when the reed switch opens.

2.2.1 Microprocessor Circuit (Continued)

The syringe selector switch is connected to U1-24. When the switch is in the "Mono" position, the microprocessor input port is pulled low. When the switch is in the "B-D" position, the port is pulled high.

The audio alarm indicator is connected to U1-4. It is activated when the microprocessor output pin is driven high.

2.2.2 Motor Drive Circuit

The motor drive circuit is responsible for controlling the pump's DC motor under all delivery modes (PURGE, INFUSE, and BOLUS). For the motor shaft to rotate, the processor's motor enable line (U1-9) must be high and the motor drive line (U1-10) must be pulsed. The drive line is AC coupled through capacitor C5 which prevents continuous motor operation in the event that the processor drive and enable lines remain high. Transistor Q9 forms a dynamic brake that is used to stop the motor quickly.

During typical operation, the enable line will be turned on when the pump is in a delivery mode of operation. With the enable line high, the motor is driven by pulsing the drive line. The drive pulse duration, or duty cycle, is varied to control the motor speed. After the motor drive pulse is given, the dynamic brake is applied to slow down the motor. At high pump delivery rates, the dynamic brake is not used.

A constant forward bias current is applied across the motor windings limited by resistor R12. This bias current prevents backward motion due to mechanical wind-up in the motor gear train during pulsed motor operation. Motor power is supplied through switch S1, the occlusion switch. At the instant an occlusion is detected, the motor power is removed ensuring that the motor cannot operate while an occlusion exists. A diode CR4 across the motor terminals protects the enable transistor Q1 and the drive transistor Q2 from transient voltages that develop when the motor is turned on quickly.

2.2.3 Power Supply Circuit

The power supply circuit consists of a linear voltage regulator VR1 and two stabilizing capacitors C15 and C16. The regulator provides a 5 volt output. The dropout voltage is typically 0.6 volts across the regulator. A diode CR9 is added across the voltage regulator to protect it from damage if the batteries are inserted into the pump backwards.

2.2.4 Low Battery Detection Circuit

A low battery condition is detected by monitoring the regulated voltage supply. An op amp U2-A is configured as a voltage comparator without hysteresis. The non-inverting input to the comparator is the regulated supply voltage divided through a resistor pair (R5, R6). This is compared to a 2.5 volt reference diode CR2 connected to the inverting input of the op amp. When the divided supply voltage drops below the reference voltage, the comparator output goes low signaling a low battery condition to the microprocessor. This occurs when the supply voltage is within the range of 4.87 to 5.13 volts.

The comparator output will stay low only while the divided voltage is less than the reference voltage. The comparator output is connected to U1-17.

2.2.5 Primary Encoder Detector Circuit

An electro-optical encoder which is part of the motor provides the primary signal for controlling pump delivery. The encoder provides a sinusoidal signal to the encoder circuitry at connector J2-3 that is directly related to the rate at which the motor is rotating. The purpose of the encoder detection circuitry is to transform the sinusoidal signal into a digital pulse train that can be interpreted by the pump's microprocessor.

The encoder detection circuit has two main parts: A low pass filter/sample and hold circuit and a zero crossing detection circuit. The encoder sinusoidal output can vary in peak to peak magnitude from 0.2 to 2.0 volts. It also has a DC offset that can vary from 0.1 to 1.8 volts. The low pass filter/sample and hold circuit functions to capture the DC offset component of the encoder output to be used as the zero crossing detector reference.

The low pass filter is made with RA 10-1 and C7 and has a corner frequency of 18 Hz. The filter output is connected to the input of op amp U2-C. The output of this op amp is connected to the sample and hold transistor Q8. When the microprocessor turns the sample and hold transistor on, the DC offset voltage is passed through to charge a capacitor C8. When the transistor is turned off by the processor, the DC offset voltage is stored across C8. This voltage is then connected to a voltage follower circuit U2-D before it is connected to the zero crossing detector U2-B.

2.2.5 Primary Encoder Detector Circuit (Continued)

The zero crossing detector uses the DC offset voltage as its reference level which it compares to the sinusoidal encoder output signal. This transforms the sinusoidal signal into a 5 volt square wave with the same frequency as the original encoder sinusoid. The output square wave is connected to the base of transistor Q4 via a high pass filter made from C11 and RA8. This allows the transistor to be turned on for approximately 20 microseconds at each positive transition of the 5 volt square wave. When the transistor is turned on, the microprocessor IRQ line U1-2 is pulled low. After 20 microseconds it returns to a high level.

2.2.6 Hall Sensor Circuit

A circuit board mounted just under the front switch panel of the InfusO.R. Pump contains three pairs of hall effect sensors which are used to decode the magnetically encoded Smart Labels. When the Smart Label is placed on the pump, high strength magnets placed in the label align with the hall sensor pairs to activate them. These magnets are oriented with either north or south poles closest to the sensor board depending on the digital code the label makes with the sensors.

Each Smart Label has a unique combination of magnets with a choice of three states for each: north pole active, south pole active or no magnet present to activate the hall sensor pair. Each hall sensor pair is made to detect a north magnet with one sensor and a south magnet with the other sensor of the pair. Thus the hall sensors will be turned on depending on the magnet orientation. When no magnet is present, neither hall sensor is on. The output from the sensors is read by the pump microprocessor through the status input circuit. The microprocessor interprets the attached Smart Label through the code created by the hall sensor pairs.

2.2.7 Status Input Circuit

The status input circuit polls the front panel rotary switches and hall effect sensors and sends the switch setting information to the pump's microprocessor. Each of the three rate setting switches on the pump are twelve position rotary switches. Turning the switch causes a central wiper to contact one of the twelve switch positions. The contacts for the three switches are connected to a common bus labelled P1 through P12. The bus is connected to the first 12 bits of a pair of parallel-in, serial-out shift registers. The sixteen inputs of the two shift registers are normally pulled up via 10K resistors.

2.2.7 Status Input Circuit (Continued)

Each switch wiper is connected to an individual output port from the microprocessor. When the switch is being read, its wiper is pulled low by the microprocessor. The processor then looks for the low signal to appear on one of the twelve bits from the shift register connected to the switch contacts. Since only one wiper is pulled low at a time, the microprocessor is able to distinguish between the switches when it reads the common bus. When a switch is not being read, its wiper is in a high impedance state.

The operating mode selection switch is a double pole switch with two wipers. One is configured to decode the five positions on this switch. The other wiper is connected to the battery input voltage. Whenever the switch is placed in an operating mode, this wiper supplies battery power to the pump power supply circuitry.

When the Body Weight switch and the Infusion Rate switch are polled, the wiper also supplies power to one hall effect sensor in each pair. The hall effect sensor outputs are connected to three of the remaining four shift register bits from each of these switches. Information from the four rotary switches and six hall effect sensors are presented to the shift registers U3 and U4. The microprocessor sets U1-16 high which allows the shift registers to load the data on sixteen input lines. U1-16 is then set low by the microprocessor which serially clocks the data into the microprocessor on input U1-19.

2.2.8 LED Drive Circuit

The LED drive circuit consists of three transistors that provide ground to the cathode of the pump's three indicator LEDs when the transistors are turned on by the pump microprocessor. Output port U1-5 turns on transistor Q6 which illuminates the green "Infusing" LED. U1-7 turns on transistor Q7 which illuminates the red "Attention" LED. U1-6 turns on transistor Q5 which illuminates the green "Bolusing" LED.

2.2.9 External Timer Circuit

The external timer circuit functions as a microprocessor watchdog for the Hitachi [1] microprocessor. It will reset the processor if it gets stuck in a software loop and will also provide a reset pulse to the processor at power up.

The circuit uses a retriggerable monostable multivibrator (one-shot) which the microprocessor must pulse at least once every 300 milliseconds. The pulse is provided on output pin U1-26. The pulse time is determined from the time constant set by resistor R14 and capacitor C20. If no pulse from the microprocessor is received during the time period, then U6-13 will go low causing a reset of the microprocessor. It will stay low until C21 charges up through the microprocessor's internal 100K pull up resistance. This occurs in approximately 150 msec. At power down, all of the capacitors discharge through diodes CR6 and CR1, preventing them from providing any input voltage to the unpowered microprocessor.

2.2.10 LCD Driver Circuit

The liquid crystal display module in the pump front cover is a 5 digit, 35 segment display with a built in serial input driver IC. The driver IC is capable of driving only 32 segments, therefore, an additional exclusive OR gate is used to drive the remaining segments.

For the 32 segments driven by the display driver IC, the data is clocked using the microprocessor output pins U1-33 (DATA) and U1-34 (CLK). When 32 bits have been clocked in the display driver, U1-36 (LOAD) is pulsed causing the desired segments to be displayed. U1-27 provides power for the display and also for the exclusive OR gates (U5). The remaining three segments are driven by setting U1-30, 31, and 32 high or low to turn the segments on or off, respectively. U5 is provided with the signal that clocks the LCD to make the segments appear at the appropriate time.

[1] Hitachi, Ltd.

THIS PAGE INTENTIONALLY BLANK

3.0 DISASSEMBLY/ASSEMBLY

3.1 GENERAL

This section contains a sequential step-by-step description of the disassembly/assembly of the InfusO.R. Pump. Contact Baxter Healthcare Corporation technical service if you have any questions while servicing the InfusO.R. Pump.

CAUTION: When performing the following procedures, exercise caution during disassembly to protect the PC boards from stray static discharge. The inspection or repair bench, all equipment, and personnel should be grounded.

NOTE: During disassembly, note orientation and routing of all cables and connectors. Failure to do so may result in improper operation upon reassembly.

NOTE: All pumps must pass the Functional Test found in Section 6.0 after repair is completed.

3.2 DISASSEMBLY/ASSEMBLY SEQUENCE

Disassembly is identified by the steps listed below. Steps to complete subassembly/component removal must be followed in sequential order.

To reassemble, reverse procedures unless otherwise stated.

STEP	PRIOR STEPS TO COMPLETE
1. Rear Case Half Assembly	-
2. Syringe Holder	-
3. Mechanism Assembly	1
4. Reed Switch Assembly	1,3
5. MPU/Mechanism Circuit Board	1,3
6. Motor Assembly	1,3,4
7. Syringe Block	1,2,3,5
8. Pusher Block Assembly	1,2,3,5,7
9. Guide Rod	1,2,3,4,5,7,8
10. Front Case Half Assembly	1,3
11. Switchboard	1,3,10
12. Front Cover/Hall Effect Assembly	1,3,10,11
13. LCD Assembly	1,3,10,11

3.3 DISASSEMBLY/ASSEMBLY INSTRUCTIONS

1. Rear Case Half Assembly (Figure 3-1)
   - A. Lay pump face down on clean work area.
   - B. Remove (2) screws from pole clamp mounting bracket.
   - C. Remove (4) rear case half screws.
   - D. Separate rear case half from front case half by gently pulling apart.

2. Syringe Holder (Figure 3-1)
   - A. Remove syringe loading label.
   - B. Remove (2) screws securing holder to end block and remove.

3. Mechanism Assembly (Figure 3-2)
   - A. Remove J1 ribbon cable and J4 2 pin cable from MPU board.
   - B. Lift up on mechanism, guide cables J1 and J4 through mechanism assembly.

4. Reed Switch Assembly (Figure 3-2)
   - A. Remove connector at J5 on MPU board.
   - B. Remove (2) screws securing reed switch assembly to motor pillow block and remove.

5. MPU Board (Figure 3-2)
   - A. Remove all cable connections to MPU board.
   - B. Remove (2) screws securing board to middle pillow block.
   - C. Slide MPU board off of alignment pin.

6. Motor Assembly (Figure 3-2, 3-7)
   - A. Remove (3) screws securing motor to motor pillow block.
   - B. Remove black and red wires from 8 pin connector.

7. Syringe Block (Figure 3-3)
   - A. Loosen preload and limit collar cap screws.
   - B. Carefully slide syringe block, collars and preload spring off guide rods. (Use caution as preload spring is under tension).
   - C. Refer to Section 3.4 for mechanism reassembly.

8. Pusher Block Assembly (Figure 3-2, 3-4)
   - A. With 7/16" open end wrench and 7/16" nut driver remove threaded bushing from leadscrew.
   - B. Loosen (2) screws on top of middle pillow block.
   - C. Carefully slide middle pillow block off guide rods.
   - D. Remove pusher block.
   - E. Refer to Section 3.4 for mechanism reassembly.

9. Guide Rod (Figure 3-2)
   - A. Loosen set screws on motor pillow block.
   - B. Gently tap motor pillow block off guide rods.
   - C. Refer to Section 3.4 for mechanism reassembly.

10. Front Case Half Assembly (Figure 3-5)
    - A. Remove (4) screws from inside of front case half.
    - B. Lift up tape strip and slide cable through hole in front case.

11. Switchboard (Figure 3-5, 3-6)
    A. Remove knob labels.
    B. Remove set screws and knobs.
    C. Remove (5) screws securing switchboard to the switch plate.
    D. Gently pull switchboard free of case cover (switchboard may adhere to front label initially).

12. Front Cover/Hall Effect Assembly (Figure 3-8)
    A. Using a small screwdriver, pry the hot melt adhesive from the hall effect board.
    B. Desolder the 6 wires from the hall effect board.
    C. Remove (2) nuts securing syringe selector switch.

13. LCD Assembly (Figure 3-9)
    A. Desolder the 9 wires from the switchboard.

3.4 MECHANISM REASSEMBLY (Refer to Figures 3-3, 3-4, 3-10, 3-11)

A. Insert guide rods into motor pillow block so the end of the guide rods are flush with the face of the motor pillow block.
B. Tighten the motor pillow block set screws.
C. Install leadscrew assembly through motor pillow block.
D. Slide pusher block assembly onto guide rods. Position pusher block assembly up against the motor pillow block.
E. Install middle pillow block on guide rods. Slide it along guide rods until it is flush with the end of the leadscrew. Insert a screwdriver into the middle pillow block slot if it is difficult to slide along the guide rods.
F. Install the threaded bushing loosely onto the leadscrew.
G. Use a nut driver to adjust position of the middle pillow block so that the distance from the inside edge of the middle pillow block to the outside edge of the motor pillow block is 6.75".
H. While holding the threaded bushing stationary with nut driver, use open end wrench to tighten jam nut. Assure that the leadscrew turns freely with no binding or excessive play.
I. Place assembly into rear case and assure that the two pillow blocks fit within the locators molded into the case.
J. Remove assembly from rear case.
K. Tighten screws on the middle pillow block.
L. If not already attached, install motor to motor pillow block. Check that there is no binding between the motor and leadscrew gears. If necessary loosen and retighten motor screws.
M. Place syringe block and limit collar onto guide rods. Slide preload spring 3/4 of the way onto guide rod.
N. Using needlenose pliers, grasp preload collar (leave space at tip of pliers for end of spring).
O. Push preload spring and preload collar completely onto guide rod.
P. Adjust syringe block as outlined in Section 3.5.

3.5 SYRINGE BLOCK ALIGNMENT (Refer to Figures 3-3, 3-12)

3.5.1 Syringe Block Alignment

A. Insert a .030 gauge between the syringe block and the outside surface of the threaded bushing.
B. Tighten the preload collar cap screw.
C. Verify the .030 distance between the syringe block and threaded bushing.
D. Bend the switch arm until it just touches the syringe block actuator.

3.5.2 Limit Distance Calibration

A. Insert a .038 gauge between the limit collar and the syringe block.
B. Slide the limit collar against the gauge and tighten the limit collar cap screw.
C. Verify the .038 distance between the limit collar and the syringe block.

3.5.3 Syringe Block Stroke Adjustment

A. Holding the mechanism assembly firmly, pull back the syringe block toward the occlusion microswitch.
B. Install a .014 gauge between the preload collar and the syringe block, then release the syringe block.
C. Using an ohmmeter measure between the two outside terminals of the microswitch.
D. Check the meter reading for a "closed" condition. This is the normal operating position.
E. If the circuit reads "open," bend the switch arm using needlenose pliers slightly away from the syringe block actuator until a "closed" circuit is obtained.
F. Remove the .014 gauge and install a .023 gauge in its place.
G. Using an ohmmeter measure between the two outside terminals of the microswitch.
H. Check the meter reading for an "open" condition. This is the occlusion activation position.
I. If the circuit reads "closed," bend the switch arm using needlenose pliers slightly tighter to the syringe block actuator until an "open" circuit is obtained.
J. Return to Step A, and repeat this procedure completely until no further adjustments are required.

3.6 END OF SYRINGE ADJUSTMENT (Refer to Figure 3-13)

A. Adjust the plunger of a 60 cc syringe so that it lines up with the 5 mL division and install in the pump. Insure the syringe flange is properly seated in the syringe holder.

B. Pull up on the pusher block release lever and engage it onto the syringe plunger.

C. Initiate an infusion and allow the pump to run until it alarms EOS. This will be indicated by an audible alarm, flashing red LED and EOS flashing on the display.

D. Verify the syringe reads approximately 1 mL. If not, make adjustment as outlined in step E or F as appropriate.

E. If the alarm sounded too early, loosen the nut closest to the plunger screw head and tighten the other nut. This will move the plunger screw away from the EOS switch.

F. If the alarm sounded too late, loosen the nut closest to the halfnut and tighten the other nut. This will move the plunger screw closer to the EOS switch.

G. Return to step A and repeat this procedure until no further adjustment is required.

H. A drop of Loctite [2] thread lock # 425 should be added to the adjustment plunger nuts of the plunger screw once the plunger screw has been adjusted and properly verified.

[2] Loctite Corporation

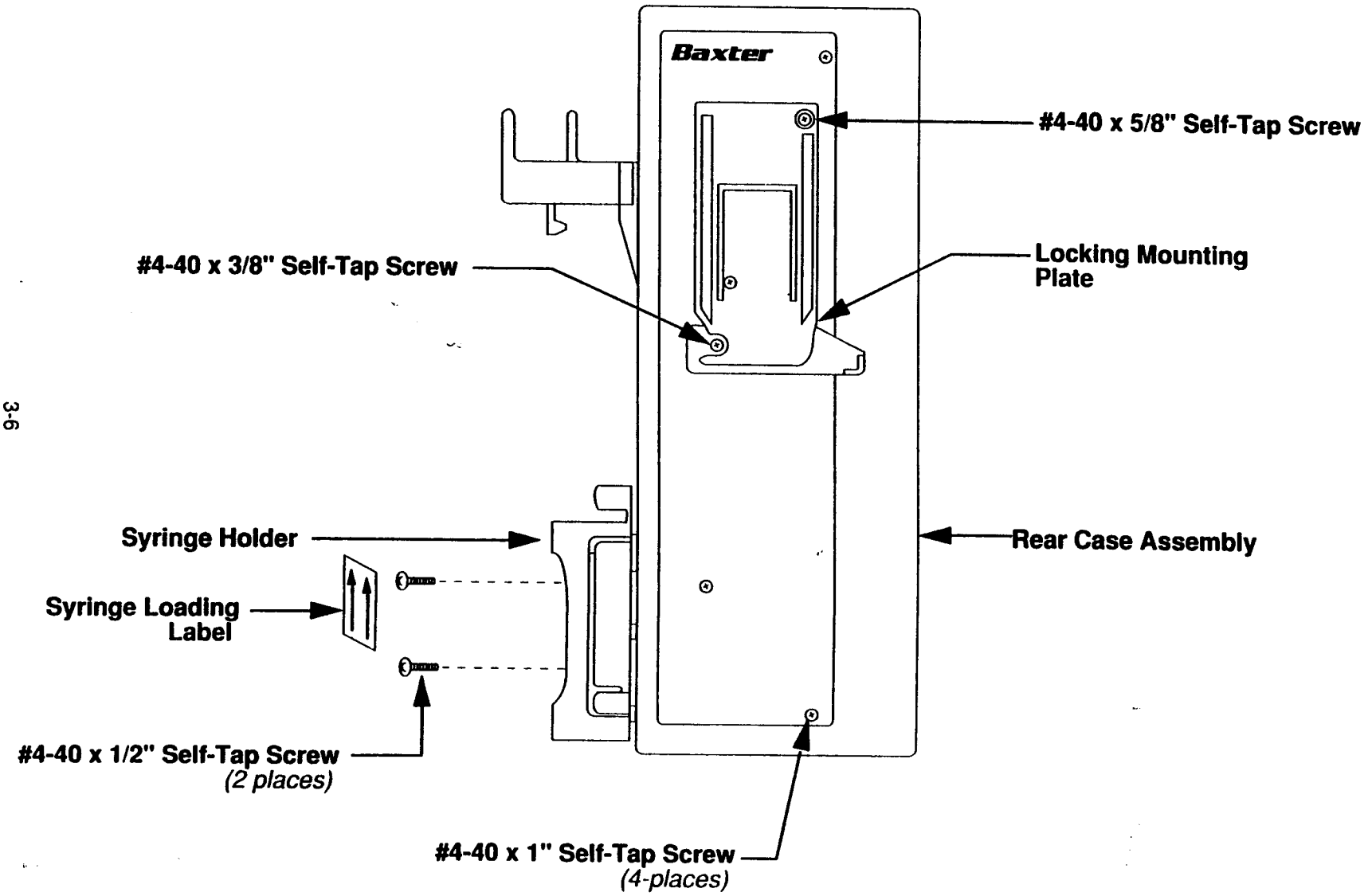

Baxter
#4-40 x 5/8" Self-Tap Screw
#4-40 x 3/8" Self-Tap Screw
Locking Mounting Plate
Syringe Holder
Rear Case Assembly
Syringe Loading Label
#4-40 x 1/2" Self-Tap Screw
(2 places)
#4-40 x 1" Self-Tap Screw
(4-places)

FIGURE 3-1

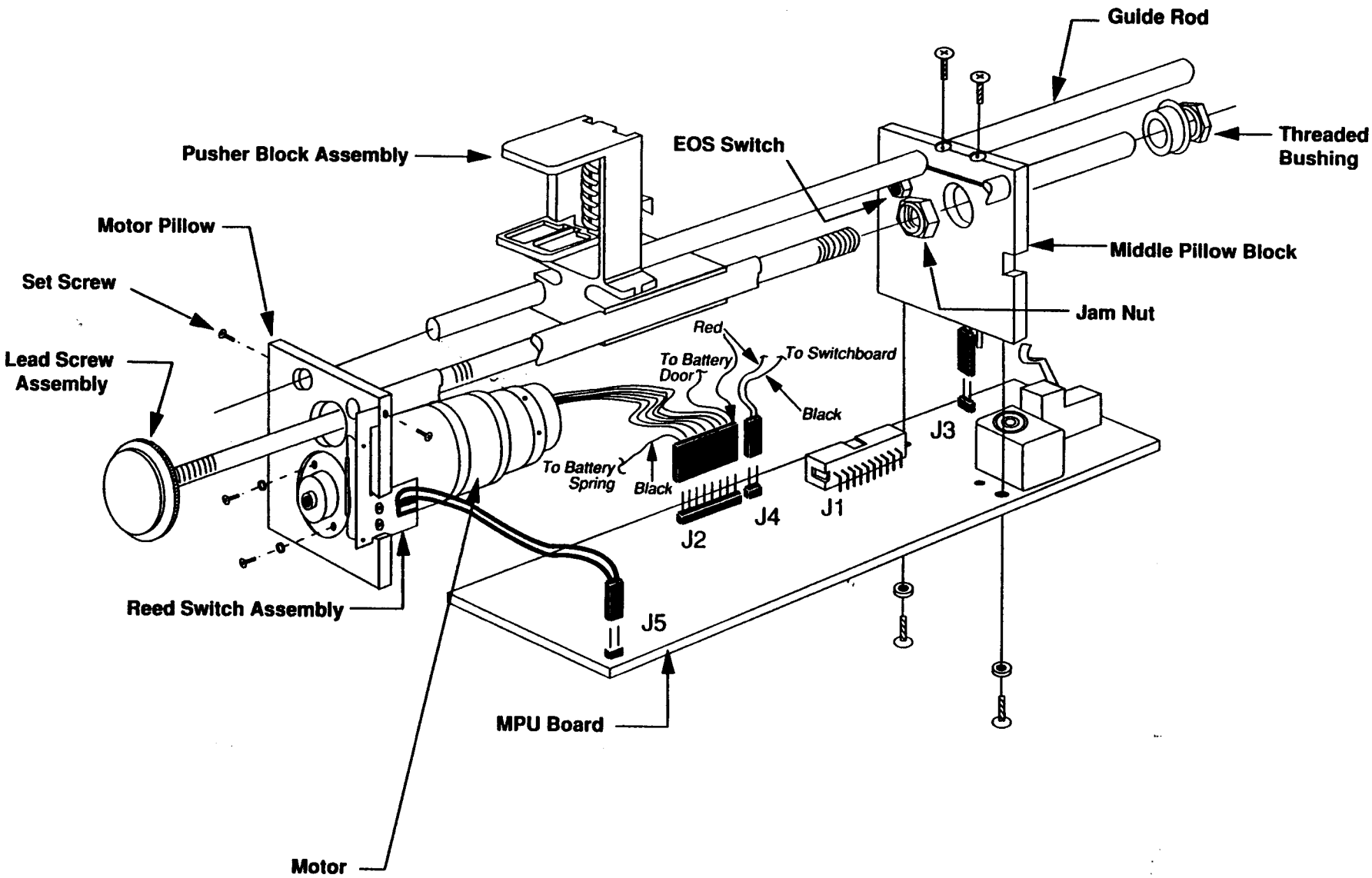

Guide Rod
Threaded Bushing
Pusher Block Assembly
EOS Switch
Motor Pillow
Middle Pillow Block
Set Screw
Jam Nut
Lead Screw Assembly
Red
To Battery Door
To Switchboard
Black
To Battery Spring
Black
J3
J4
J1
J2
J5
Reed Switch Assembly
MPU Board
Motor

FIGURE 3-2

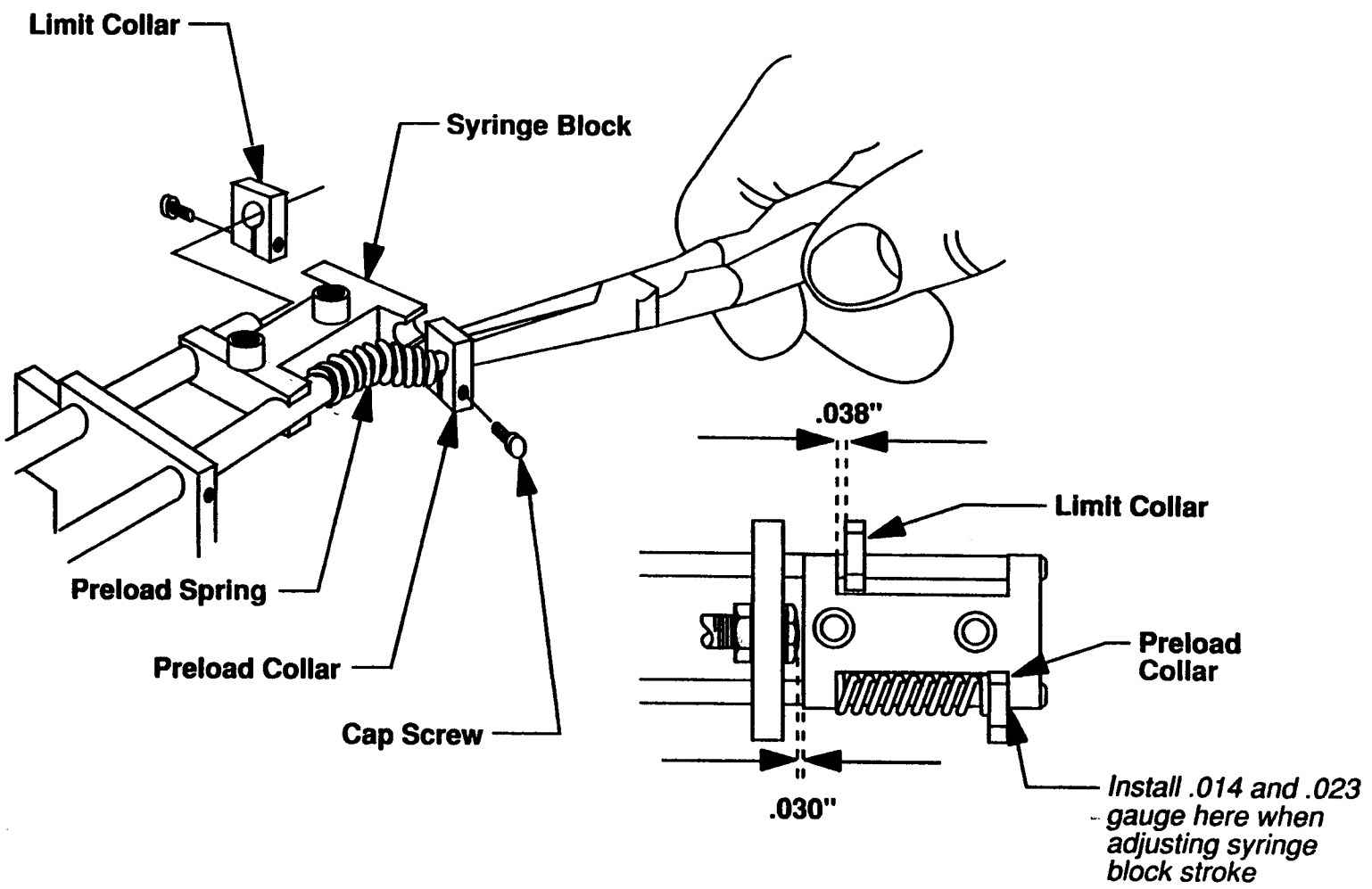

Limit Collar
Syringe Block
Preload Spring
Preload Collar
Cap Screw
.038"
Limit Collar
Preload Collar
.030"
Install .014 and .023 gauge here when adjusting syringe block stroke

FIGURE 3-3

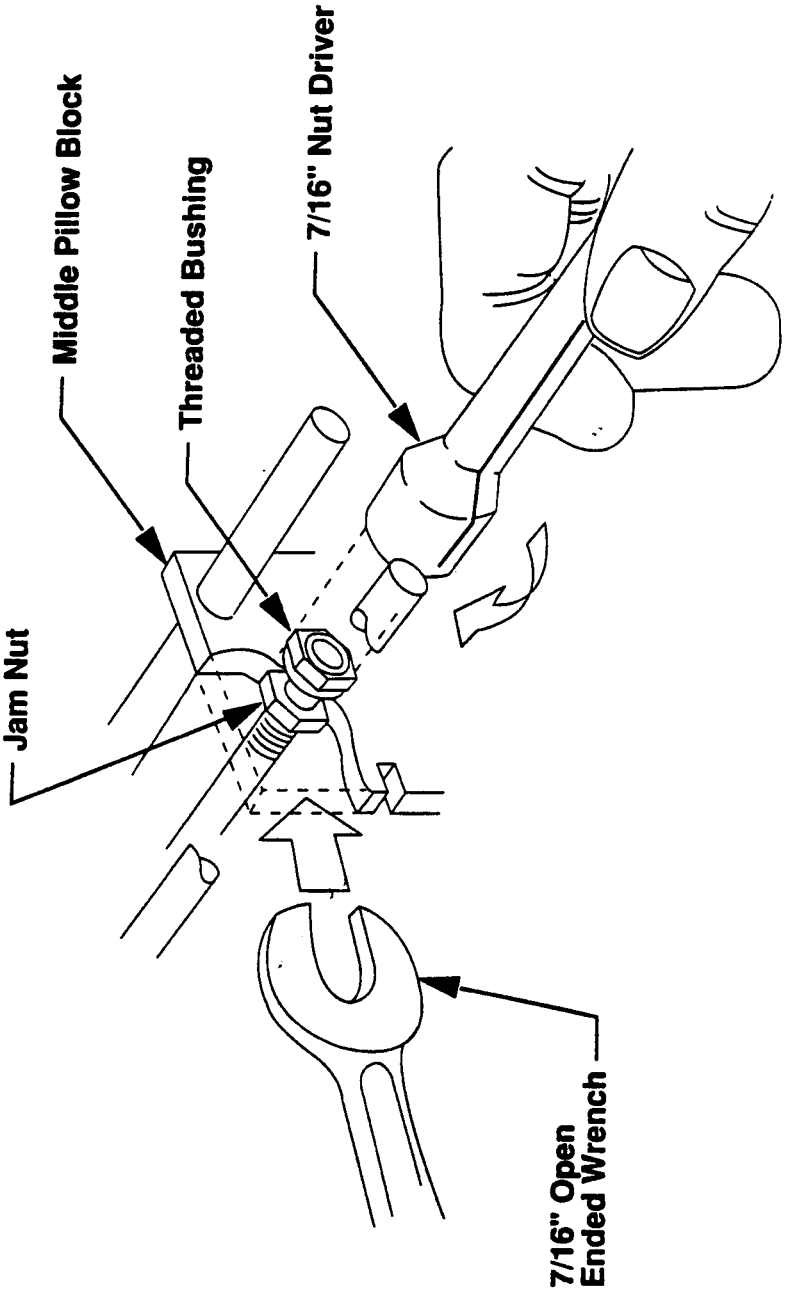

Middle Pillow Block
Threaded Bushing
7/16" Nut Driver
Jam Nut
7/16" Open Ended Wrench

FIGURE 3-4

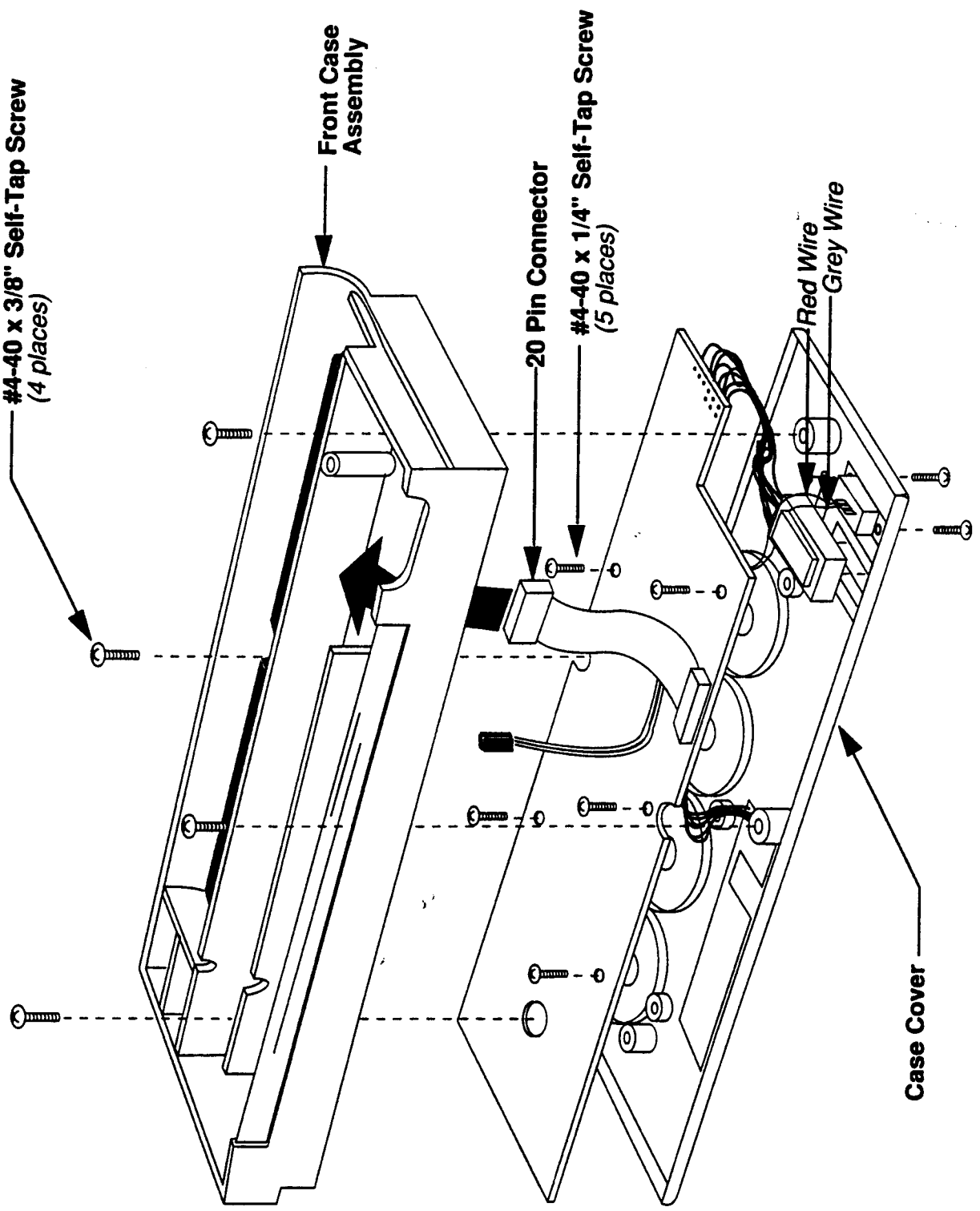

#4-40 x 3/8" Self-Tap Screw
(4 places)
Front Case
Assembly
20 Pin Connector
#4-40 x 1/4" Self-Tap Screw
(5 places)
Red Wire
Grey Wire
Case Cover

FIGURE 3-5

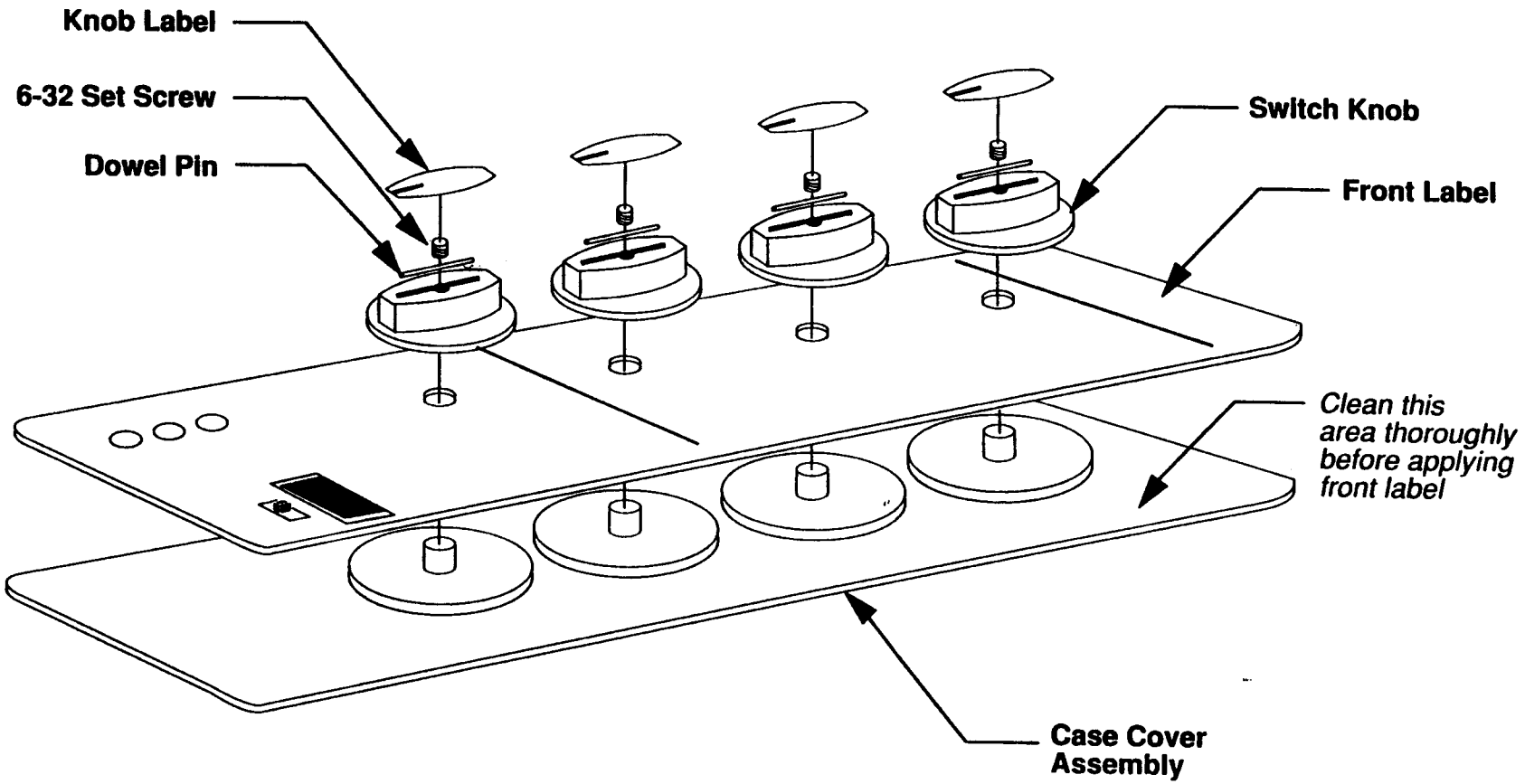

Knob Label
6-32 Set Screw
Dowel Pin
Switch Knob
Front Label
Clean this area thoroughly before applying front label
Case Cover Assembly

FIGURE 3-6

To remove wires from connector, gently lift up on plastic tab and pull wire out of slot.

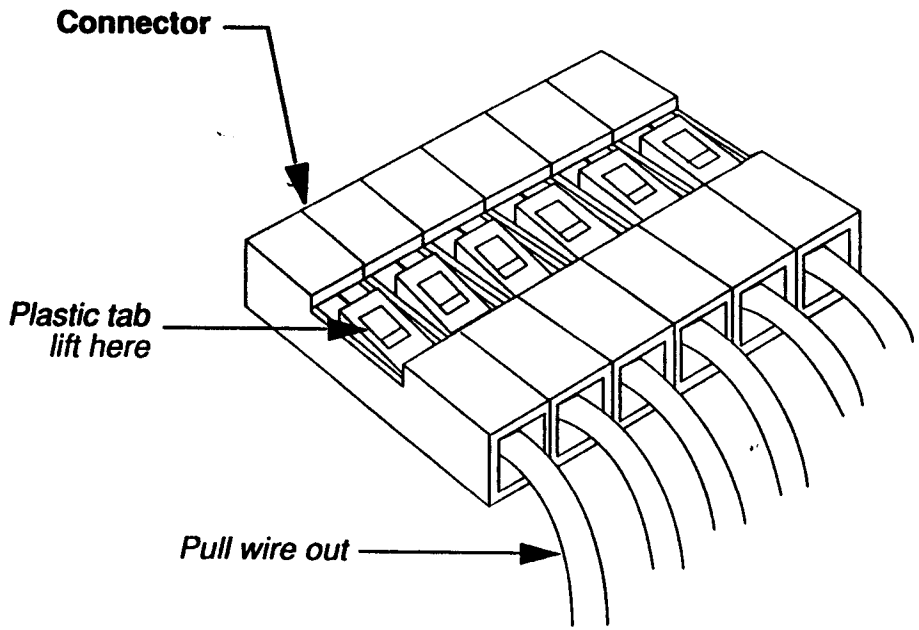
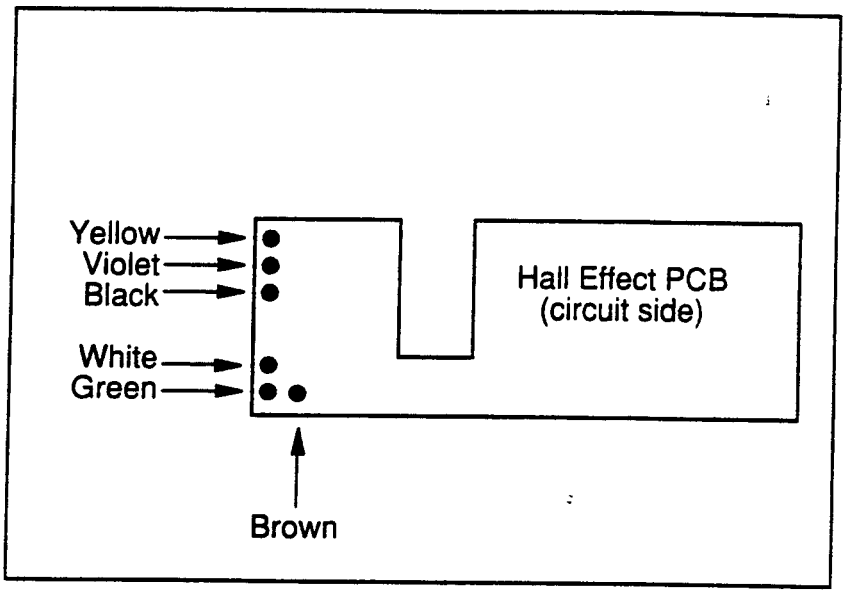
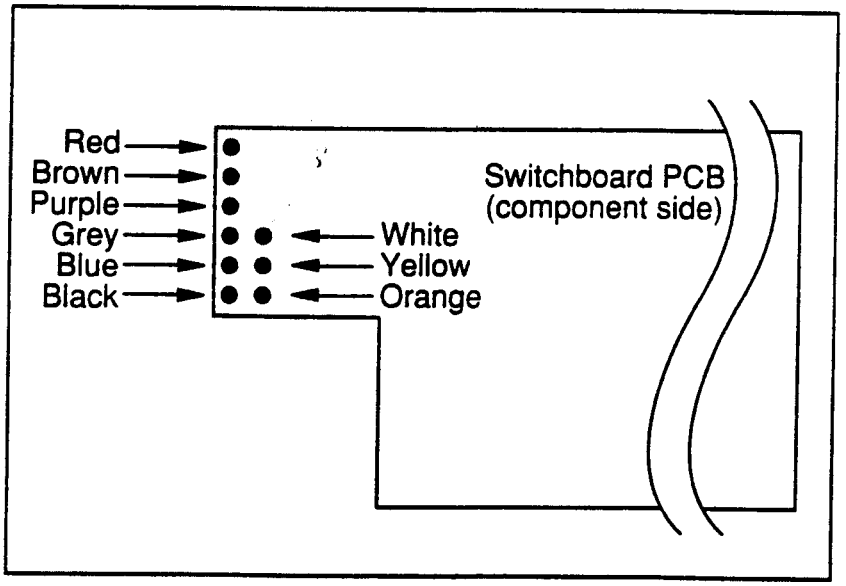


FIGURE 3-7



HALL EFFECT PCB WIRING

FIGURE 3-8



LCD WIRING TO SWITCHBOARD PCB

FIGURE 3-9

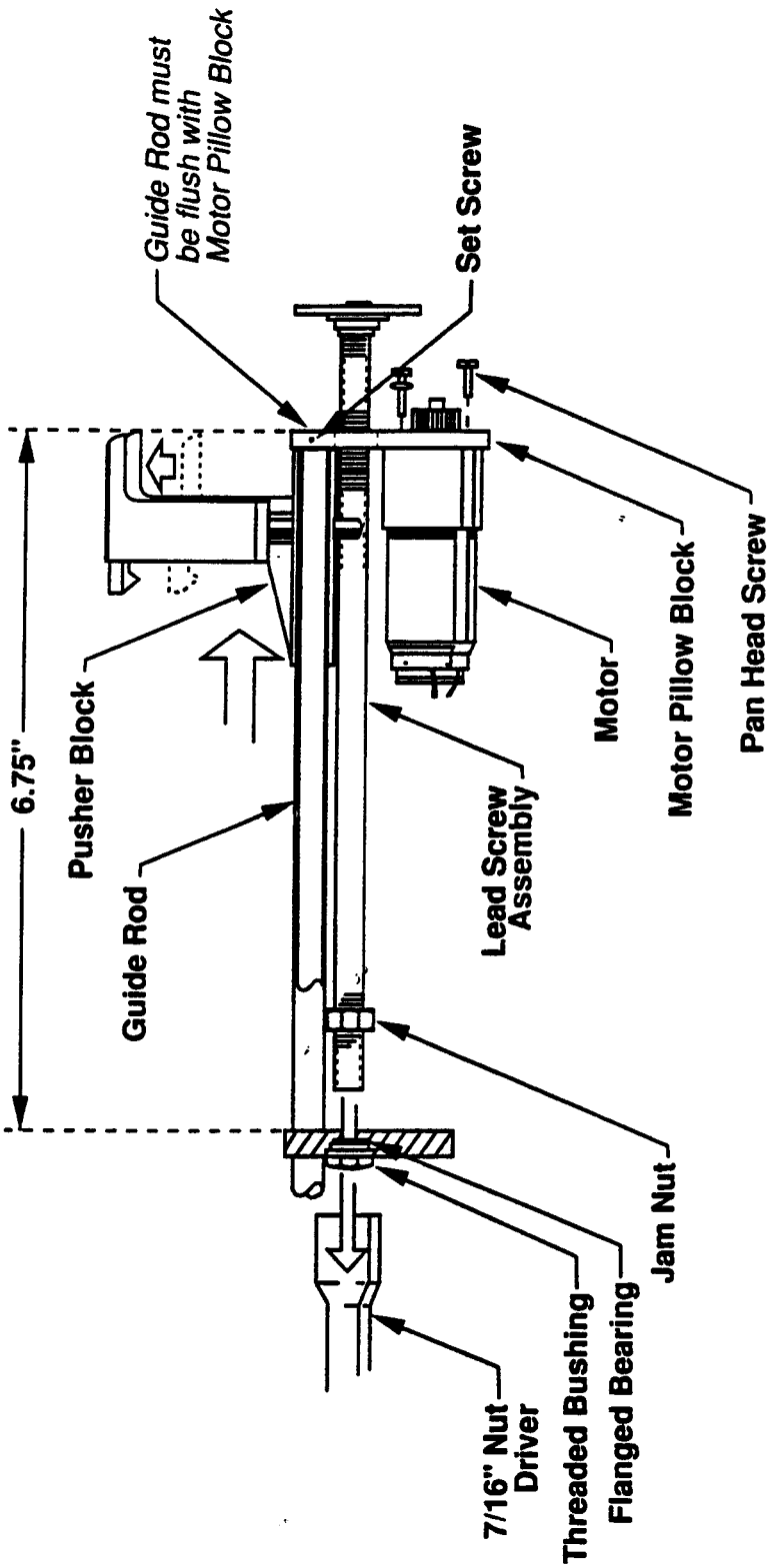

Guide Rod must be flush with Motor Pillow Block
Set Screw
6.75"
Pusher Block
Guide Rod
Lead Screw Assembly
Motor
Motor Pillow Block
Pan Head Screw
Jam Nut
Flanged Bearing
Threaded Bushing
7/16" Nut Driver

FIGURE 3-10

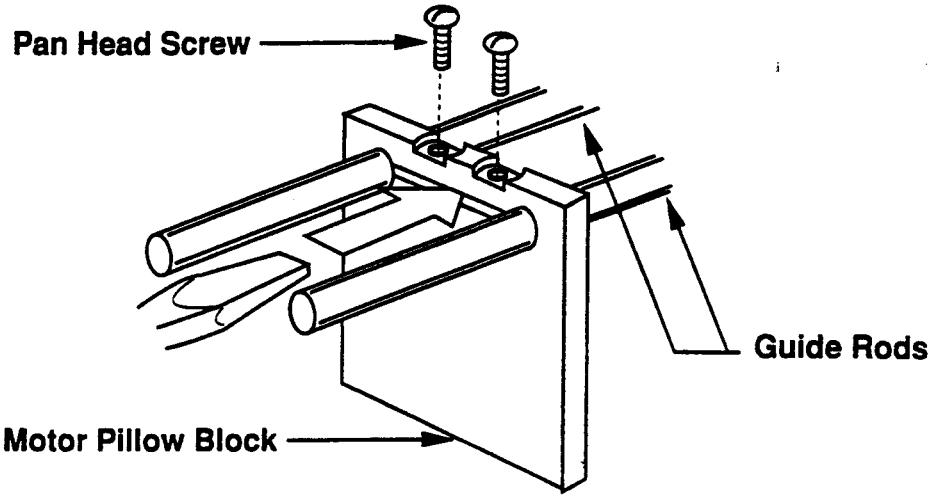


FIGURE 3-11

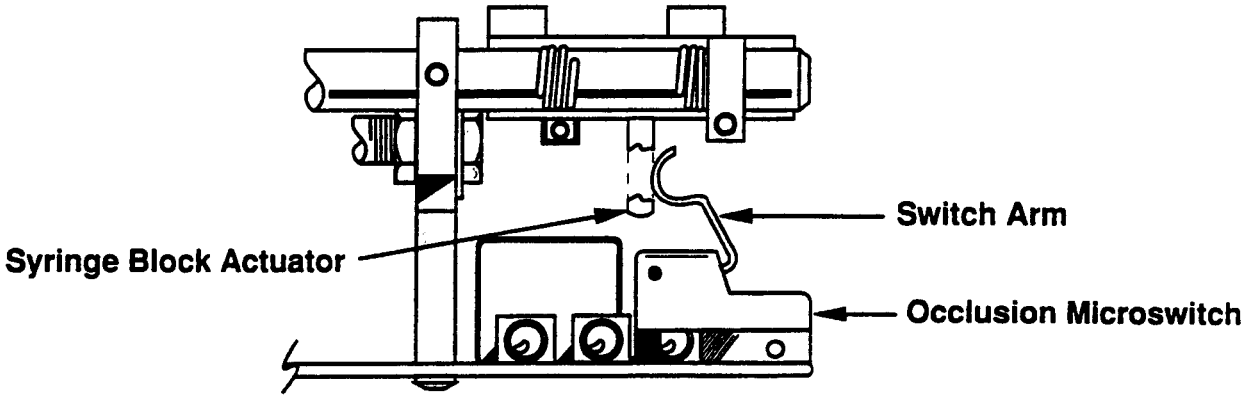


FIGURE 3-12

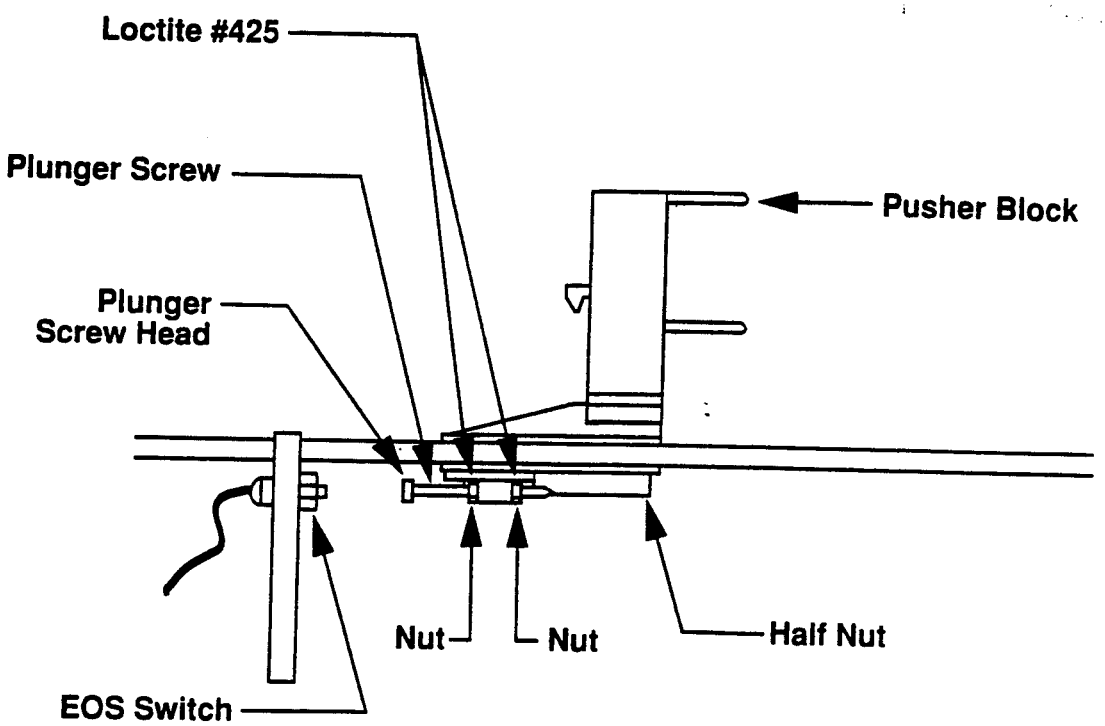

Loctite #425
Plunger Screw
Plunger
Screw Head
Pusher Block
Nut
Nut
Half Nut
EOS Switch

FIGURE 3-13

4.0 TROUBLESHOOTING AND REPAIR

4.1 Tools and Equipment

The following list contains the tools and equipment necessary to repair and maintain the InfusO.R. Pump:

Oscilloscope
6 Volt power supply
Screwdriver (Phillips [3])
Wire cutters
Needlenose pliers
7/16" open end wrench
Soldering iron
Digital voltmeter
ESD protection (anti-static mat and wrist strap)
Tubing set
60 mL syringe (B-D® [4] or Monoject® [5])
10 mL, 0.05 mL/div burette with stand
Stopwatch or timer (minutes and seconds)
Non-vented luer lock cap or tubing set clamp

4.2 Board Exchange

A board exchange program is available for the MPU board. Baxter Healthcare Corporation provides a refurbished board of equal revision in exchange for a returned defective board. This program requires inspection of the returned board prior to shipment of a refurbished board. Boards which are damaged through rework or otherwise, or boards with missing components will not be eligible for this program. Call for an authorization number prior to shipping the defective board.

4.3 Troubleshooting Tips

It is helpful to use a 6 Volt power supply when servicing a disassembled pump. Assure correct polarity configuration prior to applying power.

[3] Phillips Screw Company
[4] Becton-Dickinson and Company
[5] Sherwood Medical Company

4.4 TROUBLESHOOTING CHART

Symptom	Causes	Solution
No power	Dead battery	Check/replace batteries.
	Battery door connection	Inspect/repair as needed.
	Battery spring connection	Inspect/repair as needed.
No audio alarm visual alarm OK	Buzzer	Check Pin 4 of U1 on the MPU board for a positive going pulse, if present replace buzzer.
	Microprocessor (U1)	Replace U1.
	MPU board	Replace MPU board.
End of Syringe (EOS) alarm inoperative	EOS switch	Check/replace switch.
	Pusher block assembly	Check if the actuator on the pusher block is intact and making contact with the microswitch. Replace/adjust as needed.
	Wiring connector	Inspect/repair as needed.
	Microprocessor (U1)	Replace U1.
Occlusion alarm inoperative	Occlusion microswitch	Check/replace microswitch.
	Syringe block	Assure the actuator on the syringe block is tripping the microswitch when activated. Replace as needed.
	Microprocessor	With occlusion alarm activated, check pin 11 of U1 for a low signal. If present replace U1.
LCD not working or missing segment	LCD	Replace LCD.
	Microprocessor (U1)	Replace U1.
	Defective MPU board	Replace MPU board.
Will not infuse	Pusher block	If leadscrew is turning, replace pusher block.
	Motor	Replace motor.
	Defective MPU board	Replace MPU board.

TROUBLESHOOTING CHART (CONTINUED)

Symptom	Causes	Solution
Inaccurate flow rate	Wear of pumping mechanism	Clean/lubricate leadscrew and retest.
	Worn half-nut	Inspect/replace pusher block assembly.
	Syringe selector switch	Inspect wiring/replace switch.
Bolus LED inoperative	LED 1	Check the collector of Q6 for a 0V to 5V pulse. If present, replace LED.
	Drive transistor (Q6)	Check the base of Q6 for a 0V to 5V pulse, if present replace Q6.
	Microprocessor (U1)	If no pulse is present, replace U1.
Attention LED inoperative	LED 2	Check the collector of Q7 for a 0V to 5V pulse, if present, replace LED.
	Drive transistor (Q7)	Check the base of Q7 for a 0V to 5V pulse, if present, replace Q7.
	Microprocessor (U1)	If no pulse is present, replace U1.
Infuse LED inoperative	LED 3	Check the collector of Q5 for a 0V to 5V pulse, if present, replace LED.
	Drive transistor (Q5)	Check the base of Q5 for a 0V to 5V pulse, if present, replace Q5.
	Microprocessor (U1)	If no pulse is present, replace U1.
All three LED's lit, and audible alarm while in STOP/CONFIRM position	Reset delay	Whenever the pump is switched from an "active" state to "off," then back to an "active" state, you must wait 5 seconds while in the "off" state. This is a normal condition.
	Smart Label	Check to see that Smart Label is properly attached. Try a known good label. Replace Smart Label as needed.
	Hall Effect board	Check for broken wires, replace front cover assembly.

TROUBLESHOOTING CHART (CONTINUED)

Symptom	Causes	Solution
All three LED's lit and audible alarm while in PRIME, INFUSE or BOLUS position	Reset delay	Whenever the pump is switched from "active" state to "off," then back to an "active" state, you must wait 5 seconds while in the "off" state. This is a normal condition.
	Reed switch assembly	Adjust/replace Reed Switch.
	Motor	Replace motor.
	Syringe selector switch	Check for broken wires, check/replace switch.
	Switchboard	Replace switchboard.
All three LED's lit and audible alarm only when switching into BOLUS position	Mode switch	Replace switchboard.

5.0 ROUTINE MAINTENANCE

5.1 General

The pump is designed to provide reliable service with only minor routine maintenance. A periodic functional inspection of the pump should be made at least every six months to assure proper operation. The pump should be cleaned and disinfected, if necessary, according to frequency of use and hospital protocol.

5.2 Cleaning and Disinfecting

The exterior surfaces of the pump may be cleaned using a cloth dampened with water or a mild detergent, then wiped dry. A mild germicide may be used as a disinfectant. DO NOT USE alcohol based cleaners as it may adversely affect the integrity of plastic components.

CAUTION: The InfusO.R. Pump and Smart Labels are not waterproof and should not be immersed. Avoid getting liquids inside the pump or permanent damage may result. If liquids are spilled on pump, the device should be removed from service, and checked and cleaned by a biomedical technician. Do not use alcohol for cleaning. Sterilization by ETO, steam, dry heat, etc., should not be attempted.

5.3 Lubrication

The lead screw should be lubricated at least every six months using General Electric [6] Versilube® [7] G322L grease. Using the nozzle applicator supplied with the grease, squeeze a small amount onto the entire length of the lead screw. Do this by carefully inserting the nozzle straight into the case channel, thereby spreading the rubber seal. Use care to avoid damaging the seal.

CAUTION: Use only recommended lubricant. Use of a substitute may cause permanent damage.

[6] General Electric Company
[7] General Electric Company

THIS PAGE INTENTIONALLY BLANK

6.0 FUNCTIONAL TEST

NOTE: The InfusO.R. Pump is shipped without batteries. Install batteries before functional testing and initial operation.

Every pump should pass the functional test before the unit is used and again at 6 month intervals. Each pump has been tested to the performance standards of Baxter Healthcare Corporation. However, abusive handling during shipment may cause hidden damage. Test each pump to verify proper operation.

If the pump does not pass the functional test and cause is traced to shipping, notify the carrier's agent at once. Do not return the equipment to the factory without written authorization.

THE FUNCTIONAL TEST FOR THE InfusO.R. PUMP IS DETAILED BELOW.

CAUTION: If the pump fails to perform as specified during the following procedure, the pump is not operational and must be returned to Baxter Healthcare Corporation for service.

6.1 Pusher Block - Squeeze the release lever of the pusher block and check for free movement of the pusher block over the complete travel range. Release the lever and check for engagement of the pusher block assembly.

6.2 Syringe Holder - Check the condition and holding ability of the syringe holder. Assure that 60 cc and 20 cc plastic syringes sit firmly in the holder and are retained by the barrel notch. Also, check that the anti-siphon latch of the pusher block captures the syringe plunger to prevent siphoning.

6.3 End of Syringe Alarm - The End of Syringe Alarm occurs when approximately 1 mL is remaining in the syringe. To check the alarm, place a syringe with the plunger located at approximately 3 mL in the pump. Initiate an infusion and check for:

- o Flashing Infusion Light with the LCD incrementing in milliliters.
- o Audible Alarm when End of Syringe occurs. The pumping operation should cease and the Attention light should flash. The display should flash EOS.

6.4 Occlusion Alarm - The Occlusion Alarm occurs when the pusher block encounters 8 ± 1 lbs. of force. To check the alarm, move the syringe holder downward while the pump is infusing (8 ± 1 lbs. force required). Check for:

- o Audible Alarm and flashing Attention Light with pumping operation discontinued. The display should also flash OCC.

6.5 Input Switches - The front panel input switches should be checked for proper rotation and function. Check as follows:

- o The three input switches should rotate through 12 discrete positions. Rotation directly from the highest to the lowest switch setting should not occur.
- o Rotate the Function switch through 5 discrete positions. The two end positions are momentary and should return to the previous switch location upon release.

6.6 Accuracy Check Using a Burette and Timer

To check rates and volume, Baxter Healthcare Corporation recommends the use of the Accuracy Check Kit (Catalog No. 6464460). Alternatively, a burette and timer can be used.

1. Fill a syringe with water and install it in the pump. Attach a tubing set and prime the system to eliminate all air from the fluid path.

2. Connect the tubing set to the burette and Prime until the fluid reaches the first graduation mark on the burette.

3. Using the following equations, determine the infusion rate, bolus volume and bolus duration for the Smart Label and switch settings in use.

$$Infusion\ Flow(mL/min) = \frac{Infusion\ Rate(mcg/kg/min) \times Body\ Weight(kg)}{Drug\ Concentration(mcg/mL)}$$

$$Infusion\ Flow(mL/min) = \frac{Infusion\ Rate(mcg/min)}{Drug\ Concentration(mcg/mL)}$$

$$Infusion\ Volume(mL) = Infusion\ Flow(mL/min) \times Time\ *(min)$$

$$Total\ Bolus\ Volume(mL) = \frac{Bolus\ Dose(mcg/kg) \times Body\ Weight(kg)}{Drug\ Concentration(mcg/mL)}$$

$$Bolus\ Duration(min) = \frac{Bolus\ Dose(mcg/kg)}{Bolus\ Delivery\ Rate\ For\ Drug^{**}(mcg/kg/min)}$$

* This value (time) is a variable and should be chosen with the intention of making the result a round number. Consideration should also be given to assure an adequate measurement can be made.

** Refer to Table 6-1

4. Record the reading of the starting point on the burette. Initiate the infusion or bolus and the stopwatch simultaneously.

5. When checking infusion rates, turn the pump to OFF when the desired time limit is reached. Subtract the volume shown on the burette from the initial reading. This value is the volume delivered and should be within ± 3% of the calculated value.

6. When checking bolus volume and duration, stop the stopwatch when the bolus is complete. Subtract the volume shown on the burette from the initial reading. This value is the total bolus volume and should be within ± 3% of the calculated value. The reading on the stopwatch should be within ± 6% of the calculated bolus duration.

EXAMPLE: Using the Alfentanil Smart Label (Label 01)
Drug Concentration 500 mcg/mL (Indicated on label)

Infusion Rate set to 3 mcg/kg/min
Body Weight set to 100 kg
Bolus Dose set to 50 mcg/kg

$$Infusion\ Flow(mL/min) = \frac{3mcg/kg/min \times 100kg}{500mcg/mL} = .6mL/min$$

$$Infusion\ Volume(mL) = .6mL/min \times 5min = 3mL$$

$$Total\ Bolus\ Volume(mL) = \frac{50mcg/kg \times 100kg}{500mcg/mL} = 10mL$$

$$Bolus\ Duration(min) = \frac{50mcg/kg}{500\ mcg/ml} = 1min$$

Label #	Drug	Bolus Delivery Rate
L01	Alfentanil	50 mcg/kg/min
	Succinylcholine	1000 mcg/kg/min
L02	Propofol	1000 mcg/kg/min
L03	Atracurium	400 mcg/kg/min
L04	Vecuronium	50 mcg/kg/min
	Fentanyl	2.5 mcg/kg/min
L08	Esmolol	500 mcg/kg/min
L10	Sufentanil	1.5 mcg/kg/min

TABLE 6-1

6.7 Accuracy check using a distance gauge or the Accuracy Check Kit (Part No. 6464460).

EQUIPMENT REQUIRED:

- Distance gauge or Accuracy Check Kit (Part No. 6464460)
- Stopwatch

1. Install the distance gauge
   - With the pump turned off, squeeze the Pusher Block and move it to the top of the pump.
   - Put the distance gauge and the syringe barrel into the Syringe Holder.
   - Move the Pusher Block down so that it captures the disc on the end of the gauge.
   - Turn the outer dial on the distance gauge until the zero position is aligned with the needle.
2. Prime
   - Attach a Smart Label to the pump front.
   - Turn the Function switch to purge and hold it until the needle on the distance gauge has moved about 0.020 inches. (This takes up any slack in the system.)
   - Record the reading on the distance gauge as Reading #1 on the chart on page 4. (Note: The outer dial shows thousandths of an inch from 0.001 to 0.099 while the small inner dial shows the number of tenths of inches of travel. You must add the tenths to the thousandths before recording the reading.)

3. Test the Bolus Accuracy
   - o Set the Bolus switch to the setting indicated in the Table 6-2. The table lists bolus settings for each Smart Label. Find the setting that corresponds to the label attached to the pump.
   - o Set the Body Weight switch to the setting from the table.
   - o Set the syringe selector switch to Mono.

NOTE: When measuring the bolus accuracy, the Syringe Manufacturer Selector switch MUST be in the Monoject position.

InfusO.R. Pump Bolus Travel

Label #	Drug	Bolus	Body Weight (Kg)	Displacement (inches)
L01	Alfentanil	15 mcg/kg	30	0.0635 +/- 0.0019
	Succinylcholine	300 mcg/kg	30	0.0635 +/- 0.0019
L02	Propofol	1000 mcg/kg	70	0.4932 +/- 0.0148
L03	Atracurium	200 mcg/kg	50	0.1215 +/- 0.0036
L04	Vecuronium	100 mcg/kg	35	0.4248 +/- 0.0127
	Fentanyl	5 mcg/kg	35	0.4248 +/- 0.0127
L08	Esmolol	2000 mcg/kg	45	0.6346 +/- 0.0190
L10	Sufentanil	1.5 mcg/kg	40	0.1456 +/- 0.0044

TABLE 6-2

- o Turn the Function switch to STOP/CONFIRM and verify the label identification code with the pump's display.
- o Turn the Function switch to BOLUS START and hold it until an audible indication is heard.
- o Release the switch and the bolus will begin. The motor will run causing the distance gauge to move.
- o When the distance gauge stops moving, the bolus is completed. Record the gauge reading as Reading #2.
- o Subtract the distance gauge Reading #1 from distance gauge Reading #2. Record it a #2 - #1 and compare it to the linear travel value given in the table for the Smart Label and Bolus and Body Weight setting selections.

4. Test the Infusion Rate Accuracy
   - o Set the Infusion Rate switch to the setting indicated in Table 6-3 for the Smart Label that is attached to the pump.
   - o Set the Body Weight switch to the setting also indicated from the table for the Smart Label attached to the pump.
   - o Set the Syringe Selector switch to B-D.

NOTE: When measuring these linear rates, the Syringe Manufacturer Selector switch MUST be in the B-D position.

InfusO.R. Pump Infusion Rates

Label #	Drug	Infusion Rate	Body Weight (Kg)	Linear Rate (inches/hr)
L01	Alfentanil	0.25 mcg/kg/min	30	0.0635 +/- 0.0019
	Succinylcholine	5 mcg/kg/min	30	0.0635 +/- 0.0019
L02	Propofol	25 mcg/kg/min	100	1.0569 +/- 0.0317
L03	Atracurium	8 mcg/kg/min	40	0.2632 +/- 0.0079
L04	Vecuronium	1.2 mcg/kg/min	50	0.4929 +/- 0.0148
L05	Dobutamine	14 mcg/kg/min	60	0.7110 +/- 0.0213
L06	Dopamine	1.0 mcg/kg/min	70	0.0740 +/- 0.0022
L07	Isoproterenol	2.0 mcg/min	N/A	0.4230 +/- 0.0127
	Epinephrine	2.0 mcg/min	N/A	0.4230 +/- 0.0127
	Lidocaine	1.0 mg/min	N/A	0.4230 +/- 0.0127
	General mL	6 mL/hr	N/A	0.4230 +/- 0.0127
L08	Esmolol	100 mcg/kg/min	30	1.2683 +/- 0.0380
L09	Nitroglycerin	3 mcg/kg/min	90	1.1418 +/- 0.0343
	Nitroprusside	3 mcg/kg/min	90	1.1418 +/- 0.0343
L10	Sufentanil	0.8 mcg/kg/hr	50	0.1097 +/- 0.0033

TABLE 6-3

- o Turn the Function switch to STOP/CONFIRM from OFF and verify the label identification code with the pump's display.
- o Simultaneously turn the Function Switch to Infuse and start the stopwatch. The motor will pulse causing the distance gauge to move in steps.
- o When the stopwatch reads 30 minutes, turn the Function Switch to STOP/CONFIRM. Record the distance gauge reading as Reading #3.
- o Subtract distance gauge Reading #2 from Reading #3. Multiply this value by 2 to get the linear travel in inches/hour; record it as (#3 - #2) x 2 and compare it to the linear rate value given in the table for that Smart Label and Infusion Rate and Body Weight setting selections.

NOTE: The total linear travel that the gauge can measure is 1.0 inch. Choose bolus and infusion rate combinations to test that will not exceed 1.0 inch of linear travel.

5. Remove the distance gauge
   - o Turn pump off
   - o Squeeze the pusher block and move it to the top of the pump.
   - o Remove the distance gauge and syringe barrel.

InfusO.R. Pump Accuracy Check

Pump serial number: _____

Date: _____

Performed by: _____

Label # Tested: _____

Bolus setting: _____mcg/kg Body Weight setting:_____kg

Distance Gauge

Reading #1 _____inches

Reading #2 _____inches

#2 - #1 = _____inches

Desired value from bolus table _____inches

Label # Tested: _____

Infusion Rate setting: _____mcg/kg/min Body Weight setting:___kg

Distance Gauge

Reading #3 _____inches

#3 - #2 = _____inches

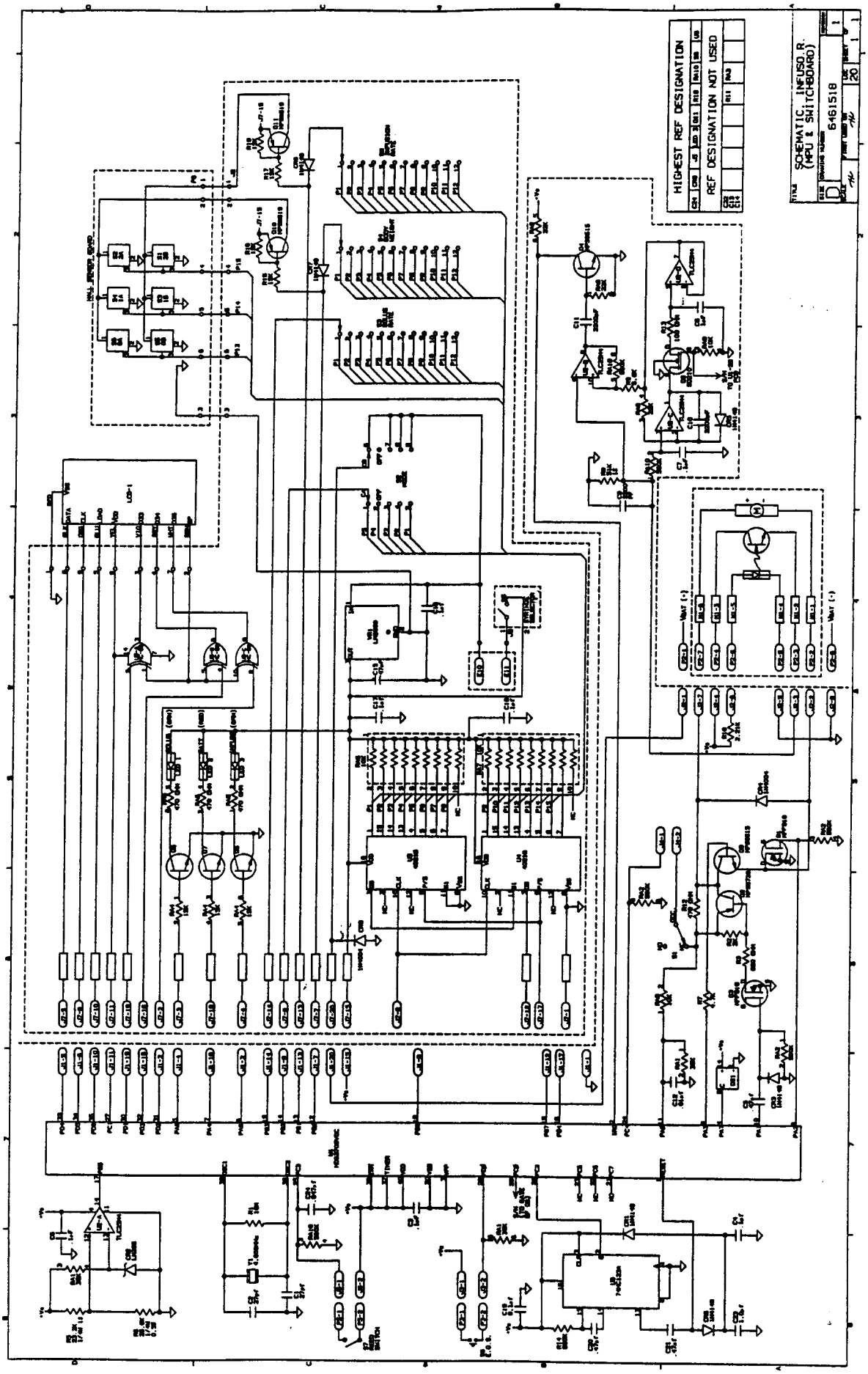
(#3 - #2) x 2 = _____inches/hr

Desired value from infusion table _____inches/hr

NOTE: This page may be copied for internal record keeping.

APPENDIX 1.0

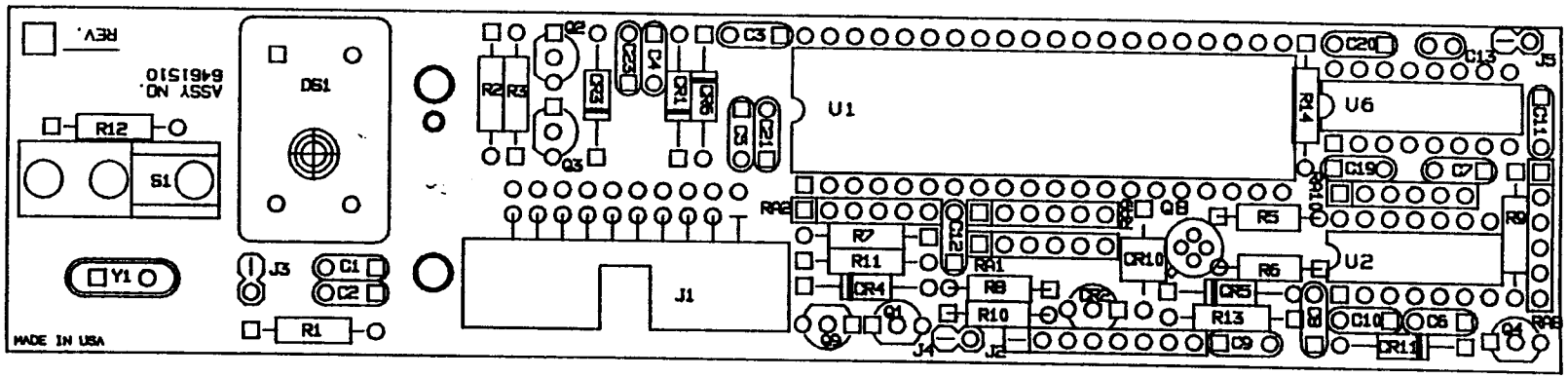
SCHEMATICS



APPENDIX 2.0

CIRCUIT BOARD ASSEMBLY DRAWINGS

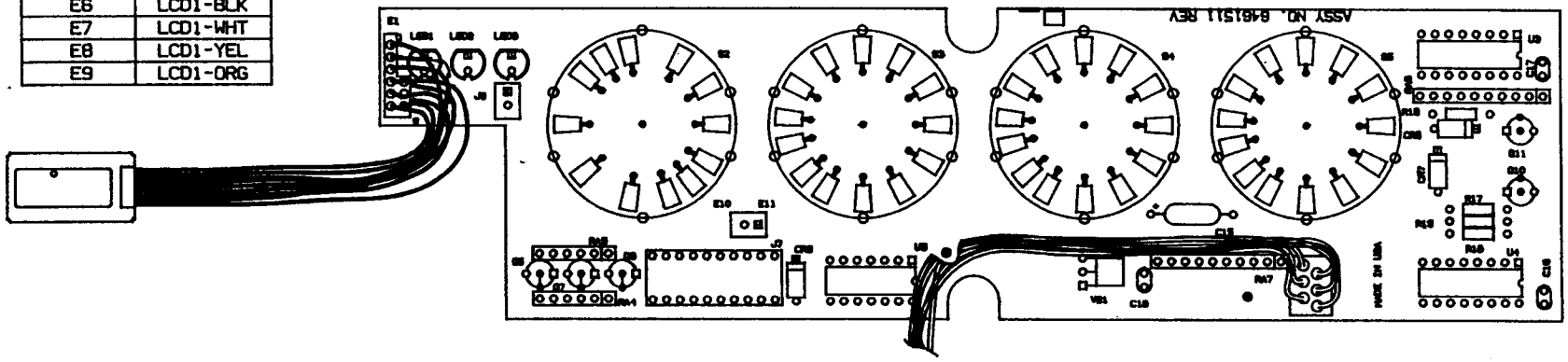
NOTICE-CONFIDENTIAL/PROPRIETARY INFORMATION



TITLE: ASSY PCB A1 MPU INFUSO.R.		
SIZE: C	DRAWING NUMBER: 6461510	REVISION: 1
SCALE: 2:1	FIRST USED ON: 6461503	LOC / SHEET 1 OF 1

NOTICE-CONFIDENTIAL/PROPRIETARY INFORMATION

WIRE RUN LIST	
FROM	TO
E1	LCD1-RED
E2	LCD1-BRN
E3	LCD1-VIO
E4	LCD1-GRY
E5	LCD1-BLU
E6	LCD1-BLK
E7	LCD1-WHT
E8	LCD1-YEL
E9	LCD1-ORG



TITLE			
ASSY A2 SWITCHBOARD INFUSO.R. FINAL			
SIZE: C	DRAWING NUMBER: 6461511		REVISION: 2
SCALE: NONE	FIRST USED ON	LOC: 39	SHEET: 1 OF 1

A2-3

5371159 Rev. 3
Sheet 54 of 76

THIS PAGE INTENTIONALLY BLANK

APPENDIX 3.0

PARTS LIST/DIAGRAMS

PARTS LIST

Ref. Diagram	Part Number	Description	Qty
A1	6461262RP	Case Cover Assembly *(Must order item A2 separately)*	1
A2	6461695	Front Label	1
A3	6461419	Switch Knob	4
A4	6461420	Knob Label	4
A5	5115056	#6-32 Set Screw	4
A6	5107085	Dowel Pin	4
B1	6461261RP	Front Case Assembly (includes B2 and B4)	1
B2	5020174	Neoprene Tape	1
B3	5101168	#4-40 X 3/8" Self-Tap Screw	4
B4	6461434	Polyurethane Seal	1
B5	6461511	Switchboard (includes B7)	1
B6	6461438	LCD Spacer	1
B7	6461263RP	LCD Assembly	1
B8	5137044	#1-64 X 1/4" Flat Head Screw	2
B9	021000026	Syringe Selector Switch	1
B10	5110047	#1 Split Lockwasher	2
B11	5135010	#1-64 Hex Nut	2
B12	5101167	#4-40 X 1/4" Self-Tap Screw	5
C1	6465441	Locking Mounting Plate	1
C2	5117017	#4-40 X 5/8" Self-Tap Screw	1
C3	5101168	#4-40 X 3/8" Self-Tap Screw	1
C4	6465504	Syringe Holder	1
C5	6461137A	Syringe Loading Label	1
C6	5137039	#4-40 X 1/2" Self-Tap Screw	2
C7	5137035	#4-40 X 1" Self-Tap Screw	4
C8	6461664	Rear Label	1
D1	6461345RP	Rear Case Assembly (includes C8, D2-D4)	1
D2	6461434	Polyurethane Seal	1
D3	5020174	Neoprene Tape	1
D4	5020169	Polarity Label	1
D5	6461423A	Battery Door Assembly (includes D6-D9)	1
D6	6461497	Battery Door Insulator	1
D7	5137047	#2-56 X 1/4" Flat Head Screw	1

PARTS LIST (Continued)

Ref. Diagram	Part Number	Description	Qty
D8	5141009	#2 Lockwasher	1
D9	5135001	#2-56 Hex Nut	1
D10	5146717	Ring Terminal	1
D11	6465153RP	Battery Spring Assembly	1
E1	5146628	Buzzer	1
E2	5146626	Overpressure Switch	1
E3	6107011	Roll Pin	1
E4	5136014	Jam Nut	1
E5	6461116	Middle Pillow Block	1
E6	5011037	Bearing	1
E7	6461110	Threaded Bushing	1
E8	6461424	Guide Rod	2
E9	5101166	#4-40 X 1/4" Slotted Screw	2
E10	021000014	EOS Switch	1
E11	6461115	Motor Pillow Block	1
E12	5115054	#4-40 X 1/8" Set Screw	2
E13	6461467	Lead Screw Assembly (includes E4 and E14)	1
E14	5146846	Magnet	1
E15	5101164	M2 X 6mm Screw	3
E16	5141009	#2 Lockwasher	5
E17	5101101	#2-56 X 1/4" Screw	2
E18	6461490	Reed Switch Assembly	1
E19	6461466	Motor Assembly	1
E20	6461510	MPU Board (includes E1 and E2)	1
E21	5101061	#4-40 X 1/4" Screw	2
E22	5140008	#4 Split Lockwasher	2
F1	6465169	Syringe Block	1
F2	6461321	Collar Preload, Limit	2
F3	5009074	Preload Syringe	1
F4	5119055	#4-40 X 5/16" Cap Screw	2
F5	6461492RP	Pusher Block Assembly (includes F6 - F8)	1
F6	5009083	PB Spring	1
F7	6461138A	"Squeeze Fully" Label	1
F8	6461489	EOS Actuator Block	1
F9	6461612	Plunger Screw	1
F10	5141009	#2 Lockwasher	2
F11	5135001	#2-56 Hex Nut	2

MPU BOARD PARTS LIST
(Reference MPU Board Assembly Drawing in Section A2)

Ref Desig	Part No.	Description	Qty
J3,4,5	010135003	Conn PCB Male 2 SIP	3
J1	5146753	Conn PCB HDR 20 DIP RTAN	1
U1	5146730	Conn SKT 1C 40 DIP	1
J2	5146164	Conn PCB Male 8 SIP	1
DS1	5146628	Buzzer 6V CMB-06	1
Y1	010900004	XTAL MPU 4.00 MHz HC18	1
U6	010500237	IC CMO DR-MM 16 74 HC123A	1
U2	010500232	IC UN OPAMP 14 TLC 25 M4	1
Q2	010400016	XSTR PWR PNP 30 MPS6726	1
Q8	010400015	XSTR M-FET-N-C 30 SD210 D	1
Q4,9	010400011	XSTR AMP GP NPN 25 MPS6515	2
Q1,3	010400010	XSTR M-FET N-C 60 MPF910	2
CR4	5145443	Diode PWR 400V IN4004	1
CR2	010300003	Diode VR 2.5V LM3858Z	1
CR1,3,5,6	010300001	Diode SW 75V IN4148	4
C8,23	5146289	CAP CER IMF 50V 10%	2
C3,4,6	5146049	CAP CER .1MF 50V 20/80%	3
C7,19	010200026	CAP CER .1MF 50V 10%	2
C9,10,11	010200018	CAP CER 2200PF 50V 10%	3
C1,2	010200017	CAP CER 27PF 50V 10%	2
C5,20,21	010200011	CAP CER .47MF 50V 10%	3
C12	010200010	CAP CER .01MF 50V 10%	1
C24	010200015	CAP CER .047 MF 50V 20%	1
R14	010166684	RES CFR 680K 1/4W 5%	1
R3	010166621	RES CFR 620 OHM 1/4W 5%	1
R7	010166472	RES CFR 4.7K 1/4W 5%	1
R12	010166471	RES CFR 470 OHM 1/4W 5%	1
R2	010166202	RES CFR 2K 1/4W 5%	1
R9	010166682	RES CFR 6.8K 1/4W 5%	1
R1	010166106	RES CFR 10M 1/4W 5%	1
R13	010166101	RES CFR 100 OHM 1/4W 5%	1
R10	010165222	RES MFR 2.21K 1/4W 1%	1
R8	010165005	RES MFR 51.1K 1/4W 1%	1
RA2,10	010131564	RES NTWK 3 150L 560K SIP	2
RA1	010131393	RES NTWK 3 150L 39K SIP	1
RA8	010131223	RES NTWK 3 150L 22K SIP	1
RA9	010131103	RES NTWK 3 150L 10K SIP	1
R6	010100003	RES MFR 25.8K 1/4W 1%	1
R5	010100001	RES MFR 23.2K 1/4W 1%	1
U1	6461509	PROM MPU LP InfusO.R.	1
S1	5146626	Microswitch	1

SWITCHBOARD PARTS LIST

(Reference Switchboard Assembly Drawing in Section A2)

Ref Desig	Part No.	Description	Qty
P4	010135004	CONN WA FEM 02 SIP	1
J8	5146752	CONN PCB 02 RTAN	1
	5146046	CONN TERM CRIMP 24	2
U5	010500129	IC CMD MM 74HC86	1
U3,4	010500127	IC SHIFT REGIST CD4021B	2
Q10,11	010400012	XSTR PNP MPS6519	2
Q5-7	010400011	XSTR NPN MPS6515	3
VR1	5146743	VOLT REGULATOR LP2950CZ	1
LED1,3	010600005	LED GREEN	2
LED2	010600003	LED RED	1
CR9	5145443	DIODE SIG 1N4004	1
CR7,8	5113257	DIODE SIGN 100V 1N4148	2
C15	010200023	CAP 47u*f* 6V	1
C16-18	5146049	CAP .1u*f* 50V	3
RA5	010131471	RES NETWORK 3 X 470	1
RA4	010131153	RES NETWORK 3 X 15K	1
RA6,7	010130103	RES NETWORK 9 X 10K	2
R15-18	010100020	RES MFR 15K 1/3W 5%	4
W1	6461481	ASSY CABLE W1 INTCON	1

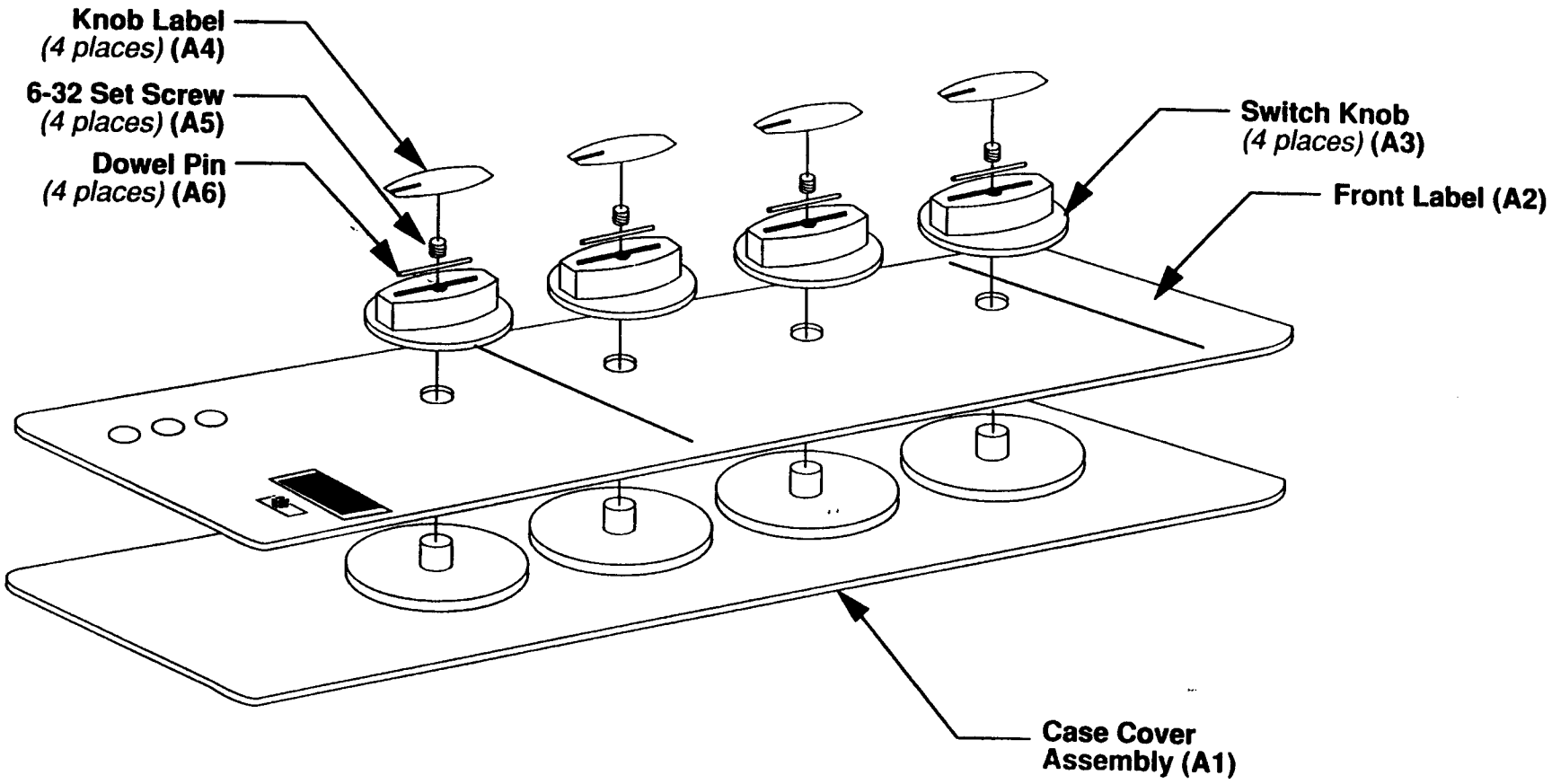

Knob Label
(4 places) (A4)
6-32 Set Screw
(4 places) (A5)
Dowel Pin
(4 places) (A6)
Switch Knob
(4 places) (A3)
Front Label (A2)
Case Cover
Assembly (A1)

FIGURE A

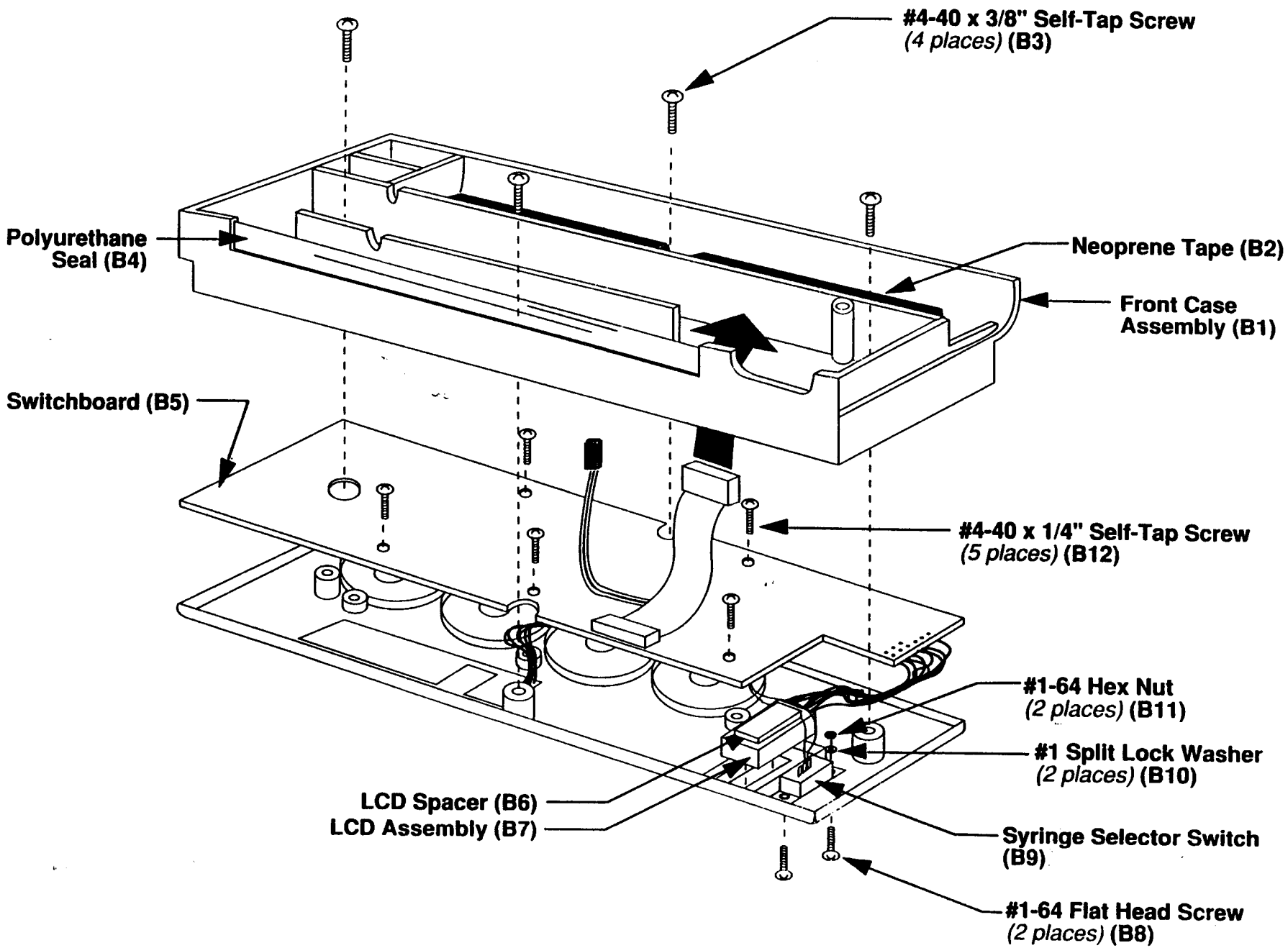

#4-40 x 3/8" Self-Tap Screw
(4 places) (B3)
Polyurethane
Seal (B4)
Neoprene Tape (B2)
Front Case
Assembly (B1)
Switchboard (B5)
#4-40 x 1/4" Self-Tap Screw
(5 places) (B12)
#1-64 Hex Nut
(2 places) (B11)
#1 Split Lock Washer
(2 places) (B10)
LCD Spacer (B6)
LCD Assembly (B7)
Syringe Selector Switch
(B9)
#1-64 Flat Head Screw
(2 places) (B8)

FIGURE B

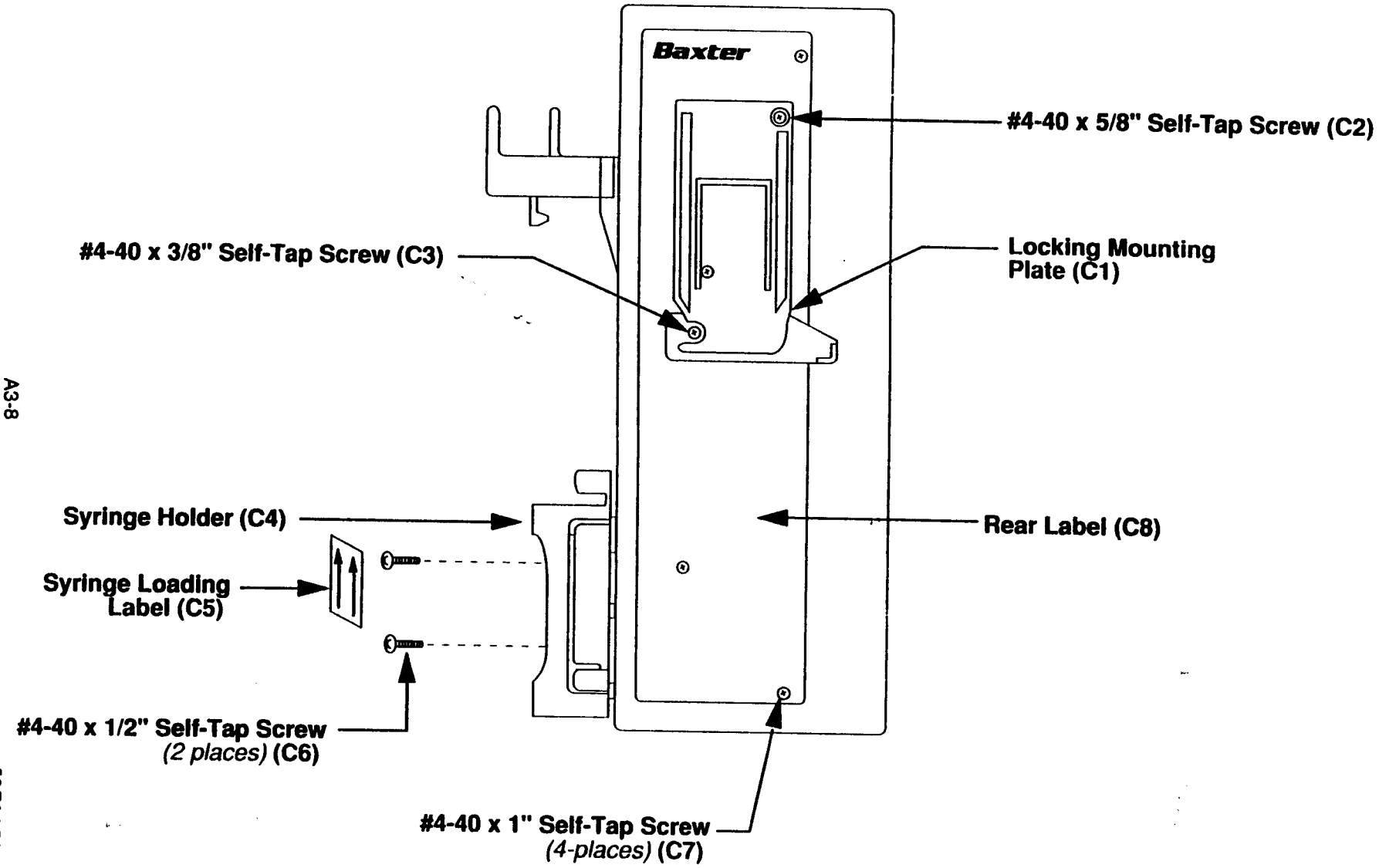

Baxter
#4-40 x 5/8" Self-Tap Screw (C2)
#4-40 x 3/8" Self-Tap Screw (C3)
Locking Mounting Plate (C1)
Syringe Holder (C4)
Rear Label (C8)
Syringe Loading Label (C5)
#4-40 x 1/2" Self-Tap Screw (2 places) (C6)
#4-40 x 1" Self-Tap Screw (4-places) (C7)

FIGURE C

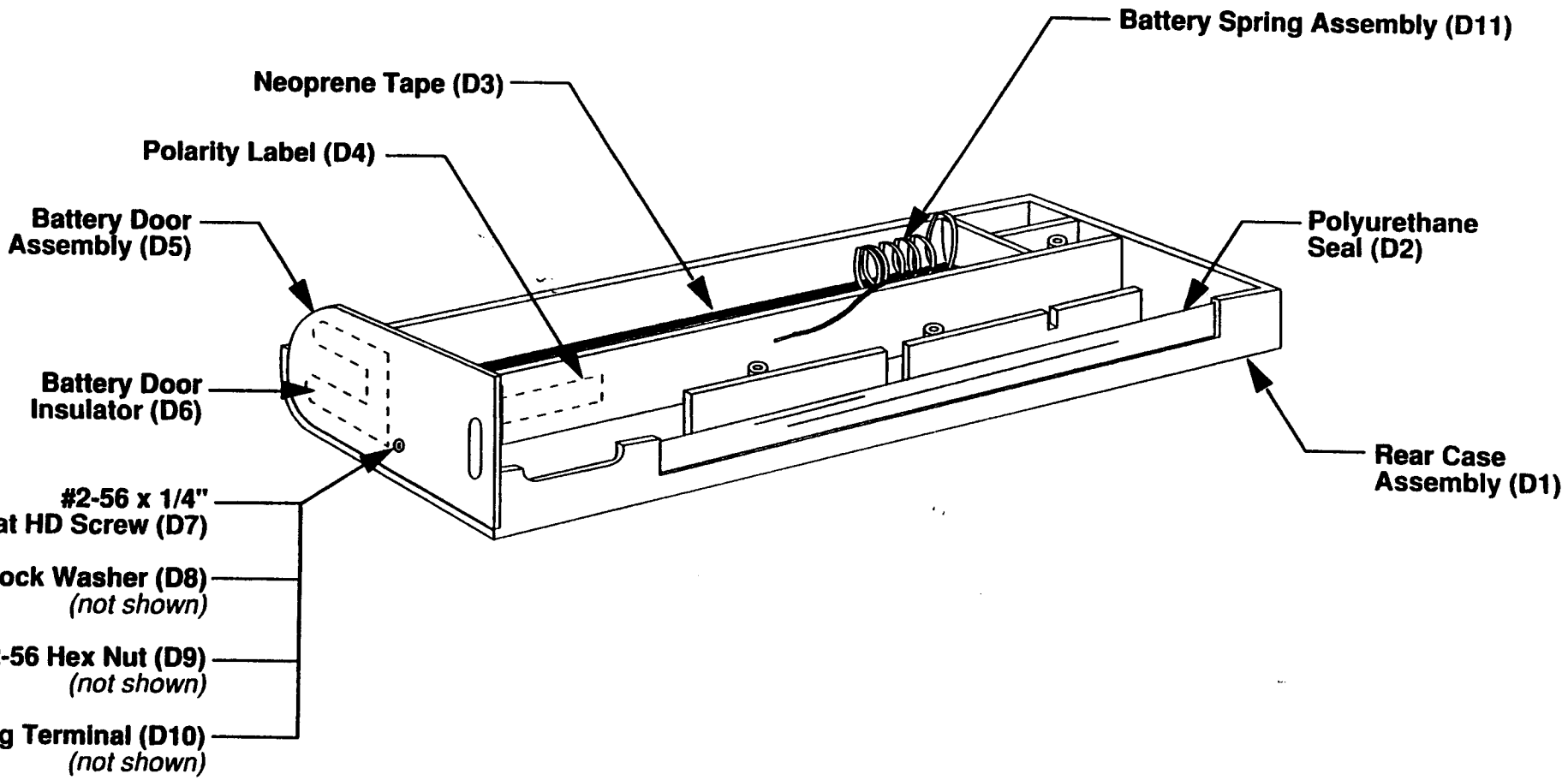

Battery Spring Assembly (D11)
Neoprene Tape (D3)
Polarity Label (D4)
Battery Door Assembly (D5)
Polyurethane Seal (D2)
Battery Door Insulator (D6)
Rear Case Assembly (D1)
#2-56 x 1/4" Flat HD Screw (D7)
#2 Lock Washer (D8) (not shown)
#2-56 Hex Nut (D9) (not shown)
Ring Terminal (D10) (not shown)

FIGURE D

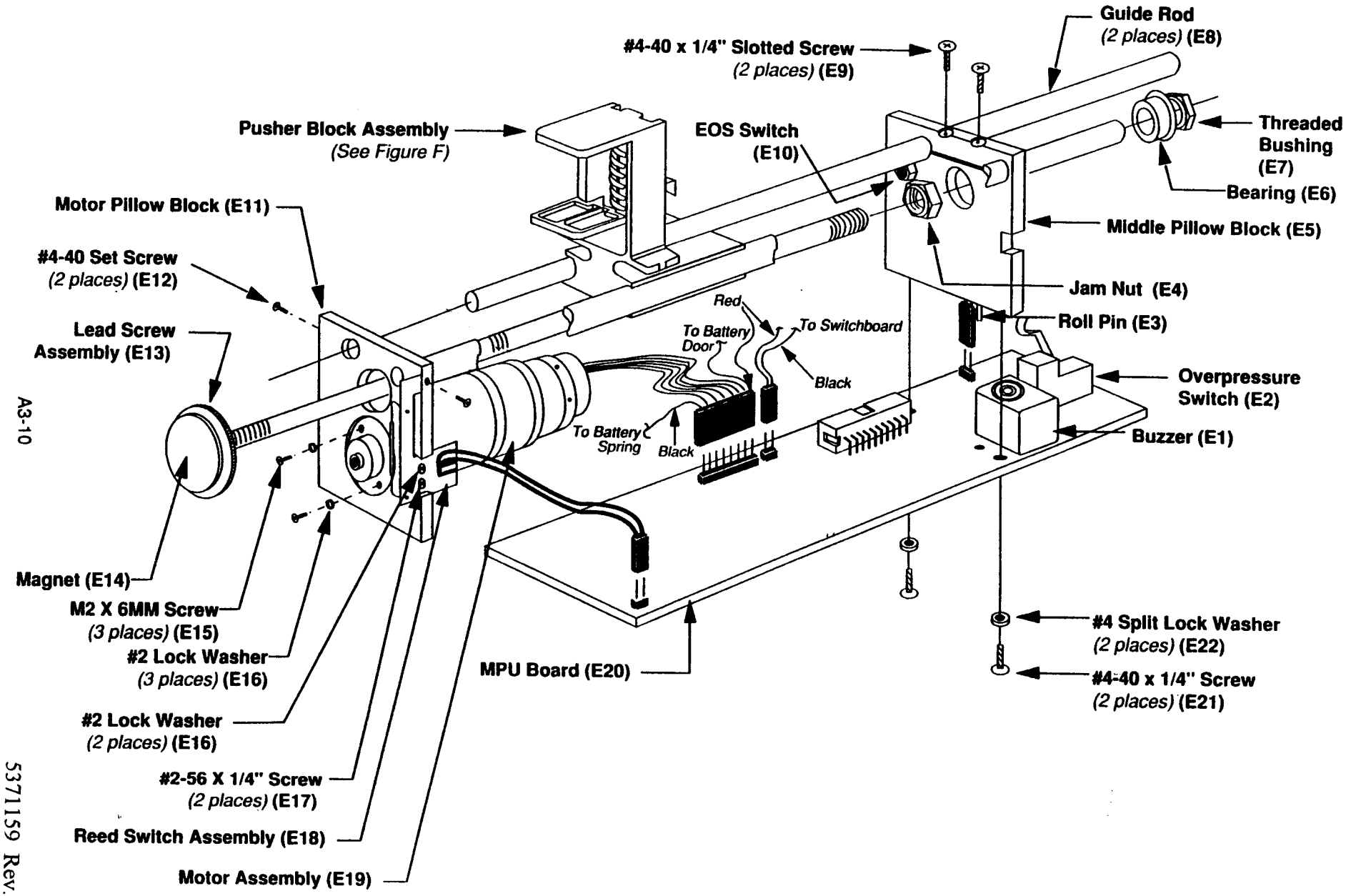

Guide Rod
(2 places) (E8)
#4-40 x 1/4" Slotted Screw
(2 places) (E9)
Pusher Block Assembly
(See Figure F)
EOS Switch
(E10)
Threaded
Bushing
(E7)
Bearing (E6)
Motor Pillow Block (E11)
Middle Pillow Block (E5)
#4-40 Set Screw
(2 places) (E12)
Jam Nut (E4)
Roll Pin (E3)
Lead Screw
Assembly (E13)
Red
To Battery
Door
To Switchboard
Black
Overpressure
Switch (E2)
To Battery
Spring
Black
Buzzer (E1)
Magnet (E14)
M2 X 6MM Screw
(3 places) (E15)
#2 Lock Washer
(3 places) (E16)
MPU Board (E20)
#4 Split Lock Washer
(2 places) (E22)
#4-40 x 1/4" Screw
(2 places) (E21)
#2 Lock Washer
(2 places) (E16)
#2-56 X 1/4" Screw
(2 places) (E17)
Reed Switch Assembly (E18)
Motor Assembly (E19)

FIGURE E

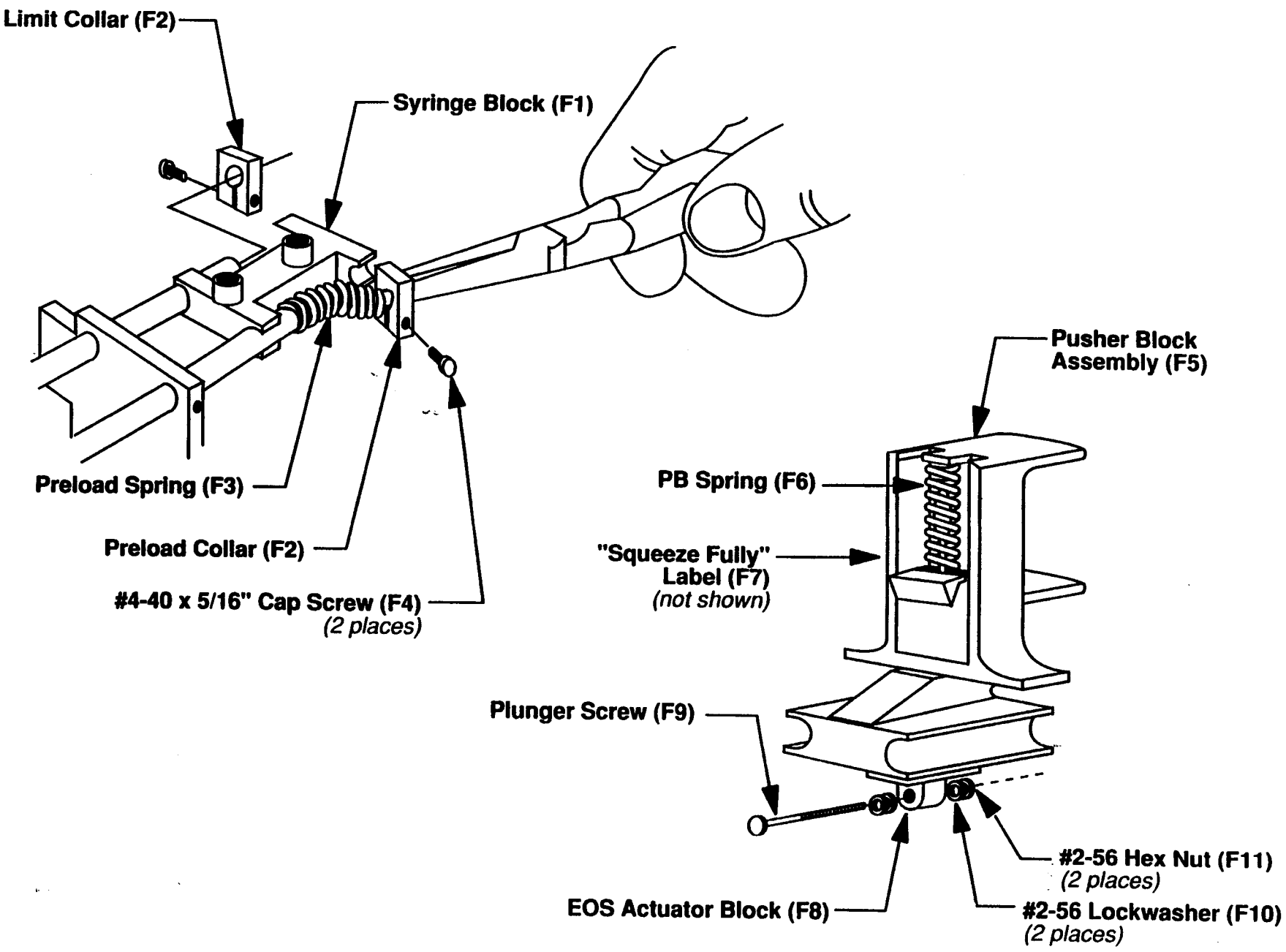

Limit Collar (F2)
Syringe Block (F1)
Preload Spring (F3)
Preload Collar (F2)
#4-40 x 5/16" Cap Screw (F4)
(2 places)
Pusher Block
Assembly (F5)
PB Spring (F6)
"Squeeze Fully"
Label (F7)
(not shown)
Plunger Screw (F9)
EOS Actuator Block (F8)
#2-56 Hex Nut (F11)
(2 places)
#2-56 Lockwasher (F10)
(2 places)

FIGURE F

THIS PAGE INTENTIONALLY BLANK

APPENDIX 4.0

PRODUCT UPDATES

THIS PAGE INTENTIONALLY BLANK

APPENDIX 5.0

MANUAL REVISION NOTICES

Date	Rev Level	Reason For Change
8/91	0	Document Release
12/91	1	Add table "A" for page style
3/94	2	Logo change (Bard to Baxter)
2/98	A	Misc. administrative changes

THIS PAGE INTENTIONALLY BLANK

APPENDIX 6.0

REPAIR HISTORY

THIS PAGE INTENTIONALLY BLANK

APPENDIX 7.0

OPERATOR'S MANUAL

THIS PAGE INTENTIONALLY BLANK

INTRODUCTION	THEORY OF OPERATION	DISASSEMBLY/ASSEMBLY	TROUBLESHOOTING AND REPAIR	ROUTINE MAINTENANCE	FUNCTIONAL TEST	
FUNCTIONAL TEST	ROUTINE MAINTENANCE	TROUBLESHOOTING AND REPAIR	DISASSEMBLY/ASSEMBLY	THEORY OF OPERATION	INTRODUCTION	
SCHEMATICS AND WIRING DIAGRAMS	CIRCUIT BOARD ASSEMBLY DRAWINGS	PARTS LIST/DIAGRAMS	PRODUCT UPDATES	MANUAL REVISION NOTICES	REPAIR HISTORY	OPERATOR'S MANUAL
OPERATOR'S MANUAL	REPAIR HISTORY	MANUAL REVISION NOTICES	PRODUCT UPDATES	PARTS LIST/DIAGRAMS	CIRCUIT BOARD ASSEMBLY DRAWINGS	SCHEMATICS AND WIRING DIAGRAMS