

# **IVAC SYRINGE PUMPS**

**P1000,P2000,P3000 and P4000**

## **TECHNICAL SERVICE MANUAL**

**Pub No.1000PB00048 Issue 5  
VERSION 4 SYRINGE PUMPS**

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Printed in England (February 1998)

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## INTRODUCTION TO THE TECHNICAL SERVICE MANUAL

This manual is designed to enable you to carry out routine maintenance, trouble shooting and repair tasks on the IVAC range of P1000,P2000,P3000,P4000 syringe pumps also referred to as P100,P200,P300,P400 (French Labelled) syringe pumps.

The revisions of IVAC pumps covered by this manual are listed below:

Units with Serial Numbers:-	1001-10000 to current
	2001-10000 to current
	3001-10000 to current
	4001-10000 to current

Please ensure that you are thoroughly familiar with the operations and controls of the equipment and with the differences between the types of units outlined above prior to attempting any fault finding or repair work.

Carefully study the sections of the manual relevant to the pump serial number and its build status revision.

If you have any problems or questions please feel free to contact either;-

**ALARIS Medical Systems Customer/Technical Service:**

**01256 327917    from within the UK**

**Outside of the UK contact your local ALARIS distributor see Service Centre Addresses.**

who will be happy to provide assistance in case of difficulty.

Also attached to the technical manual, section 13 there are copies of various publications and bulletins sent out to customers from time to time which result from improvements and enhancements to our products.

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## **1.0 GENERAL INFORMATION**

### **1.1 INTRODUCTION**

The **IVAC P1000, P2000, P3000 and P4000 syringe pumps and IVAC P100, P200, P300 and P400 French labelled syringe pumps** are designed to deliver a continuous and accurate infusion whenever small fluid volumes need to be administered with great precision. High performance, comprehensive alarm protection and sophisticated monitoring systems, combine with simple operation to make these syringe pumps suitable for both general and critical infusions.

The **IVAC P1000, P2000, P3000 and P4000 syringe pumps and IVAC P100, P200, P300 and P400 French labelled syringe pumps** allow the use of standard disposable syringes and any suitable standard extension line.

This Technical Service Manual relates to all syringe pumps greater than serial number X001-10000 only.

**Ensure that you are fully familiar with this equipment by carefully studying the Directions for Use prior to attempting any repairs or servicing.**

As part of a policy of continuous improvement, product enhancements and changes are introduced from time to time.

Where the changes do not result in the need for a change in the model and part number of the equipment, these changes are documented via the build status of the unit. Software changes can be identified via the version and revision status of the resident software of the equipment. Other individual changes which do not affect the overall specification or operation of the equipment are documented individually in the schematics attached.

### **1.2 REGISTRATION FOR UPDATES**

Please complete the registration form on the next page and return it to your nearest Service Centre.

**\*\*\*\*\* REGISTER NOW \*\*\*\*\***

Dear Customer,

In order for us to provide you with ongoing technical support for our products, please help us by completing and returning this registration form.

Name: \_\_\_\_\_

Department: \_\_\_\_\_

Hospital: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Postcode: \_\_\_\_\_

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### 1.3 GENERAL PRECAUTIONS

Please read the general precautions described in the Directions for Use carefully prior to using this equipment.

An electrical shock hazard exists if the instrument casing is opened or removed. Refer all servicing to qualified service personnel only.

This instrument is protected against the effects of high energy radio frequency emissions and is designed to fail safe if extremely high levels of interference are encountered. Should false alarm conditions be encountered either, remove the source of the interference, or, regulate the infusion by another appropriate means.

If the instrument is dropped, subjected to excessive moisture, humidity or high temperature, or otherwise suspected to have been damaged, remove it from service for inspection by a qualified service engineer.

**This equipment contains static-sensitive components. Observe strict precautions for the protection of static sensitive components when attempting to repair and service the equipment.**

### 1.4 ROUTINE PREVENTATIVE MAINTENANCE AND ELECTRICAL SAFETY CHECKS

See DFU (Directions for Use)

## 2.0 RS232 COMMUNICATIONS INTERFACE

### 2.1 BATTERY POWER CONSUMPTION

When the pump is run from its internal battery and an active RS232 cable is connected, the RS232 interface in the pump is powered-up. Battery power is conserved by disconnecting the RS232 connector, or powering down a computer connected to the other end of the cable, when the interface is not being used. This facility is provided by the 'ENABLE' signal in the RS232 connector. A summary of the minimum expected battery life is shown below.

MINIMUM BATTERY LIFE		
OPTION ENABLED	MODEL NUMBER	
	P1000, P2000, P3000	P4000
RS232 fitted and disabled	15 hours	8 hours
RS232 fitted and enabled	12 hours	6 hours
Nurse call fitted	8 hours	6 hours
Nurse call fitted and RS232 disabled	12 hours	6 hours
Nurse call fitted and RS232 enabled	8 hours	4 hours

### 2.2 SETTING UP AN RS232 INTERFACE

Syringe Pumps fitted with an RS232 interface have a 9-pin D Type socket on the side of the pump near the mains inlet socket. If the socket is not fitted, an RS232 interface upgrade is available.

The pump software allows the communication interface to be enabled or disabled. To use the RS232 interface communications must be enabled.

To check communications are enabled switch the pump on whilst holding down the START button on the front panel. The display will show '---'. Use the rate up/down buttons below the display to set the digits to '167'. Then press the 'STOP' button. The display will show either 'C-0' (communications disabled) or 'C-1' (communications enabled). Ensure the communications are enabled, use the arrow button under the '0' digit if they are disabled. Then press the 'STOP' button again to store the new setting of the communications status.

Wire up an RS232 interface cable of suitable length as specified in Section 2.6, Interface Interconnections.

Note that the nominal maximum length of an RS232 cable is about 15 metres. Cables in excess of this length may not yield reliable communication.

Plug the 9-pin D Type plug into the pump, and the 9-pin D type socket connector into the computer serial port. Switch both the computer and pump on and check the interface using the demonstration software.

## 2.3. INTERFACE PROTOCOL

Alpha information is sent in ASCII whilst numeric data is sent in binary. All data bytes following the header are mandatory. A minimum delay of 100ms is necessary between successive host commands.

When the pump is started by a command from the serial interface the pump will flash 'REM' on the display to indicate that the pump was started remotely. Whilst running in this mode some communication must take place over the serial interface at least once every 10 seconds or the pump will alarm (display shows 'Con': communications failure) and stop. This feature protects against failure of communications including removal of the RS232 cable. The most suitable regular communication is for the host computer to request an information set every 10 seconds. (This does not apply to units sold in France and Germany).

Note: Commands RT and RE will restart the pump motor control software with a new rate, for a consistent rate the RT and RE commands should not be sent repeatedly.

Information sets numbers 1, 2 and 3 are sent in complete blocks when prompted respectively by the host commands M1, M2 and M3.

## 2.4 PUMP ORIGIN PARAMETERS - INFORMATION SETS

INFORMATION SET NO. 1			
HEADER	CONTROL RANGE	DATA (BYTES)	DESCRIPTION
SN	0-127	1	Pump identity previously set by host.
RT	0.1 - 99.9 ml/h	3	Infusion rate sent as <tens> <units> <tenths>.
RE	or, if rate > 99.9 ml/h:- 1-199 ml/h	3	Infusion rate sent as <hundreds> <tens> <units>. (P4000 only).
RE	or, if rate > 199 ml/h:- 1-999 ml/h	3	When extended flow rate range has been selected. Otherwise as above.
PI	00-255	2	Current pumping pressure sent as raw data values from internal pressure sensor <high nibble> <low nibble>.
PA	0 - 6	1	Current occlusion alarm level.

## 2.4 PUMP ORIGIN PARAMETERS - INFORMATION SETS (continued)

<b>VI</b>	0.0 - 999.9 ml	4	Contents of volume infused counter sent as <hundreds> <tens> <units> <tenths>.
<b>VL</b>	0.0 - 99.9 ml	3	Volume limit setting sent as <tens> <units> <tenths>.
<b>ST</b>	Individual bits set/reset	1	Current pump status as described below:
	Run (1) /Stop (0) Purge (1) /No purge (0) Vol Limit Enabled (1) /Disabled (0) AC (1) /Battery Power (0) Near End of Infusion Region (1) KVO Enabled (1) /Disabled (0) Extended Rate Range Enabled(1)		-bit0 (lsb) -bit 1 -bit 2 -bit 3 -bit 4 -bit 5 -bit 6 (P4000 2R2 onwards only)
<b>VR</b>	0.0 - 99.9 ml	3	Volume limit counter sent as <tens> <units> <tenths> (counts from 0 towards VL).

### INFORMATION SET NO. 1 (continued)

HEADER	CONTROL RANGE	DATA (BYTES)	DESCRIPTION
<b>AL</b>	Individual bit set/reset	2	Pump alarms information as described below:
	<b>ALARM CONDITION</b> Declutch (1) Occlusion (1) Battery Operation (1) Volume Limit Reached (1) Low Battery Detected (1)  <b>ALARM CONDITION</b> Near End of Infusion (1) End of Infusion (1) Syringe Not Fitted (1)		<b>FIRST DATA BYTE</b> -bit1 (lsb) -bit2 -bit3 -bit4 -bit6  <b>SECOND DATA BYTE</b> -bit2 -bit3 -bit4



## 2.4 PUMP ORIGIN PARAMETERS - INFORMATION SETS (continued)

INFORMATION SET NO. 2			
HEADER	CONTROL RANGE	DATA (BYTES)	DESCRIPTION
<b>SU</b>		3	Set up configuration information
	Syringe Type 0-8 (first data byte)		0 - BD Plastipak 1 - Terumo 2 - B Braun Omnifix 3 - B Braun Perfusor 4 - Fresenius Injectomat 5 - Sherwood Monoject 6 - RR Pronto 7 - B-D Plastipak ("World-wide" version) 8 - Once
	Syringe size 0-4 (second data byte)		0 - no defaults 1 - 10 ml 2 - 20 ml 3 - 30 ml 4 - 50 ml
	Occlusion calibration constant 1-20 (third data byte)		

INFORMATION SET NO. 3			
HEADER	CONTROL RANGE	DATA (BYTES)	DESCRIPTION
<b>SP</b>		3	Pump configuration information
	Pump Type 1-4 (first data byte)		1 - P1000 2 - P2000 3 - P3000 4 - P4000
	Software version 0 - F (second data byte)		
	Software revision 0 - F (Third data byte)		

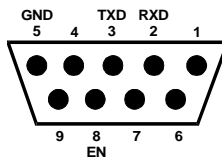
## 2.5 HOST ORIGIN COMMANDS

HEADER	CONTROL RANGE	DATA (BYTES)	DESCRIPTION
<b>SR</b>	nil	0	Starts pump if rate is > 0.0 ml/hr.
<b>SS</b>	nil	0	Stops pump.
<b>RS</b>	0.1 - 99.9 ml/h	3	Sets infusion rate to be sent as <tens> <units> <tenths>. Pump must not be running.
<b>RE</b>	100 -199 ml/h	3	Sets infusion rate to be sent as <hundreds> <tens> <units>. Pump must not be running (P4000 only).
<b>RE</b>	1-999 ml/h	0	When extended flow rate range has been selected. Otherwise as above.
<b>VC</b>	nil	0	Clears the volume infused counter and display to zero. Pump must not be running.
<b>PR</b>	1-7	1	Sets occlusion alarm level. Pump must not be running.
<b>IP</b>	0-127	1	Sets pump identity. (default value 0) Pump must not be running.
<b>M1</b>	nil	0	Requests from pump information set number 1.
<b>M2</b>	nil	0	Requests from pump information set number 2.
<b>M3</b>	nil	0	Requests from pump information set number 3.
<b>&lt;ESC&gt;</b>	nil	0	Clears input buffer.

## 2.5 HOST ORIGIN COMMANDS

SPECIFICATION	
CONNECTOR	9-pin D Type Socket
RX/TX	EIA RS232-C standard
TX OUTPUT VOLTAGE RANGE	Min. -5V (mark), +5V (space) Typ. -7V (mark), +7V (space) with 3K load to ground.
RX INPUT VOLTAGE RANGE	-30V to +30V max
RX INPUT THRESHOLDS	Low: 0.6V min High: 3.0V max
RX INPUT RESISTANCE	3K min
ENABLE	Active: low -7V to -12V or high +7V to +12V, powers up the isolated RS232 circuitry. Inactive: floating/open circuit, allows isolated RS232 circuitry to power down.
ISOLATION SOCKET/PUMP	4kV (dc, or ac peak)
BAUD RATE	9600 baud
START BITS	One start bit
DATA BITS	Seven data bits
PARITY	Odd parity
STOP BITS	Two stop bits

## 2.5 HOST ORIGIN COMMANDS (continued)

INTERFACE INTERCONNECTIONS	PIN NUMBER	DESCRIPTION
	Pin 1	Not Used
	Pin 2	Receive Data (RXD)
	Pin 3	Transmit Data (TXD)
	Pin 4	Not Used
	Pin 5	Ground (GND)
	Pin 6	Not Used
	Pin 7	Not Used
	Pin 8	Enable Input - (connects to RTS on computer)
	Pin 9	Not Used
	9-Pin D Type Connector Pin Numbering. (view from outside of pump):	
		

ALARIS Medical Systems reserves the right to alter product specifications without notice.

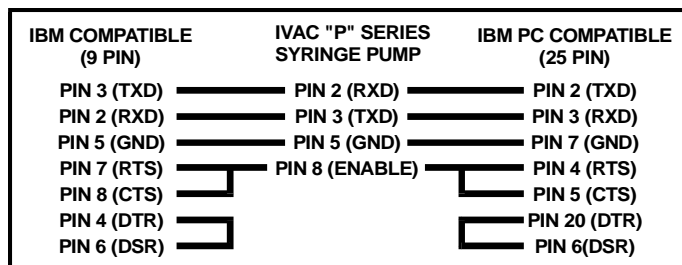
## 2.6 RS232 INTERFACE INTERCONNECTIONS

The interface needs a four conductor cable to link the pump to the host computer. The Enable Input (pin 8) detects an active PC connected to the pump. The active signal can be positive or negative and is typically connected to the RTS output of the PC.

With some PC software this signal may remain active high, with others it may go low during communication. In normal operation the transition of the signal from high to low will not disable the interface. When the PC is switched off, or the interface cable disconnected the enable input will go inactive, and the RS232 interface circuitry in the pump powered down. The power down of the interface saves about 100mW of power consumption.

## 2.6 RS232 INTERFACE INTERCONNECTIONS (continued)

### TYPICAL CONNECTION TO AN IBM COMPATIBLE PC-AT



Note: The IBM PC connector pins grouped in pairs above should be linked at the connector.

## 2.7 COMPATIBILITY WITH OLDER SYRINGE PUMPS

Two versions of older IVAC and WELMED syringe pumps incorporating an RS232 interface exist. The 9-pin D Type socket is fully compatible with the 8-pin DIN isolated RS232 interface of older pumps. Early, non isolated interfaces used a different interface enable pin. Pin 6 was active when connected to 0V, and inactive with the pin left open circuit. This pin was normally wired to pin 5 in the plug, so that while plugged in the RS232 interface was powered up. Pin 8 was not used as an enable on the early pumps. For compatibility with older pumps therefore, pin 6 can be connected in the pump connector to pin 5.

### **3.0 PRODUCT FEATURES, UPDATES, AND INTERCHANGEABILITY**

Product updates and enhancements are generally identified by the version and revision status of the resident software of the equipment.

The software status may be interrogated by following the self test procedure described in this service manual.

The following sub-sections describe the updates and enhancements that have been introduced during ongoing development of our range of syringe pumps.

- [3.1 P1000/P2000/P3000 SOFTWARE \(1000EL00127\)](#)
- [3.2 P4000 SOFTWARE \(4000EL00003\)](#)
- [3.3 SUMMARY GUIDE TO BUILD REVISION \(1000ME00152\)](#)
- [3.4 ENGINEERING UPDATES AND INTERCHANGEABILITY](#)

### 3.1 P1/2/3 SUMMARY OF SOFTWARE REVISION: 1000EL00127

#### P1000, P2000 and P3000

Issue	Description
V4R0	<b>PRODUCTION</b> <ul style="list-style-type: none"><li>• Version 4 first release.</li></ul>
V4R1	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Janpol syringe option added</li></ul>
V4R2	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Watchdog test moved to enable stabilisation</li><li>• RS232 french now control/monitor</li><li>• Plunger detect test on power up modified</li></ul>
V4R3	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Alarm in purge mode modified</li></ul>
V4R4	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• EOI now 1% of syringe volume</li></ul>
V4R5	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Data moved from internal to ext. ram to increase stock size</li><li>• Drawing reformatted</li><li>• Eprom type changed</li><li>• Software not changed</li></ul>
V4R6	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Length of serial data limited to 5 bytes.</li><li>• Option to disable pump running when volume limit reached</li></ul>
V4R7	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Purge Bolus rate for 30ml syringe now 100ml</li><li>• AC alarm disable option added (Code 624)</li><li>• Rate limit option of 9.9ml/hr added (Code 804)</li><li>• Default set-up codes added for French, German, English and Spanish</li><li>• Total time on mains/battery code added (Codes 371&amp; 372)</li></ul>
V4R8	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Option to select either 1 second or 10 second declutch pulse in (Code '808')</li></ul>

<b>3.1</b>	<b>P1/2/3 SUMMARY OF SOFTWARE REVISION: 1000EL00127 (CONT)</b>
<b>V4R9</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"> <li>• French option - 'PrE Fin' displayed at NEOI. 'dIS' if comms failure</li> </ul>
<b>V4R9</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"> <li>• References to serial No. removed. Part Number dashes removed</li> </ul>
<b>V4RA</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"> <li>• During purge / bolus then change max. level</li> </ul>
<b>V4RB</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"> <li>• Option to set KVO rate to 0.5ml/hr (Code 318)</li> </ul>
<b>V4RC</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"> <li>• Occlusion constants for BD syringes updated</li> </ul>
<b>V4RD</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"> <li>• Option for 10% NEOI added (Code 319)</li> </ul>
<b>V4RE</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"> <li>• Stop at volume limit option modified</li> <li>• Setting default occlusion alarms modified</li> </ul>
<b>V4RF</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"> <li>• Add beep in self test of NEOI between 4-0 and 4-1.</li> <li>• Default automatically Sy3, Sy5, SyA to 50ml syringes (d50).</li> </ul>
<b>V4RG</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"> <li>• 10% volume infusion (customer request) option amended.</li> </ul>
<b>V4RH</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"> <li>• Intermittent ERC during start up routine. Time allowed for full circle increased from 50ms to 60ms.</li> </ul>



## **3.2 P4 SUMMARY OF SOFTWARE REVISION: 4000EL00003**

### **P4000 only**

<b>Issue</b>	<b>Description</b>
<b>V4R0</b>	<b>PRODUCTION</b> <ul style="list-style-type: none"><li>• Version 4 first release.</li></ul>
<b>V4R1</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Double key push introduced for German version.</li></ul>
<b>V4R2</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• RS232 French now control/monitor.</li><li>• RR Pronto and Sherwood syringe data modified.</li><li>• AD_test now monitored every 0.5s.</li></ul>
<b>V4R3</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Rate break now at 3.9ml (4.9).</li></ul>
<b>V4R4</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Stack length increased and bottom test added - error code 'Er-' added.</li><li>• Plunger stuck at power up test limited to 6 bits to eliminate occasional 10ml syringe ErE false alarms.</li><li>• If rate &gt; 499 on 10ml syringe confirm display shows '---'.</li><li>• Purge limit maximum limited to 9.9ml/h in code '150'</li></ul>
<b>V4R5</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Serial data length limited to 5 bytes to prevent overflow.</li></ul>
<b>V4R6</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Grid test modified to remove truncation - caused Er2 at extended rates between 980ml/h and 999ml/h.</li><li>• Eprom type changed.</li></ul>
<b>V4R6</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Drawing reformatted.</li></ul>
<b>V4R7</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Er'r' limits increased to prevent false alarms.</li></ul>
<b>V4R8</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Autoinduction option added.</li></ul>
<b>V4R9</b>	<b>ENHANCEMENTS</b> <ul style="list-style-type: none"><li>• Option code for ac alarm disable added.</li></ul>

### **3.2 P4 SUMMARY OF SOFTWARE REVISION: 4000EL00003 (CONT)**

- Country specific default codes added.
- Total/battery time now stored.

#### **V4RA ENHANCEMENTS**

- Stack re-organised to eliminate Er-
- Auto induction modified
- Volume limit/rate display modified.

#### **V4RB ENHANCEMENTS**

- Option to stop at alarm limit added.
- Option to limit pulse in to 1 second added.

#### **V4RC ENHANCEMENTS**

- Spanish EOI option added.

#### **V4RC ENHANCEMENTS**

- Drawing Reformatted.

#### **V4RD ENHANCEMENTS**

- Option to disable purge/bolus alarm added (code 229)
- French default settings updated

#### **V4RE ENHANCEMENTS**

- Watchdog test added to 't-1' in self test
- Beep added to 4-0 to 4-1 in self test
- Default syringe size of 50ml if Sy3/4/8 or A selected
- Sy0 B-D 10,20,30 syringe data now common with Sy7 WWD syringe
- B-D 10,30,50 Occlusion constants updated in line with syringe performance
- Option '230' added to limit rate to 99.9ml/hr
- Option '319' added for 10% NEOI alarm

#### **V4RF ENHANCEMENTS**

- The syringe misfit calibration value has now modified to 15.8mm to 15mm.
- Auto-induction modified, the start key is disabled if in induction mode.

## **3.2**

### **P4 SUMMARY OF SOFTWARE REVISION: 4000EL00003 (CONT)**

#### **V4RG**

#### **ENHANCEMENTS**

- Check if tenths or units keys have been checked at limit check beep code and restore both working values (used for display) from RAM copies.
- Correct and added comments for clarity (eg error code numbers).

### 3.3 GUIDE TO BUILD STATUS: 1000ME00152

ALARIS MEDICAL SYSTEMS Bill of Materials Print

Item Number: 1000ME00152 P1 - 4 Family

Iss: 87

PCD: 503	Iss: 16 COMMON MULTI LANGUAGE BASE PANEL LABELS CREATED TO REPLACE ENGLISH, FRENCH, GERMAN AND DUTCH PANELS – INSTRUCTIONS REMOVED FROM THE LABELS AND REFERENCE MADE IN THE DFU.
PCD: 600	Iss: 26 UNIT LABEL SET INTRODUCED, INDIVIDUAL SERIAL NUMBER, ISSUE STATUS AND BOX END LABELS REPLACED WITH A COMBINED LABEL.
PCD: 599	Iss: 27 ADD 1001FAOPT94 USA CORD OPTION TO V4 AND P5 BOM. DELETE THE 5001FAOPT90-94 FOR THE POWER CORD AND REPLACE WITH THE 1001FAOPT90-94.
PCD: 613	Iss: 28 1000ME00152 27 TO 28, FLEXI UPISSUE 1000SP01006 ISSUE 4 TO 5 HUNGARIAN OPTION NOW ADDED.
PCD: 630	Iss: 29 PLASTIC BAG REMOVED FROM V4 AND P5 BOMS. PACKAGING HAS BEEN IMPROVED SO THE PLASTIC IS NO LONGER REQUIRED 0000ME00062 BAG PLASTIC.
PCD: 628	Iss: 30 SEALING CORD CHANGED. CHANGE OF SEALING CORD INNER BORE SIZE. NEW PART NUMBER REQUIRED.
PCD: 492	Iss: 31 SYRINGE SHAFT CIRCLIP CHANGE. DEEPEN CIRCLIP SLOT FROM 5.00 DIA TO 3.73 DIA. 1000ME01041 REDRAWN TO 1000ME01086. 5000ME00014 REDRAWN TO 5000ME00078.
PCD: 648	Iss: 32 FOAM NO LONGER AVAILABLE, SPECIFICATION TO BE AMENDED TO INCLUDE 5041 NEOPRENCE 2mm THICK WAS 4730 TESSAMOL, EXTRA FOAM PIECE TO BE ADDED PARALLEL TO THE EXISTING FOAM PAD IN THE LOWER CASE ASSEMBLY.
PCD: 658	Iss: 33 PLASTIC BAG 0000ME00062 DELETED FROM V4 AND P5 BOMS, FOLLOWING CUSTOMER FEEDBACK, PLASTIC BAG IS TO BE REFITTED BEFORE THE PUMP IS SHIPPED.
PCD: 513	Iss: 34 SPACER TRANSMISSION. NEW MOULDED TRANSMISSION SPACER 2 IN 1 TO REPLACE THE 2 SINGLE SPACERS CALLED UP AT THE MOMENT.
PCD: 656	Iss: 35 RUBBER KEYCAP 1000ME01057 TI REPLACE YELLOW SPACER 100ME01076.
PCD: 480	Iss: 36 CONSOLIDATE P1000/P2000/P3000 AND P4000 DFU'S (V4) ENGLISH AND THE RS232 MANUAL.
PCD: 675	Iss: 37 NEW DFU SPANISH P1000/2000/3000 NEEDS ADDING TO THE BOMS 1001FA2USP0, 2001FA2USP0 3001FA2USP0.

### 3.3 GUIDE TO BUILD STATUS: 1000ME00152

PCD: 645	Iss: 38 LOCTITE 242 ADDED TO MAINS INLET SCREWS TO PREVENT OVER COMPRESSING THE MAINS INLET GASKET.
PCD: 663	Iss: 39 1000ME01021 PLATE CHASSIS, ALTERNATIVE INSERT ADDED TO DRAWING. 1001PP00004 ASSY TRANSMISSION ITEM 63 11 OFF NOW 8 OFF 0000ME00070 3 OFF ADDED.
PCD: 634	Iss: 40 CHANGE OUTER TUBE SUPPLIER AND MANUFACTURING PROCESS.
PCD: 718	Iss: 41 CORD REDESIGNED WITH WALL THICKNESS AS UNIFORM AS POSSIBLE. 1000ME01087 TO BE SUPERSEDED BY 1000ME01090.
PCD: 713	Iss: 42 SLOTTED SCREWS TO BE REPLACED BY POSI SCREWS. 0ME04-0ME221, 0ME05-0ME222, 0ME35-0ME224, 0ME36-0ME225, 0ME38-0ME226, 0ME108-0ME227, 0ME128-0ME228, 0ME130-0ME229, 0ME147-0ME230, 0ME70-0ME231.
PCD: 740	Iss: 43 SYRINGE SIZING MISFIT MODIFICATION.
PCD: 500	Iss: 44 LINEAR POT CHANGED TO MEASURE 100ml SYRINGE. REPLACE 47K POT (0000EL00137) BY 50K POT (0000EL00267) DELETE PART 1000EL00057. POT NO LONGER DRILLED, REPLACE POT ASSY 10000SP00016 WITH POT ASSY 1000SP01017.
PCD: 717	Iss: 45 1000ME00042 – PRESS FIT THE BEAM BEARING INTO BEAM. AMEND BEAM BONDED DRAWING AND CREATE BILL OF MATERIALS 1000SP00003 – DELETE MOLEX CONNECTOR/CRIMPS AND LOCTITE FOR BEAM BONDED ASSY. 1000ME00007 – AMEND BEARING HOLE DIMS ON DRG.
PCD: 742	Iss: 46 IMPROVE SURFACE FINISH AND CONCENTRICITY OF THE OUTER TUBE.
PCD: 738	Iss: 47 INTRODUCTION OF 1000EL00137 TO P1000/2000/3000/5000.
PCD: 749	Iss: 48 CE MARKING ADDED TO V4 AND P5 UNITS. ADD CE MARKING TO ARTWORKS OF V4 AND P5 BASE LABELS/LABEL SETS.
PCD: 755	Iss: 49 REPLACE THREE SCREWS ON LINEAR GRID. M3X8 TOO LONG, REPLACE WITH M3X6 EQUIVALENTS.
PCD: 655	Iss: 50 MOTOR SUPPRESSION ADDED TO FLEXI CIRCUIT. NEW PART NUMBERS REQUIRED FOR P1-3/P5 FLEXI AND P4 FLEXI. ADD TO V4 AND P5 BOMS.
PCD: 756	Iss: 51 IMPLEMENT NEW LEADSCREW SEAL 1000ME0195 TO REPLACE 1000ME01081. REPLACE O RING 0000ME00185 WITH NEW PART 0000ME00237.
PCD: 765	Iss: 52 SILICONE CORD MODIFICATION 1000ME01090 TO BE REPLACED WITH 1000ME01087 ON V4/P5/P7 UNITS.

### 3.3 GUIDE TO BUILD STATUS: 1000ME00152

PCD: 782	Iss: 53 OPTION 05 ADDED TO ALL DUTCH UNITS, P1,2,3 AND P4.
PCD: 716	Iss: 54 SUPERSEDE 1000ME00089 WITH PRE-BONDED COUPLING VERSION, 1000SP01042 (P1/2/3/5) AND 4000SP00018 (P4). THIS THEREFORE REMOVES THE REQUIREMENT FOR THE COUPLING 1000ME00090 TO BE CALLED UP IN THE BOM. ADD MOTOR WIRES TO MOTOR GEARBOX ASSEMBLIES WHERE APPLICABLE.
PCD: 808	Iss: 55 NEW PROTECTOR ROCKER SWITCH IS NOW MOULDED AND AVAILABLE FOR ALL PRODUCTS.
PCD: 907	Iss: 56 ADDITION OF STAR WASHER TO NURSECALL CONNECTOR.
PCD: 940	Iss: 57 INTRODUCTION OF OPTION 10 (1001FAOPT10 & 7001FAOPT10) RS232/NURSECA;; NIRA COMPATABILITY.
PCD: 900	Iss: 58 REPLACE SPACER 12.7mm LONG 0000ME00129 WITH 4.9mm LONG 0000ME00115 ON 1000EL00085. REPLACE ITM 54 0000ME00228 WITH 0000ME00189.
PCD: 859	Iss: 59 ADD OPTION 09 10% VOLUME NEOI TO ALL V4 UNITS.
PCD: 958	Iss: 60 AMEND PART NUMBER OF 1001FAOPT10 /7001FAOPT10 TO CORRECT FORMAT 1001FAOPT0B /7001FAOPT0B. ORIGINAL OPTION NUMBERS RAISED IN ERROR.
PCD: 851	Iss: 61 IMPLEMENT MOULDED POLE CLAMP PAD AND KNOB/STUD TO ADD TO THE EASE OF ASSEMBLY.
PCD: 905	Iss: 62 V4 TORSION ROD (1000ME01015) REPLACED BY P7 TORSION ROD (7000ME00015).
PCD: 979	Iss: 63 RETURN TO OLD POLE CLAMP ASSEMBLY.
PCD: 981	Iss: 64 ADD SPANISH NEOI FLAG OPTION TO THE V4 PRODUCT. THE OPTION 1001FAOPT0C TO BE ADDED TO ALL V4 SPANISH UNITS.
PCD: 1008	Iss: 65 CHANGE TO ONE PIECE POLE CLAMP KNOB/STUD.
PCD: 1023	Iss: 66 IMPLEMENT COMMON SYRINGE TYPE LABEL SET 1000LB01011.
PCD: 1024	Iss: 66 IMPLEMENT COMMON V4 LABEL SET 1000LB01009.
PCD: 1077	Iss: 67 FLEXI ROUTING CHANGED.
PCD: 1092	Iss: 68 OPTION 0C NO LONGER AVAILABLE.
PCD: 1078	Iss: 69 IMPLEMENT FLEXIBLE CIRCUIT ON BEAM ASSEMBLY.
PCD: 1009	Iss: 70 MOULDING OF GEARS WITH HOLES.
PCD: 1067	Iss: 71 IMPLEMENTATION OF NORYL UPPER AND LOWER CASES.
PCD: 1135	Iss: 72 FOLD OVER CAP ADDED TO RS232 GASKET.

### **3.3 GUIDE TO BUILD STATUS: 1000ME00152**

PCD: 1153	Iss: 73 MODIFICATION TO V4 NORYL CASE LOWER TOOLING AND UPPER INSERTS.
PCD: 1087	Iss: 74 IMPLEMENTATION OF NEW SEALS ON TRANSMISSION TO RECTIFY FLUID INGRESS PROBLEMS.
PCD: 1166	Iss: 75 MODIFICATION TO V4 NORYL CASE UPPER TOOLING.
PCD: 1147	Iss: 76 SPLASH COVER REDESIGN TO RECTIFY FLUID INGRESS PROBLEMS.
PCD: 1168	Iss: 77 MOULDING OF BUTTON PLUNGER HOLDER.
PCD: 1167	Iss: 78 MOULDING OF LEADSCREW SEAL.
PCD: 1010	Iss: 79 MOULDING OF MOTOR MOUNTING PLATE BUSH.
PCD: 1144	Iss: 80 CREATE NEW SWAGED POLE CLAMP ASSEMBLY.
PCD: 1090	Iss: 81 1000LB01010 AS AN OPTION (1001FAOPT0F, 5001FAOPT0F, 6001FAOPT0F AND 7001FAOPT0F).
PCD: 1006	Iss: 82 IMPLEMENTATION OF THE COMBINED RS232/NURSECALL CONNECTOR.
PCD: 1220	Iss: 83 NEW PRODUCT OPTION – 1001FA1USP0, 2001FA1USP0 AND 3001FA1USP0 ADDED.
PCD: 1243	Iss: 84 IMPLEMENTATION OF V4 SURFACE MOUNT CONTROL BOARD.
PCD: 1223	Iss: 85 CHANGE RS232 BASE PLATE SECURING SCREWS TO STAINLESS STEEL.
PCD: 1225	Iss: 86 CHANGE OF CONNECTOR ON BEAM ASSEMBLY.
PCD: 1234	Iss: 87 ADD NEW OPTION 1001FAOPT97 MAINS LEAD RETENTION OPTION TO BOMS.

### **3.4 ENGINEERING UPDATES AND INTERCHANGEABILITY**

The boards from units with serial numbers X001-XXXXXX cannot be replaced by boards with serial numbers lower than those shown.

Use only software status version 4 or above (e.g. 4rX).



## 4.0 CIRCUIT DESCRIPTION

The main circuitry within the **IVAC P-Series** syringe pumps is contained on three printed circuit boards - Power Supply, Control and Display PCBs. A fourth printed circuit board incorporates the RS232 and Nurse Call interface circuitry; this is optional on the **P1000**, **P2000** and **P3000**, but is a standard option on **P4000**.

In addition, a flexible printed circuit is utilised to hold the optical sensors and to provide the necessary interconnects to the moving parts of the pump.

The circuitry is largely common to all four models of the pumps - the **P1000**, **P2000**, **P3000** and the **P4000**. Features and circuitry which is unique to each model is described individually in the relevant sections of this manual.

The circuit description for each of the printed circuits is covered in the following sections.

## 4.1 Power Supply PCB.

Refer to the circuit diagram, component location drawing (1000EL00082) and parts list in section 5.

The Power Supply PCB is located in the lower case assembly of the pump, refer to section 7 for disassembly and removal.

All connections between the Power Supply PCB and the Control PCB are made via connector PL0.

### 4.1.1 Mains Input (AC Power)

The pumps can be operated either from 110/120V or 220/240V AC power supplies depending on the configuration of the links on the power supply PCB.

( LK1 & LK3 for 110/120V, or LK2 for 220/240V - these links are made using insulated wire on the non-component side of the PCB).

AC power is applied to the unit using a standard IEC connector from which an internal connection takes the AC power to the power supply PCB via PL1. A ferrite on the mains inlet is fitted to protect the unit from electrical interference; on the PCB a metal oxide varistor, D10, protects against over voltage surges and R23 & C6 filter low frequency interference. The live connection is protected by fuse, FS1.

### 4.1.2 Rectification

The AC supply voltage is stepped down using transformer T1, which has two 7.5V secondary windings in parallel. The output from the transformer is then rectified by bridge rectifier, D0.

The output from the bridge rectifier is then diverted two ways, one is routed through the power on/off switch, smoothed using capacitor C0 and fed to the 5V regulator, the other output is not smoothed but is supplied to the battery charging and AC signal detect circuits.

### 4.1.3 5 Volt Regulation

The input to the 5 Volt regulator is supplied either by the switched, rectified AC supply if operating on AC power or the switched battery voltage when on battery. The 5 Volt output from the voltage regulator is split into three supply rails, Vcc, Analogue Vcc and Motor Vcc.

The 5V regulator provides the reset signal for the microprocessor on power up and if the input voltage level to the regulator is outside its limits to be able to achieve correct regulation. In addition output zener diodes protect the Control PCB components if IC0 fails short circuit; diodes D11 and D12 limit the absolute maximum voltage on the '5V' supply to 5.6V.

#### 4.1.4 Battery Charging

The internal lead acid battery is automatically recharged whenever it is connected to the AC power supply.

When AC power is applied to the pump, the unsmoothed output from the bridge rectifier, D0, is connected to the input of the variable voltage regulator, IC1. The output voltage from IC1 is altered by adjusting the potentiometer, RV0.

The peak output voltage from IC1 should be adjusted to 7.0V +/-0.1V for effective battery charging. The output current from IC1 is limited by R0. The battery must be disconnected whilst making any adjustments to RV0 in order to see the peak battery charging voltage changes.

Diodes D14 and D15 protect the battery from overcharging in the event of failure of IC1. These zener diodes limit the maximum battery terminal voltage to 7.5 volts.

The battery is protected against short circuit by a fuse FS2, rated at 2A. FS2 is a Picofuse type and is soldered directly on the PCB next to PL3.

#### 4.1.5 AC Power Present Signal

When AC power is connected to the pump the output from the bridge rectifier is connected to the base of TR6 and produces a low signal to the control PCB via PL0. If the AC supply is removed from the pump, the voltage is removed from the base of TR6 and the output signal changes to a high.

The drive voltage for the AC power LED on the display PCB is sourced from the output of the bridge rectifier and is fed through via the control PCB.

#### 4.1.6 Audible Alarm

The audible alarm is located on the power supply PCB and can be enabled either by the audible alarm drive, the keypad alarm drive or the watchdog fail signal. In the event of PL0 not being connected the audible alarm will also sound.

#### 4.1.7 Watchdog Sense

Two watchdog signals are supplied to the power supply PCB from the control PCB.

Watchdog Fail is normally low but changes to a high level if the watchdog times out. This signal is used to drive transistor TR1 and controls the audible alarm in a watchdog fail situation.

Watchdog /Fail is the inverse of the previous signal i.e. active low. This signal is used to drive transistor TR5 which in turn controls the motor voltage supply transistor TR4, supplying Motor Vcc to PL0. This ensures that in the event of the watchdog circuit detecting a system failure the motor drive voltage is disconnected from the motor drive circuit on the Control PCB.

#### 4.1.8 Motor Supply Current

The motor supply current is controlled by TR4 and TR5 with the supply voltage derived prior to the 5 volt regulator.

The minimum motor voltage will be the minimum battery voltage less the forward voltage drop of the schottky diode D7 and is thus approximately 5.6 volts. When the unit is powered from the AC supply this will rise to approximately 9 volts.

The supply voltage is set by links A and B, the link should always be fitted in position A.

#### 4.1.9 Battery Voltage Detection

The battery voltage is fed via RV1 to PL0. The potential divider of RV1 and R3 is set by adjusting RV1, so that the appropriate low battery voltage detection is made by the pump. The low battery voltage is set to switch the control board comparator at the following voltages:

P1000, P2000, P3000:	5.90V
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P4000 (no RS232/Nurse Call):	5.90V
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P4000 (RS232/Nurse Call):	5.93V
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## 4.2 Control PCB

The Control PCB is located in the upper case assembly of the pump.

Refer to the circuit diagram, component location drawing (1000EL00089) and parts list in section 5.

### 4.2.1 Microprocessor Group

The microprocessor, IC1, is a low power CMOS 8 bit microcontroller with 24 user definable input/output pins, 4 interrupt inputs and internal RAM.

The microprocessor reset pin is pulled low on power up by the reset signal from the power supply PCB to initiate operation. The clock frequency of 7.3728MHz is generated by crystal, X1, and the internal circuitry of the IC.

The control program is held in the eprom, IC2, (32k x 8) which resides in address range 0000H to 7FFFH. The data latch, IC3, is used to decode the Address/Data Bus from the microprocessor and holds the current address location for the lower address byte.

The upper address byte is output directly from the address port of the microprocessor. Only address lines A0 to A14 are used to decode the eprom address. Address line A15 is used for address decoding of the eprom, input/output expansion and the A to D converter and are input to the dual 2 to 4 line decoder, IC4 in conjunction with the /DS and P34 signals from the microcontroller.

### 4.2.2 Input Port Expansion

The input capabilities of the microprocessor, IC1, have been expanded by adding a data latch, IC9, on the data bus. The outputs from this latch are tri-state until its /OE pin is taken low by the address decoder, IC4. The input data is read by the microprocessor via the data bus.

### 4.2.3 Output Port Expansion

The output capabilities of the microprocessor, IC1, have been expanded by adding three data latches, IC7, IC8, and IC21 on the data bus. These output latches are addressed by the address decoder, IC4.

### 4.2.4 Non-volatile Data Storage

A battery backed memory (RAM) IC18, is used to store the calibration and setup values for the pump.

The transfer of data to and from the RAM is initiated when the reset line /RST is taken low. Bi-directional data is transferred from the RAM on the DIO pin. Data transmission to and from the RAM is clocked using the serial clock line CLK.

#### 4.2.5 Pumping Pressure Measurement

The pumping pressure of the pump is detected by measuring the deflection of a beam at the end of the leadscrew on the transmission by using a full bridge strain gauge.

The output from the strain gauge is applied to the control PCB, via PL5, and fed to a 2 stage differential amplifier, IC12. An inverted signal is created using IC16 which has a valid output voltage when negative pressures exist on the beam.

The offset value of the amplifier i.e. with no pumping pressure applied, can be adjusted using potentiometer RV1.

The excitation voltage supplied to the bridge is turned off using TR4, controlled from an output port of the microprocessor, when not in use to reduce power consumption.

An offset is switched in and out of circuit during normal operation by T3. This adds a known voltage to the signal fed to the A to D converter, allowing the software to check for the correct gain in the 2 stage differential amplifier.

The output from the amplifier, IC12 is fed into the input of the A to D converter.

The current in the strain gauge bridge is monitored by resistor R64 and an input to the A to D converter.

#### 4.2.6 Analogue to Digital Converter

An 8 bit, 8 channel A to D converter, IC19, is used to monitor the amplified pumping pressure signals (positive and negative pressures), the strain gauge bridge current, the syringe size value, half rail voltage, reference voltage, and AC/DC logic level input.

The output from the A to D converter is tri-state until its /CS pin is taken low by the address decoder, IC4. The input data is read by the microprocessor via the data bus.

The half rail voltage and reference voltages are used in a software comparison in software to check that the 5V supply voltage is within acceptable limits.

The AC fail signal is a 5V Logic signal from the Power Supply PCB. This signal is low when AC is connected.

#### 4.2.7 Motor Drive and Speed Control

The motor speed is controlled by adjusting both the mark-space ratio of the drive signal and its repetition rate applied to the DC motor.

Feedback from the motor is obtained using two optical switches monitoring the movement of the rear output shaft of the motor.

The DC motor is driven using two independent transistor stages, TR1 and TR2. When the pump is started TR1 is enabled directly from the output port of the microprocessor. The drive signal to TR2 is from the output port expansion, IC7, and it is this signal which is adjusted to maintain a constant linear speed. When the pump is stopped both TR1 and TR2 are disabled.

The motor speed control algorithm uses three feedback signals from the optical switches, the leading optical encoder, the lagging optical encoder and the inverse of the leading optical encoder.

The leading optical encoder signal is fed through a schmitt trigger, IC11, the output of which is connected both to an interrupt input to the microprocessor and another schmitt trigger to produce the inverse of the leading encoder. This inverted signal is also connected to an interrupt input of the microprocessor.

The lagging optical encoder signal is fed through an schmitt trigger, IC11, and the output is connected to an input port of the microprocessor.

#### 4.2.8 Watchdog

The watchdog circuit consists of two D type flip-flops IC13, a ripple counter IC14 with a crystal input X2, and logic circuitry of IC17 and IC20.

The circuit needs to be periodically serviced to prevent the ripple counter from overflowing and activating the alarms. In addition if the circuit is serviced too rapidly the alarms will be activated on assumption that the crystal frequencies of either X2 or X1 (connected to the microprocessor) are no longer correct.

The first flip-flop IC13a is triggered every 5 msecs by being clocked from the address decoder IC4. The alternating high-low signal on data bus bit 0 produces an output signal of 100Hz on the Q output of the D flip-flop.

This signal is then AC coupled and fed to the clear CLR input of the ripple counter IC14 to reset the current count. The output of the ripple counter on pins 13, 14 & 15 synchronise with the trigger signal to IC13-1 and the alternating high-low input to IC13-2 to ensure the IC14 is cleared within a certain time interval. If it is cleared too early or too late the IC13b is clocked to set a watchdog alarm.

While this signal is held low, i.e. no timeout, the Q output will remain low with /Q high. If the CLR input is not toggled within the correct timeout period, the ripple counter will overflow, the Q output will go high and /Q will go low enabling the audible alarm drive to the PSU and disabling the motor supply current.

In addition the timeout period and the watchdog circuit is tested as part of the power-on self-test routine.

#### 4.2.9 Linear Travel Monitor

The linear movement of the pump transmission is monitored using a slotted optical switch, LINEAR SPEED OPTO, coupled with a linear grid.

As the optical switch moves over the slots in the linear grid, the signal from its output changes state. This signal is applied to a schmitt trigger, IC11, via PL1. The output from the schmitt trigger can then be read by the microprocessor, IC1, via input port expansion, IC9, over the data bus.

#### 4.2.10 Near End of Infusion Detection

The near end of infusion point is detected using a slotted optical switch which is located on the motor mounting plate of the transmission assembly.

The signal from the optical switch changes state, thus detecting a near end of infusion, when a flag which is mounted on the transmission carriage passes through the slot in the optical switch. The change of state position is independent of the actual syringe near end of infusion point. The change of state initiates a count down to the near end of infusion alarm point in software. The countdown depends upon the syringe type and rate of infusion.

This signal is applied to a schmitt trigger, IC11, via PL1. The output from the schmitt trigger can then be read by the microprocessor, IC1, via input port expansion, IC9, over the data bus.

#### 4.2.11 Syringe Plunger Detection

The syringe plunger button position is detected using a slotted optical switch which is mounted inside the plunger holder. The signals are connected via the plunger detect flexible circuit which passes down inside the transmission outer tube.

The signal from the optical switch changes state when the syringe plunger is located correctly; this signal is fed via a schmitt trigger IC11 to input port IC9.

The LED in the optical switch is switched on and off by IC10 so that the operation of the optical device can be self tested during normal operation.

#### 4.2.12 Transmission Disengaged Detection

A micro switch is mounted on the transmission carriage to detect when the transmission drive has been disengaged.

The signal from the microswitch changes state when the declutch levers are activated. This signal is fed directly to an input port on the microprocessor.



#### 4.2.13 AC Power Detection

A signal is supplied from the power supply PCB to the control PCB, via PL2, indicating whether the pump is operating on AC power or its internal battery.

This signal, low for AC, high for battery is buffered and inverted by IC10. This inverted signal is then fed to the A to D converter.

#### 4.2.14 Audible Alarm Drive

The audible alarm is located on the Power Supply PCB and the Keypad Alarm is driven through darlington driver, IC10, which is controlled by output port expansion, IC7, over the data bus. The main alarm signal is fed directly from the microprocessor to PL2.

#### 4.2.15 Visual Indicator Drives

The start and stop LEDs are located on the display PCB but are driven through darlington driver, IC10, which is controlled by output port expansion, IC7, over the data bus.

#### 4.2.16 Keypad Read

The keypad is located on the display PCB and is arranged in an X-Y matrix. The keypad is polled by sequentially taking the keypad rows low and testing the state of the keypad columns to determine which button is activated.

The keypad rows are driven through the output expansion port, IC8, via the data bus and the keypad columns are read through the input expansion port, IC9, via the data bus.

#### 4.2.17 Battery Low Detection

The battery level signal is supplied from the power supply PCB via PL2. This signal is input to a comparator and is compared to a voltage determined by a resistor divider chain, R33 & R34.

The signal is adjusted by a potentiometer on the power supply PCB so that when the low battery point is reached, the output from the comparator changes from low to high.

The output from the comparator can then be read by the microprocessor, IC1, via input port expansion, IC9, over the data bus.

#### 4.2.18 LCD Display Drive

The LCD display is located on the display PCB but the control signals are driven both directly from the output port of the microprocessor, IC1, and by output port expansion, IC8, over the data bus.

The /BUSY signal from the display driver is read by an input port of the microprocessor.

#### 4.2.19 Syringe Size Measurement

A linear potentiometer mounted in the upper case detects the movement of the syringe clamp shaft.

The linear potentiometer is configured as a potential divider and produces a signal relative to the syringe diameter.

The signal from the potentiometer passes through a unity gain amplifier IC16. The output from the amplifier is fed to the input of the A-D converter IC19.

#### 4.2.20 RS232

The RS232 signals are fed to the RS232 connector. A pull up resistor is fitted to the RX input so that when no RS232 board is fitted the input to the microprocessor is held high.

#### 4.2.21 Nurse Call Alarm

The nurse call alarm signal is fed to the connector PL4. This signal is the same as the alarm signal from the microprocessor when the nurse call alarm is enabled. When the nurse call alarm is disabled this signal is always held high to ensure the nurse call relay on the RS232/Nurse call PCB is not powered. The nurse call disabled feature saves battery power allowing the unit to run for longer on battery than if the relay is powered.

### 4.3 Display PCB

The Display PCB is located in the upper case assy of the pump.

Refer to the circuit diagram, component location drawing (1000EL00111) and parts list in section 5.

All connections between the Display PCB and the Control PCB are via connectors PL3/SK1.

#### 4.3.1 LCD Display driver

LCD1 which is a custom static LCD, is driven by display driver, IC1. The display fitted depends upon the language of the pump; an English, French or German LCD can be fitted.

The LCD clock signal is generated by resistor R4 and the internal circuitry of IC1.

LCD1 bias voltages are determined by resistors R1 and R2. The display driver has been configured to accept combined commands and data from the control PCB by pulling the /C/D line high.

The commands for controlling LCD1 are sent serially from the control PCB to the display driver. Four lines are used in this serial data transmission:-

/CS -	Chip select for display driver
/SCK -	Serial clock, used to clock serial data into driver
SI -	Serial data input
/BUSY -	Low when display driver is busy

On the P2000, P3000 and P4000 syringe pumps a second display LCD2 is utilised to display volume infused and syringe size information.

In addition, the pumping pressure levels are indicated on this display on the P3000 and P4000 syringe pumps.

LCD2 in conjunction with display driver IC2, operates similarly to LCD1 and IC1 as described above. LCD2 is however, not a static display but contains two way multiplex elements and IC2 is thus configured to drive LCD2 in multiplexed form.

#### 4.3.2 Visual Indicators

The start led, D2, and the stop led, D1, are driven via a darlington driver on the control PCB. Resistors R5 and R6 limit the current through these leds.

The AC power led is driven directly from the power supply PCB via connections on the control PCB.

#### 4.3.3 Keypad

The keypad is made up of up to 14 individual mechanical switches and is arranged in an X-Y matrix. The keypad is polled from the control PCB by sequentially taking the keypad rows low and testing the state of the keypad columns to determine which button is activated.

Diodes in the keypad matrix decouple the rows and columns to prevent false switch decoding if more than one switch is held down at a time.

#### 4.3.4 Backlight

The LCDs are backlit by LED modules behind the transfective LCDs.

The backlight modules are enabled whenever the unit is connected to the AC supply. The signal to the AC power on LED also turns on transistor TR1 and enables the backlight module.

## 4.4 Flexible Circuit

Refer to Wiring Diagram Drg. No.1000EL00123.

Two flexible circuits are used to make all the interconnections to the transmission components located in the upper case assembly.

Flexi 1 is different for P1000/P2000/P3000 and for P4000. The two flexible circuit part numbers are 1000SP01040 for P1000/P2000 and P3000, and 1000SP01041 for P4000.

Flexi 2 (1000SP01007) is the same for all types.

All connections between the flexible circuit and the control PCB are made via PL1.

### 4.4.1 Motor Optical Encoders

Two slotted optical switches are mounted on the back of the motor/gearbox assembly to detect the speed of rotation.

The optical switches are activated by a flag mounted on the rear output shaft of the motor.

### 4.4.2 End of Infusion Optical Switch

A slotted optical switch is mounted on the transmission motor plate to detect a near end of infusion. It is activated by a flag which is mounted on the transmission carriage.

### 4.4.3 Linear Speed Optical Switch

A slotted optical switch is mounted on the transmission carriage and is used in conjunction with a slotted grid to monitor the linear travel of the unit.

### 4.4.4 Transmission Disengaged Microswitch

A micro switch, SW1, is mounted on the transmission carriage to detect when the transmission drive has been disengaged.

### 4.4.5 Plunger Detect Optical Switch

A slotted optical switch is mounted inside the syringe plunger holder body and is used in conjunction with a cruciform actuator, in turn connected to the plunger detection button. The optical switch detects when a syringe plunger is correctly located in the plunger holder.

## 4.5 RS232/Nursecall PCB

For pumps fitted with the optional RS232 communications link and Nurse Call facility, an additional PCB is provided which contains the necessary interface driver.

The RS232/Nursecall PCB is located in the lower case assembly of the pump under a baseplate on the base of the syringe pump.

Refer to the circuit diagram, component location drawing (1000EL00102 and parts list in section 5).

### 4.5.1 RS232 Interface

Additional details on using the RS232 communications link are provided in Section 2.

**Do not enable the RS232 communications option unless the optional the optional PCB or components are fitted. Details on enabling and disabling this option are provided in Section 10.1**

The RS232 interface is isolated to 4kV. The interface to the microprocessor uses the MAX250, IC1 to drive an isolate power transformer T1, and opto couplers OP1 and OP2. The isolated supply is created by IC2, MAX251, which interfaces to the RS232 voltage levels of about +/-10V. The interface is enabled by a positive or negative voltage applied to the CTS input pin of the RS232 interface. This signal is rectified by diode bridge D4 - D7 and powers opto coupler OP3. The non-isolated side of OP3 drives the SHUTDOWN input to IC1, allowing power to be conserved when the RS232 interface is not in use.

### 4.5.2 Nurse Call Interface

Where the nurse call option is fitted on the pump, a potential free, normally open, contact is provided via relay RL1. If Option OB is fitted, the contacts will normally be closed.

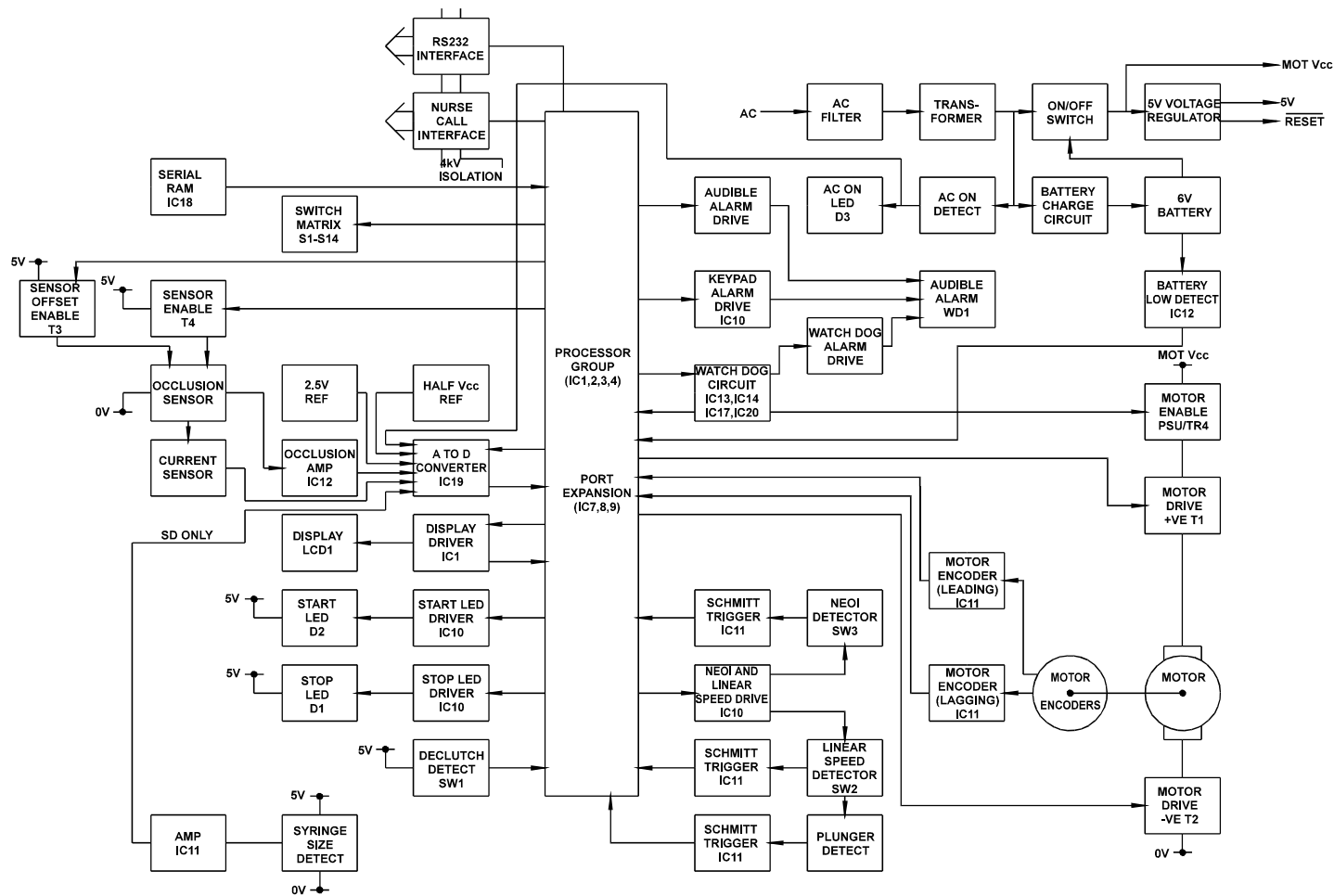
The relay contacts can switch 1 amp at up to 30V dc; the contacts are isolated from the coil to 4kV.

RL1 is energised by transistors TR1 and TR2 which are driven from the alarm signal from the control PCB. TR2 provides the necessary pull-in current for RL1 and is subsequently turned off after the time set by R3, R7 and C5 in order to reduce current consumption. TR1 provides the holding current for RL1.

## **5.0 ELECTRICAL SCHEMATICS, COMPONENT LOCATIONS, AND PARTS LISTS**

### **5.1 Electrical Block Diagram:**

1000EL00108                      Block Diagram (not issue controlled)  
See next sheet.

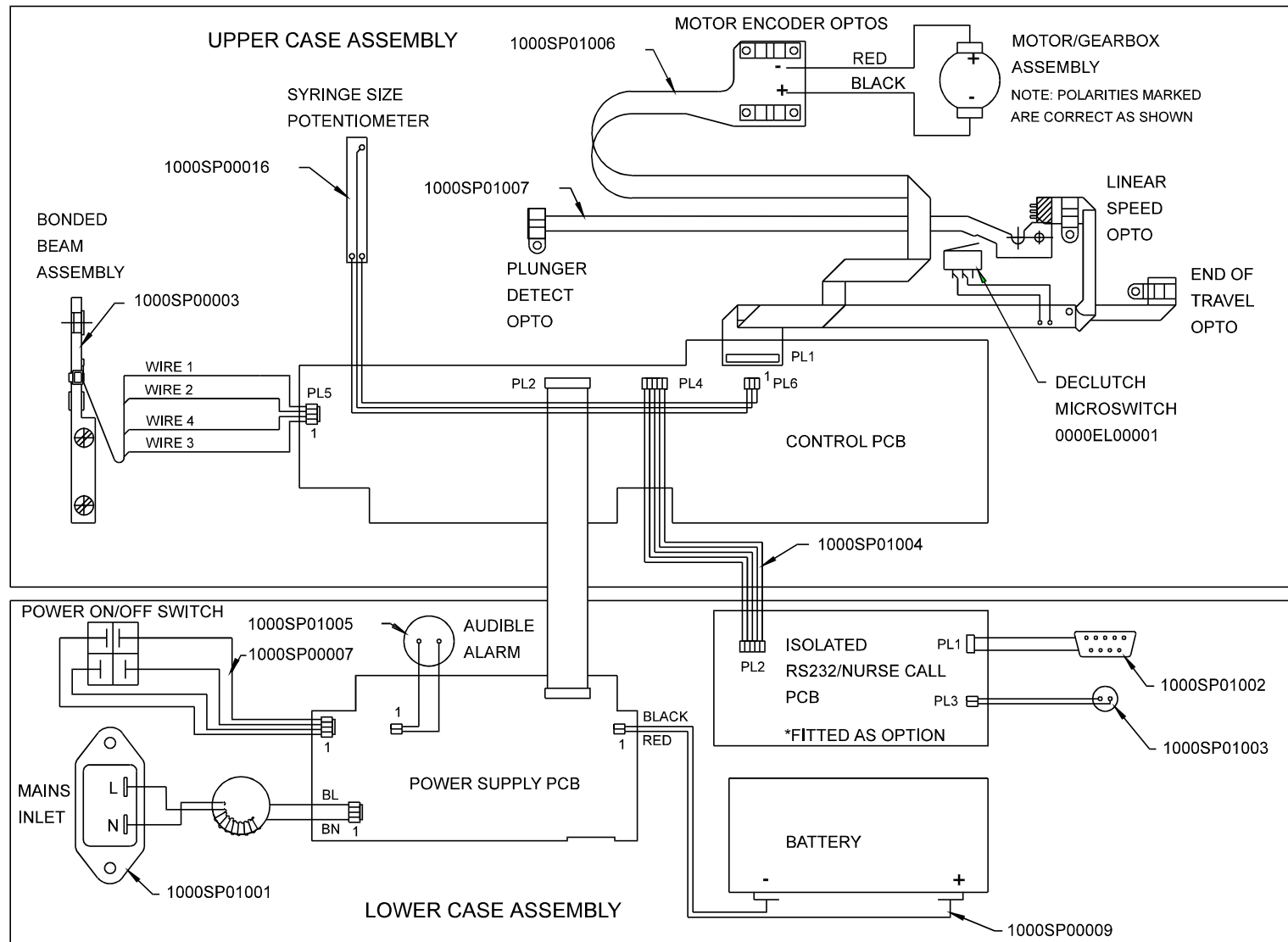


**Electrical Block Diagram 1000EL00108 (not issue controlled)**



## 5.2 Wiring Diagram:

1000EL00123      Wiring Diagram (not issue controlled)  
See next sheet

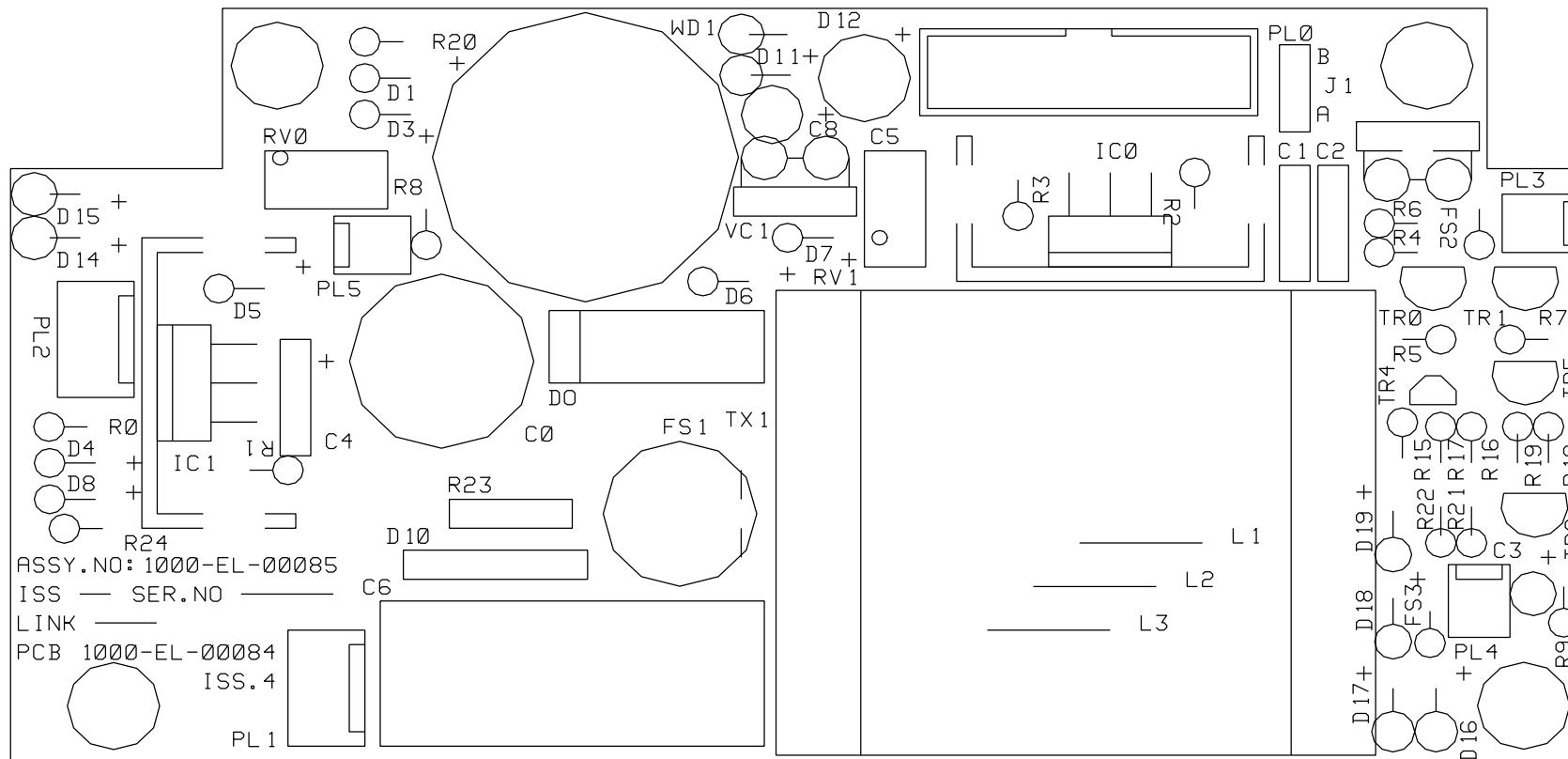


**Wiring Diagram 1000EL00123 (not issue controlled)**

### 5.3 Power Supply Board:

1000EL00079	Schematic Diagram (not issue controlled)
1000EL00082	Component Location (not issue controlled)
1000EL00085	Assy PCB Power Supply (not issue controlled)
See next sheets.	





**Power Supply PCB Component Location 1000EL00082 (not issue controlled)**

Item Number: 1000EL00085 ASSY PCB PSU 240V V4

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## ASSEMBLY NOTES

1. FIT LINK TO UNDERSIDE OF PCB: UNIT VOLTAGE 220/240V: LINK 2
2. ALL COMPONENT LEADS TO BE CROPPED TO WITHIN 1mm OF THE BOARD UNLESS OTHERWISE STATED.
3. FIT ITEM 10 2 OFF BEHIND THE HEAD OF ITEM 8 (NYLON SCREW 0000ME00127).
4. FIT C4 + TO PIN 1 OF IC1.

Part Number	Reference	Description	Qty
1000PR00011		SCHEDULE TEST PSU	1.0
0000EL00144		LINK JUMPER	1.0
0000EL00165		TRANSFORMER 7.5V 8VA A0807	1.0
0000EL00093		FUSE 50mA 20mm A/S	1.0
0000EL00100		CABLE BLACK 7/0.2	0.1
1000EL00084	1	OUTLINE PSU V4	1.0
0000ME00048	10	WASHER M3 PLAIN Z+C	2.0
0000ME00015	2	WASHER M3 WAVEY SST	2.0
0000ME00292	3	NUT M3 A2 STAINLESS STEEL	2.0
0000ME00089	4	SCREW M3x6 NYLON	2.0
0000EL00024	5	HEATSINK	2.0
0000ME00228	6	SCREW M3x20 PAN HD POSI 1 ZP+P	2.0
0000ME00221	7	SCREW M3x6 PAN HD POSI ZP+P	2.0
0000ME00126	8	SPACER M3x9.53 HEX NYLON	2.0
0000ME00044	9	WASHER M3 NYLON	2.0
0000EL00266	C0	CAPACITOR 3300uF 16V ELECTROLYTIC 25	1.0
0000EL00028	C1,2	CAPACITOR 100n 25V CERAMIC	2.0
0000EL00029	C3	CAPACITOR 1u0 35V TANT	1.0
0000EL00054	C4	CAPACITOR 10u 16V TANT	1.0
0000EL00030	C5	CAPACITOR 100u ELECTR.	1.0
0000EL00031	C6	CAPACITOR 470n 250V AC X2	1.0
0000EL00054	C8	CAPACITOR 10u 16V TANT	1.0
0000EL00014	D0	RECTIFIER BRIDGE 2KBP02	1.0
0000EL00015	D1	DIODE IN4001	1.0
0000EL00018	D10	SUPPRESSOR V250LA40A	1.0
0000EL00161	D11,12	DIODE 1N5339B ZENER 5V6	2.0
0000EL00162	D14,15	DIODE 1N5343B ZENER 7V5	2.0
0000EL00017	D3,4,7	DIODE 11DQ03	3.0
0000EL00016	D5,6,8	DIODE IN4148	3.0
0000EL00026	FS1	HOLDER FUSE 20MM VERTICAL	1.0
0000EL00284	FS2	LINK FUSE 2A PICO FUSE	1.0
0000EL00022	IC0	REGULATOR L387	1.0
0000EL00023	IC1	REGULATOR L200	1.0
0000EL00143	J1	CONNECTOR PLUG 3 WAY MOLEX	1.0
0000EL00011	PL0	CONNECTOR PLUG 16 WAY HEADER	1.0
0000EL00012	PL1,PL2	CONNECTOR PLUG 4 WAY MOLEX	2.0
0000EL00013	PL3,PL5	CONNECTOR PLUG 2 WAY MOLEX	2.0
0000EL00033	R0	RESISTOR 1R0 0.25W 1%	1.0
0000EL00034	R1	RESISTOR 5K6 0.25W 1%	1.0
0000EL00039	R17	RESISTOR 470R 0.25W 1%	1.0
0000EL00035	R2,15,16	RESISTOR 100K 0.25W 1%	3.0
0000EL00041	R20	RESISTOR 270K 0.25W 1%	1.0
0000EL00042	R22	RESISTOR 10K 0.25W 1%	1.0
0000EL00043	R23	RESISTOR 1M0 0.5W 1%	1.0
0000EL00155	R24	RESISTOR 100R 0.25W 1%	1.0
0000EL00036	R3,6,7,18,21	RESISTOR 2K2 0.25W 1%	5.0
0000EL00040	R4,5,19	RESISTOR 20K 0.25W 1%	3.0
0000EL00037	R8	RESISTOR 1K0 0.25W 1%	1.0
0000EL00038	R9	RESISTOR 200K 0.25W 1%	1.0
0000EL00044	RV0,RV1	POTENTIOMETER 10K 25 TURNS	2.0
0000ME00115	SP1,2,3,4	SPACER 4.8mm SELF RETAINING	4.0
0000EL00019	TR0,1,5,6	TRANSISTOR BC546	4.0
0000EL00021	TR4	TRANSISTOR FZT 751 SOT22 3	1.0

## 5.4

## Control Board

1000EL00086

Schematic Diagram (not issue controlled)

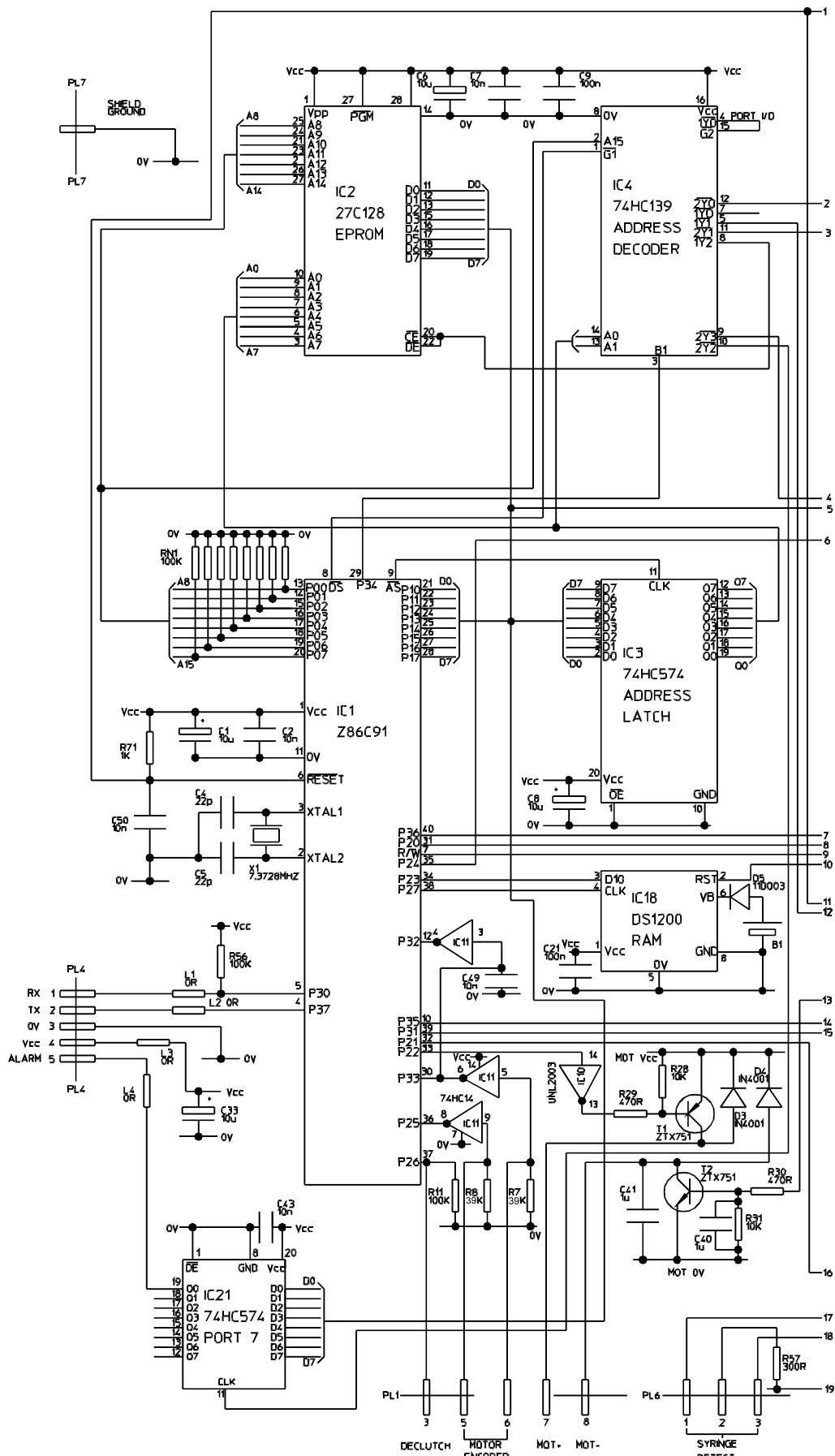
1000EL00089

Component Location (not issue controlled)

1000EL00091

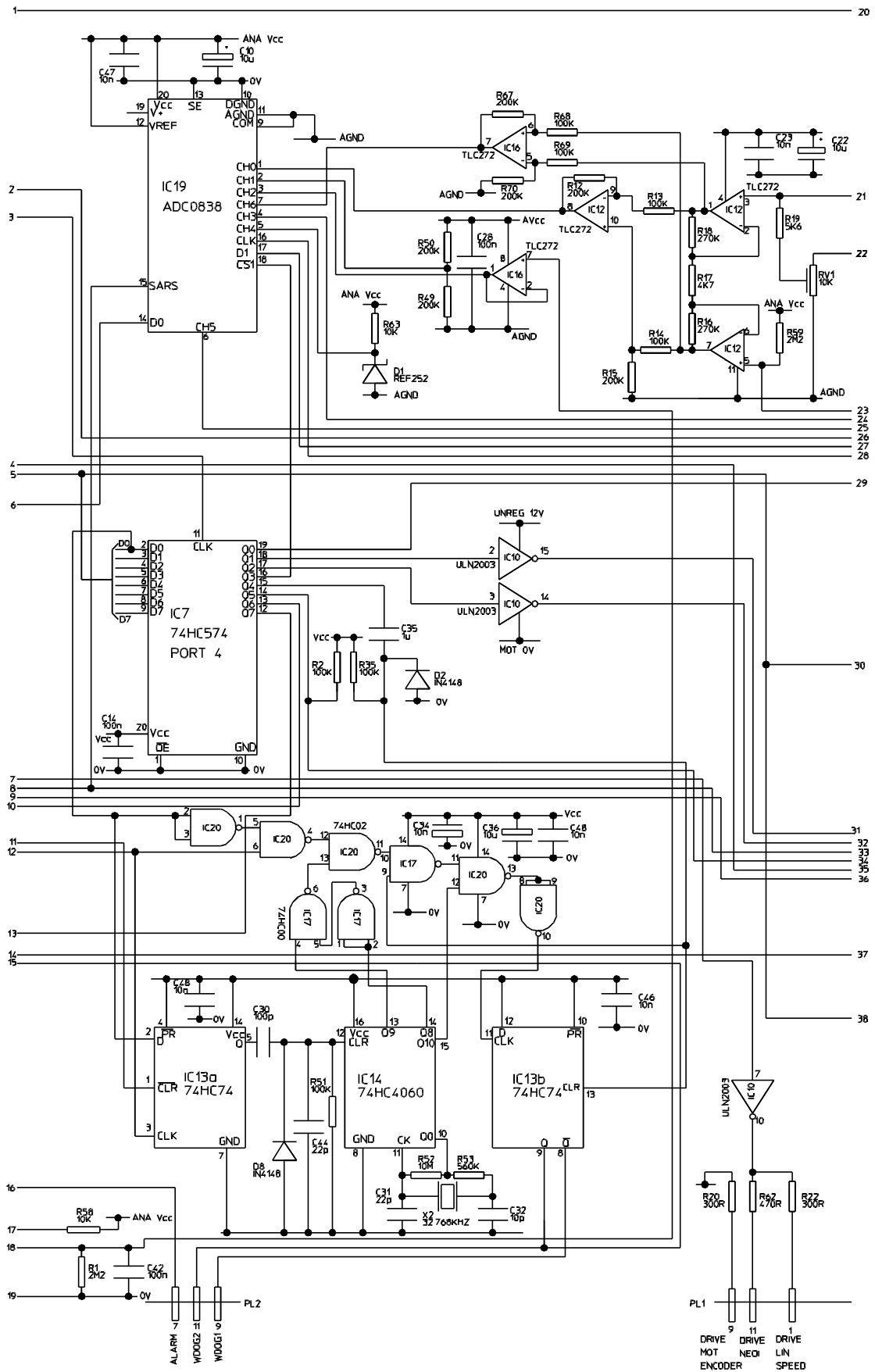
Assy PCB Control (not issue controlled)

See next sheets.

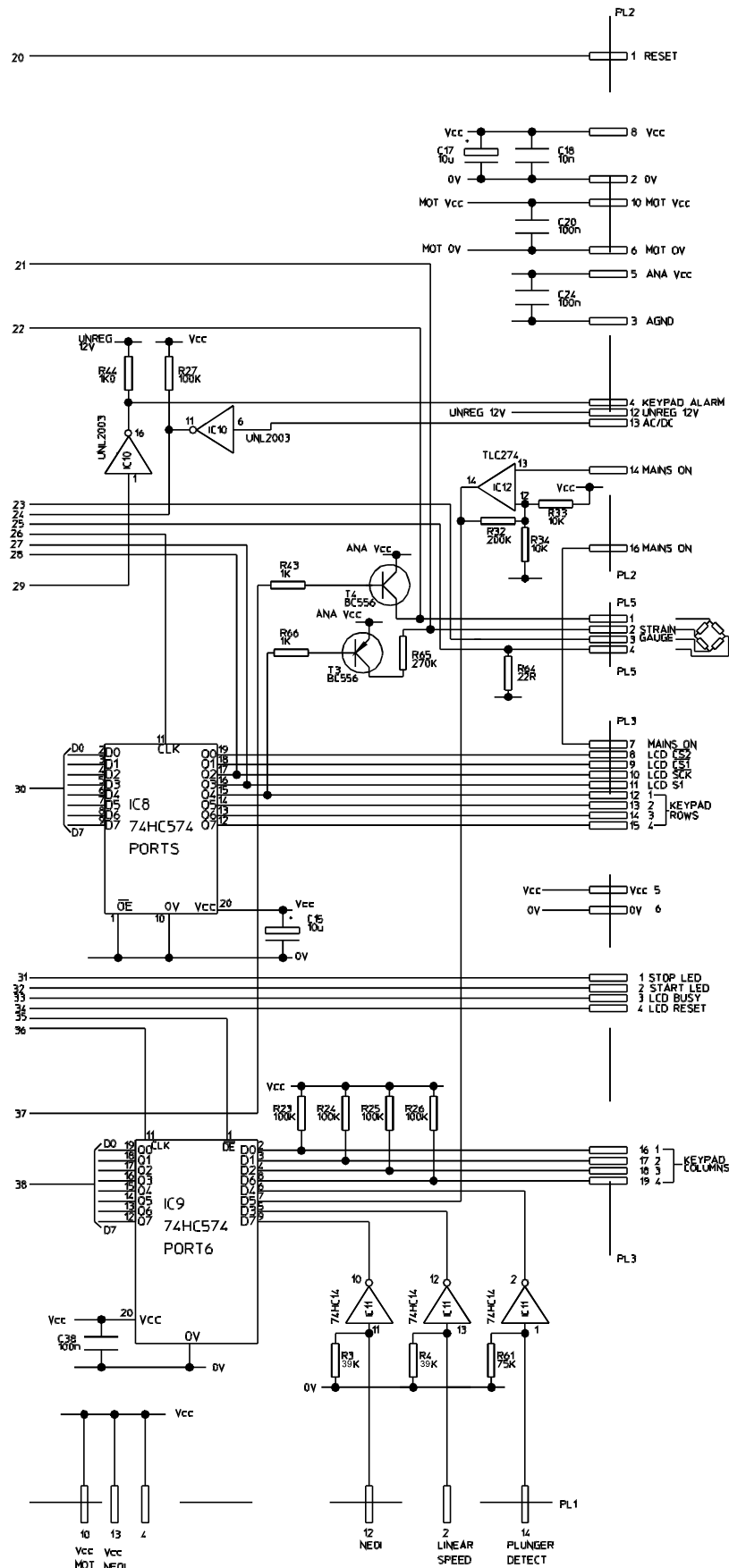


**Schematic Diagram Control Board 1000EL00086 Sheet 1 (not issue controlled)**





Schematic Diagram Control Board 1000EL00086 Sheet 2 (not issue controlled)



**Schematic Diagram Control Board 1000EL00086 Sheet 3 (not issue controlled)**



Item Number: 1000EL00091 ASSY PCB CONTROL V4

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## ASSEMBLY NOTES

1. C15 TO BE BENT OVER FLAT ON BOARD AWAY FROM EDGE OF BOARD.
2. TR1+TR2 TO BE FITTED AS CLOSE AS POSSIBLE TO BOARD.
3. FIT PAD (0000ME00119) TO PCB BENEATH B1, ENSURING B1 IS FITTED WITHOUT A GAP BETWEEN IT AND THE PAD.
4. CRIMP A LENGTH OF INSULATED WIRE (ITM3) TO THE INSULATED CRIMP (PL7) AND SOLDER THE OTHER END OF THE WIRE INTO THE PCB PL7.
5. NOTE VIA HOLE OBSCURES THE MARKING OF R26 - THE HOLE IS IN THE CENTRE OF THE '6'.
6. TRIM AND FIT ITEM 4 (0000ME00053) TO THE LOCATIONS X1 AND X2 ON THE PCB PRIOR TO FITTING ITEMS X1 AND X2 (CRYSTALS)

Part Number	Reference	Description	Qty
1000PR00010		SCHEDULE TEST CNTRL PCB	1.0
0000EL00083	2	CONNECTOR SOCKET IC 28 WAY	1.0
0000EL00136	B1	BATTERY LITHUM 3V	1.0
0000EL00054	C1,6,8,10,15	CAPACITOR 10u 16V TANT	5.0
0000EL00054	C17,22,33,36	CAPACITOR 10u 16V TANT	4.0
0000EL00055	C2,7,18,20	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00055	C23,34,43,45	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00028	C28,38,42	CAPACITOR 100n 25V CERAMIC	3.0
0000EL00138	C30	CAPACITOR 100pf CERAMIC 100V	1.0
0000EL00282	C32	CAPACITOR 10pF 100V CERAMIC	1.0
0000EL00140	C35,40,41	CAPACITOR 1uF 50V CERAMIC	3.0
0000EL00108	C4,5,31	CAPACITOR 22p 63V CERAMIC	3.0
0000EL00055	C46,47,48,49	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00055	C50	CAPACITOR 10n 25V CERAMIC	1.0
0000EL00028	C9,14,21,24	CAPACITOR 100n 25V CERAMIC	4.0
0000EL00174	D1	DIODE REF25Z 2.5 REFERENCE	1.0
0000EL00016	D2,8	DIODE IN4148	2.0
0000EL00015	D3,4	DIODE IN4001	2.0
0000EL00017	D5	DIODE 11DQ03	1.0
0000EL00056	IC1	IC TYPE Z86C9116PSC	1.0
0000EL00063	IC10	IC TYPE ULN2003A	1.0
0000EL00060	IC11	IC TYPE 74HC14	1.0
0000EL00064	IC12	IC TYPE TLC27L4ACN	1.0
0000EL00065	IC13	IC TYPE MM74HC74AN	1.0
0000EL00132	IC14	IC TYPE MC14060BCP	1.0
0000EL00170	IC16	IC TYPE TLC272CP	1.0
0000EL00172	IC17	IC TYPE 74HC00	1.0
0000EL00135	IC18	IC TYPE DS1200	1.0
0000EL00169	IC19	IC TYPE ADC0838	1.0
0000EL00167	IC2	IC TYPE M27C256B15F1 EPROM	1.0
0000EL00171	IC20	IC TYPE 74HC02	1.0
0000EL00058	IC3,7,8,9,21	IC TYPE 74HC574	5.0
0000EL00168	IC4	IC TYPE 74HC139	1.0
0000ME00115	ITM1	SPACER 4.8mm SELF RETAINING	6.0
0000ME00119	ITM2	PAD SELF ADHESIVE NEOPRENE 22x15x2mm	1.0
0000EL00182	ITM3	CABLE BLACK 16/0.2	0.1
0000ME00053	ITM4	PAD SELF ADHESIVE DOUBLE SIDED	1.0
0000EL00102	L1,2,3,4	RESISTOR ZERO OHM LINK	4.0
1000EL00121	PCB	OUTLINE CONTROL TUV	1.0
0000EL00104	PL1	CONNECTOR SOCKET 14 WAY	1.0
1000EL00135	PL2	ASSY CABLE 16 WAY RIBBON	1.0
0000EL00071	PL3	CONNECTOR PLUG 20 WAY	1.0
0000EL00156	PL4	CONNECTOR PLUG 5 WAY MOLEX	1.0
0000EL00012	PL5	CONNECTOR PLUG 4 WAY MOLEX	1.0
0000EL00131	PL6	CONNECTOR PLUG 3 WAY MOLEX	1.0
0000EL00189	PL7	TERMINAL CRIMP INSULATED RING	1.0
0000EL00082	R1,59	RESISTOR 2M2 0.33W 5%	2.0
0000EL00038	R12,15,32,49	RESISTOR 200K 0.25W 1%	4.0
0000EL00041	R16,18,65	RESISTOR 270K 0.25W 1%	3.0
0000EL00105	R17	RESISTOR 4K7 0.25W 1% 50PPM	1.0
0000EL00034	R19	RESISTOR 5K6 0.25W 1%	1.0
0000EL00035	R2,11,13,14	RESISTOR 100K 0.25W 1%	4.0
0000EL00052	R20,22,57	RESISTOR 300R 0.25W 1%	3.0
0000EL00035	R23,24,25,26	RESISTOR 100K 0.25W 1%	4.0
0000EL00035	R27,35,51,56	RESISTOR 100K 0.25W 1%	4.0
0000EL00042	R28,31,33,34	RESISTOR 10K 0.25W 1%	4.0
0000EL00039	R29,30,62	RESISTOR 470R 0.25W 1%	3.0

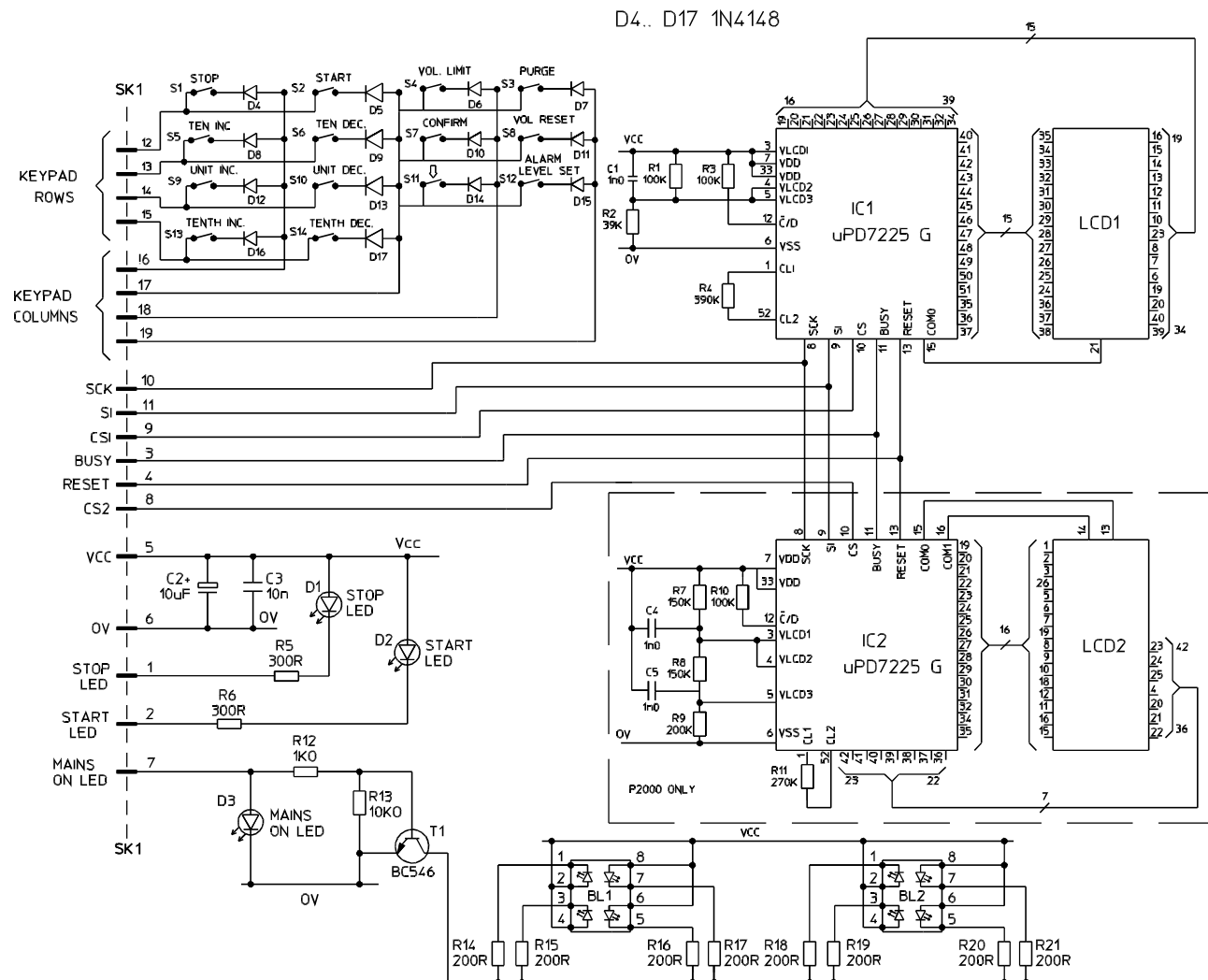
Item Number: 1000EL00091 ASSY PCB CONTROL V4

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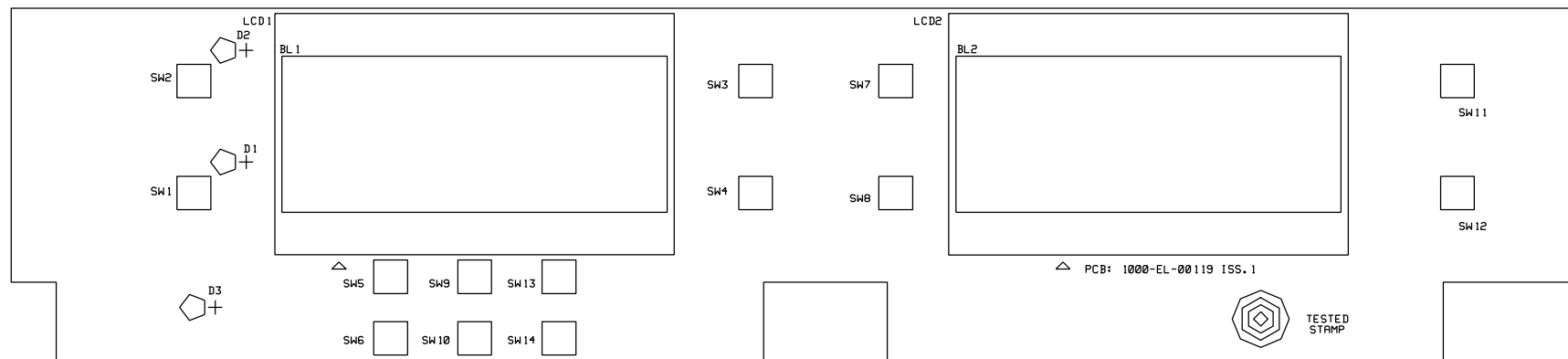
Part Number	Reference	Description	Qty
0000EL00079	R3,4,61	RESISTOR 75K 0.25W 1%	3.0
0000EL00037	R43,44,66	RESISTOR 1K0 0.25W 1%	3.0
0000EL00038	R50,67,70	RESISTOR 200K 0.25W 1%	3.0
0000EL00130	R52	RESISTOR 10M 0.6W 1%	1.0
0000EL00283	R53	RESISTOR 560K 0.25W 1%	1.0
0000EL00042	R58,63	RESISTOR 10K 0.25W 1%	2.0
0000EL00175	R64	RESISTOR 22R 0.25W 1%	1.0
0000EL00035	R68,69	RESISTOR 100K 0.25W 1%	2.0
0000EL00051	R7,8	RESISTOR 39K 0.25W 1%	2.0
0000EL00078	RN1	RESISTOR NETWORK 100K 8 COMMON	1.0
0000EL00044	RV1	POTENTIOMETER 10K 25 TURNS	1.0
0000EL00021	TR1	TRANSISTOR FZT 751 SOT22 3	1.0
0000EL00067	TR2	TRANSISTOR ZTX651 SOT223	1.0
0000EL00020	TR3,4	TRANSISTOR BC556	2.0
0000EL00069	X1	CRYSTAL 7.3728MHZ HC18/U	1.0
0000EL00128	X2	CRYSTAL 32.768KHZ WATCH	1.0

## 5.5 Display Board

1000EL00120	Schematic Diagram (not issue controlled)
1000EL00111	Component Location Side 1 (not issue controlled)
1000EL00112	Component Location Side 2 (not issue controlled)
1000EL00115	Assy PCB Display P1000 English (not issue controlled)
1000EL00096	Assy PCB Display P1000 French (not issue controlled)
1000EL00097	Assy PCB Display P1000 German (not issue controlled)
2000EL00010	Assy PCB Display P2000 English (not issue controlled)
2000EL00008	Assy PCB Display P2000 French (not issue controlled)
2000EL00009	Assy PCB Display P2000 German (not issue controlled)
See next sheets.	

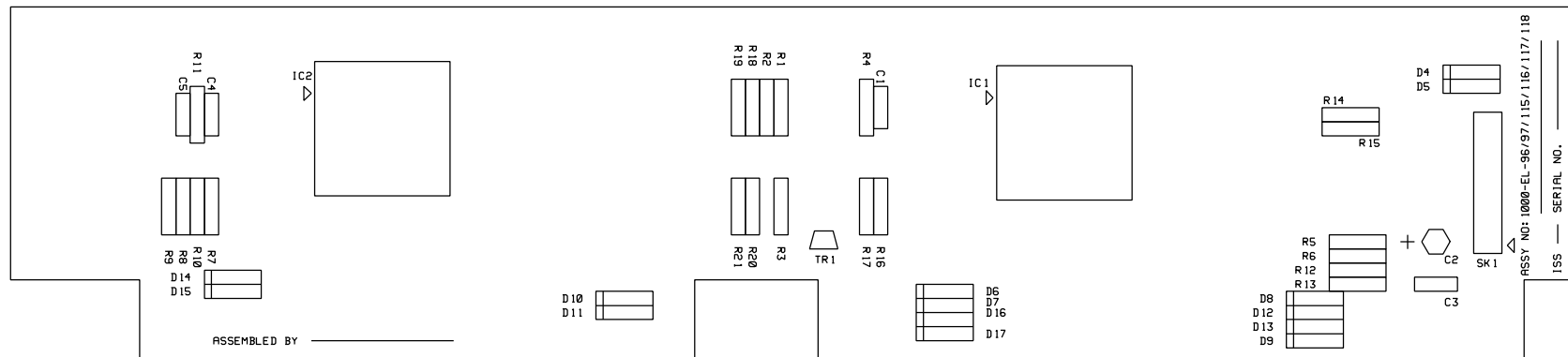


**Schematic Diagram Display Board 1000EL00120 (not issue controlled)**



**Display PCB Component Location Side 1 1000EL00111 Iss 1 (not issue controlled)**





**Display PCB Component Location Side 2 1000EL00112 Iss 1 (not issue controlled)**

Item Number: 1000EL00115 ASSY PCB DISPLAY P1000

Iss: 3

## ASSEMBLY NOTES

1. MARK THE PCB WITH THE DRAWING NUMBER AND ISSUE.
2. ALL ITEMS FITTED TO SIDE 1 TO BE BENT OVER FLAT.
3. ALL COMPONENT LEADS TO BE CROPPED TO WITHIN 1mm OF THE BOARD UNLESS OTHERWISE STATED.

Part Number	Reference	Description	Qty
1000PR0001	2	SCHEDULE TEST DISPLAY P1000/P2000 PCB	1.0
1000EL00119	1	OUTLINE PCB DISPLAY TUV	1.0
1000EL00052	BL1	LED BACKLIGHT	1.0
0000EL00053	C1	CAPACITOR 1n0 25V CERAMIC	1.0
0000EL00054	C2	CAPACITOR 10u 16V TANT	1.0
0000EL00055	C3	CAPACITOR 10n 25V CERAMIC	1.0
0000EL00049	D1,D3	LED YELLOW T1/3MM	2.0
0000EL00016	D10,11,12,13	DIODE IN4148	4.0
0000EL00016	D16,17	DIODE IN4148	2.0
0000EL00050	D2	LED GREEN T1/3MM	1.0
0000EL00016	D4,5,6,7,8,9	DIODE IN4148	6.0
0000EL00047	IC1	IC TYPE UPD7225G00	1.0
1000EL00051	LCD1	LCD SPEC TRANS	1.0
0000EL00035	R1,3	RESISTOR 100K 0.25W 1%	2.0
0000EL00037	R12	RESISTOR 1K0 0.25W 1%	1.0
0000EL00042	R13	RESISTOR 10K 0.25W 1%	1.0
0000EL00160	R14,15,16,17	RESISTOR 220R 0.25W 1%	4.0
0000EL00051	R2	RESISTOR 39K 0.25W 1%	1.0
0000EL00096	R4	RESISTOR 390K 0.25W 1%	1.0
0000EL00052	R5,6	RESISTOR 300R 0.25W 1%	2.0
0000EL00048	S1,2,3,4,5,6	SWITCH P/BUTTON MINIATURE	6.0
0000EL00048	S14	SWITCH P/BUTTON MINIATURE	1.0
0000EL00048	S7,8,9,10,13	SWITCH P/BUTTON MINIATURE	5.0
0000EL00046	SK1	CONNECTOR SOCKET 20 WAY	1.0
0000EL00019	T1	TRANSISTOR BC546	1.0

Item Number: 1000EL00096 ASSY PCB DISPLAY P100 FR V4

Iss: 3

## ASSEMBLY NOTES

1. MARK THE PCB WITH THE DRAWING NUMBER AND ISSUE.
2. ALL ITEMS FITTED TO SIDE 1 TO BE BENT OVER FLAT.
3. ALL COMPONENT LEADS TO BE CROPPED TO WITHIN 1mm OF THE BOARD UNLESS OTHERWISE STATED.

Part Number	Reference	Description	Qty
1000PR00012		SCHEDULE TEST DISPLAY P1000/P2000 PCB	1.0
1000EL00119	1	OUTLINE PCB DISPLAY TUV	1.0
1000EL00052	BL1	LED BACKLIGHT	1.0
0000EL00053	C1	CAPACITOR 1n0 25V CERAMIC	1.0
0000EL00054	C2	CAPACITOR 10u 16V TANT	1.0
0000EL00055	C3	CAPACITOR 10n 25V CERAMIC	1.0
0000EL00049	D1,3	LED YELLOW T1/3MM	2.0
0000EL00016	D10,11,12,13	DIODE IN4148	4.0
0000EL00016	D16,17	DIODE IN4148	2.0
0000EL00050	D2	LED GREEN T1/3MM	1.0
0000EL00016	D4,5,6,7,8,9	DIODE IN4148	6.0
0000EL00047	IC1	IC TYPE UPD7225G00	1.0
1000EL00092	LCD1	LCD P1000 FRENCH TRANS-FLECTIVE	1.0
0000EL00035	R1,3	RESISTOR 100K 0.25W 1%	2.0
0000EL00037	R12	RESISTOR 1K0 0.25W 1%	1.0
0000EL00042	R13	RESISTOR 10K 0.25W 1%	1.0
0000EL00160	R14,15,16,17	RESISTOR 220R 0.25W 1%	4.0
0000EL00051	R2	RESISTOR 39K 0.25W 1%	1.0
0000EL00096	R4	RESISTOR 390K 0.25W 1%	1.0
0000EL00052	R5,6	RESISTOR 300R 0.25W 1%	2.0
0000EL00048	S1,2,3,4,5,6	SWITCH P/BUTTON MINIATURE	6.0
0000EL00048	S14	SWITCH P/BUTTON MINIATURE	1.0
0000EL00048	S7,8,9,10,13	SWITCH P/BUTTON MINIATURE	5.0
0000EL00046	SK1	CONNECTOR SOCKET 20 WAY	1.0
0000EL00019	T1	TRANSISTOR BC546	1.0

Item Number: 1000EL00097 ASSY PCB DISPLAY P1000 DD V4

Iss: 3

## ASSEMBLY NOTES

1. MARK PCB WITH THE DRAWING NUMBER AND ISSUE.
2. ALL ITEMS FITTED TO SIDE 1 TO BE BENT OVER FLAT.
3. ALL COMPONENT LEADS TO BE CROPPED TO WITHIN 1mm OF THE BOARD UNLESS OTHERWISE STATED.

Part Number	Reference	Description	Qty
1000PR00012		SCHEDULE TEST DISPLAY P1000/P2000 PCB	1.0
1000EL00119	1	OUTLINE PCB DISPLAY TUV	1.0
1000EL00052	BL1	LED BACKLIGHT	1.0
0000EL00053	C1	CAPACITOR 1n0 25V CERAMIC	1.0
0000EL00054	C2	CAPACITOR 10u 16V TANT	1.0
0000EL00055	C3	CAPACITOR 10n 25V CERAMIC	1.0
0000EL00049	D1,3	LED YELLOW T1/3MM	2.0
0000EL00016	D10,11,12,13	DIODE IN4148	4.0
0000EL00016	D16,17	DIODE IN4148	2.0
0000EL00050	D2	LED GREEN T1/3MM	1.0
0000EL00016	D4,5,6,7,8,9	DIODE IN4148	6.0
0000EL00047	IC1	IC TYPE UPD7225G00	1.0
1000EL00093	LCD1	LCD P1000 GERMAN TRANS-FLECTIVE	1.0
0000EL00035	R1,3	RESISTOR 100K 0.25W 1%	2.0
0000EL00037	R12	RESISTOR 1K0 0.25W 1%	1.0
0000EL00042	R13	RESISTOR 10K 0.25W 1%	1.0
0000EL00160	R14,15,16,17	RESISTOR 220R 0.25W 1%	4.0
0000EL00051	R2	RESISTOR 39K 0.25W 1%	1.0
0000EL00096	R4	RESISTOR 390K 0.25W 1%	1.0
0000EL00052	R5,6	RESISTOR 300R 0.25W 1%	2.0
0000EL00048	S1,2,3,4,5,6	SWITCH P/BUTTON MINIATURE	6.0
0000EL00048	S14	SWITCH P/BUTTON MINIATURE	1.0
0000EL00048	S7,8,9,10,13	SWITCH P/BUTTON MINIATURE	5.0
0000EL00046	SK1	CONNECTOR SOCKET 20 WAY	1.0
0000EL00019	T1	TRANSISTOR BC546	1.0

Item Number: 2000EL00010 ASSY PCB DISPLAY P2000/3000 V4

Iss: 4

## ASSEMBLY NOTES

1. MARK THE PCB WITH THE DRAWING NUMBER AND ISSUE.

2. ALL ITEMS FITTDE TO SIDE 1 TO BE BENT FLAT.

3. ITEMS S11 AND S12 TO USE ONLY OMRON B3F - 1000 SWITCHES, NO EQUIVALENT IS ACCEPTABLE UNLESS PRIOR AUTHORISATION IS GIVEN

4. ALL COMPONENT LEADS TO BE CROPPED TO WITHIN 1mm OF THE BOARD UNLESS OTHERWISE STATED.

Part Number	Reference	Description	Qty
1000PR00012		SCHEDULE TEST DISPLAY P1000/P2000 PCB	1.0
1000EL00119	1	OUTLINE PCB DISPLAY TUV	1.0
1000EL00052	BL1	LED BACKLIGHT	1.0
1000EL00052	BL2	LED BACKLIGHT	1.0
0000EL00053	C1	CAPACITOR 1n0 25V CERAMIC	1.0
0000EL00054	C2	CAPACITOR 10u 16V TANT	1.0
0000EL00055	C3	CAPACITOR 10n 25V CERAMIC	1.0
0000EL00053	C4,5	CAPACITOR 1n0 25V CERAMIC	2.0
0000EL00049	D1,3	LED YELLOW T1/3MM	2.0
0000EL00016	D10,11,12,13	DIODE IN4148	4.0
0000EL00016	D14,15	DIODE IN4148	2.0
0000EL00016	D16,17	DIODE IN4148	2.0
0000EL00050	D2	LED GREEN T1/3MM	1.0
0000EL00016	D4,5,6,7,8,9	DIODE IN4148	6.0
0000EL00047	IC1	IC TYPE UPD7225G00	1.0
0000EL00047	IC2	IC TYPE UPD7225G00	1.0
1000EL00051	LCD1	LCD SPEC TRANS	1.0
2000EL00006	LCD2	LCD SPEC TRANS P2000/P3000/4000	1.0
0000EL00035	R1,3	RESISTOR 100K 0.25W 1%	2.0
0000EL00035	R10	RESISTOR 100K 0.25W 1%	1.0
0000EL00041	R11	RESISTOR 270K 0.25W 1%	1.0
0000EL00037	R12	RESISTOR 1K0 0.25W 1%	1.0
0000EL00042	R13	RESISTOR 10K 0.25W 1%	1.0
0000EL00160	R14,15,16,17	RESISTOR 220R 0.25W 1%	4.0
0000EL00160	R18,19,20,21	RESISTOR 220R 0.25W 1%	4.0
0000EL00051	R2	RESISTOR 39K 0.25W 1%	1.0
0000EL00096	R4	RESISTOR 390K 0.25W 1%	1.0
0000EL00052	R5,6	RESISTOR 300R 0.25W 1%	2.0
0000EL00452	R7,8	RESISTOR 150K 0.25W 1%	2.0
0000EL00038	R9	RESISTOR 200K 0.25W 1%	1.0
0000EL00048	S1,2,3,4,5,6	SWITCH P/BUTTON MINIATURE	6.0
0000EL00048	S11,12	SWITCH P/BUTTON MINIATURE	2.0
0000EL00048	S14	SWITCH P/BUTTON MINIATURE	1.0
0000EL00048	S7,8,9,10,13	SWITCH P/BUTTON MINIATURE	5.0
0000EL00046	SK1	CONNECTOR SOCKET 20 WAY	1.0
0000EL00019	T1	TRANSISTOR BC546	1.0

Item Number: 2000EL00008 ASSY PCB DISPLAY P2000/3000 V4

Iss: 4

## ASSEMBLY NOTES

1. MARK PCB WITH THE DRAWING NUMBER AND ISSUE.
2. ALL ITEMS FITTED TO SIDE 1 TO BE BENT OVER FLAT.
3. ITEMS S11 AND S12 TO BE USE ONLY OMRON TYPE B3F - 1000 SWITCHES, NO EQUIVALENT IS ACCEPTABLE UNLESS PRIOR AUTHORISATION IS GIVEN.
4. ALL COMPONENT LEADS TO BE CROPPED TO WITHIN 1mm OF THE BOARD UNLESS OTHERWISE STATED.

Part Number	Reference	Description	Qty
1000PR00012		SCHEDULE TEST DISPLAY P1000/P2000 PCB	1.0
1000EL00119	1	OUTLINE PCB DISPLAY TUV	1.0
1000EL00052	BL1,BL2	LED BACKLIGHT	2.0
0000EL00053	C1,4,5	CAPACITOR 1n0 25V CERAMIC	3.0
0000EL00054	C2	CAPACITOR 10u 16V TANT	1.0
0000EL00055	C3	CAPACITOR 10n 25V CERAMIC	1.0
0000EL00049	D1,3	LED YELLOW T1/3MM	2.0
0000EL00016	D10,11,12,13	DIODE IN4148	4.0
0000EL00016	D14,15,16,17	DIODE IN4148	4.0
0000EL00050	D2	LED GREEN T1/3MM	1.0
0000EL00016	D4,5,6,7,8,9	DIODE IN4148	6.0
0000EL00047	IC1,2	IC TYPE UPD7225G00	2.0
1000EL00092	LCD1	LCD P1000 FRENCH TRANS-FLECTIVE	1.0
2000EL00006	LCD2	LCD SPEC TRANS P2000/P3000/4000	1.0
0000EL00035	R1,3	RESISTOR 100K 0.25W 1%	2.0
0000EL00035	R10	RESISTOR 100K 0.25W 1%	1.0
0000EL00041	R11	RESISTOR 270K 0.25W 1%	1.0
0000EL00037	R12	RESISTOR 1K0 0.25W 1%	1.0
0000EL00042	R13	RESISTOR 10K 0.25W 1%	1.0
0000EL00160	R14,15,16,17	RESISTOR 220R 0.25W 1%	4.0
0000EL00160	R18,19,20,21	RESISTOR 220R 0.25W 1%	4.0
0000EL00051	R2	RESISTOR 39K 0.25W 1%	1.0
0000EL00096	R4	RESISTOR 390K 0.25W 1%	1.0
0000EL00052	R5,6	RESISTOR 300R 0.25W 1%	2.0
0000EL00452	R7,8	RESISTOR 150K 0.25W 1%	2.0
0000EL00038	R9	RESISTOR 200K 0.25W 1%	1.0
0000EL00048	S1,2,3,4,5,6	SWITCH P/BUTTON MINIATURE	6.0
0000EL00048	S12,13,14	SWITCH P/BUTTON MINIATURE	3.0
0000EL00048	S7,8,9,10,11	SWITCH P/BUTTON MINIATURE	5.0
0000EL00046	SK1	CONNECTOR SOCKET 20 WAY	1.0
0000EL00019	T1	TRANSISTOR BC546	1.0

Item Number: 2000EL00009 ASSY PCB DISPLAY P2000/30 V4

Iss: 4

## ASSEMBLY NOTES

1. MARK THE PCB WITH THE DRAWING NUMBER AND ISSUE.

2. ALL ITEMS FITTED TO SIDE 1 TO BE BENT FLAT.

3. ITEMS S11 AND S12 TO USE ONLY OMRON TYPE B3F - 1000 SWITCHES, NO EQUIVALENT IS ACCEPTABLE UNLESS PRIOR AUTHORISATION IS GIVEN.

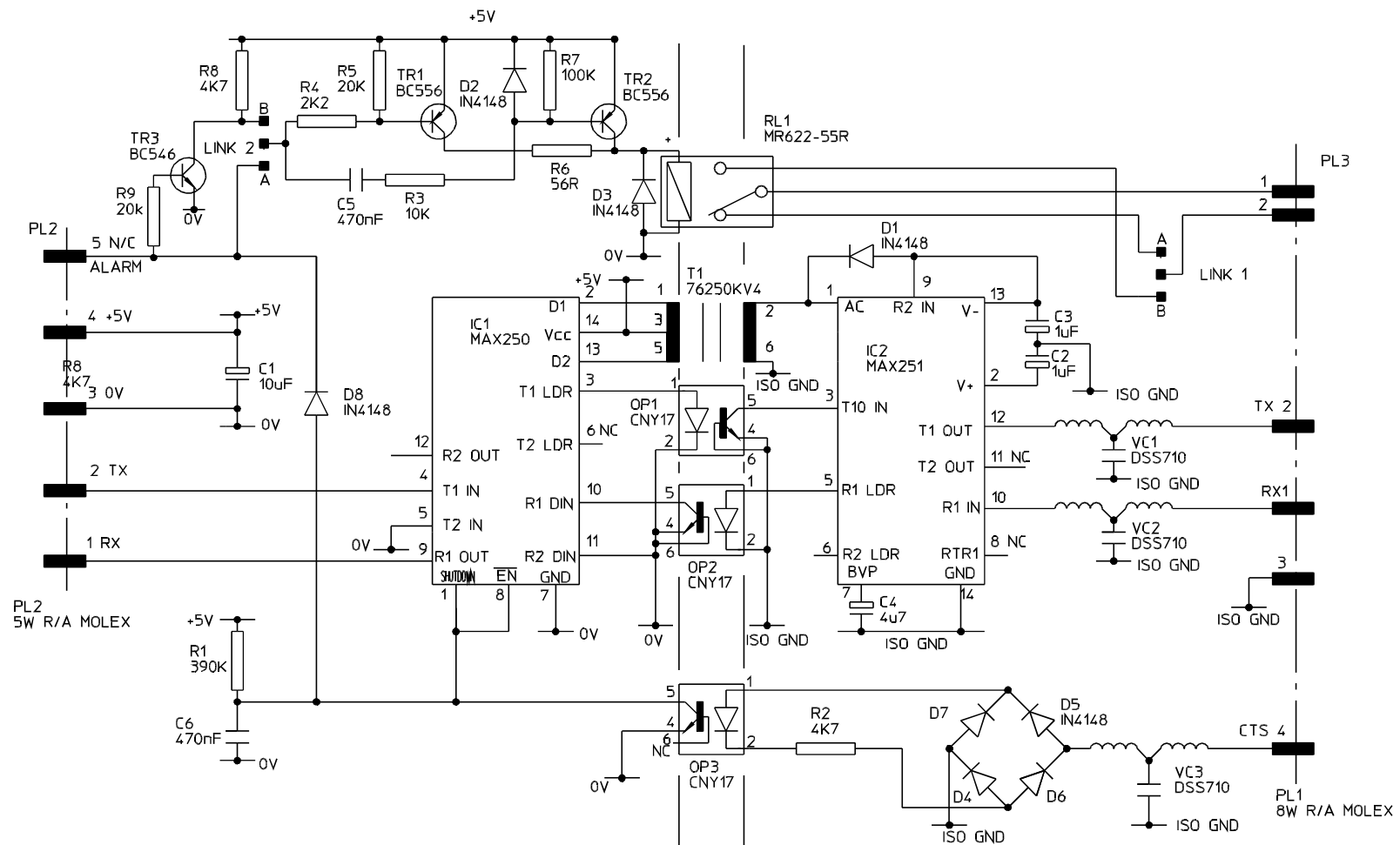
4. ALL COMPONENT LEADS TO BE CROPPED TO WITHIN 1mm OF THE BOARD UNLESS OTHERWISE STATED.

Part Number	Reference	Description	Qty
1000PR00012		SCHEDULE TEST DISPLAY P1000/P2000 PCB	1.0
1000EL00119	1	OUTLINE PCB DISPLAY TUV	1.0
1000EL00052	BL1,2	LED BACKLIGHT	2.0
0000EL00053	C1,4,5	CAPACITOR 1n0 25V CERAMIC	3.0
0000EL00054	C2	CAPACITOR 10u 16V TANT	1.0
0000EL00055	C3	CAPACITOR 10n 25V CERAMIC	1.0
0000EL00049	D1,3	LED YELLOW T1/3MM	2.0
0000EL00016	D10,11,12,13	DIODE IN4148	4.0
0000EL00016	D14,15,16,17	DIODE IN4148	4.0
0000EL00050	D2	LED GREEN T1/3MM	1.0
0000EL00016	D4,5,6,7,8,9	DIODE IN4148	6.0
0000EL00047	IC1,2	IC TYPE UPD7225G00	2.0
1000EL00093	LCD1	LCD P1000 GERMAN TRANS-FLECTIVE	1.0
2000EL00006	LCD2	LCD SPEC TRANS P2000/P3000/4000	1.0
0000EL00035	R1,3	RESISTOR 100K 0.25W 1%	2.0
0000EL00035	R10	RESISTOR 100K 0.25W 1%	1.0
0000EL00041	R11	RESISTOR 270K 0.25W 1%	1.0
0000EL00037	R12	RESISTOR 1K0 0.25W 1%	1.0
0000EL00042	R13	RESISTOR 10K 0.25W 1%	1.0
0000EL00160	R14,15,16,17	RESISTOR 220R 0.25W 1%	4.0
0000EL00160	R18,19,20,21	RESISTOR 220R 0.25W 1%	4.0
0000EL00051	R2	RESISTOR 39K 0.25W 1%	1.0
0000EL00096	R4	RESISTOR 390K 0.25W 1%	1.0
0000EL00052	R5,6	RESISTOR 300R 0.25W 1%	2.0
0000EL00452	R7,8	RESISTOR 150K 0.25W 1%	1.0
0000EL00038	R9	RESISTOR 200K 0.25W 1%	1.0
0000EL00048	S1,2,3,4,5,6	SWITCH P/BUTTON MINIATURE	6.0
0000EL00048	S12,13,14	SWITCH P/BUTTON MINIATURE	3.0
0000EL00048	S7,8,9,10,11	SWITCH P/BUTTON MINIATURE	5.0
0000EL00046	SK1	CONNECTOR SOCKET 20 WAY	1.0
0000EL00019	T1	TRANSISTOR BC546	1.0

## 5.6 RS232/Nursecall Board

1000EL00099	Schematic Diagram (not issue controlled)
1000EL00102	Component Location (not issue controlled)
	See next sheets.
1000EL00107	RS232/Nursecall Bill of Materials.





**Schematic Diagram RS232 Board 1000EL00099 (not issue controlled)**



Item Number: 1000EL00107 ASSY PCB RS232/N V4/P7

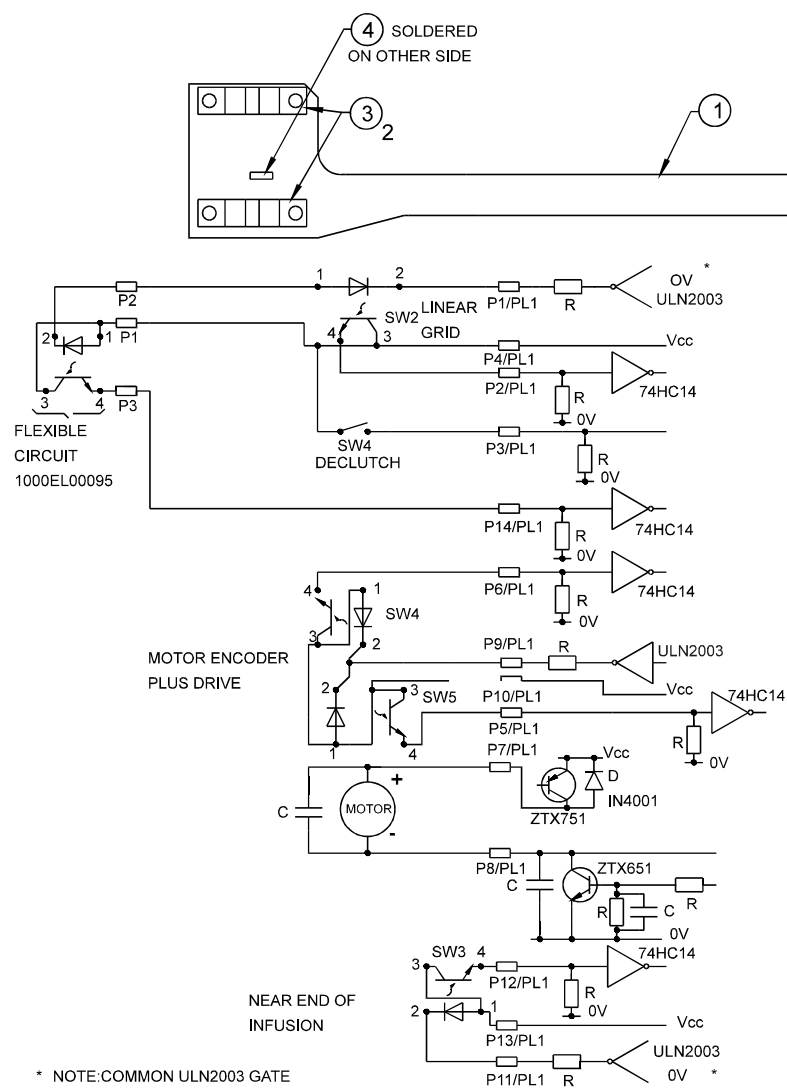
Iss: 6

Part Number	Reference	Description	Qty
1000PR00013		SCHEDULE TEST RS232/NC PCB	1.0
1000EL00104	1	OUTLINE ISOLATED RS232 NC	1.0
0000EL00054	C1	CAPACITOR 10u 16V TANT	1.0
0000EL00029	C2,3	CAPACITOR 1u0 35V TANT	2.0
0000EL00150	C4	CAPACITOR 4u7 16V TANT	1.0
0000EL00077	C5,6	CAPCITOR 470N 50V TANT	2.0
0000EL00016	D1,2,3,4,5,6	DIODE IN4148	6.0
0000EL00016	D7	DIODE IN4148	1.0
0000EL00016	D8	DIODE IN4148	1.0
0000EL00152	IC1	IC TYPE MAX 250	1.0
0000EL00153	IC2	IC TYPE MAX 251	1.0
0000EL00151	OP1,2,3	ISOLATOR OPTO CNY17	3.0
0000EL00177	PL1	CONNECTOR HEADER 4 WAY R/A	1.0
0000EL00146	PL2	CONNECTOR HEADER 5 WAY R/A	1.0
0000EL00147	PL3	CONNECTOR PLUG 2 WAY R/A	1.0
0000EL00096	R1	RESISTOR 390K 0.25W 1%	1.0
0000EL00105	R2	RESISTOR 4K7 0.25W 1% 50PPM	1.0
0000EL00042	R3	RESISTOR 10K 0.25W 1%	1.0
0000EL00036	R4	RESISTOR 2K2 0.25W 1%	1.0
0000EL00040	R5	RESISTOR 20K 0.25W 1%	1.0
0000EL00142	R6	RESISTOR 56R 0.25W 1%	1.0
0000EL00035	R7	RESISTOR 100K 0.25W 1%	1.0
0000EL00105	R8	RESISTOR 4K7 0.25W 1% 50PPM	1.0
0000EL00040	R9	RESISTOR 20K 0.25W 1%	1.0
0000EL00148	RL1	RELAY ISOLATED 5V MR622-5SR	1.0
0000EL00149	T1	TRANSFORMER ISOLATED RS232	1.0
0000EL00020	TR1,2	TRANSISTOR BC556	2.0
0000EL00019	TR3	TRANSISTOR BC546	1.0
0000EL00163	VC1,2,3	VARIATOR MURATA DSS710D223	3.0

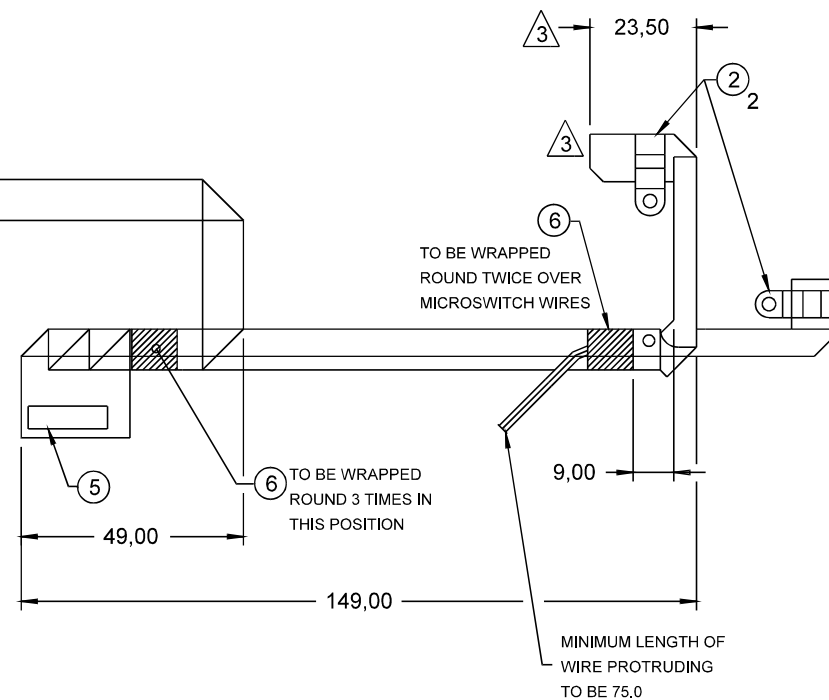
## 5.7 Flexible Circuit Assembly:

1000SP01006	Circuit Diagram	(not issue controlled)
1000SP01006	Bill of Materials	(not issue controlled)
1000SP01040	Circuit Diagram	(not issue controlled)
1000SP01040	Bill of Materials	(not issue controlled)
1000SP01041	Circuit Diagram	(not issue controlled)
1000SP01041	Bill of Materials	(not issue controlled)
1000SP01007	Circuit Diagram	(not issue controlled)
1000SP01007	Bill of Materials	(not issue controlled)

See next sheet.



CIRCUIT DIAGRAM FOR REFERENCE ONLY



NOTES:-

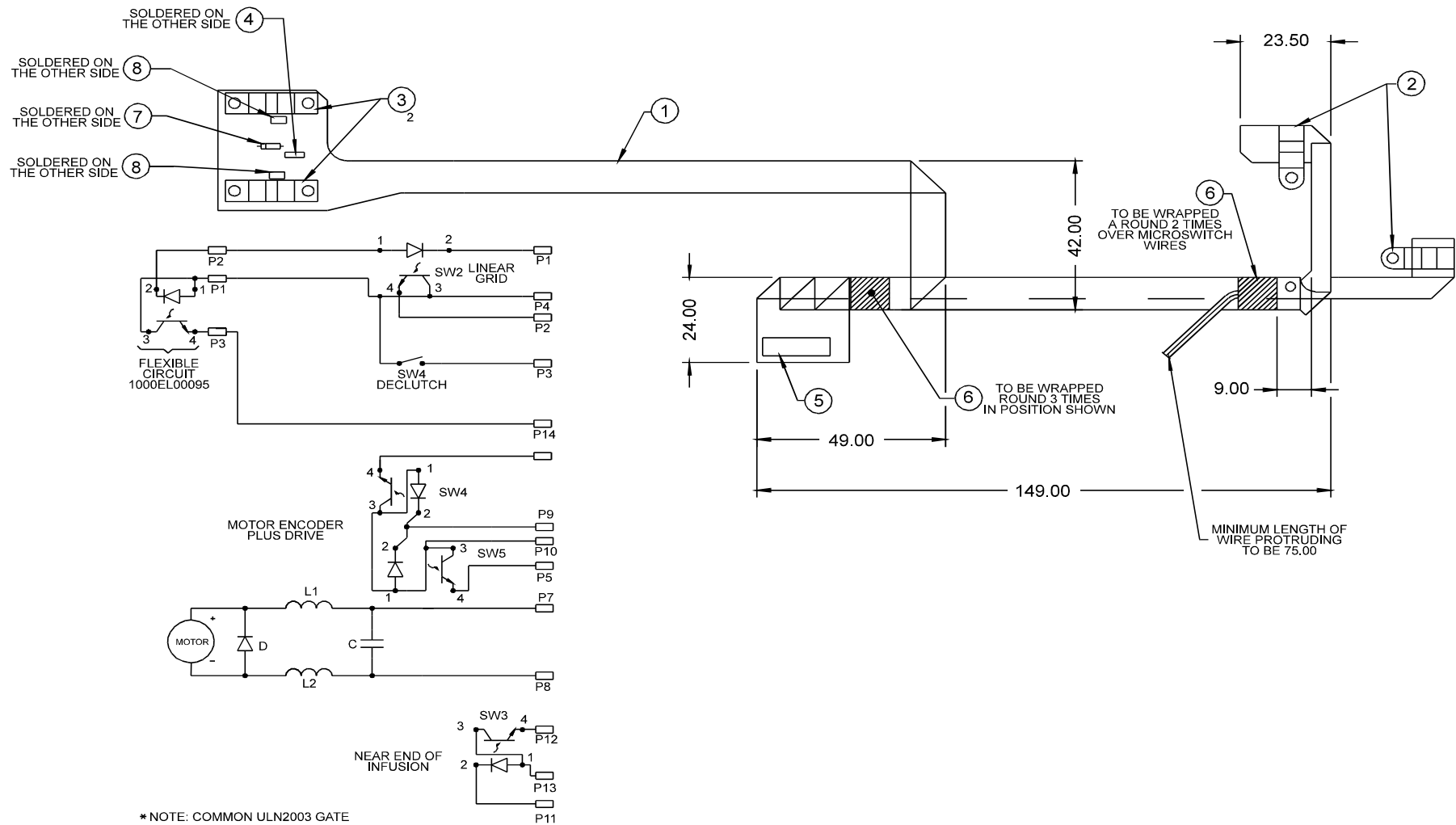
1. USE LOW MELTING POINT SOLDER ON ALL COMPONENTS (179°C MELTING POINT).

## Flexible Circuit Assembly 1000SP01006 (not issue controlled)

Item Number: 1000SP01006 ASSY CIR FLEXI NO.1

Iss: 5

Part Number	Reference	Description	Qty
1000EL00094	1	OUTLINE FLEXIBLE CIRCUIT	1.0
0000EL00185	2	SWITCH OPTO SLOTTED SINGLE	2.0
0000EL00003	3	SWITCH OPTO SLOTTED DUAL	2.0
0000EL00141	4	CAPACITOR 100nF CERAMIC CHIP	1.0
0000EL00106	5	CONNECTOR PLUG 14 WAY	1.0
0000ME00238	6	TAPE PVC 12mm BLACK	0.1



FLEXIBLE CIRCUIT ASSEMBLY 1000SP01040  
(not issue controlled)

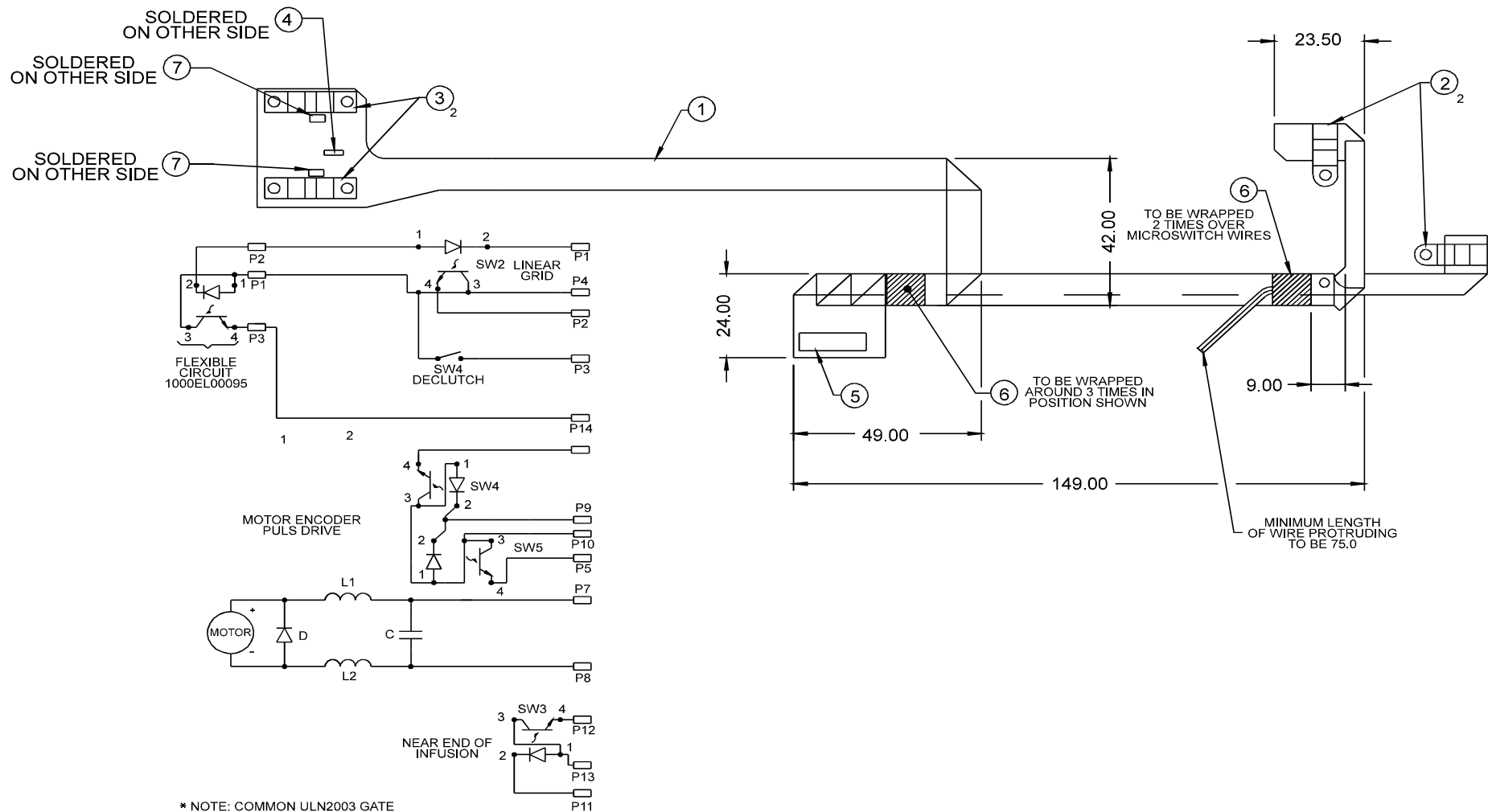
Item Number: 1000SP01040 ASSY FLEXI CIR NO1 P1-3/P5

Iss: 4

ASSY FLEXIBLE CIRCUIT MUST HAVE THE 'P4' MARK DELETED WITH BLACK PERMANENT MARKER TO IDENTIFY THE FLEXI TYPE.

Part Number	Reference	Description	Qty
1000EL00094	1	OUTLINE FLEXIBLE CIRCUIT	1.0
0000EL00185	2	SWITCH OPTO SLOTTED SINGLE	2.0
0000EL00003	3	SWITCH OPTO SLOTTED DUAL	2.0
0000EL00141	4	CAPACITOR 100nF CERAMIC CHIP	1.0
0000EL00106	5	CONNECTOR PLUG 14 WAY	1.0
0000ME00238	6	TAPE PVC 12mm BLACK	0.01
0000EL00352	7	DIODE ZENER BZX55C15	1.0
0000EL00334	8	INDUCTOR 100uH 10% SM	2.0
0000EL00308	9	CABLE RIBBON 16 WAY	0.1





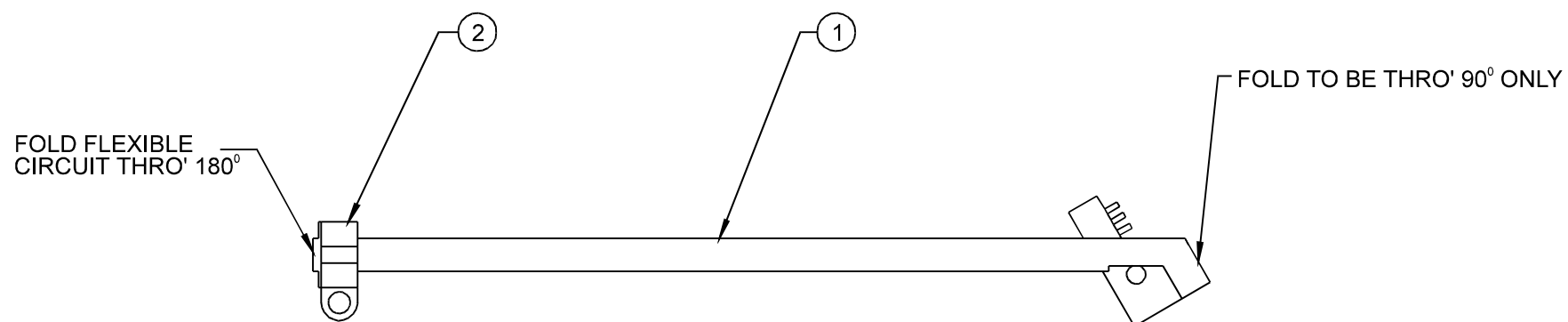
FLEXIBLE CIRCUIT ASSEMBLY 1000SP01041  
(not issue controlled)

Item Number: 1000SP01041 ASSY FLEXI CIR NO1 P4

Iss: 4

ASSY FLEXIBLE CIRCUIT MUST HAVE THE 'P1' MARK DELETED WITH BLACK PERMANENT MARKER TO IDENTIFY THE FLEXI TYPE.

Part Number	Reference	Description	Qty
1000EL00094	1	OUTLINE FLEXIBLE CIRCUIT	1.0
0000EL00185	2	SWITCH OPTO SLOTTED SINGLE	2.0
0000EL00003	3	SWITCH OPTO SLOTTED DUAL	2.0
0000EL00141	4	CAPACITOR 100nF CERAMIC CHIP	1.0
0000EL00106	5	CONNECTOR PLUG 14 WAY	1.0
0000ME00252	6	TAPE PVC 12mm BLUE	0.01
0000EL00311	7	RESISTOR 0R CRG1206	2.0
0000EL00308	8	CABLE RIBBON 16 WAY	0.1



NOTES:

1. FOLD ON SILKSCREEN FOLD LINES
2. USE LOW MELTING POINT SOLDER ON ALL COMPONENTS (179°C)

**FLEXIBLE CIRCUIT ASSEMBLY 1000SP01007**  
(not issue controlled)

Item Number: 1000SP01007 ASSY CIR FLEXI NO 2

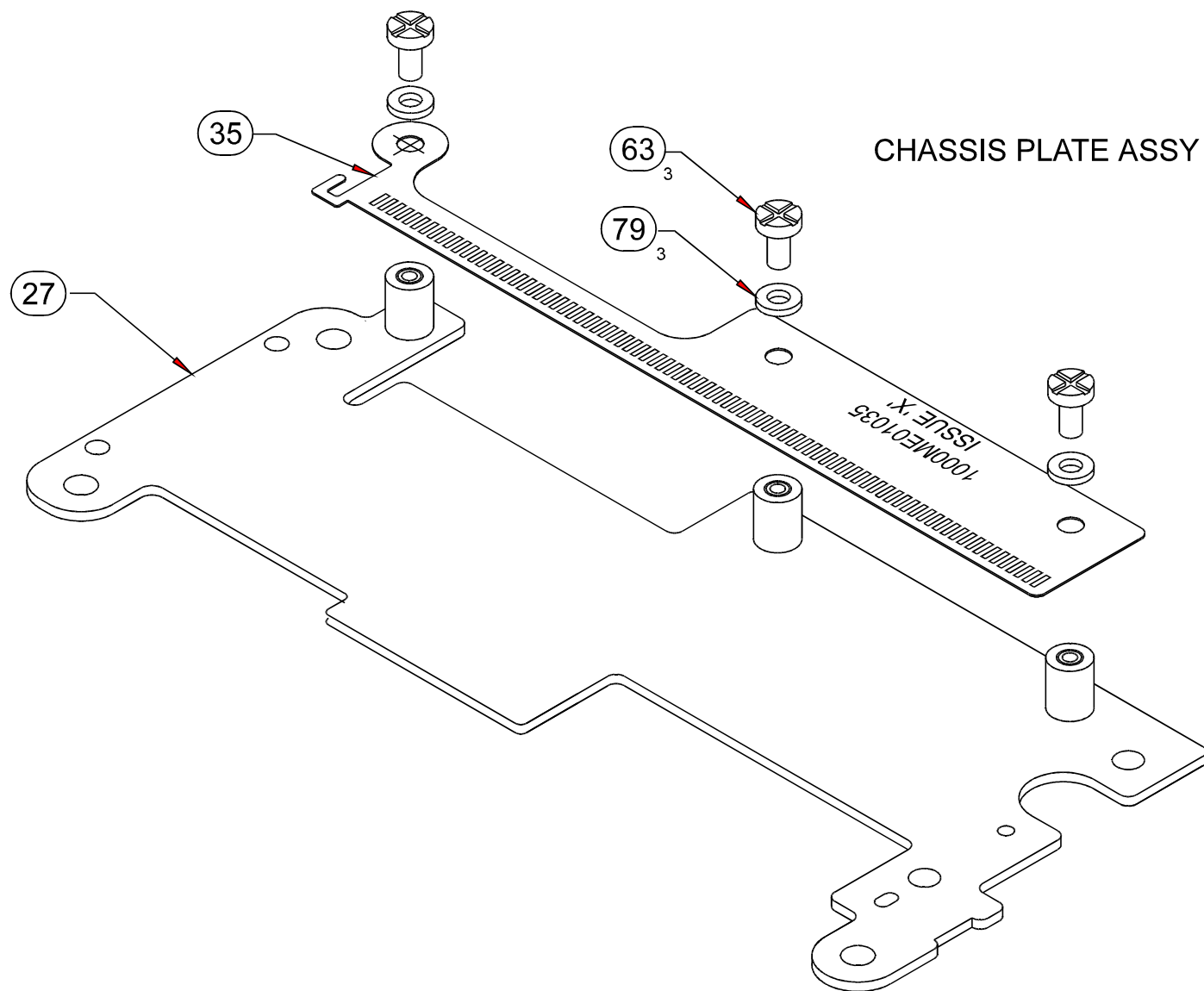
Iss: 2

Part Number	Reference	Description	Qty
1000EL00095	1	FLEXIBLE CIRCUIT PLUNGER	1.0
0000EL00185	2	SWITCH OPTO SLOTTED SINGLE	1.0

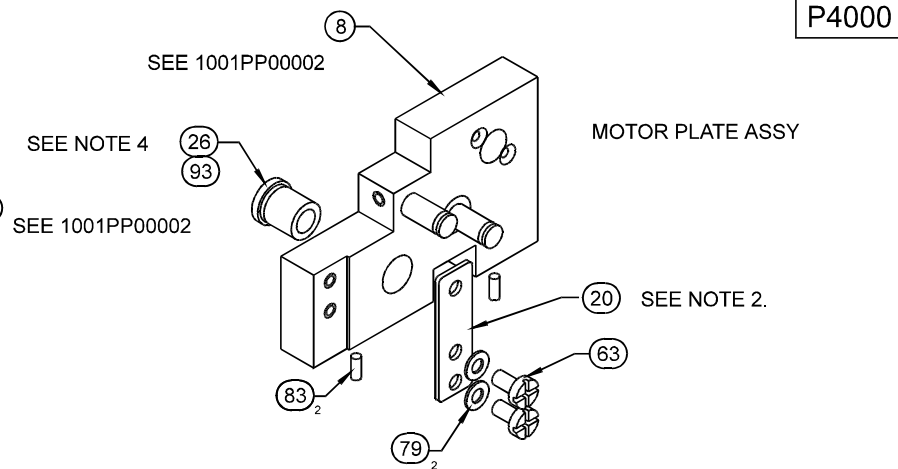
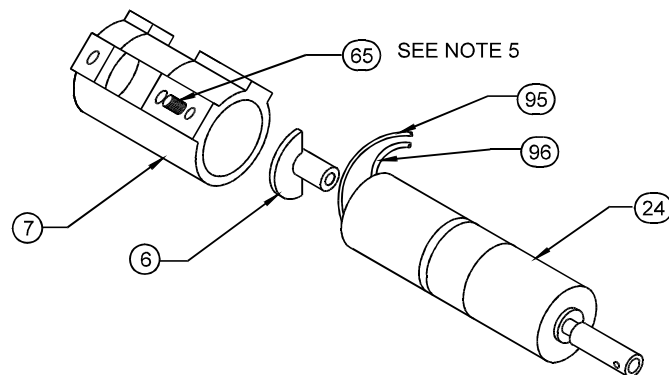
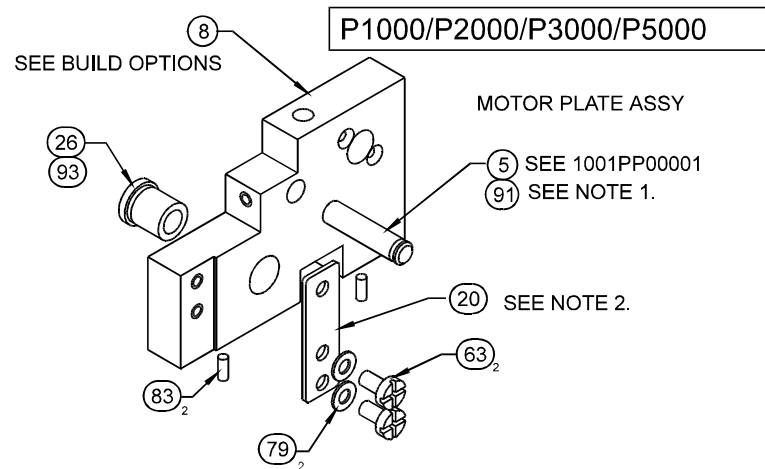
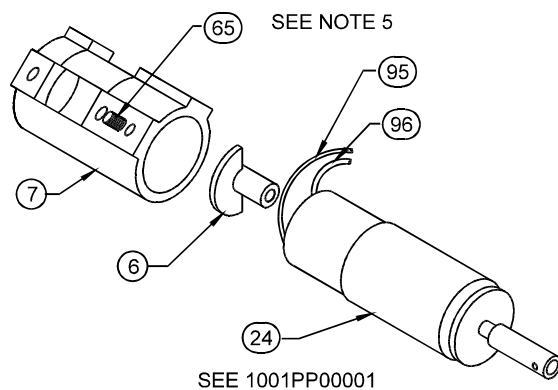
## **6.0 MECHANICAL ASSEMBLY DRAWINGS AND PARTS LISTS**

### **6.1 Transmission Assembly Common Kit 1001PP00004**

See next sheets.



Transmission Assembly  
(not issue controlled) 1001PP00004 Sheet 1

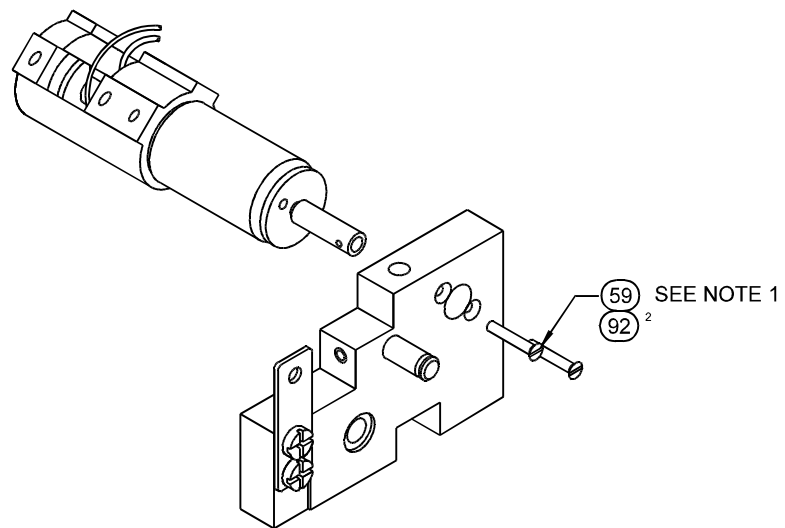


#### NOTES

1. FIT ITEM 5 FLUSH WITH REVERSE FACE OF ITEM 8.
2. FIT ITEM 20 SO EDGE IS PARALLEL AND FLUSH WITH LEDGE IN ITEM 8.
4. BOND ITEM 26 INTO ITEM 8 USING ITEM 93 ACCORDING TO PROCEDURE 0000PR00014.
5. FIT ITEM 65 INTO ITEM 7 APPLYING 25cNm OF TORQUE TO SECURE TO ITEM 24.

### Transmission Assembly (not issue controlled) 1001PP00004 Sheet 2

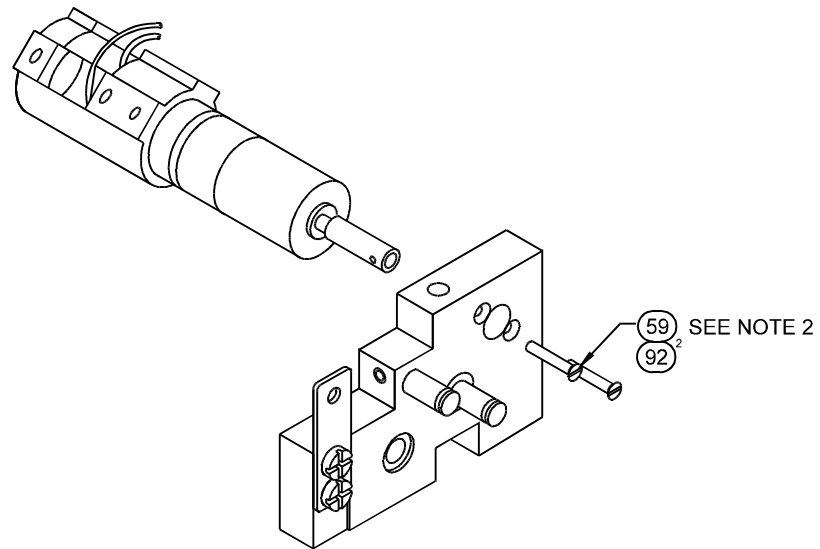
P1000/P2000/P3000/P5000



NOTES

1. APPLY ITEM 92 TO ITEM 59 BEFORE ASSEMBLY OF THE MOTOR GEARBOX TO THE MOTOR PLATE. SECURE USING 2 HOLES ON MOTOR MARKED WITH RED PAINT.

P4000

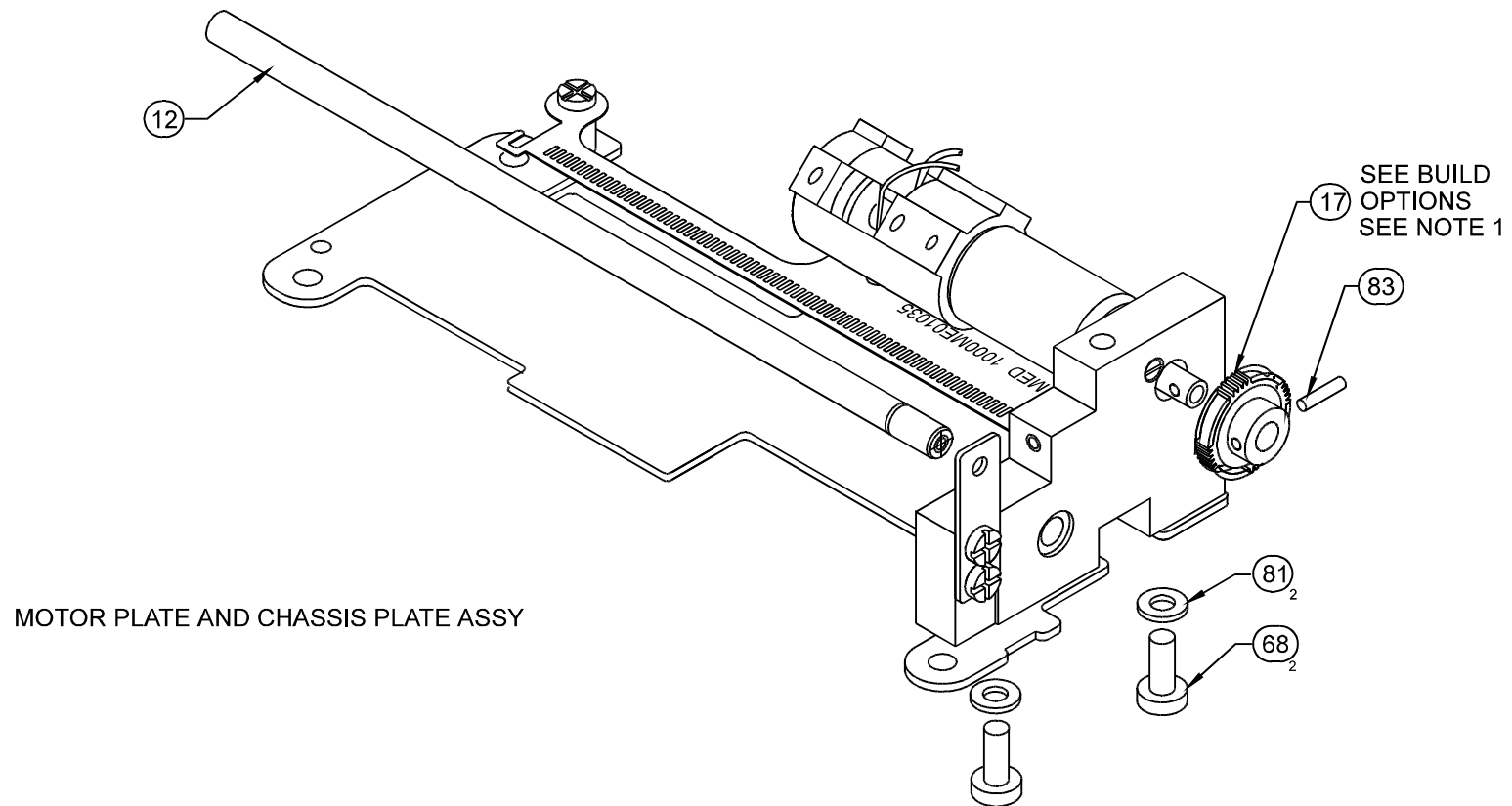


NOTES

2. APPLY ITEM 92 TO ITEM 59 BEFORE ASSEMBLY OF THE MOTOR GEARBOX TO THE MOTOR PLATE.

Transmission Assembly  
(not issue controlled) 1001PP00004 Sheet 3

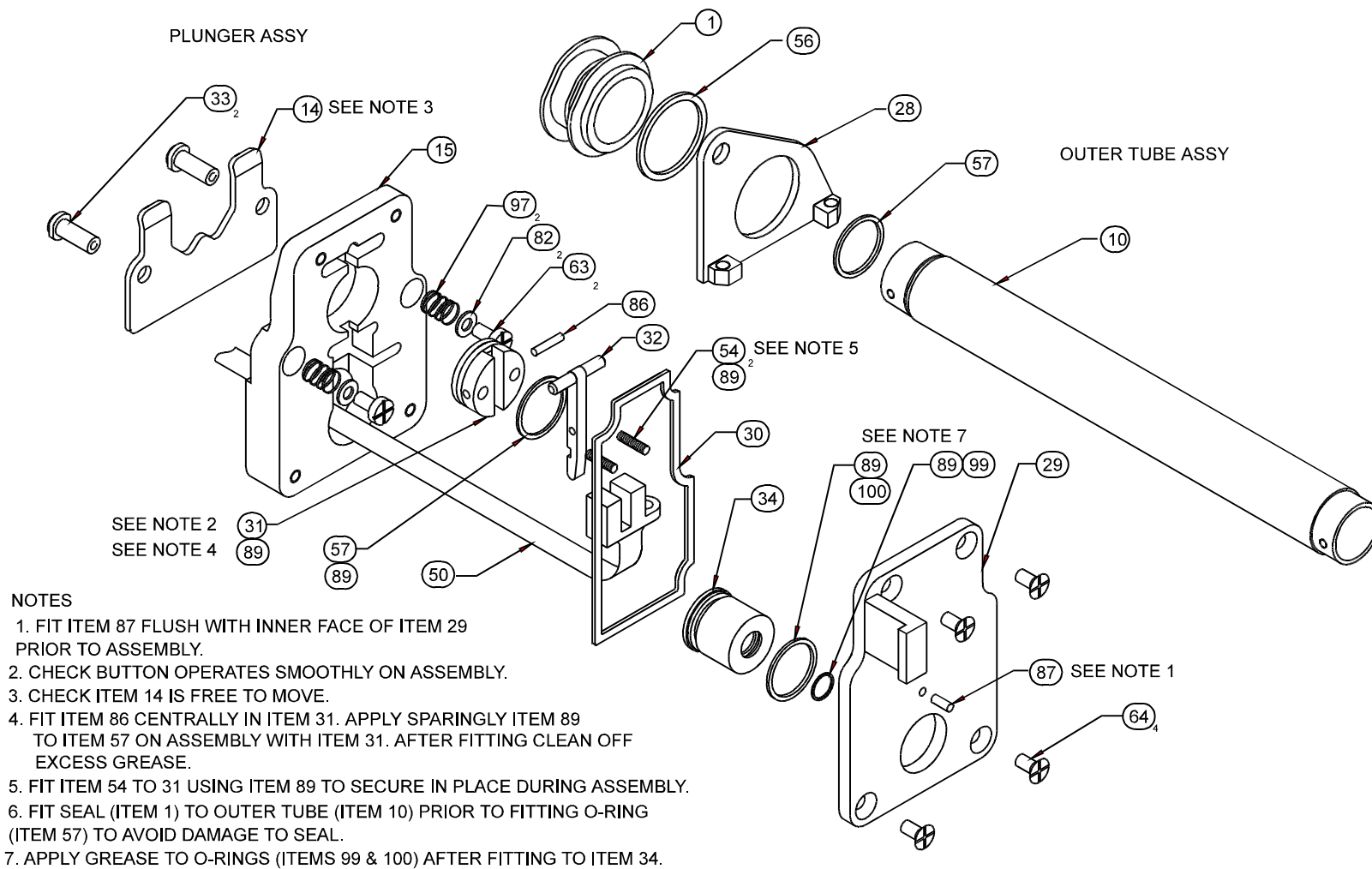




NOTES:

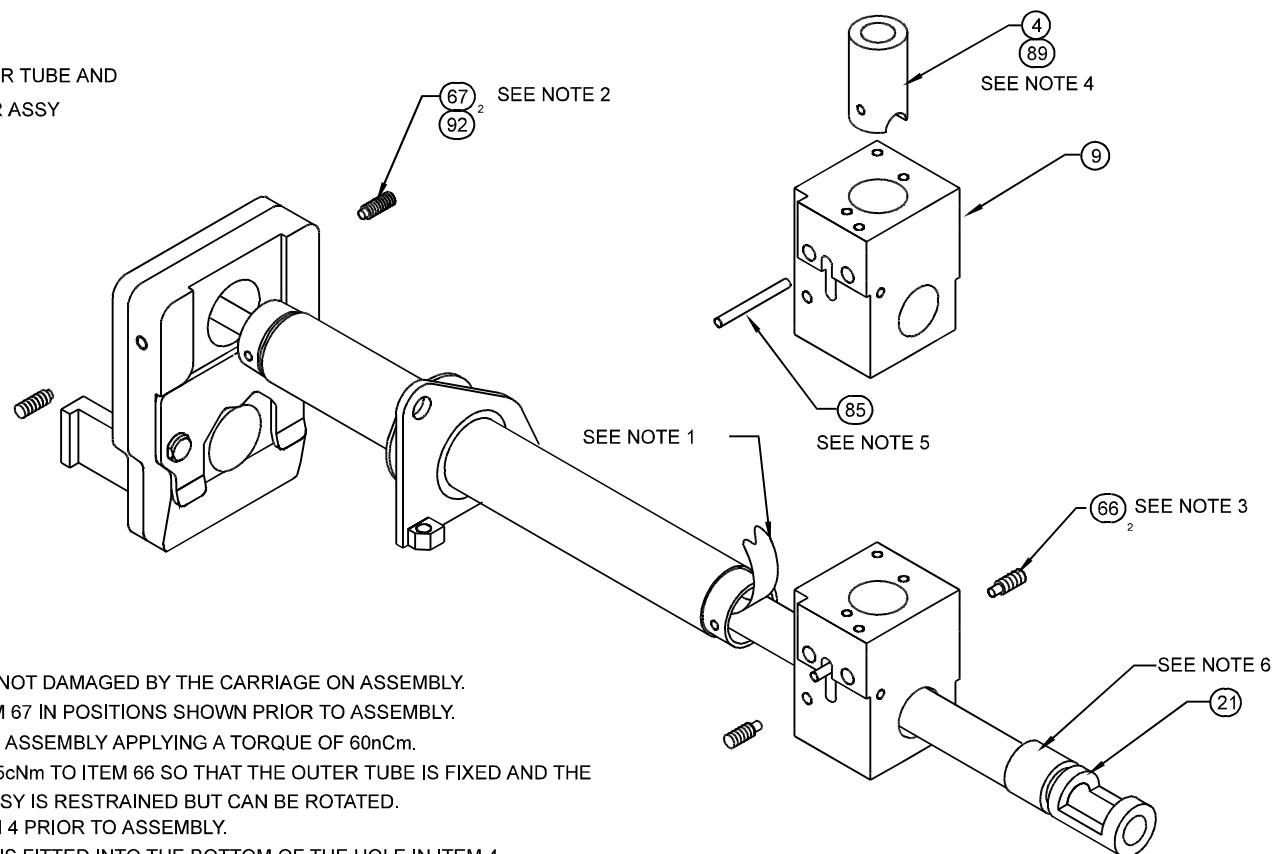
1. WHEN FITTING ITEM 83 TAKE CARE NOT TO DAMAGE THE TEETH OR BEND THE GEARBOX OUTPUT SHAFT.
2. ENSURE TORSION ROD 7000ME00015 IS USED. REF No. 12

Transmission Assembly  
(not issue controlled) 1001PP00004 Sheet 4



Transmission Assembly  
(not issue controlled) 1001PP00004 Sheet 5

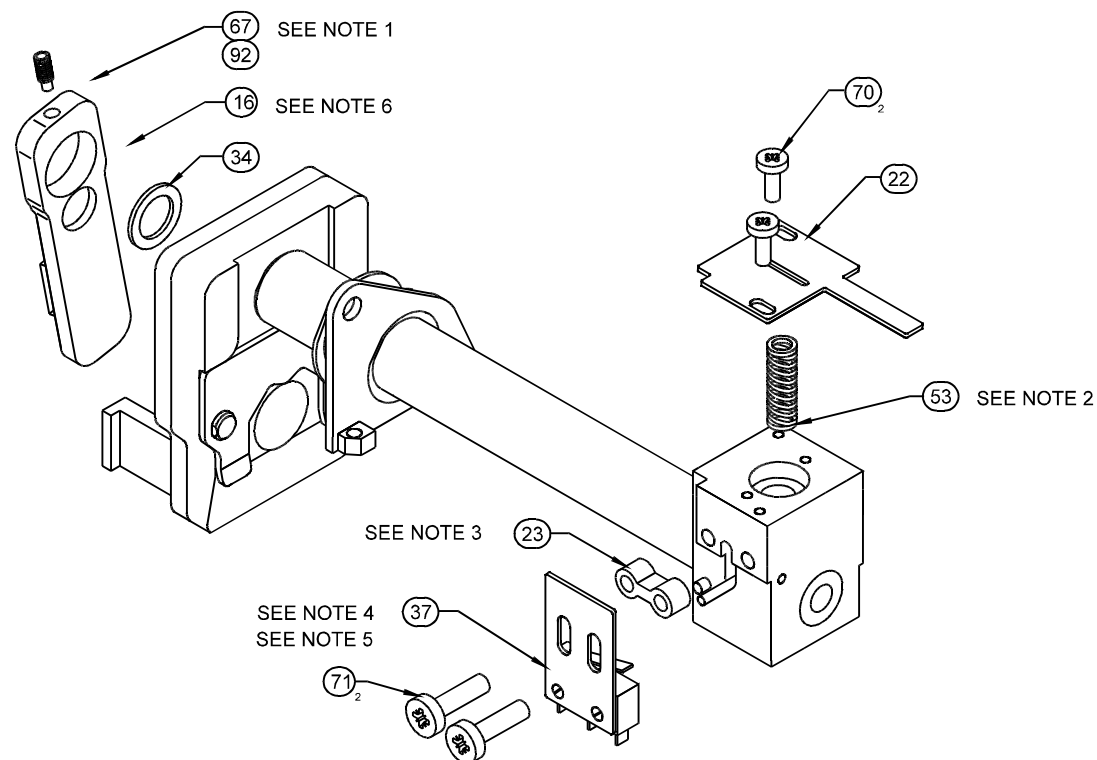
CARRIAGE, OUTER TUBE AND  
PLUNGER ASSY



#### NOTES

1. ENSURE THE FLEXI IS NOT DAMAGED BY THE CARRIAGE ON ASSEMBLY.
2. APPLY ITEM 92 TO ITEM 67 IN POSITIONS SHOWN PRIOR TO ASSEMBLY.  
FIT ITEM 67 TO PLUNGER ASSEMBLY APPLYING A TORQUE OF 60nNm.
3. APPLY A TORQUE OF 25cNm TO ITEM 66 SO THAT THE OUTER TUBE IS FIXED AND THE  
INTERMEDIATE TUBE ASSY IS RESTRAINED BUT CAN BE ROTATED.
4. APPLY ITEM 89 TO ITEM 4 PRIOR TO ASSEMBLY.
5. ENSURE THAT ITEM 85 IS FITTED INTO THE BOTTOM OF THE HOLE IN ITEM 4.
6. APPLY ITEM 89 TO AREA SHOWN PRIOR TO ASSEMBLY.

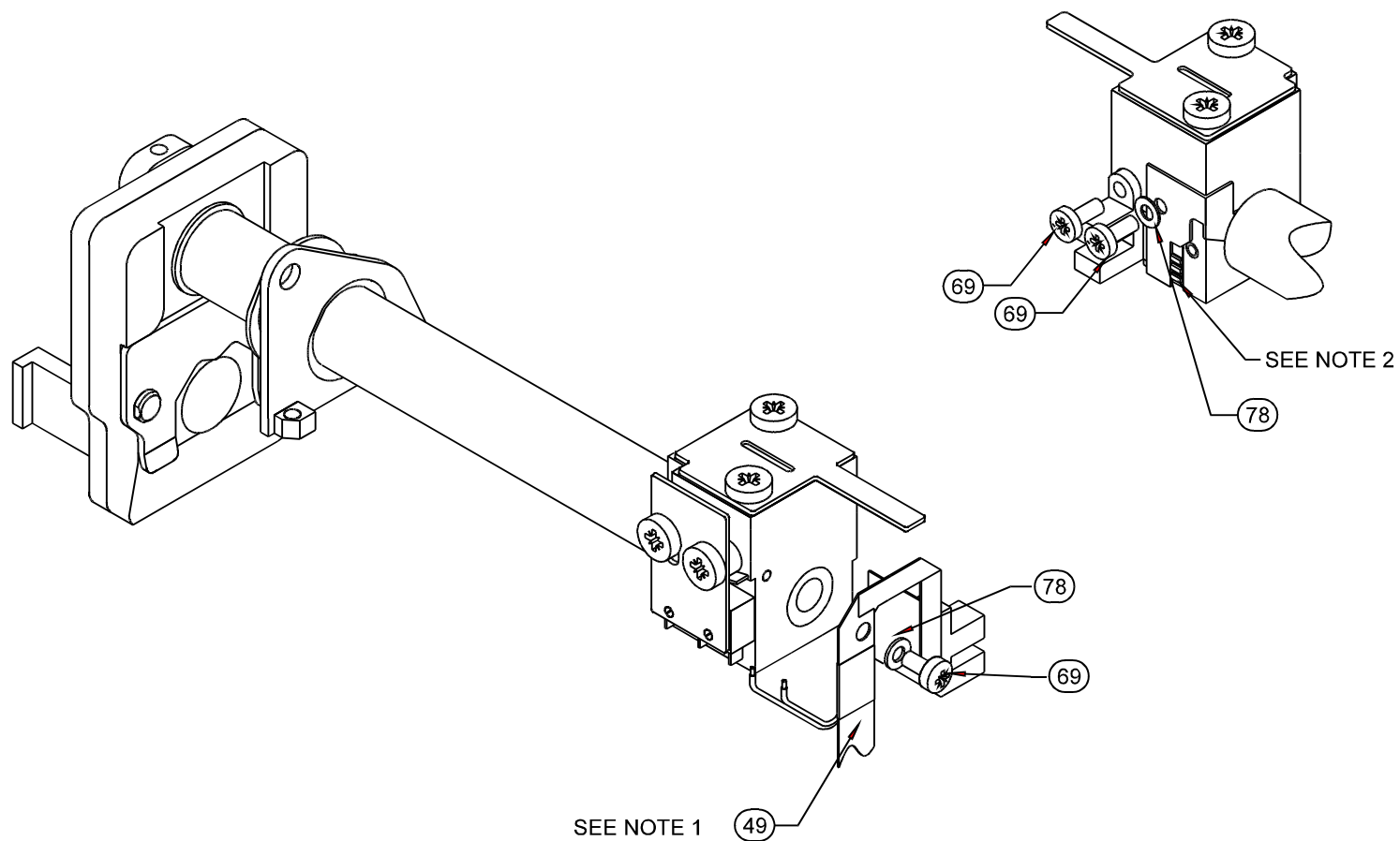
Transmission Assembly  
(not issue controlled) 1001PP00004 Sheet 6



#### NOTES

1. APPLY ITEM 92 TO ITEM 67 IN POSITION SHOWN PRIOR TO ASSEMBLY. TORQUE SETTING FOR ITEM 67 TO BE 45cNm.
2. CHECK THE DECLUTCH ACTION FOR A MIS-ALIGNED SPRING.
3. ENSURE THE SPACER IS NOT COMPRESSED EXCESSIVELY DURING FITTING.
4. CHECK THE MICROSWITCH SETTING AT THIS STAGE.
5. MICROSWITCH POSITION TO BE SET WHEN HALF NUT IS FULLY ENGAGED. ADJUST SO THAT THE MICROSWITCH IS ACTUATED WITHIN LIMITS DEFINED BY 0000JG00016.
6. POSITION OF THE DECLUTCH LEVER TO BE SET BY THE HOLE IN THE INTERMEDIATE TUBE.

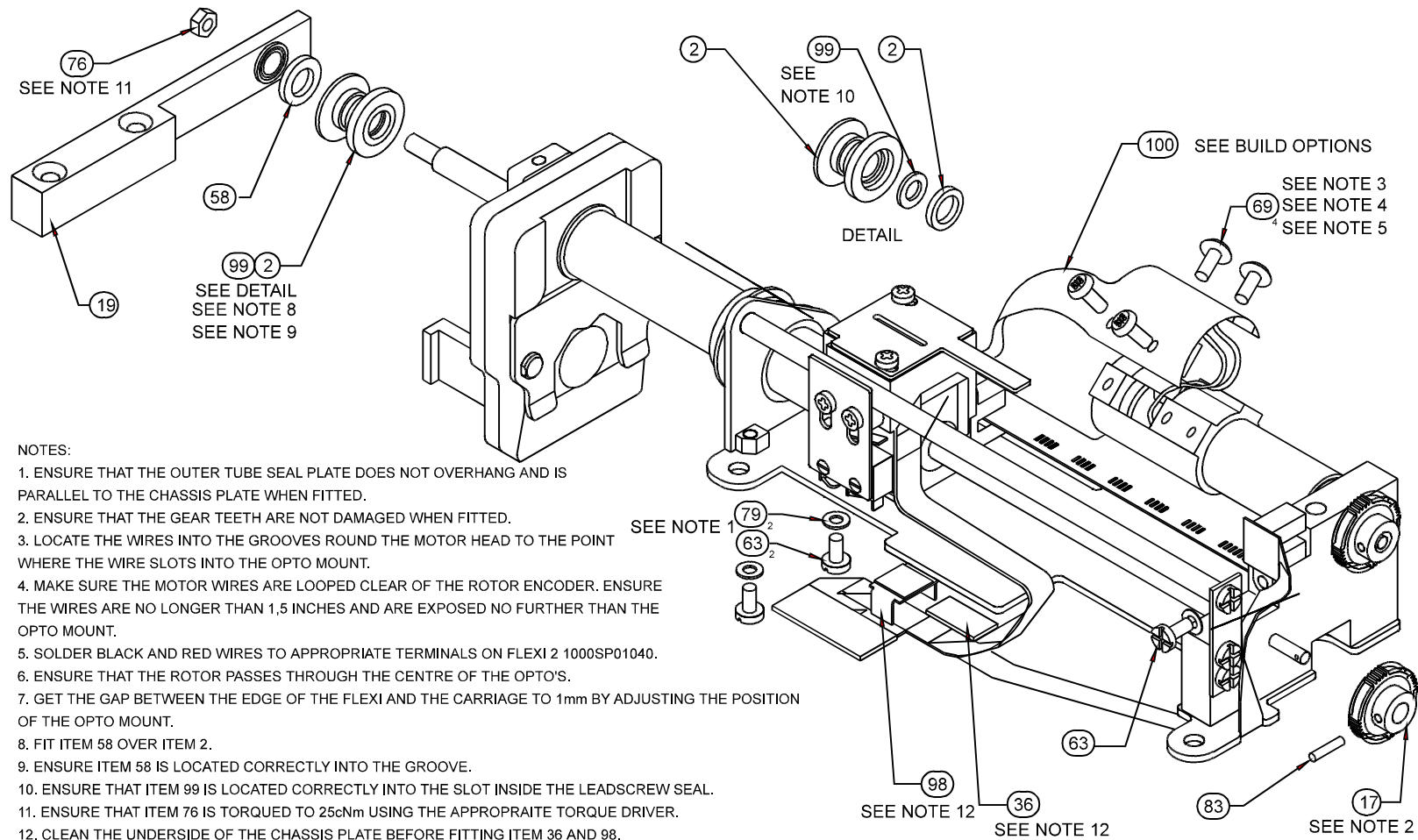
### Transmission Assembly (not issue controlled) 1001PP00004 Sheet 7



NOTES

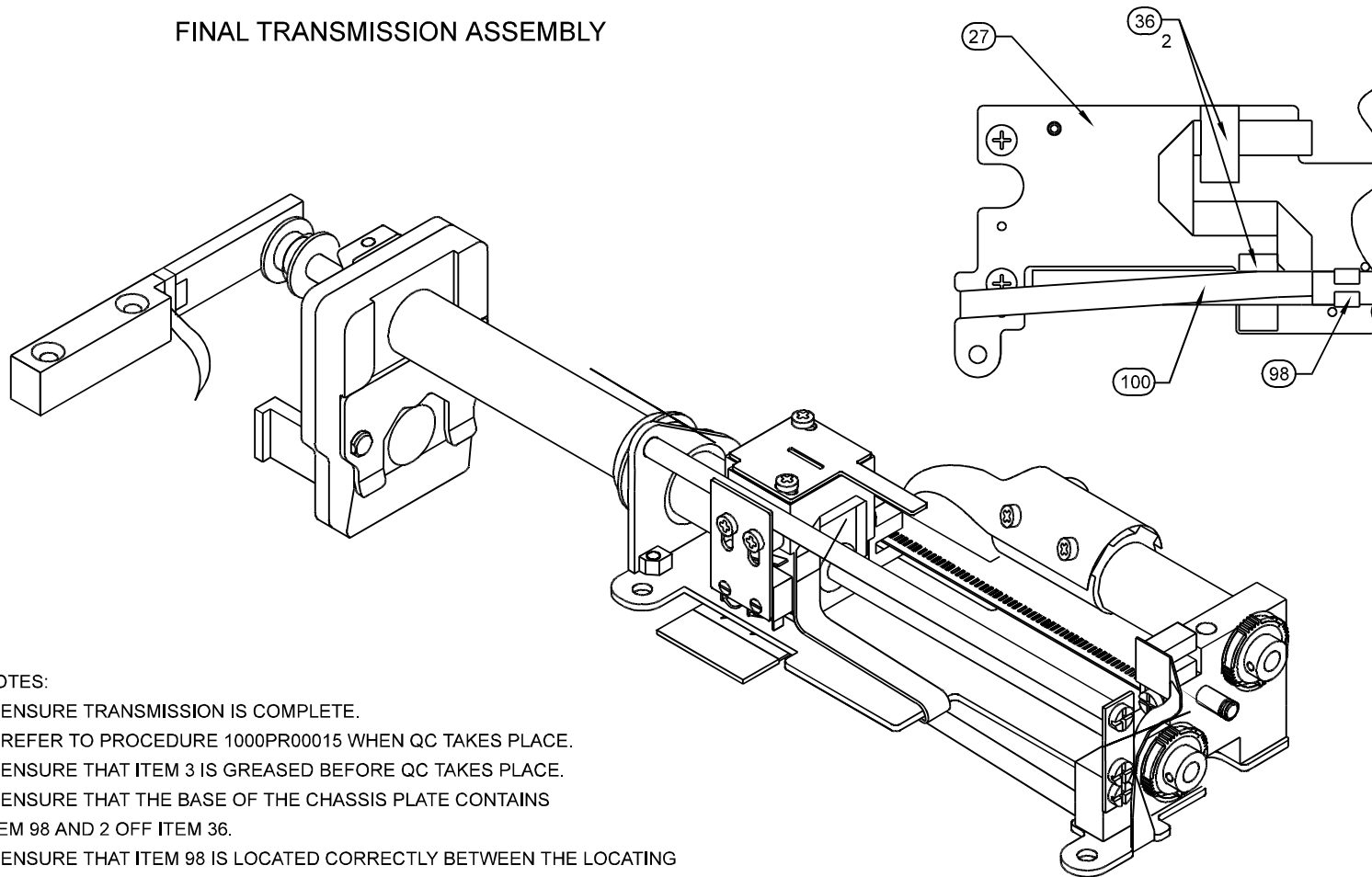
1. FIT FLEXI NO. 1 FIRST.
2. ALIGN SOLDER PADS CAREFULLY.

Transmission Assembly  
(not issue controlled) 1001PP00004 Sheet 8



## Transmission Assembly (not issue controlled) 1001PP00004 Sheet 9

## FINAL TRANSMISSION ASSEMBLY



### NOTES:

1. ENSURE TRANSMISSION IS COMPLETE.
2. REFER TO PROCEDURE 1000PR00015 WHEN QC TAKES PLACE.
3. ENSURE THAT ITEM 3 IS GREASED BEFORE QC TAKES PLACE.
4. ENSURE THAT THE BASE OF THE CHASSIS PLATE CONTAINS ITEM 98 AND 2 OFF ITEM 36.
5. ENSURE THAT ITEM 98 IS LOCATED CORRECTLY BETWEEN THE LOCATING HOLES.

Transmission Assembly  
(not issue controlled) 1001PP00004 Sheet 10

Item Number: 1001PP00004 V4 TRANS KIT COMMON ISS: 33

Part Number	Reference	Description	Qty
1000ME01121	1	SEAL OUTER TUBE RECESSED	1.0
1000ME01112	2	SEAL LEADSCREW MOULDED	1.0
1000ME01011	3	LEADSCREW V4	1.0
1000ME00097	4	HALFNUT V4	1.0
1000ME00174	6	ENCODER MOTOR	1.0
1000ME01069	7	MOUNT OPTO MOULDED V4	1.0
1000ME01013	9	CARRIAGE V4	1.0
1000ME01122	10	TUBE OUTER 'O' RING GROOVE	1.0
7000ME00015	12	ROD TORSION P7000	1.0
1000ME01056	14	PLATE PLUNGER RESTRAINT	1.0
1000ME01059	15	HOLDER PLUNGER V4	1.0
1000ME01116	16	LEVER DECLUTCH FLUID SEAL	1.0
1000SP00003	19	ASSY BEAM BONDED	1.0
1000ME00048	20	PLATE TORSION MOTOR END	1.0
1000ME01019	21	TUBE INTERMEDIATE ASSY	1.0
1000ME00108	22	ACTUATOR NEOI	1.0
1000ME00177	23	SPACER DUAL TRANSMISSION	1.0
1000ME01113	26	BUSH MOTOR BEARING MOULDED	1.0
1000ME01021	27	PLATE CHASSIS V4	1.0
1000ME01022	28	PLATE OUTER TUBE SEAL V4	1.0
1000ME01117	29	PLATE BACK PLUNGER HOLDE R FLUID SEAL	1.0
1000ME01107	30	GASKET PLUNGER HOLDER MOULDED A4	1.0
1000ME01114	31	BUTTON PLUNGER HOLDER MOULDED	1.0
1000ME01026	32	HOLDER PLUNGER CRUCIFORM	1.0
1000ME01027	33	PIN PLUNGER PLATE	2.0
1000ME01111	34	SEAL BACKPLATE A4	1.0
1000ME01035	35	GRID LINEAR 1.5 PITCH V4	1.0
1000ME01066	36	FOAM PAD CHASSIS PLATE	2.0
1000SP01022	37	ASSY MICROSWITCH V4	1.0
1000EL00123	48	DIAGRAM WIRING P1000/P20 00	1.0
1000SP01007	50	ASSY CIR FLEXI NO.2	1.0
0000ME00002	52	CIRCLIP E TYPE SHAFT DIA 4.8	1.0
0000ME00003	53	SPRING COMP OD 6.1 19 LONG	1.0
0000ME00133	54	SPRING COMPRESSION 2.24 DIA x 7.9mm	2.0
0000ME00034	55	GREASE MOLYBDENUM DISULPHIDE	0.05
1000ME01047	56	SEAL RING OUTER TUBE	1.0
0000ME00136	57	O RING 13.0 I/D x 1.5	2.0
1000ME01048	58	SEAL RING LEADSCREW	1.0
0000ME00084	59	SCREW M2x12 CSK HD SLOTT ED	2.0
0000ME00221	63	SCREW M3x6 PAN HD POSI ZP+P	11.0
0000ME00222	64	SCREW M3x6 CSK HD POSI 1 Z+BLACK	4.0
0000ME00009	65	SCREW M3x5 CSK SET CUP	1.0
0000ME00030	66	SCREW M3x8 SKT SET FULL	2.0
0000ME00146	67	SCREW M3x8 SKT SET PART	3.0
0000ME00246	68	SCREW M4x8 PAN HD POSI	2.0
0000ME00011	69	SCREW No4 X 1/4" PAN HD	7.0
0000ME00031	70	SCREW No4x3/8" PAN HD	2.0
0000ME00032	71	SCREW No4x1/2" PAN HD	2.0
0000ME00292	76	NUT M3 A2 STAINLESS STEEL	1.0
0000ME00044	78	WASHER M3 NYLON	2.0
0000ME00015	79	WASHER M3 WAVEY SST	9.0
0000ME00027	80	WASHER M5 PLAIN Z+C	1.0
0000ME00045	81	WASHER M4 WAVEY SST	2.0
0000ME00048	82	WASHER M3 PLAIN Z+C	2.0
0000ME00016	83	PIN TENSION DIA 2.0x10mm	4.0
0000ME00018	85	PIN TENSION DIA 2.0x20mm	1.0
0000ME00132	86	PIN TENSION DIA 1.5 x 10mm	1.0
0000ME00142	87	PIN TENSION DIA 2.0 x 5.0mm	1.0
0000ME00058	89	GREASE SILICONE	0.05
0000ME00051	92	ADHESIVE LOCTITE 242	0.05
0000ME00052	93	ADHESIVE LOCTITE 495	0.05
0000EL00100	95	CABLE BLACK 7/0.2	0.1
0000EL00101	96	CABLE RED 7/0.2	0.1
0000ME00134	97	SPRING COMPRESSION 5.33 DIA x 7.9mm	2.0
0000EL00095	98	CLIP CABLE SELF ADHESIVE	1.0
0000ME00237	99	O RING 6.5 x 1.0 NITRILE	2.0
0000ME00277	100	O RING NITRILE 11.5X1.5	1.0

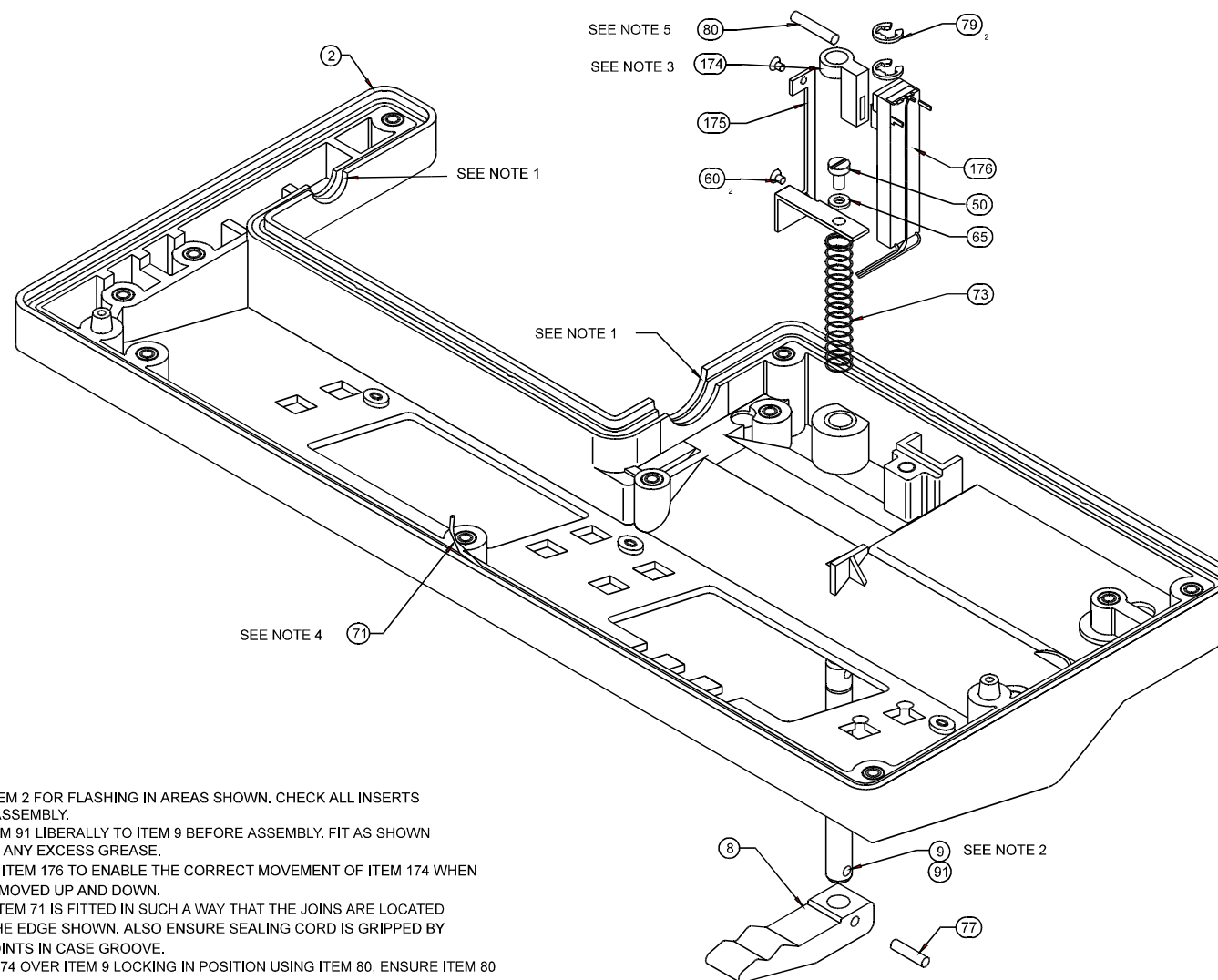


Item Number: 1001PP00002 V4 P4000 UNIQUE TRANS ISS: 3

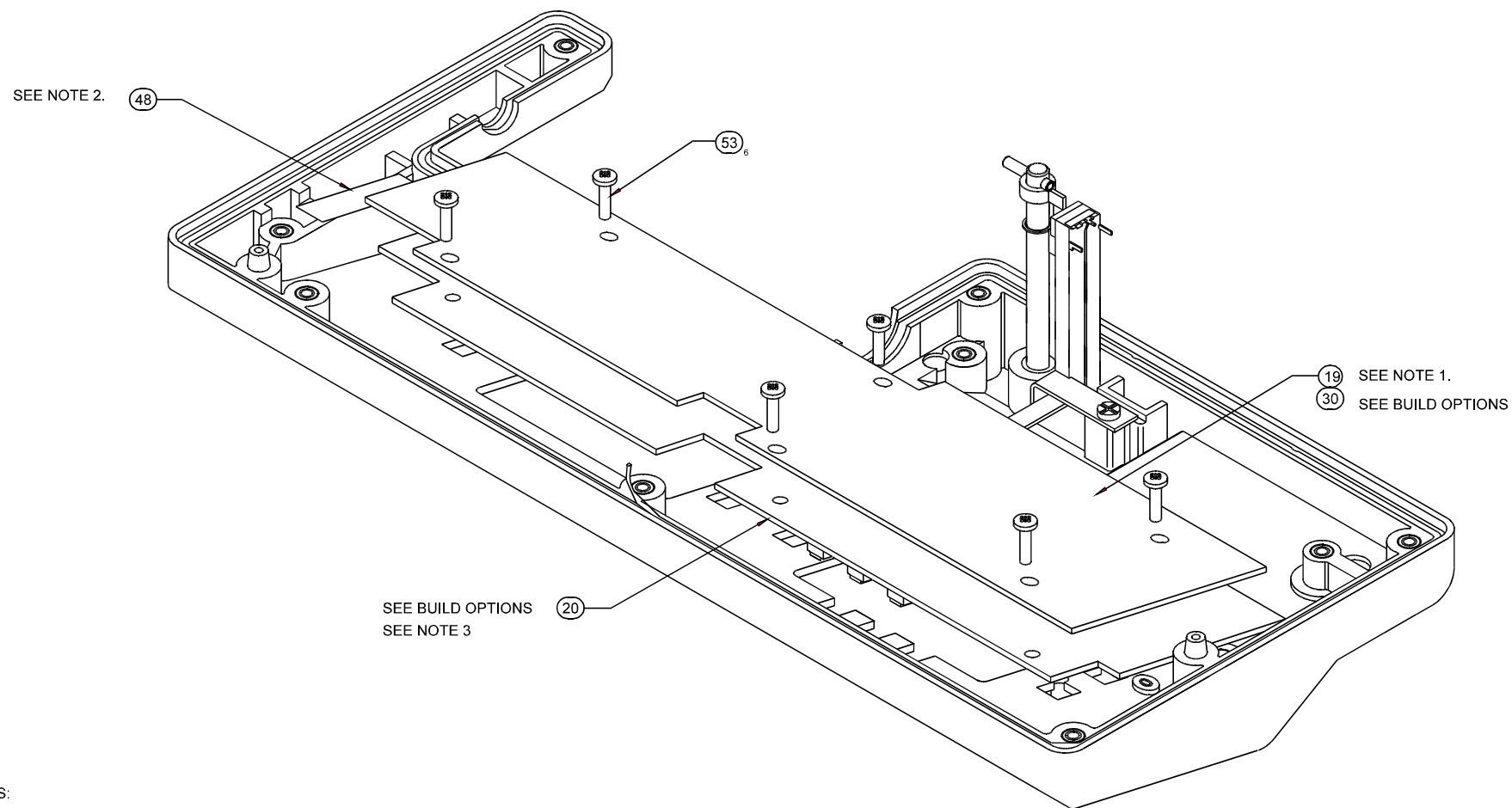
Part Number	Reference	Description	Qty
4000ME01002	8	PLATE MOTOR MNT V4 P4000	1.0
4000ME00004	17	GEAR MACHINED P4000	1.0
4000SP00018	24	MOTOR GEARBOX V4 ASSY P4000	1.0
4000EL00003	30	EPROM PROGRAM P4000 V4	1.0
0000ME00002	52	CIRCLIP E TYPE SHAFT DIA 4.8	1.0
0000ME00114	55	GEAR SPUR 0.5M 30T 20 DEG PA P4	2.0
0000ME00027	80	WASHER M5 PLAIN Z+C	1.0
1000SP01041	100	ASSY FLEXI CIR NO 1 P4000	1.0

## **6.2 General Assembly Common Kit 1001PP00003**

See next sheets.



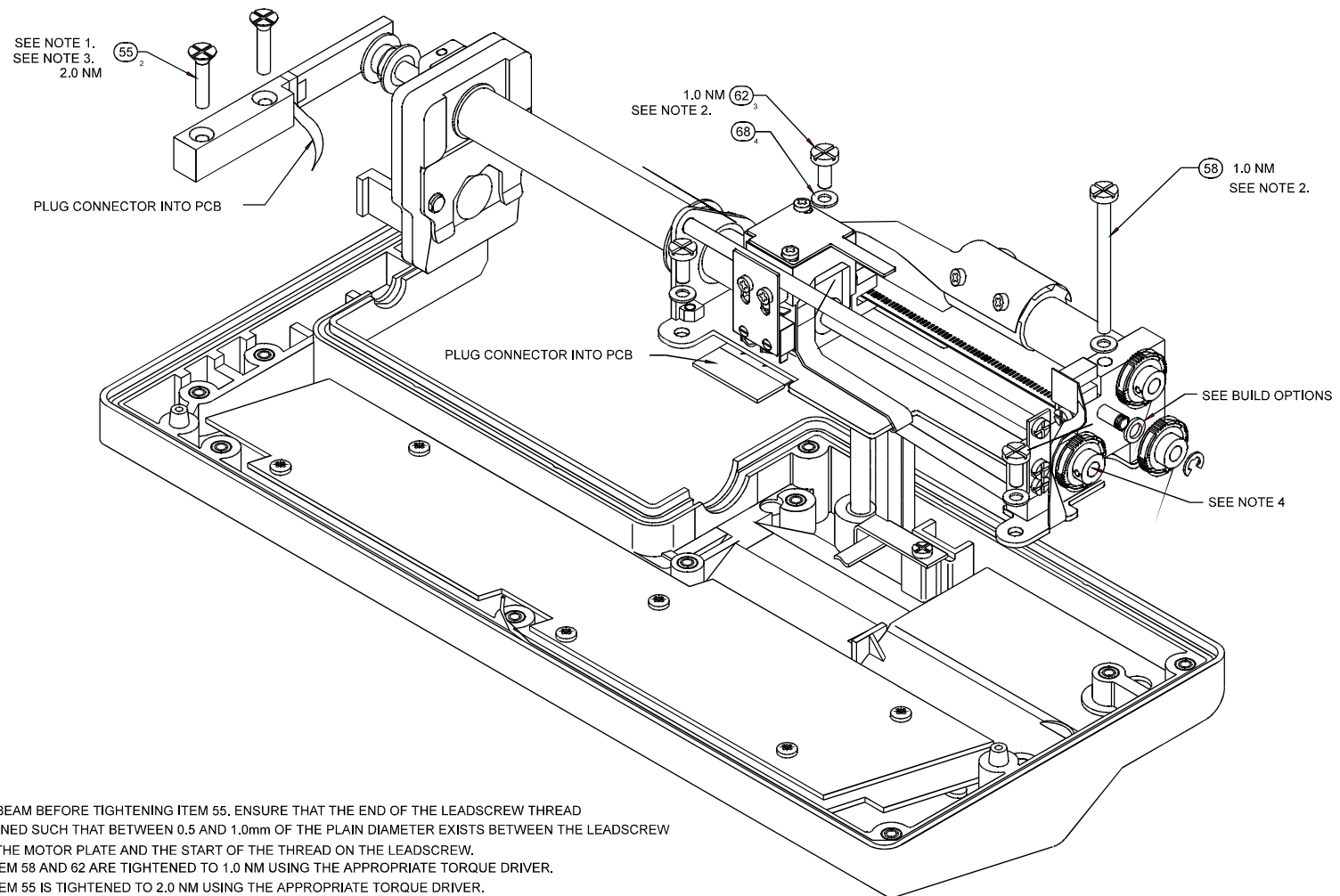
## Pump Syringe Assembly (not issue controlled) 1001PP00003 Sheet 1



NOTES:

1. CHECK EPROM IS FITTED ACCORDING TO THE BUILD OPTIONS, PCB DELIVERED WITH EPROM FITTED.
2. ENSURE ITEM 48 CONTAINS THE UNITS SERIAL NUMBER IN ACCORDANCE WITH THE DEVICE HISTORY FILE.
3. CHECK THE ALIGNMENT OF THE SWITCHES AND LEDS WITH THE CASE CUT OUT POSITIONS.

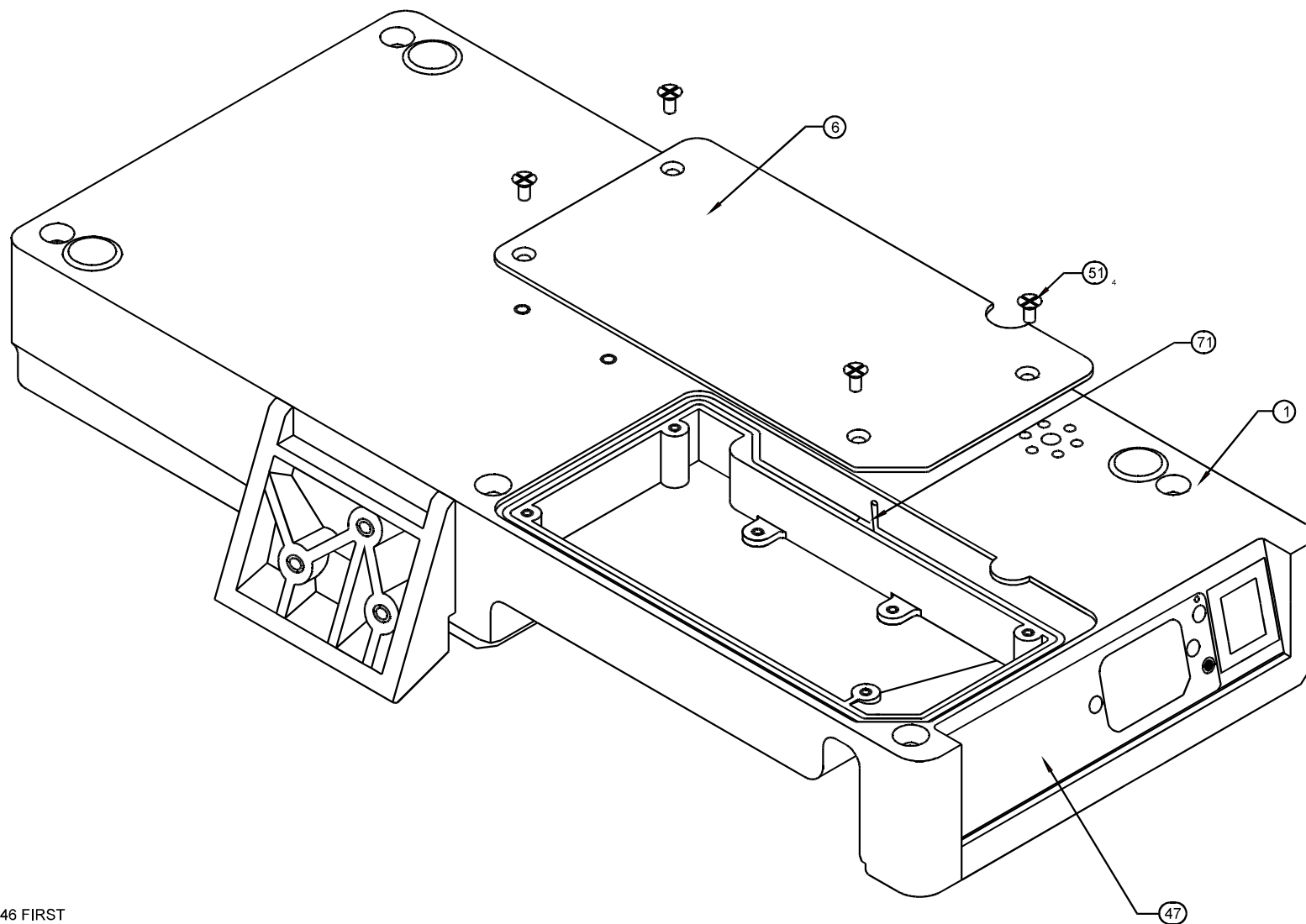
## Pump Syringe Assembly (not issue controlled) 1001PP00003 Sheet 2



NOTES:

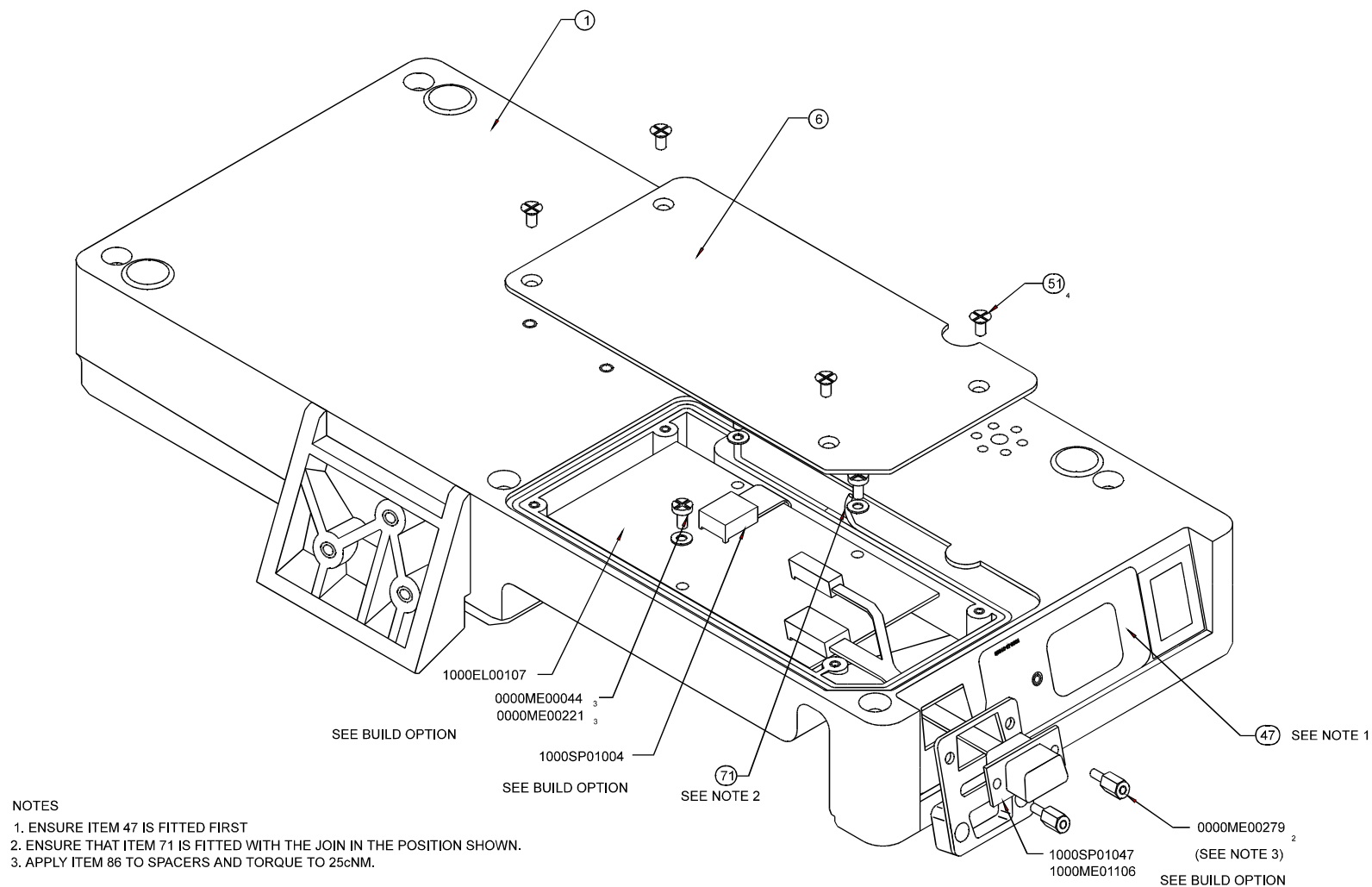
1. POSITION BEAM BEFORE TIGHTENING ITEM 55. ENSURE THAT THE END OF THE LEADSCREW THREAD IS POSITIONED SUCH THAT BETWEEN 0.5 AND 1.0mm OF THE PLAIN DIAMETER EXISTS BETWEEN THE LEADSCREW BUSH ON THE MOTOR PLATE AND THE START OF THE THREAD ON THE LEADSCREW.
2. ENSURE ITEM 58 AND 62 ARE TIGHTENED TO 1.0 NM USING THE APPROPRIATE TORQUE DRIVER.
3. ENSURE ITEM 55 IS TIGHTENED TO 2.0 NM USING THE APPROPRIATE TORQUE DRIVER.
4. CHECK THAT THE LEADSCREW ROTATES FREELY PRIOR TO FITTING THE IDLER GEAR(S), WASHER(S) AND CIRCLIP(S).

## Pump Syringe Assembly (not issue controlled) 1001PP00003 Sheet 3

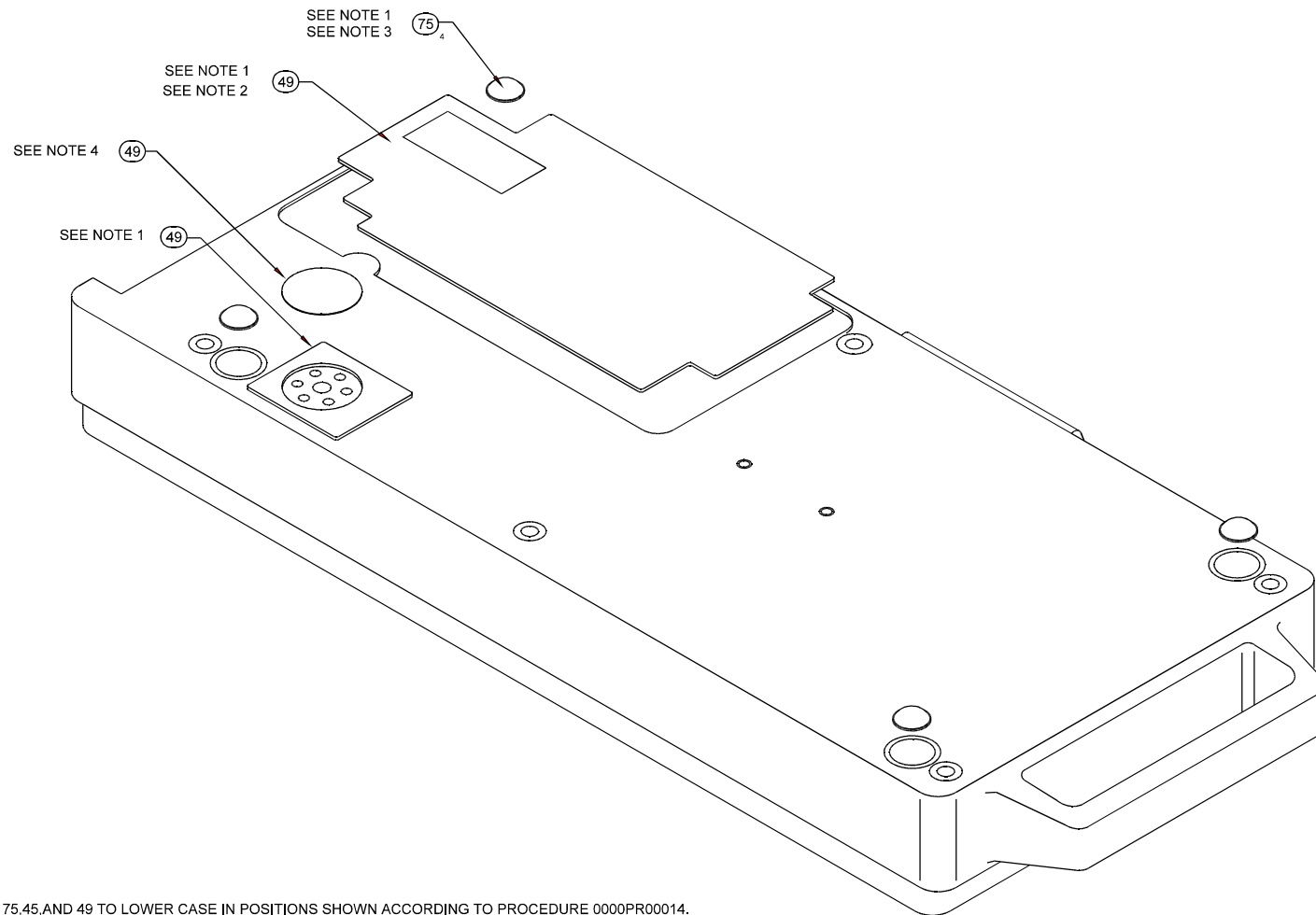


NOTES:  
1. FIT ITEM 46 FIRST

Pump Syringe Assembly  
not issue controlled) 1001PP00003 Sheet 4



### Pump Syringe Assembly (not issue controlled) 1001PP00003 Sheet 5

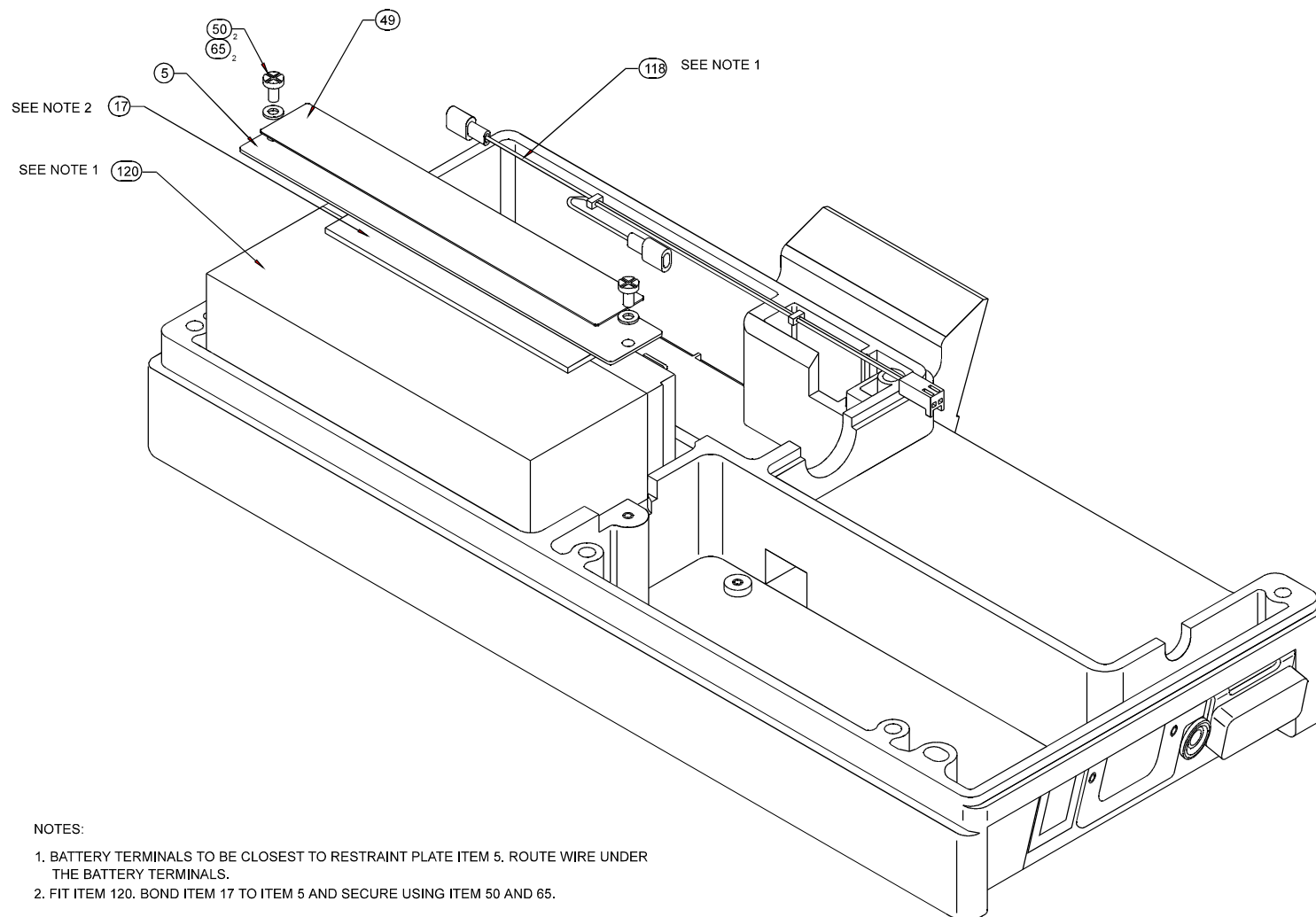


NOTES:

1. BOND ITEM 75,45,AND 49 TO LOWER CASE IN POSITIONS SHOWN ACCORDING TO PROCEDURE 0000PR00014.
2. ITEM 49 TO BE MARKED IN ACCORDANCE WITH DRAWING NO. 1000ME00057.
3. FIT ITEM 75 4OFF TO LOWER CASE IN POSITIONS SHOWN, THREE POSITIONS ARE INDICATED ON THE LOWER CASE  
THE FORTH FOOT IS TO BE POSITIONED ON THE RS232 PLATE IN A PARALLEL POSITION TO THE OTHER FEET.
4. BOND ITEM 49 TO LOWER CASE OF FRENCH UNITS ONLY IN POSITION SHOWN ACCORDING TO PROCEDURE 0000PR00014.

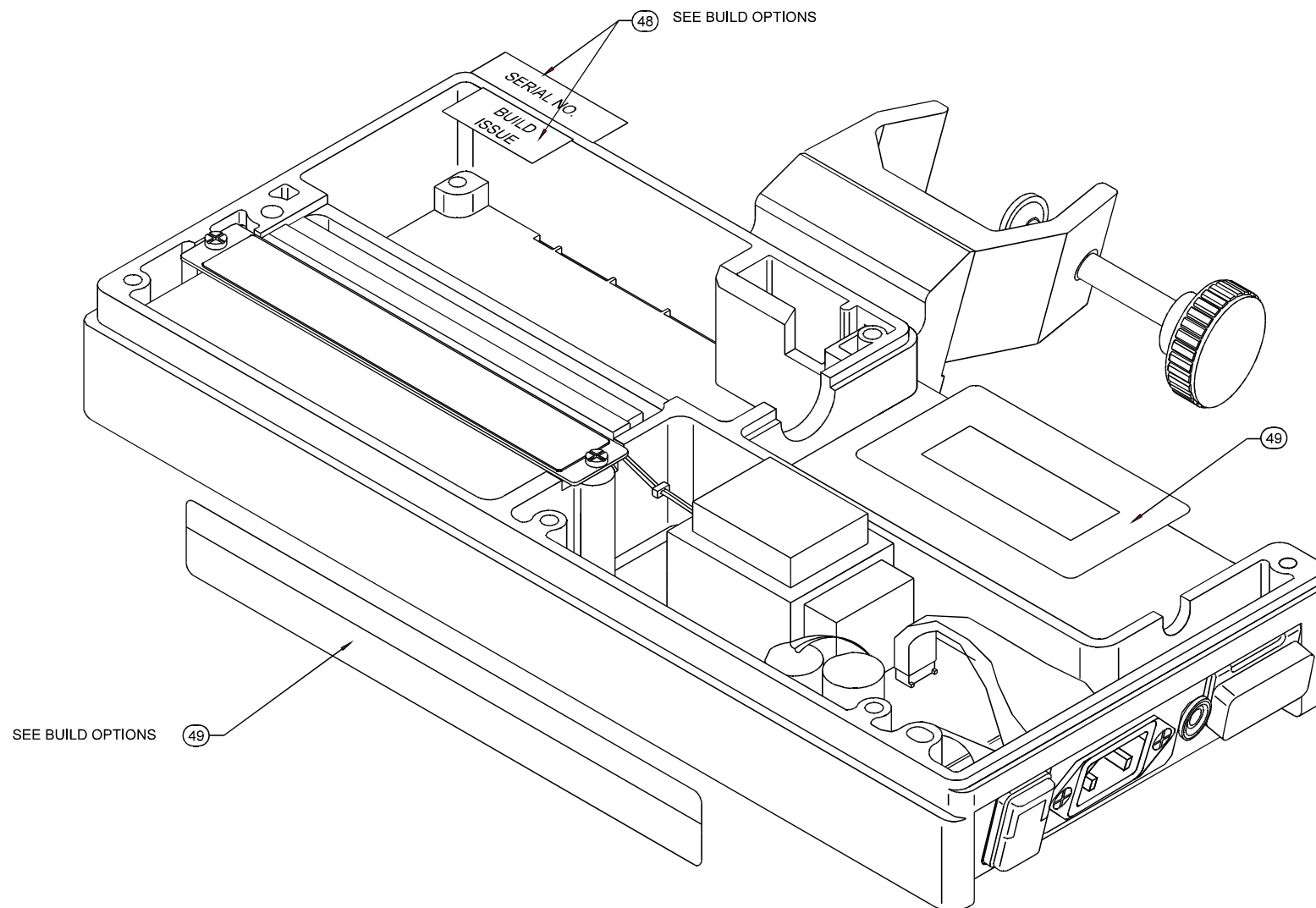
Pump Syringe Assembly  
(not issue controlled) 1001PP00003 Sheet 6



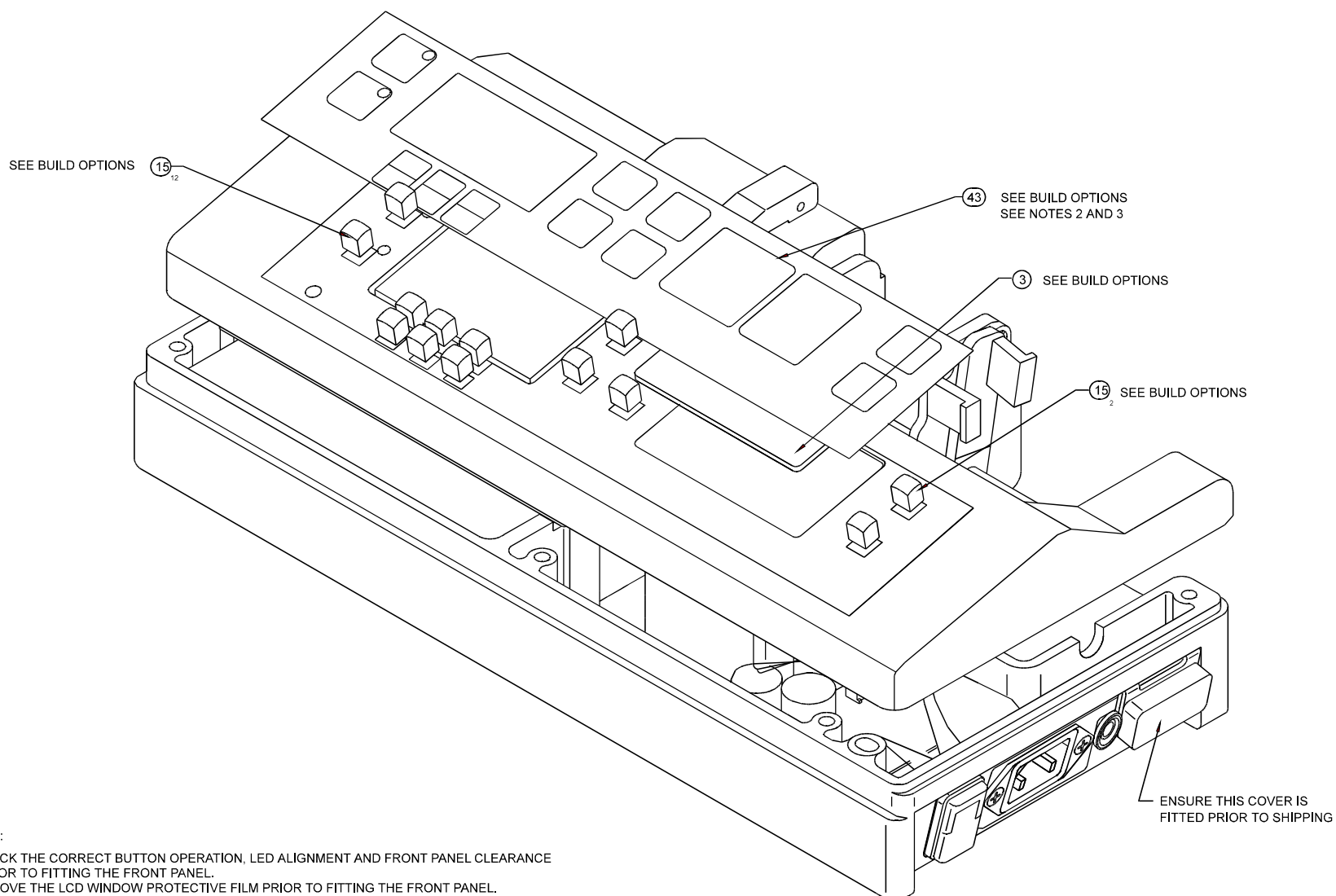


## Pump Syringe Assembly (not issue controlled) 1001PP00003 Sheet 7





Pump Syringe Assembly  
(not issue controlled) 1001PP00003 Sheet 9



NOTES:

1. CHECK THE CORRECT BUTTON OPERATION, LED ALIGNMENT AND FRONT PANEL CLEARANCE PRIOR TO FITTING THE FRONT PANEL.
2. REMOVE THE LCD WINDOW PROTECTIVE FILM PRIOR TO FITTING THE FRONT PANEL.

Pump syringe Assembly  
(not issue controlled) 1001PP00003 Sheet 10

Item Number: 1001PP00003 V4 KIT COMMON ISS: 49

Part Number	Reference	Description	Qty
1001PP00004		V4 TRANS KIT COMMON	1.0
1000PR00009		PROC TEST V4	1.0
1000ME01100	1	CASE LOWER VERSION 4	1.0
1000ME01101	2	CASE UPPER VERSION 4	1.0
1000ME01123	5	PLATE BATTERY RESTRAINT PUNCHED	1.0
1000ME01005	6	PLATE BASE RS232 V4	1.0
1000SP00076	7	ASSY POLE CLAMP 40MM SWAGED	1.0
1000ME01006	8	CLAMP SYRINGE MACH. V4	1.0
1000ME01086	9	SHAFT SYRINGE CLAMP V4 SYRINGE SIZING	1.0
1000ME01051	10	ALARM TUBE V4	1.0
1000ME01057	15	KEYCAP RUBBER	12.0
0000ME00141	16	STUD PE CONNECTOR M6 THREAD	1.0
1000ME01064	17	FOAM PAD BATTERY	1.0
1000SP01005	27	ASSY ALARM AUDIBLE	1.0
1000LB01011	46	LABEL SET V4 SYR TYPE	1.0
1000LB01015	47	LABEL SET END V4/P7	1.0
1000LB00102	48	LABEL COMB SERIAL\STATUS	1.0
1000LB01009	49	LABEL SET COMMON V4	1.0
0000ME00221	50	SCREW M3x6 PAN HD POSI ZP+P	3.0
0000ME00268	51	SCREW M3x8 CSK HD POSI S TAINLESS STEEL	4.0
0000ME00189	53	SCREW M3x12 POZI HD Z+C	6.0
0000ME00189	54	SCREW M3x12 POZI HD Z+C	4.0
0000ME00255	55	SCREW M4x20 CSK HD POSI STAINLESS STEEL	2.0
0000ME00225	58	SCREW M4x40 PAN HD POSI 2 ZP+P	1.0
0000ME00224	59	SCREW M4x45 PAN HD POSI ZP+P	6.0
0000ME00164	60	SCREW M2x3 CSK HD SLOTTE D	2.0
0000ME00227	61	SCREW M4x16 PAN HD POSI 2 ZP+P	3.0
0000ME00246	62	SCREW M4x8 PAN HD POSI	3.0
0000ME00230	63	SCREW M3x8 CSK HD POSI Z+BLACK	2.0
0000ME00015	65	WASHER M3 WAVEY SST	2.0
0000ME00048	66	WASHER M3 PLAIN Z+C	1.0
0000ME00045	68	WASHER M4 WAVEY SST	10.0
0000ME00286	69	WASHER M4 SHAKEPROOF	3.0
1000ME01087	71	CORD SEALING SILICONE INTERNAL	
		BORE 0.95DIA	1.6
1000ME01103	72	ON/OFF SPLASH COVER A4	1.0
0000ME00110	73	SPRING COMP OD 7.62 44 LONG	1.0
0000ME00026	75	FOOT SELF ADHESIVE V4	4.0
0000ME00257	77	PIN TENSION 3.0x10.0	1.0
0000ME00002	79	CIRCLIP E TYPE SHAFT DIA 4.8	2.0
0000ME00116	80	PIN TENSION DIA 3.0x16mm	1.0
1000ME01047	82	SEAL RING OUTER TUBE	1.0
0000ME00051	86	ADHESIVE LOCTITE 242	0.05
0000ME00058	91	GREASE SILICONE	0.05
0000ME00143	96	ADHESIVE CYN0-ACRYLATE -C	0.05
1000ME01074	117	GASKET MAINS INLET V4	1.0
1000SP00009	118	ASSY CABLE BATTERY	1.0
0000EL00004	120	BATTERY 6V NP2.8-6 RECHARGE	1.0
1000SP00007	121	ASSY ON/OFF SWITCH POWER	1.0
1000SP01001	122	ASSY INLET MAINS CONN	1.0
1000ME01043	141	PACKAGING SPEC. V4/P7000	1.0
0000ME00062	143	BAG POLYTHENE 20" X 15"	1.0
0000ME00063	144	TAPE ADHESIVE PACKAGING	1.0
1000EL00123	151	DIAGRAM WIRING P1000/P20 00	1.0
0000ME00118	173	LABEL "READ BEFORE OPERATING"	1.0
1000ME00175	174	ACTUATOR POT. MOULDED	1.0
1000ME00207	175	PLATE POTENTIOMETER PUNC HED	1.0
1000SP01017	176	ASSY POTENTIOMETER 50K	1.0
1000LB01017	177	LABEL PROTECTIVE PLUNGER	1.0

## **7.0 DISASSEMBLY, COMPONENT REPLACEMENT AND ASSEMBLY**

- 7.1 1000PB00018 - Fitting Instructions Front Panel Label.
- 7.2 1000PB00058 - Fitting Instructions Case Upper Assembly.
- 7.3 1000PB00044 - Fitting Instructions Motor Gearbox.
- 7.4 1000PB00092 - Fitting Instructions Case Lower.
- 7.5 1000PB00124 - Fitting Instructions Control Board Assembly.
- 7.6 1000PB00126 - Fitting Instructions Power PCB Assembly.
- 7.7 1000PB00127 - Fitting Instructions Battery.
- 7.8 1000PB00128 - Fitting Instructions Power Switch.
- 7.9 1000PB00129 - Fitting Instructions Mains Fuse.
- 7.10 1000PB00167 - Fitting Instructions Display Board Assembly.
- 7.11 1000PB00168 - Fitting Instructions Transmission Assembly.

## 7.1 1000PB00018 ISSUE 7

### Spares Kit Front Panel Label V4

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1000ME00052/1001PP00003/5000PP00001 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004/5000JG00001.**

## 1.0 Introduction

This instruction applies to all front labels as fitted to all models and versions of the P1000, P2000, P3000, P4000 and P5000 Syringe Pumps.

## 2.0 Removal Instructions

- 2.1 The front panel is designed to protect and seal against fluid ingress. If its is suspected that fluid has entered the pump it is strongly recommended that the unit is opened and the Display PCB, Control PCB and the PSU PCB are removed for examination.  
Once it has been ascertained that no damage has occurred to the internal components of the pump the existing front panel may be removed.
- 2.2 Using a sharp edge (e.g. a scalpel) carefully lift one corner of the panel, taking care not to damage the painted surface of the upper case.

## 7.1 1000PB00018 ISSUE 7 (CONT)

- 2.3 Peel the panel away from the case, and ensure that all the spacers fitted into the switch recess are retained in their existing locations.
- 2.4 Peel or rub off any adhesive residue and then degrease the inset with isopropyl alcohol. Ensure that the solvent does not enter the case and get onto the rate switches or any other part of the PCB's.  
Ensure that the displays are clean and that no debris has found its way into the recesses around the switches or displays.

## **3.0 Fitting Instructions**

- 3.1 Ensure that the displays are clean and that no debris has found its way into the recesses around the switches or displays.

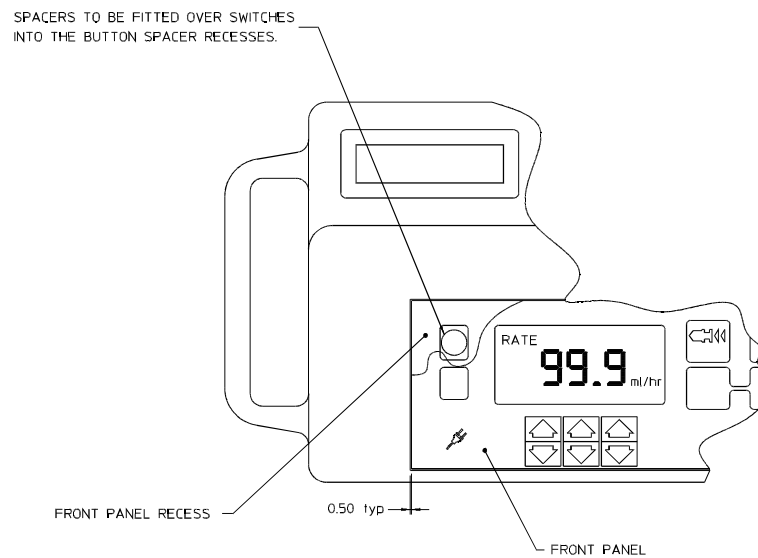
**Note: MANUFACTURING USE ONLY: The Teknek DCR4 roller may be used to improve cleaning and dust removal.**

- 3.2 If using the clip front panel buttons, place these over the switches. Check that all switches operate correctly.
- 3.3 Place the panel into the case recess (see diagram 1) as shown. Ensure it has the correct clearance around the label, we recommend 0.5mm on both sides.  
If necessary trim the panel with a scalpel and steel rule.
- 3.4 Remove the protective film (if fitted). Clean the back of the window (P5000 units only).
- 3.5 Remove the section of the adhesive backing up to about halfway along the main rate LCD display. Leave the rest of the backing in place.  
Then press the part of the panel with the backing removed into the inset smoothly, avoiding trapping any air behind it. Take care that the panel is properly positioned, since once it has been fitted it is difficult to remove without damaging it.
- 3.6 Now lift the rest of the label and remove the remaining backing before pressing this down.
- 3.7 Carefully test that all the switches operate correctly. Complete the self test sequence '223' as described in the relevant section of the service manual.
- 3.8 The unit may now be returned into service.



## 7.1 1000PB00018 ISSUE 7 (CONT)

Figure 1.



## **4.0 Technical Inquiries.**

For additional technical assistance, contact your local ALARIS Service Centre.

## 7.2 1000PB00058 ISSUE 4

### Spares Kit Case Upper V4

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

### 1.0 Introduction

This fitting instruction applies to the replacement of the V4 style upper case. To replace the upper case it will be necessary to gain access to the inside of the Syringe Pump.

**Important before fitting the new upper case it will be necessary to purchase a new front panel label, see table overleaf for part number and type :**

## 7.2 1000PB00058 ISSUE 4 (CONT)

PART NUMBER	DESCRIPTION
1000LB00032	LABEL FRONT PANEL IVAC P1000 ENGLISH
1000LB00040	LABEL FRONT PANEL IVAC P1000 DUTCH
1000LB00047	LABEL FRONT PANEL IVAC P100 FRENCH
1000LB00055	LABEL FRONT PANEL IVAC P1000 GERMAN
1000LB00066	LABEL FRONT PANEL IVAC P1000 SPANISH
1000LB00088	LABEL FRONT PANEL IVAC P1000 SWEDISH
2000LB00019	LABEL FRONT PANEL IVAC P2000 ENGLISH
2000LB00025	LABEL FRONT PANEL IVAC P2000 DUTCH
2000LB00031	LABEL FRONT PANEL IVAC P200 FRENCH
2000LB00037	LABEL FRONT PANEL IVAC P2000 GERMAN
2000LB00054	LABEL FRONT PANEL IVAC P2000 SWEDISH
3000LB00005	LABEL FRONT PANEL IVAC P3000 ENGLISH
3000LB00006	LABEL FRONT PANEL IVAC P3000 DUTCH
3000LB00007	LABEL FRONT PANEL IVAC P300 FRENCH
3000LB00008	LABEL FRONT PANEL IVAC P3000 GERMAN
3000LB00009	LABEL FRONT PANEL IVAC P3000 SPANISH
3000LB00013	LABEL FRONT PANEL IVAC P3000 SWEDISH
4000LB00002	LABEL FRONT PANEL IVAC P4000 ENGLISH
4000LB00003	LABEL FRONT PANEL IVAC P4000 DUTCH
4000LB00004	LABEL FRONT PANEL IVAC P400 FRENCH
4000LB00005	LABEL FRONT PANEL IVAC P4000 GERMAN
4000LB00006	LABEL FRONT PANEL IVAC P4000 SPANISH
4000LB00009	LABEL FRONT PANEL IVAC P4000 SWEDISH

## 2.0 Access to the Pump

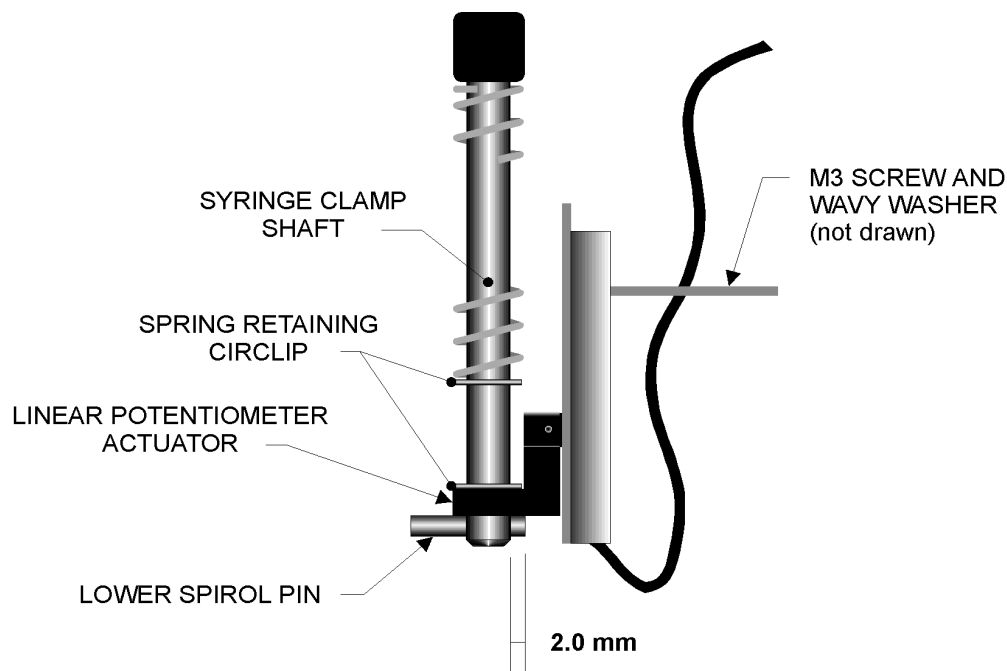
- 2.1 Place the unit on a static dissipative surface that is correctly grounded.
- 2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit.
- 2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply and RS232 cables if fitted.

## **7.2 1000PB00058 ISSUE 4 (CONT)**

### **3.0 Fitting Instructions**

- 3.1 Carefully remove the syringe type label from the existing upper case and transfer it to the new upper case.  
Fit the serial label (supplied) to the new upper case and copy across the number from the old upper case.
- 3.2 Carefully remove the transmission flexible circuit connector, strain gauge beam connector, linear potentiometer connector and shielding cable.
- 3.3 Remove the six PCB fixing screws and withdraw both the control and display PCB's together. The two PCB's are linked by a turned pin connector.  
Fitted over the buttons on the control panel are spacers, ensure these are still in position and are not still in the recesses of the old upper case.  
Fit the PCB's into the new upper case taking care not to disturb the spacers. Secure using the six screws removed earlier.
- 3.4 Remove the three M4 screws and washers securing the transmission chassis plate to the upper case, then remove the two M4 countersunk screws from the beam. Lift the transmission assembly out of the upper case. Do not refit.
- 3.5 Remove the lower spirol pin which retains the linear potentiometer actuator. Undo the M3 screw which retains the potentiometer mounting bracket and slide the actuator off the syringe clamp shaft, removing the assembly from the case half.  
Carefully prise the spring retaining circlips (2 off) from the shaft and remove the shaft and spring. Refit into the new upper case.  
Now slide the actuator over the shaft and refit the diameter 3.0mm x 16mm long spirol pin, such that the pin is orientated to slide in the groove in the lower case. 2mm should protrude through the other side of the shaft to aid in the location and support of the actuator.
- 3.6 Fit the silicone cord (1000ME01087) into the groove in the upper case. The join of the silicone cord is to be fitted in the same position as the old case. Ensure that the cord is not stretched as it is fitted as this will impair the cords ability to seal the join between the two cases when the unit is fully assembled.

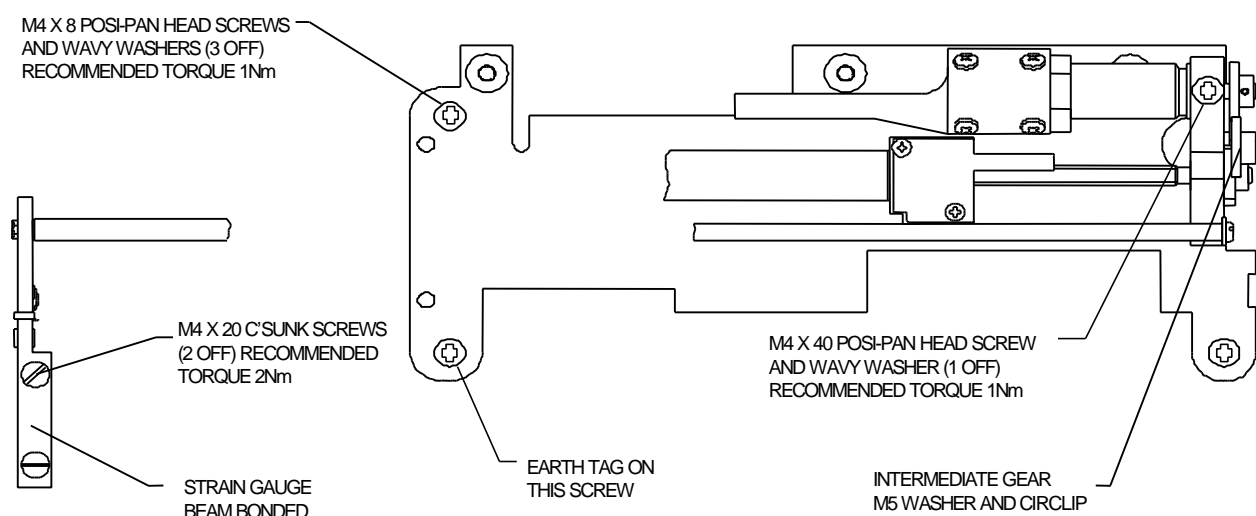
## 7.2 1000PB00058 ISSUE 4 (CONT)



### POTENTIOMETER ACTUATOR ASSEMBLY

- 3.7 Refit the M3 screw and wavy washer to secure the potentiometer mounting bracket. Before tightening the screw fully check the potentiometer is fitted parallel to the syringe clamp shaft subtly bending the bracket if necessary.  
Tighten the screw fully and check that the shaft, potentiometer actuator and slider operate freely.
- 3.8 Replace the transmission assembly into the new upper case, ensuring that the torsion rod is correctly located in the torsion rod bracket and that both the outer tube and leadscrew seals are correctly located in their respective positions in the case.  
Screw down the transmission at the beam end and chassis plate using the M4 screws and washers removed earlier on the chassis plate and the two countersunk screws on the beam end and also the earth tag.  
Check that the leadscrew gear does not touch the upper case wall and that a minimum gap of 1mm exists between the back face of the gear and the front face of the motor bearing plate. The clearance is dependant upon the fixing position of the strain gauge beam. Refit the idler and circlip.  
Remove the middle idler gear on the motor mounting plate. Check the leadscrew rotates smoothly and both the outer tube seal and leadscrew seal are free to rotate without binding. If there is resistance or a tight spot it will be necessary to remove the transmission and investigate this.

## 7.2 1000PB00058 ISSUE 4 (CONT)



PART VIEW OF THE TRANSMISSION ASSEMBLY

- 3.9 Confirm that the declutch microswitch actuates before the transmission can be disengaged and the transmission can be moved freely along the leadscrew.  
If the movement is restricted it will be necessary to readjust the two screws securing the microswitch mounting plate to the carriage.
- 3.10 Refit the transmission flexible connector, strain gauge beam connector, linear potentiometer connector and shielding cable back to the control PCB. This needs to be done when transmission is fitted.
- 3.11 Reconnect the upper and lower case halves ensuring the grey ribbon cable is reconnected to the control PCB and the RS232 cables (if fitted) are reconnected.  
Before screwing the unit back together it is advisable to carry out the self test routine as described in the technical service manual. Functionally check the operation and sensitivity of the various front panel buttons. Secure the two case halves using the M4 x 45mm long screws and washers.
- 3.12 Repeat the self test routine and confirm the occlusion and linear speed calibration. Functional testing may also be advisable prior to returning the unit back into service.

## **4.0 Technical Inquiries.**

For additional technical assistance, contact your local ALARIS Service Centre.

## 7.3 1000PB00044 ISSUE 4

### Spare Motor Gearbox V4

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1000ME00052/1001ME00152 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

### 1.0. Introduction

This motor gearbox assembly 1000SP00030 is a direct replacement for all units manufactured post build issue 1000ME00052 Issue 15 and all Version 4 units.

Pumps manufactured prior to this build issue require a different assembly 1000SP00031 which includes additional items to bring the transmission up to the current specification.

## **7.3 1000PB00044 ISSUE 4 (CONT)**

### **2.0 Access to the Pump**

- 2.1 Place the unit on a static dissipative surface that is correctly grounded.
- 2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit and withdraw the base plate.
- 2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply PCB.

### **3.0 Fitting Instructions**

- 3.1 Remove the circlip and idler gear from the spigot on the motor mounting plate. Retain the spacer (an M5 plain washer) fitted behind the idler gear.
- 3.2 Rotate the gear fitted to the motor until it is positioned such that the securing pin can be removed.  
Since the motor gearbox is already damaged the pin can be drifted out in situ using a 2 m.m. diameter punch. However take care not to damage the gear teeth during this process as it will need to be fitted to the new motor gearbox later.
- 3.3 Disconnect the flexible circuit from the motor opto mount by removing the four self-tapping screws (No 4 x 1/4" ; 4 off).  
Desolder the two motor wires noting carefully the routing of the two wires. It is important on reassembly to ensure that these wires are correctly positioned and do not foul the opto rotor fitted to the rear of the motor.
- 3.4 Disconnect the motor/gearbox assembly from the motor mounting plate by removing the fixing screws (M2 x 12 m.m. ; 2 off).
- 3.5 Examine the relationship between the opto mount, the four mounting holes on the front face of the motor gearbox and the motor mounting plate. This is shown pictorially in Figure 1.
- 3.6 Having noted this, loosen the M3 grubscrew (where fitted) on the opto mount and then remove both the opto mount and rotor from the rear of the motor.
- 3.7 Carefully push the opto rotor onto the rear output shaft of the replacement motor, leaving approximately 0.5 m.m. of the shaft visible between the flag hub and the rear face of the motor body.
- 3.8 Replace the opto mount onto the rear of the motor such that it is orientated correctly with respect to the mounting holes (see Fig. 1.) and touches the gearbox sleeve. Tighten the grubscrew (where fitted) sufficiently only to retain the mount - do not over tighten.



### 7.3 1000PB00044 ISSUE 4 (CONT)

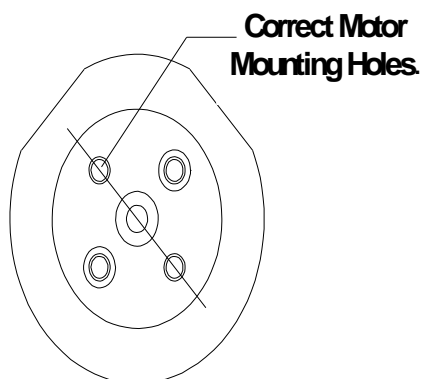


Figure 1. Correct orientation of opto mount with respect to the four holes on the front face of the motor gearbox.

Route the two wires on the rear of the motor around the inside of the opto mount, clear of the opto rotor. If either of the two wires rubs against the shaft of the opto rotor it will stall the motor and give error code 'Er4'.

- 3.9 Fit replacement motor gearbox assembly to the motor mounting plate. Use Loctite 242 (or equivalent) to the ends of the screw threads to prevent the screws working loose.

Note that of the four holes arranged on the face of the gearbox, the two holes without the rings around them are the two which must be used to secure the motor to the mounting plate.

- 3.10 Trim and strip the wires to imitate the original wire routing. This is best achieved by tucking the spare wire up between the encoder mount and the under-side of the flexible circuit, looping it neatly out of the way as shown in figure 2.

Solder the two motor wires to the flexible circuit such that the black wire is connected to the pad marked '+'.

Secure the flexible circuit to the motor gearbox assembly using the four self tapping screws. Note that the two shorter screws are fitted to the locations nearest to the motor mounting plate.

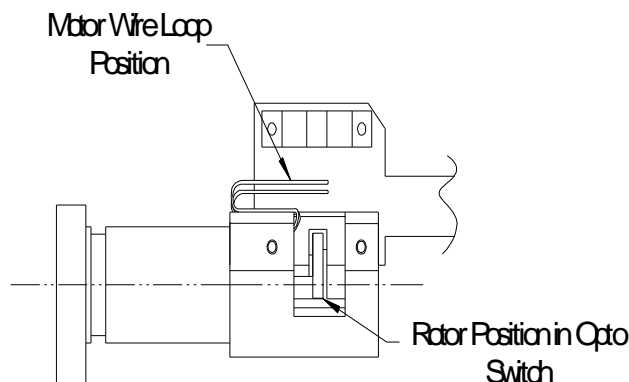


Figure 2. Routing of motor wires between opto mount and flexible circuit.

### **7.3 1000PB00044 ISSUE 4 (CONT)**

Ensure that the two wires from the motor to the flexible circuit do not foul the opto rotor or it is likely that the motor will stall, producing an error code, 'Er4'.

- 3.11 Check also that the opto rotor passes through the centre of the opto switch without touching any part of the switch as it rotates. Adjustment is best achieved by subtly adjusting the position of the opto mount rather than moving the opto rotor.
- 3.12 Refit the gear to the motor coupling by re-using the spirol pin (2 m.m. dia. by 10 m.m. ; 1 off) removed earlier.  
The motor shaft must be adequately supported whilst the pin is refitted. It is recommended that the pin is pressed in (for example by a vice ) in preference to other physical methods (for example a hammer) which may irreparably damage the gearbox output bearings  
Avoid damaging the input stages of the gearbox by spinning the gear fitted to the output shaft quickly. Only rotate the gear slowly to check the correct operation.
- 3.13 Refit the idler gear and circlip ensuring that the M5 plain washer is fitted in place behind the gear.
- 3.14 Reconnect any linking cables between the upper and lower case assemblies and carefully re-fit the base panel. Finally re-fit the pole clamp assembly, if previously removed.  
Use the self test procedure to check that the pump operates correctly and also confirm the appropriate calibrations for linear speed and occlusion alarm level.  
Once this has been completed the unit may be returned into service.

### **4.0 Technical Inquiries.**

For additional technical assistance, contact your local ALARIS Service Centre.

## 7.4 1000PB00092 ISSUE 9

### Spare Upgrade Kit Lower Case V4

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

After fitting any component ensure that all the test calibration procedures are carried out as recommended in the technical service manual.

For further information refer to final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the service manual 1000PB00048 when following this instruction.

Ensure that no undue force is applied to the plunger holder and leadscrew when the unit is placed upside down to remove the six retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

## 1.0 Introduction

Units with a build issue below 20 were fitted with lower case 1000ME01001. This part was superseded by 1000SP01026 and has since been superseded by 1000ME01100.

The lower case 1000ME01100 is made from a stronger material and is directly interchangeable with the 1000SP01026 lower case (build issues 20 - 70). It also has an easily cleanable drainage channel to allow spilt fluid to run off the pump and prevent the mechanism from being clogged up.

The RS232 and nursecall connectors have been redesigned since Build Issue 20. This was done to improve the ease of fitting the connectors into their appropriate ports. For units below Issue 20, there is a requirement to increase the length of the nursecall connector.

## 7.4 1000PB00092 ISSUE 9 (CONT)

The extension connector 1000SP01038 has been supplied in this kit for this purpose. The end label will also have to be replaced.

The RS232 Connector Gasket and the Splash Cover for the On/Off switch have also been redesigned. Both of these have been amended to improve sealing against fluid ingress. The new designs will withstand prolonged periods of fluid dripping or spraying onto them.

It will also be necessary to replace the instruction label when replacing the lower case. An additional label is to be fitted to the base of the pump. This is the alarm volume label.

### **2.0 Access to the Pump**

- 2.1 Place the unit on a static dissipative surface that is correctly grounded.
- 2.2 Remove the six retaining screws (M4 x 45mm pan head) located on the base of the unit.
- 2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply.

### **3.0 Fitting Instructions**

- 3.1 Carefully remove the serial number and syringe location label and refit them to new case supplied. If necessary, a new syringe location label is available on the label set. A new build issue label is supplied with the new lower case. The build issue label must be updated to the correct build status of the pump e.g. 1000ME00152 issue 2 plus 5, 6 etc. Add '71' to indicate Noryl case fitted. Fit the appropriate end label from 1000LB01015 in the same position as 1000LB01001 on the old case.
- 3.2 Remove the base plate and retaining screws from the old lower case.

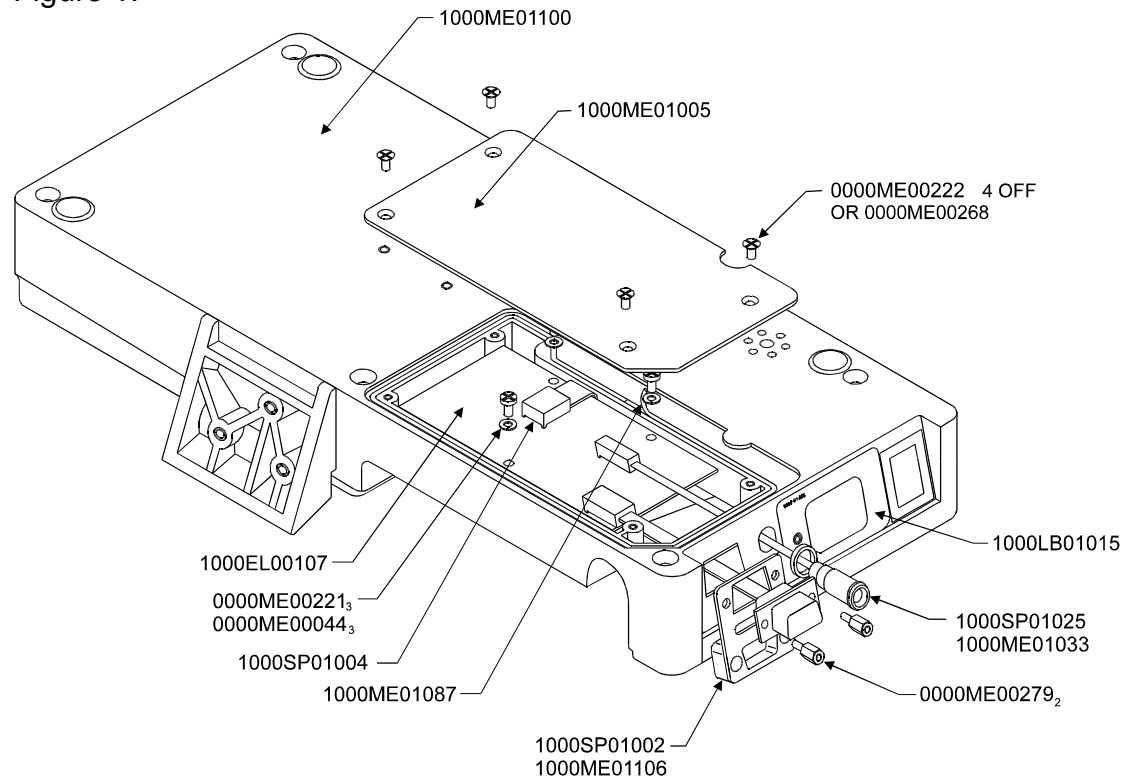
**Note: Instructions 3.3 to 3.6 apply to units fitted with the RS232 option only. If the unit you are working on does not have the RS232 option fitted then proceed to 3.7.**

- 3.3 Disconnect all the connectors from the communications board. Remove the three board retaining screws and washers from the communications board and remove the complete board assembly from the lower case. Refit the assembly into the new lower case and secure with the retaining screws removed earlier. See figure 1 for further information.

## 7.4 1000PB00092 ISSUE 9 (CONT)

- 3.4 Remove the nut and star washer retaining the nursecall connector. Remove the nursecall connector complete with the nursecall seal from the lower case assembly. Fit the nursecall extension lead 1000SP01038 (if required) to the nursecall connector and refit the assembly to the new lower case. Secure the assembly with the nut and star washer removed earlier. See Figure 1 for further information.

Figure 1.

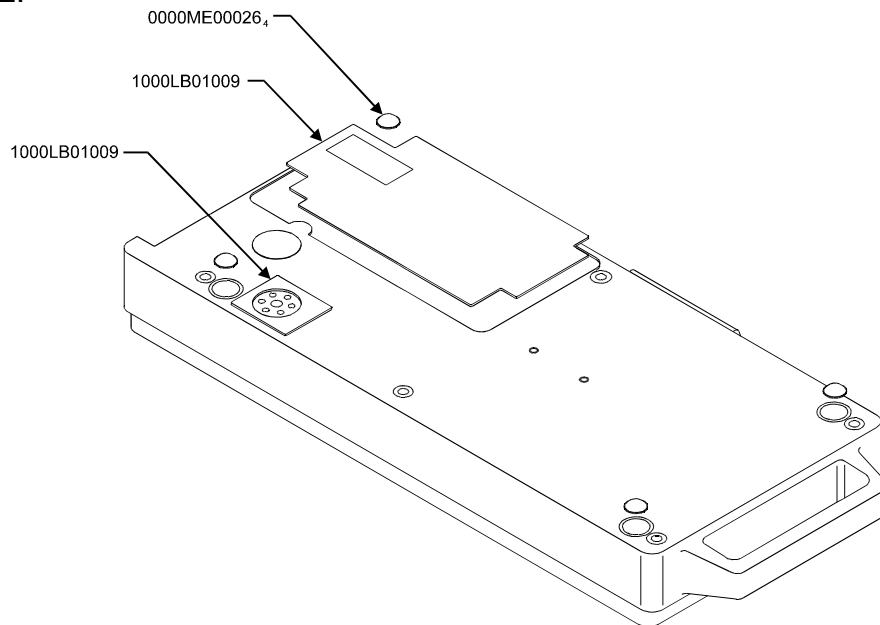


- 3.5 Remove the male/female spacers 0000ME00279 that secure the RS232 connector to the lower case. Remove the RS232 connector and the RS232 gasket from the lower case. Discard the RS232 gasket. Fit the RS232 gasket 1000ME01106 supplied to the RS232 connector assembly and refit into the new lower case. Secure the complete assembly with the male/female spacers removed earlier. If available, apply threadlock adhesive Loctite 242 or equivalent to the threads in order to secure them well. See figure 1 for further information. Fit the rubber cap over the connector when RS232 is not in use, to prevent fluid ingress through the connector.
- 3.6 Fit all the connectors into their appropriate sockets on the communications board.

## 7.4 1000PB00092 ISSUE 9 (CONT)

- 3.7 Remove the sealing cord fitted into the groove in the lower case. Fit the cord into the new lower case, ensure that the joint is in the same place as it is in the old lower case. See figure 1 for further information.
- 3.8 Fit the base plate and secure with the four retaining screws removed earlier. See figure 1 for further information.

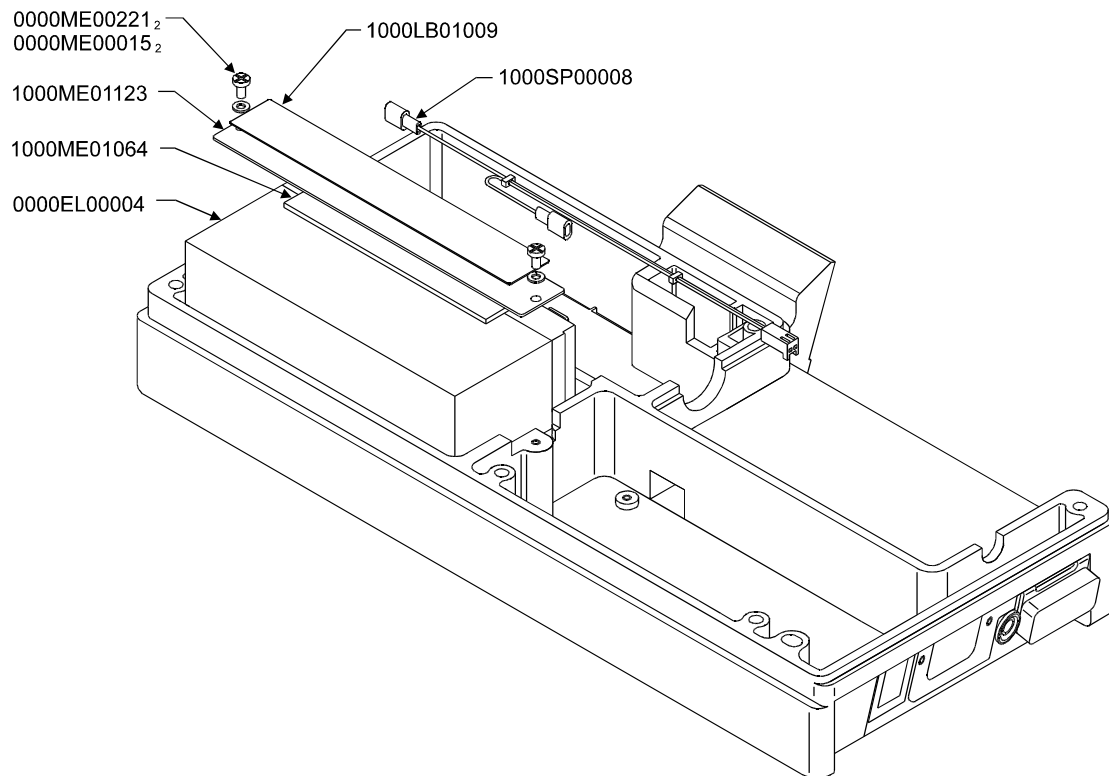
Figure 2.



- 3.9 Copy all the details pertaining to the specification of the syringe pump onto the specification label (1000LB01004) supplied. Fit the specification label centrally behind the clear panel on the base panel label. Ensure there is adequate adhesive margin around the fitted specification label. Peel off the backing paper from the base panel label and fit it centrally onto the RS232 plate.
- 3.10 Fit the four self-adhesive feet supplied to the same positions as those on the old lower case.
- 3.11 Fit the alarm volume label to the base of the pump. This is to be fitted with the artwork facing the pole clamp and alarm tube hole visible through the cut out.
- 3.12 Disconnect all battery, mains inlet and power switch connectors from the power board assembly. Remove the two battery plate retaining screws and remove the battery and battery plate assembly.
- 3.13 Fit the battery and battery plate assembly into the lower case and secure with the retaining screws removed earlier. Ensure that the battery cable assembly is loomed under the battery plate into the slot in the lower case. See figure 3 for further information.

## 7.4 1000PB00092 ISSUE 9 (CONT)

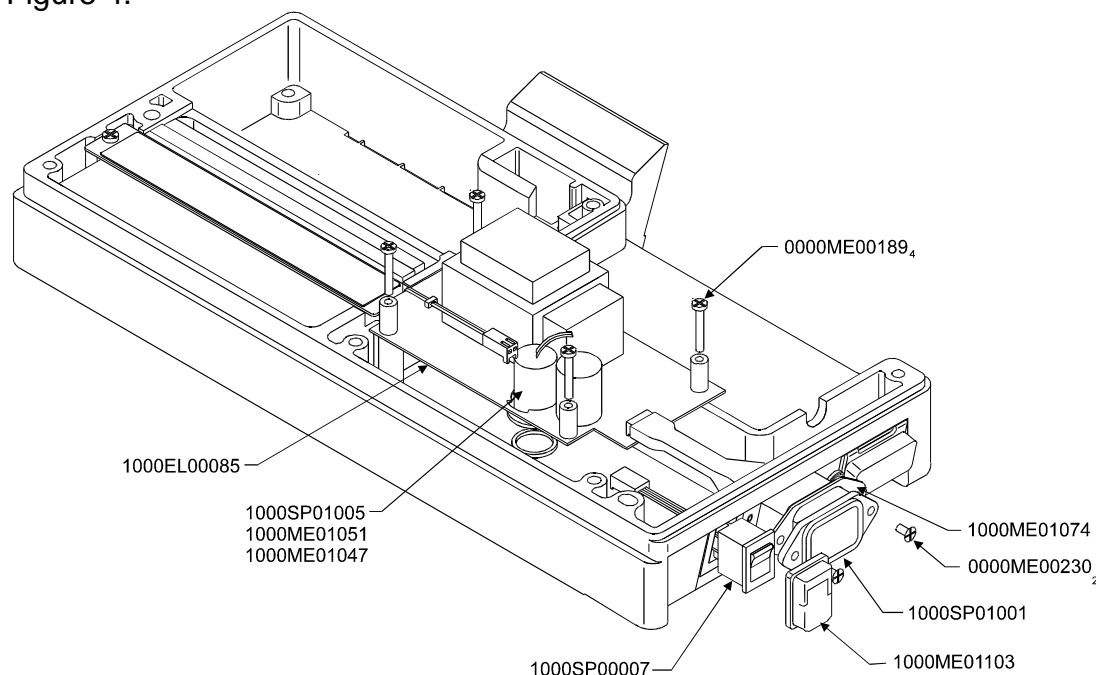
Figure 3.



- 3.14 Remove the power supply board retaining screws and remove the power supply board and audible alarm assembly from the lower case. Refit the audible alarm and power supply board assembly into the new lower case, secure with the four screws removed earlier.
- 3.15 Remove the two mains inlet retaining screws and remove the mains inlet and gasket from the lower case. Refit the gasket and mains inlet assembly to the new lower case. Secure with the two screws removed earlier. See figure 4 for further information.

## 7.4 1000PB00092 ISSUE 9 (CONT)

Figure 4.



- 3.16 Remove the power switch assembly from the old lower case. Remove the splash cover and black plastic shroud (if fitted). Fit the new splash cover 1000ME01103 onto the power switch. This cover has a built in shroud to prevent the power from accidentally being switched off. Ensure that the U shaped shroud is fitted over the "OFF" side of the switch. Refer to Figure 4 for additional information. Refit the power switch assembly to the new lower case.
- 3.17 Fit the mains inlet, power switch, and battery cable assemblies into the appropriate sockets on the power supply board.
- 3.18 Fit the appropriate alarm code label from 1000LB01009 to the front of the case.
- 3.19 Refit the upper and lower case assemblies back together, checking that the grey ribbon cable is connected to the control board and stowed in front of the heatsink. Ensure the syringe clamp operates freely, and then refit the six case retaining screws and washers removed earlier.
- 3.20 Carry out the self-test routine as outlined in the Directions for Use and check the linear speed and occlusion calibrated is within the appropriate limits published.

## 4.0 Technical Inquiries.

For additional technical assistance, contact your local Alaris Service Operations.



## 7.5 1000PB00124 ISSUE 3

### Fitting & Removal Instructions for Control PCB Assembly P1/2/3/4 Version 4

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

## 1.0 Introduction

This instruction applies to Control boards as fitted to all Models of the Version 4 P1000, P2000, P3000 and P4000.

## 2.0 Fitting & Removal Instructions

- 2.1 Carefully disconnect the flexible circuit (1000SP01040/1000SP01041), beam assembly strain gauge connection (1000SP00003), and the potentiometer connection (1000SP01017) from the board.
- 2.2 Remove the six mounting screws (1000ME00189). Retain these screws for later use when reassembling the boards.
- 2.3 Remove the control board (1000EL00091) and the display board assemblies from the unit.

## 7.5 1000PB00124 ISSUE 3 (CONT)

- 2.4 Carefully disconnect the control and the display boards (See below for part numbers). The boards should be disposed of in an environmental manner. Do not send back to the manufacturer.

Display Board Part No.	Language
1000EL00115	ENGLISH (P1000)
1000EL00096	FRENCH (P1000)
1000EL00097	GERMAN (P1000)
2000EL00010	ENGLISH (P2/3/4)
2000EL00008	FRENCH (P2/3/4)
2000EL00009	GERMAN (P2/3/4)

- 2.5 Connect the control and display board together with 6 spacers (0000ME00115) in between the two boards before securing the boards in the unit. Before placing a new board in the unit. Make sure that there is no dust on the front panel label or the LCDs on the display board.
- 2.6 Place the new boards in the unit and place the six mounting screws (1000ME00189) removed earlier.
- 2.7 Carefully reconnect the flexible circuit (1000SP01007), beam assembly strain gauge connection (1000SP00003), and the potentiometer connection (1000SP01017) to the board.
- 2.8 Once the new control board has been fitted then the following procedures need to be followed in order for the unit to work effectively.

## 3.0 Full Retest on Unit

### 3.1 Pump Set Up and Configuration

Test	Prompt	Setting	Comments	Access Code
Battery Low P1,P2,P3 P4	5.90V $\pm$ 0.02V 5.93V $\pm$ 0.02V	V		
RAM Clear '611'	Tick	[ ]		
Language/Default Code Configuration	2UGB0-Default [ ] L-0 [ ] 2FFR0 - ONLY [ ] L-1 [ ] 2DDD0 -ONLY [ ] L-2 2USP0 - ONLY L-0 Others - Appendix E	L -		***650*** ***651*** ***652*** ***653*** ***_ _ _***
Check Language Code	Tick	[ ]		***422***
Pump configuration	P1,2,3 / (P4, No Config.)	P	ALL	***251***
Syringe type	Sy X / (Symbol )	Sy	ALL	***462***

## 7.5 1000PB00124 ISSUE 3 (CONT)

100ml option selection	y-0 or y-1	y -	OPTION	***802***
Syringe size	d00	d	ALL	***359***
RS232 setting	C-0 or C-1	C -	ALL	***167***
Nursecall Enable/disable	nc-0 or nc-1	nc -	ALL	***168***
Declutch micro-switch set	3-1 to 3-0		Pass/Fail	***125***
NEOI point setting	4-0 to 4-1	Jig [ ] ml	See limits	
Plunger detect test	8-1 to 8-0		Pass/Fail	
Occlusion base level	L0D - L13	L	Ripple<8bits	***717***
Syringe size operation	C15-24 Bottom C90-D4 Top	[ ] [ ]	ALL	***243***
Labels & Buttons Check	Tick		ALL	***223***

### Test Results Sheet

Test	Prompt	Setting	P/F	Comments	Access Code
Pump type	P X	P		ALL	***123***
Pump ident	XX			ALL	
Software version	XrX	r		ALL	
Syringe type	SyX	Sy		ALL	***462***
100ml option	y-X	y -		ALL	***802***
Syringe size	dXX	d		ALL	
Extended rate	n-X	n -		P4	***906***
Running rate	r-X	r -		P4	***269***
Occlusion default	L-4	L -		ALL	***474***
Rate save	A-0 or A-1	A -		ALL	***983***
Vol infused save	b-0 or b-1	b -		ALL	***983***
Vol limit save	F-0 or F-1	F -		ALL	***983***
RS232 setting	C-0 or C-1	C -		ALL	***167***
Nursecall enable/disable	nc-0 or nc-1	nc -		ALL	***168***
KVO setting	E-0 or E-1	E -		ALL	***314***
Purge vol limit	X.X ml	. ml		ALL	
Audible alarm	Sounds t-1	two tones heard		ALL	***124***
Display test	Segments	*****		ALL	
Declutch switch	3-1 to 3-0	*****		ALL	***125***
NEOI detector	4-0 to 4-1	. ml Jig [ ]		ALL	
Linear grid test	5-0,-1,-0	*****		ALL	

## 7.5 1000PB00124 ISSUE 3 (CONT)

Motor test	6-0 to 6-1	*****		ALL	
Panel button	7-0 to 7-1	*****		ALL	
Plunger detect test	8-1 to 8-0	*****		ALL	
Test gear spacer Cal syr size base Difference	tick as appropriate CXX LXX	0000TG0001 0 0000TG0001 1 C L	[ ] [ ]	STANDARD 100ml OPT ALL	***243***
10ml syr size check	10ml	*****		P2,P3,P4	
100ml Option syr size check	<b>Check Operation</b> A1	***** *****		<b>P1-No Display</b> P2,P3,P4	
No load value	LXX (stored)	L (LOD-L13)		ALL	***717***
10 Kgf test	10kgF/LXX	10 kgf/L (Min Value > LA0)		ALL	
Occlusion cal	4.0kgf/LXX	L		ALL	
Bits/kgf	LXX/kgf	L		ALL	
Occlusion test	XX Kgf	kgf		ALL	

<b>Note Any Special Codes Configured Here &gt;&gt;&gt;&gt;&gt;</b>	
<b>Other Comments</b>	

Test	Prompt	Setting	P/F	Comments	Access Code
Speed test	m:ss:ss	: :		ALL	
PE resistance test	<10 Kohm	<10 Kohm		ALL	
Insulation resistance	>200Mohm	>200Mohm		ALL	
AC power failure	LED OFF 'AC' Alarm 'Bat Symbol'	*****	[ ] [ ] [ ]	ALL OPT, not FFR0 ALL	Disable 'AC' ***624***
Backlight check	ALL LED'S	*****		ALL	
RS232 test	Functions	*****		OPTION	
Nursecall test	Alarms	nc - 0 to nc-1 Test Function		OPTION	***168***
Nursecall disabled	nc - , check	nc - 0		OPTION	***168****

## 7.5 1000PB00124 ISSUE 3 (CONT)

Linear Performance Test	5ml/hr	<0.75 ml Peak To Peak		OPTION	METLIN34
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COMMENTS:

Unit tested and passed by: \_\_\_\_\_

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Test	Prompt	Setting	Initials	P/F	Comment	Access Code
Battery run start	dd/mth/Year hrs/mins	____/____/____ ____:____			ALL	
Battery run	P1,2,3; nc - 0 > 16hrs [ ] P4 ; nc - 0 > 8 hrs [ ] nc - 0 > 4hrs [ ]		***** ***** ***		For Opt 0B refer to 17.3	
Volume infused	Ref: Procedure	ml	*****		ALL	
Syringe check	Ref: Procedure	ml	*****		ALL	

## 7.5 1000PB00124 ISSUE 3 (CONT)

### 3.1.1 FINAL CHECK

TEST		PASS QC	
DOCUMENTATION			
Final tests completed, logged and within stated limits for unit and syringe type.		YES	NO
Pump information correct and all serial numbers recorded on test sheet.		YES	NO
SELF TEST			
Self test undertaken and all tests passed, configuration correct. ( 123 Test)		YES	NO
Language Code L- ____ (422)    Base level Recheck (+/-4bits) L____ (717)			
ELECTRICAL			
All keys functioning correctly without stickiness. (223 Test)		YES	NO
Unit resets correctly when switched on & off, volume infused & rate are zeroed.		YES	NO
MECHANICAL			
All screws and connectors correctly and securely fitted.		YES	NO
Syringe clamp rotates and lifts freely. Syringe sizing operates correctly and the sizes are displayed as appropriate.		YES	NO
Transmission is free and has no excessive mechanical noise when moved manually or when running.		YES	NO
All feet are present and secured.		YES	NO
No loose components are detected inside the pump when shaken.		YES	NO

**SIGNATURE** \_\_\_\_\_ **DATE** \_\_\_\_\_

## 4.0 Low Battery Level Calibration

- 4.1 Ensure that the unit is switched **OFF** and is not connected to any mains AC supply.
- 4.2 Turn the RV1 on the power PCB fully anticlockwise.
- 4.3 Disconnect the battery connector and connect a variable DC power supply to the power supply PCB (0v to pin 1) with short thick power leads. Note: some DC power supplies do not have sufficient output capacitance to simulate a battery. If variability is found in setting and checking the low battery level during setup then add a large (1000uF) electrolytic capacitor to the DC power supply output and ensure the leads to the unit are short (ie not inductive).
- 4.4 Set DC power supply to 6.5V and switch unit **ON**.

## 7.5 1000PB00124 ISSUE 3 (CONT)

- 4.5 Adjust the DC power supply downwards slowly until the unit alarms continuously and note the value of the power supply output. If this meets the requirements of the table below, ensure that the RV1 on the power supply PCB is sealed and then proceed.
- 4.6 Switch the pump off and set the DC power supply back to 6.5V.
- 4.7 Adjust the RV1 on the power supply PCB anticlockwise a number of turns. Switch the pump on and then adjust the DC power supply slowly down to the voltage shown. If you overshoot the voltage start again from section 4.6.
- 4.8 Now adjust the RV1 slowly clockwise until the unit goes into an intermittent audible alarm and the LCD display shows 'LO'. Ensure that this adjustment is carried out carefully and slowly to avoid overshooting the alarm set point.
- 4.9 Turn the unit **OFF** and then **ON** and a continuous audible alarm coupled with 'LO' shown on the LCD display should be present.

Note: That the alarm cannot reset or be muted by pressing the **STOP** button.

If the 'LO' display and a continuous alarm is not present repeat the above procedure from section 4.5.

- 4.10 Set the DC power supply to 6.5v and switch the unit **ON**.
- 4.11 Adjust the DC power supply downwards slowly until the unit alarms continuously and note the value of the power supply output. If this meets the requirements of the table seal the RV1 on the power supply PCB.
- 4.12 Turn the unit and the power supply **OFF**, remove any connections and refit the battery connector.

Figure 1

P1000, P2000, P3000	Without RS232/Nursecall	5.90V
	With RS232/Nursecall	5.90V
P4000	Without RS232/Nursecall	5.90V
	With RS232/Nursecall	5.93V

## 5.0 Technical Inquires.

For additional technical assistance, contact your local ALARIS Service Centre.

## 7.6 1000PB00126 ISSUE 4

### Fitting & Removal Instructions for Power PCB Assembly P1/2/3/4 Version 4

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

## 1.0 Introduction

This instruction applies to all Power PCBs as fitted to all Models of the Version 4 P1000, P2000, P3000 and P4000 Syringe Pumps.

## 2.0 Fitting & Removal Instructions

- 2.1 Disconnect the AC leads, DC Power ON/OFF and battery connections from the PSU board.
- 2.2 Remove the four mounting screws (0000ME00189). Retain the screws for board reassembly.
- 2.3 Withdraw the power PCB assembly (1000EL00085 (240V) or 1000EL00129 (110V)) from the unit.



## 7.6 1000PB00126 ISSUE 4 (CONT)

- 2.4 To fit the new Power PCB assembly, place the new board in position and screw back into position using the screws earlier removed and reconnect the AC leads, DC power ON/OFF and the battery connections.
- 2.5 When the new assembly is fitted then the following procedures need to be followed in order for the unit to work effectively.

### 3.0 Self Test '123'

- 3.1 Press power **ON/OFF** switch to the **OFF** position.
- 3.2 Hold down the **START** button and press power **ON/OFF** switch to the **ON** position.
- 3.3 Display will show "- - -".
- 3.4 Enter "**123**" using the rate selection buttons.
- 3.5 Press **STOP** to commence self test sequence.
- 3.6 The unit will now proceed through a series of tests as described below. Press the **STOP** button to move to the next test, or press the **START** button to exit the self test mode and return to normal operation.
- 3.7 Should the unit fail this test sequence, it should be taken out of use and inspected by a qualified service engineer.

DISPLAY		TEST DESCRIPTION
1	P1 P2 P3 P4	<b>PUMP MODEL</b> P1000 Syringe Pump <b>P2000 Syringe Pump</b> P3000 Syringe Pump <b>P4000 Anaesthesia Syringe Pump</b>
2	00	<b>PUMP IDENTITY NUMBER:</b> Set via RS232 communications link. Default 00: can be set in the range of 0 -127.
3	_r_	<b>SOFTWARE ISSUE FITTED</b>
4	Sy-  Sy0  Sy0 Sy1 Sy2 Sy3  Sy4 Sy5 Sy6 Sy7 Sy8 SyA	<b>SYRINGE CALIBRATION CHECK:</b> Confirm that the code corresponds with the syringe label on the pump. IVAC, BD PLASTIPAK, SHERWOOD MONOJECT - P1000. IVAC, BD PLASTIPAK - P2000, P3000 AND P4000. TERUMO. B.BRAUN OMNIFIX. B.BRAUN PERFUSOR - 50ml syringe only (special kit required). FRESENIUS INJECTOMAT - 50ml syringe only. SHERWOOD MONOJECT. R.R. PRONTO. BD PLASTIPAK (Special "worldwide" version). ONCE - 50ml syringe only. JANPOL - 50ml syringe only.

## 7.6 1000PB00126 ISSUE 4 (CONT)

5	Y-0 Y-1	<b>100ml SYRINGE OPTION:</b> Refer to <b>USER DEFINED OPTIONS</b> . 100ml syringe option disabled. 100ml syringe option enabled – 100ml syringe kit fitted.
6	d00 d10 d20 d30 d50 Da1	<b>DEFAULT SYRINGE SIZE:</b> Refer to <b>USER DEFINED OPTIONS</b> . 10ml, 20ml, 30ml and 50/60ml syringes (P2,P3 and P4 only). 10ml syringe only 20ml syringe only 30ml syringe only 50/60ml syringe only 100ml syringe only – the 100ml syringe kit must be fitted.
7	P4000 only n-0 n-1	<b>EXTENDED FLOW RATE RANGE:</b> Indicates default status. 0.3ml/h up to 199ml/h – normal rate range 0.3ml/h up to 999ml/h (max 499ml/h for 10ml syringes). (min 0.5ml/h for 100ml syringes).
8	P4000 only r-0 r-1	<b>CHANGE INFUSION RATE STAUTS:</b> Indicates default status. Rate arrows disabled during infusion – normal rate range Rate arrows enabled during infusion
9	L-__	<b>OCCLUSION ALARM LEVEL:</b> Refer to <b>USER DEFINED OPTIONS</b> . Normal Default Level L-4: can be set in range L-0 to L-6.
10	A-0 A-1	<b>Infusion Rate set to zero</b> <b>Infusion Rate retained</b>
11	b-0 b-1	<b>Volume Limit set to zero</b> <b>Volume Limit retained</b>
12	F-0 F-1	<b>Volume Limit set to zero</b> <b>Volume Limit retained</b>
13	C-0 C-1	<b>RS232 COMMUNICATIONS LINK:</b> RS232 connector and hardware must be installed before communications are enabled. <b>Communications Disabled</b> <b>Communications Enabled</b> – the RS23 connector must be fitted.
14	nc0 nc1	<b>NURSECALL ALARM:</b> When fitted the nursecall alarm can be disabled to increase battery life. <b>Nursecall disabled</b> <b>Nursecall enabled</b>
15	E-0 E-1	<b>KVO (KEEP VEIN OPEN):</b> KVO enabled KVO Disabled

## 7.6 1000PB00126 ISSUE 4 (CONT)

16	<b>LIMIT 5.0ml</b>	<b>PURGE/BOLUS LIMIT:</b> Can be set in range 0.0ml up to 9.9ml.
17	<b>t-1</b>	<b>AUDIBLE ALARM TEST:</b> Check continuous alarm.
18	<b>00-FFF</b>	<b>DISPLAY TEST:</b> Check display through the full sequence.
19	<b>3-1</b> <b>3-0</b>	<b>DECLUTCH SWITCH TEST:</b> Squeeze plunger holder finger grips and check that the display alternates between 3-1 and 3-0. Drive engaged Drive disengaged
20	<b>4-0</b> <b>4-1</b>	<b>NEAR END OF INFUSION TEST:</b> Starting with an empty, extended 50/60ml syringe on the unit, squeeze the finger grips and move the plunger holder slowly to the left.  Check that the display switches from 4-0 to 4-1 indicating operation of the alarm system. The position at which the display changes will depend on the syringe type being used. (For example 4.7ml on a BD Plastipak 5/60ml syringe and 2ml on a TERUMO 50ml syringe). <b>Normal State</b> <b>Alarm Position and beyond</b>
21	<b>5-0</b> <b>5-1</b>	<b>LINEAR GRID TEST:</b> Squeeze the finger levers and position the drive mechanism to the right, then slowly move the syringe plunger holder to the left observing the display alternate between 5-0 and 5-1. <b>OPTO over slot in linear grid</b> <b>OPTO over bar in linear grid</b>
22	<b>6-1</b> <b>6-0</b>	<b>MOTOR ENCODER TEST:</b> Motor is pulsed while encoders are tested. Check display changes from 6-0 to 6-1 as encoder pass test. Encoders <b>PASS</b> – both encoders are operational. Encoders <b>FAIL</b>
23	<b>7-1</b> <b>7-0</b>	<b>FRONT PANEL TEST:</b> All front panel switches are checked to ensure that no buttons are stuck down. Check display changes from 7-0 to 7-1 indicating that all buttons have passed test. Control Buttons <b>PASS</b> Control Buttons <b>FAIL</b> – button continuously operating.
24	<b>8-0</b> <b>8-1</b>	<b>PLUNGER DETECT TEST:</b> Remove syringe then press plunger plate button to check. Syringe Plunger fitted No syringe fitted

## 7.6 1000PB00126 ISSUE 4 (CONT)

25	L _ _	<b>PUMPING PRESSURE DETECTION SYSTEMS TEST:</b> Unit runs for 10 seconds then stops. Confirm value is within normal range. Gently press back on the plunger holder and observe the value increase. Normal Base Level Range L08-L20 - hexadecimal format
26	C _ _	<b>SYRINGE SIZE DETECTION SYSTEM:</b> Lift syringe clamp and check that the number shown in the display increases within the normal range. Normal Range C20-Cff - hexadecimal format.
27		Press <b>STOP</b> to exit self test mode and return to normal operation.

## 4.0 Battery Run Test

**NOTE:** The pump under test must be fully charged before commencing the battery run test.

- 4.1 Switch the pump **OFF** and disconnect from the AC power.
- 4.2 Select a 50/60ml test syringe (0000TG00005) of the type specified on the label on the front of the pump. Refer to table below:

SYRINGE CODE	SYRINGE USED	START POINT
SY0	BD	60ml
SY1	Terumo	60ml
SY2	Braun Omnifix	60ml
SY3	Braun Perfusor	50ml
SY4	Fresenius	60ml
SY5	Sherwood, Ivac (or BD)	60ml, 50ml (60ml)
SY6	RR Pronto	60ml
SY7	BD Worldwide	60ml
SY8	Once	60ml
SYA	Janpol	60ml

- 4.3 Fit the test syringe to the pump and position the piston marker so that the leading edge is aligned with the 50/60ml mark as detailed above.
- 4.4 Switch the pump **ON** and if a P2000, P3000 or P4000 confirm a 50ml syringe size.
- 4.5 If starting from 60ml mark, set a rate of 2.5ml/hr.  
If starting from 50ml mark, set a rate of 2.0ml/hr.

## 5.0 Battery Charging and Low Battery Level Calibration

If the battery charging circuitry on the power supply PCB has been repaired the following sequence should be carried out to ensure that the battery can be charged correctly.

## 7.6 1000PB00126 ISSUE 4 (CONT)

Field replacement power supply PCB assemblies are supplied from ALARIS with the charging voltage set to the correct value. The procedure below can be followed in order to check the setting if deemed necessary.

- 5.1 Ensure that the unit is tuned off and disconnected from the AC power supply.
- 5.2 Obtain access to the unit.
- 5.3 Disconnect the battery connector from the power supply PCB.
- 5.4 Connect an oscilloscope to measure the DC voltage on PL3. (0v to pin 1).
- 5.5 Set the range on the oscilloscope to be able to display 0 to 7V DC.
- 5.6 Connect the unit to an AC power supply.
- 5.7 Adjust the RV0 on the power supply PCB until the peak voltage level displayed on the oscilloscope is 7.0V +/-0.1 volts.
- 5.8 Seal the RV0 to avoid battery charge level changing.
- 5.9 Disconnect the AC power supply, remove the oscilloscope connections and refit the battery connector.

### Low Battery Level Calibration

If either the control or power supply PCB have been replaced or modified then the following sequence should be carried out to ensure that the correct low battery level is detected.

- 5.10 Obtain access to the unit.
- 5.11 Ensure the unit is switched **OFF** and that it is not connected to the mains AC supply.
- 5.12 Turn the RV1 on the power PCB fully anticlockwise.
- 5.13 Disconnect battery connector and connect a variable DC power supply to the power supply PCB (0V to pin 1) with short, thick power leads. Note: some DC power supplies do not have sufficient output capacitance to simulate a battery. If variability is found in setting and checking the low battery level during set-up add a large (1000uF) electrolytic capacitor to the DC power supply output and ensure the leads to the unit are short (ie not inductive).
- 5.14 Set the DC power supply to 6.5V and switch the unit **ON**.
- 5.15 Adjust the DC power supply slowly downwards until the unit alarms continuously and note the value of the power supply output. If this meets the requirements of the table below, ensure the RV1 on the power supply PCB is sealed and then proceed to step 5.22.
- 5.16 Switch the pump off and set the DC power supply back to 6.5V.
- 5.17 Adjust the RV1 on the power supply PCB anticlockwise a number of turns. Switch the pump on and then adjust the DC power slowly down to the voltage shown in the table below. If you overshoot the voltage start again from section 5.16.

## 7.6 1000PB00126 ISSUE 4 (CONT)

- 5.18 Now adjust the RV1 slowly clockwise until the unit goes into an intermittent audible alarm and the LCD display shows 'LO'. Ensure that this adjustment is carried out carefully and slowly to avoid overshooting the alarm set point.
- 5.19 Turn the unit **OFF** and then **ON** and a continuous audible alarm coupled with 'LO' shown on the LCD display should be present.

Note: That the alarm cannot be reset or muted by pressing the STOP button.

If the 'LO' display and a continuous alarm is not present repeat the above procedure from step 5.15.

- 5.20 Set the DC power supply to 6.5V and switch the unit **ON**.
- 5.21 Adjust the DC power supply downwards slowly until the unit alarm continuously and note the value of the power supply output. If this meets the requirements of the table below, seal the RV1 on the power supply PCB.
- 5.22 Turn the unit and power supply **OFF**, remove the connections and refit the battery connector.

P1000/P2000/P3000	Without RS232/Nursecall With RS232/Nursecall	5.90V 5.90V
P4000	Without RS232/Nursecall With RS232/Nursecall	5.90V 5.93V

## 6.0 Potential Equalisation Terminal Resistance Test

The equipment for this testing is as follows:

DVM Resistance Meter (e.g Fluke)

- 6.1 Connect one lead from the DVM resistance meter to the PE terminal on the pole clamp of the unit and the other end to the leadscrew. Check that the settled value of resistance is less than 10k Ohms.

Note: If option 0G is fitted, use the pin on the pole clamp instead of the PE terminal.

- 6.2 Move the lead from the leadscrew and repeat the check with the lead to the outer tube. Check that the settled value of resistance is less than 10k.
- 6.3 If either of the readings are greater than 10k Ohms, the pump fails this test and must be removed from service and labelled for further investigation.

## 7.6 1000PB00126 ISSUE 4 (CONT)

### 7.0 Electrical Safety Test

The equipment required for this test is as follows:

500V DC Megger tester.

Modified AC power cable with plug fitted and live and neutral pins linked.

- 7.1 Ensure that the pump is switched **OFF** and not connected to the AC Power.
- 7.2 Connect one lead from the megger to the linked live and neutral pins of the AC power cable and the other lead to the exposed metal leadscrew of the pump under test.
- 7.3 Activate the megger and keep the button depressed whilst the needle settles.
- 7.4 For the pump to pass this test the value displayed must be greater than 200M.

**7.5 If the pump is greater than this, the unit has passed this test if the value is less than this, then the unit has failed and the unit will need to be removed from service and require further investigation.**

### 8.0 AC Power Fail Test

- 8.1 Connect the pump to a convenient AC power source and ensure that the AC power led is illuminated.
- 8.2 Switch the pump **ON**.
- 8.3 Fit a syringe if necessary confirm a syringe size and set a rate using the rate increment buttons. Press **START** and the green **START** led will flash indicating that the pump is running. The battery symbol should not be visible.
- 8.4 Unplug the AC power lead. The AC power led should extinguish but the green **START** led should continue to flash.
- 8.5 If the AC alarm is enabled, the pump should alarm intermittently and the display prompt 'AC'. Press **STOP** to silence the alarm and **START** to restart the pump. The AC led should remain extinguished.

**8.6 The display should now show the set rate along with 'rate' and the battery symbol. Units with the AC alarm disabled, including all French default units, will proceed directly to this point.**

### 9.0 Technical Inquires.

For additional technical assistance, contact your local ALARIS Service Operations.

## 7.7 1000PB00127 ISSUE 2

### Battery V4

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

### 1.0 Introduction

This instruction applies to all Batteries as fitted to all Models of the P1000, P2000, P3000 and P4000.

### 2.0 Removal Instructions

- 2.1 Carefully disconnect battery socket from Power PCB assembly.
- 2.2 Remove two mounting screws from battery retaining plate. Retain the screws and washers for reassembly.
- 2.3 Withdraw battery and retaining plate from unit.
- 2.4 Disconnect crimp terminals from battery.
- 2.5 If necessary, detach retaining plate from battery, breaking bond created by adhesive pads.



## **7.7 1000PB00127 ISSUE 2 (CONT)**

### **3.0 Fitting Instructions**

- 3.1 To fit the new battery reverse the above instructions as in section 2.0.

### **4.0 Technical Inquires.**

For additional technical assistance, contact your local ALARIS Service Centre.

## 7.8 1000PB00128 ISSUE 2

### Power Switch V4

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

### 1.0 Introduction

This instruction applies to all Power Switches as fitted to all Models of the P1000, P2000, P3000 and P4000.

### 2.0 Removal Instructions

- 2.1 Disconnect power switch connector from power supply assembly.
- 2.2 Depress switch retaining clips and withdraw switch from lower case.
- 2.3 Retain shroud and splash cover.

## **7.8 1000PB00128 ISSUE 2 (CONT)**

### **3.0 Fitting Instructions**

- 3.1 Fit shroud and splash cover to switch.
- 3.2 Ensure that the shroud is fitted correctly with the widest part of shroud at the top.
- 3.3 Refit the switch in the lower case and connect to the power supply assembly.

### **4.0 Technical Inquires.**

For additional technical assistance, contact your local ALARIS Service Operations.

## 7.9 1000PB00129 ISSUE 2

### Mains Fuse V4

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

### 1.0 Introduction

This instruction applies to all Mains Fuses as fitted to all Models of the P1000, P2000, P3000 and P4000. If the pump continually displays the battery symbol and the AC Power indicator light does not illuminate when the pump is connected to the AC Power supply and switched **ON**, suspect that either the power supply fuse or the internal fuse has blown.

### 2.0 Removal Instructions

- 2.1 Switch the power **ON/OFF** switch to the **OFF** position and disconnect the unit from the AC power supply.

## **7.9 1000PB00129 ISSUE 2 (CONT)**

- 2.2 Carefully support the unit upside down and remove the six fixing screws. The pole clamp and base plate may be left in position.
- 2.3 Carefully separate the upper and lower sections of the unit and identify fuse holder reference FS1 on the power supply PCB in the lower case assembly.
- 2.4 Unscrew the fuse holder cap, remove and check fuse.
- 2.5 If the fuse has blown. Fit a new fuse of the correct type and rating. Do not exceed the current rating specified.

**Fuse: 220/240V units - T50mA Time Lag (5mmx20mm) (Pt/No 0000EL00093)**  
**110/120V units - T100mA Time Lag (5mmx20mm) (Pt/No 0000EL00094)**

- 2.6 If the fuse fails again after a short period, or the fuse in the power supply plug fails, take the unit out of service for examination by a qualified service engineer.

## **3.0 Technical Inquires.**

For additional technical assistance, contact your local ALARIS Service Operations.

## 7.10 1000PB00167 ISSUE 1

### Fitting & Removal Instructions for Display Board Assembly P1/2/3/4 Version 4

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1001PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

#### 1.0 Introduction.

This instruction applies to all display boards as fitted to all models of the Version 4 P1000, P2000, P3000 and P4000 Syringe Pumps.

#### 2.0 Fitting & Removal Instructions.

- 2.1 Carefully disconnect flexible circuit (1000SP01040/1000SP01041), beam assembly strain gauge connection (1000SP00003), potentiometer connection (1000SP01017).
- 2.2 Remove the six mounting screws (0000ME00189). Retain screws and washers for board reassembly.
- 2.3 Withdraw control and display PCB assemblies from unit.
- 2.4 Carefully disconnect control and display boards.
- 2.5 To fit a new display board assembly, connect the board to the control board and make sure that there is no dust on the front panel label and carefully remove the plastic cover protecting the display screen, place in the case making sure not to damage the display board screen.

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- 2.6 Refit the six securing screws removed earlier and then reconnect the flexible circuit, beam assembly strain gauge connection, potentiometer connection.
- 2.7 Once the display board has been fitted then the following procedures need to be followed in order for the unit to work effectively.

### 3.0 Self Test '123'

- 3.1 Press power **ON/OFF** switch to the **OFF** position.
- 3.2 Hold down the **START** button and press power **ON/OFF** switch to the **ON** position.
- 3.3 Display will show "- - -".
- 3.4 Enter "123" using the rate selection buttons.
- 3.5 Press STOP to commence self test sequence.
- 3.6 The unit will now proceed through a series of tests as described below. Press the STOP button to move to the next test, or press the **START** button to exit the self test mode and return to normal operation.
- 3.7 Should the unit fail this test sequence, it should be taken out of use and inspected by a qualified service engineer.

DISPLAY		TEST DESCRIPTION
1	P1	<b>PUMP MODEL</b> P1000 Syringe Pump P2000 Syringe Pump P3000 Syringe Pump P4000 Anaesthesia Syringe Pump
	P2	
	P3	
	P4	
2	00	<b>PUMP IDENTITY NUMBER:</b> Set via RS232 communications link. Default 00: can be set in the range of 0 -127.
3	_r_	<b>SOFTWARE ISSUE FITTED</b>
4	Sy-	<b>SYRINGE CALIBRATION CHECK:</b> Confirm that the code corresponds with the syringe label on the pump. IVAC, BD PLASTIPAK, SHERWOOD MONOJECT - P1000. IVAC, BD PLASTIPAK - P2000, P3000 AND P4000. TERUMO. B.BRAUN OMNIFIX. B.BRAUN PERFUSOR - 50ml syringe only (special kit required). FRESENIUS INJECTOMAT - 50ml syringe only. SHERWOOD MONOJECT. R.R. PRONTO. BD PLASTIPAK (Special "worldwide" version). ONCE - 50ml syringe only. JANPOL - 50ml syringe only.
	Sy0	
	Sy0	
	Sy1	
	Sy2	
	Sy3	
	Sy4	
	Sy5	
	Sy6	
	Sy7	
	Sy8	
	SyA	

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5	Y-0 Y-1	<b>100ml SYRINGE OPTION:</b> Refer to <b>USER DEFINED OPTIONS</b> . 100ml syringe option disabled. 100ml syringe option enabled – 100ml syringe kit fitted.
6	d00 d10 d20 d30 d50 dA1	<b>DEFAULT SYRINGE SIZE:</b> Refer to <b>USER DEFINED OPTIONS</b> . 10ml, 20ml, 30ml and 50/60ml syringes (P2,P3 and P4 only). 10ml syringe only 20ml syringe only 30ml syringe only 50/60ml syringe only 100ml syringe only – the 100ml syringe kit must be fitted.
7	P4000 only n-0 n-1	<b>EXTENDED FLOW RATE RANGE:</b> Indicates default status. 0.3ml/h up to 199ml/h – normal rate range 0.3ml/h up to 999ml/h (max 499ml/h for 10ml syringes). (min 0.5ml/h for 100ml syringes).
8	P4000 only r-0 r-1	<b>CHANGE INFUSION RATE STAUTS:</b> Indicates default status. Rate arrows disabled during infusion – normal rate range Rate arrows enabled during infusion
9	L- <u>  </u>	<b>OCCLUSION ALARM LEVEL:</b> Refer to <b>USER DEFINED OPTIONS</b> . Normal Default Level L-4: can be set in range L-0 to L-6.
10	A-0 A-1	<b>Infusion Rate set to zero</b> <b>Infusion Rate retained</b>
11	b-0 b-1	<b>Volume Limit set to zero</b> <b>Volume Limit retained</b>
12	F-0 F-1	<b>Volume Limit set to zero</b> <b>Volume Limit retained</b>
13	C-0 C-1	<b>RS232 COMMUNICATIONS LINK:</b> RS232 connector and hardware must be installed before communications are enabled. <b>Communications Disabled</b> <b>Communications Enabled</b> – the RS23 connector must be fitted.
14	nc0 nc1	<b>NURSECALL ALARM:</b> When fitted the nursecall alarm can be disabled to increase battery life. <b>Nursecall disabled</b> <b>Nursecall enabled</b>
15	E-0 E-1	<b>KVO (KEEP VEIN OPEN):</b> KVO enabled KVO Disabled



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16	<b>LIMIT 5.0ml</b>	<b>PURGE/BOLUS LIMIT:</b> Can be set in range 0.0ml up to 9.9ml.
17	<b>t-1</b>	<b>AUDIBLE ALARM TEST:</b> Check continuous alarm.
18	<b>00-FFF</b>	<b>DISPLAY TEST:</b> Check display through the full sequence.
19	<b>3-1</b> <b>3-0</b>	<b>DECLUTCH SWITCH TEST:</b> Squeeze plunger holder finger grips and check that the display alternates between 3-1 and 3-0. Drive engaged Drive disengaged
20	<b>4-0</b> <b>4-1</b>	<b>NEAR END OF INFUSION TEST:</b> Starting with an empty, extended 50/60ml syringe on the unit, squeeze the finger grips and move the plunger holder slowly to the left.  Check that the display switches from 4-0 to 4-1 indicating operation of the alarm system. The position at which the display changes will depend on the syringe type being used. (For example 4.7ml on a BD Plastipak 5/60ml syringe and 2ml on a TERUMO 50ml syringe). <b>Normal State</b> <b>Alarm Position and beyond</b>
21	<b>5-0</b> <b>5-1</b>	<b>LINEAR GRID TEST:</b> Squeeze the finger levers and position the drive mechanism to the right, then slowly move the syringe plunger holder to the left observing the display alternate between 5-0 and 5-1. <b>OPTO over slot in linear grid</b> <b>OPTO over bar in linear grid</b>
22	<b>6-1</b> <b>6-0</b>	<b>MOTOR ENCODER TEST:</b> Motor is pulsed while encoders are tested. Check display changes from 6-0 to 6-1 as encoder pass test. Encoders <b>PASS</b> – both encoders are operational. Encoders <b>FAIL</b>
23	<b>7-1</b> <b>7-0</b>	<b>FRONT PANEL TEST:</b> All front panel switches are checked to ensure that no buttons are stuck down. Check display changes from 7-0 to 7-1 indicating that all buttons have passed test. Control Buttons <b>PASS</b> Control Buttons <b>FAIL</b> – button continuously operating.
24	<b>8-0</b> <b>8-1</b>	<b>PLUNGER DETECT TEST:</b> Remove syringe then press plunger plate button to check. Syringe Plunger fitted No syringe fitted

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25	L _ _	<b>PUMPING PRESSURE DETECTION SYSTEMS TEST:</b> Unit runs for 10 seconds then stops. Confirm value is within normal range. Gently press back on the plunger holder and observe the value increase. Normal Base Level Range L08-L20 - hexadecimal format
26	C _ _	<b>SYRINGE SIZE DETECTION SYSTEM:</b> Lift syringe clamp and check that the number shown in the display increases within the normal range. Normal Range C20-Cff - hexadecimal format.
27		Press <b>STOP</b> to exit self test mode and return to normal operation.

### 3.3 Electrical Safety Test

The equipment required for the electrical safety test is as follows:

500V DC megger tester.

Modified AC power cable with plug fitted and live and neutral pins linked.

- 3.3.1 Ensure the pump that is under test is switched **OFF** and not connected to the AC power.
- 3.3.2 Connect one lead from the megger to the modified AC power cable and the other to the exposed metal leadscrew of the pump under test.
- 3.3.3 Activate the megger and keep the button depressed whilst the needle settles.
- 3.3.4 For the pump to pass this section the value displayed must be greater than 200M.
- 3.3.5 If the reading is less than this, the pump fails this test and must be removed from service and investigated further.

### 3.4 Potential Equalisation Terminal Resistance Test

The equipment required for the potential equalisation terminal resistance test is as follows:

DVM Resistance Meter (e.g Fluke)

- 3.4.1 Connect one lead from the DVM resistance meter to the PE terminal on the pole clamp of the unit and the other to the pump leadscrew. Check that the settled value of resistance is less than 10K.

If option OG is fitted, use the pin on the pole clamp instead of the PE terminal.

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- 3.4.2 Move the lead from the leadscrew and repeat the check with the lead to the outer tube. Check that the settled value of resistance is less than 10K.
- 3.4.3 If both the values are less than 10K then place the pump back into operation.
- 3.4.4 If the value of either of the readings are greater than 10K, the pump fails this test and must be removed from service and investigated further.

## 3.5 AC Power Fail Test

- 3.5.1 Connect the pump to a convenient AC power source and ensure that the AC power LED is illuminated.
- 3.5.2 Switch the pump **ON**.
- 3.5.3 Fit a syringe and if necessary confirm a syringe size and set a rate using the rate increment buttons. Press **START** and the green **START** led will flash indicating that the pump is running.
- 3.5.4 Unplug the AC power lead. The AC power led should extinguish but the green **START** led should continue to flash.
- 3.5.5 If the AC alarm is enabled, the pump should alarm intermittently and the display prompt 'AC'. Press **STOP** to silence the alarm and **START** to restart the pump. The AC led should remain extinguished.
- 3.5.6 The display should now show the set rate along with 'rate' and the battery symbol. Units with the AC alarm disabled, including french default units, will proceed directly to this point.

## 4.0 Technical Inquires

For additional technical assistance, contact your local ALARIS Service Centre.

## 7.11 1000PB00168 ISSUE 1

### Fitting & Removal Instructions for Transmission Assembly P1/2/3/4 Version 4

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no.1001PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

## 1.0 Introduction.

This instruction applies to all Transmission Assemblies as fitted to all models of the Version 4 P1000, P2000, P3000 and P4000 Syringe Pumps.

## 2.0 Fitting & Removal Instructions.

- 2.1 Remove the six transmission assembly screws (0000ME00255 x 2 off, 0000ME00246 x 3 off and 0000ME00225), the four wavey washers (0000ME00045), the flexible circuit assy and the beam connection from the transmission assembly.
- 2.2 Retain screws and washers for reassembly.
- 2.3 Withdraw the transmission from the upper case.
- 2.4 To fit a new transmission assembly, place the transmission into the upper case, ensuring that the seals are correctly located and that the beam is positioned before securing into position.

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- 2.5 Secure the transmission in place making sure that the torsion rod is correctly located in the torsion rod bracket and that both the outer tube and the leadscrew seals are located in their respective positions in the case.
- 2.6 Screw down the transmission at the beam end and chassis plate using the screws removed earlier.
- 2.7 Check that the leadscrew gear does not touch the upper case wall and that a minimum gap of 1mm exists between the back face of the gear and the front face of the motor bearing plate. The clearance is dependant upon the fixing position of the strain gauge beam. Refit the idler and the circlip.
- 2.8 Remove the middle idler gear on the motor mounting plate. Check the leadscrew rotates smoothly and both the outer tube seal and the leadscrew seal are free to rotate without binding. If there is resistance or a tight spot it will be necessary to remove the transmission and investigate this.
- 2.9 Confirm that the declutch microswitch actuates before the transmission can be disengaged and the transmission can be moved freely along the leadscrew.
- 2.10 If the movement is restricted it will be necessary to readjust the two screws securing the microswitch mounting plate to the carriage.
- 2.11 Refit the transmission flexible connector, strain gauge beam connector, linear potentiometer connector and the shielding cable back to the control board. This needs to be done when the transmission is finally fitted.
- 2.12 Once the transmission assembly has been fitted then the following procedures need to be followed in order for the unit to work effectively.

## 3.0 Self Test '123'

- 3.1 Press power **ON/OFF** switch to the **OFF** position.
- 3.2 Hold down the **START** button and press power **ON/OFF** switch to the **ON** position.
- 3.3 Display will show "- - -".
- 3.4 Enter "123" using the rate selection buttons.
- 3.5 Press **STOP** to commence self test sequence.
- 3.6 The unit will now proceed through a series of tests as described below. Press the **STOP** button to move to the next test, or press the **START** button to exit the self test mode and return to normal operation.
- 3.7 Should the unit fail this test sequence, it should be taken out of use and inspected by a qualified service engineer.

DISPLAY		TEST DESCRIPTION
1	<b>P1</b> <b>P2</b> <b>P3</b> <b>P4</b>	<b>PUMP MODEL</b> P1000 Syringe Pump P2000 Syringe Pump P3000 Syringe Pump P4000 Anaesthesia Syringe Pump
2	<b>00</b>	<b>PUMP IDENTITY NUMBER:</b> Set via RS232 communications link. Default 00: can be set in the range of 0 –127.
3	<b>_r_</b>	<b>SOFTWARE ISSUE FITTED</b>

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4	<b>Sy-</b>  <b>Sy0</b>  <b>Sy0</b> <b>Sy1</b> <b>Sy2</b> <b>Sy3</b>  <b>Sy4</b> <b>Sy5</b> <b>Sy6</b> <b>Sy7</b> <b>Sy8</b> <b>SyA</b>	<b>SYRINGE CALIBRATION CHECK:</b> Confirm that the code corresponds with the syringe label on the pump. BD PLASTIPAK. IVAC, BD PLASTIPAK - P2000, P3000 AND P4000. TERUMO. B.BRAUN OMNIFIX. B.BRAUN PERFUSOR – 50ml syringe only (special kit required). FRESENIUS INJECTOMAT - 50ml syringe only. SHERWOOD MONOJECT, IVAC. R.R. PRONTO. BD PLASTIPAK (Special “worldwide” version). ONCE - 50ml syringe only. JANPOL - 50ml syringe only.
5	<b>Y-0</b> <b>Y-1</b>	<b>100ml SYRINGE OPTION:</b> Refer to <b>USER DEFINED OPTIONS</b> . 100ml syringe option disabled. 100ml syringe option enabled – 100ml syringe kit fitted.
6	<b>d00</b>  <b>d10</b> <b>d20</b> <b>d30</b> <b>d50</b> <b>dA1</b>	<b>DEFAULT SYRINGE SIZE:</b> Refer to <b>USER DEFINED OPTIONS</b> . 10ml, 20ml, 30ml and 50/60ml syringes (P2,P3 and P4 only). 10ml syringe only 20ml syringe only 30ml syringe only 50/60ml syringe only 100ml syringe only – the 100ml syringe kit must be fitted.
7	<b>P4000 only</b>  <b>n-0</b> <b>n-1</b>	<b>EXTENDED FLOW RATE RANGE:</b> Indicates default status. 0.3ml/h up to 199ml/h – normal rate range 0.3ml/h up to 999ml/h (max 499ml/h for 10ml syringes). (min 0.5ml/h for 100ml syringes).
8	<b>P4000 only</b>  <b>r-0</b> <b>r-1</b>	<b>CHANGE INFUSION RATE STAUTS:</b> Indicates default status. Rate arrows disabled during infusion – normal rate range Rate arrows enabled during infusion
9	<b>L-__</b>	<b>OCCLUSION ALARM LEVEL:</b> Refer to <b>USER DEFINED OPTIONS</b> . Normal Default Level L-4: can be set in range L-0 to L-6.
10	<b>A-0</b> <b>A-1</b>	<b>Infusion Rate set to zero</b> <b>Infusion Rate retained</b>
11	<b>b-0</b> <b>b-1</b>	<b>Volume Limit set to zero</b> <b>Volume Limit retained</b>

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12	F-0 F-1	<b>Volume Limit set to zero</b> <b>Volume Limit retained</b>
13	C-0 C-1	<b>RS232 COMMUNICATIONS LINK:</b> RS232 connector and hardware must be installed before communications are enabled. <b>Communications Disabled</b> <b>Communications Enabled</b> – the RS23 connector must be fitted.
14	nc0 nc1	<b>NURSECALL ALARM:</b> When fitted the nursecall alarm can be disabled to increase battery life. <b>Nursecall disabled</b> <b>Nursecall enabled</b>
15	E-0 E-1	<b>KVO (KEEP VEIN OPEN):</b> KVO enabled KVO Disabled
16	<b>LIMIT 5.0ml</b>	<b>PURGE/BOLUS LIMIT:</b> Can be set in range 0.0ml up to 9.9ml.
17	t-1	<b>AUDIBLE ALARM TEST:</b> Check continuous alarm.
18	00-FFF	<b>DISPLAY TEST:</b> Check display through the full sequence.
19	3-1 3-0	<b>DECLUTCH SWITCH TEST:</b> Squeeze plunger holder finger grips and check that the display alternates between 3-1 and 3-0. Drive engaged Drive disengaged
20	4-0 4-1	<b>NEAR END OF INFUSION TEST:</b> Starting with an empty, extended 50/60ml syringe on the unit, squeeze the finger grips and move the plunger holder slowly to the left.  Check that the display switches from 4-0 to 4-1 indicating operation of the alarm system. The position at which the display changes will depend on the syringe type being used. (For example 4.7ml on a BD Plastipak 5/60ml syringe and 2ml on a TERUMO 50ml syringe). <b>Normal State</b> <b>Alarm Position and beyond</b>
21	5-0 5-1	<b>LINEAR GRID TEST:</b> Squeeze the finger levers and position the drive mechanism to the right, then slowly move the syringe plunger holder to the left observing the display alternate between 5-0 and 5-1. <b>OPTO over slot in linear grid</b> <b>OPTO over bar in linear grid</b>

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22	6-1 6-0	<b>MOTOR ENCODER TEST:</b> Motor is pulsed while encoders are tested. Check display changes from 6-0 to 6-1 as encoder pass test. Encoders <b>PASS</b> – both encoders are operational. Encoders <b>FAIL</b>
23	7-1 7-0	<b>FRONT PANEL TEST:</b> All front panel switches are checked to ensure that no buttons are stuck down. Check display changes from 7-0 to 7-1 indicating that all buttons have passed test. Control Buttons <b>PASS</b> Control Buttons <b>FAIL</b> – button continuously operating.
24	8-0 8-1	<b>PLUNGER DETECT TEST:</b> Remove syringe then press plunger plate button to check. Syringe Plunger fitted No syringe fitted
25	L _ _	<b>PUMPING PRESSURE DETECTION SYSTEMS TEST:</b> Unit runs for 10 seconds then stops. Confirm value is within normal range. Gently press back on the plunger holder and observe the value increase. Normal Base Level Range L08-L20 - hexadecimal format
26	C _ _	<b>SYRINGE SIZE DETECTION SYSTEM:</b> Lift syringe clamp and check that the number shown in the display increases within the normal range. Normal Range C20-Cff - hexadecimal format.
27		Press <b>STOP</b> to exit self test mode and return to normal operation.

### 3.1 Occlusion Calibration Test

To set up the occlusion alarm level for pumps, use occlusion test gear 0000TG00020 and follow the following procedure :

- 3.1.1 Ensure Power **ON/OFF** Switch is in the **OFF** position.
- 3.1.2 Hold down **START** button and press Power **ON/OFF** Switch to **ON** position.
- 3.1.3 Display will show - - -.
- 3.1.4 Enter 717 using the rate selection buttons.
- 3.1.5 Press **STOP** button and display will show LXX, where XX is the current reading from the pressure monitoring system displayed in hexadecimal format.
- 3.1.6 Press **STOP** again to start motor running.  
The display value may oscillate as the leadscrew rotates but this must not exceed an 8 bit span and should always be between 08 hex and 18 hex with no load applied.  
If calibration of the occlusion alarm level is not required, press **START** at this point.
- 3.1.7 To change this "base level", open pump and adjust RV1 on the control PCB and set within stated limits. Seal RV1 to prevent the base level from changing.



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- 3.1.8 Ensure unit is reassembled correctly and screwed together before attempting to calibrate the unit.
- 3.1.9 To begin calibration with unit still running, ensure the base level is stabilised and then press **STOP**.
- 3.1.10 Fit occlusion test gear 0000TG00020 and the plunger protector (0000JG00014) into the plunger holder. Move plunger holder towards dial gauge until it is just clear of the pad. Ensure the test gear is reset to zero.
- 3.1.11 Press **STOP** to start unit running.
- 3.1.12 When 4.0 Kgf is reached, as displayed on the test gear, press **STOP**.  
The display will then show the 4 Kgf bit value.  
Press **STOP** to store this value.
- 3.1.13 The display will now show the bits/Kgf value.  
Press **STOP** to store this value.
- 3.1.14 Remove test gear and switch unit **OFF**.
- 3.1.15 Proceed to the occlusion test procedure to confirm that the correct value has been stored.

## 3.2 OCCLUSION TEST

To test the occlusion alarm levels use test gear 0000TG00020 and follow the procedure below:

- 3.2.1 Declutch plunger holder and move to the right.
- 3.2.2 Fit occlusion test gear 0000TG00020 and fit the plunger protector (0000JG00014) in the plunger holder. Move plunger holder towards the test gear actuator pad, leaving the plunger holder just clear of the actuator pad. Ensure test gear is reset to 0Kg
- 3.2.3 Switch unit **ON**, and select 50ml syringe (not on P1000).  
**NOTE** It may be necessary to fit a spacer under the syringe clamp to register as 50ml syringe.
- 3.2.4 Set rate to 99.9 ml/hr and press **START**.
- 3.2.5 When unit alarms, check display says "**OCC**".
- 3.2.6 Press **STOP** to silence alarm.
- 3.2.7 Check with occlusion tables below (Table 3.2.1 or Table 3.2.2) that the unit alarms at the desired level.
- 3.2.8 If outside the stated limits, then repeat the occlusion calibration procedure and retest.  
Otherwise declutch, remove test gear and switch the unit **OFF**.

The values shown in Tables 3.2.1 and 3.2.2 are for 50/60ml and 10ml syringes only.

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**Table 3.2.1**  
**50/60ml Syringe Occlusion Test Limits for the P2000, P3000 & P4000**  
**Default level of L-4**

<b>Syringe Type</b>	<b>Alarm Level (Kgf)</b>	<b>Lower Limit (Kgf)</b>	<b>Upper Limit (Kgf)</b>
Sy0 B-D Plastipak	3.5	3.1	3.9
Sy1 Terumo	5.0	4.6	5.4
Sy2 B.Braun Omnifix	4.1	3.7	4.5
Sy3 B.Braun Perfusor	4.0	3.6	4.4
Sy4 Fresenius Injectomat	5.7	5.3	6.1
Sy5 Sherwood Monoject/IVAC	3.9	3.5	4.3
Sy6 RR Pronto	4.7	4.3	5.1
Sy7 BD Plastipak (World-wide)	3.6	3.2	4.0
Sy8 Once	3.9	3.5	4.3
SyA Janpol	3.9	3.5	4.3

**Table 3.2.2**  
**10ml Syringe Occlusion Test Limits for the P2000 and P3000**

<b>Syringe Type</b>	<b>Alarm Level (Kgf)</b>	<b>Lower Limit (Kgf)</b>	<b>Upper Limit (Kgf)</b>
Sy0 B-D Plastipak	1.5	1.1	1.9
Sy1 Terumo	2.0	1.6	2.4
Sy2 B.Braun Omnifix	1.3	0.9	1.7
Sy5 Sherwood Monoject/IVAC	1.4	1.0	1.8
Sy6 RR Pronto	1.5	1.1	1.9
Sy7 BD Plastipak (World-wide)	1.5	1.1	1.9

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### 3.3 Linear Speed Test

The linear accuracy of the pump can be checked by measuring the time that the plunger holder takes to travel a specified distance.

The distance travelled can be measured using a dial indicator which can be mounted in place of the syringe and the elapsed time can be measured using a stop watch.

To test the linear drive accuracy use test gear 0000TG00002 or equivalent and follow the procedure below:

- 3.3.1 Declutch the drive mechanism and move the plunger holder to the right.
- 3.3.2 Fit the linear test gear 0000TG00002 and fit the plunger protector (0000JG00014). Move plunger holder towards dial gauge until it is about 3mm clear of probe.
- 3.3.3 Turn the unit on and if the unit is a **P2000**, **P3000** or **P4000** then select or confirm that the syringe size is 50ml.
- 3.3.4 Set the rate to 99.9ml/hr and press **START**.
- 3.3.5 Allow the unit to run until it touches the probe and then using a stop watch, time the travel over a distance of 15.00mm.
- 3.3.6 Using the values specified in Table 3.3.1, check that the unit is travelling at the correct speed.
- 3.3.7 If the test values fall outside the stated limits then remove the unit for further investigation.
- 3.3.8 Switch the unit **OFF** and remove the test gear.

**Note that data for a combination of rates and syringe sizes have been provided should further testing be deemed necessary. It is not normally necessary to test for all the combinations provided.**

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**Table 3.3.1**  
**Linear Accuracy Table**

The following table of times relate to a specified distance travelled of 15.00mm.

Syringe Type Tolerance (1%)	Size (ml)	Flow Rate (ml/hr)	Time mins:secs	+/- sec
IVAC	50	99.9	05:01	03
	100	99.9	10:07	06
B-D Plastipak	10	10.0	14:18	10
		19.9	07:11	05
	20	10.0	25:16	16
		39.9	06:20	04
	30	10.0	32:19	20
		59.9	05:24	04
	50/60	10.0	49:00	30
		99.9	04:54	03
Terumo	10	10.0	17:52	11
		19.9	08:58	06
	20	10.0	28:16	17
		39.9	07:05	05
	30	10.0	37:23	23
		59.9	06:14	04
	50/60	10.0	58:27	36
		99.9	05:51	04
B.Braun Omnifix	10	10.0	17:48	11
		19.9	08:57	06
	20	10.0	28:07	18
		39.9	07:03	05
	30	10.0	34:26	22
		59.9	05:45	04
	50/60	10.0	53:31	33
		99.9	05:21	04
B.Braun Perfusor	50	10.0	54:37	33
		99.9	05:28	04
Fresenius Injectomat	50/60	10.0	60:16	36
		99.9	06:02	04
Sherwood Monoject	10	10.0	17:17	11
		19.9	08:41	06
	20	10.0	28:14	18
		39.9	07:05	05
	30	10.0	38:50	25
		59.9	06:29	04
	50/60	10.0	50:01	30
		99.9	05:00	03
RR Pronto	10	10.0	18:19	11
		19.9	09:12	06
	20	10.0	31:46	20
		39.9	07:58	05
	30	10.0	39:22	24
		59.9	06:34	04
	50/60	10.0	60:16	36
		99.9	06:02	04
ONCE	50/60	10.0	54:29	33
		99.9	05:29	04
JANPOL	50	10.0	53:27	32
		99.9	05:21	03

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### **3.4 Electrical Safety Test**

The equipment required for the electrical safety test is as follows:

500V DC megger tester.

Modified AC power cable with plug fitted and live and neutral pins linked.

- 3.4.1 Ensure the pump that is under test is switched **OFF** and not connected to the AC power.
- 3.4.2 Connect one lead from the megger to the modified AC power cable and the other to the exposed metal leadscrew of the pump under test.
- 3.4.3 Activate the megger and keep the button depressed whilst the needle settles.
- 3.4.4 For the pump to pass this section the value displayed must be greater than 200M.
- 3.4.5 If the reading is less than this, the pump fails this test and must be removed from service and investigated further.

### **3.5 Potential Equalisation Terminal Resistance Test**

The equipment required for the potential equalisation terminal resistance test is as follows:

DVM Resistance Meter (e.g Fluke)

- 3.5.1 Connect one lead from the DVM resistance meter to the PE terminal on the pole clamp of the unit and the other to the pump leadscrew. Check that the settled value of resistance is less than 10K.

If option OG is fitted, use the pin on the pole clamp instead of the PE terminal.

- 3.5.2 Move the lead from the leadscrew and repeat the check with the lead to the outer tube. Check that the settled value of resistance is less than 10K.
- 3.5.3 If both the values are less than 10K then place the pump back into operation.
- 3.5.4 If the value of either of the readings are greater than 10K, the pump fails this test and must be removed from service and investigated further.

### **3.6 AC Power Fail Test**

- 3.6.1 Connect the pump to a convenient AC power source and ensure that the AC power LED is illuminated.

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- 3.6.2 Switch the pump **ON**.
- 3.6.3 Fit a syringe and if necessary confirm a syringe size and set a rate using the rate increment buttons. Press **START** and the green **START** led will flash indicating that the pump is running.
- 3.6.4 Unplug the AC power lead. The AC power led should extinguish but the green **START** led should continue to flash.
- 3.6.5 If the AC alarm is enabled, the pump should alarm intermittently and the display prompt 'AC'. Press **STOP** to silence the alarm and **START** to restart the pump. The AC led should remain extinguished.
- 3.6.6 The display should now show the set rate along with 'rate' and the battery symbol. Units with the AC alarm disabled, including french default units, will proceed directly to this point.

## 4.0 Technical Inquires

For additional technical assistance, contact your local ALARIS Service Centre.

## 8.0 TROUBLESHOOTING

If you experience problems with your syringe pump use the trouble shooting table below to help identify the cause of the problem.

If the problem is unclear, carry out a self test routine in section 8.5. This will check the correct operation of the main functions of the syringe pump.

If the problem is included in the list below, read the details in the appropriate section. Before beginning diagnosis read section 8.1.

Fault	English	French	German	See Section
Pump has been dropped or damaged				8.3
Pump has been exposed to fluids				8.3
Pump will not power from battery				8.4
Pump will not power from AC mains				8.4
Power-up continuous alarm, abnormal display				8.6.1
Pump runs normally and resets after a time				8.6.2
Pump alarms showing	'SYR'	'SEr'	'A2'	8.6.3
Pump alarms showing	'DEC'	'dES'	'A1'	8.6.4
Pump alarms showing	'OCC'	'OCC'	'A3'	8.6.5
Pump alarms showing	'EOI'	'Fin'	'A4'	8.6.6
Pump alarms showing	'Er1'			8.6.7
Pump alarms showing	'Er2'			8.6.8
Pump alarms showing	'Er3'			8.6.9
Pump alarms showing	'Er4'			8.6.10
Pump alarms showing	'Er5'			8.6.11
Pump alarms showing	'Er6'			8.6.12
Pump alarms showing	'Er7'			8.6.13
Pump alarms showing	'Er8'			8.6.14
Pump alarms showing	'Er9'			8.6.15
Pump alarms showing	'ErA'			8.6.16
Pump alarms showing	'ErB'			8.6.17
Pump alarms showing	'ErC'			8.6.18
Pump alarms showing	'ErD'			8.6.19
Pump alarms showing	'ErE'			8.6.20
Pump alarms showing	'ErF'			8.6.21
Pump alarms showing	'Err'			8.6.22
Pump alarms showing	'Ery'			8.6.23
Pump alarms showing	'ErP'			8.6.24
Pump alarms showing	'ErO'			8.6.25
Pump alarms showing	'Ern'			8.6.26
Pump transmission rates excess/variable/low				8.6.27
Switch(es) do not function correctly				8.6.28

## 8.1 SAFETY FIRST

Before beginning diagnosis read this section carefully.

### WARNINGS

**Use extreme caution when servicing equipment whilst it is connected to the AC mains. Hazardous voltages are present at the mains inlet and on the power supply board even when the pump is switched off.**

**The internal battery can deliver high electrical current, especially if its connections are shorted before the power board battery fuse. Disconnect the battery and AC power whenever removing or inserting PCBs or other connectors.**

**This equipment contains static-sensitive components. Observe strict precautions for the protection of static-sensitive components when attempting to service and repair the equipment.**

## 8.2 TECHNICAL ENQUIRES

Contact the **ALARIS** service centre for further assistance see section 1.

## 8.3 VISUAL INSPECTION

Visually inspect the pump, power cord and plug for damage. If the power cord or plug are damaged they should be replaced.

### **\* If The Pump Is Dropped Or Damaged**

If the pump is damaged, the damaged parts should be identified and replaced before any further troubleshooting is carried out.

During inspection careful attention should be paid to the upper and lower case halves which can be damaged if the pump is dropped from a height. Damage to these parts can interfere with the correct function of the pump transmission and therefore result in a variety of error codes.

Check the transmission moves freely and that the leadscrew is not bent.

### **\* If The Pump Gets Wet**

Excessive fluid spills can lead to fluid ingress into the pump. Even if the fluid dries out deposits can be left which cause the pump to fail.

If fluid ingress is suspected the pump should be inspected internally. Clean and dry out the pump. Take care to ensure dried out deposits do not remain on the PCBs or other electrical components.



## 8.4 POWER CHECKS

### \* Pump Will Not Power From Battery

If the pump will not power up from the internal battery, check that the battery has been charged for at least two hours or check that the on/off switch is operating correctly. The battery terminal voltage should exceed 6.0V. Check continuity of the battery fuse FS2 on the Power Supply Board. The fuse is a board mounted device of a similar shape to a resistor. Check the continuity of the battery connection wires and associated crimped connector contacts.

### \* Pump Will Not Power From AC Mains

First check the function of the mains cable with another piece of working equipment. Check that the mains is switched on at the wall outlet. Check that the power cord is seated properly in the mains inlet.

If the AC indicator does not light when the pump is connected to a live AC cable check the mains fuse FS1 mounted in the fuse holder on the Power Supply Board. Trace the power from the transformer secondary through the bridge rectifier D0. Check for a voltage on R8 on the Power Board which supplies the AC Power LED. Refer to the Technical Service Manual Power Supply Board circuit diagram.

## 8.5 USING THE SELF TEST ROUTINE

All **ALARIS** syringe pumps incorporate a number of self test and monitoring routines within the resident software to assist in the detection and rectification of any faults in the units' operation.

Before carrying out any detailed diagnosis of reported faults, perform the self test routine described below.

The self test routine was designed so that the correct operation of the main functions of the syringe pump can be confirmed without having to physically open the unit.

If at any stage during the self test the unit does not perform as expected, this section can be used to help identify the problem.

### To enter the self test routine:-

- o Ensure power ON/OFF switch is in the off position.
- o Hold down start button and press power ON/OFF switch to ON position.
- o Display will show '- - -'.
- o Enter '123' using the rate selection arrows.
- o Press stop to commence the self test routine.

The display will now show the pump type. Press the **STOP** button to commence the pump configuration and operational tests.

**Refer to Directions for Use for the full description of tests and display steps in the self test routine.** The following sections provide guidelines to identifying the cause of the problem should the particular test fail.

### **8.5.1 AUDIBLE ALARM TEST.**

In self test the display shows 't-1' and the audible alarm should be enabled.

If no alarm is heard, open unit and check the following :-

1. Check connections between the control and the power supply PCB.
2. Alarm signal at the connection between R4 and R6 on the power supply PCB should be high.
3. Alarm drive signal on pin 32 of IC1 on the control PCB should be high.

### **8.5.2 DISPLAY TEST.**

The display should proceed through a test sequence from '00' to 'FFF' and then enable all segments on the main display.

On the P2000, P3000 and P4000, the auxiliary displays will proceed through a functional sequence and then enable all segments.

If a particular segment is not functioning then use the display PCB circuit diagram to locate the appropriate pins on the LCD and driver IC and check connections. If a connection from the driver integrated circuit to the circuit board fails it may be difficult to find. Re-soldering the joint will reform the failed connection.

If the display self test routine will not execute then check interconnections between the control PCB and the display PCB and check operation of the display driver IC1 (and IC2 for the P2000, P3000 and P4000).

Check that the /busy line of the display driver(s) pin 11 of IC1 and IC2 (both uPD7225G) on the display PCB and pin 31 of IC1 (Z86C91) on the control PCB is high.

### **8.5.3 DECLUTCH TEST.**

The display should show '3-X', where X is the status of the declutch microswitch.

When the transmission is engaged, the display should show '3-1' and when it is declutched it should show '3-0'.

If the display does not change its state then check the following :-

1. The wiring to the microswitch on the transmission is intact.

2. The connections between the flexible circuit and the control PCB are fully and correctly engaged.
3. The microswitch activates when the unit is declutched, if not then adjust the microswitch mounting plate so that it does. The switch will click audibly as it changes state.
4. The 5 volts supply signal from the control PCB, PL1 pin 4, is present at the microswitch.
5. If the above are all correct check the signal path on the control PCB. The declutch signal should change state at IC1 pin 37 when the unit is declutched.

#### **8.5.4 NEAR END OF INFUSION TEST.**

The display should show '4-X' where X is the current status of the NEOI signal.

Declutch the unit and move the transmission to the right, the display should show '4-0'. Declutch the unit and move the transmission fully to the left and the display should now show '4-1'.

If it does not follow the above sequence then check the following :-

1. Is there anything blocking the slot in NEOI optical switch SW3.
2. Ensure the connections between flexible circuit and control PCB are fully engaged.
3. Check the operating point of the NEOI flag.
4. The 5V supply signal from the control PCB, PL1 pin 13, is present at the optical switch, on the flexible circuit solder joint, furthest from the upper case and nearest the exposed leadscrew.
5. Check that the signal on the control PCB at IC9 pin 9 changes state when you block the beam of SW3. If it does, then suspect IC9 otherwise, suspect optical switch.

#### **8.5.5 LINEAR GRID TEST.**

The display should show '5-X', where X is the current grid status.

Declutch the transmission and move the plunger holder very slowly along and check that the display changes from '5-0' to '5-1'.

If it does not then check the following:-

1. The grid has not become dislodged.
2. The grid is passing through the slot in the linear speed optical switch SW2.

3. Ensure connections between flexible circuit and control PCB are fully engaged.
4. The 5 Volts supply signal from the control PCB, PL1 pin 10, is present at the optical switch SW2, which passes over the linear grid, on the flexible circuit solder joint nearest the case and nearest the exposed leadscrew.
5. Check signal on control PCB at IC9 pin 5 changes state when you block the beam of the linear speed optical switch. If it does then suspect IC9, otherwise suspect the optical switch.

#### **8.5.6 MOTOR ENCODER TEST.**

The display should show '6-0', the motor should pulse and the display should change to '6-1' to show that the motor and encoders are functioning.

If the motor does not pulse then check the following :-

1. Motor drive +ve on control PCB, IC1 pin 33 is low.
2. Motor drive -ve on control PCB, IC7 pin 16 is high.
3. If the above two are correct then check the respective drive transistor circuits, T1 and T2, on the control PCB for correct operation.
4. Ensure connections between flexible circuit and control PCB are fully engaged.
5. Check that the drive voltage is actually reaching the motor connections on the flexible circuit.

If the motor is enabled but the display does not change then check the following:-

1. Ensure connections between flexible circuit and control PCB are fully engaged.
2. The flag mounted on the rear output shaft of the motor is secure and passes through the slots in the optical switches mounted on the motor gearbox assembly.
3. The 5V supply signal from the control PCB, PL1 pin 10, is present at the motor encoder optical switches.
4. The two square wave motor encoder signals are present on IC11 pins 5 and 9, and the inverse of these signals are present on IC11 pins 6 and 8.
5. Check that the signal from IC11 pin 6 is inverted by IC11 to feed IC11 pin 4.

### **8.5.7 FRONT PANEL TEST.**

The display should show '7-0' and change to '7-1' once it has tested that no switches are activated permanently.

If the display does not change state one of the switches is being activated all the time.

Next try self test code '223' this will determine which button is not active.

Once the faulty switch has been located check that there is not something preventing its normal operation and if not then remove the display PCB and replace the switch.

### **8.5.8 PLUNGER DETECT TEST.**

Display shows 8-0 changes to 8-1 when plunger button is depressed. If display does not change check any of the following:

1. Connection between flexi 2 and flexi 1.
2. Breaks in the flexi.
3. Connection to Control Board.

### **8.5.9 PUMPING PRESSURE MEASUREMENT SYSTEM.**

The display should show 'LXX' where XX is current value read from the pumping pressure measurement system and this should be between 08 and 18 hex with no pressure applied.

To test operation gently press back on the plunger holder and observe the value increase.

If the value is outside the set limits or it does not change with pressure then check the following:-

1. The connections between the beam assembly and the control PCB connector, PL5, are fully engaged. Check for failure of crimp connections - it is likely that these failures would cause an 'Erb' failure during normal operation.
2. The transmission is free to move when pressure is applied.
3. The output from the instrumentation amplifier, IC12 pin 8, rises when pressure is applied.
4. The A to D serial data on IC19 pin 14 oscillates every 100ms as data is read.
5. The A to D /CS signal pulses active a number of times every 100ms.

Refer to the circuit description in section 5 and the control PCB circuit diagram 1000EL00086 for further information.

### 8.5.10 SYRINGE SIZE MEASUREMENT.

The display should show 'CXX' where XX is the current value in hexadecimal read from the syringe sizing detection system and should be between C13 and CD6 hex depending on the position of the syringe shaft.

If the displayed value does not change when the syringe clamp shaft is moved, then check the following:

1. The connection between the linear potentiometer and the control PCB connector PL6 is fully engaged.
2. The syringe clamp shaft moves freely in the case and the slide on the linear potentiometer moves with it.
3. The output from the unity gain amplifier IC16 pin 1 changes as the input changes.
4. The A to D data signal, IC19 pin 14 oscillates every 100ms as data is read.
5. The A to D /CS signal pulses active several times every 100ms.

**NOTE:** Values may be higher if part number 1000EL00091 is lower than issue 9.

## 8.6 DETAILED TROUBLESHOOTING GUIDE.

If a fault in the pump is not highlighted by the self test functions use the sections below to identify the cause of the fault.

### 8.6.1 POWER-UP CONTINUOUS ALARM, ABNORMAL DISPLAY.

The syringe pump is designed to alarm if any significant component of the pump fails. If a continuous alarm sounds when the pump is powered up check:

- a) the connector from the control board to power board is correctly fitted,
- b) the 5V regulator IC0 on the power board is functioning correctly with 4.9 to 5.1V between pins 3 and 5,
- c) for a short circuit on control or power supply boards,
- d) for IC2 (EPROM) on control board dislodged.
- e) for exhausted battery.

If IC0 on the power board were to fail it could short circuit - the voltage will be limited to the control board by the zener diodes D11 and D12.

### **8.6.2 PUMP RUNS NORMALLY AND RESETS AFTER A TIME.**

The syringe pump reset during normal running would be characterised by a momentary bleep followed by the displayed rate resetting to show 0.0ml/hr. There are a couple of possible causes for this type of fault:

- a) A reset could be caused by excessive motor noise present if the control board components C40, C41 or the 1uF 50V surface mount capacitor fitted to the flexible circuit next to the motor connections were missing.
- b) Excessive radio frequency interference can cause the pump to lock up or reset. One possible source of interference in an operating theatre is diathermy equipment. The source of the interference should be identified if possible and the pump located as far from the source as possible to minimise the effect of radiated interference. Conducted interference on mains cables can be reduced both by fitting an appropriate in line filter in the pump mains connection to reduce its susceptibility and in the mains cable to the source of the interference to reduce emission from the source.

### **8.6.3 PUMP ALARMS SHOWING 'SYR'.**

The 'SYR' alarm normally shows while the pump is running if the syringe clamp is tampered with. Check first that the alarm has not been caused by simply knocking the syringe clamp whilst the pump is running.

Check also that the syringe clamp and its shaft have not been damaged.

Check the operation of the syringe sizing potentiometer; IC16-1 should adjust between about 1V and 4V as the syringe clamp is moved between its extremes. If the voltage is not correct check the connector crimp connections and follow the circuit from the linear potentiometer and onto the control board.

Check that the syringes being used are in accordance with the Syringe Type Selection ('Sy\_' code).

In self test (code 123) step through until '8-1' is seen on display. Press the plunger button and ensure display changes to '8-0' if this is not occurring, check the soldered connections between the two flexible circuits (located on the carriage inside the pump), resolder if necessary. If this is not the cause, check correct operation of the plunger detect optical sensor.

Recalibrate the syringe size detection system as detailed in the Technical Service Manual Section 9.3.

### **8.6.4 PUMP ALARMS SHOWING 'DEC'.**

The declutch alarm would normally sound if the pump were running and the declutch lever was operated. The declutch is detected by a microswitch fitted on the transmission which is operated by a pin mounted in the half-nut. The

declutch operation can be checked initially by listening for the switch click which should occur as the declutch lever is moved. The switch should click between the lever end moving about 3mm to 6mm. If the microswitch is incorrectly set it may be too sensitive and cause false alarms.

Check the connections between the microswitch and the control board, particularly checking for intermittent failure in the flexible circuit.

Check that the wires to the microswitch do not foul on the microswitch actuator arm; and are not squashed at the extremities of the transmission.

### **8.6.5 PUMP ALARMS SHOWING 'OCC'.**

The occlusion alarm detects excessive force measured in the beam mounted behind the transmission. The occlusion default alarm level is normally level 4 (L-4) - see Self Test Routine (Directions for Use), and User Defined Options, Default Pumping Pressure Alarm Level. On the P3000 and P4000 pumps the level can be adjusted at the front panel. If the alarm level is set too low in normal operation false alarms can be triggered. First check that the alarm level default is set correctly and that the level is not being set too low in operation.

The occlusion sensing system must also be calibrated correctly to ensure false alarms are not triggered. Before further fault finding check the occlusion calibration as set out in section 9.6. If necessary recalibrate the occlusion setting using section 9.4. If it is not possible to calibrate, the electrical connections and signals need to be checked as below.

Check for damage to the beam which could have occurred if the pump were dropped. Such a problem could show up as a base level shifted outside the limits 'L08' to 'L18'.

Check for excessive force being set up due to misalignment in the transmission (possibly due to the pump being dropped). Check the free movement of the transmission, particularly for the presence of dried fluids or any other foreign bodies which may prevent its free movement.

If 'OCC' alarms still occur check the signals from the strain gauges mounted on the beam. Check the connections between the strain gauges and the control board, including the crimp contacts. Check the signal path to IC19 (ADC0838) on the control board.

### **8.6.6 PUMP ALARMS SHOWING 'EOI'.**

First check normal function of the Near End Of Infusion detector, and adjust the setup if necessary - see Section 9.2.

If the 'EOI' alarm occurs well away from the normal end of infusion point check the connections between the NEOI opto, along the flexible circuit, onto the control board via IC11 to IC9.



If the alarm occurs intermittently check for an intermittent failure in the flexible circuit.

#### **8.6.7 PUMP ALARMS SHOWING 'Er1'. ERROR CODE 1 - MOTOR FAST/TOO MANY LINEAR GRID ENCODERS**

The linear grid has detected that the pump is running too fast for the rate that has been selected.

This could be caused by one of the following :-

1. Ensure the connections between the flexible circuit and control PCB are fully engaged. Also check for intermittent failure of the flexible circuit. Use the Self Test: display '5-0' - '5-1' and move the transmission slowly, whilst declutched, along the full length.
2. Motor encoder flag slipping on the rear output shaft of the motor/gearbox assembly. Check that the flag is secure.
3. The flag mounted on the rear output shaft of the motor is secure and passes through the slots in the optical switches mounted on the motor gearbox assembly.
4. The 5V supply signal from the control PCB, PL1 pin 10, is present at the optical switches SW4 and SW5.
4. One of the optical switches, SW4 and SW5, mounted on the motor/gearbox assembly could be faulty. Check using the Self Test: display '6-0' - '6-1'.
5. The two square wave motor encoder signals are present on IC11 pins 5 and 9, and the inverse of these signals are present on IC11 pins 6 and 8.

#### **8.6.8 PUMP RUNS ALARMS SHOWING 'Er2'. ERROR CODE 2 - MOTOR SLOW/TOO FEW LINEAR GRID ENCODERS.**

The linear grid has detected that the pump is running too slow for the rate that been selected.

This could be caused by one of the following :-

1. The transmission is obstructed. Check that the transmission moves freely.
2. Ensure connections between flexible circuit and control PCB are fully engaged.
3. Fault in drive from motor. Check that the motor drives the leadscrew. A faulty motor gearbox could be sticking and may be characterised by a clicking sound whilst the motor is running. Similarly a failure in the bonding of the motor output coupling to the gearbox output shaft could

allow the gearbox output to rotate without coupling the torque to the transmission.

4. Motor is not being enabled. If the motor does not pulse then check the following:-

Motor drive +ve on control PCB, IC1 pin 33 is low.

Motor drive -ve on control PCB, IC7 pin 12 is high.

5. If the above two are correct then check the respective drive transistor circuits, T1 and T2, on the control PCB for correct operation.
6. Check that the drive voltage is actually reaching the motor connections on the flexible circuit.
7. If the motor is powered then check that the flag mounted on the rear output shaft of the motor is secure and passes through the slots in the optical switches mounted on the motor gearbox assembly. Check that the 5V supply signal from the control PCB, PL1 pin 10, is present at the optical switches. Check that the two square wave motor encoder signals are present on IC11 pins 5 and 9, and the inverse of these signals are present on IC11 pins 6 and 8.
8. Check the linear opto output signal.

Declutch the transmission, observe the linear speed signal at IC11-13 as the carriage is moved slowly along. This should change as the opto moves along the linear grid. Check for intermittent connections in the flexible circuit, especially in the joints to the opto LED and detector.

#### **8.6.9 PUMP ALARMS SHOWING 'Er3'. ERROR CODE 3 - TOO MANY MOTOR ENCODERS**

Too many motor encoders have been detected in a motor drive period.

Check the following :-

1. Ensure connections between flexible circuit and control PCB are fully engaged.
2. The flag mounted on the rear output shaft of the motor is secure and passes through the slots in the optical switches mounted on the motor gearbox assembly. Check the 5V supply signal from the control PCB, PL1 pin 10, is present at the optical switches.
3. Check that the two square wave motor encoder signals are present on IC11 pins 5 and 9, and the inverse of these signals are present on IC11 pins 6 and 8.

#### **8.6.10 PUMP ALARMS SHOWING 'ER4' ERROR CODE 4 - ZERO MOTOR ENCODERS**

No motor encoders have been detected in a motor drive period.

This could be caused either because the transmission motor fails to rotate or because excessive friction prevents the motor from maintaining an adequate drive speed. Certain problems can cause 'ER4' alarms to occur at rare intervals. Since the cause of such errors may be difficult to identify the following scheme should be followed step by step.

1. Run the pump at 90.0ml/hr with no load - fit plunger part number 0000JG00014 into the plunger restraint. If the pump goes ER4 within a few minutes, switch the pump off, and on; start the pump again and check the rotation of the motor encoder flag and the transmission gears. If it does not show ER4 go on to step 2 below.
2. **If the motor encoder flag rotates but the gears do not** then a failure inside the motor gearbox may have occurred. In this case the motor will need to be replaced. Note the large gearbox ratio (485:1 on P1000, P2000 and P3000) means that the drive will increment very slowly compared to the rotation of the motor encoder.

Failure of TR4 and/or TR5 is self tested during power up and will appear as an error 'ErC' or 'ErD'. So encoder failure should be detected without causing an 'Er4'.

3. **If the encoder flag does not rotate** ensure the flag mounted on the rear output shaft of the motor is secure and passes freely through the slots in the optical switches mounted on the motor gearbox assembly.

Check the motor drive rotates as the drive is applied to the motor connections. If not the motor gearbox may have jammed.

4. **Excessive friction may cause intermittent errors.** Possible Sources Of Excess Friction are detailed below.

The transmission may be obstructed internally.

Check that the transmission moves freely, especially in the seal bobbins which fit into the upper case half.

Check that the lead screw is not clogged and is lightly greased.

Check that the leadscrew is not bent. Remove the idler gear from the motor bearing plate; and rotate the leadscrew. Observe the syringe plunger holder for excessive lateral movement as the leadscrew rotates.

Check that the transmission torsion rod is not damaged and the torsion plate is not too tightly clamped to the torsion rod.

Check that the flexible circuit does not foul against the transmission; this could occur if the flexible circuit is not secured correctly.

Check that motor gearbox output shaft is not bent. This would cause the gears to jam against one another. The ER4 would always occur with the gears meshed in the same position.

Check that under load the gear fitted to the leadscrew does not move back and touch the case and motor bearing plate. If this occurs the

leadscrew can be repositioned by slackening the beam screws and pushing the leadscrew gear as far as possible from the motor bearing plate, before tightening the screws again.

5. **Intermittent error 4 caused by a dirty motor commutator.** If an ER4 has not been observed in testing to this stage the motor drive voltage and current needs to be checked. Check the motor drive voltage pulses:

Motor drive +ve on control PCB, IC1 pin 33 is low: 0.2V  
Motor drive -ve on control PCB, IC7 pin 16 is high: 0.2V below MOTOR Vcc: see Control PCB Schematic

The motor current can be checked with the aid of a power supply to control board extension lead, a current probe and storage oscilloscope. Running the pump at 90.0ml/hr and measuring the current pulses in lead wire 10 (MOT Vcc) of the extension lead should yield current pulses about 10ms wide.

These pulses would be approximately:

50mA - 30mA	24V Motor	P1000, P2000, P3000
150mA - 120mA	12V Motor	P1000, P2000, P3000
150mA - 120mA		P4000

A baseline current representing the fixed drive current through R29 will also be visible. Small pulses may be present on top of the current pulses. If short pulses appear in the main pulse representing the current falling to the baseline (0mA flowing through the motor) deposits on the motor commutator may be inhibiting current flow. This problem can be characteristic of certain cleaning chemicals in the atmosphere which leave oxide deposits on the commutator.

The commutator can be cleaned in this case using the following procedure:

#### **Current Dead Space: Motor Commutator Cleaning.**

Disconnect the flexible circuit from the control PCB, and insert an insulator between the pins and the socket. Ensure there is no syringe in the transmission.

When removed set the carriage back in the transmission.

Check the build issue label inside the base of the pump. Build issues 14 and lower used a 12V motor. Build issues 15 and above have 24V motors. Apply the appropriate voltage 12V or 24V DC to the motor connections with the correct polarity (as marked on the flexible circuit near the motor wiring).

Allow the motor to run at full speed while the plunger holder moves about 10mm. This run will clean any oxide deposits from the commutator.

Disconnect the power supply and reconnect the flexible circuit.

Recheck the MOT Vcc current; no 0mA drop-outs during the motor current pulses should be observed.

In the event that an ER4 has not been observed during evaluation to this stage, the pump should be returned to the **ALARIS** service centre for further analysis.

#### **8.6.11 PUMP ALARMS SHOWING 'Er5'. ERROR CODE 5 - NON-VOLATILE DATA STORAGE ERROR**

Error Code 5 indicates that the data read from the RAM is invalid.

This could be caused by the RAM not retaining its data when the power is turned off; probably due to a faulty backup battery B1. Check that the voltage across the pins of battery B1 is greater than 2 volts.

#### **8.6.12 PUMP ALARMS SHOWING 'Er6'. ERROR CODE 6 - WATCHDOG FAILURE - TOO SLOW**

The watchdog time interval tested on the microprocessor on power up was found to be slower than the expected period of 17 msecs. Check the following signals :

1. 100ms square wave signal present on pin 5 of IC13.
2. AC coupled reset signal present on pin 12 of IC14.
3. Crystal oscillator of 32kHz on pin 10 and pin 11 of IC14.
4. Check for shorts or failure of IC17 and/or IC20.

**Use only a calibrated high impedance probe to measure the signal as severe distortion of the signal will occur if the signal is loaded.**

#### **8.6.13 PUMP ALARMS SHOWING 'Er7'. ERROR CODE 7 - WATCHDOG FAILURE -TOO FAST**

The watchdog time interval tested by the microprocessor on power up was found to be faster than the expected period of 17 msecs.

Refer to the Technical Service Manual Section 4.2.8 to diagnose the watchdog circuit fault.

#### **8.6.14 PUMP ALARMS SHOWING 'Er8'. ERROR CODE 8 - INVAILD SYRINGE CALIBRATION**

The syringe calibration data read from the battery backed RAM by the microprocessor was found to be invalid.

This could be caused by the following :

1. RAM not retaining the data when the pump is turned off. This could be caused by a faulty backup battery B1. Check that the battery voltage is greater than 2 volts.
2. Invalid combination of syringe type and size as selected by the syringe size defaults.

#### **8.6.15 PUMP ALARMS SHOWING 'Er9'. ERROR CODE 9 - MOTOR MALFUNCTION**

The microprocessor has detected an internal fault in the motor which prevents it from controlling at the set rate.

#### **8.6.16 PUMP ALARMS SHOWING 'ErA'. ERROR CODE A - VOLTAGE REFERENCE FAULT**

An error was detected in a comparison between the half voltage rail created by R49 and R50 on the Control PCB and the voltage reference created by D1 (2.5V). A failure of IC0, L387, on the Power Supply board would be detected by an ErA.

Otherwise an error could occur only if D1, R63, R49 or R50 connections were to fail; or the A to D converter IC19 were to fail.

#### **8.6.17 PUMP ALARMS SHOWING 'Erb'. ERROR CODE b - STRAIN GAUGE CURRENT FAULT**

An error was detected in the current flow through the occlusion beam strain gauge bridge. Such an error can occur if one of the crimped wire joints fails on connector, PL5 on the Control PCB. Similarly a fault of the wiring on the beam itself will be detected by error 'Erb'.

#### **8.6.18 PUMP ALARMS SHOWING 'ErC'. ERROR CODE C - MOTOR DRIVE TRANSISTOR FAULT - TRANSISTOR OFF WHEN SHOULD BE ON**

The motor drive transistors are checked during power up tests. If an error is detected during self test in one of the motor drive transistors an error 'ErC' may be displayed. Check for an open circuit fault in transistors T1 or T2 on the Control PCB, or in TR4 on the Power Supply PCB. Also check for shorts that may hold one of these transistors switched off or that the diode on the back of the flexi is working, also check that the transmission is connected to the Control Board.

#### **8.6.19 PUMP ALARMS SHOWING 'Erd'.**

##### **ERROR CODE d - MOTOR DRIVE TRANSISTOR FAULT - TRANSISTOR ON WHEN SHOULD BE OFF**

The motor drive transistors are checked during power up tests. If an error is detected during self test in one of the motor drive transistors an error 'Erd' may be displayed. Check for a short circuit fault in transistors T1 or T2 on the Control PCB, or in TR4 on the Power Supply PCB. Also check for shorts that may hold one of these transistors switched on.

#### **8.6.20 PUMP ALARMS SHOWING 'ErE'.**

##### **ERROR CODE E - PLUNGER DETECT ERROR**

The plunger detect optical switch is continually self tested during normal operation. If a fault is detected in that the optical switch sensor detects light from the optical sensor LED when the LED should be switched off an error 'ErE' is set. Check for a stuck output on IC10 pin 10. Also check for a fault in the signal from the optical switch sensor and its connection to IC11 pin 1.

#### **8.6.21 PUMP ALARMS SHOWING 'ErF'.**

##### **ERROR CODE F - INTERNAL/EXTERNAL RAM ERROR**

The system constantly checks RAM variables against their complements also stored in RAM. If a RAM corruption is detected an error 'ErF' is set.

A one off 'ErF' may be caused by excessive radio frequency interference causing malfunction in the microprocessor system.

Repeated, or continual error 'ErF' could be caused by failure of the microprocessor internal RAM in IC1 or the external RAM IC18.

#### **8.6.22 PUMP ALARMS SHOWING 'Err'.**

##### **ERROR CODE r - OCCLUSION OFFSET ERROR**

The system constantly checks the gain of the occlusion detection amplifier, adding an offset voltage by switching resistor R65 via T3 in and out of circuit. If an error 'Err' occurs the assumption is that the amplifier gain has changed. Check the operation of the occlusion amplifier surrounding IC12 and half of IC16.

A one off 'Err' may be caused by abnormally rapid changes in beam pressure, which would not be characteristic of clinical pressure changes in a syringe.

In early software revisions, Err was sometimes caused by the software limits being too tight for strain gauge monitoring. This was cured in:

**1000EL00127 V4R7**

**4000EL00003 V4R7**

#### **8.6.23 PUMP ALARMS SHOWING 'Ery'. ERROR CODE y - MOTOR DATA ERROR**

The system checks motor constants which have been read from RAM every 100ms with values being used by the microprocessor. If a comparison error is detected an error 'Ery' is set.

#### **8.6.24 PUMP ALARMS SHOWING 'ErP'. ERROR CODE P - CRC ERROR**

The system checks program values stored in the EPROM using a cyclic redundancy code check. If an error is detected in the EPROM an error 'ErP' is set.

#### **8.6.25 PUMP ALARMS SHOWING 'ErO'. ERROR CODE 0 - MICROPROCESSOR INTERNAL FAULT**

The microprocessor checks itself during power up self tests. If an error is detected in the microprocessor an error 'ErL' is set.

#### **8.6.26 PUMP ALARMS SHOWING 'Ern'. ERROR CODE n - WATCHDOG WINDOW CIRCUIT FAULT**

The microprocessor checks the operation of the watchdog windowing circuit during power up self tests. If an error is detected an error 'Ern' is set. The fault will need to be identified somewhere in the watchdog circuitry on the Control PCB. Investigate the circuit around IC13, IC14, IC17, and IC20.

#### **8.6.27 PUMP TRANSMISSION RATES EXCESS/VARIABLE/LOW**

Specialised equipment is required to check delivery rate accuracy. However serious damage to the transmission could yield slightly excess, variable, or low rates. Check for damage to the pump characteristic of it having been dropped.

Visually check the straightness of the transmission lead screw. It may be worth dismantling the transmission and removing the leadscrew to check its straightness.

Check also for interference which may prevent the leadscrew rotating smoothly as previously described in section 8.6.10.

Check for foreign materials, incorrect routing of the battery wires or the flexible circuit not secured.



In the event that an error has not been observed during evaluation to this stage, the pump should be returned to the **ALARIS** service centre for further analysis.

#### **8.6.28 SWITCH(ES) DO NOT FUNCTION CORRECTLY**

Check that the front panel is not lifting or bulging.

Check that the tactile feel of the switch functions correctly. If not check that the switch spacers are all present between the display board and front panel. This is only likely to be a problem if the display board has been removed from the pump and one or more switches then fail to function. Switches held down would be identified during self test.

## 9.0 TEST AND CALIBRATION

### 9.1 SYRINGE TYPE SELECTION

**IVAC MEDICAL SYSTEMS syringe pumps** can be calibrated to use one of a choice of standard disposable syringes as follows:-

English/German	French	Syringe Type	Comments
Sy0	b-d	B-D Plastipak	
Sy1	tEr	Terumo	
Sy2	brO	B.Braun Omnifix	
Sy3	brP	B.Braun Perfusor	(50ml with Sy3 kit only)
Sy4	-	Fresenius Injectomat	(50ml only)
Sy5	Shr	Sherwood Monoject IVAC 50ml	
Sy6	-	R.R. Pronto	
Sy7	-	BD Plastipak (World-wide version)	(P2000/P3000/P4000 only)
Sy8	-	Once	(50ml only)
SyA	-	Janpol	(needs kit)

**To ensure correct and accurate operation, only use the syringe make and size(s) indicated on the case of the pump.**

**Syringes may vary slightly due to the manufacturing process and if used for testing will change over a period of time.**

To change the syringe type:

1. Ensure Power ON/OFF Switch is in the OFF position.
2. Hold down START button and press Power ON/OFF Switch to ON position.
3. Display will show - - -. Enter **462** using the rate selection buttons.
4. Press STOP button and display will show SyX, where X is the previously stored syringe type.
5. Press tenths rate selection buttons until required syringe type is displayed.
6. Press STOP to save selection and enter syringe size code mode. Press START to return to normal operation.
7. Turn unit off and then on, check display shows new syringe type.

### IMPORTANT

**SYRINGE OPTION "SY3" - B.BRAUN PERFUSOR, "SYA" - JANPOL AND 100ml IVAC CAN ONLY BE USED IF CORRECT KIT IS FITTED TO PUMP.**

## 9.2 NEAR END OF INFUSION (NEOI) SET UP

The NEOI position determines the point at which the pump alarms to warn of impending end of infusion.

If the Keep Vein Open (KVO) option is enabled, the pump will switch to the KVO rate of 2.0ml/hr at the NEOI position if the set rate is greater than 2.0ml/hr. If the set rate is less than 2.0ml/hr, the pump will continue at the set rate.

If the KVO option is not enabled, at the NEOI position, the pump will continue at the set rate.

To set NEOI position use the following syringes and tables as references then follow the procedure set out on the following pages.

The setting and checking procedure is common to all pumps.

The pump uses a combination of an initial trip position and a software routine counter. This allows a common initial trip point for all syringe types and sizes.

**Once factory calibrated, all that is required to change the syringe type is to change the syringe code, change the syringe label and complete a check of the linear speed and occlusion alarm values, as described in sections 9.5 and 9.7.**

## 9.2 NEAR END OF INFUSION (NEOI) SET UP (continued)

### PROCEDURE FOR SETTING UP THE NEOI POSITION :

1. Open the unit.
2. Ensure Power ON/OFF Switch is in the OFF position.
3. Hold down START button and press Power ON/OFF Switch to ON position.
4. Display will show - - -.
5. Enter 125 using the rate selection buttons.
6. Press STOP button and display will show 3-0 / 3-1.  
  
Press STOP button and the display shows '4 - X' where X is current status of the NEOI detector.
7. Move plunger holder to the right, display will show '4-0'.  
  
Fit appropriate syringe selected from Table 9.2 and move the plunger holder to the desired NEOI position.
8. Separate the lower and upper case of the pump and adjust the position of the EOI actuator on the bottom of the carriage to the desired NEOI position, so that the display changes from '4-0' to '4-1' at the position set in Table 9.2. (NB for V4RF or greater, the pump will beep when the display changes)
9. Move plunger holder and observe that the display changes from '4-0' to '4-1' as the syringe passes NEOI position.  
  
If not then repeat from step 7.
10. Screw case halves together and check end of infusion point again.
11. Press stop and turn pump off.

## 9.2 NEAR END OF INFUSION (NEOI) SET UP (continued)

**Table 9.2**  
**Reference syringes for IVAC MEDICAL SYSTEMS**  
**P1000/P2000/P3000/P4000 Syringe Pump :**

Use the following syringes for setting up.

<b>Pump</b>	<b>Code</b>	<b>Syringe Type And Size</b>	<b>Set Pos'n (ml)</b>
ALL	Sy0	B-D Plastipak 50/60ml	4.7
ALL	Sy1	Terumo 50/60ml	2.0
ALL	Sy2	Braun Omnifix 50/60ml	3.5
WITH KIT	Sy3	B.Braun Perfusor 50ml	2.0
ALL	Sy4	Fresenius Inject't 50/60ml	4.5
ALL	Sy5	Sherwood Monoject/IVAC 50/60ml	4.7
ALL	Sy6	RR Pronto 50/60ml	7.5
P2,P3,P4	Sy7	B-D Worldwide 50/60ml	5.5
ALL	Sy8	Once 50/60ml	3.2
WITH KIT	SyA	Janpol	2.0

**NOTE:** These figures are nominal. When setting the NEOI, the reading should be +0.5/-0.0. Readings may vary between syringes due to tolerances in syringe manufacture.

## 9.3 SYRINGE SIZE MEASUREMENT DETECTION SYSTEM CALIBRATION

The syringe size detection system stores the characteristics of the syringe clamp assembly, including the travel of the linear potentiometer in non-volatile memory and allows automatic compensation for the mechanical tolerances and variances.

Should the syringe clamp assembly or any of its constituent parts be disassembled or changed this calibration will need to be carried out before the unit can be put into use.

### 9.3 SYRINGE SIZE MEASUREMENT DETECTION SYSTEM CALIBRATION (continued)

To calibrate the syringe size detection system, it will be necessary to use the syringe size calibration spacer Part Number 0000TG00010 (See Spares Parts List.)

1. Ensure Power ON/OFF Switch is in the OFF position.
2. Hold down **START** button and press Power ON/OFF Switch to ON position.
3. Display will show - - -.
4. Enter **243** using the rate selection buttons.
5. Press **STOP** once.

The display will show "CXX" where "XX" represents the current hexadecimal reading from the linear potentiometer.

6. Position the syringe clamp shaft at its lowest point (touching the upper case) and enter using the '**STOP**' button. The display will show the hexadecimal value to be stored at this point "CXX".
7. Next, position the syringe size calibration spacer (0000TG00010) under the syringe clamp in the place where a syringe would normally fit.

The display will then show the hexadecimal value of that in step 6.

8. Press **STOP**. The display will show the upper level value at that position.
9. Press **STOP** again and the display will show the difference between the calibration position and the bottom position (no syringe fitted).

This is the value that will be stored at this point **LXX**.

10. Press **STOP** to store this value in the pump.
11. Turn unit OFF.

## 9.4 OCCLUSION CALIBRATION

To set up the occlusion alarm level for pumps, use occlusion test gear 0000TG00020 and follow the following procedure :

1. Ensure Power ON/OFF Switch is in the OFF position.
2. Hold down **START** button and press Power ON/OFF Switch to ON position.
3. Display will show - - -.
4. Enter 717 using the rate selection buttons.
5. Press STOP button and display will show LXX, where XX is the current reading from the pressure monitoring system displayed in hexadecimal format.
6. Press STOP again to start motor running.

The display value may oscillate as the leadscrew rotates but this must not exceed an 8 bit span and should always be between 08 hex and 18 hex with no load applied.

If calibration of the occlusion alarm level is not required, press **START** at this point.

7. To change this "base level", open pump and adjust RV1 on the control PCB and set within stated limits. Seal RV1 to prevent the base level from changing.
8. Ensure unit is reassembled correctly and screwed together before attempting to calibrate the unit.
9. To begin calibration with unit still running, ensure the base level is stabilised and then press STOP.
10. Fit occlusion test gear 0000TG00020 and the plunger protector (0000JG00014) into the plunger holder. Move plunger holder towards dial gauge until it is just clear of the pad. Ensure the test gear is reset to zero.
11. Press STOP to start unit running.
12. When 4.0 Kgf is reached, as displayed on the test gear, press STOP.

The display will then show the 4 Kgf bit value.

Press STOP to store this value.

13. The display will now show the bits/Kgf value.

Press STOP to store this value.

14. Remove test gear and switch unit OFF.
15. Proceed to the occlusion test procedure to confirm that the correct value has been stored.

## 9.5 OCCLUSION TEST

To test the occlusion alarm levels use test gear 0000TG00020 and follow the procedure below:

1. Declutch plunger holder and move to the right.
2. Fit occlusion test gear 0000TG00020 and fit the plunger protector (0000JG00014) in the plunger holder. Move plunger holder towards the test gear actuator pad, leaving the plunger holder just clear of the actuator pad. Ensure test gear is reset to 0Kg
3. Switch unit ON, and select 50ml syringe (not on P1000).

NOTE It may be necessary to fit a spacer under the syringe clamp to register as 50ml syringe.

4. Set rate to 99.9 ml/hr and press START.
5. When unit alarms, check display says "OCC".
6. Press STOP to silence alarm.
7. Check with occlusion tables below (Table 9.5.1 or Table 9.5.2) that the unit alarms at the desired level.
8. If outside the stated limits, then repeat the occlusion calibration procedure and retest.

Otherwise declutch, remove test gear and switch the unit OFF.



## 9.5 OCCLUSION TEST (continued)

The values shown in Tables 9.5.1 , 9.5.2 , 9.5.3 and 9.5.4 are for 50/60ml , 20/30ml and 10ml syringes only.

**Table 9.5.1**  
**50/60ml Syringe Occlusion Test Limits for the P2000, P3000 & P4000**  
**Default level of L-4**

<b>Syringe Type</b>	<b>Alarm Level (Kgf)</b>	<b>Lower Limit (Kgf)</b>	<b>Upper Limit (Kgf)</b>
Sy0 B-D Plastipak	3.5	3.1	3.9
Sy1 Terumo	5.0	4.6	5.4
Sy2 B.Braun Omnifix	4.1	3.7	4.5
Sy3 B.Braun Perfusor	4.0	3.6	4.4
Sy4 Fresenius Injectomat	5.7	5.3	6.1
Sy5 Sherwood Monoject/IVAC	3.9	3.5	4.3
Sy6 RR Pronto	4.7	4.3	5.1
Sy7 BD Plastipak (World-wide)	3.6	3.2	4.0
Sy8 Once	3.9	3.5	4.3
SyA Janpol	3.9	3.5	4.3

**Table 9.5.2**  
**30ml Syringe Occlusion Test Limits for the P2000, P3000 & P4000**  
**Default level of L-4**

<b>Syringe Type</b>	<b>Alarm Level (Kgf)</b>	<b>Lower Limit (Kgf)</b>	<b>Upper Limit (Kgf)</b>
Sy0 B-D Plastipak	2.4	2.2	2.6
Sy1 Terumo	4.0	3.8	4.2
Sy2 B.Braun Omnifix	2.3	2.1	2.5
Sy5 Sherwood Monoject	3.1	2.9	3.3
Sy6 RR Pronto	2.7	2.5	2.9
Sy7 BD Plastipak (World-wide)	2.4	2.2	2.6

**Table 9.5.3**  
**20ml Syringe Occlusion Test Limits for the P2000, P3000 & P4000**  
**Default level of L-4**

<b>Syringe Type</b>	<b>Alarm Level (Kgf)</b>	<b>Lower Limit (Kgf)</b>	<b>Upper Limit (Kgf)</b>
Sy0 B-D Plastipak	2.2	2.0	2.4
Sy1 Terumo	2.4	2.2	2.6
Sy2 B.Braun Omnifix	2.3	2.1	2.5
Sy5 Sherwood Monoject	3.1	2.9	3.3
Sy6 RR Pronto	2.4	2.2	2.6
Sy7 BD Plastipak (World-wide)	2.2	2.0	2.4

**Table 9.5.4**  
**10ml Syringe Occlusion Test Limits for the P2000 and P3000**

<b>Syringe Type</b>	<b>Alarm Level (Kgf)</b>	<b>Lower Limit (Kgf)</b>	<b>Upper Limit (Kgf)</b>
Sy0 B-D Plastipak	1.5	1.1	1.9
Sy1 Terumo	2.0	1.6	2.4
Sy2 B.Braun Omnifix	1.3	0.9	1.7
Sy5 Sherwood Monoject	1.4	1.0	1.8
Sy6 RR Pronto	1.5	1.1	1.9
Sy7 BD Plastipak (World-wide)	1.5	1.1	1.9

## 9.6 REVIEW OCCLUSION CALIBRATION

The occlusion calibration values are stored in non-volatile memory on the control PCB. These values are read by the microprocessor when the unit is powered up.

In the event that it is necessary to validate the values stored against the values entered during the occlusion calibration process, it is possible to review the stored calibration values.

If necessary carry out the occlusion calibration and test for the pump using the procedures set out in sections 9.4 and 9.5.

To review the occlusion calibration values follow the procedure below:

1. Ensure Power ON/OFF Switch is in the OFF position.
2. Hold down START button and press Power ON/OFF Switch to ON position.
3. Display will show - - -.
4. Enter **532** using the rate selection buttons.
5. Press STOP button and display will show either of the following :  
  
**LXX** where **XX** is the bits per kgF value computed during calibration.
6. Press the STOP button to display -  
  
**LXX** where **XX** is the offset level displayed in hexadecimal corresponding to the base offset of the pressure measurement system stored during calibration.
7. Press START to return to normal operation.

## 9.7 LINEAR SPEED

The linear accuracy of the pump can be checked by measuring the time that the plunger holder takes to travel a specified distance.

The distance travelled can be measured using a dial indicator which can be mounted in place of the syringe and the elapsed time can be measured using a stop watch.

To test the linear drive accuracy use test gear 0000TG00002 or equivalent and follow the procedure below:

1. Declutch the drive mechanism and move the plunger holder to the right.
2. Fit the linear test gear 0000TG00002 and fit the plunger protector (0000JG00014). Move plunger holder towards dial gauge until it is about 3mm clear of probe.
3. Turn the unit on and if the unit is a **P2000**, **P3000** or **P4000** then select or confirm that the syringe size is 50ml.
4. Set the rate to 99.9ml/hr and press START.
5. Allow the unit to run until it touches the probe and then using a stop watch, time the travel over a distance of 15.00mm.
6. Using the values specified in Table 9.7, check that the unit is travelling at the correct speed.
7. If the test values fall outside the stated limits then remove the unit for further investigation.
8. Switch the unit OFF and remove the test gear.

**Note that data for a combination of rates and syringe sizes have been provided should further testing be deemed necessary. It is not normally necessary to test for all the combinations provided.**

## 9.7 LINEAR SPEED (continued)

**Table 9.7**  
**Linear Accuracy Table**

The following table of times relate to a specified distance travelled of 15.00mm.

Syringe Type Tolerance (1%)	Size	Flow Rate	Time	
	(ml)	(ml/hr)	mins:secs	+/- sec
B-D Plastipak	10	10.0	14:18	10
		19.9	07:11	05
	20	10.0	25:16	16
		39.9	06:20	04
	30	10.0	32:19	20
		59.9	05:24	04
	50/60	10.0	49:00	30
99.9		04:54	03	
Terumo	10	10.0	17:52	11
		19.9	08:58	06
	20	10.0	28:16	17
		39.9	07:05	05
	30	10.0	37:23	23
		59.9	06:14	04
	50/60	10.0	58:27	36
99.9		05:51	04	
B.Braun Omnifix	10	10.0	17:48	11
		19.9	08:57	06
	20	10.0	28:07	18
		39.9	07:03	05
	30	10.0	34:26	22
		59.9	05:45	04
	50/60	10.0	53:31	33
99.9		05:21	04	
B.Braun Perfusor	50	10.0	54:37	33
		99.9	05:28	04
Fresenius Injectomat	50/60	10.0	60:16	36
		99.9	06:02	04
Sherwood Monoject	10	10.0	17:17	11
		19.9	08:41	06
	20	10.0	28:14	18
		39.9	07:05	05
	30	10.0	38:50	25
		59.9	06:29	04
	50/60	10.0	50:01	30
99.9		05:00	03	
RR Pronto	10	10.0	18:19	11
		19.9	09:12	06
	20	10.0	31:46	20
		39.9	07:58	05
	30	10.0	39:22	24
		59.9	06:34	04
	50/60	10.0	60:16	36
99.9		06:02	04	
ONCE	50/60	10.0	54:29	33
		99.9	05:29	04
IVAC	50	99.9	05:01	03
	100	99.9	10:07	06
JANPOL	50	10.0	53:27	32
		99.9	05:21	03

## 9.8 BATTERY CHARGING

If the battery charging circuitry on the power supply PCB has been repaired the following sequence should be carried out to ensure that the battery can be charged correctly.

Field replacement power supply PCB assemblies are supplied from **IVAC** with the charging voltage set to the correct value. The procedure below can be followed in order to check the setting if deemed necessary.

1. Ensure that the unit is turned off and disconnected from the AC power supply.
2. Obtain access to the unit as detailed in section 7.
3. Disconnect battery connector, PL3, from the power supply PCB.
4. Connect an oscilloscope to measure the DC voltage on PL3 ( 0V to pin 1).
5. Set the range on the oscilloscope to be able to display 0 to 7 Volts DC.
6. Connect the unit to an AC power supply.
7. Adjust RV0 on the power supply PCB until the peak voltage level displayed on the oscilloscope is 7.0 Volts +/-0.1 Volts.
8. Seal RV0 to avoid battery charge level changing.
9. Disconnect the AC power supply, remove the oscilloscope connections and refit the battery connector.

## 9.9 LOW BATTERY LEVEL CALIBRATION

If either the control PCB or the power supply PCB have been replaced or modified then the following sequence should be carried out to ensure that the correct low battery level is detected.

1. Access to unit as detailed in section 7.
2. Ensure unit is switched OFF and is not connected to mains AC supply.
3. Turn RV1 on power PCB fully anticlockwise.
4. Disconnect battery connector, PL3, and connect a variable DC power supply to the power supply pcb ( 0V to pin 1) with short, thick power leads. Note: some DC power supplies do not have sufficient output capacitance to simulate a battery. If variability is found in setting and checking the low battery level during set-up add a large (1000uF) electrolytic capacitor to the DC power supply output and ensure the leads to the unit are short (ie not inductive).
5. Set DC power supply to 6.5V and switch unit ON.
6. Adjust DC power supply downwards slowly until the unit alarms continuously and note the value of the power supply output. If this meets the requirements of the table below, ensure RV1 on the power supply PCB is sealed and then proceed to step 14 below.
7. Switch pump off and set the DC power supply back to 6.5V.
9. Adjust RV1 on the power supply pcb anticlockwise a number of turns. Switch pump on and then adjust the DC power supply slowly down to the voltage shown in the table below. If you overshoot the voltage start again from section 7.
10. Now adjust RV1 slowly clockwise until unit goes into an intermittent audible alarm and the LCD display shows 'LO'. Ensure that this adjustment is carried out carefully and slowly to avoid overshooting the alarm set point.
11. Turn the unit OFF and then ON and a continuous audible alarm coupled with 'LO' shown on the LCD display should be present.  
  
(Note that the alarm cannot be reset or muted by pressing the STOP button.)  
  
If the 'LO' display and a continuous alarm is not present repeat the above procedure from step 6.
12. Set DC power supply to 6.5V and switch unit ON.
13. Adjust DC power supply downwards slowly until the unit alarms continuously and note the value of the power supply output. If this meets the requirements of the table below, seal RV1 on the power supply PCB.
14. Turn the unit and power supply OFF, remove connections and refit battery connector.

**TABLE 9.9 LOW BATTERY VOLTAGE VALUE**

<b>P1000, P2000, P3000</b>	<b>Without RS232/Nurse Call</b>	<b>5.90V</b>
	<b>With RS232/Nurse Call</b>	<b>5.90V</b>
	<b>Without RS232/Nurse Call</b>	<b>5.90V</b>
	<b>With RS232/Nurse Call</b>	<b>5.93V</b>

**9.10 SYRINGE CONSTANTS FOR LINEAR PERFORMANCE TESTING**

<b>Syringe Type</b>	<b>Syringe size</b>	<b>Diameter (mm)</b>	<b>mm/ml</b>
B-D Plastipak	50ml	26.33	1.84
	30ml	21.38	2.79
	20ml	18.90	3.56
	10ml	14.22	6.30
Terumo	50ml	28.76	1.54
	30ml	23.00	2.41
	20ml	20.00	3.18
	10ml	15.90	5.04
B.Braun Omnifix	50ml	27.52	1.68
	30ml	22.07	2.61
	20ml	19.94	3.20
	10ml	15.87	5.05
B.Braun Perfusor	50ml	27.80	1.65
Fresenius Injectomat	50ml	29.20	1.49
Sherwood Monoject	50ml	26.60	1.80
	30ml	23.44	2.32
	20ml	19.99	3.19
	10ml	15.64	5.21
RR Pronto	50ml	29.20	1.49
	30ml	23.65	2.28
	20ml	21.20	2.83
	10ml	16.10	4.91
Once	50ml	27.85	1.64
Janpol	50ml	27.50	1.68



### 9.11 Calibration Requirements After Replacing Internal RAM Or RAM Battery Backup

If the internal RAM or its associated battery is replaced on the Control PCB it will be necessary to recalibrate the complete unit. Initially however the unit will not power up until the RAM is cleared.

**Warning: Do not clear the RAM unless absolutely necessary, because all calibration and configuration in the pump will be cleared.**

To clear the internal RAM:

1. Ensure Power ON/OFF switch is in the OFF position.
2. Hold down START button and press Power ON/OFF switch to ON.
3. Display will show - - -. Enter **611** using the rate selection buttons.
4. Turn the unit off, wait for a few seconds and then on.

Initially set the unit type and language. Use the sequence shown above with the code **251** - use the tenths rate selection button to select P1, P2 or P3 if the unit is a P1000, P2000 or P3000. Use the code **422** to select the correct language L-0 (English), L-1 (French), or L-2 (German).

Set the unit options as required from the list shown in section 11.

Then calibrate the syringe size measurement detection system (section 9.3), and the occlusion calibration system (section 9.4). Carry out a full self test.

## 10.0 OPTION KITS

- 10.1 1001FAOPT01 - RS232/Nursecall Upgrade Option.
- 10.2 1001FAOPT02 - 100ml Upgrade Option.
- 10.3 1001FAOPT03 - Braun Perfusor Upgrade Option.  
1001FAOPT04 - Janpol 50ml Option.
- 10.4 1001FAOPT09 - 10% Volume Neoi Option.
- 10.5 1001FAOPT0B - RS232/Nursecall Option (special).

## 10.1 1000PB00053 ISSUE 9

### Fitting and Removal Instructions RS232/Nursecall

This instruction applies only to **IVAC 'P' Series Syringe Pumps**.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

## 1 Introduction

This fitting instruction enables fitting of our RS232 / Nurse Call option allowing the Syringe Pump to communicate via a serial RS232C link with a computer or monitoring system. The nurse call provides a single pole potential free output to an external circuit.

To fit this kit it will be necessary to gain access to the inside of the Syringe Pump.

The Syringe Pump is made up of two case halves, the RS232 / NC option fits to the case lower.

## 2 Access to the Pump

2.1 Place the unit on a static dissipative surface that is correctly grounded.

2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit and withdraw the base plate.

2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply PCB.

### 3 Fitting Instructions

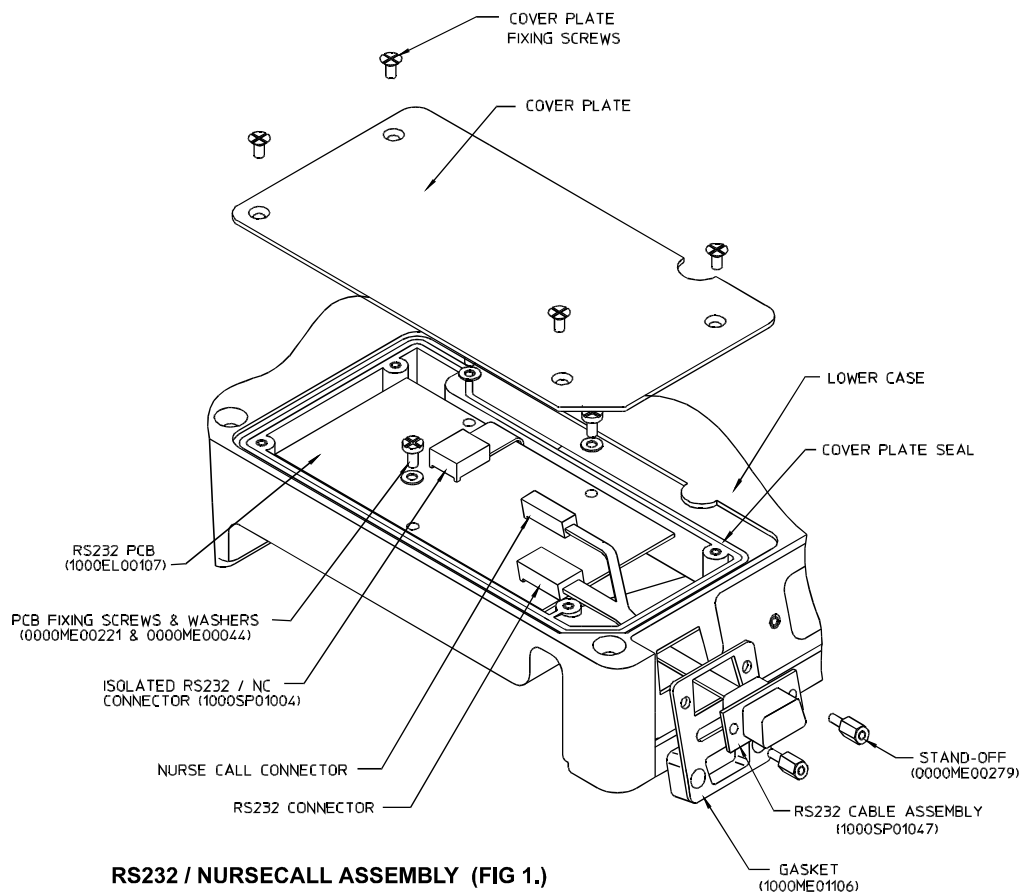
- 3.1 Disconnect the AC mains inlet connector and the DC power ON/OFF switch connector from the power supply PCB. Remove the AC mains inlet from the case by unscrewing the two screws (M3 x 6mm black c'sk) securing the adapter to the case, retain the mains inlet, screws and gasket for refitting.

Remove the DC ON/OFF switch by simultaneously easing the securing tags in and prising the ON/OFF switch out. Retain the switch and splash proof cover for refitting.

Remove the battery connector and the 4 screws (M3 x 20mm pan head) holding the power PCB into the lower case, remove the power supply PCB and retain for refitting.

- 3.2 Carefully peel off the label bonded to the switch panel and clean off any adhesive residue with isopropyl alcohol or a similar non-aggressive solvent. Fit new label (1000LB01015) supplied.
- 3.3 Remove the four screws (M3 x 6mm black c'sk) securing the cover plate to the underside of the lower case. Carefully hinge the panel open taking care not to damage the base label.
- 3.4 Fit the RS232 PCB assembly (1000EL00107) using the three M3 x 6mm screws (0000ME00221) and M3 nylon washers (0000ME00044) supplied.

Fit the ribbon cable (1000SP01004) to PL 2 on the RS232 PCB and feed the cable through the slot in case wall adjacent to the power supply PCB area.



- 3.5 Assemble the RS232 D type connector (1000SP01047) using the two RS232 threaded stand-offs (0000ME00279). Apply loctite 242 to the two threaded stand-offs before they are fitted. Ensure that the gasket (1000ME01106) is located behind the connector. When RS232 is not in use, the rubber cap in the gasket should be folded down over the connector to prevent fluid ingress through the pins. Fit the 4-way connector to PL 1 and the 2-way connector to PL3 on the RS232 PCB.
- 3.6 Refit the power supply PCB into the lower case and secure with the four M3 x 20 pan head screws retained from earlier disassembly. Reconnect the AC mains inlet with its gasket and the DC power ON/OFF switch with its splash proof cover, refitting is reverse of removal. Reconnect the AC mains inlet to PL 1, the ON/OFF switch to PL 2 and the battery to PL 3 on the power supply PCB.

Reassemble the two case halves reconnecting the grey ribbon cable to the connector on the power supply PCB. Fit the new RS232 cable to PL 4 on the control PCB.

- 3.7 Replace the cover plate on underside of the lower case checking that the gasket seal is undamaged and located correctly. Secure the cover plate using the four M3 x 6mm black c'sk screws retained from the earlier disassembly.
- 3.8 Configure the pump to enable the RS232 option, as described below.
- To enable RS232 communications switch the pump on whilst holding down the START button on the front panel. The display will show '- - -'. Use the rate up/down buttons to set the digits to '1 6 7'. Then press the STOP button. The display will show 'C - 0' (RS232 communications disabled). Use the rate button below the '0' digit to change the display to 'C - 1' (RS232 communications enabled). Finally press the STOP button to store the new setting, and switch the pump OFF.
- Test the RS232 interface using the free demonstration program (0000TG00015) available from ALARIS MEDICAL SYSTEMS, together with a suitable RS232 cable (9 pin 'D' type connector 1000SP00046).
- 3.9 Configure the pump to enable the nurse call option as described below.
- To enable nurse call communications switch the pump on whilst holding down the START button on the front panel. The display will show '- - -'. Use the rate up/down buttons to set the digits to '1 6 8'. Then press the STOP button. The display will show 'n c 0' (nurse call communications disabled). Use the rate button directly below the '0' digit to change the display to 'n c 1' (nurse call communications enabled). Finally press the STOP button to store the new setting and switch the pump OFF.
- Test nurse call is operating by checking that the resistance between pins 6 and 9 on the D type connector goes from open to close circuit when the pump is in alarm condition.
- When the nurse call option is enabled more current is consumed during normal operation of the pump as the relay contacts are held open. This means battery life is reduced; it is therefore recommended that the nurse call feature is only enabled if required.
- 3.10 Carry out self test routine as described in the Directions for Use.

## **4 Removal Instructions**

- 4.1 Disable RS232 communications 'C - 1' to 'C - 0', as detailed in section 3.8.
- Disable Nurse call communications 'n c 1' to 'n c 0', as detailed in section 3.9.
- 4.2 Obtain access to the pump as detailed in section 2.0.
- 4.3 Remove the four screws (M3 x 6mm black c'sk) securing the cover plate to the underside of the lower case. Carefully hinge the panel open taking care not to damage the base label.
- Disconnect the isolated RS232 / NC ribbon cable from the control panel and remove it from the RS232 PCB. Disconnect the RS232 and nurse

call cable from the RS232 PCB. Retain if the option is required in the future.

Remove the four screws securing the PCB and withdraw it from the lower case. Retain PCB and fixings if the option is required in the future.

- 4.4 Remove the RS232 / nurse call connector, removal is the reverse of fitting see section 3.5. Retain part if the option is required in the future.
- 4.5 Carefully peel off the label bonded to the switch panel and clean off any adhesive residue with isopropyl alcohol or a similar non-aggressive solvent. Fit a new switch panel label (1000LB01015), the new label will need to be purchased from ALARIS Medical Systems.
- 4.6 Carry out the self test routine as described in the Directions for Use. Check calibration values and return unit to service.

## **5 Technical Inquiries.**

For additional technical assistance, contact your local ALARIS Service Operations.

Item Number: 1001FAOPT01 OPTION RS232 N/C V4

Iss: 7

Part Number	Description	Qty
0000ME00044	WASHER M3 NYLON	3.0
0000ME00221	SCREW M3x6 PAN HD POSI ZP+P	3.0
1000EL00107	ASSY PCB RS232/N V4/P7	1.0
1000ME01106	GASKET RS232 MOULDED & CAP A4	1.0
1000PB00053	FIT INSTR RS232/NC UPGRD	1.0
1000SP01004	ASSY RS232/NURSECALL COMBINED CONNECTOR	1.0
0000ME00279	SCREW MALE/FEMALE M3.4 BRASS AND NICKEL	2.0



## 10.2 1000PB00054 ISSUE 4

### Fitting & Removal Instructions - 100ml Option Kit (V4)

Ensure the unit is disconnected from the AC power supply and switched off before attempting to service the unit

**This equipment contains static sensitive components. Observe strict precautions for the protection of static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to the final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the technical service manual, publication number 1000PB00048 when following this instruction.

When disassembling the unit, ensure that no undue force is applied to the plunger holder and leadscrew, particularly when the unit is placed upside down to remove the six case retaining screws on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary but for regular servicing, we recommend the use of the upper case support cradle Part No. 0000JG00004.**

### 1.0 Introduction

This fitting instruction applies to all V4 Syringe Pumps from build issue 1000ME00152 issue 4 onwards.

With the 100ml option kit fitted the P1000 Syringe pumps will only accept the 100ml syringe. The P2000, P3000 and P4000 Syringe pumps will accept the 100ml and 50/60ml syringes only.

### 2.0 Access to the Pump

- 2.1 Place the unit on a static dissipative surface that is correctly grounded.
- 2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit.
- 2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply PCB and RS232 / nurse call cable (if fitted).

- 2.4 On reassembly carry out the self test routine as described in the Directions for Use.

### **3.0 Fitting Instruction**

Note :

If the Syringe pump to be modified is a P4000 fitted with software V4R2 or less then the EPROM needs to be changed to V4R3 or greater. The Eprom is supplied to 100ml kit when ordered.

- 3.1 Remove the lower spirol pin which retains the linear potentiometer actuator to the shaft, and retain for refitting.

Undo the M3 pan head screw with wavy washer which retains the potentiometer mounting bracket and slide the actuator off the syringe clamp shaft.

Leave the potentiometer assembly in the upper case connected to the control PCB, ready for reassembly.

- 3.2 Carefully prise the spring retaining circlip from the syringe clamp shaft and remove the spring.

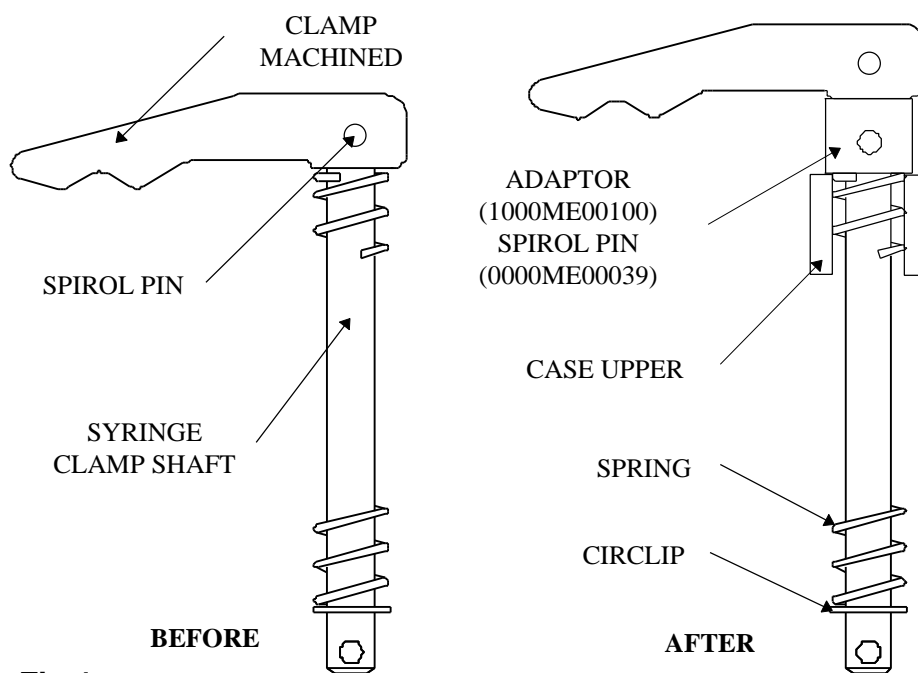
Slide the syringe clamp assembly out from the upper case.

- 3.3 Remove the spirol spring pin which retains the syringe shaft to the syringe clamp.

- 3.4 Fit the adapter (1000ME00100) supplied in the kit to the syringe shaft using the spirol pin, diameter 3.0mm x 12mm long (0000ME00039) supplied.

This fits to the end of the shaft without the circlip groove.

Refit the syringe clamp onto the adapter using the pin removed earlier (see fig.1).



**Fig.1**

- 3.5 Refit the assembly back into the upper case, fitting the spring and circlip. Fitting is the reverse of removal.

Slide the actuator over the syringe shaft and refit the diameter 3.0mm x 16mm long spirol pin, such that the pin is orientated to slide in the groove on the lower case. Sufficient should protrude (approx. 2.0mm) through the other side of the shaft to aid in the location and support of the actuator.

- 3.6 Refit the M3 pan head screw and wavy washer to secure the potentiometer mounting bracket. The fixing position of the bracket should be determined such that the linear potentiometer is parallel to the syringe clamp shaft and as the shaft is raised the actuator bracket is not unduly stressed.

It may be necessary to subtly bend the bracket to achieve this.

Tighten the screw fully and check that the shaft, the potentiometer actuator and slider operate freely.

- 3.7 Reassemble the two case halves reconnecting the grey ribbon cable to the connector on the power supply PCB. Secure the two halves using the six M4 x 45 long screws and washers removed on disassembly.

## **10.2 1000PB00054 ISSUE 4 (CONT)**

- 3.8 Configure the Syringe pump software to accept 100ml syringe option kit (as described below).

Press and hold down the 'START' button whilst simultaneously turning the Syringe Pump 'ON'. The display will show '- - -'.

Using the rate up/down arrow buttons enter the access code '8 0 2' and then press 'STOP'. The display will show 'Y - 0'.

Use the arrow button directly below the '0' to change the display to 'Y - 1'. Press 'STOP' and turn the Syringe Pump 'OFF'.

The Syringe Pump has now been configured for the 100ml option.

- 3.9 Remove the Syringe type label fitted to the upper case and replace it with the correct syringe type label from the label set supplied.
- 3.10 Complete the self test routine as described in the Directions for Use and confirm the occlusion and linear speed calibration.

Ensure the Pump functions correctly with the option kit fitted. Functional testing of the Syringe Pump is advised prior to returning the unit back into service, this should confirm correct operation of the Pump.

## **4.0 Removal Instructions**

- 4.1 Disable the 100ml option, 'Y - 1' to 'Y - 0' as detailed in section 3.8.
- 4.2 Obtain access to the Pump as detailed in section 2.0.
- 4.3 Remove the syringe clamp assembly as detailed in sections 3.1 to 3.3. Retain the adapter (1000ME00100) if the 100ml option is required in the future.

Refit the syringe clamp to the shaft and fit back into the upper case. Assemble the spring, circlip and potentiometer actuator (refer to sections 3.5 and 3.6). Fitting is the reverse of removal.

To refit the 100ml option in the future a new syringe type label set will need to be purchased, for information on ordering spare parts see the relevant section in the technical service manual (1000PB00048).

## **10.2 1000PB00054 ISSUE 4 (CONT)**

- 4.4 Reassemble the two case halves ensuring the grey ribbon cable and RS232 / nurse call cables (if fitted) are reconnected.
- 4.5 Remove the syringe type label and replace with the correct label type. Refer to the relevant sections of the technical service manual (1000PB00048) for ordering new label sets.
- 4.6 Complete the self test routine as described in the Directions for Use and confirm the occlusion and linear speed calibration.

### **5.0 Technical Inquiries.**

For additional technical assistance, contact your local ALARIS Service Operations.

Item Number: 1001FAOPT02 OPTION 100ML V4

Iss: 3

Part Number	Description	Qty
1000ME00100	ADAPTOR 100ML SYRINGE	1.0
1000PB00054	FIT INSTR 100ML SYRINGE KIT	1.0
0000ME00257	PIN TENSION 3.0X10.0	1.0
1000LB01012	LABEL SET SYRINGE 100ML	1.0

### 10.3 1000PB00006 ISSUE 7

#### **Fitting & Removal Instructions - 1001FAOPT03 -B Braun Perfusor 1001FAOPT04 - Janpol**

This instruction applies only to **ALARIS 'P' Series Syringe Pumps**.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after the fitting of any addition/replacement component.

For further information refer to final assembly drawing no. 1000ME00052/1001PP00003/ 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048/5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004 (V2/V4) / 5000JG00001 (P5).**

#### **1.0 Introduction**

This fitting instruction applies to all V2 Syringe Pumps, V4 Syringe Pumps and P5 Syringe Pumps, allowing them to be adapted to USE ONLY 50ml B BRAUN PERFUSOR or 50ml JANPOL SYRINGES.

Units with the build issue 1000ME00052 issue 1 to 27 are fitted with the actuator (1000ME00064) which has its fixing holes vertically opposite. Its B Braun Perfusor option equivalent is ALARIS MEDICAL SYSTEMS part no. 1000ME01083.

### 10.3 1000PB00006 ISSUE 7 (CONT)

Units with the build issue 1000ME00052 issue 28 onwards and 1000ME00152/5000ME00020 issue 1 onwards are fitted with the actuator (1000ME00108) which has its fixing holes diagonally opposite. Its B Braun Perfusor option equivalent is ALARIS MEDICAL SYSTEMS part no. 1000ME01083.

#### **2.0 Access to the Pump**

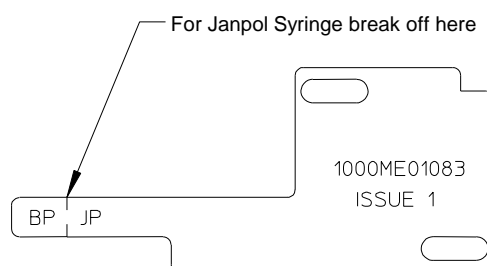
- 2.1 Place the unit on a static dissipative surface that is correctly grounded.
- 2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit and withdraw the base plate.
- 2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the power supply PCB and RS232 / NC cable from the control board PCB if fitted.
- 2.4 On reassembly carry out the self test routine as described in the Directions for Use.

#### **3.0 Fitting Instructions**

- 3.1 To replace the actuator (1000ME00108 or 1000ME00064) remove the two screws (No.4 x 3/8") and retain for reassembly. Retain the old actuator (1000ME00108 or 1000ME00064) if you require the use of alternative syringes in future.

Fitting the new actuator (1000ME01083) is the reverse of removal.

If fitting the Janpol syringe option break off the end piece of the actuator as shown below (fig 1.), the rest of the fitting instruction is the same as the B Braun syringe option.

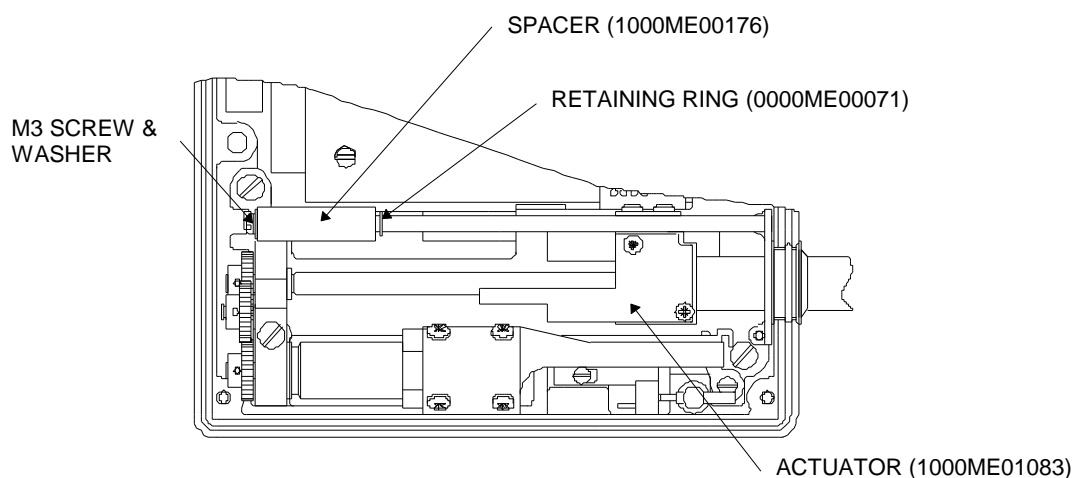


**B.BRAUN PERFUSOR or JANPOL 50ml KIT FIG.1.**



### 10.3 1000PB00006 ISSUE 7 (CONT)

- 3.2 To fit the spacer (1000ME00176) remove the torsion rod by undoing the screw (M3 x 6mm pan head) and washer (M3 wavy) securing it to the plate. Retain the fixings for reassembly.  
Slide the spacer onto the torsion rod, refit the torsion rod. Fitting is the reverse of removal.  
Slide the spacer to the end nearest the motor mounting plate.
- 3.3 Fit the retaining ring (0000ME00071) by pushing it onto the torsion rod at the point furthest away from the motor mounting plate after the spacer, slide the ring up the torsion rod hard against the spacer to secure it (see fig.2).



#### B.BRAUN PERFUSOR or JANPOL 50ml KIT FIG.2.

- 3.4 Reassemble the upper and lower case halves, reconnecting the grey ribbon cable to the power PCB and the RS232 / NC cable to the control PCB if fitted.
- 3.5 Remove the syringe label type, and replace with the new label (1000LB00099 B Braun or 1000LB00076 Janpol) supplied, V4/V2 units only.
- 3.6 Reconfigure the pump to "Sy3" and default the syringe size to d50 (50ml syringes only) as detailed in the technical service manual, section 9.1. Carry out the operational and alarm tests.

### 4.0 Removal Instructions

This part of the fitting instruction applies to the return of standard syringe N.E.O.I options. Protect plunger holder and leadscrew, take precautions to protect the static sensitive components as outlined earlier in this instruction.

### 10.3 1000PB00006 ISSUE 7 (CONT)

- 4.1 To replace the actuator (1000ME01083) remove the two screws (No.4 x 3/8") and retain for reassembly. Retain the old actuator (1000ME01083) if the B Braun Perfusor 50ml syringe option is required in the future. Refit the actuator (1000ME00108 or 1000ME00064) retained from earlier fitting (see section 3.1). If the actuator is damaged or lost a new part can be ordered from ALARIS MEDICAL SYSTEMS, part number 1000ME00064 or 1000ME00108.

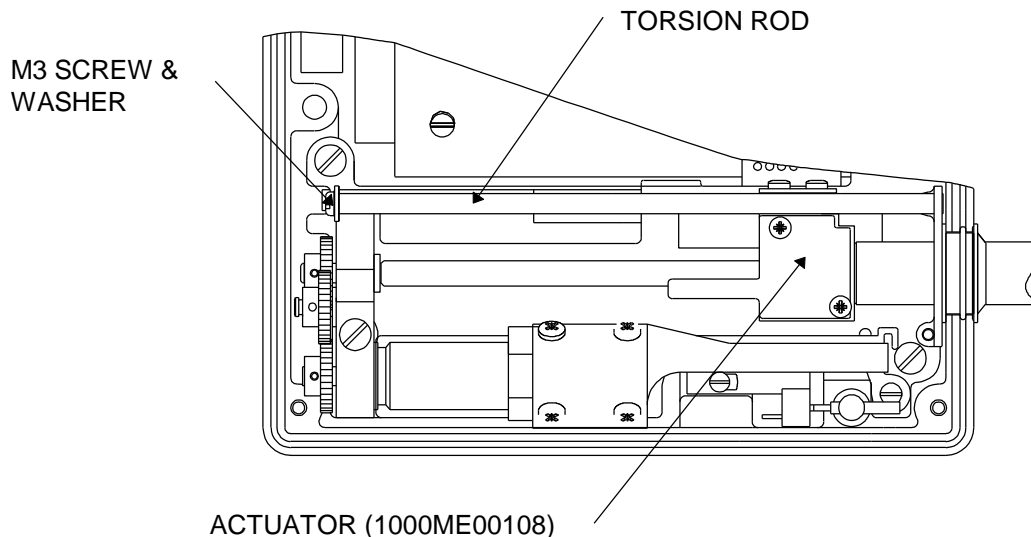
Fitting the actuator (1000ME00064 or 1000ME00108) is the reverse of removal.

- 4.2 To remove the spacer (1000ME00176) and retaining ring (0000ME00071) it will be necessary to remove the torsion rod. Undo the screw (M3 x 6mm) and washer (M3 wavy) securing the torsion rod to the plate. Retain the parts for reassembly.

Slide the spacer off the torsion rod and retain if the B Braun Perfusor or Janpol option is required in the future.

Slide the retaining ring off torsion rod and retain if the B Braun Perfusor or Janpol option is required in the future.

Refitting the torsion rod is the reverse of removal, see figure 3.



**STANDARD SYRINGE SIZE OPTION LAYOUT**

**FIG.3**

- 4.3 Reassemble the upper and lower case halves reconnecting the grey ribbon cable to the power supply PCB and RS232 / NC cable to the control PCB if fitted.

### **10.3 1000PB00006 ISSUE 7 (CONT)**

- 4.4 Remove the syringe label type and replace with the appropriate label supplied with the pump. To order a replacement label set see the spares listings in the technical service manual.
- 4.5 Reconfigure the pump to the appropriate syringe type setting "SYX" as detailed in the technical service manual, section 9.1. Carry out the operational and alarm tests.

### **5.0 Technical Inquiries.**

For additional technical assistance, contact your local ALARIS Service Operations.

Item Number: 1001FAOPT03 OPTION BRAUN PERFUSOR V4

Iss: 2

Part Number	Description	Qty
0000ME00071	RING SELF LOCK SHFT OD5	1.0
1000LB01014	LABEL SET SYRINGE BRAUN	1.0
1000ME00176	SPACER NEOI PERFUSOR/JANPOL	1.0
1000ME01083	ACTUATOR NEOI BRAUN/JANPOL	1.0
1000PB00006	FIT INSTR B.BRAUN/JANPOL	1.0

Item Number: 1001FAOPT04 OPTION JANPOL 50ML V4

Iss: 1

Part Number	Description	Qty
0000ME00071	RING SELF LOCK SHFT OD5	1.0
1000LB00076	LABEL GB SYRG JANPOL 50m I ENGLISH	1.0
1000ME00176	SPACER NEOI PERFUSOR/JANPOL	1.0
1000ME01083	ACTUATOR NEOI BRAUN/JANPOL	1.0
1000PB00006	FIT INSTR B.BRAUN/JANPOL	1.0

## **10.4 0000TB00011 ISSUE 1**

### **Software upgrade for V4 ALARIS P1000,P2000 and P3000 Syringe Pumps (Software V4RD)**

This software upgrade can be fitted to the following units:

Serial numbers:     1001-10000 onwards  
                          2001-10000 onwards  
                          3001-10000 onwards

#### **1.0 Description**

##### **1.1 Option to set 10% NEOI alarm**

The software has been updated following customer request for a near end of infusion alarm at 10% of the syringe volume.

To enable this function enter code '319' and use the tenths up arrow to set 'J-1'.

This option also requires the fitting of a new NEOI flag Part No: 1000ME01096 and setting the NEOI test ( '4-0' to '4-1') to 5ml on a Terumo 50ml syringe.

#### **2.0 Technical Inquiries**

For further assistance, contact your local ALARIS service operation.  
UK Only

Item Number: 1001FAOPT09 OPTION 10% VOLUME NEOI

Iss: 1

Part Number	Description	Qty
1000ME01096	ACTUATOR NEOI 10% VOLUME	1.0
1000ME00108	ACTUATOR NEOI	-1.0
0000TB00011	FIT INSTR BULLETIN S/W UPGRD V4RD	1.0

10.5 1001FAOPT0B ISSUE 1

13.8.3 \*Bill of Materials Print ALARIS MEDICAL SYSTEMS

Item Number: 1001FAOPT0B OPTION RS232/NURSECALL Iss: 1

Part Number	Description	Qty
1001FAOPT01	OPTION RS232 N/C V4	1.0
1000PB00111	FIT INSTR NURSECALL MOD	1.0
1000PB00053	FIT INSTR RS232/NC UPGRADE	-1.0



## 11.0 SUMMARY OF ENGINEERING ACCESS CODES AND ERROR CODES

### 11.1 ACCESS CODES

The **USER DEFINED OPTIONS** and **ENGINEERING CALIBRATION MODES** available on the **ALARIS P1000, P2000, P3000** and **P4000 syringe pumps** are selected by entering the following sequence of control button presses :-

- 1 Press Power ON/OFF Switch to the OFF position.
- 2 Hold down START button and press Power ON/OFF Switch to ON position.
- 3 Display will show - - -.
- 4 Use rate arrows to enter appropriate ACCESS CODE. See table below.
- 5 Press STOP once and display will show current option.
- 6 Use UP/DOWN rate arrows to select required option.
- 7 Press STOP to save selection.
- 8 Press the power ON/OFF Switch to the OFF position.

The summary codes provided on the following page is for guidance only. Please ensure that you are fully familiar with the operation and performance of the unit prior to attempting any calibration or change in its defaults.

**ALARIS MEDICAL SYSTEMS** can accept no liability for unauthorised or misuse of the access codes and their subsequent impact on the unit and its performance.

PUMP TYPE	ACCESS CODE	DESCRIPTION	INTRODUCED AT P1/P2/P3	INTRODUCED AT P4000
P1/2/3/4	123	Self test routine (From the start).	-	-
P1/2/3/4	124	Self test routine (Enters at audible alarm).	-	-
P1/2/3/4	125	Self test routine (Enters at declutch test).	-	-
P1/2/3/4	150	Change purge/bolus volume.	-	-
P1/2/3/4	167	Comms enable/disable.	-	-
P1/2/3/4	168	Nurse call enable/disable.	-	-
P1/2/3/4	222	Display test - Press stop to go into 223.	-	-

## 11.1 ACCESS CODES (CONT)

PUMP TYPE	ACCESS CODE	DESCRIPTION	INTRODUCED AT P1/P2/P3	INTRODUCED AT P4000
P1/2/3/4	223	Display switch self test.	-	-
P4	229	Option to disable purge/bolus alarm.	-	V4RD
P4	230	Enables rate limit to be set at 99.9 ml/hr.	-	V4RE
P1/2/3/4	243	Calibrate syringe sizing.	-	-
P1/2/3	251	Set pump type.	-	-
P4	269	Change rate while running.	-	-
P1/2/3/4	314	KVO enable/disable.	-	-
P4	315	d-0 - d-1 spanish option.	-	V4RC
P1/2/3/4	316	Stop at volume limit.	V4R6	V4R9
P1/2/3/4	317	Clear at volume limit.	V4RC	V4RB
P1/2/3	318	0.5ml KVO rate.	V4RB	-
P1/2/3/4	319	10% NEOI point.	V4RD	V4RE
P1/2/3/4	359	Set default syringe size.	-	-
P1/2/3/4	371	Total hours used.	V4R7	V4R9
P1/2/3/4	372	Total battery used.	V4R7	V4R9
P1/2/3/4	376	Review last error code.	-	-
P1/2/3/4	422	Change selected language.	-	-
P1/2/3/4	462	Change syringe type.	-	-
P1/2/3/4	474	Set default occlusion.	-	-
P1/2/3/4	532	Review previous occlusion settings.	-	-
P1/2/3/4	611	Clear memory.	-	-
P4	622	Auto Induction		V4R8
P1/2/3/4	624	AC alarm disable.	V4R7	V4R9
P1/2/3/4	717	Occlusion calibration.	-	-

## 11.1 ACCESS CODES (CONT)

P1/2/3/4	799	Set pump identification.	-	-
P1/2/3/4	802	Select 100ml syringe option.	-	-
P1/2/3	804	9.9ml rate limit.	V4R7	-
P1/2/3/4	808	Declutch pulse in period. (d0 = 10 secs) (d1 = 1 sec)	V4R8	V4RB
P4	906	Extended flow rate option.	-	-
P1/2/3/4	983	Set auto save options.	-	-

## 11.2 ERROR CODES

SUMMARY OF ERROR CODES	
Er0	Microprocessor fault. This also appears if nothing is stored.
Er1	Linear speed too fast - grid.
Er2	Linear speed too slow - grid.
Er3	Too many motor encoders.
Er4	Zero motor encoders.
Er5	RAM data invalid.
Er6	Watchdog failure - slow.
Er7	Watchdog failure - fast.
Er8	Invalid syringe data.
Er9	Motor Malfunction.
ErA	Voltage reference.
Erb	Strain gauge current.
ErC	Motor drive transistor - off.
Erd	Motor drive transistor - on.
ErE	Plunger detect error.
ErF	RAM error - complement error.
Erh	Configuration Error.
Err	Pumping pressure offset error.
Ery	Motor data error.
ErP	CRC error.
Er-	Memory stack overflow.
Ern	Watchdog window error.

## **12.0 SPARE PARTS LIST**

Component Item	Description
0000EL00003	SWITCH OPTO SLOTTED DUAL
0000EL00004	BATTERY 6V NP2.8-6 RECHARGE
0000EL00011	CONNECTOR PLUG 16 WAY HEADER
0000EL00012	CONNECTOR PLUG 4 WAY MOLEX
0000EL00013	CONNECTOR PLUG 2 WAY MOLEX
0000EL00014	RECTIFIER BRIDGE 2KBP02
0000EL00015	DIODE IN4001
0000EL00016	DIODE IN4148
0000EL00017	DIODE 11DQ03
0000EL00018	SUPPRESSOR V250LA40A
0000EL00019	TRANSISTOR BC546
0000EL00020	TRANSISTOR BC556
0000EL00021	TRANSISTOR ZTX 751
0000EL00022	REGULATOR L387
0000EL00023	REGULATOR L200
0000EL00024	HEATSINK
0000EL00026	HOLDER FUSE 20MM VERTICAL
0000EL00028	CAPACITOR 100n 25V CERAMIC
0000EL00029	CAPACITOR 1u0 35V TANT
0000EL00030	CAPACITOR 100u ELECTR.
0000EL00031	CAPACITOR 470n 250V AC X2
0000EL00033	RESISTOR 1R0 0.25W 1%
0000EL00034	RESISTOR 5K6 0.25W 1%
0000EL00035	RESISTOR 100K 0.25W 1%
0000EL00036	RESISTOR 2K2 0.25W 1%
0000EL00037	RESISTOR 1K0 0.25W 1%
0000EL00038	RESISTOR 200K 0.25W 1%
0000EL00039	RESISTOR 470R 0.25W 1%
0000EL00040	RESISTOR 20K 0.25W 1%
0000EL00041	RESISTOR 270K 0.25W 1%
0000EL00042	RESISTOR 10K 0.25W 1%
0000EL00043	RESISTOR 1M0 0.5W 1%.0
0000EL00044	POTENTIOMETER 10K 25 TURNS
0000EL00046	CONNECTOR SOCKET 20 WAY
0000EL00047	IC TYPE UPD7225G00
0000EL00048	SWITCH P/BUTTON MINIATURE
0000EL00050	LED GREEN T1/3MM
0000EL00051	RESISTOR 39K 0.25W 1%
0000EL00052	RESISTOR 300R 0.25W 1%
0000EL00053	CAPACITOR 1n0 25V CERAMIC
0000EL00054	CAPACITOR 10u 16V TANT
0000EL00055	CAPACITOR 10n 25V CERAMIC
0000EL00056	IC TYPE Z86C9116PSC
0000EL00058	IC TYPE 74HC574
0000EL00060	IC TYPE 74HC14
0000EL00063	IC TYPE ULN2003A
0000EL00064	IC TYPE TLC27L4ACN
0000EL00065	IC TYPE MM74HC74AN
0000EL00067	TRANSISTOR ZTX651
0000EL00069	CRYSTAL 7.3728MHZ HC18/U
0000EL00071	CONNECTOR PLUG 20 WAY
0000EL00077	CAPACITOR 470n 50 V CERAMIC
0000EL00078	RESISTOR NETWORK 100K 8 COMMON
0000EL00079	RESISTOR 75K 0.25W 1%
0000EL00082	RESISTOR 2M2 0.33W 5%
0000EL00083	CONNECTOR SOCKET IC 28WAY
0000EL00093	FUSE 50mA 20mm A/S
0000EL00094	FUSE 100mA 20MM A/S
0000EL00095	CLIP CABLE SELF ADHESIVE 0
0000EL00096	RESISTOR 390K 0.25W 1%
0000EL00100	CABLE BLACK 7/0.2
0000EL00101	CABLE RED 7/0.2
0000EL00102	RESISTOR ZERO OHM LINK
0000EL00105	RESISTOR 4K7 0.25W 1% 50PPM
0000EL00106	CONNECTOR PLUG 14 WAY
0000EL00108	CAPACITOR 22p 63V CERAMIC
0000EL00124	CONNECTOR SHROUDED 16 WAY
0000EL00128	CRYSTAL 32.768KHZ WATCH
0000EL00130	RESISTOR 10M 0.6W 1%
0000EL00131	CONNECTOR PLUG 3 WAY MOLEX
0000EL00132	IC TYPE MC14060BCP
0000EL00135	IC TYPE DS1200
0000EL00136	BATTERY LITHIUM 3V
0000EL00138	CAPACITOR 100pf CERAMIC 100V
0000EL00140	CAPACITOR 1uF 50V CERAMIC
0000EL00142	RESISTOR 56R 0.25W 1%
0000EL00143	CONNECTOR PLUG 3 WAY MOLEX
0000EL00144	LINK JUMPER
0000EL00146	CONNECTOR HEADER 5 WAY R/A MOLEX
0000EL00147	CONNECTOR PLUG 2 WAY R/A MOLEX
0000EL00148	RELAY ISOLATED 5V MR622-5SR IMO
0000EL00149	TRANSFORMER ISOLATED RS232
0000EL00150	CAPACITOR 4u7 16 V TANT
0000EL00151	ISOLATOR OPTO CNY17
0000EL00152	IC TYPE MAX 250
0000EL00153	IC TYPE MAX 251
0000EL00155	RESISTOR 100R 0.25W 1%
0000EL00156	CONNECTOR PLUG 5 WAY MOLEX
0000EL00157	CONNECTOR PCB PIN STRIP R/A HEADER
0000EL00160	RESISTOR 220R 0.25W 1%
0000EL00161	DIODE 1N5339B ZENER 5V6

Component Item	Description
0000EL00162	DIODE 1N5343B ZENER 7V5
0000EL00163	VARIATOR MURATA DSS710D223
0000EL00165	TRANSFORMER 7.5V 8VA A0807
0000EL00168	IC TYPE 74HC139
0000EL00169	IC TYPE ADC0838
0000EL00170	IC TYPE TLC272CP
0000EL00171	IC TYPE 74HC02
0000EL00172	IC TYPE 74HC00
0000EL00174	DIODE REF25Z 2.5 REFERENCE
0000EL00175	RESISTOR 22R 0.25W 1%
0000EL00177	CONNECTOR HEADER 4 WAY R/A MOLEX
0000EL00180	TRANSFORMER 7.5V 8VA PRIMARY
0000EL00182	CABLE BLACK 16/0.2
0000EL00185	SWITCH OPTO SLOTTED SINGLE
0000EL00187	CONNECTOR SHELL 9W D TYPE
0000EL00189	TERMINAL CRIMP INSULATED RING
0000EL00266	CAPACITOR 3300uF 16V ELECTROLYTIC 25
0000EL00282	CAPACITOR 10pF 100V CERAMIC
0000EL00283	RESISTOR 560K 0.25W 1%
0000EL00284	LINK FUSE 2A PICO FUSE
0000JG00004	JIG V4/P7 CASE UPPR ASSY
0000JG00014	JIG PLUNGER DETECT SPATULA
0000ME00002	CIRCLIP E TYPE SHAFT DIA 4.8
0000ME00003	SPRING COMP OD 6.1 19 LONG
0000ME00009	SCREW M3x5 CSK SET CUP
0000ME00011	SCREW No4x1/4" PAN HD
0000ME00014	NUT M3 Z + C
0000ME00015	WASHER M3 WAVEY SST
0000ME00016	PIN TENSION DIA 2.0x10mm
0000ME00018	PIN TENSION DIA 2.0x20mm
0000ME00026	FOOT SELF ADHESIVE V4
0000ME00027	WASHER M5 PLAIN Z+C
0000ME00029	NUT M2 Z+C
0000ME00030	SCREW M3x8 SKT SET FULL
0000ME00031	SCREW No4x3/8" PAN HD
0000ME00032	SCREW No4x1/2" PAN HD
0000ME00044	WASHER M3 NYLON
0000ME00045	WASHER M4 WAVEY SST
0000ME00048	WASHER M3 PLAIN Z+C
0000ME00066	LABEL SERIAL NUMBER
0000ME00071	RING SELF LOCK SHFT OD5
0000ME00084	SCREW M2x12 CSK HD SLOTTED
0000ME00089	SCREW M3x6 NYLON
0000ME00110	SPRING COMP OD 7.62 44 LONG
0000ME00112	CIRCLIP
0000ME00115	SPACER 4.8mm SELF RETAINING
0000ME00116	PIN TENSION DIA 3.0x16mm
0000ME00117	SCREW M3x5 CSK HD SLOTTED
0000ME00118	LABEL "READ BEFORE OPERATING"
0000ME00119	PAD SELF ADHESIVE NEOPRENE 22x15x2mm
0000ME00126	SPACER M3x9.53 HEX NYLON
0000ME00129	SPACER M3x12.7mm
0000ME00132	PIN TENSION DIA 1.5 x 10mm
0000ME00133	SPRING COMPRESSION 2.24 DIA x 7.9mm
0000ME00134	SPRING COMPRESSION 5.33 DIA x 7.9mm
0000ME00136	O RING 13.0 I/D x 1.5
0000ME00141	STUD PE CONNECTOR M6 THREAD
0000ME00142	PIN TENSION DIA 2.0 x 5.0mm
0000ME00146	SCREW M3x8 SKT SET PART
0000ME00164	SCREW M2x3 CSK HD SLOTTED
0000ME00189	SCREW M3x12 POZI HD Z+C
0000ME00221	SCREW M3x6 PAN HD POSI ZP+P
0000ME00222	SCREW M3x6 CSK HD POSI 1 Z+BLACK
0000ME00223	SCREW M3x10 PAN HD POSI ZP+P
0000ME00224	SCREW M4x45 PAN HD POSI ZP+P
0000ME00225	SCREW M4x40 PAN HD POSI 2 ZP+P
0000ME00226	SCREW M4x20 CSK HD POSI 2 ZP+P
0000ME00227	SCREW M4x16 PAN HD POSI 2 ZP+P
0000ME00228	SCREW M3x20 PAN HD POSI 1 ZP+P
0000ME00229	SCREW M4x10 PAN HD SLOTTED
0000ME00230	SCREW M3x8 CSK HD POSI Z+BLACK
0000ME00231	SCREW M3x8 PAN HD POSI ZP+P
0000ME00246	SCREW M4x8 PAN HD POSI
0000ME00257	PIN TENSION DIA 3.0x12
0000ME00279	SPACER MALE/FEMALE
0000TG00002	TEST GEAR P1000 LINEAR SPEED
0000TG00010	TEST GEAR S.S. 50 SPACER
0000TG00011	TEST GEAR S.S. 100ml SPACER
0000TG00020	TEST GEAR OCCLUSION HIGH ACCURACY
1000EL00051	LCD SPEC TRANS
1000EL00052	LED BACKLIGHT
1000EL00092	LCD P1000 FRENCH TRANSFLECTIVE
1000EL00093	LCD P1000 GERMAN TRANSFLECTIVE
1000EL00107	ASSY PCB RS232/NC
1000EL00127	EPROM PROGRAM P1000 V4
1000EL00135	ASSY CABLE 16 WAY RIBBON
1000LB00001	LABEL BATTERY TYPE
1000LB00020	LABEL ISSUE STATUS
1000LB00032	LABEL GB FP V4 P1000 ENGLISH
1000LB00040	LABEL NL FP V4 P1000 DUTCH
1000LB00047	LABEL FR FP V4 P100 FRENCH

Component Item	Description
1000LB00055	LABEL DD FP V4 P1000 GERMAN
1000LB00066	LABEL SP FP V4 P1000 SPANISH
1000LB00069	LABEL FR FP V4 P100 ALARIS FRENCH
1000LB00079	LABEL DD/SW FP V4 P1000 GERMAN/SWISS
1000LB00088	LABEL SW FP V4 P1000 SWEDISH
1000LB00089	LABEL CZ FP V4 P1000 CZECH
1000LB00090	LABEL HU FP V4 P1000 HUNGARIAN
1000LB00091	LABEL PO FP V4 P1000 POLISH
1000LB00092	LABEL IT FP V4 P1000 ITALIAN
1000LB00099	LABEL GB SYRG BRAUN ENGLISH
1000LB01002	LABEL SWITCH PANEL OPT01
1000LB01005	LABEL BASE PANEL V4
1000LB01007	LABEL SWITCH PANEL V4
1000LB01009	LABEL SET COMMON V4
1000LB01011	LABEL SET V4 SYR TYPE
1000LB01014	LABEL SET SYRINGE BRAUN
1000LB01015	LABEL SET END V4/P7
1000ME00010	SPIGOT IDLER
1000ME00026	PLATE MICROSWITCH MTG
1000ME00048	PLATE TORSION MOTOR END
1000ME00073	SPACER NEOI BRAUN PERF
1000ME00097	HALF NUT V4
1000ME00108	ACTUATOR NEOI
1000ME00169	STUD POLE CLAMP
1000ME00170	PAD POLE CLAMP
1000ME00174	ENCODER MOTOR
1000ME00175	ACTUATOR POT. MOULDED
1000ME00176	SPACER NEOI PERFUSOR/JANPOL
1000ME00192	KNOB DIA 35MM INSERT M8
1000ME00207	PLATE POT SS V4
1000ME01005	PLATE BASE RS232 V4
1000ME01006	CLAMP SYRINGE MACH. V4
1000ME01011	LEADSCREW V4
1000ME01012	PLATE MOTOR MTG V4 P1000/2000/3000
1000ME01013	CARRIAGE V4
1000ME01017	HOLDER PLUNGER V4
1000ME01019	TUBE INTERMEDIATE ASSY
1000ME01021	PLATE CHASSIS V4
1000ME01022	PLATE OUTER TUBE SEAL V4
1000ME01026	HOLDER PLUNGER CRUCIFORM
1000ME01027	PIN PLUNGER PLATE
1000ME01030	PLATE BLANK CASE UPPER
1000ME01033	SEAL NURSECALL
1000ME01035	GRID LINEAR 1.5 PITCH V4
1000ME01047	SEAL RING OUTER TUBE
1000ME01048	SEAL RING LEADSCREW
1000ME01051	ALARM TUBE V4
1000ME01056	PLATE PLUNGER RESTRAINT
1000ME01057	KEYCAP RUBBER
1000ME01058	ACTUATOR NEOI BRAUN/JANPOL
1000ME01064	FOAM PAD BATTERY
1000ME01066	FOAM PAD CHASSIS PLATE
1000ME01073	GASKET RS232
1000ME01074	GASKET MAINS INLET
1000ME01079	GASKET RS232 MOULDED P5
1000ME01081	SEAL LEADSCREW
1000ME01082	CORD SILICONE SPONGE
1000ME01083	ACTUATOR NEOI BRAUN PERF
1000ME01086	SHAFT SYRINGE CLAMP – SYRINGE SIZING
1000ME01091	TUBE OUTER POLISHED 5/8"
1000ME01103	COVER SPLASH ON/OFF SWITCH
1000ME01106	GASKET RS232 MOULDED V4
1000ME01109	GEAR TRANSMISSION 35T P1
1000ME01110	GEAR SPUR 0.5M 30T 20DEG PA P4000
1000ME01111	GASKET INTERMEDIATE TUBE
1000ME01113	BUSH LEADSCREW
1000ME01114	BUTTON PLUNGER HOLDER
1000ME01116	LEVER DECLUTCH V4
1000ME01117	HOLDER BACKPLATE PLUNGER
1000ME01121	SEAL OUTER TUBE
1000ME01123	PLATE BAT RESTRAINT V4
1000PB00021	MANUAL RS232
1000PB00048	MANUAL TECHNICAL SERVICE V4
1000SP00003	ASSY NURSECALL CONN V4
1000SP00007	ASSY ON/OFF SWITCH POWER
1000SP00009	ASSY CABLE BATTERY
1000SP00030	SPARE MOTOR G/BOX V2 P1000/2000/3000
1000SP00076	PAD POLE CLAMP 40MM
1000SP01001	ASSY INLET MAINS CONN
1000SP01004	ASSY CONN ISO RS232
1000SP01005	ASSY ALARM AUDIBLE
1000SP01007	ASSY CIR FLEXI NO.2
1000SP01008	ASSY CABLE RS232 (V4)
1000SP01011	SPARE CASE UPPER V4
1000SP01013	ASSY TRANSMISSION
1000SP01015	SPARE POLE CLAMP 40mm V4
1000SP01017	ASSY LINEAR POT
1000SP01022	ASSY MICROSWITCH V4
1000SP01025	ASSY NURSECALL CONN V4
1000SP01033	SPARE UPGRADE LOWER V4
1000SP01038	ASSY NURSECALL EXTENSION



Component Item	Description
1000SP01039	SPARE UPGRADE MOTOR FLEXI
1000SP01040	ASSY CIR FLEXI NO. 1
1000SP01041	ASSY CIR FLEXI NO. 1
1000SP01047	ASSY RS232 CONNECTOR
1000SP01048	SPARE UPGRADE FLUID INGRESS V4
1000SP01050	ASSY PCB CONTROL V4
1000SP01051	ASSY PCD DISPLAY P1000 ENGLISH
1000SP01052	ASSY PCB PSU 240V V4
1000SP01053	SPARE TRANSMISSION V4
1000SP01054	SPARE TRANSMISSION V4 P4000
1000SP01055	ASSY PCB PSU 120V V4
1000SP01056	ASSY PCB DISPLAY P100 FRENCH
1000SP01057	ASSY PCB DISPLAY P1000 GERMAN
1001FAOPT01	OPTION RS232 N/C V4
1001FAOPT02	OPTION 100ml V4
1001FAOPT03	OPTION BRAUN PERFUSOR V4
1001FAOPT04	OPTION JANPOL 50ml V4
1001FAOPT71	OPTION DFU GB P1000/2000/3000/4000 ENGLISH
1001FAOPT72	OPTION DFU DD P1000/2000/3000 GERMAN
1001FAOPT73	OPTION DFU FR P100/200/300/400
1001FAOPT91	OPTION CORD POWER R/A GB MOULDED
1001FAOPT92	OPTION CORD POWER EUROPEAN
1001FAOPT93	OPTION CORD POWER 2M R/A UNTERMINATED
2000EL00006	LCD SPEC TRANS P2000/3000/4000
2000LB00019	LABEL GB FP V4 P2000 ENGLISH
2000LB00025	LABEL NL FP V4 P2000 DUTCH
2000LB00031	LABEL FR FP V4 P200 FRENCH
2000LB00032	LABEL FR SYRG TYPE P200 FRENCH
2000LB00037	LABEL DD FP V4 P2000 GERMAN
2000LB00038	LABEL DD SYRG TYPE P2000 GERMAN
2000LB00043	LABEL SP FP V4 P2000 SPANISH
2000LB00046	LABEL DD/SW FP V4 P2000 GERMAN/SWISS
2000LB00054	LABEL SW FP V4 P2000 SWEDISH
2000LB00055	LABEL CZ FP V4 P2000 CZECH
2000LB00056	LABEL HU FP V4 P2000 HUNGARIAN
2000LB00057	LABEL PO FP V4 P2000 POLISH
2000LB00058	LABEL IT FP V4 P2000 ITALIAN
3000LB00005	LABEL GB FP V4 P3000 ENGLISH
3000LB00006	LABEL NL FP V4 P3000 DUTCH
3000LB00007	LABEL FR FP V4 P300 FRENCH
3000LB00008	LABEL DD FP V4 P3000 GERMAN
3000LB00009	LABEL SP FP V4 P3000 SPANISH
3000LB00010	LABEL FR FP V4 P300 ALARIS FRENCH
3000LB00011	LABEL DD/SW FP V4 P3000 GERMAN/SWISS
3000LB00013	LABEL SW FP V4 P3000 SWEDISH
3000LB00014	LABEL CZ FP V4 P3000 CZECH
3000LB00015	LABEL HU FP V4 P3000 HUNGARIAN
3000LB00016	LABEL PO FP V4 P3000 POLISH
3000LB00017	LABEL IT FP V4 P3000 ITALIAN
4000EL00003	EPROM PROGRAM P4000 V4
4000LB00002	LABEL GB FP V4 P4000 ENGLISH
4000LB00003	LABEL NL FP V4 P4000 DUTCH
4000LB00004	LABEL FR FP V4 P400 FRENCH
4000LB00005	LABEL DD FP V4 P4000 GERMAN
4000LB00006	LABEL SP FP V4 P4000 SPANISH
4000LB00009	LABEL SW FP V4 P4000 SWEDISH
4000LB00010	LABEL CZ FP V4 P4000 CZECH
4000LB00011	LABEL HU FP V4 P4000 HUNGARIAN
4000LB00012	LABEL PO FP V4 P4000 POLISH
4000LB00013	LABEL IT FP V4 P4000 ITALIAN
4000ME01002	PLATE MOTOR MNT V4 P4000
4000SP00001	SPARE MOTOR G/BOX V2/4 P4000
4001FAOPT71	OPTION DFU GB P4000 ENGLISH
4001FAOPT72	OPTION DFU DD P4000 GERMAN

## 13.0 TECHNICAL INFORMATION BULLETINS

- 13.1 0000TB00005 - Software Upgrade for V4 IVAC P1000 - P3000 Syringe Pumps (V4RA and V4RB).
- 13.2 0000TB00007 - Syringe Location Feature added to V4 Pumps & Modification to Calibration Equipment.
- 13.3 0000TB00008 - Software Upgrade for V4 IVAC P4000 Syringe Pumps (V4RD).
- 13.4 0000TB00009 - Fluid Ingress Kit.
- 13.5 0000TB00010 - Software Upgrade for V4 IVAC P1000 - P3000 Syringe Pumps (V4RC).
- 13.6 0000TB00011 - Software Upgrade for V4 IVAC P1000 - P3000 Syringe Pumps (V4RD).
- 13.7 0000TB00012 - Software Upgrade for V4 IVAC P1000 - P3000 Syringe Pumps (V4RE).
- 13.8 0000TB00024 - Software Upgrade for V4 IVAC P1000 - P3000 Syringe Pumps (V4RG).
- 13.9 0000TB00027 - Software Upgrade for V4 P4000 Syringe Pumps (V4RF).
- 13.10 1000PB00074 - Fitting Instructions for PSU Modification - Battery Fuse Blowing.
- 13.11 1000PB00080 - Fitting Instructions for V4 Alarm Tube Seal Upgrade.
- 13.12 1000PB00091 - Fitting Instructions Front Panel Spacers.
- 13.13 0000TB00038 - Alternative Routing for P1-3, P4 and P5 Flexible Circuit.
- 13.14 0000TB00056 - Fluid Ingress Sealing Enhancements.
- 13.15 0000TB00057 - Recommendation of DC/AC Inverter.
- 13.16 0000TB00058 - Syringe Plunger Detect Problems.
- 13.17 0000TB00059 - Transmissions Tight when declutched.
- 13.18 0000TB00060 - Software Upgrade V4RH – Intermittent ERC.

## **13.1 0000TB00005 ISSUE 1**

### **Software upgrade for V4 ALARIS P1000, P2000 and P3000 Syringe Pumps (Software V4RA and V4RB)**

This software upgrade can be fitted to the following units:

Serial numbers:     1001-10000 onwards  
                             2001-10000 onwards  
                             3001-10000 onwards

#### **1.0 Description**

The software for the V4 P1000, P2000 and P3000 has been upgraded to incorporate customer requested options and design enhancements.

#### **1.1 Software V4RA**

The setting of the occlusion alarm is automatically adjusted to the maximum level during the purge / bolus function.  
This is a customer requested change and is intended to minimise the nuisance alarms caused by the increased flow rates.

#### **1.2 Software V4RB**

In addition to the features of V4RA, Code '318' has been added to allow the user to select a kvo rate of either 2ml/hr or 0.5ml/hr. The default kvo rate is 2ml/hr. To select a kvo rate of 0.5ml/hr enter code '317' and set the display to 'd-1' using the tenths up arrow. The limits for the syringe size detection system have been tightened to be used in conjunction with the syringe misfit modification to the upper case. Refer to 0000TB00007 for description of the syringe misfit modification.

#### **2.0 Technical Inquiries**

For further assistance, contact your local ALARIS Service Centre.

## 13.2 0000TB00007 ISSUE 2

### **Syringe location feature added to Version 4 Pumps & Modification to 'P' series test and calibration equipment**

This feature has been implemented on the following units:

Serial numbers:     1001-13634 onwards, Software version V4RB  
                             2001-14704 onwards, Software version V4RB  
                             3001-14034 onwards, Software version V4RB  
                             4001-11164 onwards, Software version V4RD

#### **1.0 Introduction**

A modification has been made to the upper case to further improve the location of the syringe and assist the user to fit the syringe correctly into the pump. i.e. with the finger grips located in the correct 'v' slot in the case. See fig. 1. below.

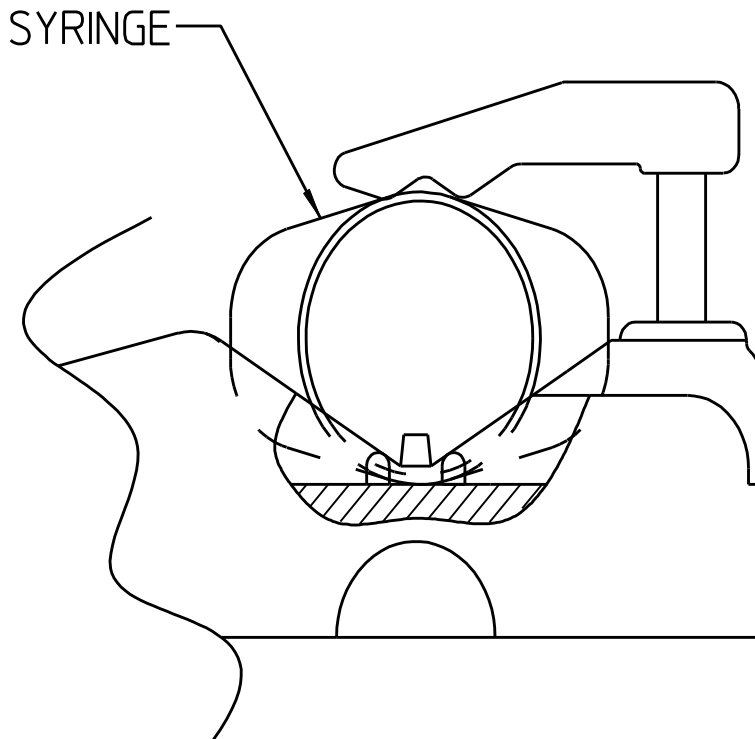


Figure 1

#### **1.1 How the modification works**

If the syringe is incorrectly fitted, i.e. with the finger grips to the right of the 'v' groove in the case, the syringe sizing feature lifts the barrel of the syringe up and the size is therefore not detected. See fig. 2. below.

## 13.2 0000TB00007 ISSUE 2 (CONT)

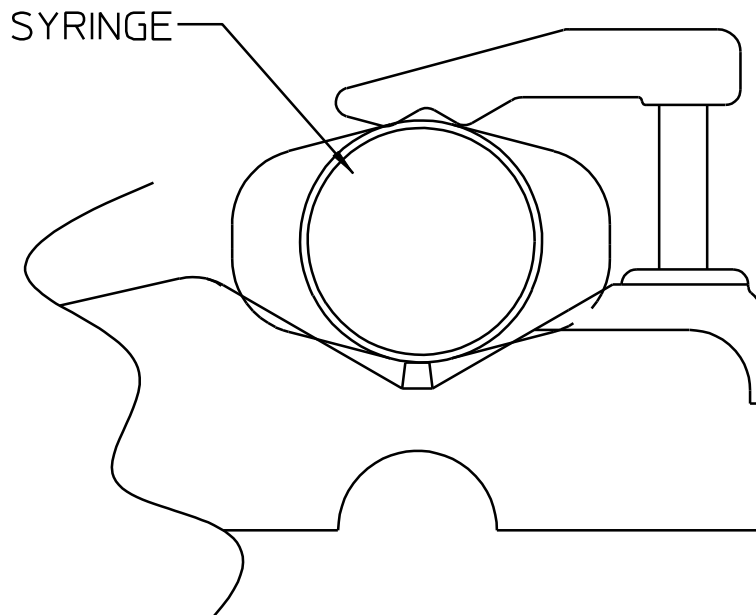


Figure 2

### IMPORTANT NOTE:

In some cases when 20 ml syringes are incorrectly fitted, because the external diameter is close to that for the 30 ml syringe of the same type it is possible that the syringe can be seen as a 30 ml syringe. This is where the importance of 'CONFIRM SYRINGE' comes in. It must be stressed to the users that this is very important. They must not confirm a 20 ml syringe as a 30 ml syringe.

Even with the syringe location feature fitted the following types of 20 ml syringes **WHEN INCORRECTLY FITTED** can be seen as 30 ml syringes of the same type:

BD (Plastipak and World Wide)

Braun Omnifix

RR Pronto

Terumo

This syringe location feature is not designed to replace the function of the 'Confirm Syringe Size' button (P2000/3000/4000 only) which is most important if the wrong size of syringe is fitted, or a is fitted such that it can be incorrectly identified by the pumps syringe detection system. It is the users responsibility to check the size of the syringe being displayed against the actual size of the syringe fitted to the pump, before pressing the 'Confirm Syringe Size' button, see the directions for use for further information.

**NB: P1000 which can only accept 50ml syringes and does not have a confirm syringe button, but the unit will alarm if syringe misfitted.**

## 13.2 0000TB00007 ISSUE 2 (CONT)

### **2.0 Modification to test and calibration gear**

Because of this design change a groove (or slot) is necessary in the test gear to accommodate this new feature. The following test gear are effected.

0000TG00001	Occlusion Test Equipment, superseded by
0000TG00020	Occlusion Test Equipment
0000TG00002	Linear Performance Test Equipment

### **2.1 Occlusion Test Gear - 0000TG00020**

The latest versions of these test gear have a groove as required, 0000TG00020 Iss. 2 . Earlier issues require either renewal or modification prior to use with a pump with the new syringe location feature. 0000TG00001 does not have this feature and therefore will have to be modified.

### **2.2 Modification of Occlusion Test Gear**

- 2.2.1 In order to ensure correct fitting of the equipment a slot is required in the body of the test equipment immediately next to the retaining flange. See Fig. 3. below.

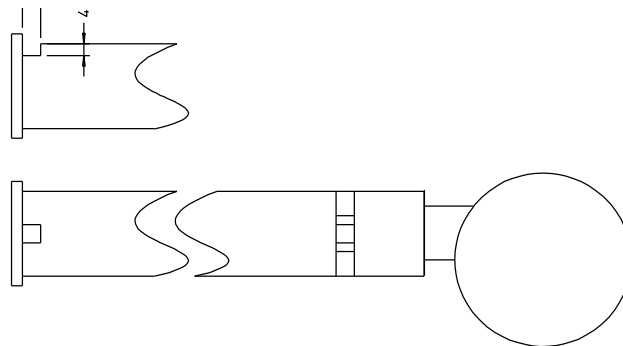
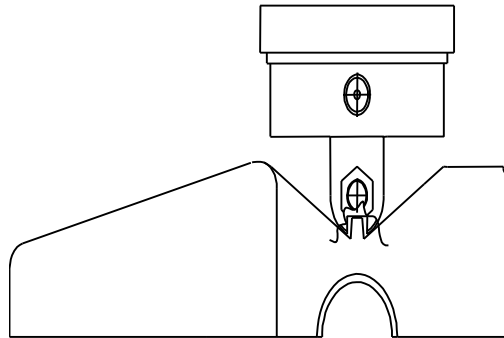


Figure 3

- 2.2.2 Before carrying out this modification ensure that the gauge head is protected from shock and damage.
- 2.2.3 Use an appropriate hand tool, such as a file, or a machine shop to create a slot 6mm wide and 4mm deep in the body of the occlusion test equipment where the instrument will contact the syringe location feature. This is shown more clearly In Fig. 4 below.

## 13.2 0000TB00007 ISSUE 2 (CONT)



VIEW SHOWING SYRINGE POSITIONING FEATURE

Figure 4

### **2.3 Linear Performance Test Equipment - 0000TG00002**

Recently supplied linear performance test equipment has a slot as required, 0000TG00002 Iss. 5, however earlier equipment will require the fitting of a new part. this is described in Section 2.4.

### **2.4 Modification to Linear Performance Test Equipment**

- 2.4.1 Modification requires the fitting of a new test equipment body, Part No. 0000TG00018.
- 2.4.2 Unscrew the M6 body securing nut and remove the body from the test equipment.
- 2.4.3 Install the new test equipment body, 0000TG00018. This may require some rotation to ensure full insertion.
- 2.4.4 Ensure the slot in the body is positioned so as to accommodate the syringe location feature when in use, See Fig. 5 below.

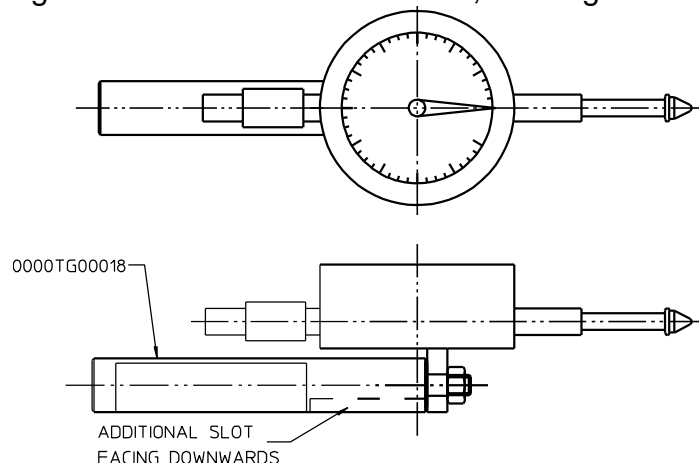


Figure 5

- 2.4.5 Refit the M6 nut and secure, taking care not to over tighten the nut.

### **3.0 Technical Inquiries**

For further assistance, contact your local ALARIS Service Centre.

### **13.3 0000TB00008 ISSUE 2**

#### **Software upgrade for V4 ALARIS P4000 Syringe Pumps (Software V4RD)**

This software upgrade can be fitted to the following units:

Serial numbers: 4001-10000 onwards

#### **1.0 Description**

- 1.1 Option to disable the audible alarm during purge or bolus delivery  
Code '229' has been added to allow the user to disable the audible beep during the purge or bolus delivery. To select this mode of operation enter code '229' and set display to 'd-1' using tenths up arrow.

#### **1.2 French default settings amended**

The French default settings have been modified as follows:

- Purge limit set to 9.9ml (was previously 5.0ml)
- Pump stops when volume limit reached
- Ac fail alarm disabled

#### **1.3 Syringe misfit modification**

The limits for the syringe size detection system have been tightened to be used in conjunction with the syringe misfit modification to the upper case. Refer to 0000TB00007 for description of the syringe misfit modification.

#### **2.0 Technical Inquiries**

For further assistance, contact your local ALARIS Service Centre.



## 13.4 0000TB00009 ISSUE 3

### Fitting Instructions - Fluid Ingress Kit 1000SP01037

This instruction applies only to **ALARIS** 'P' Series Syringe Pumps.

Serial Numbers:

1001-00001 to 1001-12533

2001-00001 to 2001-13099

3001-00001 to 3001-12252

4001-00001 to 4001-10871

5001-00001 to 5001-01022

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1001PP00003 or 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048 or 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45 mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004 (V4) or 5000JG00001 (P5).**

### 1.0 Introduction

This fitting instruction applies to V4 and P5 syringe pumps, serial numbers as above, allowing the sealing of the pump to be upgraded and improved using the fluid ingress kit, part number 1000SP01037.

## **13.4 0000TB00009 ISSUE 3 (CONT)**

### **2.0 Access to the pump**

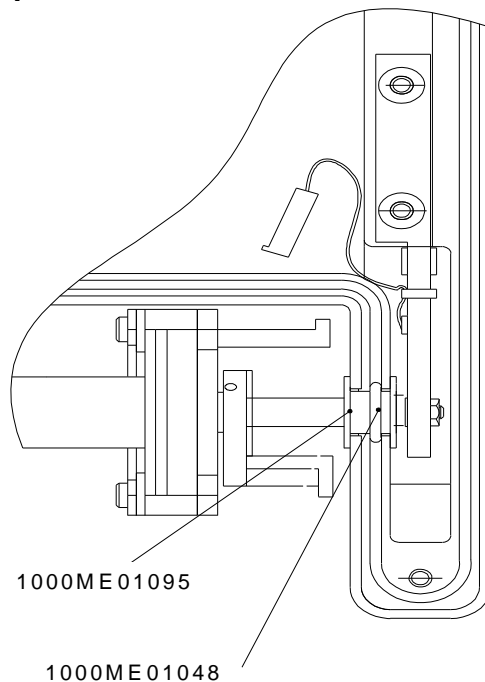
- 2.1 Place the unit on a static dissipative surface that is correctly grounded
- 2.2 Remove the six case retaining screws (M4 x 45 mm pan head) located in the base of the unit.
- 2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the power supply PCB and RS232 / NC cable from the control board PCB if fitted.
- 2.4 On reassembly carry out the self test routine as described in the Directions for Use.

### **3.0 Fitting Instructions**

- 3.1 Sealing cord between upper and lower case halves.
  - 3.1.1 To replace the sealing cord between the upper and lower case remove the transmission assembly. This is done by removing the two fixing screws at the beam end, the three screws in the chassis plate and the one screw through the motor plate. Retain these screws and washers for reassembly. Remove the cord from the recess around the upper case, this can then be discarded.
  - 3.1.2 To fit the new sealing cord, 1000ME01087, start at the middle fixing screw on the straight front edge. Then place the cord into the recess, this may need to be stretched slightly around the corners. Ensure that the cord does not come out of the recess. Trim the end from the length of cord, retaining this for replacing the cord under the base plate.
- 3.2 Seal on leadscrew
  - 3.2.1 Take the transmission assembly and remove the beam from the leadscrew using an M3 nut spinner taking care not to bend and damage the leadscrew. Remove the leadscrew seal from the leadscrew. Take the new leadscrew seal and fit the o ring 0000ME00237 supplied into the groove inside the new leadscrew seal 1000ME01095, fit the leadscrew seal ring provided in the groove, 1000ME01048. Fit this leadscrew seal onto the leadscrew with the internal o ring groove facing away from the beam. Reassemble the beam onto the transmission assembly again taking care of the leadscrew when tightening the nut. See figure 1 for further details.
  - 3.2.2 Reassemble the upper case and the transmission assembly using the fixing screws and washers removed earlier. When tightening screws ensure that the two at the beam are torqued to 2 Nm and the screw at the motor plate is torqued to 1 Nm.

## 13.4 0000TB00009 ISSUE 3 (CONT)

Fig. 1



### 3.3 Sealing cord lower case, RS232 baseplate

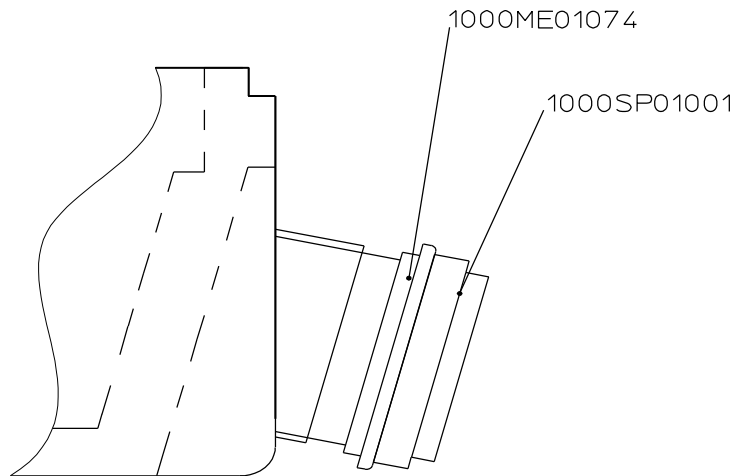
- 3.3.1 Remove the four screws from the RS232 baseplate on the lower case, retaining these for reassembly. Remove the old sealing cord from the recess in the lower case and discard. Fit the new cord into the recess again trimming any excess carefully. Reassemble the baseplate onto the lower case using the four screws removed earlier.

### 3.4 Mains inlet gasket

- 3.4.1 It is not necessary to change this gaskets in all pumps. This change has been used on line for some time, therefore it is necessary to check your particular pump before disassembling the mains inlet connector. If there is a blue moulded gasket part number, 1000ME01074, fitted it is not necessary to change the gasket. However if your pump is fitted with a black cut out gasket, 1000ME01029 it should be changed.
- 3.4.2 To replace this gasket remove the two fixing screws from the mains inlet connector in the case, retaining these for reassembly. The connector does not need to be fully removed from the case, the gasket can be removed by gently pulling over the connector. The new gasket should be fitted by gently stretching over the clamping face of the connector, ensure that this gasket is in the correct orientation see fig. 2. Use the retained screws to fit the connector assembly back in to the case.

## 13.4 0000TB00009 ISSUE 3 (CONT)

Fig. 2



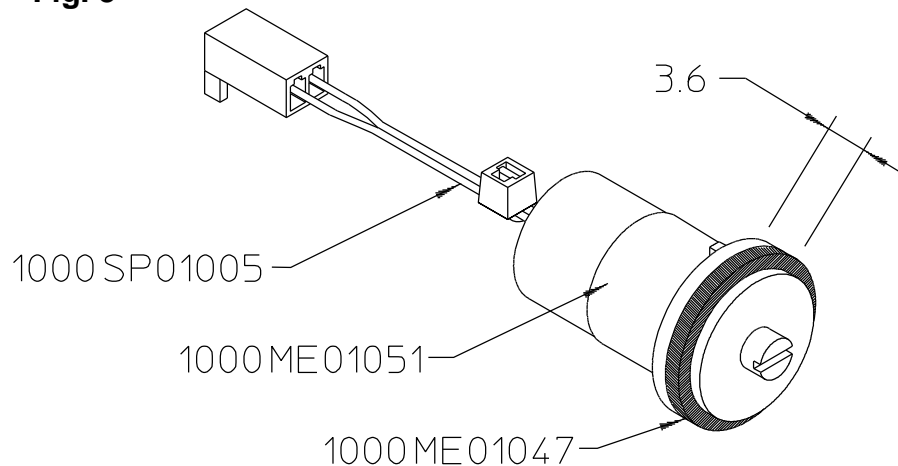
### 3.5 Alarm tube seal

3.5.1 This change has been in production for some time, it is however necessary to check each pump to find out which seal is fitted around the alarm tube in the lower case.

3.5.2 Disconnect the mains inlet connector, the ON / OFF connector and the alarm tube lead from the power supply PCB. Remove the four mounting screws from the power supply PCB (M3 x 20 pan head) retaining these for reassembly . Carefully remove the power supply PCB from the lower case. Remove the alarm tube assembly from the lower case. Check the seal on the alarm tube, if this is a black 'O' ring (0000ME00138) then it needs to be removed. Replace if necessary with the white seal provided, 1000ME01047. Ensure that the seal ring is in the correct orientation, the seal should be inverted and fitted to the alarm tube, see Fig. 3. Apply a small amount of silicon grease to the seal and refit the alarm tube assembly to the lower case. Refit the power supply PCB and secure in place with the four mounting screws (M3 x 20 pan head) retained from earlier.

## 13.4 0000TB00009 ISSUE 3 (CONT)

**Fig. 3**



- 3.6 Update the build issue of the unit with 'FI'.
- 3.7 Reassemble the upper and lower case halves, reconnecting the grey ribbon cable to the power supply PCB and RS232 / NC cable to the control board PCB if fitted.
- 3.8 Refit the six case retaining screws (M4 x 45 mm pan head) in to the base of the unit, clamping upper and lower cases together.
- 3.9 Enter the self test mode and check that all parameters are as they should be for the configuration of the pump.
- 3.10 Check the occlusion alarm level at L=4, following section 9.5 in the Service manual. If this is not within the stated limits given in table 9.5.1 of the service manual then the unit must be re-calibrated following section 9.4.

### **4.0 Technical Inquiries**

For additional technical assistance, contact your local ALARIS Service Centre.

## **13.5 0000TB00010 ISSUE 1**

### **Software upgrade for V4 ALARIS P1000,P2000 and P3000 Syringe Pumps (Software V4RC)**

This software upgrade can be fitted to the following units:

Serial numbers:

1001-10000 onwards

2001-10000 onwards

3001-10000 onwards

#### **1.0 Description**

##### **1.1 Occlusion constants for B-D Syringes updated**

The occlusion alarm constants for Becton Dickinson syringes have been updated following evaluation of the currently available syringes. The new KgF force levels for an equivalent line pressure of 375mmHg are:

B-D Plastipak 50ml - 3.5 KgF

B-D Plastipak 30ml - 2.4 KgF

B-D Plastipak 20ml - 2.2 KgF

B-D Plastipak 10ml - 0.9 KgF

##### **1.2 French default settings amended**

The French default settings have been modified as follows:

- Purge limit set to 9.9ml (was previously 2.0ml)
- Pump stops when volume limit reached
- Ac fail alarm disabled
- 

#### **2.0 Technical Inquiries**

For further assistance, contact your local ALARIS Service Centre.

## **13.6 0000TB00011 ISSUE 1**

### **Software upgrade for V4 ALARIS P1000,P2000 and P3000 Syringe Pumps (Software V4RD)**

This software upgrade can be fitted to the following units:

Serial numbers:

1001-10000 onwards

2001-10000 onwards

3001-10000 onwards

#### **1.0 Description**

##### **1.1 Option to set 10% NEOI alarm**

The software has been updated following customer request for a near end of infusion alarm at 10% of the syringe volume .

To enable this function enter code '319' and use the tenths up arrow to set 'J-1'.

This option also requires the fitting of a new NEOI flag Part No: 1000ME01096 and setting the NEOI test ( '4-0' to '4-1') to 5ml on a Terumo 50ml syringe.

#### **2.0 Technical Inquiries**

For further assistance, contact your local ALARIS Service Centre.

## **13.7 0000TB00012 ISSUE 1**

### **Software upgrade for V4 ALARIS P1000,P2000 and P3000 Syringe Pumps (Software V4RE)**

This software upgrade can be fitted to the following units:

Serial numbers:

1001-10000 onwards

2001-10000 onwards

3001-10000 onwards

#### **1.0 Description**

- 1.1 Software enhancements based on customer feedback.  
Modification to option to stop at volume limit. If the option has been enabled to stop the pump when a volume limit is reached then the purge/bolus button will not function immediately after the volume limit alarm.  
This was caused by the volume limit counters not being cleared and has been rectified in this software release.
- 1.2 Modification to setting of default occlusion level  
Setting a default occlusion alarm of level 0 has not previously been available to the user.  
This has now been rectified and can now be set between level 0 and level 6.

#### **2.0 Technical Inquiries**

For further assistance, contact your local ALARIS Service Centre.



## **13.8 0000TB00024 ISSUE 1**

### **Software Upgrade for V4 P1 - P3 ( Software V4RG)**

This software upgrade can be fitted to all V4 P1 - P3 units.

#### **1.0 Description**

The software for the V4 P1 - P3 units has been upgraded to incorporate the following customer requests.

- 1.1 An error in performance of the volume limit operation during the NEOI region. The volume limit was incorrectly reset when a NEOI alarm occurred.
- 1.2 An error in the special customer build option with 10% NEOI. With 10% NEOI option enabled, when a NEOI was detected the pump should continue at the set rate. In fact the infusion rate was determined by the KVO option E-0 or E-1. In addition the displayed rate always showed the set rate even when running at the KVO rate.
- 1.3 An error occurred when using the start button to cancel a volume limit in the near end of infusion region. The infusion continued at the set rate it switched to at the volume limit.(either the set rate or the KVO rate)

#### **2.0 Technical Inquiries**

For further assistance, contact your local ALARIS Service Centre.

## **13.9 0000TB00027 ISSUE 1**

### **Software Upgrade for V4 P4 units (Software V4RF)**

**This software can be fitted to all V4 P4 units**

#### **Description.**

- 1.0 It was noticed in manufacturing that there was an error stored in RAM even when a '611' Ram clear code has been entered.
- 1.1 When the stop at volume limit option is enabled and the volume limit reached the unit stops but the display shows KVO rate at 2.0ml/hr.
- 1.2 The volume option did not operate consistently within the NEOI region.
- 1.3 The KVO rate calculated at either NEOI or volume limit if the set rate is greater than 99.9ml/hr was found to be 20ml/hr instead of 2ml/hr.  
  
This was found during product release testing and would be a rare occurrence as the default setting on a P4000 is E-1.
- 1.4 The syringe misfit modification did not consistently function with all syringe options.
- 1.5 If the occlusion is set using the code '474' to level L-0 the pump reverts to default.
- 1.6 The start key is disabled while Auto-induction is running. When Auto-induction was running pressing stop / start 3x cancelled the induction.

#### **2.0 Technical Inquiries**

For further assistance, contact your local ALARIS Service Centre.

## 13.10 1000PB00074 ISSUE 2

### Fitting Instructions for PSU Modification - Battery Fuse Blowing

Ensure the unit is disconnected from the AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after component fitting.

Refer to pump assembly (V2 drg no. 1000ME00052; or V4 drg no. 1001PP00003) when following this instruction.

When disassembling the unit, ensure that no undue force is applied to the plunger holder and leadscrew, particularly when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe placed on the syringe clamp may be used if necessary but for regular servicing, we recommend the use of the upper case support cradle Part No. 0000JG00004.**

### 1.0 Introduction

The units which may be affected are the limited range with Power Supply PCBs:

1000EL00025	P1000 Serial Numbers 1000-04167
	P2000 Serial Numbers 2000-04594 to 2000-04816
	P3000 Serial Numbers 3000-04477 to 3000-04583

### Reason for modification

The PCBs listed above had a 3300uF 16V capacitor fitted in position C0. This change was required for P4000 units (to prevent any possibility of reset whilst using a very low battery); however the change was made in common on P1000, 2000 and 3000 units as well.

The power-up surge current was slightly larger with the 3300uF capacitor than with the 1000uF previously used - however the fuse type FS2 became critical. The fuse FS2 fitted on the power supply PCBs above can blow because it can be over-rated during power up whilst on battery.

## 13.10 1000PB00074 ISSUE 2 (CONT)

For this reason a 'Wickmann' type fuse must be used and it may be necessary to change some fuses on the PCBs listed above.

### 2.0 Access to the Pump

- 2.1 Place the unit on a static dissipative surface that is correctly grounded.
- 2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit.
- 2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply PCB.
- 2.4 Check fuse FS2 (next to PL3 on V4 units or next to IC1 on V2 units).

If it is a **yellow body type with 'BUSS' printed on it the fuse must be changed.**

If it is a white, with clear shrouded body the fuse does not need to be changed.

### 3.0 Description of Modification

- 3.1 Remove the power supply PCB as described in the Technical Service Manual.
- 3.2 Remove FS2 by desoldering it and replace it with:

**2A Fuse Link - Picofuse (Wickmann) (part number 0000-EL-00284).**

- 3.3 Change the power supply issue identification on the PCB:

1000EL00025	was Iss 22	mark as <b>Iss 24</b>
	or Iss 23	mark as <b>Iss 24</b>

- 3.4 Replace the power supply PCB.
- 3.5 Refit the upper and lower case assemblies back together, checking that the grey ribbon cable is connected to the control board and stowed in front of the heatsink.
- 3.6 Carry out the self test routine as described in the Directions for Use.

### 4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Centre.

## 13.11 1000PB00080 ISSUE 2

### Fitting Instructions for V4 Alarm Tube Seal Upgrade.

Ensure that the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical services manual after fitting any component.

For further information refer to the final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the service manual, publication number 1000PB00048 when following this instruction.

When disassembling the unit, ensure that no undue force is applied to the plunger holder and leadscrew, particularly when the unit is placed upside down to remove the six (M4 x 45 pan head) case retaining screws on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe clamp may be used if necessary but for regular servicing, we recommend the use of the upper case support cradle Part no. 0000JG00004.**

### 1.0 Introduction

This fitting instruction applies to the Alarm tube assy. (1000ME01051 and 1000SP01005) and outlines the necessary steps to replace the alarm tube o-ring seal (Part no. 0000ME00138) and replace the seal with (Part no. 1000ME01047).

The unit is made up of two halves, an upper and lower. The alarm tube is housed in the lower, the unit has to be disassembled to gain access to the alarm tube.

### 2.0 Access to the pump.

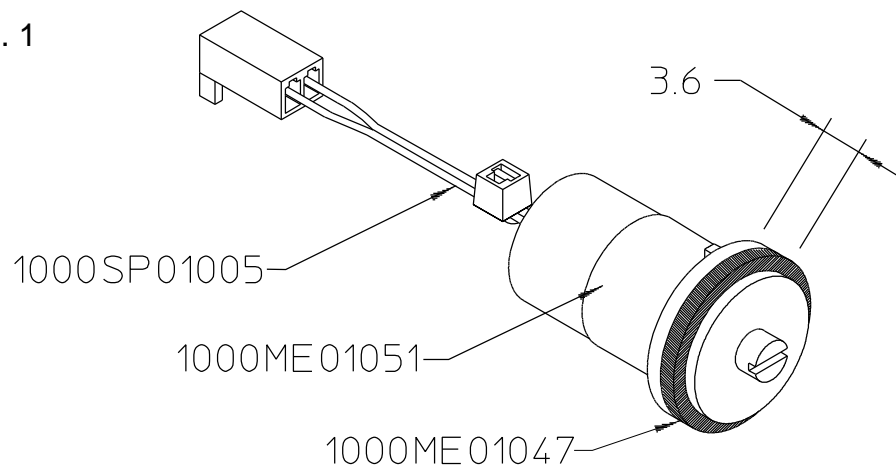
- 2.1 Place the unit on a static dissipative surface that has been correctly grounded.
- 2.2 Remove the six case retaining screws (M4 x 45 pan head) and washers (M4 wavy) located on the base of the unit, withdraw the base plate. Retain parts for refitting.
- 2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the power supply PCB and the RS232/NC cable if fitted.

## 13.11 1000PB00080 ISSUE 2 (CONT)

### 3.0 Fitting Instructions

- 3.1 Disconnect the AC lead, DC power ON/OFF lead, Alarm tube lead, and the battery connecting leads from the power supply PCB.
- 3.2 Remove the four mounting screws (M3 x 20 pan head) from the power board and retain for the board reassembly.
- 3.3 Withdraw the power supply PCB assembly from the lower case.
- 3.4 Remove the alarm tube assembly from the lower case.
- 3.5 Remove the o-ring (Part no. 0000ME00138) from the alarm tube assembly.
- 3.6 Invert the seal (Part no. 1000ME01047) and fit to the alarm tube, see fig. 1.
- 3.7 Apply silicone grease to the seal and refit the alarm tube assembly to the lower case.
- 3.8 Refit the power supply PCB and secure in place with the four mounting screws (M3 x 20 pan head) retained from earlier.
- 3.9 Reconnect the AC lead, DC power ON/OFF lead, Alarm tube lead, and battery connecting lead to the power supply PCB.
- 3.10 Reassemble the two halves reconnecting the grey ribbon cables to the power PCB.
- 3.11 Secure base plate to the case halves using the M4 x 45mm pan head screws and M4 wavy washers retained from earlier.
- 3.12 Carry out the self test routine as described in the Directions for Use.

Fig. 1



### 4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Centre.

## 13.12 1000PB00091 ISSUE 3

### Fitting Instructions Front Panel Spacers

This instruction applies only to **ALARIS** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048.

Ensure that no undue force is applied to the plunger holder and leadscrew, particularly when the unit is placed upside down to remove the six case retaining screws (M4 x 45 mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50 ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

### 1.0 Introduction

A rubber keycap (1000ME01057) has been developed to enhance the serviceability of the V4 pumps both in manufacturing and in the field.

When these rubber keycaps are fitted to a display board they will stay in place when the board is fitted or removed therefore alleviating the need to replace a front panel if the display and control boards have to be removed for any reason.

The function of the front panel is un-changed, however due to the nature of the material used to manufacture the new keycaps the 'feel' of the button is slightly different and no 'click' will be heard when a button is activated.

This fitting instruction applies to all V4 pumps with build issues prior to issue 35.

## **13.12 1000PB00091 ISSUE 3 (CONT)**

The front panel spacers fitted to these pumps (1000ME01054 or 1000ME01076) have been superseded by the rubber keycap (1000ME01057). The rubber keycap is fully interchangeable with the pumps with build issues prior to 35, no mandatory up-grade is necessary. However when servicing units with build issues prior to 35, where a spacer button requires replacement it is recommended that the spacers are replaced as a complete set. This will produce a pump with buttons all of the same 'feel'.

### **2.0 Access to the pump**

- 2.1 Place the unit on a static dissipative surface that is correctly grounded.
- 2.2 Remove the six case retaining screws (M4 X 45 mm pan head) located in the base of the unit.
- 2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the power supply PCB and RS232 / NC cable from the control board PCB if fitted.
- 2.4 Carefully remove the transmission flexi connector, the syringe sizing potentiometer connector and the beam strain gauge connector from the control board.
- 2.5 Remove the six control and display board fixing screws (M3 X 12 mm) and the earth tag fixing screw from the transmission (M4 X 10 mm pan head).
- 2.6 Carefully remove the control and display boards from the upper case.
- 2.7 Remove all the front panel spacers (1000ME01054 / 1000ME01076) from their recesses in the case.
- 2.8 Fit the rubber keycap (1000ME01057) over the buttons on the display board. Check that the rubber keycap is fitted correctly over the switch. Check the operation of each switch once the new keycap has been fitted using self test routine 223.
- 2.9 Reassemble the upper case reversing steps 2.1 to 2.6.
- 2.10 Carefully test that all the switches operate correctly when the unit is reassembled. Complete the self test sequence as described in the relevant section of the Directions for Use.
- 2.11 The unit may now be returned into service.

### **3.0 Technical Inquiries.**

For additional technical assistance, contact your local ALARIS Service Centre.



### 13.13 0000TB00038 ISSUE 1

#### Alternative Routing for the P1-3, P4 & P5 Flexible Circuit

This bulletin applies to P series pumps from the following serial numbers onwards:

1001-16138, 2001-18755, 3001-17130, 4001-11824, 5000-02094

#### Description of Change

Previous versions of the P series pumps routed the flexible circuit (1000SP01006, 1000SP01040 or 1000SP01041) for the transmission assembly underneath the chassis plate and through a cut-out in the linear grid up to the motor. This left a section of flexible circuit which, in certain circumstances, could get caught in the mechanism. Although this did not affect the functionality of the pump, it was decided that an alternative routing should be devised. This is to be implemented on all the pumps listed above.

The new method takes a different route under the chassis plate and uses one additional foam pad (part number 1000ME01066) to hold the circuit in place. It creates a shorter section of flexible circuit going to the motor and fits into the case better, avoiding any collision problems. However, the basic cut-out of the flexible circuit is identical.

A schematic of the new routing is shown in Fig 1. below, but for more details, refer to the fitting instructions for the flexible circuit 1000PB00135.

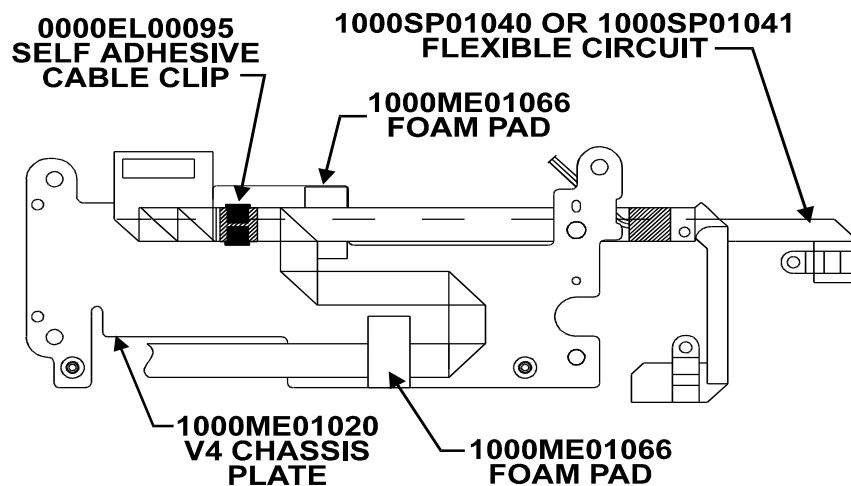


Figure 1.

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### **Impact of Change**

- 1.1 The change does not affect the functionality of the pumps, so it is not necessary to upgrade any older pumps to have this routing of flexible circuit. However, be aware that the folds shown on older drawings of the flexible circuit or transmission will no longer match the latest pumps being supplied.
- 1.2 Any spare flexible circuits that are ordered in future will be supplied with folds already in them according to the new routing. When fitting these circuits, it will be necessary to refer to the fitting instructions 1000PB00135.

### **2.0 Technical Inquiries**

For additional technical assistance, contact your local Alaris Service Centre.

## 13.14 0000TB00056 ISSUE 1

### Fluid Ingress Sealing Enhancements

This bulletin applies only to P series syringe pumps with serial numbers in the following range:

1001-00001 to 1001-20135  
2001-00001 to 2001-20374  
3001-00001 to 3001-20100  
4001-00001 to 4001-20018  
5001-00001 to 5001-02387  
7001-00001 to 7001-03092

### Introduction

Pumps with serial numbers listed above can have a modification fitted to improve the existing fluid ingress protection. All units with serial numbers greater than those listed above have the improvements fitted as standard. Upgrade kits are also available to enhance the fluid sealing properties of the product. It is not a mandatory requirement to upgrade units to this specification but in hospitals where fluid ingress has been a problem, it would be recommended.

A range of changes have now been made to all product currently being shipped, as listed below:

1. Changes to the Transmission Mechanism to fully seal the syringe plunger holder and leadscrew area. This includes a new backplate seal, backplate, declutch lever and outer tube, plus several additional O rings. The addition of the kit means that some syringes cannot be filled as far as previously.

Note: For example a BD50 can now only be filled to 58ml, rather than 60ml, although the majority of the syringes specified for use with the P series can still be filled to their maximum point.

2. Change to the lower case on P1000/2000/3000 and P4000 only. The lower case now has a drainage channel that prevents fluid from building up in the area around the plunger holder when the pump is placed on a pole with a normal ALARIS Pole Clamp.
3. Re-design of the On/Off Splash Cover.
4. Change to the design of the RS232 gasket to incorporate a rubber cap that fits over the connector when RS232 connector is not in use.

## 13.14 0000TB00056 ISSUE 1

### Upgrades Kits Available

In order to simplify the ordering system for customers wishing to upgrade units in the field, three upgrade kits have been created. These kits combine together several of the improvements, as outlined below. All of the kits are supplied with comprehensive fitting instructions outlining how to retrofit the upgrade to older pumps and can now be ordered from ALARIS Medical Systems.

#### 1.3 1000SP01046 - Applicable to All P Series units Built After 1995

This kit contains all of the parts required to upgrade and fully seal the transmission, with appropriate fitting instructions. It also contains a new On/Off splash cover, plus a replacement RS232 Gasket plus cap, should it be required.

#### 1.4 1000SP01048 – Applicable to P1000/2000/3000 and P4000 Units at Build Issue 20 or Below

Previously an upgrade kit was available for early version 4 units (1000SP01037) which contained a new case sealing cord, a new mains inlet gasket, a new leadscrew gasket and a new seal for the alarm tube.

1000SP01048 have superseded 1000SP01037; the new kit also includes the new RS232 gasket, new on/off seal and the transmission upgrade parts. This upgrade is recommended for an old unit without the previous upgrade.

#### 1.5 1000SP01033 – Fitted to P1000/2000/3000 and P4000 Units Only

This kit contains the new lower case half with a drainage channel, plus the required labels, etc. It also contains a new On/Off Splash cover and RS232 gasket with cap and Fitting Instructions.

### Recommendations About the Kits

In order to be most confident that a unit will prevent fluid ingress, it should be fitted with all of the upgrades mentioned in this bulletin. However, fitting of the transmission upgrade involves dis-assembly and re-assembly of the transmission. ALARIS would advise should only be carried out by qualified personnel. As a result, ALARIS would recommend the following:

- **P1000/2000/3000/4000 Units** – It is simpler to just fit a new lower case, (Spare Kit - 1000SP01033). It is recommended that the kits 1000SP01046 and 1000SP01048 should only be fitted when there is a history of fluid ingress.
- **PCAM and P7000 Units** – It is recommended that the transmission be sealed using kit 1000SP01046 when the pump has a history of fluid ingress.

### **13.14 0000TB00056 ISSUE 1**

Note: If fitting to a P7000 unit, it must be fitted with software version V1R6 or above, otherwise it is not possible to fully calibrate the linear position potentiometer.

### **Technical Enquiries**

For further information, please contact your local ALARIS Service Centre.

## 13.15 0000TB00057 ISSUE 1

### Technical Bulletin – Recommendation of DC/AC Inverter

**This bulletin applies to all Version 4, P5000, P6000, TIVA & P7000 syringe pumps.**

#### 1.0 Introduction

Following customer requests for a means to run the above pumps from a 12V power supply, a range of dc/ac inverters have been tested for compatibility with the IVAC syringe pumps. The inverter that passed all the tests satisfactorily is called the PROwatt 150watt Inverter. It is manufactured by STATPOWER Technologies Corporation, Canada and is distributed in the UK by The Merlin Group. This inverter is therefore being recommended for use with V4, P5000 and P7000 syringe pumps in ambulances etc.

#### 2.0 Results from Testing

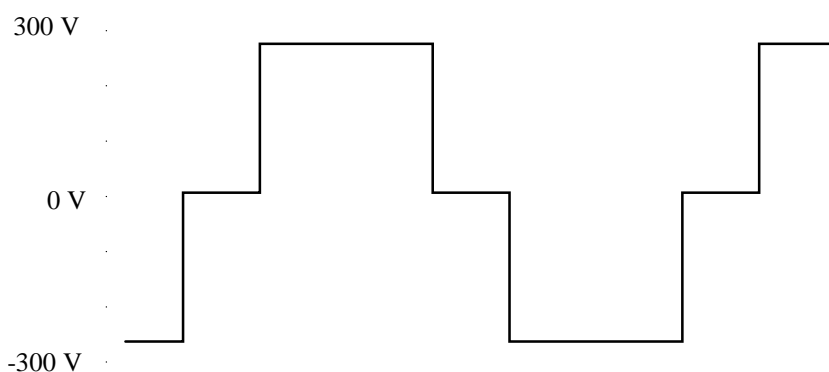
Alaris Research & Development, Beechwood carried out the following tests.

##### 2.1 *Performance when running from a vehicle's battery.*

A P7000 and P1000 (V4) were run from a PROwatt 150watt Inverter, attached to a vehicle's battery via the cigarette lighter socket, for a total of approximately 13 hours. There were no problems experienced in this situation.

##### 2.2 *Output Waveform*

- The drawing below is a visual representation of the modified sinewave output of the PROwatt 150watt Inverter.



- Maximum is approximately 280V, minimum is approximately –260V.
- The frequency is 50Hz.
- There are no spikes in the waveform, even when the attached pump is turned on and off.
- The inverter cuts out (stops) and alarms when the input voltage is either too high (>15V) or too low (<10V).
- The rms. is approximately 240VAC.

## **13.15 0000TB00057 ISSUE 1 (CONT)**

### **2.3 Volumetric and Temperature Test.**

A P7000 was run via the PROwatt 150watt Inverter (attached to a 12V power supply) at 5ml/hr. The pump and inverter were placed in an environmental test chamber running at 40°C (this is the top limit of both the pump and inverter temperature specification). A 2 hour volumetric test was then performed on the pump.

The linear accuracy of the pump in these conditions is +1.36%, which is within the specification for the P7000 (+/-2%). The heatsink is approximately 1 °C above ambient.

### **3.0 Inverter Details**

Addresses for Distributors in Europe:

#### **UK & Mainland Europe**

Statpower Technologies Limited  
Unit 1, Hithercroft Court  
Lupton Road  
Hithercroft Industrial Estate  
Wallingford  
Oxfordshire OX10 9BT

Tel: +44 (0) 1491 824333  
Fax: +44 (0) 1491 824466

#### **Germany & Netherlands**

Statpower Technologies GmbH  
Technologiezentrum Jülich  
Karl-Heinz-Beckurts-Str.13  
D-52428 Jülich  
Germany

Tel: +49 (0) 2461 690770  
Fax: +49 (0) 2461 690779

Current cost for a single PROwatt 150watt Inverter in the UK is £86.

### **4.0 Technical Inquiries.**

For further information, please contact your local Alaris Service Centre.

## 13.16 0000TB0058 ISSUE 1

### Technical Bulletin – Syringe Plunger Detect Problems

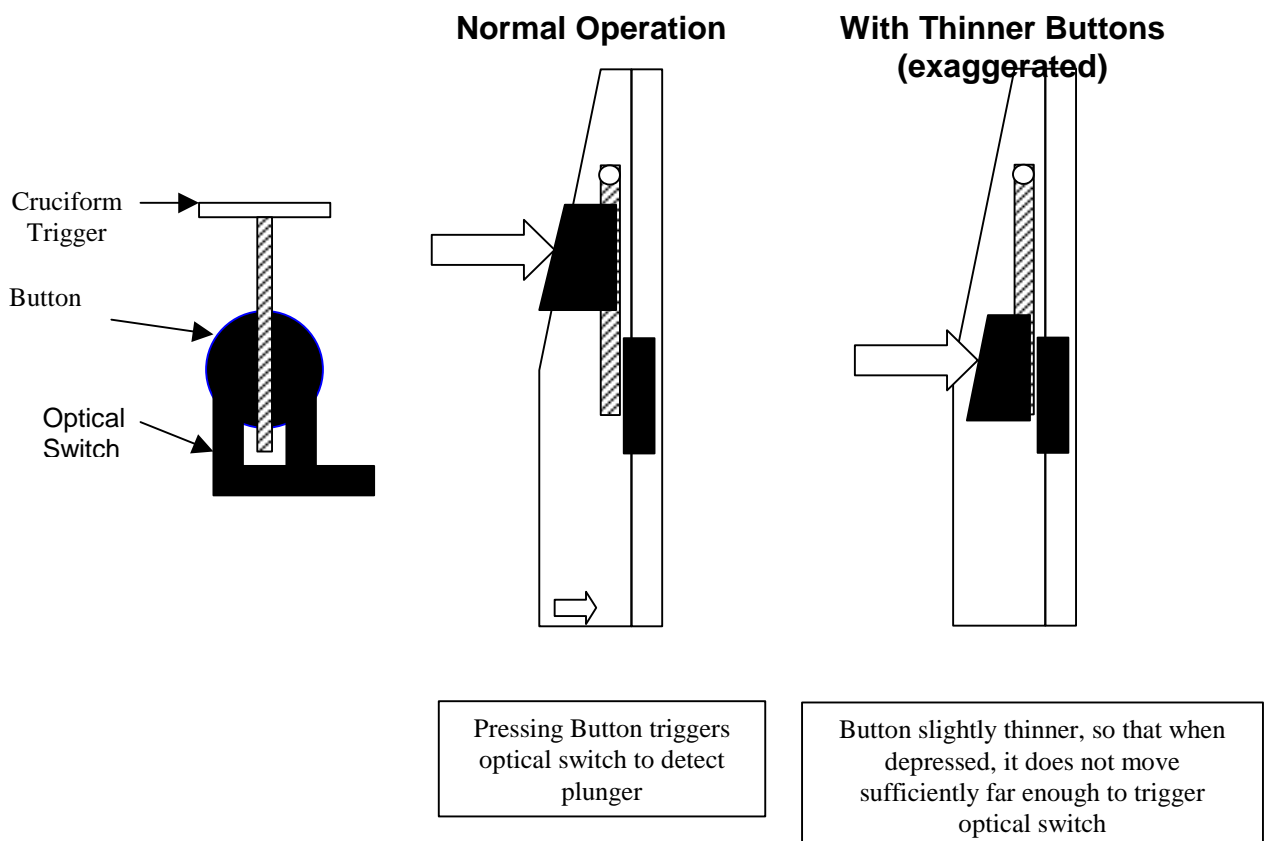
This bulletin applies only to P series syringe pumps built with the following serial numbers:

1001-20135 to 1001-20382, 2001-20374 to 2001-20598  
3001-20100 to 3001-20341, 4001-20018 to 4001-20029  
5001-02387 to 5001-02484, 6001-00100 to 6001-00203  
6002-00020 to 6002-00211, 7001-03092 to 7001-03196

#### Description of Fault

The units listed were fitted with a new moulded plunger detect button. The first batch of these buttons were slightly undersize and this has caused some problems with syringe detect on a number of units. The units will detect larger syringes (ie. 50, 100ml) of most makes, but have failed to detect smaller syringes properly.

The reason for the problem is as shown below:



This problem was quickly recognised and, as a temporary measure before new buttons could be obtained, foam pads were fitted inside the plunger holder to rectify the units shipped. The majority of the units shipped in this serial number range were fitted with these pads. Testing of the pads in house showed that all units fitted with these pads were able to detect the full range of syringes as normal, so it was deemed acceptable that they be shipped.



### 13.16 0000TB0058 ISSUE 1 (CONT)

This bulletin is intended to raise awareness of the problem, in case customers continue to experience problems. A longer-term solution is to replace the plunger button with a new one (1000ME01114),

since the problem has now been rectified. This replacement need only be done to units where problems have occurred; it is not mandatory.

Before attempting any rectification, test the unit as follows:

- Enter service code “125” and press the stop button until the plunger detect test is found. This is 8-0/8-1 on P1/2/3/4 and will be indicated in the text on other P series pumps.
- Try fitting a plunger from a standard 50ml syringe into the plunger holder, in a variety of different positions, approximately 10 times. Do the same with a smaller 10ml syringe.
- Providing the syringes are detected every time (indicated by a change from 0 to 1 on the display), it may not be necessary to carry out the rectification. Otherwise, refer to the rectification instructions below.

#### **Access to the Pump.**

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

### **13.16 0000TB0058 ISSUE 1 (CONT)**

- Place the unit on a static dissipative surface that is correctly grounded.
- Remove the six case retaining screws (M4 x 45mm Pan Head) located on the base of the unit.
- Carefully separate the upper and lower case halves and disconnect any ribbon cables that link the two halves.

#### **Rectification Required**

- Remove the grub screw that secures the declutch lever.
- Remove the four black countersunk screws that secure the backplate of the plunger holder.
- Remove the plunger detect button, plus the white cruciform from the plunger holder. Push out the pin that holds the cruciform and make up a new button assembly, using a new button (1000ME01114). Remove the O ring from the old button with pliers and fit it around the new button. Apply silicone grease to the outside of the button to ensure that it operates smoothly. Refit the new assembly into the plunger holder.
- Check that the two small springs that activate the plunger button are correctly fitted back into the new button. Replace the backplate and secure the four black countersunk screws.
- Check that the button springs back freely after being pressed. If not, it may be that one of the springs is not correctly located, or there is not enough grease on the button. Remove the backplate once more and rectify this as required.
- Refit the declutch lever. Apply Loctite 242 (part number 0000ME00051), or equivalent to the screw before refitting to ensure that it remains fixed in position. When fitting the screw, make certain that the end point of the grubscrew goes through the hole in both the plastic backplate seal and the hole in the intermediate tube.
- Re-assemble the unit, by re-connecting all of the ribbon cables and secure the two halves together with the six M4x45 case screws.
- Carry out a “123” self test, as described in the Directions For Use, to check full functionality of the pump before returning it to a clinical situation. In particular, repeat the test of the plunger detect system using a 50ml syringe and a 10ml syringe to confirm that the modification has been carried out correctly.

#### **Technical Enquiries**

For further information, please contact your local Alaris Service Centre.

## 13.17 0000TB00059 ISSUE 1

### Technical Bulletin – Transmissions Tight When Declutched

This bulletin applies only to P series syringe pumps built with the following serial numbers:

1001-20135 to 1001-20382, 2001-20374 to 2001-20598  
3001-20100 to 3001-20341, 4001-20018 to 4001-20029  
5001-02387 to 5001-02484, 6001-00100 to 6001-00203  
6002-00020 to 6002-00211, 7001-03092 to 7001-03196

#### Introduction

The units listed above were the first to be fitted with the new fluid sealing upgrade. This prevents ingress of fluid along the leadscrew when the area around the plunger holder is filled with fluid for extensive time periods. One component of this upgrade is an O ring that fits into a new plastic backplate seal (part number 1000ME01111) and seals the leadscrew.

Whilst some increase in tightness is to be expected, due to the O ring introducing additional friction, it has been noticed that, in a few cases, the transmission is excessively tight and difficult to move when declutched.

This problem has been investigated and found to be caused by the leadscrew rubbing on the plastic part of the new seal, rather than running smoothly on the O ring. This was due to tolerance variations on the first batch of seals.

Since it is due to tolerance variation, not all of the pumps in this serial number range are affected, the majority being as smooth as normal.

In order to overcome the problem initially in manufacturing, silicone grease was applied to the internal O ring and plastic, which made the declutch action a lot better, for all products shipped.

However, it is possible that the grease will dry out. Whilst the user can simply re-apply grease to the seal, a better long-term solution is to replace the backplate seal with a new one. The design of this part has now been adjusted slightly to prevent any tightness, even in the extremes of the tolerance range.

This replacement need only be done to units where problems have occurred; it is not mandatory.

If a transmission is found to be excessively tight, then a new backplate seal (1000ME01111), plus two replacement O rings (0000ME00237 and 0000ME00277) should be ordered. Refer to the following sections for details of how to remove the old part and refit the new one.

These parts cannot be fitted to older product with serial numbers below those shown, unless they have already been upgrade with the fluid sealing kits 1000ME01046 or 1000ME01048.

## 13.17 0000TB00059 ISSUE 1 (CONT)

### Access to the pump

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

**This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.**

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

**Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.**

- 1.6 Place the unit on a static dissipative surface that is correctly grounded.
- 1.7 Remove the six case retaining screws (M4 x 45mm Pan Head) located on the base of the unit.
- 1.8 Carefully separate the upper and lower case halves and disconnect any ribbon cables that link the two halves.

### Rectification Required

- 1.9 Remove the six screws that retain the transmission in the upper case and unplug the various connectors for the flexible circuit, beam, etc that connect the transmission to the control PCB. Remove the transmission assembly.
- 1.10 Remove the beam assembly from the end of the leadscrew, by removing the M3 nut from the end. Also remove the leadscrew seal. Retain all parts for re-assembly later.
- 1.11 Remove the grub screw that secures the declutch lever and remove the lever.
- 1.12 Remove the four black countersunk screws that secure the backplate of the plunger holder.
- 1.13 Remove the backplate, plus the plastic backplate seal, 1000ME01111, and discard this.

### **13.17 0000TB00059 ISSUE 1 (CONT)**

- 1.14 Assemble the replacement seal, by inserting the smaller O ring (0000ME00237 6.5x1) into the internal recess at the end of the seal and fitting the larger O ring (0000ME00277 11.5x1.5) in the external groove.
- 1.15 Apply silicone grease around the outside of the seal, over the O ring, to help lubricate it.
- 1.16 Push the replacement seal into the backplate and refit the backplate onto the plunger holder, with the four countersunk screws. When doing this, check that the two small springs that activate the plunger button are correctly fitted back into the new button.
- 1.17 Check that the button springs back freely after being pressed. If not, it may be that one of the springs is not correctly located, or there is not enough grease on the button. Remove the backplate once more and rectify this as required.
- 1.18 Refit the declutch lever. Apply Loctite 242 (part number 0000ME00051), or equivalent to the screw before refitting to ensure that it remains fixed in position. When fitting the screw, make certain that the end point of the grubscrew goes through the hole in both the plastic backplate seal and the hole in the intermediate tube.
- 1.19 Replace the leadscrew seal and the beam assembly, tightening the M3 nut securely.
- 1.20 Refit the transmission into the upper case. The four screws that hold down the chassis plate should be torqued to 1Nm, whilst the two screws for the beam should be 2Nm. Refit all the connectors onto the control board.
- 1.21 Re-assemble the unit, by re-connecting all of the ribbon cables and secure the two halves together with the six M4x45 case screws.
- 1.22 Carry out a "123" self test, as described in the Directions For Use, to check full functionality of the pump before returning it to a clinical situation. In particular, since the beam has been removed, an occlusion test should be carried out and, if necessary, the occlusion detect system should be re-calibrated, in accordance with the instructions in the relevant Technical Service Manual.

### **Technical Enquiries**

For further information, please contact your local ALARIS Service Centre.

## 13.18 0000TB00060 ISSUE 1 (CONT)

### Technical Bulletin – Software Upgrade V4RH Intermittent ERC

This bulletin applies to P series syringe pumps built with the following serial numbers:

1001-20227 to 1001-20364  
2001-20415 to 2001-20558  
3001-20207 to 3001-20309

The error may also appear in units that have been upgraded using the fluid sealing kit (1000SP01048).

#### Description of Fault

Intermittent “ERC’s” have been noted to occur as a false alarm, on a limited number of units. This error code will appear during the start up routine of the pump if a problem is seen with the motor or the drive circuitry. The motor is working correctly, however the software is not receiving the signal within the expected time frame. This is due to small changes increasing the friction in the system and the software limits being very tight historically.

This error does not affect patient safety, as it will only be seen on start up and the pump will fail-safe. If the pump is turned off and restarted, intermittent errors will clear and the pump may be used normally. Errors that do not clear should be investigated in the normal way. Refer to the Technical Service Manual for further details.

This bulletin is intended to raise awareness of the problem, in case customers experience any problems. Fitting V4RH software will eliminate intermittent errors of this type.

**This replacement need only be done to units where problems have occurred; it is not mandatory.**

#### Technical Enquiries

For further information, please contact your local Alaris Service Centre.