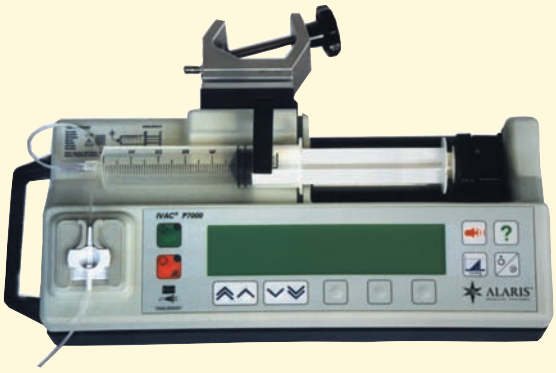
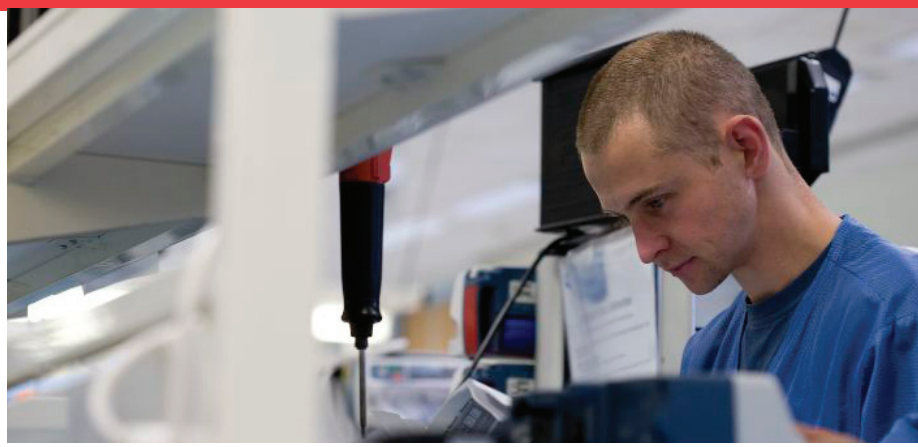
IVAC® Syringe Pumps

Models **P7000**, **P6000**, **TIVA**, **TCI & TIVA**

Technical Service Manual





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Chapter 1

Introduction & Start Up

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Introduction

The IVAC® Syringe Pumps are a range of syringe pumps with features dedicated for use in a variety of areas within a hospital. The range includes these models:

- The IVAC® P6000 Syringe Pump is a syringe pump suitable for critical care and general infusion applications
- The IVAC® P7000 Syringe Pump is a variable pressure syringe pump suitable for critical care and general infusion applications
- The IVAC® TIVA Syringe Pump is an anaesthesia syringe pump
- The IVAC® TCI & TIVA Syringe Pump is an anaesthesia syringe pump incorporating Diprifusor

Two versions of this range of pumps have been manufactured which can be identified by the type of power on/off switch:

- Mark 1 includes a mechanical power on/off switch on the end of the pump
- Mark 2 includes a soft power on/off button on the front panel

Product Familiarity

Ensure that you are fully familiar with the syringe pump by carefully studying the *Directions for Use* (*DFU*) prior to operation and prior to attempting any repairs or servicing. As part of continuous improvement, product enhancements and changes are introduced from time to time.

Purpose of this Manual

This Technical Service Manual describes how to set up, test and maintain the following IVAC® Syringe Pump models:
P6000
P7000
TIVA
TCI & TIVA

This manual is intended for use by personnel experienced in medical equipment testing and maintenance procedures.

Conventions Used in this Manual

BOLD	Used for pump Display names, access codes, controls and indicators referenced in this manual, for example, **SERVICE ACCESS** menu, access code **251**, **OK** softkey.
'Single quotes'	Used to indicate cross-references made to another section of this manual. For example, see Chapter 2, 'Configuration and Calibration'.
Italics	Used for other documents or manuals. For example, refer to the relevant *Directions for Use (DFU)* for further information.
	Wherever this symbol is shown a Hints & Tips note is found. These notes provide useful advice or information that may help to perform the task more effectively.
	Wherever this symbol is shown a Toolbox note is found. These notes highlight an aspect of test or maintenance that is important to know about. A typical example is drawing attention to a software upgrade that you should check has been installed.

General Precautions

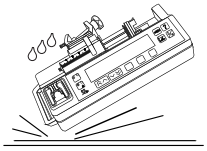
Prior to using this pump, carefully read the Operating Precautions described in the *Directions for Use (DFU)*.

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

An explosion hazard exists if the pump is used in the presence of flammable anaesthetics. Exercise care to locate the pump away from any such hazardous sources.

Dangerous Voltage. An electrical shock hazard exists if the casing of the pump is opened or removed. Refer all servicing to qualified service personnel.

This pump is protected against the effects of high energy radio frequency emissions and is designed to be 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.

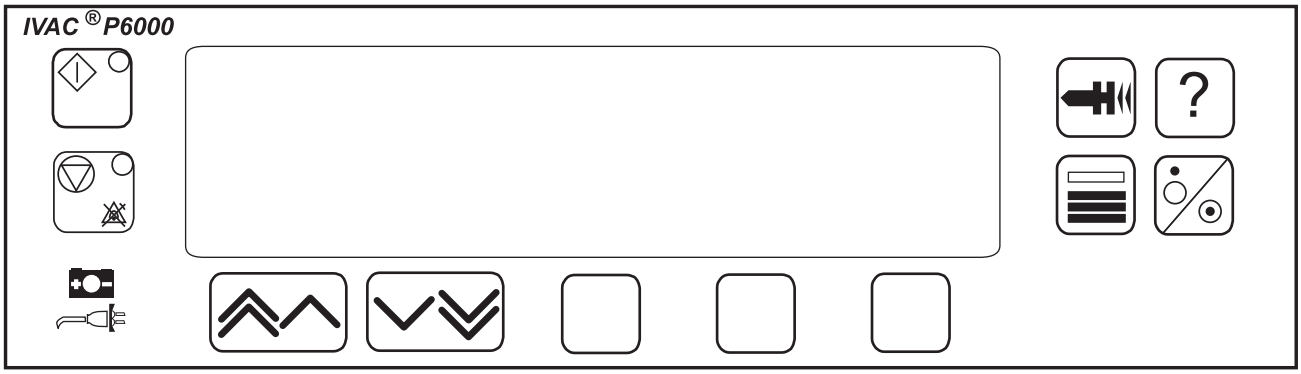


If the pump is dropped, subjected to excessive moisture, humidity or high temperature, or otherwise suspected to have been damaged, remove it from service for inspection by qualified service personnel.

When connected to an external power source, a three-wire (Live, Neutral, Earth) supply must be used. If the integrity of the external protective conductor in the installation or its arrangement is in doubt, the pump should be operated from the battery.

Front Panel, Controls and Indicators

Front Panel



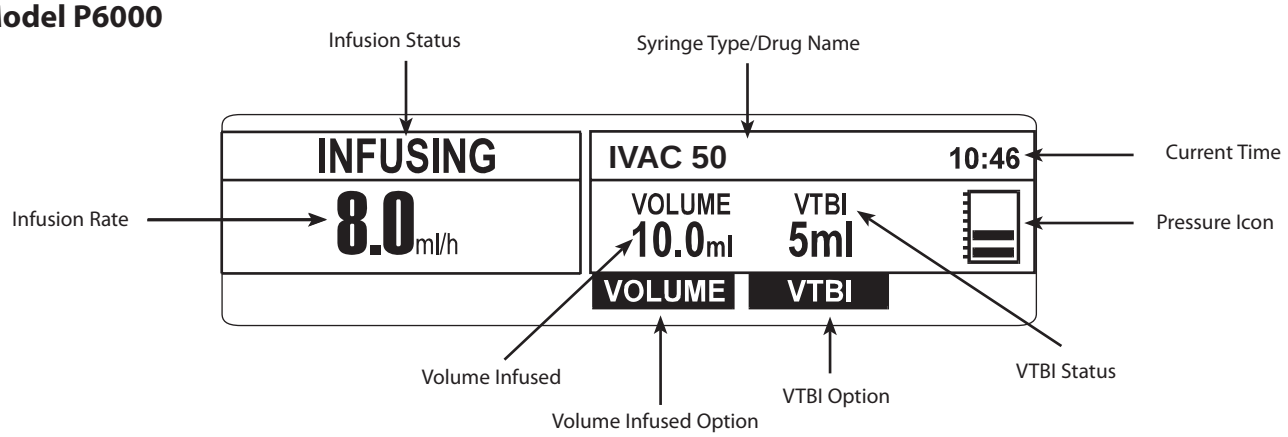
Front Panel - Model P6000 example

Controls and Indicators

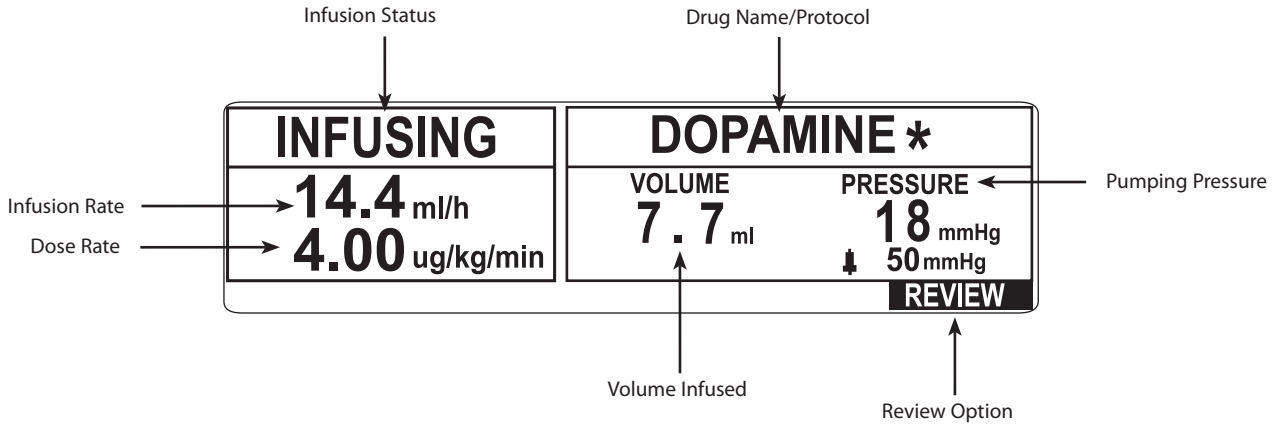
	**START**	Press to start the infusion. The green LED will flash during infusion.
	**STOP**	Press to stop/hold the infusion. The amber LED will be lit while on hold.
	**BATTERY**	When illuminated, indicates that the pump is running on the internal backup battery. When flashing, indicates that the battery power is low, with less than 30 minutes of use remaining.
	**AC POWER**	When illuminated, indicates that the pump is connected to an AC power supply and the battery is being charged.
 	**RATE KEYS/ CHEVRONS**	Double or single for faster/slower, increase or decrease of values shown on main display.
	**BLANK SOFTKEYS**	Use in conjunction with the prompts shown on the display.
	**PURGE/ BOLUS**	Press to purge the extension set during setup while the pump is on hold, or to deliver bolus at an increased rate while an infusion is running. See 'Basic Features' for further information.
	**OPTION**	Press to access optional features. See 'Basic Features' for further information.
	**PRESSURE**	(Model P6000, Model TIVA, Model TCI &TIVA). Press to display the pumping pressure and alarm level.
	**PRESSURE**	(Model P7000 only). Press to display the pumping pressure and alarm level.
	**ON/OFF**	Press once to switch the pump ON. Press and hold down for 3 seconds to switch the pump OFF. Note: Mark I pumps have a mechanical ON/OFF switch on the side of the pump.
	**24H LOG**	(Mark 1: Model P6000, Model TIVA, Model P7000). Press to display the 24 hour log of volume infused.

Main Display

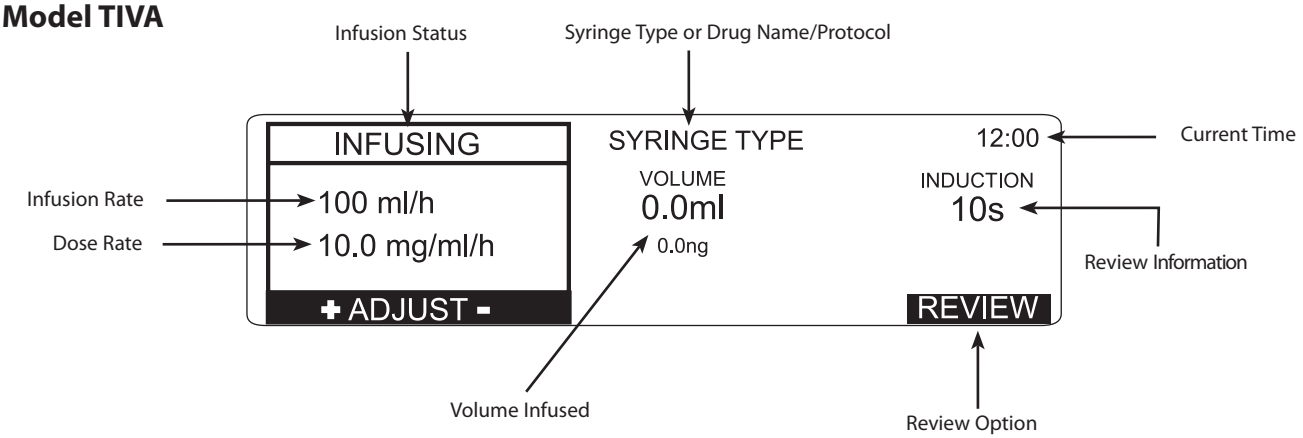
Model P6000



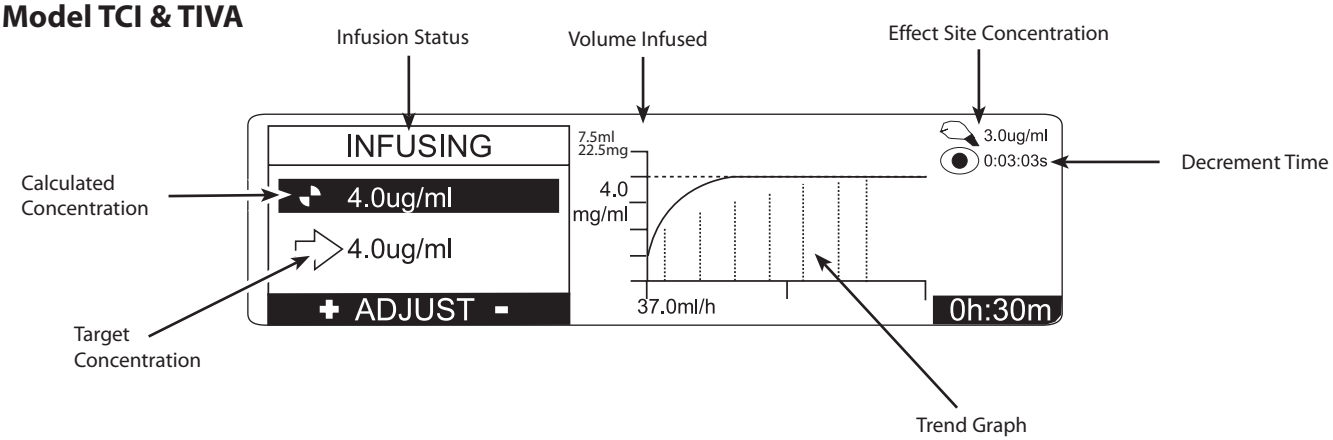
Model P7000 (Dedicated mode)



Model TIVA



Model TCI & TIVA



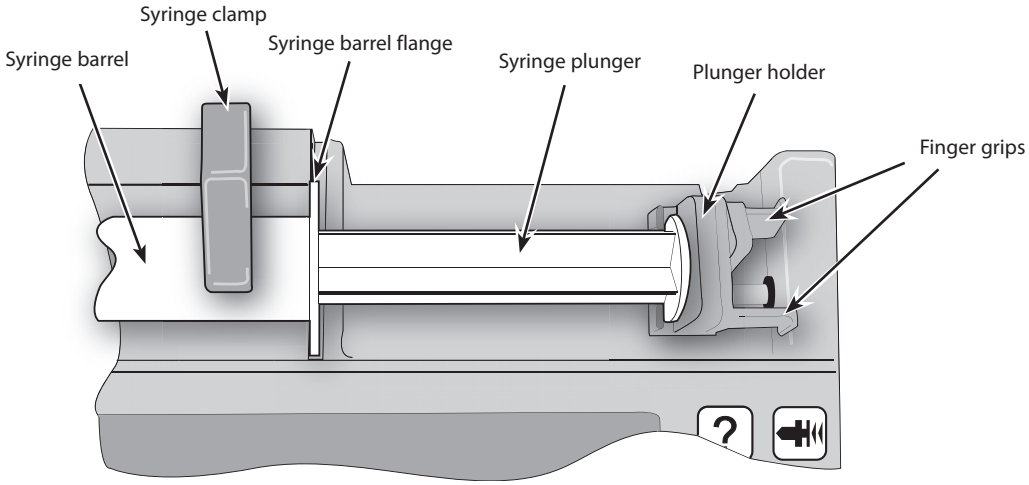
Note that the Cumulative Drug Mass Infused is also displayed (directly beneath Volume Infused) on pumps with software version V3R2 and above.

Loading a Syringe

1. Squeeze the finger grips together on the plunger holder and slide the mechanism to the left.
2. Lift the syringe clamp and rotate to the left.
3. Insert the syringe into the slots on the plunger holder (see Figure 1). For Model TCI & TIVA only - ensure that the Diprifusor tag is positioned towards the display to allow the prefilled syringe tag to be read.
4. Squeeze the finger grips on the plunger holder and slide the mechanism to the right until the syringe barrel flange locates into the V slot (see Figure 2).

Ensure that the syringe is advanced until the syringe barrel flange touches the front of the V slot closest to the syringe clamp. This is important to prevent delay at the start of the infusion.

5. Release the finger grips. Apply gentle pressure on the plunger holder to ensure that the drive is engaged.
6. Rotate the syringe clamp until it locks onto the syringe barrel (see Figure 2).
7. Check that the syringe plunger and syringe barrel flange are correctly located into their slots.



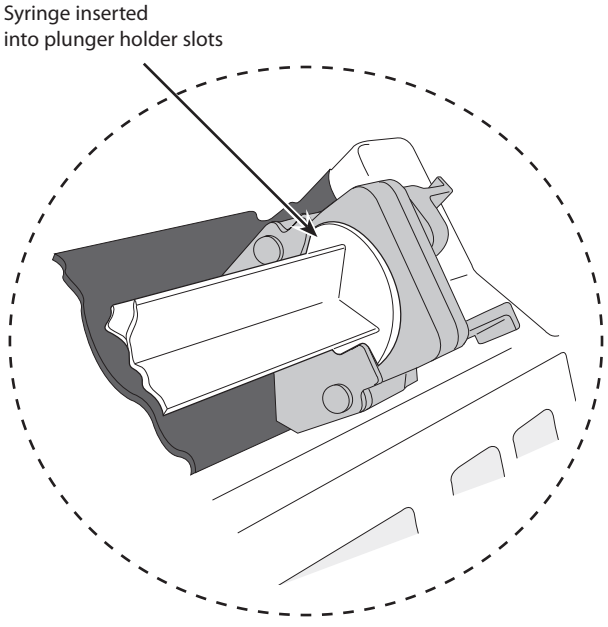


Figure 1.

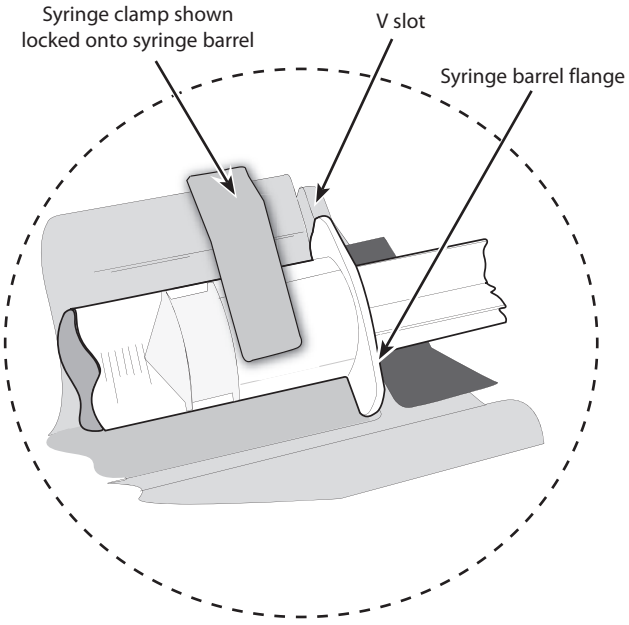


Figure 2.

Loading a Syringe *(continued)*

Guide to handling the pressure disc

1. Insert the pressure disc into pressure disc support slots as shown in Figure 1.
2. Push pressure disc securely home as shown in Figure 2.

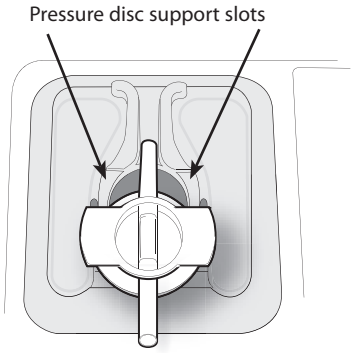


Figure 1.

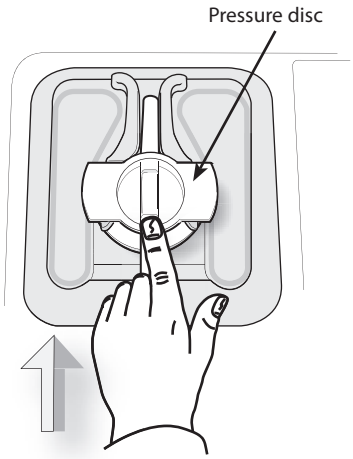


Figure 2.

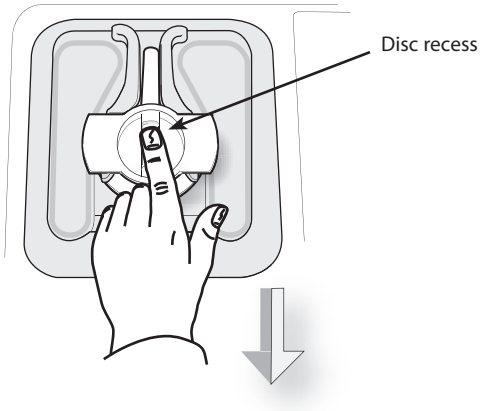


Figure 3.

When removing the pressure disc pull it with your finger inside the disc recess as shown in Figure 3. above.

Starting the Pump

1. Connect pump to AC Mains.
2. Press the ⏻ button to switch pump ON (Mark II), or switch on power switch on side of pump (Mark I).
3. **CLEAR DATA? NO** retains previous data. **YES** clears previous infusion data.
4. Load syringe. See instructions in previous section.
5. Insert pressure disc into pressure transducer (Model P7000 only). See 'Guide to handling the pressure disc' above.
6. Confirm syringe.
7. Change the rate if necessary using the ⏫⏬ keys.
8. Purge: Press the ⏏ button followed by the **PURGE** softkey.
9. Connect the pump to test equipment as required (see Chapter 2, 'Configuration & Calibration' and Chapter 3, 'Routine Maintenance').
10. Press the ▶ button to start operation.

Basic Features

Pressure Level

Press the button (On Model P7000, press the button). Line pressure occlusion alarm level and current pressure level are shown on a graph. Use the keys to adjust alarm level.

Purge/Bolus

Press the button. If required, use the buttons to set bolus dose required then press and hold down the two **PURGE/BOLUS** softkeys together to deliver.

During PURGE/BOLUS, the pressure limit alarms are temporarily increased to maximum levels.

24 Hour Log

Press the button. The 24 hour log of volume infused is shown. 24 Hour Log is also available via the ? button.

Option Button

Press the ? button to display optional features:

DRUGS AND DOSING (or DRUG NAME)	Allows the pump to be set up for use with a specific drug and/or dosing protocol. Follow Drugs and Dosing instructions as per relevant DFU.
SET VTBI*	Set a specific volume to be infused and set rate at end of VTBI (not available on Model TCI & TIVA or Model TIVA).
SET VTBI OVER TIME*	Specify a VTBI and delivery time (not available on Model TCI & TIVA or Model TIVA).
SET BY DOSERATE*	Set rate in doserate increments (mg/kg/h). The flow rate will be calculated from the doserate.
SET BY ml/h*	Set rate in flow rate increments (ml/h). The doserate will be calculated from the flow rate.
CLEAR VOLUME	Clear the displayed volume infused.
INDUCTION*	Set an induction volume (P7000 only).
MULTIDOSE*	Set multidose volumes (P7000 only).
RATE LOCK*	Prevent rate being changed once infusion has started.
24H LOG	Shows volume infused over 24 hours.
EVENT LOG*	Displays the event log. Holds up to 800 individual events.

* these options are not displayed/available when feature is disabled.

Note that option names may vary and the Model TCI & TIVA and Model TIVA pumps have additional model-specific features. For additional information, refer to the relevant *DFU*.

Backoff Feature

BACKOFF is a configurable feature, enabled/disabled via the **CONFIGURATION** menu, access code **251**. When enabled, **BACKOFF** is automatically activated every time an occlusion occurs. The pump action reverses and pumps backwards to release the pressure which has built up in the infusion system. This minimises the post occlusion bolus.

How BACKOFF works

When an occlusion occurs, the pump continues pumping until the pressure alarm level is reached and the pump stops. Note that an occlusion can be due to a clamp or stopcock being left closed, kinked line, infiltration etc. During this time, a bolus volume of fluid builds up and is stored between the occlusion and the syringe, because it is unable to be infused into the patient. BACKOFF prevents the accumulated volume of fluid from being released into the patient as a post occlusion bolus.

Following an occlusion alarm:

- Pumping mechanism reverses, it pumps backwards
- Accumulated volume of fluid (post occlusion volume) is 'taken back' into the syringe and not infused into the patient
- Post occlusion volume is deducted from the **VOLUME** (Volume Infused) value shown on the Display
- Post occlusion volume is deducted from the infused value in the **24H LOG** as this volume has not been infused into the patient
- BACKOFF time and date is recorded in the **EVENT LOG**

Clinical benefits of BACKOFF

- Reduces the pressure in the extension set due to the plunger of the syringe moving backwards
- Removes the post occlusion volume of fluid from the system, it is not delivered to the patient as a bolus on removal of the occlusion. This prevents the patient from receiving an unintentional and unnecessary bolus

Fast Start Feature (Model P7000 only)

FAST START is a configurable feature of the Model P7000 syringe pump, enabled/disabled via the **CONFIGURATION** menu, access code **251**. When enabled, **FAST START** automatically reduces the 'mechanical slack' between the plunger mechanism and syringe at the start of an infusion. The mechanical slack is a very small gap (barely visible) due to the type of syringe and mechanics of the pump, between the back of the syringe plunger and the plunger drive mechanism at the start of an infusion.

How FAST START works

At the start of an infusion, the pump starts at a faster rate for a short period of time. This action minimises the start up delay but may not eliminate it completely.

Notes:

1) The pump can be heard to pump faster than the set infusion rate and can also be felt if a hand is rested on the pump at the start of an infusion.
2) The faster rate is 50% of the maximum syringe rate, syringe rate ranges are listed in Appendix A, 'Specifications'.

Purge recommendation: Even with **FAST START** available, it is still recommended to perform a **PURGE** with the pump before connecting the extension set to the patient and starting the infusion, especially at low flow rates i.e. below 5ml/h.

Clinical benefits of FAST START

- The fluid is delivered to the patient much sooner than if fast start was not available
- The delay in delivering the drugs following the changes of syringes is reduced greatly

Chapter 2

Configuration & Calibration

In this chapter

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Access Codes

The syringe pump software contains a number of configuration and test routines that can be accessed using a technical access code. The majority of routines are 'menu' driven and are accessed by entering a technical access code as shown in the table below.

Code	Title	Description
123	SELF TEST	Self test routine begins from the start. See Chapter 3, 'Routine Maintenance' for further information
124	SELF TEST	Self test routine begins at power supply measurement
125	SELF TEST	Self test routine begins at declutch test
126	SELF TEST	Self test routine begins at pressure disc test
127	SELF TEST	Self test routine begins at beam test
128	SELF TEST	Self test routine begins at nurse call test
167	COMMS LEARN MODE	Configuration set via comms interface
168	COMMS TEACH MODE	Configuration output to another device (pump)
176	LINEAR DIAGNOSTIC	Linear potentiometer test
222	SELF TEST	Self test routine begins at display test
223	SELF TEST	Self test routine begins at keypad button test
243	SYRINGE SIZE CALIBRATION	Syringe size measurement calibration. See 'Calibration Procedures' on the following pages for instructions
251	CONFIGURATION MENU	Configuration of drugs, options, syringes and real-time clock. See 'Configuration Options (251)' on the following pages for further details
253	LINEAR POT CALIBRATION	Linear potentiometer calibration. See 'Calibration Procedures' on the following pages for instructions
263	PRESSURE CALIBRATION	Line pressure calibration. See 'Calibration Procedures' on the following pages for instructions
359	LANGUAGE	Configure language
376	SERVICE ACCESS MENU	Review service log, errors and hours of use. See 'Service Access Options' in Chapter 3 for further details
611	TOTAL MEMORY CLEAR	Reset memory. Note that the pump will require full calibration
717	BEAM OCCLUSION CALIBRATION	Beam occlusion calibration. See 'Calibration Procedures' on the following pages for instructions
901	DEDICATION MODE	Set pump to operate in fully dedicated mode. Model P7000 only, see 'Dedicated Options (901/902)' below for further details
902	DEDICATION MODE	Set pump to semi-dedicated mode. Model P7000 only, see 'Dedicated Options (901/902)' below for further details

Entering an Access Code

Each menu (and certain individual options) has its own three-digit technical access code which is entered using the following procedure:

1. Hold down the ⏻ button and turn the pump ON. The main display shows 000.
2. Enter the required access code "xxx" using the ⏶⏷ keys in conjunction with the **NEXT** softkey (to move through the digits).
3. When the required code is shown on the display, press the **OK** softkey to confirm.

Dedication Options (901/902)

The Model P7000 pump can be operated in one of two modes:

Fully dedicated mode
Operating the pump in this mode will remind a user that a pressure disc must be fitted at the start of any infusion. In this mode occlusion pressures are always displayed in **mmHg**. To set, enter access code **901**.

Semi-dedicated mode
Operating the pump in this mode will require a user that a pressure disc must be fitted only when drugs and dosing features are used. When a pressure disc is not in use, pressure levels L-0 to L-10 will be displayed. To set, enter access code **902**.

Configuration Options (251)

Enter the access code **251** (see 'Entering an Access Code' on the previous page for instructions). The **CONFIGURATION** menu is displayed:

CONFIGURATION MENU	
Option*	**Description**
DRUG SETUP	Set drug names and protocols. See 'Drug Setup' on the following pages for instructions.
GENERAL OPTIONS	See 'General Options' on the following pages for further details.
CLOCK SET	Set the current date and time. To set the clock, use ⩓⩔ and **NEXT** softkey to adjust then **OK** to store.
HOSPITAL NAME	Enables hospital/ward name to be displayed during the power-up sequence. To set the hospital name, use ⩓⩔ to toggle through characters, **NEXT** softkey to go to next character then **OK** to store.
ENABLE SYRINGES	Configure the type and size of syringes permitted for use. To enable syringes: 1. Use ⩓⩔ to select, **MODIFY** to enable/disable the selected syringe type then **OK** to store. 2. Turn the pump OFF and return to service or select the next **CONFIGURATION** option.
ENABLE UNITS	Configure the dose units permitted for use (Model P7000 only). To enable units: 1. Use ⩓⩔ to select, **MODIFY** to enable/disable the selected dose then **OK** to store. 2. Turn the pump OFF and return to service or select the next **CONFIGURATION** option.

* Note: For software versions earlier than version V3R2, the options may vary, or will not be available. Refer to the relevant IVAC® Syringe Pump *DFU* for comprehensive information.

Drug Setup (251)

Drug Setup (Model TCI & TIVA/Model TIVA)

1. Enter the access code **251** to display the **CONFIGURATION** menu.
2. Select **DRUG SETUP** using the ⋀⋀⋁⋁ keys and press the **OK** softkey. The drug name list is displayed.
3. Select the drug name using the ⋀⋀⋁⋁ keys and press the **OK** softkey. Alternatively, press **QUIT** to exit and return to the **CONFIGURATION** menu.
4. To use a drug, it must be enabled by pressing the **YES** softkey at **ENABLE DRUG**. To return to the drug name list press **QUIT.**
5. Step through each **DRUG SETUP** option (see table below) to setup or modify the drug name and protocol.
   - Press the **OK** softkey to confirm each option.
   - Press the **BACK** key at any time to go back to the previous option and make changes

DRUG SETUP option	**To adjust, use these keys...**
DRUG NAME	To toggle through characters use single chevrons ⋀ and ⋁. To go to first/last character use double chevrons ⋀⋀ and ⋁⋁. **NEXT** to go to next drug name letter.
CONCENTRATION UNITS	⋀⋀⋁⋁
DEFAULT CONCENTRATION	⋀⋀⋁⋁
MINIMUM CONCENTRATION	⋀⋀⋁⋁ or OFF
MAXIMUM CONCENTRATION	⋀⋀⋁⋁ or OFF Important: If the DEFAULT CONCENTRATION, the MINIMUM CONCENTRATION and the MAXIMUM CONCENTRATION are equal, the TIVA mode start-up sequence will bypass the CONCENTRATION option
DOSE UNITS	⋀⋀⋁⋁ then **OK** to select and continue.
INDUCTION DOSE	⋀⋀⋁⋁ Note: If the setting is less than 0.01 the TIVA mode start-up sequence will bypass the INDUCTION option
INDUCTION TIME	⋀⋀⋁⋁
MAINTENANCE RATE	⋀⋀⋁⋁
BOLUS DOSE	⋀⋀⋁⋁ Note: If the setting is less than 0.01 the BOLUS setting is turned OFF. The Bolus feature is disabled in TIVA mode.

6. At the **CONFIRM** option, review the drug setup data displayed then press the **OK** softkey to confirm. The **DRUG SETUP** menu is redisplayed.

Drug Setup (251) *(continued)*

Drug Setup (Model P6000/Model P7000)

1. Enter the access code **251** to display the **CONFIGURATION** menu.
2. Select **DRUG SETUP** using the ⏫⏬ keys and press the **OK** softkey. The drug name list is displayed.
3. Select the drug name using the ⏫⏬ keys and press the **OK** softkey. Alternatively, press **QUIT** to exit and return to the **CONFIGURATION** menu.
4. To use a drug, it must be enabled by pressing the **YES** softkey at **ENABLE DRUG**. To return to the drug name list press **QUIT.**
5. Step through each **DRUG SETUP** option (see table below) to setup or modify the drug name and protocol.
   - Press the **OK** softkey to confirm each option.
   - Press the **BACK** key at any time to go back to the previous option and make changes

DRUG SETUP option	**To adjust, use these keys...**
DRUG NAME	To toggle through characters use single chevrons ^ and v. To go to first/last character use double chevrons ⏫ and ⏬. **NEXT** to go to next drug name letter.
DOSE UNITS	⏫⏬
DEFAULT DOSERATE	⏫⏬
MINIMUM DOSERATE	⏫⏬ or OFF
MAXIMUM DOSERATE	⏫⏬ or OFF
CONCENTRATION UNITS	⏫⏬
DEFAULT CONCENTRATION	⏫⏬
MINIMUM CONCENTRATION	⏫⏬
MAXIMUM CONCENTRATION	⏫⏬
BOLUS RATE	⏫⏬
MAXIMUM BOLUS	⏫⏬
PRESSURE ALARM	⏫⏬

6. At the **CONFIRM** option, review the drug setup data displayed then press the **OK** softkey to confirm. The **DRUG SETUP** menu is redisplayed.

General Options (251)

1. Enter the access code **251** to display the **CONFIGURATION MENU**.
2. Select **GENERAL OPTIONS** using the ⩓⩔ keys and press the **OK** softkey. The **GENERAL OPTIONS MENU** is displayed:

GENERAL OPTIONS MENU (Model TIVA/Model TCI & TIVA) Software version: V3R2			
Option	**Description**	**TIVA***	**TCI &TIVA***
BACKOFF	Enable/Disable Backoff feature (feature where pump action reverses to release infusion system pressure build-up and minimise post occlusion bolus following a pressure alarm). Enabled: Backoff feature ON (This does not apply when the pump is in TCI mode). Disabled: Backoff feature OFF.	✓	✓
AC FAIL ALARM	Enable/disable AC Fail alarm (activated when AC power disconnected and pump operating on battery power). Enabled: AC Fail alarm ON. Disabled: AC Fail alarm OFF.	✓	✓
NEOI WARNING	Set the Near End Of Infusion (NEOI) warning time between 1 min. and 15 mins. (NEOI warning signals the syringe is almost empty allowing time to change syringe).	✓	✓
EOI POINT	Enable/disable Keep Vein Open at End of Infusion (KVO at EOI). Enabled: Pump will switch to run at the KVO rate 1.0ml/h (or the current set rate if this is lower) at the EOI point. Disabled: Pump will stop at the EOI point.	✓	✓
BEAM ALARM	Set the default beam occlusion alarm level between level 0 (L0) and level 7 (L7).	✓	✓
WEIGHT	Set a default patient weight between 0.1kg and 150kg. Factory default is 70kg.	✓	✓
PURGE RATE	Set the purge rate volume between 100ml/h and 500ml/h. (Rate used during PURGE operation).	✓	✓
HANDS FREE BOLUS	Enable/disable Bolus function in a 'hands-free' way—no need to hold down buttons during bolus infusion. (Bolus is a function which administers a controlled volume of fluid or drug at an increased rate). Enabled: Hands Free Bolus function allowed. Disabled: Hands Free Bolus function not allowed.	✓	✓
DEFAULT BOLUS	Set the default bolus value between 0.1ml and 25ml.	✓	✓
NURSE CALL	Enable/disable the Nurse Call feature (hardware feature which allows the pump to communicate with the hospital's nurse call system, typically linked to central nurse's station). Enabled: Nurse Call Hardware enabled. Disabled: Nurse Call hardware disabled.	✓	✓
NURSE CALL INVERTED	Enable/disable inversion of Nursecall hardware output. Enabled: Nurse Call hardware output is inverted. Disabled: Nurse Call hardware output normal.	✓	✓
COMMS PUMP ADDRESS	Set the communications address of the pump.	✓	✓
COMMS MONITOR ONLY	Enable/disable pump remote control via the comms link. Enabled: Control of pump via monitor only. Disabled: Remote control of pump via comms link allowed. Note that monitor control is always possible.	✓	✓
COMMS ODD PARITY	Enable/disable odd communication parity bit generation.	✓	✓
COMMS ASCII	Enable/Disable ASCII communications mode.	✓	✓
TCI	Enable/disable TCI option. Enabled: TCI option is activated (TCI hardware must be fitted). Disabled: TCI option not activated.	×	✓
DISPLAY TCI DECREMENT TIME	If enabled, the display shows the TCI Decrement Time Icon (TCI hardware must be fitted).	×	✓
Key: ✓ = available option × = unavailable option	* For pumps with software versions earlier than version V3R2, the options may vary, or will not be available. Refer to the relevant IVAC® Syringe Pump *DFU* for comprehensive information. Note: For default settings, refer to Appendix D, 'Configured Options and Drug Protocol Records'.		

General Options (251) *(continued)*

GENERAL OPTIONS MENU (Model P6000/Model P7000) Software version: V3R2			
Option	**Description**	**P6000***	**P7000***
AUTOSAVE	Enable/disable Autosave feature (option to retain previous settings when pump is switched on). Enabled: Confirmation is requested at power up to clear or to use previous patient data. Disabled: Patient information is cleared on power up.	✓	×
BACKOFF	Enable/disable Backoff feature (feature where pump action reverses to release infusion system pressure build-up and minimise post occlusion bolus following a pressure alarm). Enabled: Backoff feature ON. Disabled: Backoff feature OFF.	✓	×
FAST START AND BACKOFF	Enable/disable Fast Start and Backoff features (Faststart feature - drive slack fast start at start of an infusion, Backoff feature - see above). Enabled: Fast Start and Backoff ON. Disabled: Fast Start and Backoff OFF.	×	✓
SET VTBI OVER TIME	Enable/disable Volume to be Infused (VTBI) over time option (allows the setting of a fixed volume to be delivered over a fixed period of time). Enabled: VTBI OVER TIME option available via the ? button. Disabled: VTBI OVER TIME option not available.	✓	✓
VTBI	Enable/disable the Volume to be Infused (VTBI) option (allows the setting of a fixed volume to be delivered). Enabled: VTBI option available via the ? button. Disabled: VTBI option not available.	✓	✓
INDUCTION	Enable/disable the INDUCTION option (option to set an induction volume to be delivered). Enabled: INDUCTION option available via the ? button. Disabled: INDUCTION option not available.	×	✓
MULTIDOSE	Enable/disable the MULTIDOSE option (feature allowing the delivery of a prescribed dose to be repeated over a specific period). Enabled: MULTIDOSE option available via the ? button. Disabled: MULTIDOSE option not available.	×	✓
RATE LOCK	Enable/disable RATE LOCK option (anti-tamper feature preventing rate changes, bolus/ purge operations and pump powerdown). Enabled: RATE LOCK option available via the ? button. Disabled: RATE LOCK option not available.	✓	✓
QUIET MODE	Enable/disable Quiet Mode feature (keypress tones, low priority alarms and power down sequence tones are muted). Enabled: Quiet mode feature ON. Disabled: Quiet Mode is OFF.	✓	✓
PRESSURE ALARM	Set pressure alarm value between 1mmHg and 750mmHg. Default is 300mmHg.	×	✓
MAX. PRESSURE ALARM	Set maximum pressure limit value between 1mmHg and 750mmHg. Default is 750mmHg.	×	✓
AUTO PRESSURE ALARM	Enable/disable Auto Set Pressure (AUTO) option (option to adjust the pressure alarm level by a set pressure value above the measured in-line pressure, 15 mins. after start of infusion). Enabled: AUTO option available via the ◪ button. Disabled: AUTO option not available.	×	✓
AC FAIL ALARM	Enable/disable AC Fail alarm (activated when AC power disconnected and pump operating on battery power). Enabled: AC Fail alarm ON. Disabled: AC Fail alarm OFF.	✓	✓
RATE TITRATION	Enable/disable ability to adjust (titrate) infusion while infusion is running. Enabled: rate can be changed while the pump is infusing, without putting pump on hold. Disabled: START button must be pressed to confirm new rate when rate changes are made while infusing using the rate adjust keys.	✓	✓
NEOI WARNING	Set the Near End Of Infusion (NEOI) warning time between 1 min. and 15 mins. (NEOI warning signals the syringe is almost empty allowing time to change syringe).	✓	✓
EOI POINT	Set the End Of Infusion (EOI) volume as a percentage of the syringe volume between 0.5% and 2.0%.	✓	✓
KVI at EOI	Enable/disable Keep Vein Open at End of Infusion (KVO at EOI). Enabled: Pump will switch to run at the KVO rate 1.0ml/h (or the current set rate if this is lower) at the EOI point. Disabled: Pump will stop at the EOI point.	✓	✓
BEAM ALARM	Set the default beam occlusion alarm level between level 0 (L0) and level 7 (L7).	✓	✓
WEIGHT	Set a default patient weight between 0.1kg and 150kg. Factory default is 70kg.	×	✓
PURGE RATE	Set the purge rate volume between 100ml/h and 500ml/h. (Rate used during PURGE operation).	✓	✓
BOLUS	Enable/disable Bolus function. (Function which administers a controlled volume of fluid or drug at an increased rate). Enabled: Bolus function allowed. Disabled: Bolus function not allowed.	✓	✓

General Options (251) *(continued)*

GENERAL OPTIONS MENU (Model P6000/Model P7000) Software version: V3R2			
Option	**Description**	**P6000***	**P7000***
DEFAULT BOLUS	Set the default bolus rate value between 10ml/h and 1200 ml/h.	✓	✓
CAP BOLUS RATE	Set a maximum permissible bolus rate value between 10 ml/h and 1200ml/h.	✓	✓
CAP RATE	Sets maximum permissible infusion rate value between 1ml/h and 1200ml/h.	✓	✓
DISPLAY EVENT LOG	Enable/disable EVENT LOG option on OPTIONS menu. (Event Log shows record of timed and dated pump events such as power on/off, alarms, rate changes). Enabled: EVENT LOG option available via the OPTIONS menu (? button). EVENT LOG option not available via the OPTIONS menu (? button). Note that the EVENT LOG option is always available via the SERVICE ACCESS menu.	✓	✓
LOG LAST PATIENT ONLY	Enable/disable display of all patient data in Event Log. Enabled: Event Log displays last patient data only (since new patient selected). Disabled: Event Log shows all patient data.	✓	✓
NURSE CALL	Enable/disable the Nurse Call feature (hardware feature which allows the pump to communicate with the hospital's nurse call system, typically linked to central nurse's station). Enabled: Nurse Call Hardware enabled. Disabled: Nurse Call hardware disabled.	✓	✓
NURSE CALL INVERTED	Enable/disable inversion of Nursecall hardware output. Enabled: Nurse Call hardware output is inverted. Disabled: Nurse Call hardware output normal.	✓	✓
COMMS PUMP ADDRESS	Set pump address for use in communications. Range is 1-254.	✓	✓
COMMS MONITOR ONLY	Enable/disable pump remote control via the comms link. Enabled: Control of pump via monitor only. Disabled: Remote control of pump via comms link allowed. Note that monitor control is always possible.	✓	✓
COMMS ODD PARITY	Enable/disable odd communication parity bit generation.	✓	✓
COMMS ASCII	Enable/disable ASCII communications mode.	✓	✓
Key: ✓ = available option × = unavailable option	***** For pumps with software versions earlier than version V3R2, the options may vary, or will not be available. Refer to the relevant IVAC® Syringe Pump *DFU* for comprehensive information. Note: For default settings, refer to Appendix D, 'Configured Options and Drug Protocol Records'.		

Calibration Procedures

The calibration procedure for each of the four sensors within the pumps are described in this section. Calibration is only necessary if in testing, the sensor performs outside of specification or if a full memory clear has been carried out (in which case all calibration stages must be completed). Refer to Chapter 3, 'Routine Maintenance' for test procedures.

Syringe Size Calibration (243)

Calibration tools required: 1000TG00010 (50ml Spacer A) and 1000TG00011 (100ml Spacer B)

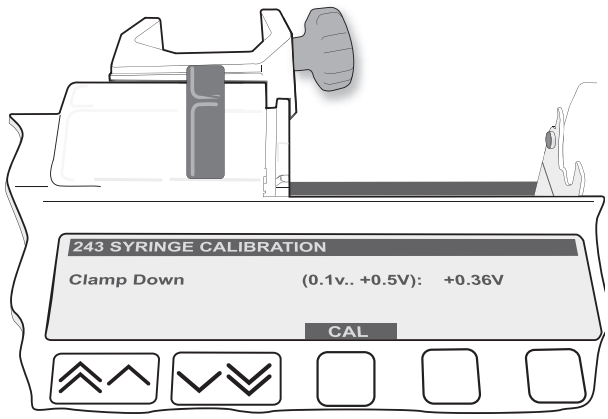
Analysis of process variation shows that a 2 point calibration system is not always sufficient to define the syringe size detection system across the 5ml to 100ml range. The effect is only observed when using 100ml syringes, which may not be recognised. If this occurs, the pump should be recalibrated using a 3 point calibration.

Calibration procedure:

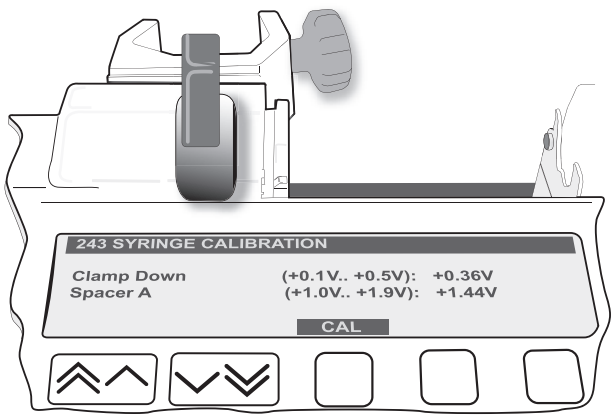
- Enter the access code **243**.
- Fit calibration tool into position on pump as shown below in Steps 1-3 and close the clamp. At each step, **CAL** is displayed if value is within tolerances.
  Press **CAL** softkey to store calibration point.

  Notes:
  1) If **CAL** is not displayed, check for correct positioning of calibration tool. If calibration cannot be performed, repairs to pump may be necessary.
  2) The calibration values shown on the pump displays are for illustrative purposes only.
- Power down to complete the calibration sequence (Step 4).

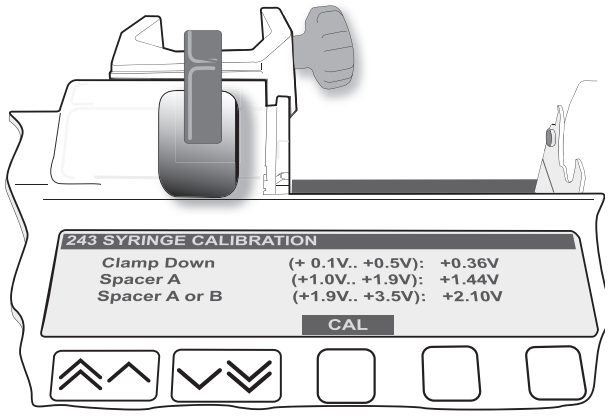
Step 1



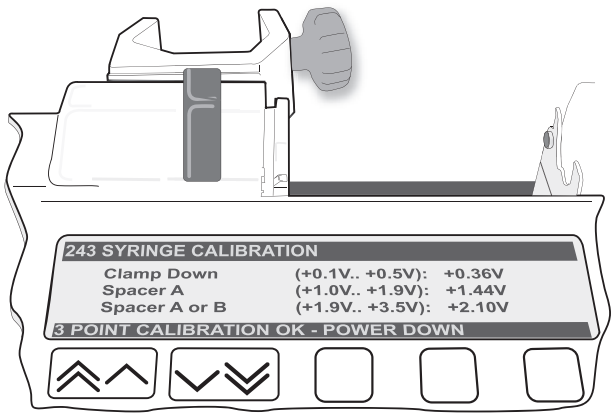
Step 2



Step 3



Step 4



Confirmatory Check - To confirm that the syringe sizing calibration has been performed correctly, select a syringe (preferably 50ml), load and confirm the correct syringe type. Check that the correct syringe size is detected and displayed.

Calibration Procedures *(continued)*

Linear Pot Calibration (253)

Calibration tools required: 0000TG00059 (105mm SPACER)

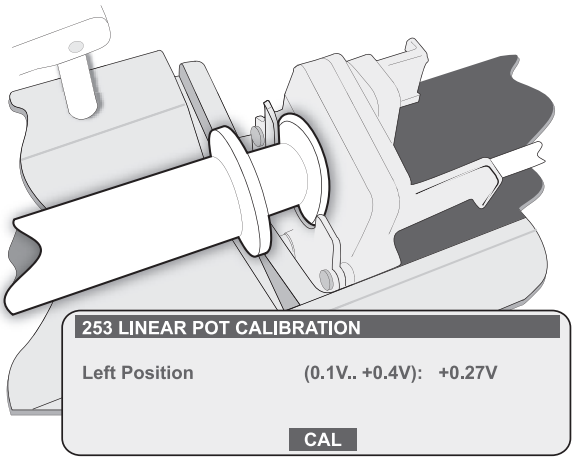
Calibration procedure:

- Enter the access code **253**.
- Fit calibration tool in position on pump as shown in Steps 1-2 below. At each step **CAL** is displayed if value is within tolerance.
  Press **CAL** softkey to store calibration point.

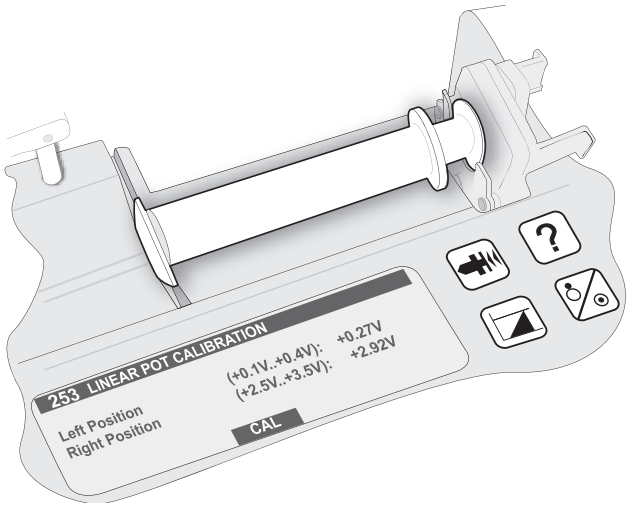
  Notes:

  1) If **CAL** does not appear in the display, check for correct positioning of calibration tool. If calibration cannot be performed, repairs to pump may be necessary.
  2) The calibration values shown on the pump displays are for illustrative purposes only.
- Power down to complete the calibration sequence.

Step 1



Step 2



Calibration Procedures *(continued)*

Beam Occlusion Calibration (717)

To convert Kilograms of Force (KgF) to Newtons (N) multiply by 9.806650. For example 10 KgF = 98.07N.

Excessive force will damage the plunger mechanism. Do not apply more than 10 KgF ±0.05 KgF to the plunger mechanism at any time.

Calibration tools required: 0000TG00020 (or 0000TG00200) and 0000JG00014

Calibration procedure:

- Enter the access code **717**.
- Fit calibration tools and position plunger as shown in Steps 1-3 below, zero the gauge dial. At each step press **CAL** softkey when required calibration force is reached.

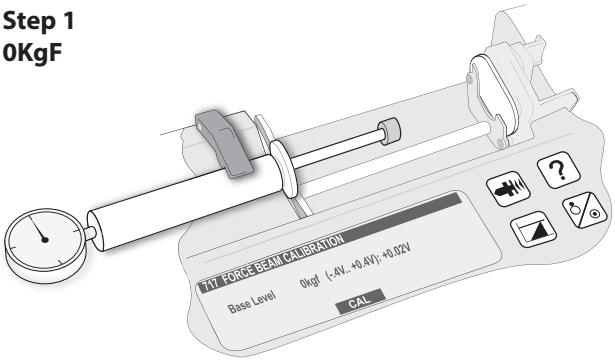
  Notes:

  1) If **CAL** does not appear in display, check for correct positioning of tool. If calibration cannot be performed, repairs to the pump may be necessary.
  2) The calibration values shown on the pump displays are for illustrative purposes only.
- Allow 30 seconds for pressure to stabilise before pressing **CAL** softkey.

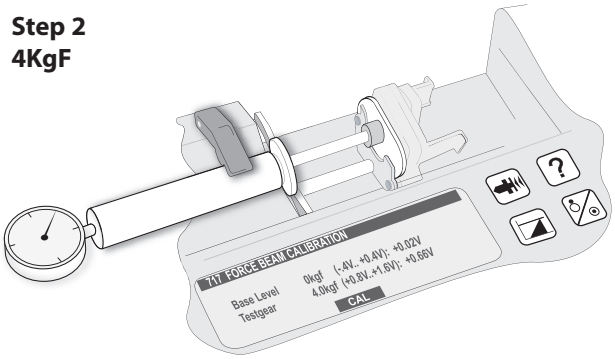
For best results, before pressing CAL softkey, strive for mid-range force value.

- Power down to complete the calibration sequence.

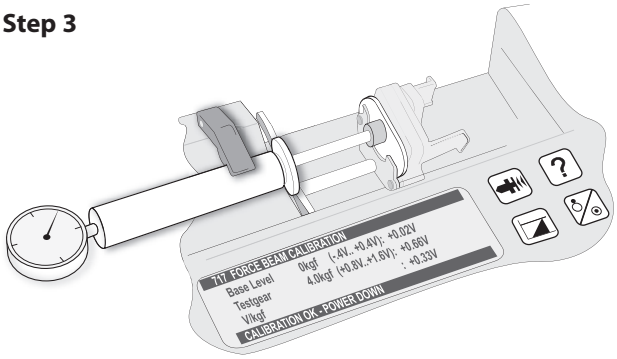
Step 1
0KgF



Step 2
4KgF



Step 3



Calibration Procedures *(continued)*

Line Pressure Calibration (263) P7000 only

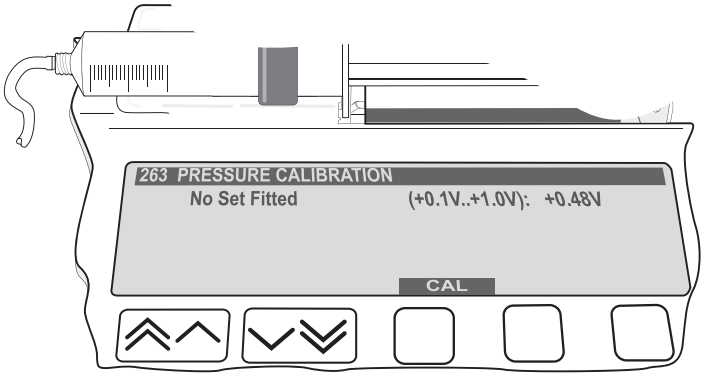
Calibration tools required:

- Pressure gauge (Range 0-1400 mmHg) (Tolerance +/- 2mmHg)
- P7000 Dedicated pressure disc infusion set (for example, G30402)
- 50ml Luer-lock syringe

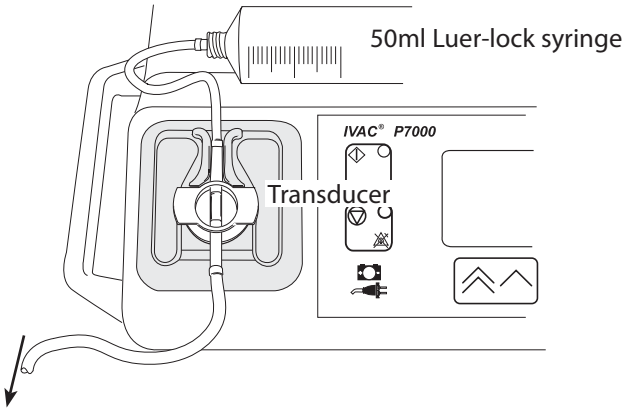
Calibration procedure:

1. Enter access code **263**.
2. Without a pressure disc infusion set fitted press **CAL** softkey (Step 1).
3. Load pressure disc infusion set into transducer (as shown in Step 2) then connect infusion set to syringe and gauge.
4. Using syringe, apply pressure required (as shown in Step 3 overleaf). Press **CAL** softkey when required calibration pressure is displayed on pressure gauge (Step 3).

Step 1
0mmHg (Without set fitted)



Step 2
Load set



To pressure gauge

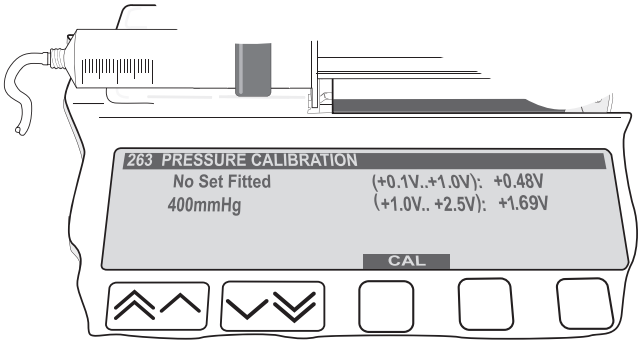
Calibration Procedures *(continued)*

Line Pressure Calibration (263) P7000 only *continued*

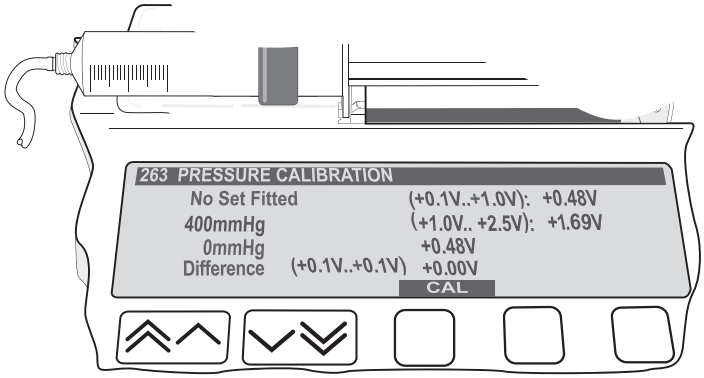
Calibration procedure (continued):

5. Release pressure but do not remove extension set as shown in Step 4.
6. Power down to complete the calibration sequence.

Step 3
400mmHg ± 2mmHg



Step 4
0mmHg (Set fitted, pressure released)



Clearing Internal RAM (611)

Warning: Do not clear the RAM unless absolutely necessary, because all calibration and configuration in the pump will be cleared.

If the internal RAM or its associated battery is replaced on the Control PCB, or if the pump fails with an 'ER5 RAM' error it will be necessary to do the following:

- Clear the internal RAM:
  1. Power up the pump holding down the ⏻ button.
  2. Enter the access code **611**.
  3. Press **ENTER** and wait for the RAM to be cleared.
  4. When the message **RAM CLEARED** appears, switch the pump off.
- Fully calibrate pump. Perform each of the four calibration procedures, as described in this chapter.
- Reconfigure the pump:
  - Set Configuration, drugs and protocol (it may be possible to use the Teach/Learn facility, see Chapter 3, 'Routine Maintenance' for instructions).
  - Enter access code **251** and set time.
  - Enter access code **359** and set language.
  - Enter access code **376** and set service date.
  - Enter access code **901** to set to dedicated (Model P7000 only).
- Carry out Performance Verification Procedure (PVP). See Chapter 3, 'Routine Maintenance' for instructions.

Chapter 3

Routine Maintenance

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Introduction

For routine maintenance, the following tests and performance verification procedures should be performed in addition to the tasks described in the section 'Physical Inspection and Clean'.

Refer to the relevant *DFU* for the recommended routine maintenance period.

Self-Test Procedure (123)

The self-test procedure is designed to allow confirmation of many of the pump functions, defaults and calibrations without requiring internal inspection.

1. Enter the access code **123**. See 'Entering an Access Code' in Chapter 2 for instructions.
2. The pump now proceeds through a series of tests. Press the **NEXT** button to move to the next test.

   Refer to the table below for details of each test.

Important: If the pump fails the test sequence at any stage, it should be taken out of service and inspected by a qualified service engineer.

Test	Display	Description/Action
Review software setup	SOFTWARE REVISION PROGRAM CRC SERIAL NUMBER LANGUAGE TCI LANGUAGE (TCI & TIVA only)	Displays software version, program CRC, serial number and language.
Review calibration data setup	SYRINGE REVIEW	Displays syringe, beam and linear calibration figures. Pressure calibration shown on P7000 only.
Internal PSU and mains voltage	PSU VOLTS: _ . _ _ V REG VOLTS: _ . _ _ V	On battery supply typically: 5.50V - 6.50V On mains supply: 6.50V - 7.50V.S
Audible Alarms	AUDIO: ALARM	Check loud alarm sound beeps.
	AUDIO: WATCHDOG	Check loud alarm sounds continuously.
	AUDIO: KEYPAD	Check soft alarm sounds continuously.
Visual: Display	DISPLAY TEST	Check that the display displays an even graduated grey tone.
Visual: Backlight	BACKLIGHT FULL / DIM / OFF	The display starts the test on FULL backlight, goes DIM and then turns OFF. At the end of the test it turns back on to FULL.
Visual: LED Indicators	LEDS: FLASHING	Check that the STOP, START and BATTERY LED'S are flashing. Note: the AC LED does not flash, it remains constant.
Touch panel buttons	KEY TEST: 00	Press buttons in turn from START (01) to PURGE (13).
	01 / 09	
	02 / or 10	
	03, 04 / or 11	
	05, 06 / 12	
	07 / 13	
	08	
Declutch switch	DECLUTCH: 1	Squeeze plunger holder finger grips and check that the display alternates between 1 (engaged) and 0 (disengaged - finger grips squeezed together).
Plunger detector	SYRINGE PLUNGER: 0	Press plunger plate button and check display switches from 0 (No syringe fitted) to 1 (Syringe plunger fitted).
Motor encoder	MOTOR / ENCODER : 1	Motor is pulsed while encoders are tested. Motor moves forwards and backwards as encoders pass.
Linear potentiometer	LINEAR POT : _ _ . _ _V	Declutch the transmission and slide plunger holder to the far left, check the value displayed (approx. 00.19V). Declutch and slide the plunger holder to the far right and check the value displayed (approx. 03.00V).
Syringe size detection	SYRINGE POT : _ _ . _ _ V	Lift the syringe clamp and check that the values displayed increase within the normal range (approx. 0.05V and 3.00V).

Self-Test Procedure (123) *(continued)*

Test	Display	Description/Action
Pumping pressure detection	BEAM FORCE : _ . _ _ V	Remove the syringe and confirm that the value displayed is within normal range (± 0.05V). Gently press back on the plunger holder and watch the value increase.
Pressure disc detection (P7000 only)	PRESSURE DISC: 0	With an extension set fitted the value should be 0. Without an extension set the value should be 1.
Pressure sensor test (P7000 only)	PRESSURE: _._ _V	Check the values displayed are in approximate range of +0.30V to +0.60V.
Nursecall	NURSECALL: ON	Check for audible clicks of the relay.
Comms	COMMS _	Self-test, transmit/receive link back check.
	DONE - SWITCH OFF	The final screen displays DONE - SWITCH OFF. Providing the pump passed all the tests it can be powered OFF and put back into service. Note that if the pump fails the test sequence at any stage, it should be taken out of service and inspected by a qualified service engineer.

Upgrading Software

Upgrade of the Models P7000, TCI & TIVA and TIVA Syringe Pumps software to V3R2 or greater is mandatory at the next service.

Perform upgrades by acquiring the software upgrade kits specified in spare parts listings.

Equipment required: Software upgrade kit (includes EPROM fitting and removal instructions)

Software Upgrade Kits Available

Syringe Pump Model	Part Number
Model P7000	1000SP00530
Model TIVA	1000SP00531
Model TCI & TIVA	1000SP00532

Note: The latest version of software for the Model P6000 syringe pump is 1000SP00529.

Event Log Download

A PC application known as the Event Log Download Utility (ELDU) (part number 1000SP00209) is available to download logs from IVAC® Syringe Pumps.

ELDU Operation

1. Click on **ELDU** icon on PC.
2. Click **Accept** to agree with Restrictions of Use and continue.
3. Select **Configure** from drop-down menu.
4. Select **Setup Pump** and choose **IVAC®** as pump type.
5. Select **Settings** to select log to be downloaded.
6. Select **Communications** then check options are set as follows:
   - Required PC com port selected.
   - Character mode and parity match IVAC® pump configuration.
   - Delay mode is Normal.
   - Pump address matches **COMMS PUMP ADDRESS** in **GENERAL OPTIONS**.
7. Click **OK** to confirm.
8. Connect the RS232 cable.
9. Power up pump.
10. Click **Download Log** from main PC screen.
11. Press **Close**, when finished.
12. Select **File** from drop-down menu and save file. Log may be printed here as required.

Teach Learn

A pump can be configured/reconfigured by transferring data from one pump (Teacher pump) to another pump (Learner pump) via the serial port.

Equipment required

- Two pumps, of the same model (for example, two Model P7000 pumps). Note that both pumps must have the same version of software
- RS232 cable. For Models P6000/P7000/TIVA use part number 1000SP01008. For Model TCI & TIVA use part number 6000SP00012

Procedure

1. Connect the Teacher pump to the Learner pump using the RS232 cable.
2. Switch both pumps ON.
3 On the Teacher pump, enter the access code **168** and on the Learner pump, enter the access code **167**.
   The Teacher pump displays **TEACHING** and the Learner pump displays **LEARNING**.
4. When complete, select **OK**.

Possible reasons for Teach/Learn failure:

- Pumps are different models
- Software versions are different
- Loose cable connection or faulty RS232 cable

Using Teach Learn to reconfigure a pump only transfers certain configuration settings. The following settings are *not* transferred and must be reset manually: CLOCK SET (251), SET LANGUAGE (359), SERVICE DATE (376), DEDICATED MODE (901/902), ENABLE UNITS (251) on P7000 only.

Once Teach Learn is complete, all configuration settings on the Learner pump, including DRUG SET UP, must be checked against the Teacher pump (original source).

Linear Speed Test

The linear accuracy of the pump can be verified by measuring the time the plunger holder takes to travel a specified distance. The distance travelled is measured using a dial indicator, mounted in place of the syringe, and the elapsed time can be measured using a stop watch.

Equipment required: 1000TG00080 and 0000JG00014

1. Declutch the drive mechanism and move the plunger holder to the right.
2. Fit the linear test gear 1000TG00080 to the pump and move plunger holder towards the dial gauge until it is a about 3mm clear of the probe. Fit a plunger detect spatula 0000JG00014.
3. Set the pump to run at a rate of 100ml/h, confirm syringe type and start it. Allow the pump to run until the plunger detect spatula touches the probe and then using a stop watch, time the travel over a distance of 15.00mm.
4. Using the values specified in table below, check that the pump is travelling at the correct speed. If the test values fall outside the stated limits (or the movements of the dial are jerky) then the pump requires further investigation.

The table below provides data for a combination of syringe types and sizes.

Syringe Type	Size (ml)	Flow Rate (ml/h)	Expected Time (min:sec)
BD Plastipak	50	100.0	4m 55s +/-3s
IVAC	50	100.0	4m 57s +/-3s
Terumo	50	100.0	5m 57s +/-4s
B.Braun Omnifix	50	100.0	5m 29s +/-4s
Monoject	50	100.0	4m 55s +/-3s
Nipro	50	100.0	5m 55s +/-4s
Fresenius Injectomat	50	100.0	5m 49s +/-4s
Braun Perfusor	50	100.0	5m 30s +/-3s
Once	50	100.0	5m 20s +/-4s
Zeneca	50	100.0	5m 02s +/-3s
BD Precise	50	100.0	5m 50s +/-4s
BD Perfusion	50	100.0	5m 28s +/-4s

Notes:

1) It is only necessary to perform the test using one syringe type, 'BD Plastipak' is recommended.
2) Not all syringe types listed are specified for use with every model of pump.

Drive Occlusion Test

Test gear required: 0000TG00020 (or 0000TG00200) and 0000JG00014

Method 1. Semi-dedicated pumps

1. Fit the test gear. (For Model P7000, set pump to semi-dedicated mode and remove pressure disc infusion set from transducer). Confirm syringe type 'BD Plastipak 50ml'. Set the beam occlusion level to L-3. Set up a continuous rate of 100ml/h.
2. Run pump and check that the force at alarm is in the range of 2.2KgF to 3KgF. If it is out of range re-calibrate (see 'Beam Occlusion Calibration' in Chapter 2) and retest.

Method 2. Dedicated pumps (Model P7000 only)

1. Fit a pressure disc infusion set into the transducer. Set the line occlusion level to 220mmHg. Fit the test gear. Confirm syringe type 'BD Plastipak 50ml' (configure if necessary). Set up a continuous rate of 100ml/h.
2. Run pump and check that the force at alarm is in the range 3.1KgF to 3.9KgF. If it is out of range re-calibrate (see 'Beam Occlusion Calibration' in Chapter 2) and retest.

Line Pressure Test (Model P7000 only)

The pressure transducer is checked at a number of pressures as indicated in the table below. If the pressure readings displayed appear consistently shifted and outside specification, the sensor may require calibration.

Equipment required: Pressure gauge (measuring accuracy +/-2mmHg), or pressure measuring instrument (measuring accuracy +/-2mmHg) with pressure setting facility.

1. Connect a line with the pressure transducer fitted to the pump with one end of the line terminated in a tap and the other connected to the measurement device.
2. Switch the pump on and observe the pressure display with the set fitted to the sensor housing. Set each pressure shown below in turn, at each stage leave the pressure stable for a few seconds; check that the independent measurement device reading is stable to verify that the set and line are sealed, before checking the displayed pressure on the pump.

Set Pressure	**Displayed Pressure**
0mmHg +/-2mmHg	0mmHg +/-20mmHg
50mmHg +/-2mmHg	50mmHg +/-23mmHg
100mmHg +/-2mmHg	100mmHg +/-25mmHg
300mmHg +/-2mmHg	300mmHg +/-35mmHg
500mmHg +/-2mmHg	500mmHg +/-45mmHg
750mmHg +/-2mmHg	750mmHg +/-58mmHg

Potential Equalisation Terminal Resistance Test (PE Test)

This is an optional test, applicable when a PE system is in use.

Note that this test is not relevant for Model TCI & TIVA.

Equipment required: DVM Resistance Meter (e.g. Fluke)

1. Connect one lead from the DVM resistance meter to the PE terminal on the pole clamp of the pump and the other to the pump leadscrew. Check that the settled value of resistance is less than 20 MΩ.
2. Move the lead from the leadscrew and repeat the check with the lead to the outer tube. Check that the settled value is less than 20 MΩ.
3. If the value of either of the two readings is greater than 20 MΩ, the pump fails this test and must be removed from service for further investigation.

Battery Maintenance

Maintenance:	To achieve optimum operation of the pump whilst being used on battery power, it is recommended that a battery test (see 'Battery Test' below) is performed to ensure that the pump will operate correctly on battery power. Where it is not possible to run a battery test, it is recommended that the battery is replaced every 2 years.
Charging:	Typically, a new battery will take approximately 24 hours from discharge to 100% charge.
New Batteries:	Where a battery is not tested prior to installation, it is recommended where possible that a battery test is performed.
Battery Test:	Run the pump on battery power at the rate of 5 ml/h, for a minimum of 4 hours (2.8Ah battery)[1] or 6 hours (3.4 Ah battery)[2]. This test should be performed annually, or more frequently as required (e.g. where charge retention is critical to pump operation).
Storage:	The pump should be fully recharged after discharge before storage, and at 3 month intervals during storage.
Battery Life:	The internal rechargeable sealed lead acid battery will retain charge if maintained correctly. Charge retention will degrade over time. The internal battery should be replaced every 3 years, or if the pump fails the battery test.

Recommended Manufacturer:
[1] Yuasa
[2] Panasonic

Linear Diagnostics Test

This test does not represent the linear or volumetric accuracy of the syringe pump. For accurate testing refer to 'Linear Speed Test' earlier in this chapter

This test should be used as a diagnostic tool only and can assist with the diagnosis of linear speed errors ER1 and ER2.

Procedure

1. Enter the access code **176**.
2. The display will show 'Linear Diagnosis xxx.xx mm' (xxx.xx mm represents the current position of the plunger holder).
3. Declutch the drive mechanism and move the plunger holder to the extreme right, past an indicated +105.00mm.
4. Re-engage the drive mechanism carefully . Sharp jolts on the transmission at this point can affect the results.
5. Over some minutes the screen will display a graph of linear error. Note: This is percentage deviation from linear path between left and right calibration points.
6. Check that the plotted line remains within the ±1% lines (Unmarked), and that no sharp increases or decreases in deviation occur.

Troubleshooting

Note that sharp jolts, or incorrect linear calibration may affect the result.

If test fails:

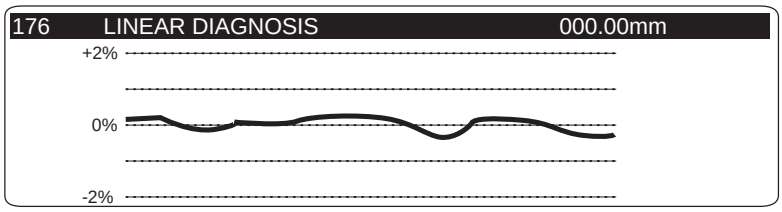
- Perform the 'Linear Pot Calibration', see Chapter 2
- Replace the Linear travel potentiometer

Test example 1

Test examples

Result: Pass

Trace is within ±1%.

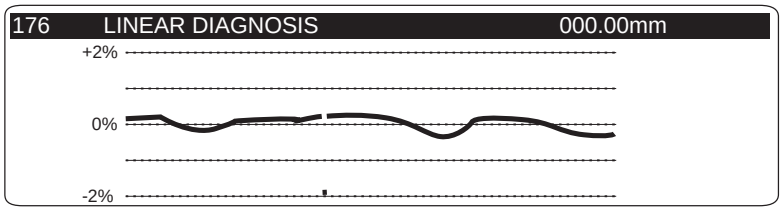


Test example 2

Result: Fail

Small sharp decrease is outside ±1%.

Recommend check/replace Linear potentiometer.

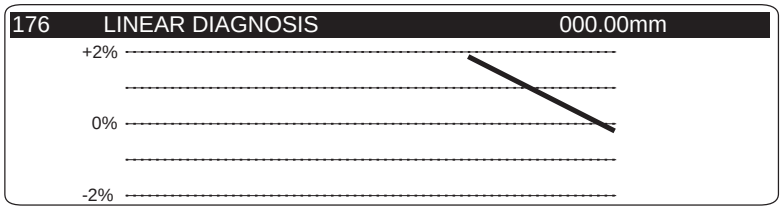


Test example 3

Result: Fail

Trace is outside ±1%. Motor speed error.

Recommend check/replace Motor gearbox, Control PCB or Optics.

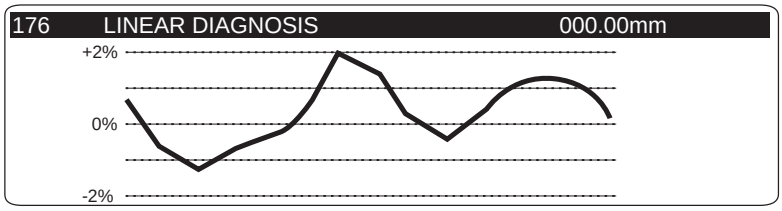


Test example 4

Result: Fail

Trace is outside ±1%.

Recommend check/replace Linear potentiometer.



Physical Inspection and Clean

To ensure the pump remains in good operating condition, it is important to keep it clean and carry out the routine procedures described below. All servicing should only be performed by a qualified service engineer.

- Thoroughly clean external surfaces of the pump, by wiping over with a cloth lightly dampened with warm water and a standard disinfectant/detergent solution.

  Do not use the following disinfectant types:

  - NaDcc (such as PRESEPT)
  - Hypochlorites (such as CHLORASOL)
  - Aldehydes (such as CIDEX)
  - Cationic Surfactants (such as Benzalkonium Chloride)
  - Iodine (such as Betadine)

Recommended disinfectants are:

Brand	**Concentration**
Hibiscrub	20% (v/v)

Before cleaning always switch OFF and disconnect from the AC power supply. Never allow fluid to enter the casing and avoid excess fluid build up on the pump.
Do not use aggressive cleaning agents as these may damage the exterior surface of the pump.
Do not steam autoclave, ethylene oxide sterilise or immerse this pump in any fluid.

Virkon	1% (w/v)

- Check that labels are flat, legible and fully adhered. Replace as necessary.
- Inspect case components for damage and replace if necessary.
- Inspect the pole clamp for damage and check that it functions correctly.
- Inspect the AC power supply plug and cable for damage.

Service Access Options (376)

Information logs and additional service options are available from the **SERVICE ACCESS** menu.

Use access code **376** to display the **SERVICE ACCESS** menu. See 'Access Codes' at the beginning of Chapter 2, 'Configuration and Calibration' for further information on access codes.

Option	**Description/Action**
VIEW SERVICE LOG	Displays the last 10 fault codes. The time and date of each fault is shown.
SERVICE DATE	Set the date when 'Service Due' is required to be displayed on the pump.
SERVICE MESSAGE	Enter (or amend) a message to be displayed on the SERVICE DATE.
USE LOG	Displays the hours of use since cleared. Press CLEAR to reset hours to zero.
SERIAL NUMBER	Record the serial number of the pump.
EVENT LOG	Displays the event log (maximum 800 events). The time and date of each event is shown. Note that pressing the ? button on the pump at any time also allows access to the EVENT LOG option (if enabled).

Performance Verification Procedure

Model / Serial Number:		**Service Order / Inventory Number:**		
Hospital Name / Reference:		**Software Version:**		
INSPECTION	**Physical inspection and clean**			
UPDATES	**Mandatory when serviced**	UPDATE REF:	Fitted ✓	Not fitted / Not Applicable ✓
	Update P7000 with V3R2 software	TSM *CH3*		
	Update TIVA and TCI & TIVA with V3R2 software	TSM *CH3*		
	Inspect and fit display spacers on pumps with serial numbers below: 6001-00001 to 6001-13816, 6002-00001 to 6002-11388, 6003-00001 to 6003-01126, 7001-00001 to 7001-13717	TSM *CH6*		
	Recommended when serviced	UPDATE REF:	Fitted ✓	Not fitted / Not Applicable ✓
	Update P6000 with V3R2 software	TSM *CH3*		
	Bond the syringe clamp assembly on pumps with serial numbers: 6001-00100 to 6001-00972, 6002-00100 to 6002-00259, 7001-00106 to 7001-04432	TSM *CH6*		
SERVICE LOG *CH3*	Check/set serial number & set service date (optional) (376)			
SELF TEST *CH3*	**Check all functions in self-test** (123) Check and adjust time and date as required (251)			
INFUSING	**Alarms functionality check** *DFU* Drive Disengaged, VTBI done, Syringe Location, Plunger Location, AC power fail, Set Removed (P7000), Near End of Syringe, Syringe Empty, KVO Ensure pump works on battery and AC mains *DFU*			
VERIFICATION TESTS *CH3*	**Linear speed test** Pump set to 100 ml/h, syringe type BD Plastipak 50, for a distance of 15 mm. 4 mins 52 secs to 4 mins 58 secs	_____ mins _____ secs		
	Occlusion test Pump set to 100 ml/h, syringe type BD Plastipak 50 Semi Dedicated, Occlusion alarm level L-3, 2.2 KgF to 3 KgF **OR** Dedicated (P7000), alarm level 220 mmHg, 3.1 KgF to 3.9 KgF	_____ KgF		
	Line pressure test (P7000) Alarm set to 50 mmHg, pump alarms 27 mmHg to 73 mmHg Alarm set to 500 mmHg, pump alarms 455 mmHg to 545 mmHg	_____ mmHg _____ mmHg		
	TCI function test Fit TCI syringe (Diprivan 1%). Set TCI mode: age=40, wt=70 kg, TCI target=4.0 µg/ml. Elapsed time to reach 4.0 µg/ml=24 ± 1 sec.	_____ mins _____ secs		
SETUP	**Set rate to zero (or lowest value possible), Clear Volume Infused and VTBI** **Clear Error / Alarm / Battery logs (as required)**			
ELECTRICAL SAFETY TESTS	**Class II Type CF - P7000, P6000, TIVA** *Alternatively attach printed test results* Insulation Resistance > 50 Megohms	_____ MΩ		
	Enclosure Leakage Current <= 100 µA	_____ µA		
	Class I Type CF - TCI & TIVA Earth Resistance Test <= 0.2 Ω	_____ Ω		
	Earth Leakage Current <= 500 µA	_____ µA		
	Enclosure Leakage Current <= 100 µA	_____ µA		
Verification Performed By	_____ **Sign**	_____ **Print**	_____ **Date**	

CHX **indicates the chapter number in the Technical Service Manual (TSM) - 1000SM00012.**
E.G. *CH3* **= Refer to TSM Chapter 3.** *DFU* **= Refer to the relevant DFU.**

Chapter 4

Troubleshooting

In this chapter

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Introduction

Use this troubleshooting guide to help identify the cause of errors and faults which may occur as a result of damage to the pump or failure of an internal component. The following table lists the error codes and describes what action to take to resolve the problem. A general fault diagnosis checklist is also provided. For information on alarm procedures and messages, refer to the relevant *Directions For Use* (*DFU*).

If the nature of the problem is unclear, step through the **SELF TEST** routine to check that the main functions of the pump are operating correctly. The **SELF TEST** routine exercises all the sensors in the pump to verify that they are functioning accurately. See Chapter 3, 'Routine Maintenance' for details.

The **ERROR LOG** records the ten most recent malfunction codes. To review the **ERROR LOG**, go to the **SERVICE ACCESS** menu by entering the access code **376**, or press the ? button.

Error Codes

Error	Failure	Action/Replace
ER1 LINEAR SPEED	Excessive linear movement detected	Check for contamination or damage to the linear potentiometer. Run the linear potentiometer self test using access code **176**. If not linear, replace.
ER2 LINEAR SPEED	Insufficient movement detected	
ER3 MOTOR	Too many motor encoders	Check mechanism is not slipping or opto flag loose. Check motor and mechanism, replace as necessary. Check connections between flexible circuit and control PCB. Check flexible circuit, replace if faulty Replace Control PCB.
ER4 MOTOR	Too few motor encoders	
ER5 RAM	Failure of RAM	Check backup battery and replace if necessary. Check EPROM socket, display spacers and torsion spring upgrades in 'Spare Parts Replacement Procedures' in Chapter 6.
ER6 WATCHDOG	Watchdog failure too slow	Replace Control PCB
ER7 WATCHDOG	Watchdog failure too fast	
ER8 HARDWARE	Power on/off fault	On Mark II hardware only. Power off occurred within 3 second power down cycle of soft power off. Fault in the soft power on/off circuitry.
ER9 MOTOR	Motor direction	Check motor wires are connected correctly. Check RL1 and TR3 on Control PCB and replace as necessary. Replace motor gearbox or Control PCB.
ER10 VREF	VREF failure	Replace PCB.
ER11 BEAM CURRENT MONITORING	Beam failure	Replace Beam bond assembly.
ER12 BEAM AMPLIFIER OFFSET	Amp failure	Replace Beam bond assembly. Replace Control PCB.
ER13 MOTOR	No motor rotation	Check transistors TR6, TR10, TR11 on Control PCB and replace if faulty. Replace motor gearbox. Replace Control PCB.
ER14 MOTOR	Motor rotating when switched off	
ER15 WATCHDOG	Watchdog failure	Check for radio frequency interference (RFI). replace Control PCB.
ER16 PLUNGER STUCK	Plunger stuck at power up	Check nothing is holding the plunger in and power on. Replace flex circuit plunger optic. Replace Control PCB.
ER17 HARDWARE	Display fault	Replace Display Board.
ER21 CRC FAILURE	CRC failure	Replace EPROM Replace Control PCB.
ER22 STACK OVERFLOW	Stack error	Check for RFI. Replace Control PCB.
ER23 OPTO FAILURE	Opto failure	Check optos in Self Test **123**. replace if faulty Check opto signals to Control PCB, replace Control PCB if unable to track fault.

Error Codes *(continued)*

Error	Failure	Action/Replace
ER24 POWER SUPPLY VOLTAGE MEASUREMENT FAILURE	Power supply measurement failure	Check voltage is between 1.5V and 13.5V on PL5-14 on Power PCB and on PL6-14 to IC5 on Control PCB. Replace Power or Control PCBs as necessary.
ER25 DISPLAY VIDEO RAM	Video RAM fault	Reseat/replace Display PCB and/or Control PCB. See also ER5 RAM.
ER27 WATCHDOG	Watchdog	Replace Control PCB.
ER28 WATCHDOG		
ER29 PRESSURE AMPLIFIER OFFSET	Pressure Amplifier	Replace Control PCB.
ER30 REAL TIME CLOCK FAILURE	Real time clock failure	Replace Control PCB.
ER32 SOFTWARE	Software flow fault	Replace Control PCB. See also ER5 RAM.
ER33 SOFTWARE	Software fault	
ER34 SOFTWARE	Software fault divide by zero fault	
ER35 SOFTWARE	Software fault invalid instruction	
ER36 SOFTWARE	Software fault address error	
ER37 SOFTWARE	Software fault NMI	
ER38 SOFTWARE	Software fault trap function	
ER39 SOFTWARE	Software fault	
ER41 TCI	Diprifusor communication failure (TCI & TIVA only).	Check TCI module connections. Where TCI hardware is not fitted, TCI option in GENERAL OPTIONS must be set to disabled. If inital TARGET concentration value is set to 0.0µg/ml, ER41 and disabling of TCI module can occur. Re-enable TCI option in GENERAL OPTIONS. Initial TARGET concentration value of 0.0µg/ml not recommended.
ER42 TCI	Diprifusor failure (TCI & TIVA only).	View ERROR LOG to review ER42 subcodes, for example, ER42 (0.0.1) - TCI watchdog timeout, communication failure. Replace TCI module.

General Fault Diagnosis

Fault	Parts to Check/Test										
	Front Case	Rear Case	Labels & Keypads	Mechanism	Syringe Sizing Potentiometer	Control PCB	Power PCB	Display PCB	Battery	Mains Lead	Fuses
Dropped or damaged	✓	✓		✓	✓	✓	✓	✓			
Exposed to fluids	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
No battery power			✓			✓	✓		✓		✓
No AC mains power			✓			✓	✓			✓	✓
Delivery rates out of tolerance	✓			✓		✓					
Continuous alarm at power up						✓	✓		✓		
Incorrect display contrast/ backlight						✓		✓			
Keypad buttons stuck			✓			✓					
Drive declutch alarm				✓							
Cannot confirm syringe				✓	✓						

Troubleshooting Tip:

Keypad alarm failure
Upgrade the Control Board insulator on pumps with serial number below 7001-02757 and with Control Board assemblies 7000EL00002 below Issue 10.
Perform upgrade by acquiring the control insulator upgrade kit 7000SP00015.

Chapter 5

Circuit Descriptions

In this chapter

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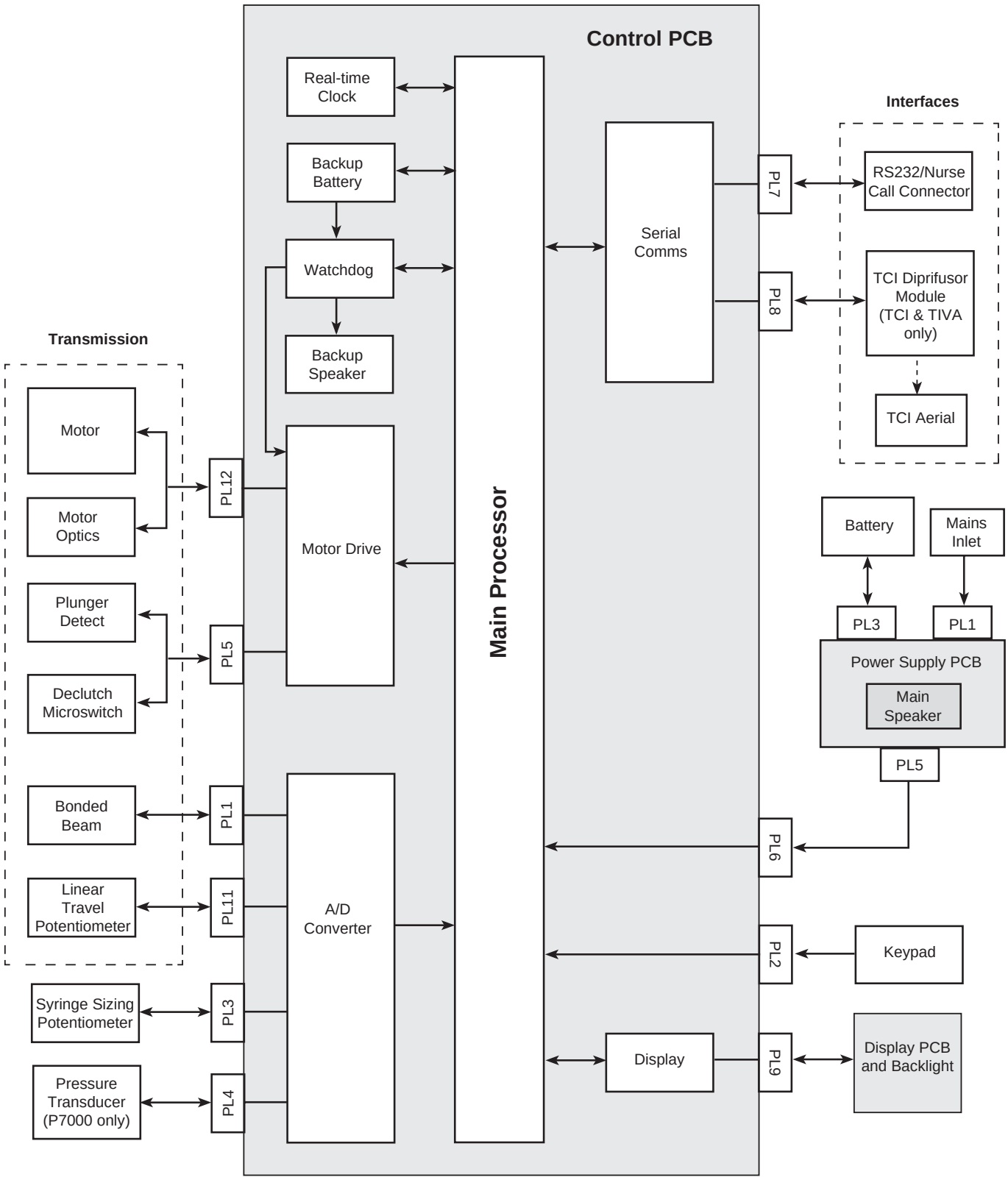
Functional Module Block Diagram

IVAC® P7000, P6000, TIVA and TCI & TIVA (Mark II)



Module Overview Functional Description

The IVAC® Syringe Pumps are designed to be serviced generally to major assembly level.

The circuitry within the pump is contained on three printed circuit boards (PCBs): Control PCB, Display PCB and Power Supply PCB. Mark I pump models also have an Interface PCB fitted. In addition, two flexible printed circuits are utilised to hold the optical sensors and to provide the necessary interconnects to the moving parts of the pump.

Cardinal Health will make available, on request, circuit diagrams which will assist appropriately qualified technical personnel to repair those parts of the device which are designated by the manufacturer as repairable.

Control PCB

Contains the main processor module which provides the control functions for almost all aspects of the pump. It drives and monitors all other modules using the program code stored in the flash EPROM. The main processor runs the main application program.

- **Power Supply Supervisor**
  The power supply voltage is monitored by IC6 which provides an active low reset signal to the microcontroller at power up and if the regulated 5V input falls below a preset level. IC6 also switches battery backup power to the static RAM IC4 and real time clock chip IC13.
- **Real Time Clock**
  The real time clock chip IC13 maintains time and date information.
- **Watchdog**
  The watchdog alarm will enable the audible alarm on the Power Supply PCB and disable the motor supply current.
- **Audible Alarm**
  The key beep/quiet alarm, SP1, is fitted to the Control PCB.
- **AC/DC Input**
  The AC/DC input level is a high or low signal from the Power Supply PCB. The signal from the Power Supply PCB is high at PL6 when AC is connected and low when the unit is being operated from its internal battery.
- **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. In normal operation if the watchdog fails power is prevented from reaching the motor.

  The motor speed control algorithm uses three feedback signals from optical switches. The optical encoder signals are all fed via schmitt trigger inverters in IC14. The direction of the motor is monitored during operation using the optical encoder signals and linear position sensor.
- **Linear Position Sensor**
  The linear speed, position and direction of the transmission are monitored using a potentiometer that runs under the carriage block. As the carriage moves over the potentiometer voltage is produced which is proportional to the position of the syringe plunger. The software checks for linear movement and the direction every 0.5mm, and checks the rate every 5mm.
- **Bonded Beam**
  The drive force of the pump is detected by measuring the deflection of a beam at the end of the lead screw on the transmission by using a full bridge strain gauge. The output from the strain gauge is fed to a two stage differential amplifier, IC1. The offset value of the amplifier i.e. with no pumping pressure applied, can be adjusted using potentiometer RV1, and is set during calibration.
- **Pressure Transducer (Model P7000 only)**
  In-line pressure measurement is detected by a pressure transducer. When a force is applied to the pressure transducer an output voltage proportional to the force is generated.
- **Disc Detect (Model P7000 only)**
  The pressure dis c is detected by a slotted optical switch. When the disc is not fitted the opto switch is off, when the disc is fitted the opto switch is on. The signal is fed to IC9.
- **Plunger Detect**
  The syringe plunger button position is detected using a slotted optical switch. The signal from the optical switch changes state when the syringe plunger is located correctly; this signal is fed to IC9.
- **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 micro switch changes state when the declutch lever is activated. This signal is fed via IC14 to the microcontroller.
- **Keypad**
  The membrane keypad is fitted to the upper case and connections are made via a flexible circuit that plugs into PL2.

Module Overview Functional Description *(continued)*

Control PCB *(continued)*

- **LCD Display Drive**
  The LCD display is located on the Display PCB; data is passed using the data bus to a graphics controller located on the Display PCB.
- **Visual Indicators**
  The AC battery, start and stop LEDs are mounted on stand-off's on the Control PCB. The AC LED is driven directly from the Power Supply PCB via a connection at PL6. The battery, start and stop LEDs are driven by the microcontroller via IC15.
- **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 is fed into one of the ADC inputs of the microcontroller.

Display PCB

The Display PCB is located in the upper case assembly of the pump. For the purposes of maintenance and repair the Display PCB is supplied as a complete module.

Flexible Circuits

Two flexible circuits are used to connect the motor, opto switches and declutch micro switch on the transmission to the Control PCB. The motor optos and power connections are made via PL12, the plunger detect opto and declutch micro switch are connected via PL5.

- **Motor Optical Encoders**
  Two slotted optical switches are mounted on the back of the motor/gearbox assembly to detect the speed and direction of rotation. The optical switches are activated by a flag mounted on the rear output shaft of the motor.
- **Declutch Microswitch**
  A microswitch, SW1, is mounted on the transmission carriage to detect when the transmission drive has been disengaged.
- **Plunger Detect Optical Switch**
  A slotted optical switch is mounted inside the plunger holder. The optical switch detects when a syringe plunger is correctly located in the plunger holder.

Interfaces

- **TCI Interface (Model TCI & TIVA only)**
  The interface PCB is located in the lower case and connects the TCI Diprifusor module into the RS232 communications port. The TCI Diprifusor module aerial lead connects directly to the aerial coil and a screened cable passes up to the TCI aerial mounted in the upper case.
- **RS232/Nursecall**
  These circuits are incorporated on the Control PCB. See also 'Mark I Hardware' below.

Power Supply PCB

WARNING: THE PUMP POWER SUPPLY HAS HIGH VOLTAGES ON THE EXPOSED SURFACES OF THE BOARD. THE PUMP MUST ONLY BE SERVICED BY QUALIFIED PERSONNEL USING THE RECOMMENDED EQUIPMENT.

The switched mode PSU used in the pump accepts an input voltage from 93V to 264V AC and generates two DC outputs that are used to power the system. The first output is rated at 7V 300mA and is used to charge the lead acid battery. The second output is rated at 7V 1.5A and is used to power the Motor, Display PCB, Control PCB and Interface PCB.

- **Audible Alarm**
  The main audible alarm is located on the Power Supply PCB and can be enabled either by the audible alarm drive, or the watchdog alarm signal.

Mark I Hardware

- **Mains On/Off Switch**
  Mechanical ON/OFF switch, located on the side of the pump.
- **RS232/Nursecall**
  Interface PCB, fitted with the isolated RS232 and Nurse Call circuits.

Chapter 6

Spare Parts Replacement Procedures

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Introduction

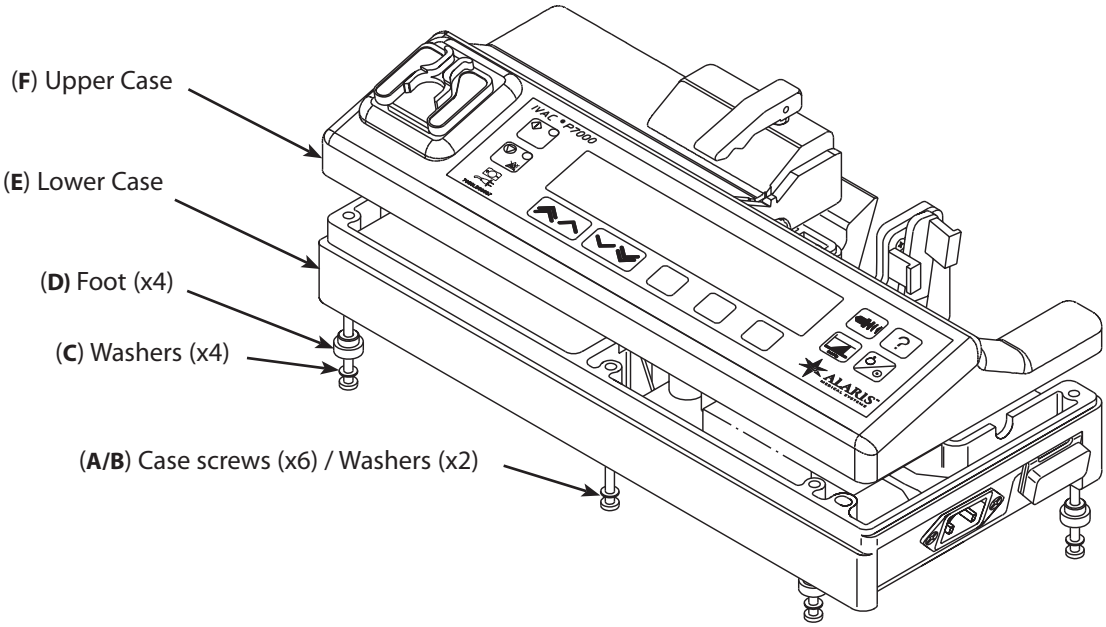
The information in this chapter is based on the Mark II pump unless otherwise stated.

- **Ensure the pump is disconnected from the AC power supply and switched off before attempting to service the pump**
- **The pump contains static-sensitive components. Observe strict ESD precautions at all times**
- **Always protect the plunger holder and syringe clamp when the pump is upside down. For regular servicing, the use of the case support cradle, part number 0000JG00004, is recommended**
- **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 on the base**
- **Batteries should be disposed of as outlined by the local country regulations: do not send back to the manufacturer**
- **For fastener torque settings, refer to Appendix C, 'Fitting & Replacement Guidelines'**
- **Only use Cardinal Health recommended spare parts**
- **Following all spare part replacement and repair activities, testing must be performed in accordance with the Performance Verification Procedure (PVP), see Chapter 3, 'Routine Maintenance'.**

Accessing the Pump

Procedure

1. Remove the six case retaining screws and washers located on the base of the pump.
2. Carefully separate the upper and lower case halves and disconnect cables.
3. Reassemble in reverse order. Note that when closing the case halves, ensure the grey ribbon cable is stowed in front of the PSU heatsink.



Spare Parts

Item	Description	Part Number
A	SCREW M4 X 50 PAN POSI	0000ME00302
B	WASHER M4 WAVEY SST	0000ME00045
C	WASHER M4 PLAIN ZINC PLATED	0000ME00310
D	SPARE UPGRADE MOULDED FOOT	1000SP01066
E	KIT CASE LOWER TIVA/TCI	6000SP00047
E	SPARE CASE LOWER P7000 MKI	7000SP00010
E	SPARE CASE LOWER P7000 MKII	7000SP00027
F	UPPER CASE 6000	6000ME00010
F	SPARE CASE UPPER TCI	6000SP00045
F	SPARE KIT UPPER P6000/TIVA	6000SP00046
F	SPARE UPPER P7000 MKII	7000SP00033
*	BLANK ON/OFF SWITCH LOWER (lower case side)	6000ME00006

* item not shown

Lower Case Assembly

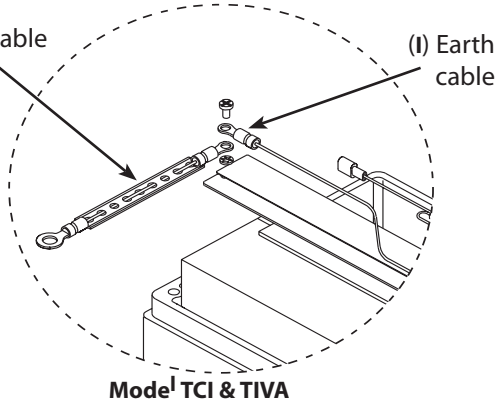
Replacing the lower case

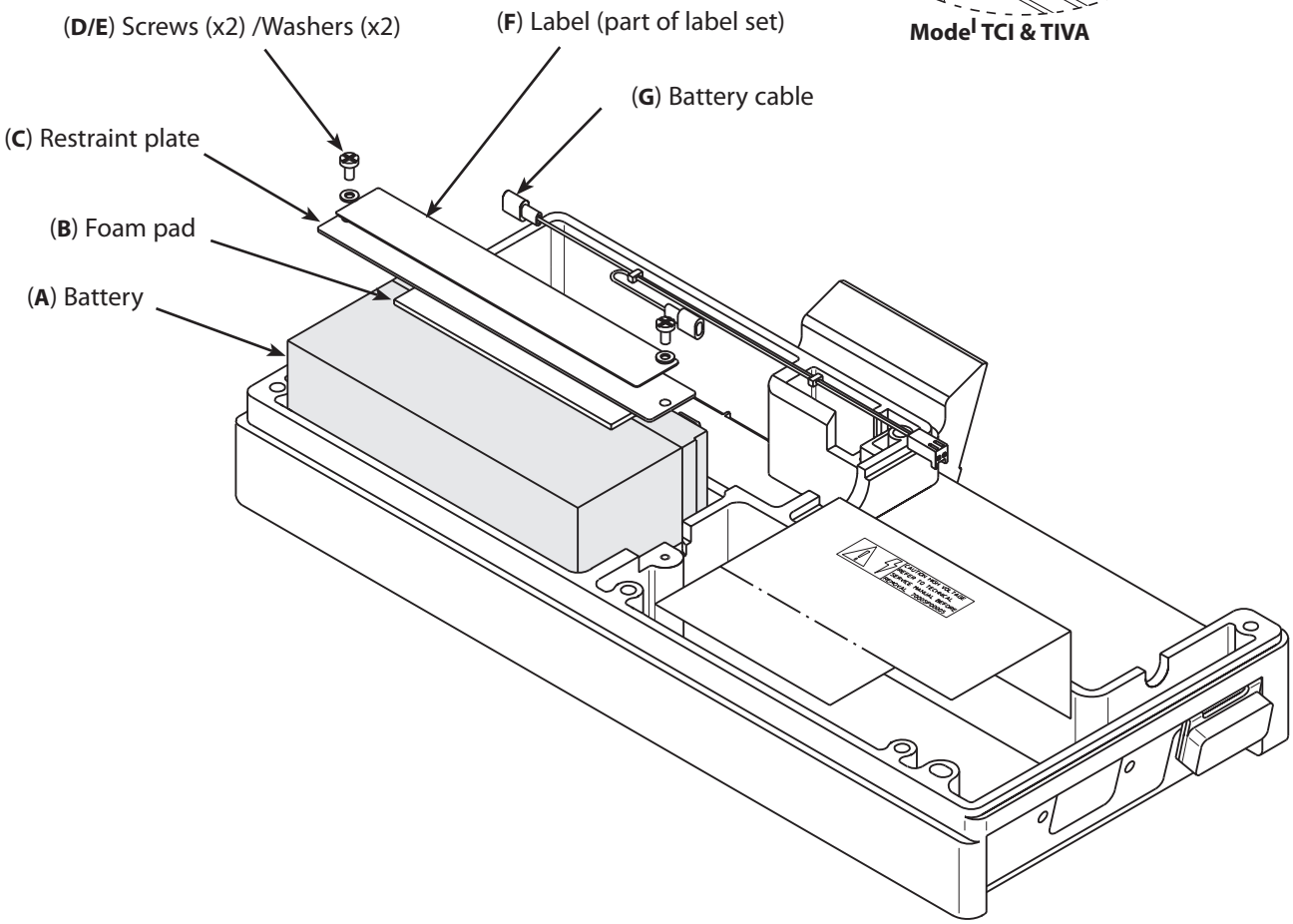
1. To replace a lower case, it will be necessary to fully strip down the old case and insert all the components into the new lower case. This task requires a good knowledge of the pump, so be certain that you are fully conversant with all the procedures in this chapter before undertaking this replacement.
2. To strip down each lower case subassembly, follow the instructions in the relevant section of this chapter. These sections are:
   - Accessing the Pump
   - Battery
   - PSU, Alarm, Mains Inlet
   - Mains On/Off Switch (Mark I)
   - RS232 Connector
   - RS232/Nursecall PCB (Mark I)
   - TCI Diprifuser Module PCB, PE Stud Connector
   - Pole Clamp Assembly
3. To reassemble the components into the new lower case, simply reverse the order of disassembly.

Battery

Procedure

1. Disconnect the battery cable from the Power Supply Unit (PSU).
2. Remove the two screws and washers which secure the battery restraining plate. Disconnect earth cable (Model TCI & TIVA only).
3. Remove the restraining plate and foam pad.
4. Lift out the battery.
5. Reassemble in reverse order.





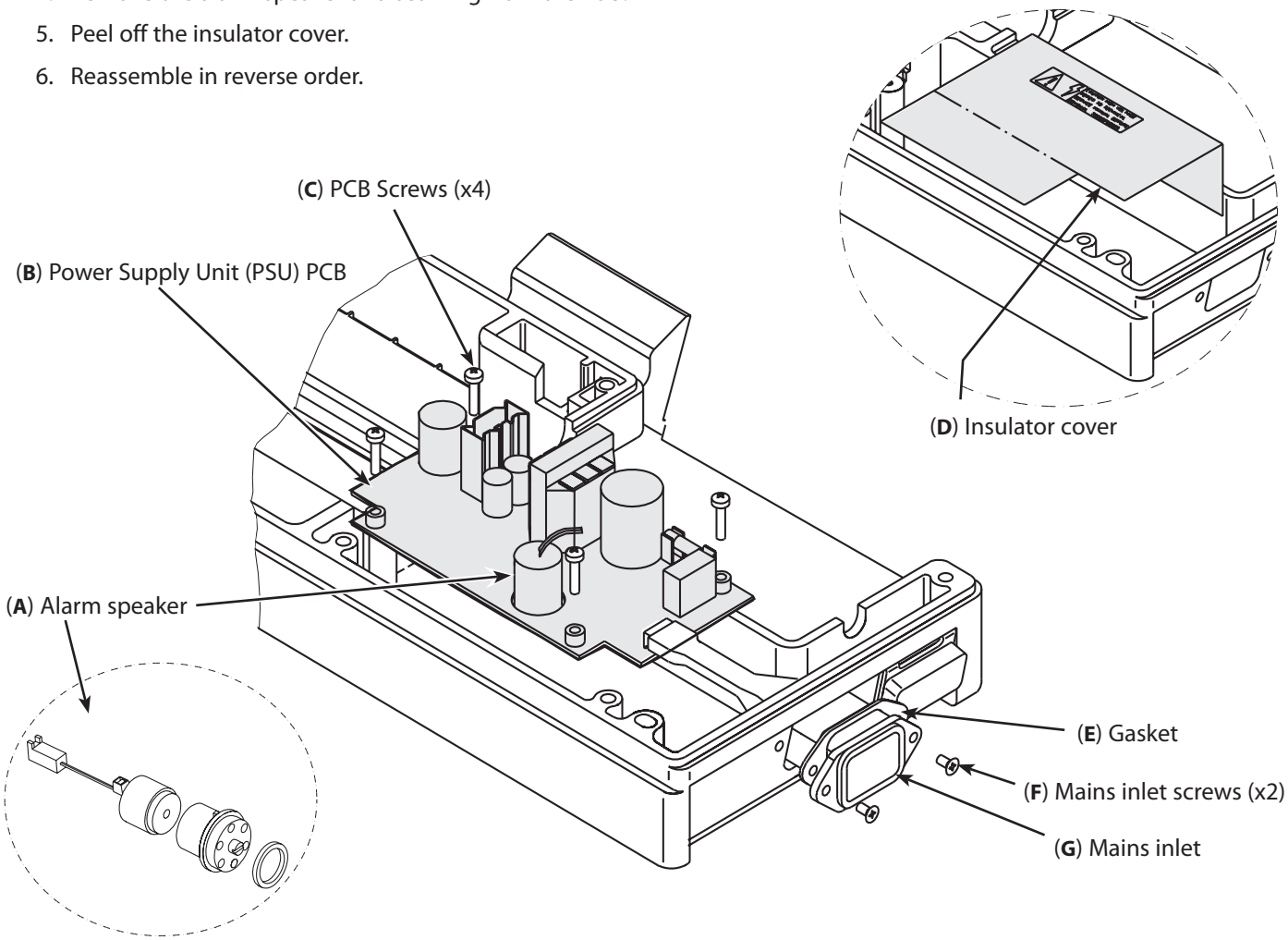
Spare Parts

Item	Description	Part Number
A	BATTERY 6V SLA RECHARGE	0000EL00004
B	FOAM PAD BATTERY	1000ME01064
C	PLATE BATTERY RESTRAINT PUNCHED	1000ME01123
D	SCREW M3X6 PAN HD POSI ZP+P	0000ME00221
E	WASHER M3 WAVEY SST	0000ME00015
F	LABEL SET P7000	7000LB00009
F	LABEL SET P6000/TIVA/P7000 MKII	6000LB00016
F	LABEL SET TIVA TCI	6000LB00015
G	ASSY CABLE BATTERY	1000SP00009
H	EARTH CABLE PE TO BEAM	6000SP00006
I	EARTH CABLE PE TO BATTERY PLATE	6000SP00005

PSU, Alarm, Mains Inlet

Procedure

1. Disconnect the grey ribbon cable, the mains inlet connector, the battery connector and the alarm speaker from the PSU PCB.
2. Remove the two screws which secure the mains inlet to the lower case. Slide out the mains inlet assembly and gasket.
3. Remove the four mounting screws which hold in the PCB and remove the PSU board.
4. Remove the alarm speaker and seal ring from the PSU.
5. Peel off the insulator cover.
6. Reassemble in reverse order.



Spare Parts

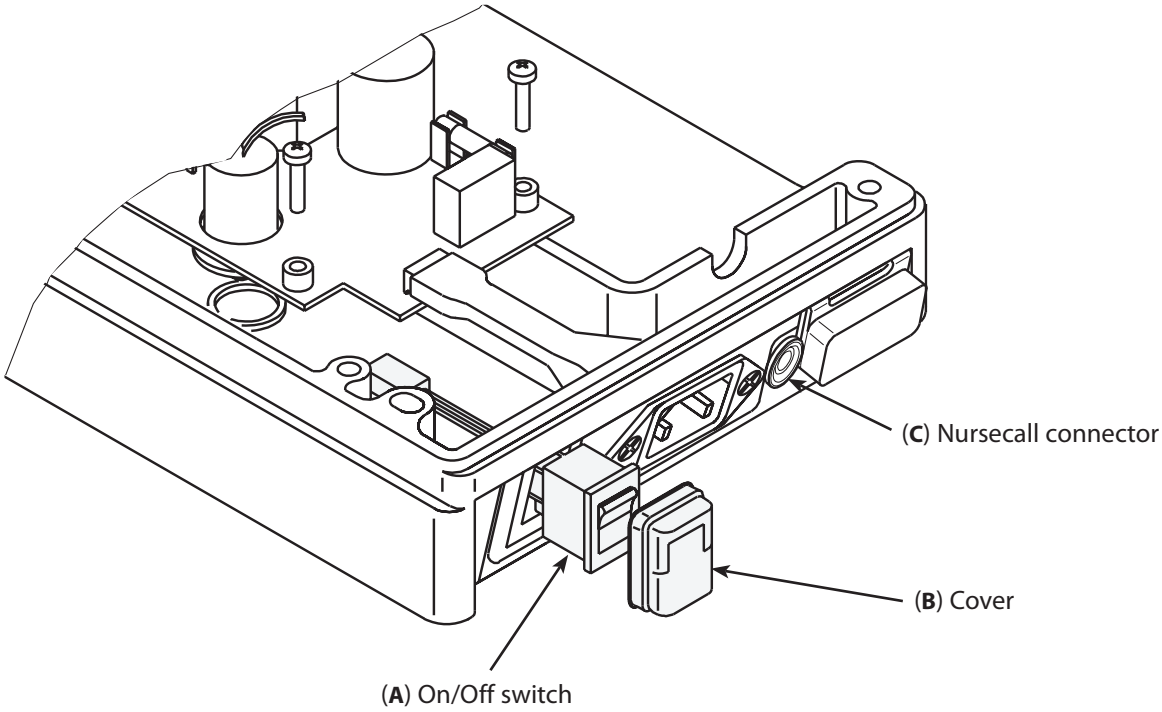
Item	Description	Part Number
A	P7 FAMILY POOR SOUNDER MODE KIT	1000SP00235
B	SPARE PSU MKII FUNCTIONAL EARTH	6000SP00026
B	PSU UPGRADE MKII FUNCTIONAL EARTH	6000SP00021
*	LINK FUSE 2A PICOFUSE	0000EL00284
*	CONNECTOR PLUG 16 WAY HEADER	0000EL00011
*	LINK FUSE 2A PICOFUSE	0000EL00284
*	ASSY ALARM TUBE WITH RESISTOR	1000SP01169
C	SCREW M3X12 POZI HD Z+C	0000ME00189
D	ASSY INSULATOR PSU (P7000 MKII, TCI & TIVA)	6000SP00008
D	ASSY INSULATOR PSU P7000 (MKI, P6000, TIVA)	7000SP00005
E	GASKET MAINS INLET V4	1000ME01074
F	SCREW M3X8 CSK HD POSI SS	0000ME00268
G	ASSY MAINS INLET FUNCTIONAL EARTH	6000SP00020
G	ASSY MAINS INLET EARTHED (TCI & TIVA)	6000SP00010

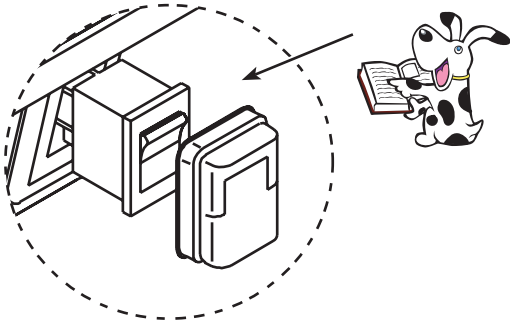
* item not shown

Mains On/Off Switch (Mark I)

Procedure

1. Disconnect the mains On/Off switch from the PSU board.
2. Lever out the On/Off switch assembly from the lower case.
3. Reassemble in reverse order.





When refitting, note that the mains On/Off switch assembly is inserted with the OFF rocker topmost, and that the cover is fitted as shown here.

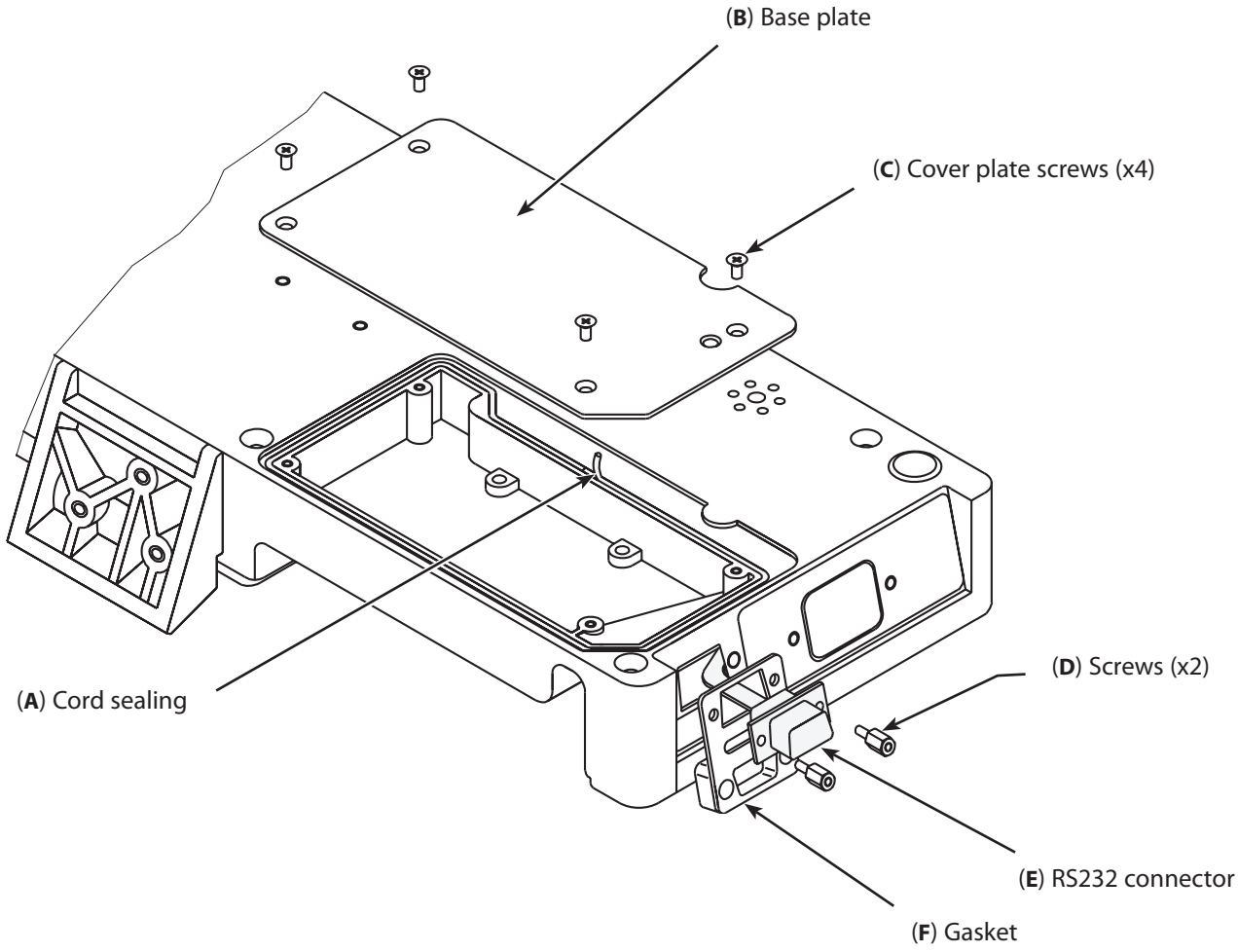
Spare Parts

Item	Description	Part Number
A	ASSEMBLY ON/OFF SWITCH	1000SP00007
B	ON/OFF SPLASH COVER A4	1000ME01103
B	SPARE FLUID SEALING UPGRADE KIT	1000SP01048
C	ASSY NURSECALL CONN V4	1000SP01025

RS232 Connector

Procedure

1. Remove the four screws which secure the cover plate to the underside of the lower case. Hinge the cover plate open and remove it.
2. Disconnect the RS232 ribbon cable from the Control PCB.
3. Remove the two screws which secure the RS232 connector to the lower case and slide out the connector assembly and gasket.
4. Reassemble in reverse order.



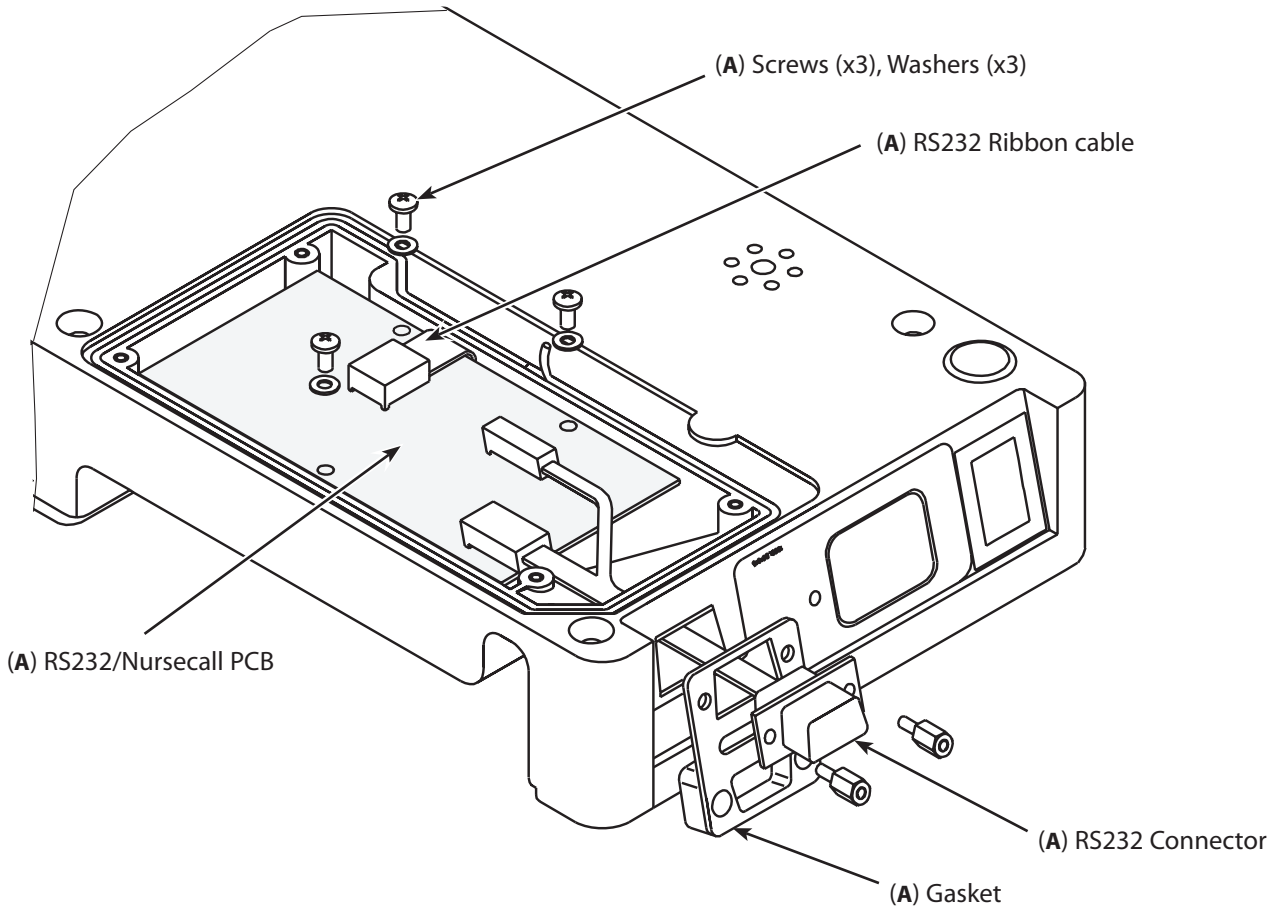
Spare Parts

Item	Description	Part Number
A	CORD SEALING SILICONE ID 0.95	1000ME01087
B	PLATE BASE P SERIES	6000ME00026
C	SCREW M3X8 CSK HD POSI SS	0000ME00268
D	SCREW MALE/FEMALE M3.4 BRASS & NICKEL	0000ME00279
E	ASSY RS232/NC CONNECTOR INSULATED	6000SP00024
F	GASKET RS232 MOULDED & CAP A4	1000ME01106

RS232/Nursecall PCB (Mark I)

Procedure

1. Remove the four screws which secure the cover plate to the underside of the lower case. Hinge the cover plate open and remove it.
2. Disconnect the RS232 ribbon cable from the Control PCB.
3. Disconnect cables from the RS232/Nursecall PCB. Remove the RS232 ribbon cable by pulling it through the slot in case wall.
4. Remove the two nuts which secure the RS232 connector. Slide out the connector assembly and gasket.
5. Remove the three screws and washers which secure the RS232/Nursecall PCB and remove the board from the lower case.
6. Reassemble in reverse order.



Spare Parts

Item	Description	Part Number
A	SPARES KIT RS232 OPTION	1000SP00210

TCI Diprifusor PCB, PE Stud Connector

Procedure

1. Remove the five screws which secure the cover plate to the underside of the lower case. Note: Use star driver to remove fifth screw. Hinge the cover plate open and remove it.
2. Disconnect ribbon cable from the TCI Diprifusor PCB.
3. Remove the two screws which secure the TCI Diprifusor PCB and remove the PCB from the lower case, carefully pulling through the aerial lead.
4. Disconnect the earth cable from the PE stud connector, as shown in Figure 2. below.
5. Remove the PE stud washers, plates and spacer slide out connector assembly.
6. Reassemble in reverse order.

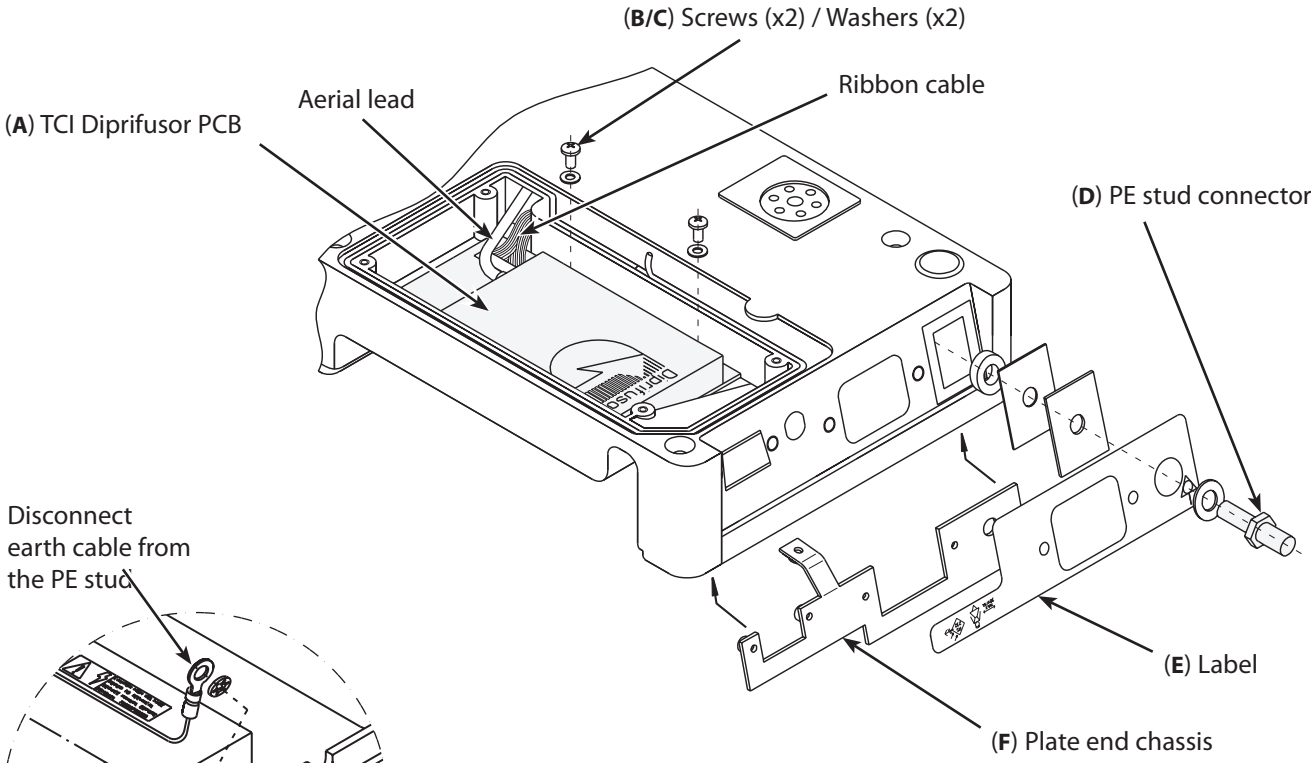


Figure 1. TCI Diprifusor PCB Procedure

Figure 2. Earth cable

Spare Parts

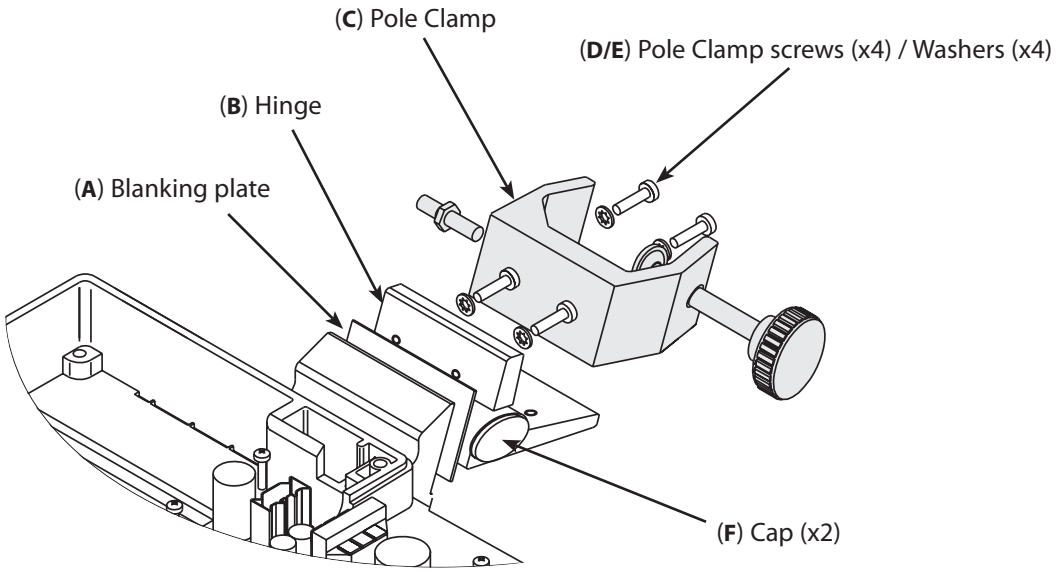
Item	Description	Part Number
A	ASSY PCB TIVA & TCI	6000EL00004
B	SCREW M3X6 PAN HD POSI ZP+P	0000ME00221
C	FLAT WASHER NYLON M3 TO ISO 7089	0000ME00044
D	STUD PE CONNECTOR M6 THREAD x 15	0000ME00141
E	LABEL SWITCH PANEL END TCI	6000LB00010 (see also 'Labels' section)
F	PLATE END CHASSIS TCI	6000ME00020

Pole Clamp Assembly

This instruction applies to the adjustable pole clamp assembly.

Procedure

1. Ensure that the hinge is fully open (for access to hinge screws).
2. Remove the two pole clamp screws and washers.
3. Remove the two hinge screws and washers. Remove blanking plate.
4. Reassemble in reverse order.



For information on pole clamp adjustment torque settings, refer to Appendix C, 'Fitting and Replacement Guidelines'.

Spare Parts

Item	Description	Part Number
A	PLATE BLANKING POLE CLAMP	1000ME00211
B	ASSY POLE CLAMP ADJUSTABLE	7000SP00016
C	SPARE POLE CLAMP 40MM	1000SP01015
*	ASSY ADJUSTABLE POLE CLAMP QUICK TRANS	7000SP00011
D	SCREW M4x16 DIN 7985 ZP+P	0000ME00227
E	WASHER M4 SHAKEPROOF	0000ME00286
F	CAP END CLAMP ADJUSTABLE	7000ME00052

* item not shown

Upper Case Assembly

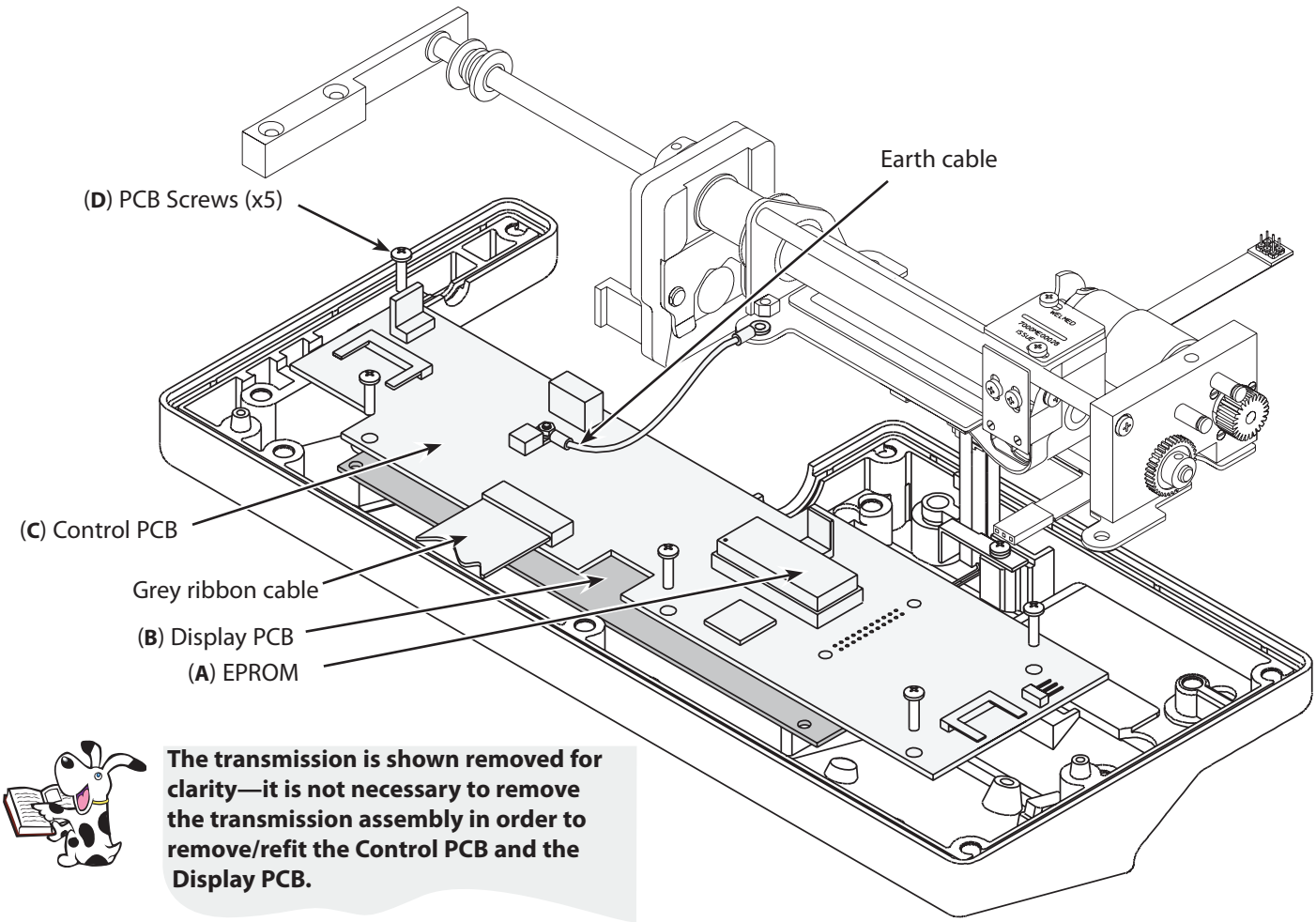
Replacing the upper case

1. To replace an upper case, it will be necessary to fully strip down the old case and insert all the components into the new upper case. This task requires a good knowledge of the pump, so be certain that you are fully conversant with all the procedures in this chapter before undertaking this replacement.
2. To strip down each upper case subassembly, follow the instructions in the relevant section of this chapter. These sections are:
   - Accessing the Pump
   - Control PCB, Display PCB
   - Transmission Assembly Removal
   - Transmission Assembly Breakdown
   - Syringe Size Pot, Syringe Clamp
   - Aerial Assembly (Mode^{l} TCI & TIVA)
   - Pressure Disc Holder (Mode^{l} P7000)
   - Pressure Transducer (Mode^{l} P7000)
   - Display, Keypad
   - Labels
3. To reassemble the components into the new upper case, simply reverse the order of disassembly.

Control PCB, Display PCB

Procedure

1. Disconnect the earth cable from the transmission assembly.
2. Remove the five PCB fixing screws and withdraw the Control PCB and Display PCB together.
3. Pull out the four standoffs/pins to separate the Control PCB and the Display PCB.
4. Reassemble in reverse order.



The transmission is shown removed for clarity—it is not necessary to remove the transmission assembly in order to remove/refit the Control PCB and the Display PCB.

Mandatory when serviced

Inspect and fit display spacers on pumps if the serial number is within the ranges:

6001-00001 to 6001-13816
6002-00001 to 6002-11388
6003-00001 to 6003-01126
7001-00001 to 7001-13717

Procedure:

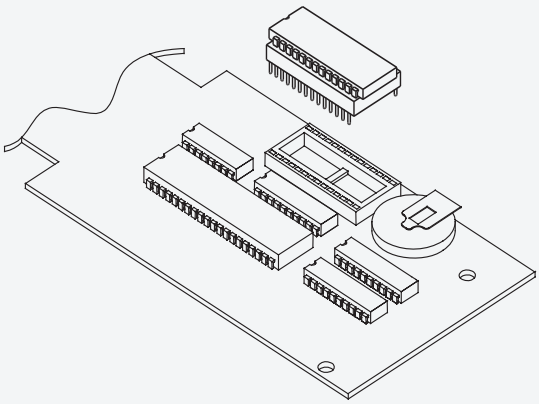
1) **Visually inspect for the correct fit of the display pcb to the control pcb it is necessary to remove the control pcb (with display pcb attached) from the upper case.**
2) **When removed, check that the display pcb is located on the four mounting spacers and is pressed as far as possible onto the mounting spacer.**
3) **There shall be no gap between the spacer mounting face and either the control or display pcbs.**
4) **If a gap is present or the pcbs are not securely fitted the spacers are to be replaced with new spacer (0000ME00387).**

Control PCB, Display PCB (continued)

EPROM socket contact failure could lead to pumps exhibiting errors 5, 25, 35, 36 or 37.
Add a new socket if a pump exhibits one of these errors, has a control pcb 6000EL00001 and issues 1 through 12 and the serial number is within the ranges:
6001-12376 to 6001-14298
6002-10096 to 6002-11583
6003-00803 to 6003-01130
7001-11090 to 7001-14716

Procedure:

1) **Remove the existing EPROM and fit the new socket (32 way Dual In Line (DIL) - 0000EL00450) into the existing socket as shown below.**
2) **Refit the EPROM as shown.**
3) **Note that minimal clearance exists between the new EPROM height and the battery plate, hence ensure new EPROM and socket are fully inserted.**



On certain Model P7000 control boards a regulator circuit is fitted to the PCB at PL11 to maintain linear position sensing regulation.
When upgrading to Version 2 software the regulator circuit should be removed if fitted.

Spare Parts

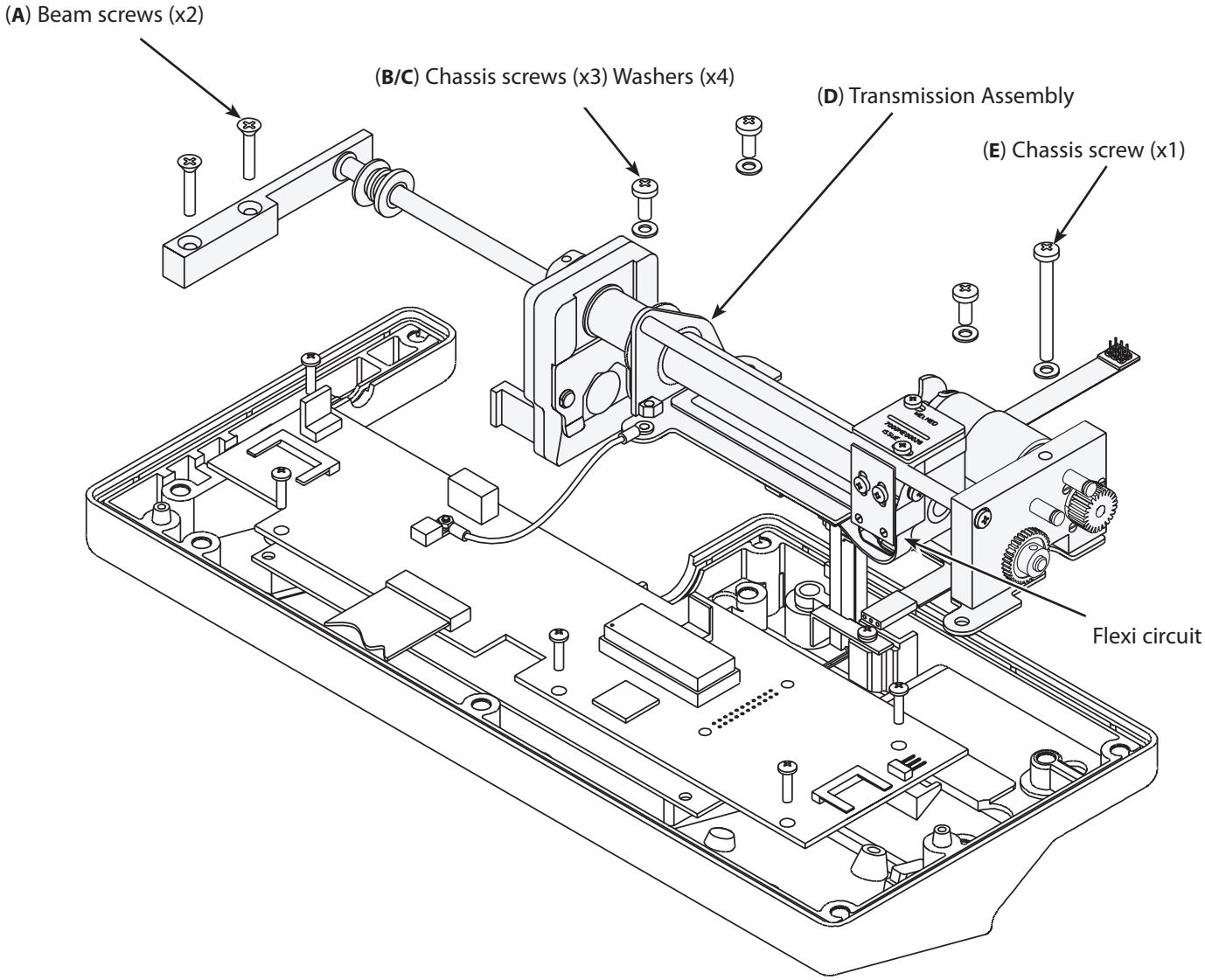
Item	Description	Part Number
A	P6000 V3R2 S/W UPGRADE KIT	1000SP00529
A	P7000 V3R2 S/W UPGRADE KIT	1000SP00530
A	P6000 (TIVA) V3R2 S/W UPGRADE KIT	1000SP00531
A	P6000 (TIVA TCI) V3R2 S/W UPGRADE KIT	1000SP00532
B	SPARE DISPLAY BOARD P6/TIVA/P7	7000SP00020
*	SPACER 4.8MM DOUBLE SELF	0000ME00387
C	SPARE UPGRADE CONTROL P6/P7/TIVA	7000SP00030
C	SPARES CONTROL PCB P6000 MKII	6000SP00018
C	SPARE UPGRADE P6000 MkI-MkII	6000SP00016
C	SPARE UPGRADE KIT P7000 MKI-MKII	7000SP00026
C	SPARE UPGRADE TIVA MkI-MkII	6000SP00017
*	ASSY CABLE 16 WAY RIBBON	1000EL00135
*	ASSY CABLE TCI	6000SP00007
*	IC SOCKET 32W-DIL TURNEDPIN	0000EL00450
*	BATTERY NiCd 2.4V 40mAH	0000EL00208
*	BUZZER PCB P7000 TMB-05	0000EL00442
D	SCREW M3X12 POZI HD Z+C	0000ME00189

* item not shown

Transmission Assembly Removal

Procedure

1. Remove the four chassis screws and washers and two beam screws which secure the transmission assembly.
2. Disconnect cables and remove the transmission assembly from the upper case.
3. Reassemble in reverse order.



When refitting the transmission assembly into the upper case, ensure that the flexi circuit is adjusted so the flex does not catch or click when mechanism is declutched or moved manually.

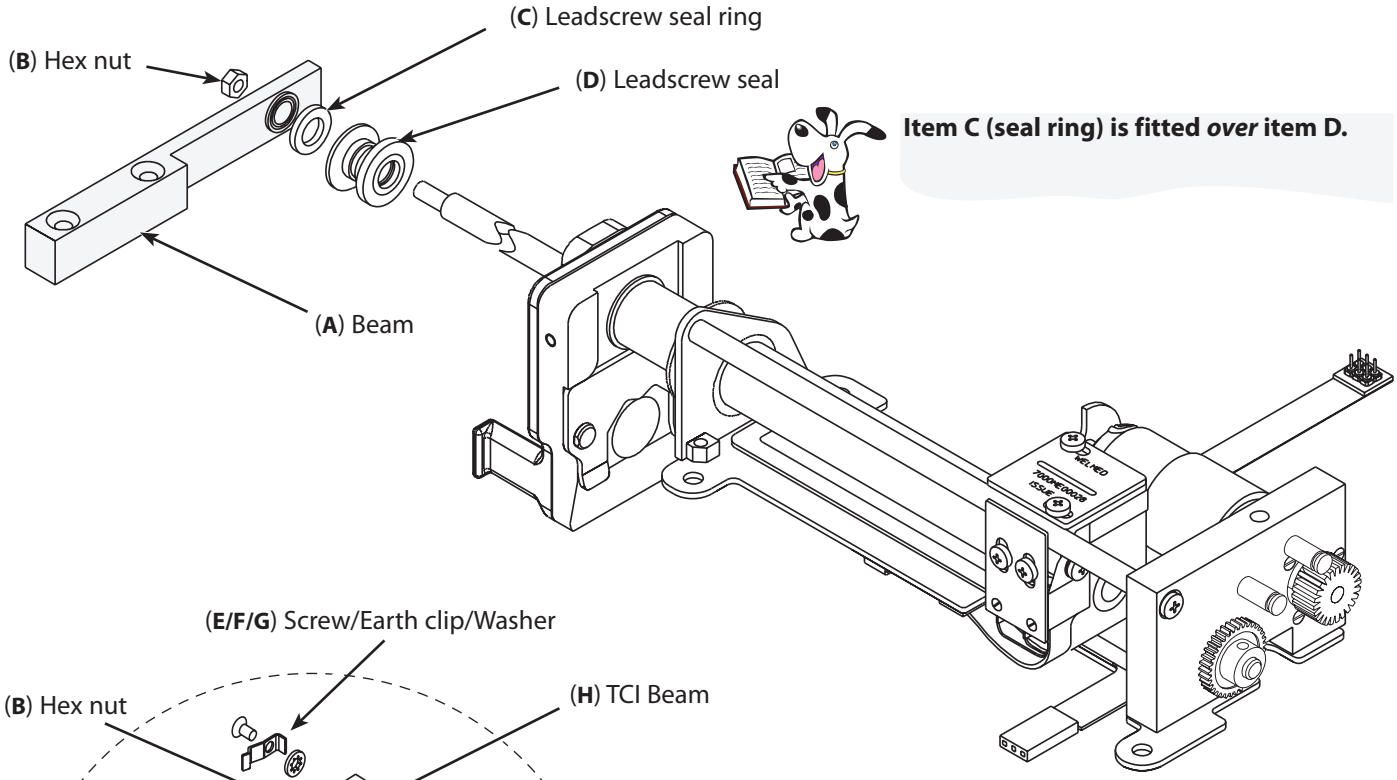
Spare Parts

Item	Description	Part Number
A	SCREW M4x20 CSK HD POSI SS	0000ME00255
B	SCREW M4x8 PAN HD POSI	0000ME00246
C	WASHER M4 WAVEY SST	0000ME00045
D	SPARE TRANSMISSION P6000/TIVA/P7000	7000SP00022
D	SPARE TRANSMISSION TCI	6000SP00027
E	SCREW M4x40 PAN HD POSI 2 ZP+P	0000ME00225

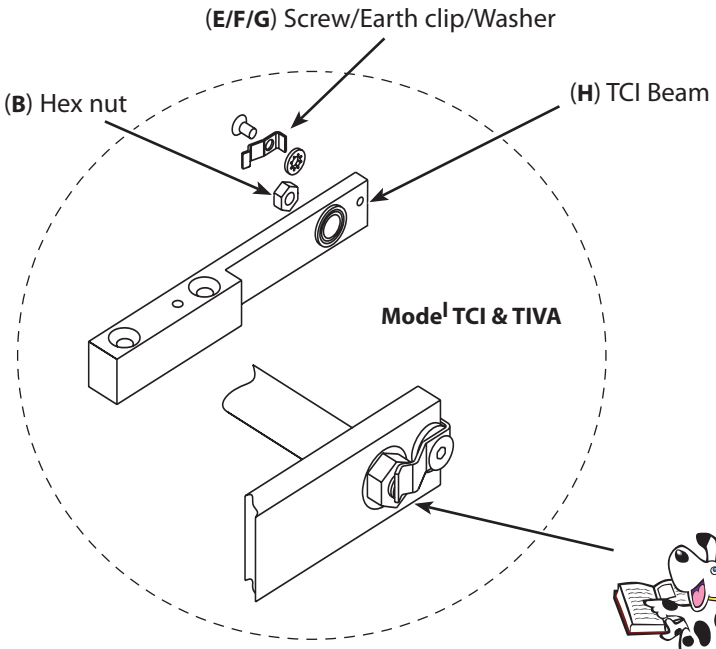
Transmission Assembly Breakdown

Bonded Beam

1. Remove nut securing the bonded beam.
2. Reassemble in reverse order.



Item C (seal ring) is fitted *over* item D.



Ensure earth clip sits squarely on end of leadscrew.

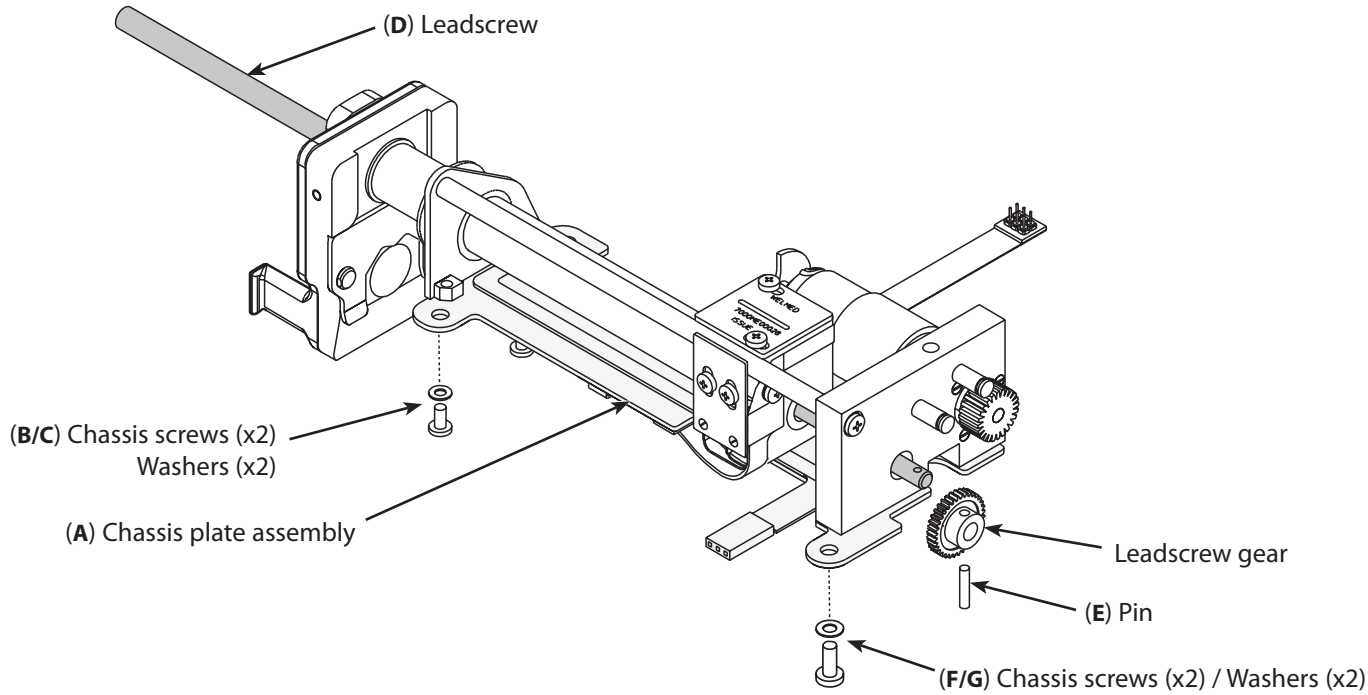
Spare Parts

Item	Description	Part Number
A	PSERIES BEAM ASSEMBLY	1000SP00247
B	HEX NUT M3 STAINLESS STEEL A4	0000ME00292
C	SEAL RING LEADSCREW	1000ME01048
D	ASSY LEADSCREW SEAL	1000SP01063
E	SCREW M2.5X6 CSK HEAD SKT A4 ST/ST	0000ME00288
F	CLIP EARTH LEADSCREW TCI	6000ME00018
G	WASHER M2.5 SHAKEPROOF	0000ME00287
H	TCI BEAM ASSEMBLY	6000SP00011

Transmission Assembly Breakdown *(continued)*

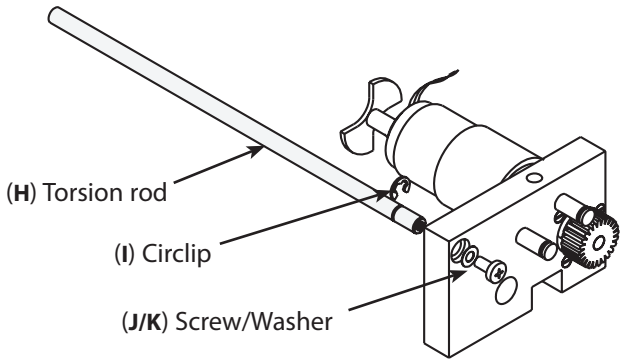
Leadscrew, Chassis Plate

1. Remove the pin securing the leadscrew gear. Declutch mechanism and pull out leadscrew.
2. Remove the four chassis plate assembly screws.
3. Reassemble in reverse order.



Torsion Rod

1. Remove the securing screw, washer and circlip then slide out torsion rod.
2. Reassemble in reverse order.



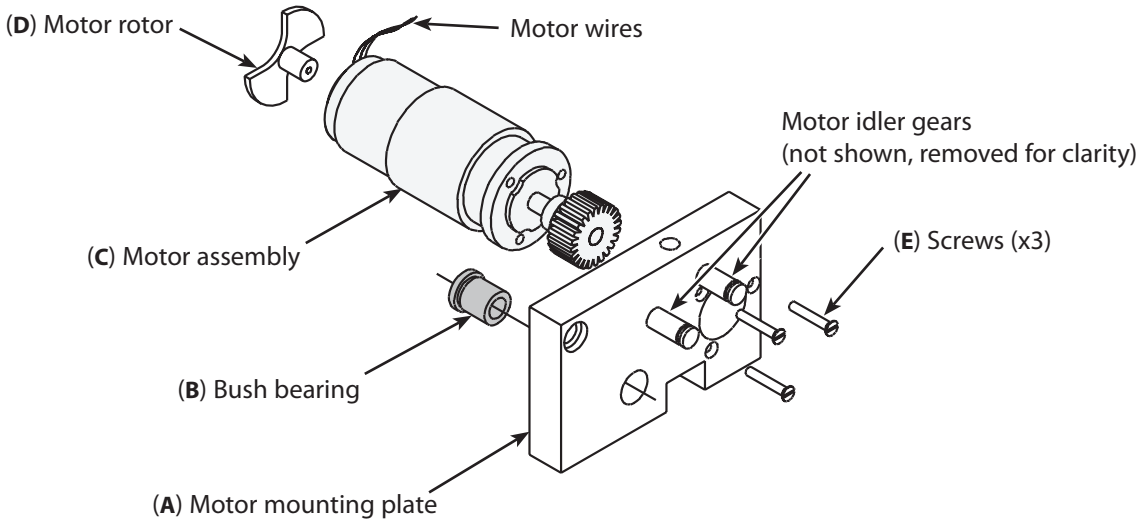
Spare Parts

Item	Description	Part Number
A	ASSY CHASSIS POTENTIOMETER	7000SP00018
B	SCREW M3X6 PAN HD POSI ZP+P	0000ME00221
C	WASHER M3 WAVEY SST	0000ME00015
D	LEADSCREW V4	1000ME01011
E	PIN TENSION DIA 2.0X10mm	0000ME00016
F	SCREW M4X8 PAN HD POSI	0000ME00246
G	WASHER M4 WAVEY SST	0000ME00045
H	ROD TORSION P7000	7000ME00015
I	CIRCLIP E TYPE SHAFT DIA 4.8	0000ME00002
J	SCREW M3X6 PAN HD POSI ZP+P	0000ME00221
J	SCREW M3X16 CSK HD POSI STAINLESS STE (TCI&TIVA)	0000ME00284
K	WASHER M3 WAVEY SST	0000ME00015
K	WASHER M3 SHAKEPROOF (TCI&TIVA)	0000ME00285

Transmission Assembly Breakdown *(continued)*

Motor

1. Remove the circlips and washers securing the two motor idler gears.
2. Disconnect (de-solder) the two motor wires from the flexible circuit.
3. Remove the three mounting plate fixing screws.
4. Reassemble in reverse order.



Ensure the motor rotor rotates freely and does not strike the motor opto switches when refitting motor assembly.

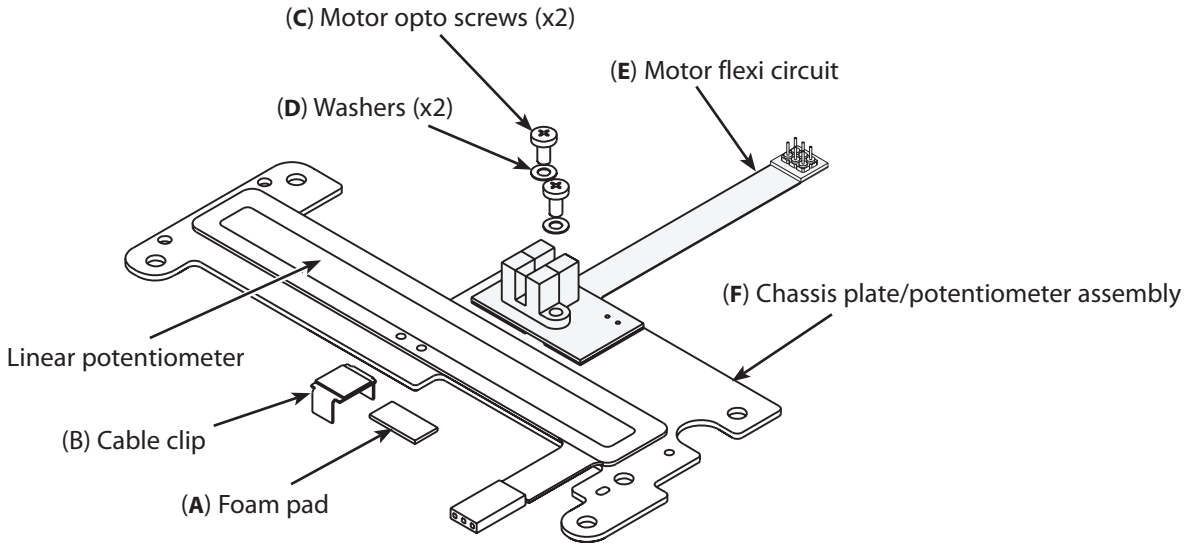
Spare Parts

Item	Description	Part Number
A	ASSY PLATE MOTOR MOUNTING P7000	7000ME00062
A	ASSY MOTOR MOUNTING TCI	6000ME00025
B	BUSH MOTOR BEARING MOULDED	1000ME01113
C	MOTOR ASSEMBLY P7000	7000ME00068
D	MOTOR ROTOR ENCODER 4 LINE MOULDED	7000ME00034
E	SCREW M2X12 CSK HD SLOTTED	0000ME00084

Transmission Assembly Breakdown *(continued)*

Linear Potentiometer, Motor Flexi Circuit

1. Remove the two motor opto screws securing the motor flexi circuit assembly.
2. Prise the chassis plate cable clip open and remove the transmission flexi cable from the chassis underside.
3. Reassemble in reverse order.



Ensure the correct positioning of the chassis plate/potentiometer assembly. Fit the motor mounting plate into the holes on the chassis plate and line the linear potentiometer up with the edge of the chassis plate and the edge of the motor mounting plate.

Spare Parts

Item	Description	Part Number
A	FOAM PAD	1000ME01066
B	CABLE CLIP ADHESIVE	0000EL00095
C	SCREW M3X6 PAN HD POSI ZP+P	0000ME00221
D	WASHER M3 WAVEY SST	0000ME00015
E	ASSY FLEXI CIRCUIT MOTOR	7000SP00002
*	CONNECTOR PLUG 14 WAY	0000EL00106
F	ASSY CHASSIS POTENTIOMETER	7000SP00018

* item not shown

Transmission Assembly Breakdown *(continued)*

Carriage, Outer Tube and Plunger Assembly

1. To breakdown the carriage, outer tube and plunger assembly, refer to the diagrams on the following pages (Figures 1, 2, 3 and 4), removing components as required.
2. Reassemble in reverse order.

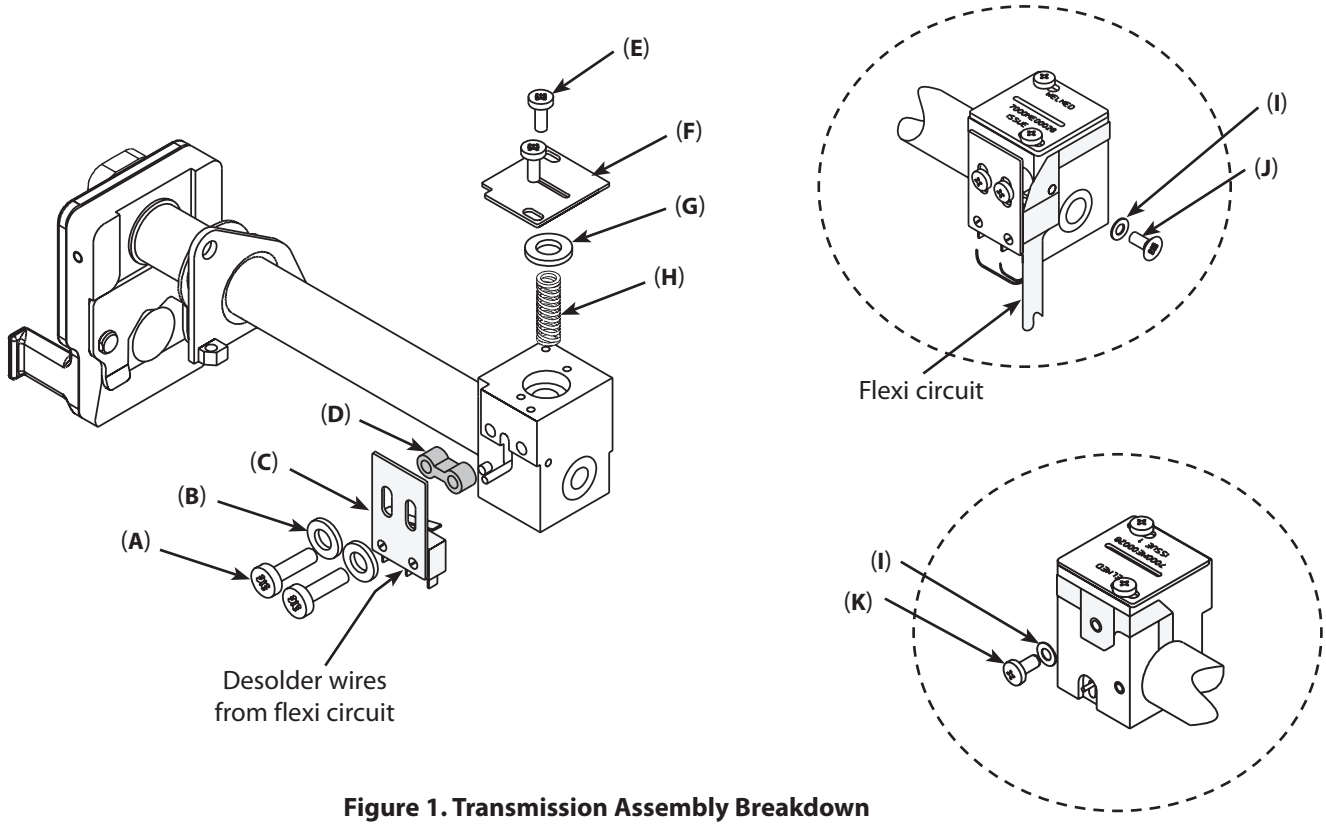


Figure 1. Transmission Assembly Breakdown

Spare Parts

Item	Description	Part Number
A	SCREW No4x1/2" PAN HD	0000ME00032
B	WASHER M3 PLAIN Z+C	0000ME00048
C	ASSY MICROSWITCH V4	1000SP01022
D	SPACER DUAL TRANSMISSION	1000ME00177
E	SCREW No3x3/8" PAN HD	0000ME00031
F	PLATE CARRIAGE	7000ME00028
G	WASHER 12X1.6X6.4 I/D NYLON	0000ME00391
H	SPRING COMP OD 6.1 19 LONG	0000ME00003
I	FLAT WASHER NYLON M3 TO ISO 7089	0000ME00044
J	SCREW No4x1/4" CSK TRUNCATED POZI SS	0000ME00313
K	SCREW No4x1/4" PAN HD	0000ME00011

Transmission Assembly Breakdown *(continued)*

Carriage, Outer Tube and Plunger Assembly *(continued)*

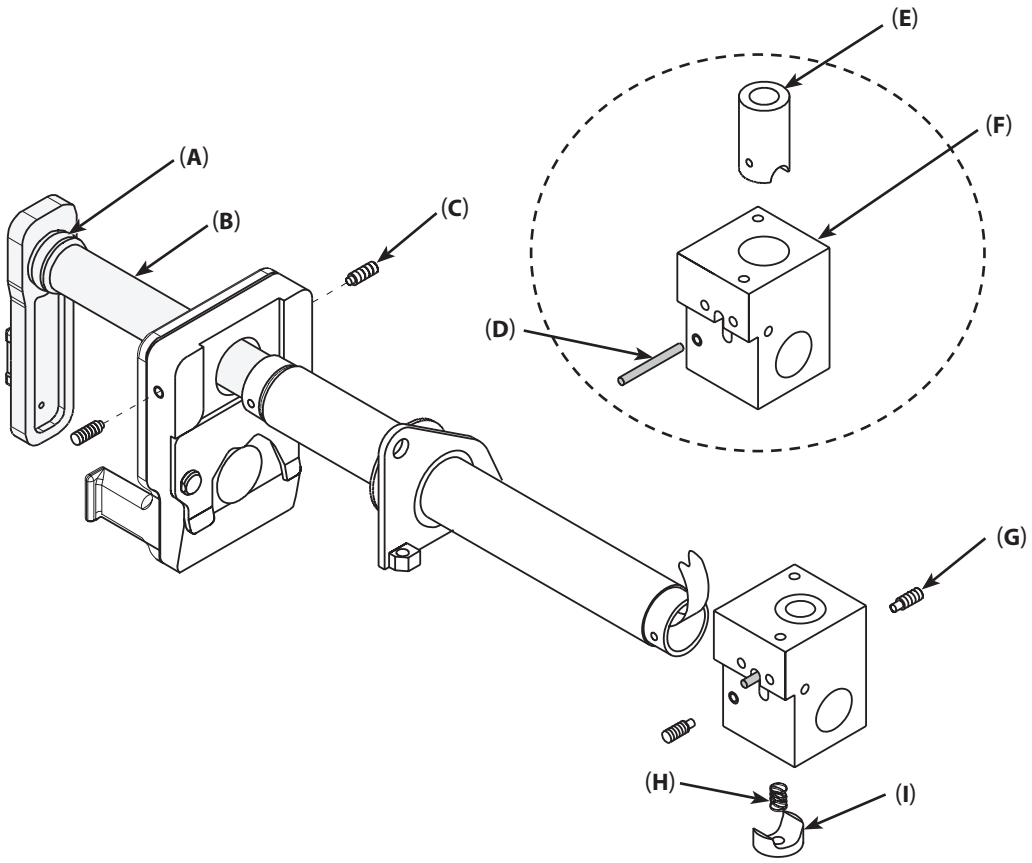


Figure 2. Transmission Assembly Breakdown

Spare Parts

Item	Description	Part Number
A	O RING NITRILE 11.5X1.5	0000ME00277
B	LEVER TUBE DECLUTCH	1000SP01084
C	SCREW M3X8 TORX T6 SET PART DOG	1000ME01134
D	PIN TENSION DIA 2.0X20mm	0000ME00018
E	HALF NUT V4	1000ME00097
F	CARRIAGE COMMON TRANS	7000ME00011
G	SCREW M3X8 TORX T6 SET FULL DOG	1000ME01133
H	SPRING COMP 8MMX6MM	0000ME00345
I	ACTUATOR LINEAR POT DELRIN	7000ME00053

Transmission Assembly Breakdown *(continued)*

Carriage, Outer Tube and Plunger Assembly *(continued)*

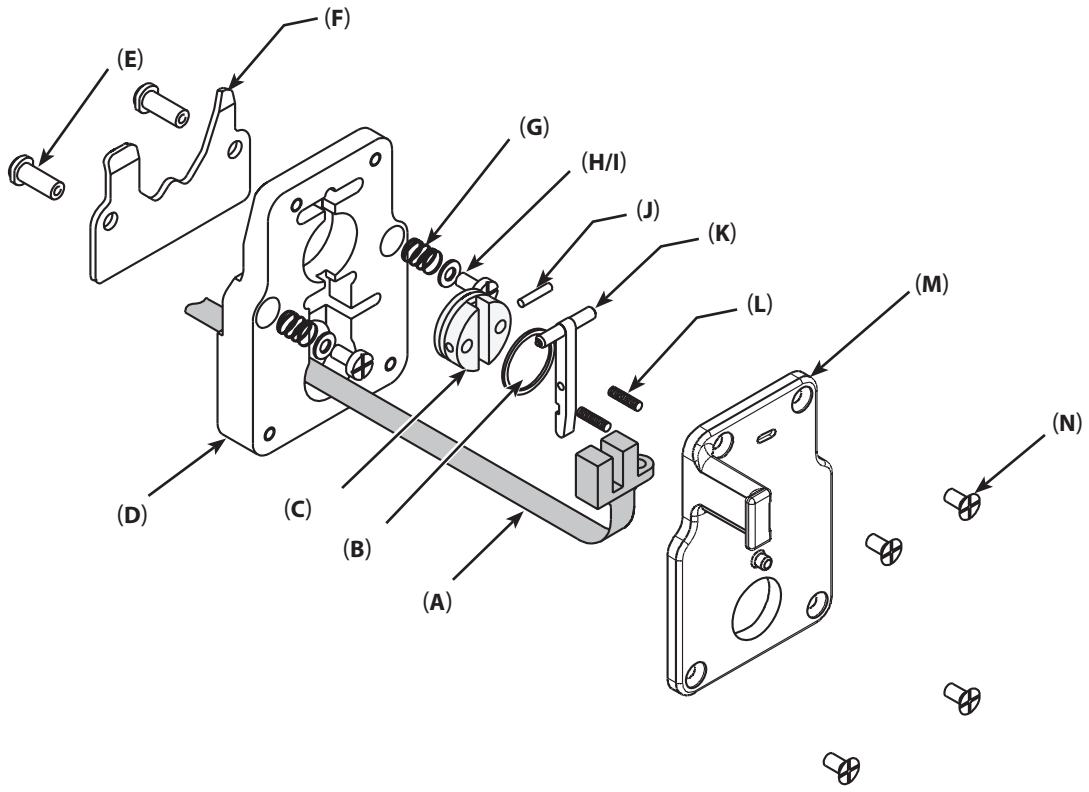


Figure 3. Transmission Assembly Breakdown

Spare Parts

Item	Description	Part Number
A	ASSY FLEXI CIRCUIT MKII TRANSMISSION	7000SP00024
B	NITRILE ORING 14.1 X 1.6	0000ME00448
C	BUTTON PLUNGER HOLDER MOULDED	1000ME01114
D	HOLDER PLUNGER V4	1000ME01059
E	PIN PLUNGER PLATE	1000ME01027
F	PLATE PLUNGER RESTRAINT	1000ME01305
G	SPRING MUSIC WIRE	0000ME00386
H	WASHER M3 PLAIN Z+C	0000ME00048
I	SCREW M3X6 PAN HD POSI ZP+P	0000ME00221
J	SPIROL PIN 1.5X10 MDP	0000ME00132
K	HOLDER PLUNGER CRUCIFORM MKII	1000ME01353
L	SPRING COMPRESSION 2.24 DIAX7.9mm	0000ME00133
M	BACKPLATEPLUNGER HOLDER OVERMOL	1000ME01325
N	SCREW M3X8 CSK HD POSI SS	0000ME00268

Transmission Assembly Breakdown *(continued)*

Carriage, Outer Tube and Plunger Assembly *(continued)*

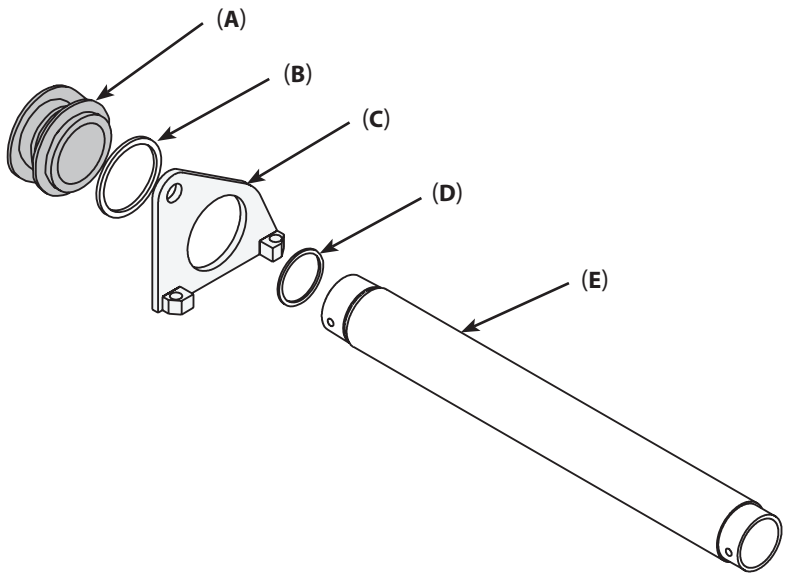


Figure 4. Transmission Assembly Breakdown

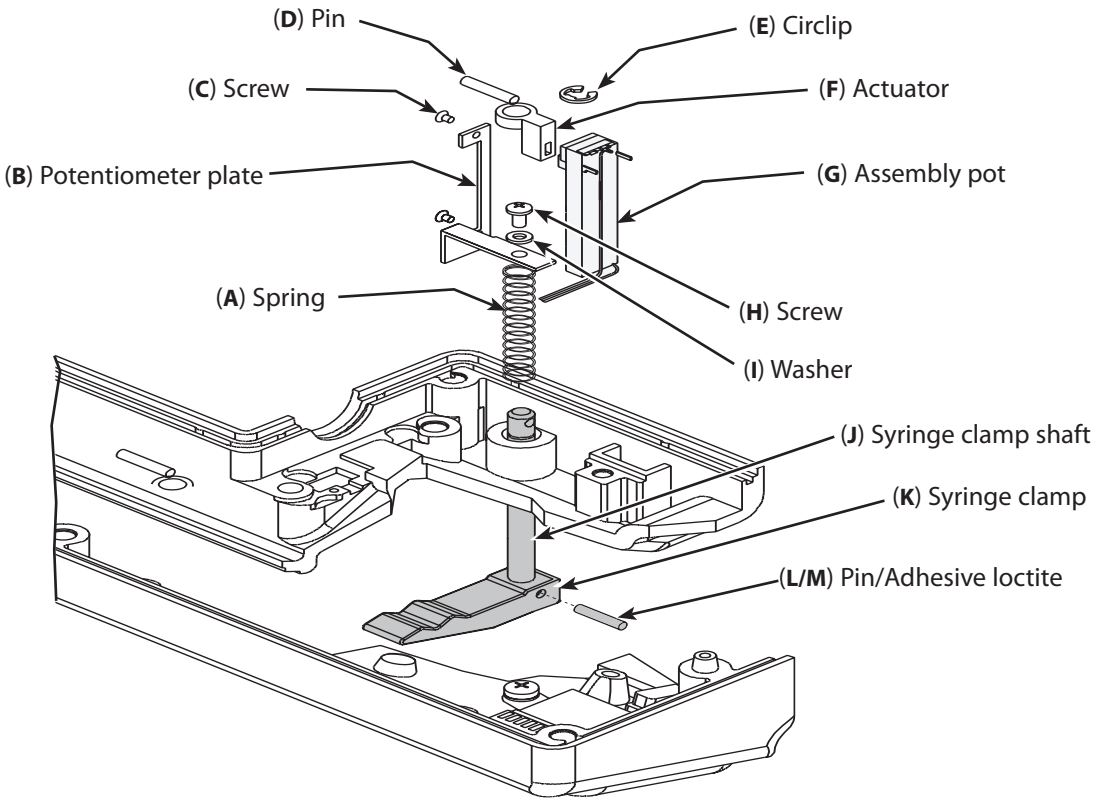
Spare Parts

Item	Description	Part Number
A	SEAL OUTER TUBE RECESSED	1000ME01121
B	SEAL RING OUTER TUBE	1000ME01047
C	PLATE OUTER TUBE SEAL V4	1000ME01022
D	NITRILE ORING 14.1 X 1.6	0000ME00448
E	TUBE OUTER 'O' RING GROOVE	1000ME01122

Syringe Size Pot, Syringe Clamp

Procedure

1. Remove the potentiometer mounting plate fixing screw, remove pin which locks the syringe sizing pot and syringe clamp in place.
2. Slide actuator off the syringe clamp shaft and remove the syringe sizing pot.
3. Reassemble in reverse order. See important note on next page.



When refitting, position the assembly pot so that actuator pot moves correctly when the syringe clamp is moved up and down.

Spare Parts

Item	Description	Part Number
A	SPRING 7.8 OD 44 LONG	0000ME00266
B	PLATE POTENTIOMETER 50MM PUNCHED	7000ME00063
C	SCREW M2X3 CSK HD SLOTTED	0000ME00164
D	PIN TENSION DIA 3.0X16MM	0000ME00116
E	CIRCLIP E TYPE SHAFT DIA 4.8	0000ME00002
F	ACTUATOR POT MOULDED SYRINGE SIZING	7000ME00033
G	ASSY POT P7000	7000SP00003
H	SCREW M3X6 PAN HD POSI ZP+P	0000ME00221
I	WASHER M3 WAVEY SST	0000ME00015
J	SHAFT SYRINGE CLAMP 100ML SYRINGE SIZING	7000ME00060
K	CLAMP SYRINGE MACH. V4	1000ME01006
L	PIN TENSION 3.0x10.0	0000ME00257
M	ADHESIVE LOCTITE 603	0000ME00107

Syringe Size Pot, Syringe Clamp (continued)

Recommended when serviced
Bond syringe clamp if the pump serial number is within the ranges
6001-00100 to 6001-00972
6002-00100 to 6002-00259
7001-00106 to 7001-04432

Procedure:

1) Remove the two circlips and spirol pin that secure the syringe clamp assembly in the upper case then slide the syringe clamp assembly out through the bush in the upper case. The potentiometer assembly and actuator can be left in place.

2) Carefully knock out the syringe shaft spirol pin, clean out the syringe shaft hole and apply Loctite (item J.4), or equivalent adhesive around the edge of the hole.

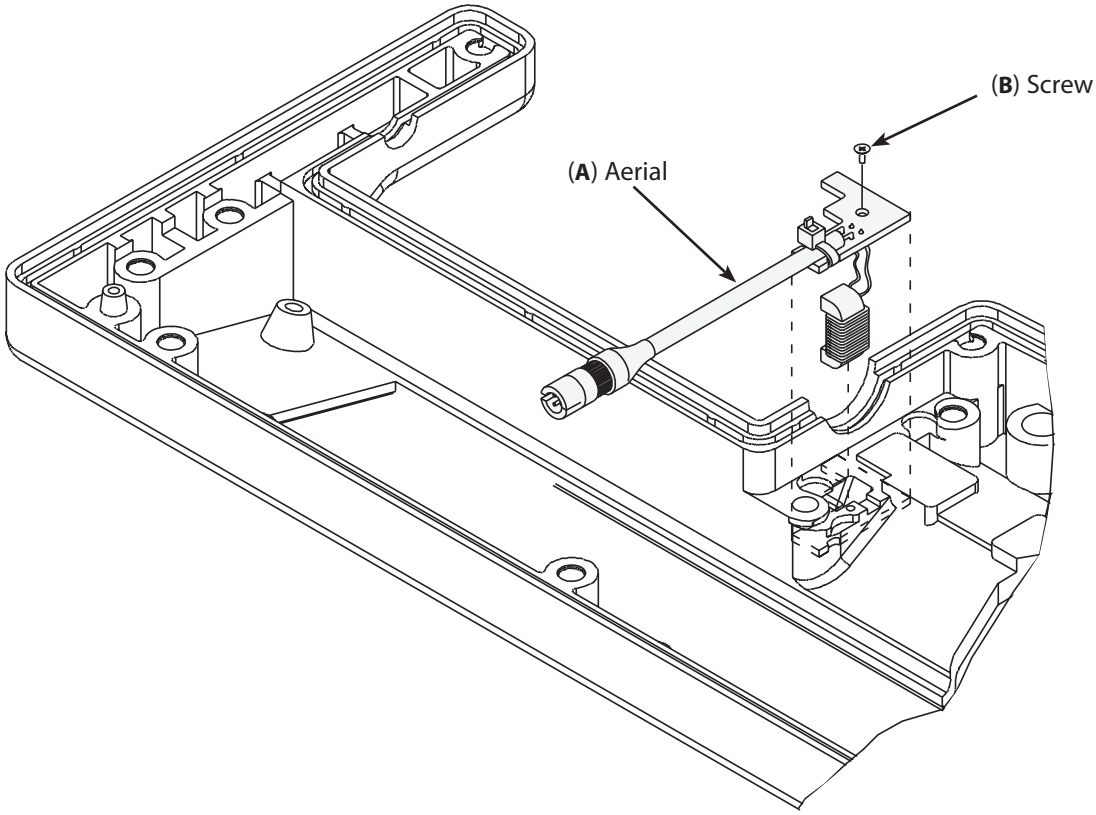
3) Reassemble the syringe clamp assembly, re-inserting the pin through the hole in the clamp and shaft.

4) Wipe off excessive adhesive and allow to cure for a minimum of 3 hours before refitting the syringe clamp assembly into the pump. Note: If cure time of 3 hours cannot be tolerated, activators may be used to reduce the cure time.

Aerial Assembly (Model TCI & TIVA)

Procedure

1. Remove screw which secures aerial assembly.
2. Remove aerial, lift out PCB and aerial wires.
3. Reassemble in reverse order.



When refitting, ensure aerial wires do not get trapped between PCB and upper case.

Spare Parts

Item	Description	Part Number
A	SPARE AERIAL TIVA & TCI	6000SP00015
B	SCREW No2 X 1/4" CSK POZD S/T "B" TYPE	0000ME00312

Pressure Disc Holder (Model P7000)

Procedure

1. Remove the two lapel labels from the outside of the upper case, as shown in Figure 1.
2. Remove the four assembly fixing screws which secure the pressure transducer holder.
3. Remove the retaining circlip, pressure disc arm spring and gasket.
4. Lift out the pressure disc flag and retaining springs from the underside of the upper case, as shown in Figure 2.
5. Reassemble in reverse order.

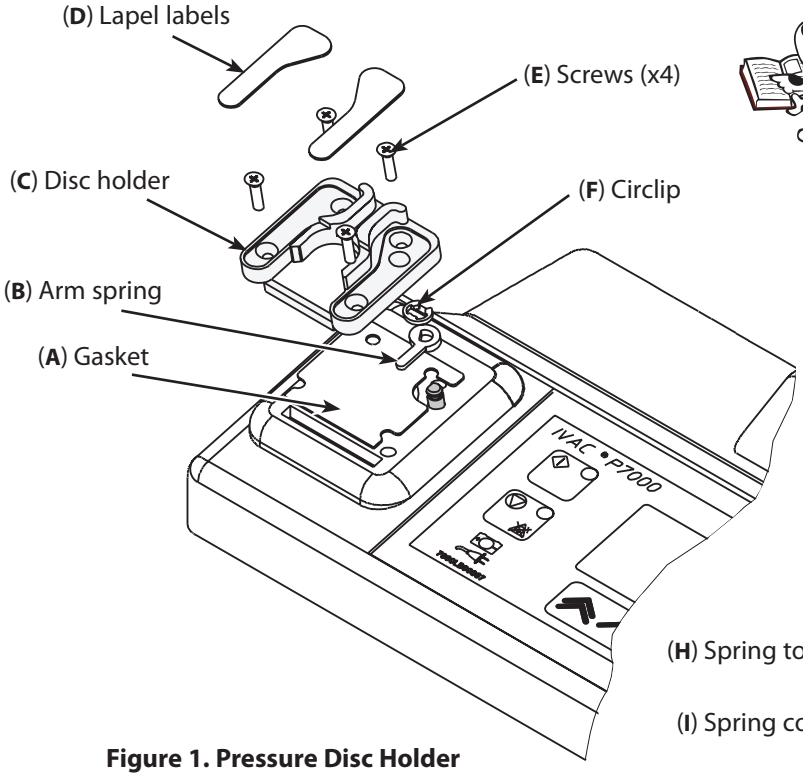


Figure 1. Pressure Disc Holder

Ensure one leg of the spring torsion is refitted over the flag and the other leg is fitted behind the step in the upper case.

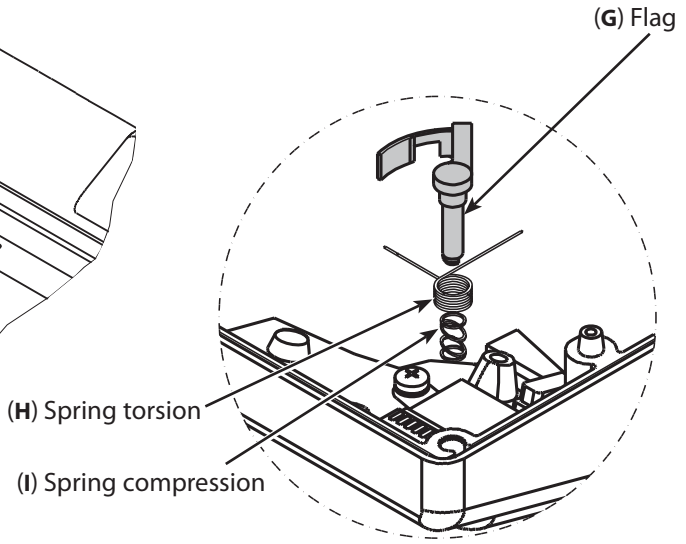


Figure 2. Pressure Disc Holder

The spring torsion of the pressure disk holder can short with the terminal of the battery on the Control PCB, causing the battery to discharge and therefore it is not backing up the RAM resulting in Error 5.
For pumps with serial numbers 7001-13344 and below it is necessary to remove 4mm of the Spring torsion with cutters where shown in Figure 3.

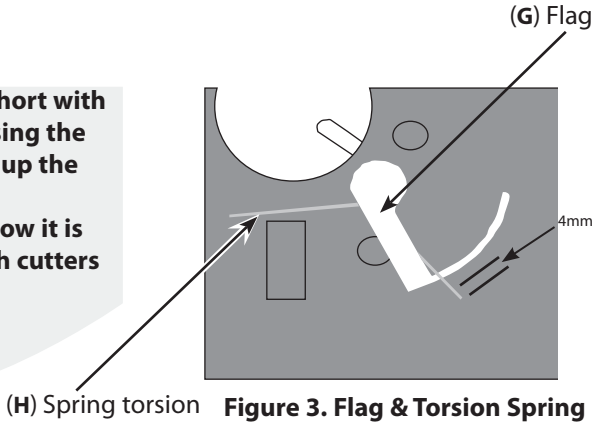


Figure 3. Flag & Torsion Spring

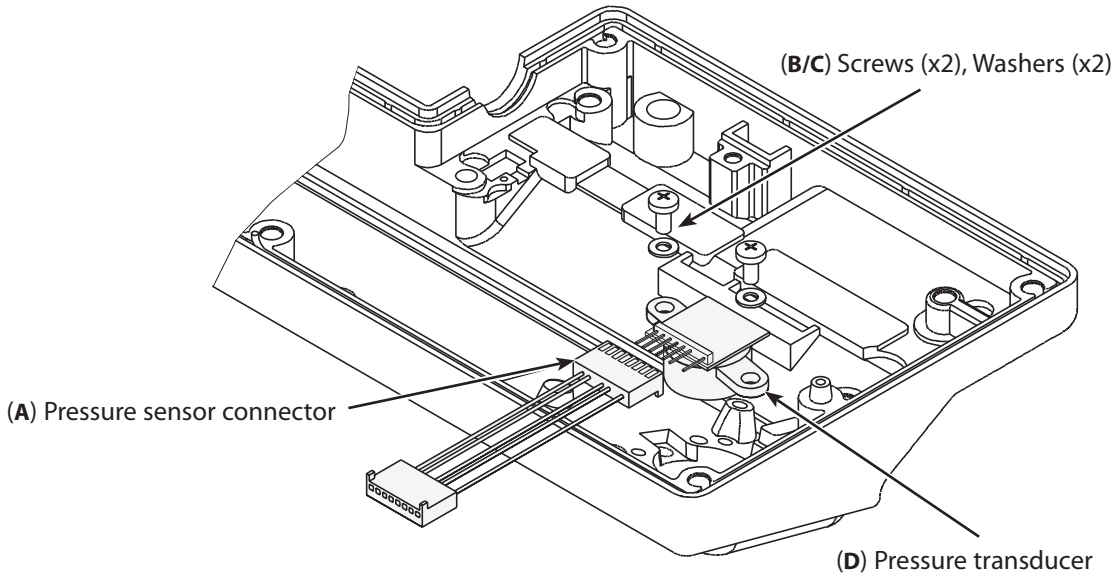
Spare Parts

Item	Description	Part Number
A	SPARE GASKET PRESSURE TRANSDUCER P7000	7000SP00007
B	ARM SPRING PRESSURE DISC	7000ME00031
C	HOLDER PRESSURE DISC P7000	7000ME00030
D	LABEL LAPEL MOULDED	7000LB00008
E	SCREW M3x8 CSK HS POSI Z+BLACK	0000ME00230
F	CIRCLIP E TYPE SHAFT DIA 4.8	0000ME00002
G	FLAG PRESSURE DISC MOULDED	7000ME00035
H	SPRING TORSION P7000	0000ME00364
I	SPRING COMPRESSION P7000	0000ME00243

Pressure Transducer (Model P7000)

Procedure

1. Remove the two screws and washers securing the pressure transducer.
2. Remove the pressure tranducer and cable connector.
3. Reassemble in reverse order.



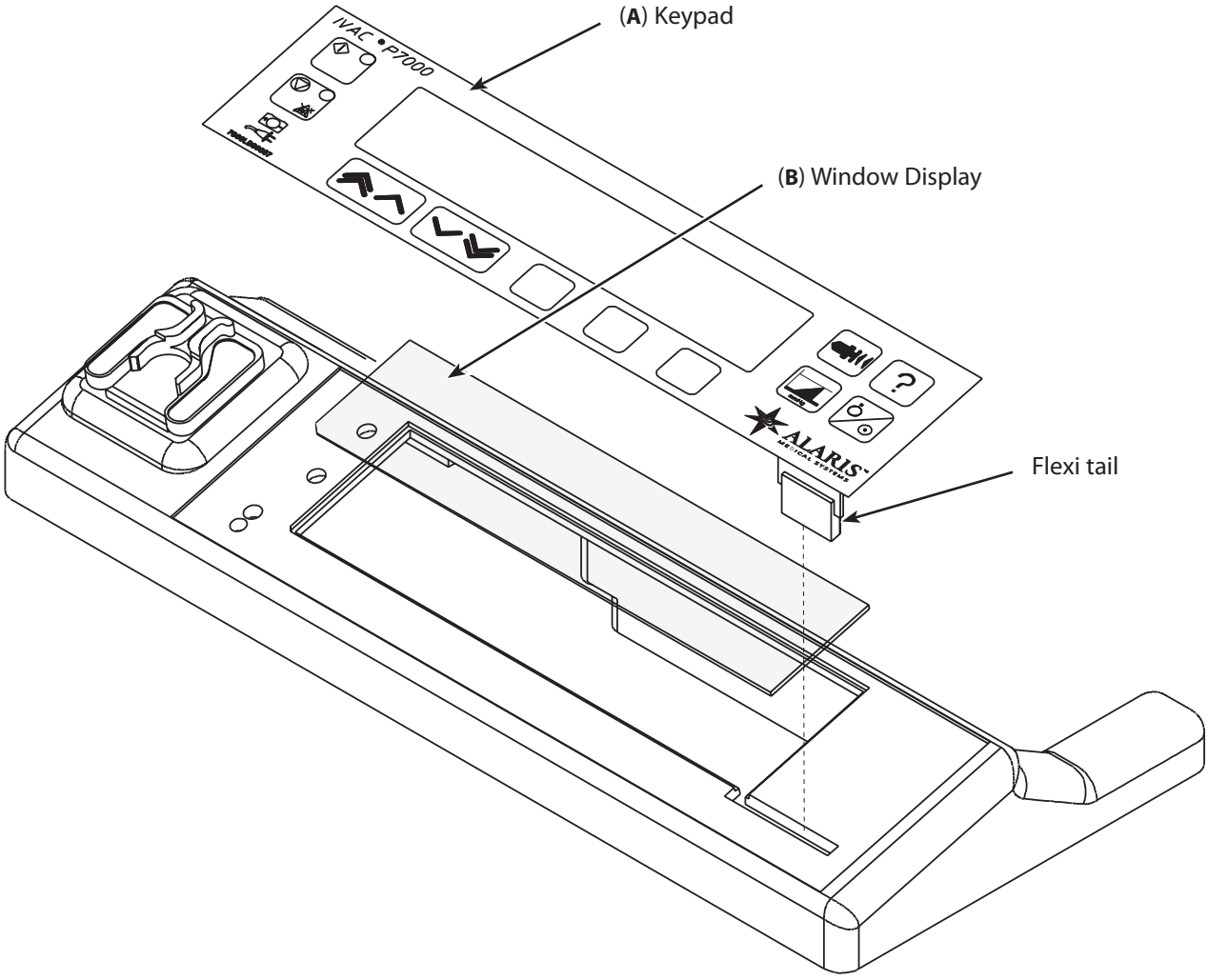
Spare Parts

Item	Description	Part Number
A	ASSY CONN PRESSURE SENSOR P7000	7000EL00014
B	SCREW M4X8 PAN HD POSI	0000ME00246
C	WASHER M4 WAVEY SST	0000ME00045
D	TRANSDUCER PRESSURE	7000ME00025

Window Display, Keypad

Procedure

1. Remove keypad and discard. Keypads cannot be reused.
2. Clean surface where replacement keypad is to be fitted.
3. Fit replacement keypads after removing backing paper from underside.
   - Handle replacement keypads with care to avoid damage
   - Ensure all keypad membrane flexi tails are correctly routed into upper case slot
4. Lift out window display.
5. Reassemble in reverse order.



Ensure window display is refitted with the anti-glare surface upwards.

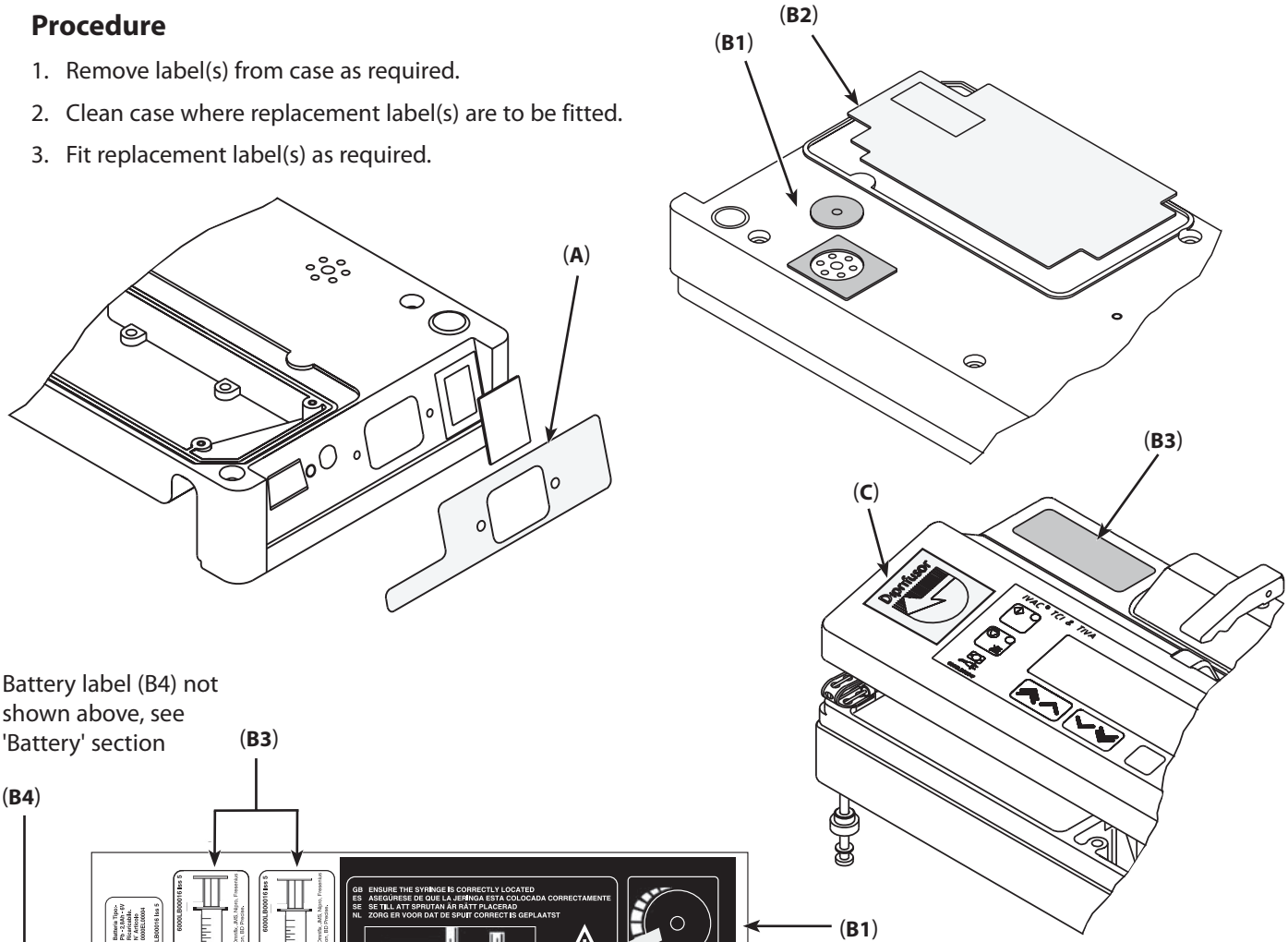
Spare Parts

Item	Description	Part Number
A	LABEL SWITCH PANEL MEMBRANE P7000 MKI	7000LB00001
A	LABEL SWITCH PANEL MEMBRANE P7000 MKII	7000LB00007
A	LABEL SWITCH PANEL MEMBRANE P6000 MKI	6000LB00001
A	LABEL FRONT PANEL P6000 MKII	6000LB00008
A	LABEL SWITCH PANEL MEMBRANE TIVA MKI	6000LB00003
A	LABEL FRONT PANEL TIVA MKII	6000LB00009
A	LABEL FRONT PANEL TCI & TIVA	6000LB00017
B	WINDOW DISPLAY P7000 MKII	7000ME00058

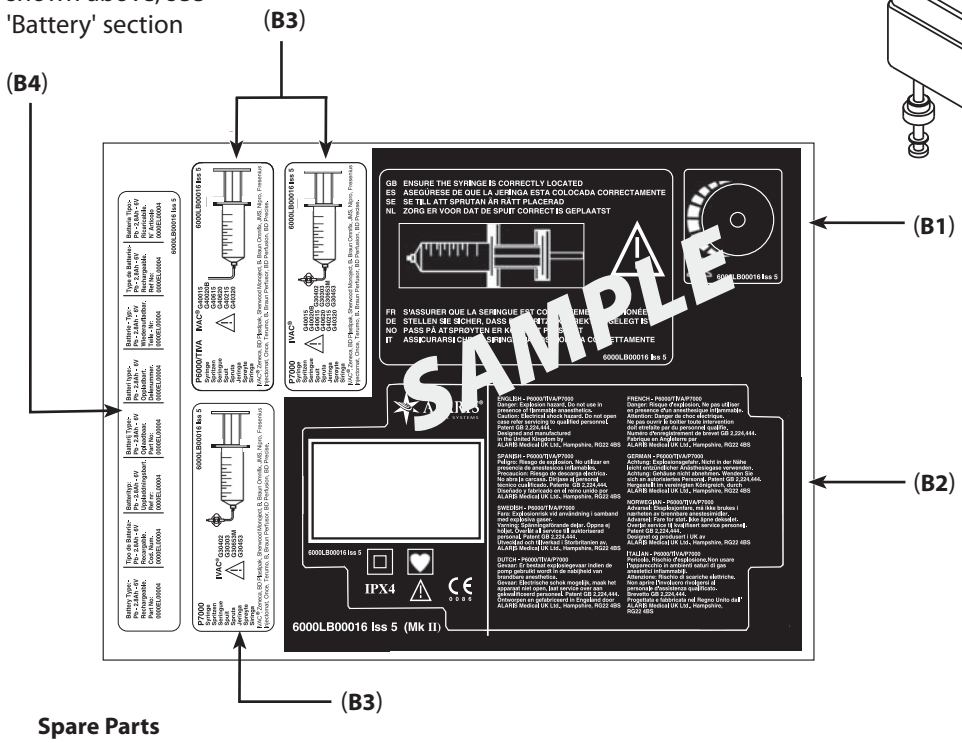
Labels

Procedure

1. Remove label(s) from case as required.
2. Clean case where replacement label(s) are to be fitted.
3. Fit replacement label(s) as required.



Battery label (B4) not shown above, see 'Battery' section



Spare Parts

Item	Description	Part Number
A	LABEL SET END	1000LB01015
A	LABEL SWITCH PANEL END TCI	6000LB00010
B	LABEL SET P6000/P7000/TIVA	7000LB00015
B	LABEL SET P6000/TIVA/P7000 MKII	6000LB00016
B	LABEL SET TIVA TCI	6000LB00015
C	LABEL TCI DIPRIFUSOR	6000LB00004
*	INSTRUMENT LABEL 1" X 1 1/2	1000LB00590

* item not shown.

Item D is a roll of blank combined serial number and status label. Transfer information from old label. This label should be used in conjuction with the clear protective cover from the universal label set.

Appendix A

Specifications

In this appendix

Infusion	**74**
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Electromagnetic Compatibility (Model P7000)	**77**

The following information is for reference purposes only. For more detailed specifications refer to relevant *DFU*. Specifications refer to all models covered by this manual, unless otherwise stated.

Infusion

Infusion rate range	
5ml syringes	0.1ml/h - 150ml/h
10ml syringes	0.1ml/h - 300ml/h
20ml syringes	0.1ml/h - 600ml/h
30ml syringes	0.1ml/h - 900ml/h
50ml + 100ml syringes	0.1ml/h - 1200ml/h
	Note: Maximum infusion rate can be set as part of the configuration.
Volume infused	0.0ml - 9990ml
Bolus rates	
5ml syringes	10 ml/h - 150 ml/h
10ml syringes	10 ml/h - 300 ml/h
20ml syringes	10 ml/h - 600 ml/h
30ml syringes	10 ml/h - 900 ml/h
50ml + 100ml syringes	10 ml/h - 1200 ml/h
	Note: Maximum bolus rates can be set as part of the configuration. Bolus rates are user adjustable.
Bolus Limit	25.0ml
Purge rate	100ml/h-500ml/h. Limited to maximum rate for syringe.
Purge limit	2.0ml
End Of Syringe, Keep Vein Open (KVO) rate (P6000/P7000 only)	Stop, KVO (1.0ml/h), or set rate if lower than KVO.
Volume To Be Infused (VTBI) rate (P6000/P7000 only)	0.1ml - 100ml, 1 min - 24 hours
VTBI complete KVO rate (P6000/P7000 only)	Stop, KVO (1.0ml/h, 2.0ml/h), set rate if lower than KVO, or continue at set rate.
Near End of Infusion (NEOI) Alarm	2.0% - 10.0% of syringe volume (TCI & TIVA/TIVA).
	1 - 15 mins (P6000/P7000).
End Of Infusion (EOI) Alarm	0.5% - 5% of syringe volume.
Critical volume	0.5ml is the maximum-over infusion which can occur in the event of a single fault condition.
Maximum Pumping Pressure Limit	280mmHg - nominal at L-3: factory preset (TCI & TIVA/P6000/P7000) 465mmHg - nominal at L-5: factory preset (TIVA) 650mmHg - nominal at L-7: highest alarm level Occlusion levels L-0 to L-7.
System Accuracy	Drive Linearity +/- 1%
	Volumetric Mean +/- 2% (nominal)
	Important: System accuracy is +/-2% typical by volume as measured using the trumpet curve test method defined in EN60601-2-24 at rates of 1.0ml/h and above when the instrument is used with the recommended syringes. Differences in factors such as size and plunger force in compatible syringes can cause variations in accuracy and trumpet curves.) Also see trumpet curves section.

Infusion (continued)

Occlusion Pressure Limits for IVAC® 50ml Syringes

The following tables show the worst case values for line pressure, time to alarm and bolus volume that can be expected in the event of an occlusion when the IVAC® 50ml syringe is selected, G40020B administration set.

Alarm level	Rate (ml/h)	Maximum time to occlusion alarm (h:min)	Nominal occlusion alarm pressure (mmHg)	Maximum bolus volume (ml)
0*	1.0	0:02	0 +50 / -50	0.1
1*	1.0	0:09	90 +50 / -90	0.2
2*	1.0	0:22	190 +50 / -150	0.3
3	1.0	0:34	280 +100 / -100	0.5
4	1.0	0:56	370 +100 / -100	0.7
5	1.0	1:10	460 +100 / -100	0.9
6	1.0	1:30	560 +100 / -100	1
7	1.0	1:45	650 +100 / -100	1.3
0*	5.0	0:01	0 +50 / -50	0.1
1*	5.0	0:02	90 +50 / -90	0.2
2*	5.0	0:06	190 + 50 /-150	0.4
3	5.0	0:08	280 +100 / -100	0.6
4	5.0	0:12	370 +100 / -100	0.8
5	5.0	0:14	460 +100 / -100	1
6	5.0	0:17	560 +100 / -100	1.2
7	5.0	0:19	650 +100 / -100	1.4

* Tests at these levels may alarm immediately - the force at these levels is commonly less than the friction in the syringe (with no additional fluid pressure). The result is that the pressure relating to the low forces will be less than the nominal quoted occlusion pressure.

Bolus volume following occlusion will be minimised by the back off feature if enabled. The back off will reduce the line pressure by removing the volume stored in the occluded line and deducting this volume from volume infused.

Electrical

Battery type	Lead acid, rechargeable, sealed. Automatically charges when the pump is connected to AC power.	
Battery life	**TCI & TIVA**	**P6000/P7000/TIVA**
	4h @ 5.0ml/h (20 ºC)	6h @ 5.0ml/h (20 ºC)
Battery charging	10 hours from discharge to 80% charge and 24 hours to 100% charge.	
AC power supply	115-230VAC, 50/60Hz, 20VA (nominal).	
Memory retention	The electronic memory of the unit will be retained for more than 6 months when not powered up.	
Protection against electrical shock hazards	**TCI & TIVA**	**P6000/P7000/TIVA**
	Class I, Type CF	Class II, Type CF

Physical

Weight	3.5kg (excluding pole clamp and power cable)		
Case material	Noryl (with fire retardant to UL94V-0)		
Latex	The IVAC® Syringe Pump range does not contain any Latex.		
Dimensions	**W**	**H**	**D**
	400mm	115mm	180mm

Environmental

IPX rating	IPX4		
Operating limits	**Temperature**	**Relative humidity**	**Atmospheric pressure**
	+5°C - +40°C	30% - 90%	700 - 1060hPa
Transport/Storage limits	-20°C - +50°C	5% - 95%	600 - 1060hPa

Recycling

Disposal of device components

Caution: Follow local governing ordinances and recycling instructions regarding disposal or recycling of device components, including batteries.

Electromagnetic Compatibility (Model P7000)

Warning:

- The use of any accessory, transducer, or cable with the IVAC® P7000 Syringe Pump other than those specified may result in increased emissions or decreased immunity of the pump.
- The IVAC® P7000 Syringe Pump should not be used adjacent to or stacked with other equipment, however if adjacent or stacked use is necessary, the IVAC® P7000 Syringe Pump should be observed to verify normal operation in the configuration in which it will be used.

Caution:

- The IVAC® P7000 Syringe Pump is a CISPR 11 Group 1 Class A Medical Equipment System and intended for use by healthcare professionals only.
- Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed, put into service and used according to the EMC information provided in the accompanying documents.
- Portable and Mobile RF communications can affect Medical Electrical Equipment.
- Operating the pump near equipment which radiates high energy radio frequencies (electro surgical or cauterizing equipment, portable radios, cellular telephones, etc.) may cause false alarm conditions. If this happens, reposition the pump away from the source of interference or turn off the pump and manually regulate the flow.

Guidance and Manufacturer's Declaration – Electromagnetic Emissions		
The IVAC® P7000 Syringe Pump is intended for use in the electromagnetic environment specified below. The customer or the user of the IVAC® P7000 Syringe Pump should assure that it is used in such an environment.		
Emissions Test	**Compliance**	**Electromagnetic Environment – Guidance**
CISPR 11 RF Emissions	Group 1	The pump uses RF energy only for its internal function in the normal product offering. Therefore, its RF emissions are very low and are not likely to cause any interface in nearby electronic equipment.
CISPR 11 RF Emissions	Class A	The pump is suitable for use in all establishments, other than domestic, and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
EN 61000-3-2 Harmonic Emissions	Class A	
EN 61000-3-3 Voltage Fluctuations, Flicker Emissions	Complies	

Electromagnetic Compatibility (Model P7000) *continued*

Guidance and Manufacturer's Declaration - Electromagnetic Immunity			
The IVAC® P7000 Syringe Pump is intended for use in the electromagnetic environment specified below. The customer or the user of IVAC® P7000 Syringe Pump should assure that it is used in such an environment.			
Immunity Test	**EN 60601-1-2 Test Level**	**Compliance Level**	**Electromagnetic Environment – Guidance**
EN 61000-4-2 Electro-Static Discharge (ESD)	±6 kV contact ±8 kV air	±8 kV contact (Note 2) ±15 kV air (Note 2)	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
EN 61000-4-4 Electrical Fast Transient, Burst (EFT) (Note 3)	±2 kV for power supply lines ±1 kV for input/ output lines	±2 kV for power supply lines N/A (Note 4)	Mains power quality should be that of a typical commercial or hospital environment.
EN 61000-4-5 Power Line Surge (Note 3)	±1 kV Line(s) to Line(s) ±2 kV Line(s) to Earth	±1 kV Line(s) to Line(s) ±2 kV Line(s) to Earth	Mains power quality should be that of a typical commercial or hospital environment.
EN 61000-4-8 Power Frequency Magnetic Field (50/60 Hz)	3 A/m	400 A/m 50 Hz (Note 2)	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
EN 61000-4-11 Voltage Dips, Short Interruptions, and Voltage Variations (Note 3)	<5 % U_T (Note 1) (>95 % dip in U_T) for 0.5 cycle	<5 % U_T (>95 % dip in U_T) for 0.5 cycle	Mains power quality should be that of a typical commercial or hospital environment. If the user of the pump requires continued operation during power mains interruptions, it is recommended that the pump be powered from an uninterruptible power supply or a battery. The pump does employ an internal short duration battery.
	40 % U_T (60 % dip in U_T) for 5 cycles	40 % U_T (60 % dip in U_T) for 5 cycles	
	70 % U_T (30 % dip in U_T) for 25 cycles	70 % U_T (30 % dip in U_T) for 25 cycles	
	<5 % U_T (>95 % dip in U_T) for 5 sec	<5 % U_T (>95 % dip in U_T) for 5 sec	

Note 1—U_T is the AC mains voltage prior to application of the test level.
Note 2—Compliance levels raised by EN 60601-2-24.
Note 3—Performed at the Minimum and Maximum Rated Input Voltage.
Note 4—Cardinal Health recommends using signal cables of less than 3 meters in length and this requirement is applicable only if signal cables are 3 meters or more in length. (EN 60601-1-2:2002, Clause 36.202.4)

Recommended Separation Distances for LIFE SUPPORT Equipment between portable and mobile RF communications equipment and the IVAC® P7000 Syringe Pump

Electromagnetic Compatibility (Model P7000) *continued*

Guidance and Manufacturer's Declaration—Electromagnetic Immunity
LIFE SUPPORT Equipment

The IVAC® P7000 Syringe Pump is intended for use in the electromagnetic environment specified below.
The customer or the user of the IVAC® P7000 Syringe Pump should ensure that it is used in such an environment.

Immunity Test	EN 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment – Guidance
EN 61000-4-6 Conducted RF	3 V rms 150 kHz to 80 MHz	10 V rms (Note 3)	Portable and mobile RF communications equipment should be used no closer to any part of the pump, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended Separation Distance** $d = \left[\frac{3.5}{V_1}\right]\sqrt{P}$
EN 61000-4-3 Radiated RF	3 V/m 80 MHz to 2.5 GHz	10 V/m (Note 3)	$d = \left[\frac{12}{V_2}\right]\sqrt{P}$ 80 MHz to 800 MHz $d = \left[\frac{12}{E_1}\right]\sqrt{P}$ 80 MHz to 2.5 GHz $d = \left[\frac{23}{E_1}\right]\sqrt{P}$ 800 MHz to 2.5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).[a] Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, [b] should be less than the compliance level in each frequency range. [c] Interference may occur in the vicinity of equipment marked with the following symbol: 

Note 1—At 80 MHz and 800 MHz, the higher frequency range applies.
Note 2—These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.
Note 3—Compliance levels raised by EN 60601-2-24.

[a] The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz are intended to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges.
[b] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the pump is used exceeds the applicable RF compliance level above, the pump should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the pump.
[c] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 10 V/m.

Electromagnetic Compatibility (Model P7000) *continued*

The IVAC® P7000 Syringe Pump is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled.
The user of the IVAC® P7000 Syringe Pump can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the IVAC® P7000 Syringe Pump as recommended below, according to the maximum output power of the communications equipment.

Rated Maximum Output Power of Transmitter W	**Separation Distance According to Frequency of Transmitter** m			
	150 kHz to 80 MHz Outside ISM bands 3.5 $d = [\text{------}]\ \sqrt{P}$ $V1$	**150 kHz to 80 MHz In ISM bands** 12 $d = [\text{------}]\ \sqrt{P}$ $V2$	**80 MHz to 800 MHz** 12 $d = [\ \text{------}]\ \sqrt{P}$ $E1$	**800 MHz to 2.5 GHz** 23 $d = [\text{------}]\ \sqrt{P}$ $E1$
0.01	0.03	0.12	0.12	0.23
0.1	0.11	0.38	0.38	0.73
1	0.35	1.20	1.20	2.30
10	1.11	3.80	3.80	7.28
100	3.50	12.00	12.00	23.00

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

Note 1—At 80 MHz and 800 MHz, the separation distance for the higher frequency range apply.
Note 2—The ISM (Industrial, Scientific, and Medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.
Note 3—An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas.
Note 4—These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

Appendix B

Spare Parts Listing

In this appendix

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Upper Case Components	**83**
Lower Case Components	**84**
Keypad and Labels	**85**
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Software	**87**

Electrical Components

Part Number	Description
0000EL00004	BATTERY 6V SLA RECHARGE
0000EL00011	CONNECTOR PLUG 16 WAY HEADER
0000EL00106	CONNECTOR PLUG 14 WAY
0000EL00208	BATTERY NiCd 2.4V 40mAH
0000EL00284	LINK FUSE 2A PICOFUSE
0000EL00442	BUZZER PCB P7000 TMB-05
0000EL00450	IC SOCKET 32W-DIL TURNEDPIN
1000EL00135	ASSY CABLE 16 WAY RIBBON
1000SP00007	ASSEMBLY ON/OFF SWITCH
1000SP00009	ASSY CABLE BATTERY
1000SP00210	SPARES KIT RS232 OPTION
1000SP00235	P7 FAMILY POOR SOUNDER MODE KIT
1000SP01022	ASSY MICROSWITCH V4
1000SP01169	ASSY ALARM TUBE WITH RESISTOR
6000EL00004	ASSEMBLY PCB TIVA & TCI
6000SP00005	EARTH CABLE PE TO BATTERY PLATE
6000SP00006	EARTH CABLE PE TO BEAM
6000SP00007	ASSY CABLE TCI
6000SP00010	ASSY MAINS INLET EARTHED
6000SP00015	SPARE AERIAL TIVA & TCI
6000SP00016	SPARE UPGRADE P6000 MkI-MkII
6000SP00017	SPARE UPGRADE TIVA MkI-MkII
6000SP00018	SPARES CONTROL PCB P6000 MKII
6000SP00020	ASSY MAINS INLET FUNCTIONAL EARTH
6000SP00021	PSU UPGRADE MKII FUNCTIONAL EARTH
6000SP00024	ASSY RS232/NC CONNECTOR INSULATED
6000SP00026	SPARE PSU MKII FUNCTIONAL EARTH
7000EL00014	ASSY CONN PRESSURE SENSOR P7000
7000SP00015	ASSY CONTROL INSULATOR UPGRADE P7000
7000ME00025	TRANSDUCER PRESSURE
7000SP00002	ASSY FLEXI CIRCUIT MOTOR
7000SP00020	SPARE DISPLAY BOARD P6/TIVA/P7
7000SP00026	SPARE UPGRADE KIT P7000 MKI-MKII
7000SP00030	SPARE UPGRADE CONTROL P6/P7/TIVA

Upper Case Components

Part Number	Description
0000ME00002	CIRCLIP E TYPE SHAFT DIA 4.8
0000ME00015	WASHER M3 WAVEY SST
0000ME00045	WASHER M4 WAVEY SST
0000ME00107	ADHESIVE LOCTITE 603
0000ME00116	PIN TENSION DIA 3.0X16MM
0000ME00164	SCREW M2X3 CSK HD SLOTTED
0000ME00189	SCREW M3X12 POZI HD Z+C
0000ME00221	SCREW M3X6 PAN HD POSI ZP+P
0000ME00230	SCREW M3x8 CSK HS POSI Z+BLACK
0000ME00243	SPRING COMPRESSION P7000
0000ME00246	SCREW M4X8 PAN HD POSI
0000ME00257	PIN TENSION 3.0x10.0
0000ME00266	SPRING 7.8 OD 44 LONG
0000ME00268	SCREW M3X8 CSK HD POSI SS
0000ME00364	SPRING TORSION P7000
0000ME00387	SPACER 4.8MM DOUBLE SELF
0000ME00312	SCREW No2 X 1/4" CSK POZD S/T "B" TYPE
1000ME01006	CLAMP SYRINGE MACH. V4
6000ME00010	UPPER CASE 6000
6000SP00045	SPARE CASE UPPER TCI
6000SP00046	SPARE KIT UPPER P6000/TIVA
7000LB00008	LABEL LAPEL MOULDED
7000ME00030	HOLDER PRESSURE DISC P7000
7000ME00031	ARM SPRING PRESSURE DISC
7000ME00033	ACTUATOR POT MOULDED SYRINGE SIZING
7000ME00035	FLAG PRESSURE DISC MOULDED
7000ME00060	SHAFT SYRINGE CLAMP 100ML SYRINGE SIZING
7000ME00063	PLATE POTENTIOMETER 50MM PUNCHED
7000SP00003	ASSY POT P7000
7000SP00007	SPARE GASKET PRESSURE TRANSDUCER P7000
7000SP00033	SPARE UPPER P7000 MKII

Lower Case Components

Part Number	Description
0000ME00015	WASHER M3 WAVEY SST
0000ME00044	FLAT WASHER NYLON M3 TO ISO 7089
0000ME00045	WASHER M4 WAVEY SST
0000ME00141	STUD PE CONNECTOR M6 THREAD x 15
0000ME00189	SCREW M3X12 POZI HD Z+C
0000ME00221	SCREW M3X6 PAN HD POSI ZP+P
0000ME00227	SCREW M4x16 DIN 7985 ZP+P
0000ME00268	SCREW M3X8 CSK HD POSI SS
0000ME00279	SCREW MALE/FEMALE M3.4 BRASS & NICKEL
0000ME00286	WASHER M4 SHAKEPROOF
0000ME00302	SCREW M4 X 50 PAN POSI
0000ME00310	WASHER M4 PLAIN ZINC PLATED
1000ME00211	PLATE BLANKING POLE CLAMP
1000ME01064	FOAM PAD BATTERY
1000ME01074	GASKET MAINS INLET V4
1000ME01087	CORD SEALING SILICONE ID 0.95
1000ME01103	ON/OFF SPLASH COVER A4
1000ME01106	GASKET RS232 MOULDED & CAP A4
1000ME01123	PLATE BATTERY RESTRAINT PUNCHED
1000SP01015	SPARE POLE CLAMP 40MM
1000SP01025	ASSY NURSECALL CONN V4
1000SP01048	SPARE FLUID SEALING UPGRADE KIT
1000SP01066	SPARE UPGRADE MOULDED FOOT
6000LB00010	LABEL SWITCH PANEL END TCI
6000ME00006	BLANK ON/OFF SWITCH LOWER
6000ME00020	PLATE END CHASSIS TCI
6000ME00026	PLATE BASE P SERIES
6000SP00008	ASSY INSULATOR PSU
6000SP00047	KIT CASE LOWER TIVA/TCI
7000SP00005	ASSY INSULATOR PSU P7000
7000SP00016	ASSY POLE CLAMP ADJUSTABLE
7000SP00010	SPARE CASE LOWER P7000 MKI
7000SP00011	ASSY ADJUSTABLE POLE CLAMP QUICK TRANS
7000SP00027	SPARE CASE LOWER P7000 MKII
7000ME00052	CAP END CLAMP ADJUSTABLE

Keypad and Labels

Part Number	Description
1000LB00590	INSTRUMENT LABEL 1" X 1 1/2
1000LB01015	LABEL SET END
6000LB00001	LABEL SWITCH PANEL MEMBRANE P6000 MKI
6000LB00003	LABEL SWITCH PANEL MEMBRANE TIVA MKI
6000LB00004	LABEL TCI DIPRIFUSOR
6000LB00008	LABEL FRONT PANEL P6000 MKII
6000LB00009	LABEL FRONT PANEL TIVA MKII
6000LB00010	LABEL SWITCH PANEL END TCI
6000LB00015	LABEL SET TIVA TCI
6000LB00016	LABEL SET P6000/TIVA/P7000 MKII
6000LB00017	LABEL FRONT PANEL TCI & TIVA
7000LB00001	LABEL SWITCH PANEL MEMBRANE P7000 MKI
7000LB00007	LABEL SWITCH PANEL MEMBRANE P7000 MKII
7000LB00015	LABEL SET P6000/P7000/TIVA
7000ME00058	WINDOW DISPLAY MKII

Transmission Assembly Components

Part Number	Description
0000EL00095	CABLE CLIP ADHESIVE
0000ME00002	CIRCLIP E TYPE SHAFT DIA 4.8
0000ME00003	SPRING COMP OD 6.1 19 LONG
0000ME00011	SCREW No4x1/4" PAN HD
0000ME00015	WASHER M3 WAVEY SST
0000ME00016	PIN TENSION DIA 2.0X10mm
0000ME00018	PIN TENSION DIA 2.0X20mm
0000ME00031	SCREW No3x3/8" PAN HD
0000ME00032	SCREW No4x1/2" PAN HD
0000ME00044	FLAT WASHER NYLON M3 TO ISO 7089
0000ME00045	WASHER M4 WAVEY SST
0000ME00048	WASHER M3 PLAIN Z+C
0000ME00084	SCREW M2X12 CSK HD SLOTTED
0000ME00132	SPIROL PIN 1.5X10 MDP
0000ME00133	SPRING COMPRESSION 2.24 DIAX7.9mm
0000ME00221	SCREW M3X6 PAN HD POSI ZP+P
0000ME00225	SCREW M4 X 40
0000ME00246	SCREW M4x8 PAN HD POSI
0000ME00255	SCREW M4x20 CSK HD POSI SS
0000ME00257	PIN TENSION 3.0x10.0
0000ME00268	SCREW M3X8 CSK HD POSI SS
0000ME00277	O RING NITRILE 11.5X1.5
0000ME00284	SCREW M3X16 CSK HD POSI STAINLESS STEEL
0000ME00285	WASHER M3 SHAKEPROOF
0000ME00287	WASHER M2.5 SHAKEPROOF
0000ME00288	SCREW M2.5X6 CSK HEAD SKT A4 ST/ST

Transmission Assembly Components *(continued)*

Part Number	Description
0000ME00292	HEX NUT M3 STAINLESS STEEL A4
0000ME00313	SCREW No4x1/4" CSK TRUNCATED POZI SS
0000ME00345	SPRING COMP 8MMX6MM
0000ME00386	SPRING MUSIC WIRE
0000ME00391	WASHER 12X1.6X6.4 I/D NYLON
0000ME00448	NITRILE ORING 14.1 X 1.6
1000ME00097	HALF NUT V4
1000ME00177	SPACER DUAL TRANSMISSION
1000ME01011	LEADSCREW V4
1000ME01022	PLATE OUTER TUBE SEAL V4
1000ME01027	PIN PLUNGER PLATE
1000ME01047	SEAL RING OUTER TUBE
1000ME01048	SEAL RING LEADSCREW
1000ME01059	HOLDER PLUNGER V4
1000ME01066	FOAM PAD
1000ME01113	BUSH MOTOR BEARING MOULDED
1000ME01114	BUTTON PLUNGER HOLDER MOULDED
1000ME01121	SEAL OUTER TUBE RECESSED
1000ME01122	TUBE OUTER 'O' RING GROOVE
1000ME01133	SCREW M3X8 TORX T6 SET FULL DOG
1000ME01134	SCREW M3X8 TORX T6 SET PART DOG
1000ME01305	PLATE PLUNGER RESTRAINT
1000ME01325	BACKPLATEPLUNGER HOLDER OVERMOL
1000ME01353	HOLDER PLUNGER CRUCIFORM MKII
1000SP00247	PSERIES BEAM ASSEMBLY
1000SP01063	ASSY LEADSCREW SEAL
1000SP01084	LEVER TUBE DECLUTCH
6000ME00018	CLIP EARTH LEADSCREW TCI
6000SP00011	TCI BEAM ASSEMBLY
6000SP00027	SPARE TRANSMISSION TCI
6000ME00025	ASSY MOTOR MOUNTING TCI
7000ME00011	CARRIAGE COMMON TRANS
7000ME00015	ROD TORSION P7000
7000ME00028	PLATE CARRIAGE
7000ME00034	MOTOR ROTOR ENCODER 4 LINE MOULDED
7000ME00053	ACTUATOR LINEAR POT DELRIN
7000ME00062	ASSY PLATE MOTOR MOUNTING P7000
7000ME00068	MOTOR ASSEMBLY P7000
7000SP00018	ASSY CHASSIS POTENTIOMETER
7000SP00022	SPARE TRANSMISSION P6000/TIVA/P7000
7000SP00024	ASSY FLEXI CIRCUIT MKII TRANSMISSION

Software

Part Number	Description
1000SP00209	ASENA SP,KIT,EVENT LOG DOWNLOAD UTILITY
1000SP00529	P6000 V3R2 S/W UPGRADE KIT
1000SP00530	P7000 V3R2 S/W UPGRADE KIT
1000SP00531	P6000 (TIVA) V3R2 S/W UPGRADE KIT
1000SP00532	P6000 (TIVA TCI) V3R2 S/W UPGRADE KIT

Test Equipment

Part Number	Description
0000JG00004	JIG V4/P7 CASE UPPR ASSY
0000JG00014	ASENA SP & P SERIES,TEST,PLUNGER PROTECT
0000TG00200	DIGITAL OCCLUSION TEST GEAR (CAL)
1000SP00373	ALARIS CALIBRATION KIT
1000SP01008	ASSY CABLE RS232 (V4/PCAM)
1000TG00010	TEST GEAR SYRINGE SIZING 50ml SPACER
1000TG00011	SYRINGE SIZING 100ml SPACER CALIBRATED
1000TG00059	LINEAR SIZING SPACER BOM
1000TG00080	LINEAR SPEED TEST GEAR BOM
6000SP00012	ASSY CABLE RS232 P6000/V2

Appendix C

Fitting and Replacement Guidelines

In this appendix

Torque Guide 89

Torque Guide

- ◆ Always use the correct torque level when making an assembly stage.
- ◆ Take care with the torque applied when re-assembling parts.
- ◆ The head patterns of the fasteners are of the following types:
  - Pozi Number 1 (smaller X head)
  - Pozi Number 2 (larger X head)
  - M3 (Hex head with 5.5mm across flats (AF) drivers)
- ◆ Always select the correct tool and bit pattern for the fastener.

The following list outlines the torque levels established during product manufacture.

Torque levels selected apply throughout product life for the IVAC® Syringe Pumps.

Use the information below as a guide to the 'do not exceed' torque levels when servicing the pump. When servicing, it is recommended that torque is applied gradually until the component is secure. In any process do not exceed the stated levels.

If a torque driver is available for servicing this will help control the applied torque; otherwise, be aware that excess force may cause the component to fail. If torque level is not stated then fixing should be hand-tight.

Transmission Assembly

Stage Description	Component Description	Qty	Established Process Torque
Plunger holder to outer tube	Screw M3x8 Torx T6 Set Part Dog	2	45cNm
Carriage block to torsion rod	Screw M3x8 SKT Set Full	2	25cNm
Bonded Beam to transmission shaft	Hex Nut M3 Stainless Steel A4	1	25cNm
Earth leadscrew clip to transmission shaft (Model TCI & TIVA)	Screw M2.5x8 CSK Head SKT A4 ST/ST	1	25cNm

Upper Case Assembly

Stage Description	Component Description	Qty	Established Process Torque
Transmission assembly beam to Upper Case	Screw M4x20 Csk Hd Posi SS	2	2.0Nm
Transmission assembly to Upper Case	Screw M4x8 Pan Hd Posi	3	1.0Nm
	Screw M4x40 Pan Hd Posi 2 ZP+P	1	1.0Nm

Lower Case Assembly

Stage Description	Component Description	Qty	Established Process Torque
RS232 Connector to Lower Case	Screw Male/Female M3.4 Brass & Nickel	2	25cNm
PSU to Lower Case	Screw M3x12 Pozi Hd Z+C	4	Hand tight
Adjustable Pole Clamp to Lower Case	Screw M4x16 Din 7985 ZP+P	2	20Nm

Torque Guide *(continued)*

Pole Clamp Fitting - Setting Adjustable Clamp

Stage Description	Component Description	Qty	Established Process Torque
Fully loosen locknut with clamp secured to Lower Case	10mm Nylok nut	N/A	N/A
Close clamp • Fit and torque • Alternatively, secure clamp to pole and apply torque until force to move pump is at desired level	5mm Allen headed bolt	N/A	10Nm
Set clamp movement force • Hold 5mm Allen headed bolt in exact position set during previous stage • Simultaneously torque locknut to ensure bolt maintains current level of torque and position	Locknut	N/A	20Nm

Final Pump Assembly

Stage Description	Component Description	Qty	Established Process Torque
Lower Case to Upper Case	Screw M4x50 Pan Posi	4	Hand tight

Pressure Disc Holder Assembly (Model P7000 only)

Stage Description	Component Description	Qty	Established Process Torque
Disc holder to Upper Case	Screw M3x8 Csk Hd Posi SS	4	20cNm

Appendix D

Configured Options & Drug Protocol Records

In this appendix

Configured Options Record Sheet

- **IVAC® P7000 Syringe Pump** 92
- **IVAC® P6000 Syringe Pump** 93
- **IVAC® TIVA Syringe Pump** 94
- **IVAC® TCI & TIVA Syringe Pump** 95

Drug Protocol Setup

- **IVAC® P7000 Syringe Pump** 96
- **IVAC® TIVA Syringe Pump** 97
- **IVAC® TCI & TIVA Syringe Pump** 98

Configured Options Record Sheet
IVAC® P7000 Syringe Pump

Enter the pump-specific information for your records on a copy of this page.

Software Version: V3R2

Option	Range	Default	Setting
FAST START & BACKOFF	Disabled/Enabled	Enabled	
SET VTBI OVER TIME	Disabled/Enabled	Disabled	
VTBI	Disabled/Enabled	Enabled	
INDUCTION	Disabled/Enabled	Disabled	
MULTIDOSE	Disabled/Enabled	Disabled	
RATE LOCK	Disabled/Enabled	Disabled	
QUIET MODE	Disabled/Enabled	Disabled	
PRESSURE ALARM	1 - 750mmHg	300mmHg	
MAXIMUM PRESSURE	1 - 750mmHg	750mmHg	
AUTO PRESSURE	Disabled/Enabled	Disabled	
AC FAIL	Disabled/Enabled	Enabled	
RATE TITRATION	Disabled/Enabled	Disabled	
NEOI WARNING	1 - 15 minutes	5 minutes	
EOI POINT	0.5 - 5.0%	1%	
KVO AT EOI	Disabled/Enabled	Enabled	
BEAM (Occlusion)	L0 - L7	L3	
PATIENT WEIGHT	0.1kg - 150kg	70kg	
PURGE RATE	100 - 500ml/h	500ml/h	
BOLUS	Disabled/Enabled	Enabled	
DEFAULT BOLUS	10 - 1200ml/h	200ml/h	
CAP BOLUS RATE	10 - 1200ml/h	1200ml/h	
CAP RATE	1 - 1200ml/h	1200ml/h	
EVENT LOG DISPLAY	Disabled/Enabled	Enabled	
LOG LAST PATIENT ONLY	Disabled/Enabled	Enabled	
NURSE CALL	Disabled/Enabled	Disabled	
NURSE CALL INVERTED	Disabled/Enabled	Disabled	
COMMS PUMP ADDRESS	1 -254	1	
COMMS MONITOR ONLY	Disabled/Enabled	Enabled	
COMMS ODD PARITY	Disabled/Enabled	Disabled	
COMMS ASCII	Disabled/Enabled	Enabled	

Syringes Enabled

Make	Size(s)	Make	Size(s)

Hospital Name: ***Serial No:*** ***Software Version:***

Approved by: ***Configured by:***

Date: ***Date:***

Configured Options Record Sheet
IVAC® P6000 Syringe Pump

Enter the pump-specific information for your records on a copy of this page.

Software Version: V3R2

Option	Range	Default	Setting
AUTOSAVE	Disabled/Enabled	Enabled	
BACKOFF	Disabled/Enabled	Enabled	
SET VTBI OVER TIME	Disabled/Enabled	Disabled	
VTBI	Disabled/Enabled	Enabled	
RATE LOCK	Disabled/Enabled	Disabled	
QUIET MODE	Disabled/Enabled	Disabled	
AC FAIL	Disabled/Enabled	Enabled	
RATE TITRATION	Disabled/Enabled	Disabled	
NEOI WARNING	1 - 15 minutes	5 minutes	
EOI POINT	0.5 - 5.0%	1%	
KVO AT EOI	Disabled/Enabled	Enabled	
BEAM (Occlusion)	L0 - L7	L3	
PURGE RATE	100 - 500ml/h	500ml/h	
BOLUS	Disabled/Enabled	Enabled	
DEFAULT BOLUS	10 - 1200ml/h	200ml/h	
CAP BOLUS RATE	10 - 1200ml/h	1200ml/h	
CAP RATE	1 - 1200ml/h	1200ml/h	
EVENT LOG DISPLAY	Disabled/Enabled	Enabled	
LOG LAST PATIENT ONLY	Disabled/Enabled	Enabled	
NURSE CALL	Disabled/Enabled	Disabled	
NURSE CALL INVERTED	Disabled/Enabled	Disabled	
COMMS PUMP ADDRESS	1 -254	1	
COMMS MONITOR ONLY	Disabled/Enabled	Enabled	
COMMS ODD PARITY	Disabled/Enabled	Disabled	
COMMS ASCII	Disabled/Enabled	Enabled	

Syringes Enabled

Make	Size(s)	Make	Size(s)

Hospital Name: ***Serial No:*** ***Software Version:***

Approved by: ***Configured by:***

Date: ***Date:***

Configured Options Record Sheet
IVAC® TIVA Syringe Pump

Enter the pump-specific information for your records on a copy of this page.

Software Version: V3R2

Option	Range	Default	Setting
BACKOFF	Disabled/Enabled	Enabled	
AC FAIL	Disabled/Enabled	Enabled	
NEOI WARNING	2 - 10%	4%	
EOI POINT	0.5 - 5.0%	1%	
BEAM (Occlusion)	L0 - L7	L5	
WEIGHT	0.1 - 150kg	70kg	
PURGE RATE	100 - 500ml/h	500ml/h	
HANDS FREE BOLUS	Disabled/Enabled	Enabled	
DEFAULT BOLUS	0.1 - 25ml	1ml	
NURSE CALL	Disabled/Enabled	Disabled	
NURSE CALL INVERTED	Disabled/Enabled	Disabled	
COMMS PUMP ADDRESS	1 -254	1	
COMMS MONITOR ONLY	Disabled/Enabled	Enabled	
COMMS ODD PARITY	Disabled/Enabled	Disabled	
COMMS ASCII	Disabled/Enabled	Enabled	

Syringes Enabled

Make	Size(s)	Make	Size(s)

Hospital Name: ***Serial No:*** ***Software Version:***

Approved by: ***Configured by:***

Date: ***Date:***

Configured Options Record Sheet
IVAC® TCI & TIVA Syringe Pump

Enter the pump-specific information for your records on a copy of this page.

Software Version: V3R2

Option	Range	Default	Setting
BACKOFF	Disabled/Enabled	Enabled	
AC FAIL	Disabled/Enabled	Enabled	
NEOI WARNING	2 - 10%	4%	
EOI POINT	0.5 - 5.0%	1%	
BEAM (Occlusion)	L0 - L7	L5	
WEIGHT	0.1 - 150kg	70kg	
PURGE RATE	100 - 500ml/h	500ml/h	
HANDS FREE BOLUS	Disabled/Enabled	Enabled	
DEFAULT BOLUS	0.1 - 25ml	1ml	
NURSE CALL	Disabled/Enabled	Disabled	
NURSE CALL INVERTED	Disabled/Enabled	Disabled	
COMMS PUMP ADDRESS	1 -254	1	
COMMS MONITOR ONLY	Disabled/Enabled	Enabled	
COMMS ODD PARITY	Disabled/Enabled	Disabled	
COMMS ASCII	Disabled/Enabled	Enabled	
TCI	Disabled/Enabled	Enabled	
DISPLAY TCI DECREMENT TIME	Disabled/Enabled	Enabled	

Syringes Enabled

Make	Size(s)	Make	Size(s)

Hospital Name: ***Serial No:*** ***Software Version:***

Approved by: ***Configured by:***

Date: ***Date:***

IVAC® P7000 Syringe Pump Drug Protocol Setup

Hospital _____ *Ward/Unit* _____

No. (1-50)	Drug Name (27 Chars max)	Dose Rate				Concentration				Bolus		Pressure Alarm
		Dose Units	Max	Default	Min	Units	Min	Default	Max	Max (ml)	Rate (ml/hr)	

Serial Number _____ *Software Version* _____

Approved by _____ *Configured by* _____

Date _____ *Date* _____

IVAC® TIVA Syringe Pump Drug Protocol Setup

Hospital _____ *Ward/Unit* _____

No (1-50	Drug Name (27 chars max)	Concentration				Dose Units	Induction	Time	Maintenance	Bolus
		Concentration Units	Default	Min	Max					

Serial Number _____ *Software Version* _____

Approved by _____ *Configured by* _____

Date _____ *Date* _____

IVAC® TCI & TIVA Syringe Pump Drug Protocol Setup

Hospital _____ *Ward/Unit* _____

No (1-50	Drug Name (27 chars max)	Concentration				Dose Units	Induction	Time	Maintenance	Bolus
		Concentration Units	Default	Min	Max					

Serial Number _____ *Software Version* _____

Approved by _____ *Configured by* _____

Date _____ *Date* _____

Appendix E

Disposal

In this chapter

Disposal	**100**
Battery Removal	**100**

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

The Pump contains static-sensitive components and therefore strict ESD precautions should be observed at all times.
Only use Cardinal Health recommended spare parts.
Following all spare part replacement and repair activities, testing must be performed in accordance with the Performance Verification Procedure (PVP), see Chapter 3, Routine Maintenance.

Disposal

Information on Disposal for Users of Waste Electrical & Electronic Equipment

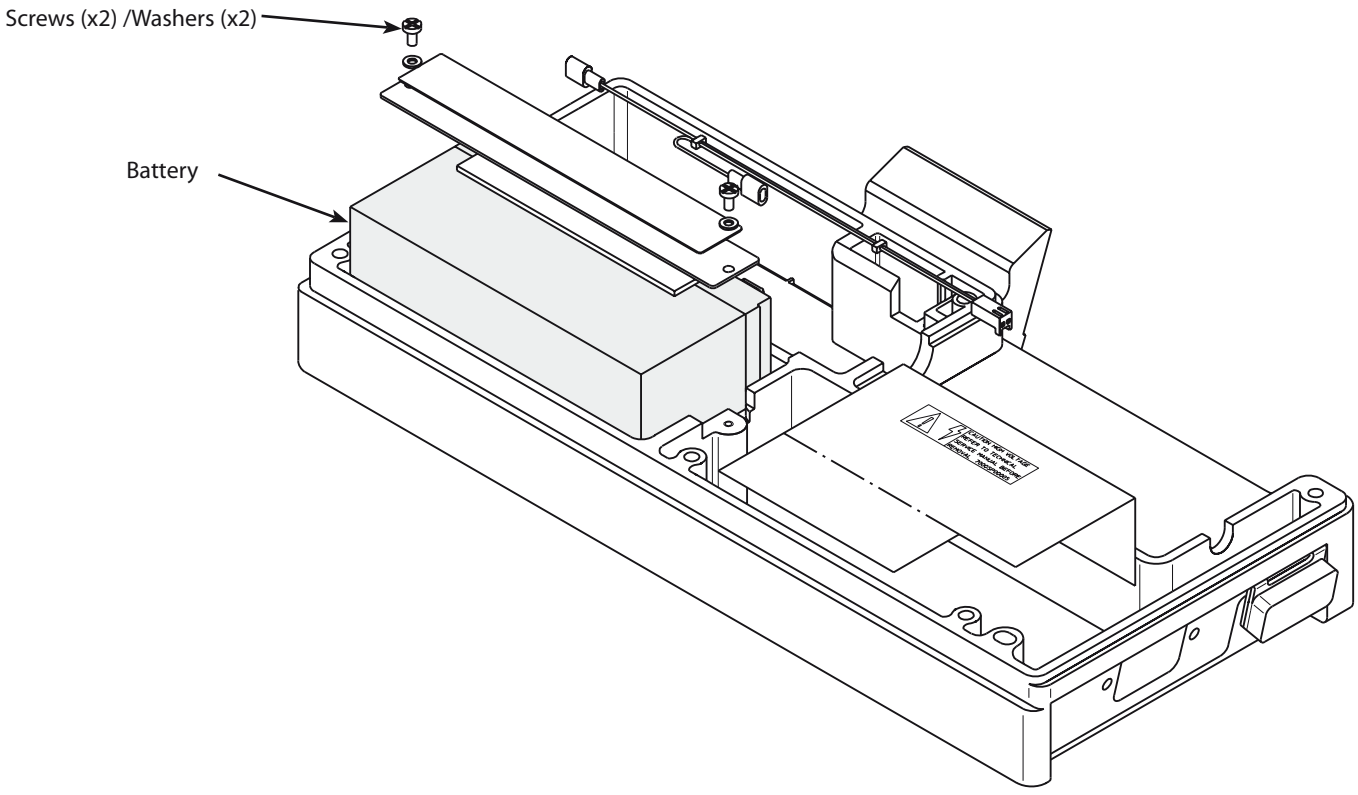
This symbol on the product and/or accompanying documents means that used electrical and electronic products should not be mixed with municipal waste.
If you wish to discard electrical and electronic equipment, please contact your Cardinal Health affiliate office or distributor for further information.
Disposing of this product correctly will help to save valuable resources and prevent any potential negative effects on human health and the environment which could otherwise arise from inappropriate waste handling.

Information on Disposal in Countries outside the European Union
This symbol is only valid in the European Union. The product should be disposed of taking environmental factors into consideration.
To ensure no risk or hazard, remove the internal rechargeable battery and the Lithium battery from the control board and dispose of as outlined by the local country regulations. All other components can be safely disposed of as per local regulations.

Battery Removal

Removal Procedure

1. Remove the six case retaining screws and washers located on the base of the pump.
2. Carefully separate the upper and lower case halves and disconnect cables.
3. Disconnect the battery cable from the Power Supply PCB.
4. Remove the two screws which secure the battery retaining plate.
5. Lift out the battery and retaining plate then disconnect the crimp terminals from the battery.
6. Detach the retaining plate from the battery.

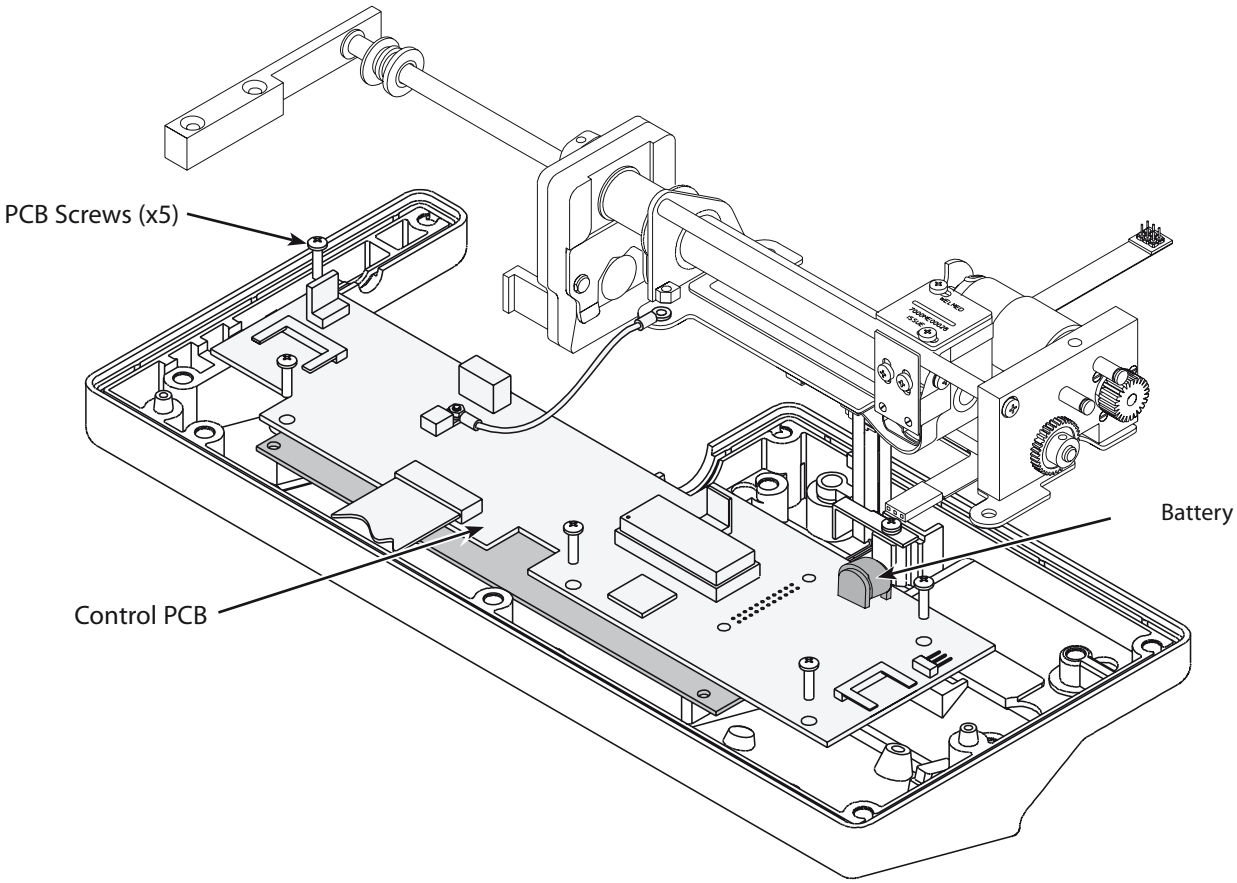


Battery Removal continued

Removal Procedure

1. Remove the six case retaining screws and washers located on the base of the pump.
2. Carefully separate the upper and lower case halves and disconnect cables.
3. Disconnect the cables from the Control PCB.
4. Remove the five PCB fixing screws and washers and withdraw the Control PCB and Display PCB together.
5. Pull out the four standoffs/pins to separate the Control PCB and the Display PCB.
6. Desolder battery from the Control PCB.

The transmission is not shown here for clarity—it is not necessary to remove the transmission assembly in order to remove the Control PCB and the Display PCB.



Appendix E

Service Contacts

Service Contacts

For service, contact your local Affiliate Office or Distributor.

AE

Cardinal Health,
PO Box 5527,
Dubai, United Arab Emirates.
Tel: (971) 4 28 22 842
Fax: (971) 4 28 22 914

AU

Cardinal Health,
8/167 Prospect Highway,
Seven Hills, NSW 2147,
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Appendix F

Document History

Document History

Issue	Date	CO No.	Author	Update Description
1	09/12/04	4713	Clare Coney	Initial release - (Supersedes 6000PB00001)
2	23/11/05	6226	Ian Tyler	Updated Performance Verification Procedure Added Battery Maintenance section to Chapter 3 'Routine Maintenance' Added updates to Chapter 6 'Spare Parts Replacement Procedures' Updated Appendix A 'Specifications' Updated Chapter 4 'Troubleshooting' Moved document history and service contacts to an appendix Rebranded from ALARIS Medical System to Cardinal Health
3	November 2006	7238	Ian Tyler	Updated pole clamp part numbers Added Disposal Appendix Corrected Battery Test criteria