Service Manual

Flo-Gard GSP

SYRINGE INFUSION PUMP

BS036010EN-P06

Baxter

Prior to servicing this pump, read this manual and the pump's Operator's Manual carefully to fully understand the pump's functionality and to ensure safe and proper servicing.

CONTENTS

1. INTRODUCTION

1.1.GENERAL INFORMATION

The Flo-Gard GSP syringe pump is designed to accurately control the delivery of solution to the patient by means of a disposable syringe.

The Flo-Gard GSP syringe pump is compatible with a wide range of standard, single-use, disposable Luer-lock syringes, ranging from 10ml to 100ml in size.

This SERVICE MANUAL describes the theory of operation, how to check, troubleshoot and repair Flo-Gard GSP syringe infusion pump.

Ensure that you are fully familiar with this equipment by carefully studying the Operator's Manual and this Service Manual prior to attempting any repairs or servicing.

1.2. GENERAL PRECAUTION

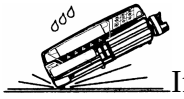
 Please read the general Operating Precautions described in the Operating Instructions carefully prior to using this pump.

 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 materials. Exercise care to locate the pump away from any such hazardous sources.

 An electrical shock hazard exists if the pump casing 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 fail-safe if extremely high levels of interference are encountered. Should false alarm condition 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 a qualified service engineer.

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2. TECHNICAL DESCRIPTION

2.1. GENERAL

The Block Diagram of the pump is given in the section 8.1. The Electrical Schematic Diagram is given in the section 8.2. The pump is composed of the following elements:

- Keypads
- Stepper motor
- Stepper motor encoder
- Syringe Force sensor
- Syringe plunger grippers and pusher lever sensor
- Drive engagement sensor
- Syringe size sensor
- Pusher position sensor
- Syringe barrel sensor
- Battery unit
- Electronic board
- Drive Unit board
- Power Supply Unit
- IRDA/RS232/Nurse Call Interface
- Hard bootstrap loader

Below follows a description of these elements, refer the appropriate diagram for full understanding of the functionality:

2.1.1. Keypads

Keypad K1 comprises of a 4 x 3 key matrix connected to the Electronic board at connector JP1. The ON/OFF key and BATTERY & MAINS LED's are also located on the K1 keypad connect to the Electronic board via JP12.
Keypad K2 comprises of a 4 x 2 key matrix. It is connected to the Electronic board via connector JP4.

2.1.2. Stepper motor

A two-phase unipolar stepper motor with 7.5º step-angle is used in the pump drive. The motor is connected to the Drive Unit board via connector P5 and is driven in micro stepping mode. There are 48 steps to complete one full revolution of the motor shaft. The motor is connected to the lead screw by means of timing belt. The belt ratio is 5:1; as a result 240 motor steps move the drive carriage by 1 mm.

2.1.3. Stepper motor encoder

Motor speed and direction is monitored by means of the encoder. It is composed of two photo-interrupters D1, D2 and a 9 slot-encoding disk mounted on the stepper motor shaft. Quadrature signals (Tax1, Tax2) are transferred to the Drive Unit board via P6 connector.

2.1.4. Syringe force sensor

As a syringe force sensor is used a strain gauge TZ1 mounted on a steel plate within the plunger retaining mechanism. When this plate is deflected by applied force on the plunger mechanism, a differential voltage is generated at gauge output. This signal, which magnitude is proportional to the applied force, is transferred to the Drive Unit board.

2.1.5. Syringe retainer (plunger grippers and pusher lever) sensors

The plunger grippers and pusher lever sensors are composed of photo interrupters D4, D5, D6. The LED's of the photo interrupters are supplied with pulse-modulated current through pin 8 of JP1 connector of the Drive Unit board.

When the syringe is loaded, the shutters controlling the photo interrupters D4 and D6 are opened. When the pusher lever is lifted up, the shutter controlling the photo interrupter D5 is opened. Output signals of these sensors are summed to form syringe retainer output voltage (at pin 7 of JP1 – Drive Unit board) in accordance with the Table 1.

Plunger grippers sensors (D4, D6)	Pusher lever sensor (D5)	Syr. retainer output voltage
Off	Off	<0.3V
On	Off	≥0.3V; ≤0.6V
Off	On	>0.6V; ≤0.95V
On	On	>0.95V; ≤1.4V

Table 1

2.1.6. Drive engagement sensor

The drive engagement sensor is comprised of photo interrupter D3. Its LED is supplied with pulse-modulated current. When the half-nuts of drive are closed (engaged), the shutter controlling the photo interrupter D3 is open and electrical pulses are generated at pin 6 of the Drive Unit's board JP1 connector.

2.1.7. Syringe size sensor

The syringe size sensing is achieved using the linear potentiometer R1. The signal from the potentiometer slider is applied to the Electronic board via pin 2 of JP8 connector.

2.1.8. Pusher position sensor

An optical absolute encoder of pusher position is comprised of a steel encoder ruler and photo interrupter D7. Ruler is attached to the drive walls, and the photo interrupter is mounted on the drive carriage and moves along ruler during infusion so that edge of the ruler is inside the gap of photo interrupter. The edge of the ruler is punched with the slots distributed with various intervals in certain pattern. Each slot passing the gap generates electrical pulse when the photo interrupter is moved along the ruler. Microcontroller permanently monitors width of intervals in

sequence of pulses and determines pusher position basing on combination of passed intervals. Obviously, certain number of slots should be passed after start of infusion before the pusher position (and, correspondingly, remaining time and volume) may be determined. Maximum delay is when the pusher is at the rightmost position (up to 9 mm of pusher travel may be required).

2.1.9. Syringe barrel sensor

The syringe barrel sensor comprises switch S1. When the syringe is loaded, the switch S1 contacts are closed and a logic "0" is generated at pin 1 of the Electronic board's JP5 connector.

2.1.10. Battery unit

The battery unit comprises the Ni-MH (7,2V x 2.5Ah) battery GB1 together with the battery monitoring circuit. The integrated circuit U1 monitors battery voltage, temperature and charge/discharge current. This data is used to calculate battery charge state and remaining working time when pump runs on battery. Data is transferred to the microcontroller via 1-Wire interface (pin 4 of the JP7 connector). R2 is a current sense resistor; R3 and C1 constitute a low pass filter for the current monitoring circuit. Thermistor R1 terminates battery charging if battery temperature exceeds the permissible value. The resettable fuse F1 protects against a short circuit of the battery.

2.2. ELECTRONIC BOARD

The electrical diagram of the Electronic board is given in section 8.3. It comprises following main parts:

- Microcontroller circuit
- Display unit
- Display contrast regulator
- RS232 interface
- Watch-dog circuit
- Piezotransducer drive
- Reference voltage source
- LED indicators

2.2.1. Microcontroller circuit

The 16 bit microcontroller U12 (SAB-C167CR-LM) controls and monitors major syringe pump functions. Clock pulses are generated by the quartz oscillator Q1 at a frequency of 3.686400 MHz and multiplied x 5. Supervisor integrated circuit U9 generates a reset signal for the microcontroller when the supply voltage changes from 0V to 5V.

Software instructions are stored in 1-Megabyte FLASH memory U10. Device constant parameters are stored in 8-kilobyte SPI EEPROM, U14. Temporary variables are stored in 128 - kilobyte SRAM U8 with real time clock and lithium battery.

The microcontroller functions include:

- Scanning the keypad via the port P8 and the buffers of the U2 and U4 ICs. The keypad status information is read via other buffers of the U2 and U4 ICs to the inputs P5.9 (pin 36), P5.10 (pin 39) and P5.11 (pin P40).
- Setting the output P2.10 (pin 59) to '0'on switching the pump on. This signal maintains power supply active. In order to switch power off, the ON/OFF key shall be kept depressed, thereby setting the P5.7 input (pin 34) to '1'. After 3 sec delay micrcontroller sets the P2.10 output (pin 59) to '1', which switches the power supply off.
- Detecting pump connection to 100-240VAC mains power or 12VDC by the signal at the P5.6 input (pin 33) ('1' – when connected). At this state transistor T11 opens thereby activating the MAINS indicator on the front panel. When pump is running on internal battery, microcontroller activates the BATTERY indicator by setting the P2.0 output (pin 47) to '1'.
- Obtaining information from the battery monitoring circuit on the battery voltage, temperature and capacity via the input P7.6 (pin 25); obtaining battery fast charge signal via the P5.14 input (pin 43) ('0' – fast charge in progress); disabling the AC mains supply by setting the P7.4 output (pin 23) to '1' in the battery calibration mode.
- Activating the Nurse Call circuit located at the Supply Unit, by setting the P2.5 output (pin 52) to '1'.
- Receiving voltage proportional to syringe size from the syringe size sensor via the AN0 input (pin 27). Force sensor reference voltage is applied to the AN1 input (pin 28). Voltage directly proportional to force acting on the syringe pusher, is applied to the AN2 input (pin 29). Force sensor reference 0 voltage is applied to the AN3 input (30 pin). Syringe retainer output voltage (see table 1) is applied to the input AN4 (pin 31). Voltage from piezo transducer current monitor is applied to the input AN5 (pin 32). The P2.12 output is used for controlling force sensor's supply.
- Controlling (pulse modulating) the current through the LEDs of the drive engaged, gripper and pusher lever sensors via the P2.13 output (pin 62); receiving signal of engagement of drive half-nuts with lead screw ('1' pulses) via the P5.13 input (pin 42) (via the buffer U20); receiving signal that syringe barrel is fitted ('0' level) via the P5.12 input (pin 41) (via the buffer U4E); receiving tachometer pulses from the Drive Unit board via the P2.15 input (pin 64). Prior to starting motor rotating backwards and during it microcontroller sets the P2.11 output (pin 60) to '0' to disable motor direction sensor in the Drive Unit board; during normal infusion this output is set to '1'.
- Generating signals for the stepper motor controller/driver which is located in the Drive Unit board: Data A via the P2.6 output (pin 53), Data B via the P2.7 (pin 54), Strobe A,B via the P2.8 (pin 57), Clock A,B via the P2.9 (pin 58). Signal controlling magnitude of motor winding current is generated at the POUT0 output (pin 19) by means of PWM; AC component of this signal is suppressed by means of the second order low-pass filter (R54, C71, R56, C73), and DC component having range 0.4 to 2.5 V is transferred via the diode D23 and pin 4 of JP10 to the Drive Unit board – REF/ENABLE A,B circuit. This circuit is used also for disabling motor driver by applying +5 V to it. For this sake pin 4 of JP10 is also connected with the P7.7 output of microcontroller (pin 26) and output of watchdog via the D21 and D22 correspondingly; logic '1' at any of these two

outputs sets windings current to zero (e.g. in STOP mode, during pause between two adjacent steps or when the watchdog is activated).
- Selecting IRDA rate via the P6.4 output (pin 5). Selecting of UART connection either with the RS232 or IRDA interface via the P6.5 output (pin 6). The P6.7 output is set to '1' when RS232 selected, and '0' is set when IRDA interface selected.
- Activates Z1 buzzer by setting output P6.7 to '1' when piezotransducer circuit is interrupted;
- receiving interrupt pulses from the SRAM (U8) Real Time Clock via the T2IN input (pin 74);
- receiving pulses from the syringe pusher position sensor via T4IN input (pin 70).

2.2.2. Display unit

A 240 x 64 dot blue negative graphic LCD display (MD1) is used in the pump. The backlight is controlled by means of PWM, using control signal generated at the POUT2 output (pin 21) of the microcontroller.

2.2.3. Display contrast regulator

Negative voltage adjustable within range of 7.5 to 8.5 V is utilized to control the display contrast. The negative voltage is generated by means of the DC/DC converter U16, and voltage regulator U17. Initial voltage value is adjusted by means of trimmer potentiometer R52. The microcontroller U12 then controls display contrast by means of PWM signal generated at the POUT3 output (pin 22) and applied to pin6 of the U17 via low-pass filter R50, C60 and diode D19.

2.2.4. RS232 interface circuit

The RS232 interface circuit is isolated from the pump circuitry by means of the opto-couplers D8, D9. This isolated part of the circuit is powered from the PC COM port using RTS (+10V) and DTR (+10V), rectified by means of the D6, D7 diodes signals. Voltage regulator U1 is used to provide the RS232 interface chip U3 with +5V supply (VDD).
U3 includes a DC/DC converter providing the necessary voltages of +7V and –7V. Integrated circuit U3 hibernates when no valid receiver level and no receiver or transmitter transient is detected for 30 seconds, and wake up when a valid receiver level or receiver or transmitter transient is detected.

2.2.5. Watchdog circuit

The watchdog function is carried out by the uP supervisory circuits with windowed (Min/Max) watchdog U9. The microcontroller generates clocks at the P2.4 output (pin 51) that are applied to the WDI input (pin 3 of U9). If the clock period goes outside the permissible range, U9 generates a short logic '0' pulse at the WDP0 output (pin 5). This pulse sets '1' at the Q output (pin5) of the flip-flop U6A, which acts as follows:

1) Stops motor (via the D22),
2) Activates red alarm LED D1 (via the D4),
3) Activates the nurse call circuit located in the Supply Unit (via the D16),

4) Launches the buzzer Z1 (via the D10),
5) Eliminates 3 s delay when switching the pump off (via the input 5 of U11),
6) Indicates to the microcontroller U12 that watchdog is activated (via the P5.8 input – pin 35).
The watchdog circuit is also activated if the motor starts rotating backwards despite forward rotation commands. In this case the rotation direction sensor in the Drive Unit board sets "Backwards" circuit (pin 3 of JP9) to '0' which inputs logic "0" to the watchdog (via D18) thus activating it.
The pump carries out watchdog test each time it is powered up, and if test passes successfully U6B trigger Q output (pin 9) is set to '0', if test fails – Q output is set to '1'. This watchdog signal is applied to the 67 pin of U12 microcontroller.

2.2.6. Piezotransducer drive

The audible signal is generated by means of PWM at the POUT1 output (pin 20) of the microcontroller U12. Carrier frequency is suppressed by third order low-pass filter (R58, C75, R60, C76, R61, C77).
In order to obtain double maximal output voltage a bridge layout of the U18 amplifier is used. The ratio of R64 and R67 determines audio gain.
R77 monitors current applied on the piezotransducer. Signal from the R77 is amplified by the U18A amplifier, rectified with the D21, C86 and applied to the AN5 input (pin 32) of the U12 microcontroller.

2.2.7. Reference voltage source

Voltage regulator U7 generates voltage Vref used as reference for the microcontroller's ADC and the syringe size sensor. U7 is switched on/off by microcontroller (via the P6.6 output).

2.2.8. LED indicators

The red LED indicator D1 flashes when an ALARM condition is detected or when the watchdog circuit is activated. It is controlled by the microcontroller U12 via the P2.2 output (pin 49) or by the watchdog (via the D4). The Green LED D2 flashes during infusion. It is controlled via the P2.3 output (pin 50) of the microcontroller. The orange LED D3 flashes in ALERT condition. It is controlled via the P2.1 output (pin 48).

2.3. DRIVE UNIT BOARD

The drive electronics is located on the separate PCB attached to drive mechanical assembly. Controller-driver U2 is used to operate the stepper motor. It controls current through motor windings by means of the PWM using control signals from the microcontroller: "Data A" (pin 6 of the U2), "Data B" (pin 17), "Strobe A,B" (pins 2, 13), "Clock A,B" (pins 5, 16), "REF/ENABLE A,B" (pins 3, 14). Each step of the motor consists of 8 successive micro-steps, which provide regulation of current through windings closely to sin/cos law, thus ensuring smooth rotation of the motor shaft. In the case the watchdog is actuated, a high level (+5V) signal is applied to the "REF/ENABLE A,B" inputs, which removes power from the motor windings.

Quadrature signals from the motor encoder are processed by means of the decoder built on the U6, U7, and U8 integrated circuits. 9 square pulses are generated at the TAX output (pin2 of JP2) during one revolution of motor shaft. The "BACKWARDS" output is used to indicate

direction of motor rotation. Logic “0” is generated at this output if motor starts rotating so as to move syringe pusher backwards while logic “1” is applied to the FWD input (i.e. motor should not rotate backwards). Logic “0” applied to the FWD input (pin 1 of JP2) disables the direction sensor and ensures that logic “1” is set at the “BACKWARDS” output regardless of rotation direction.

The operational amplifier U1 amplifies syringe force sensor’s output signal. Integrated circuit U3 produces precise supply voltage +5V both for the syringe force sensor and amplifier U1. The trimmer potentiometer R2 is used to balance the force gauge (bridge).
U5A performs buffering of syringe retainer output signal, and U5B performs conditioning of pusher position sensor’s signal.

2.4. POWER SUPPLY UNIT

The power supply unit includes switching power supply PS1, +5V voltage regulator U2, and accumulator battery fast-charge controller U1 together with transistor T4. Protective circuits built using comparators U3, U6 and thyristors D6, D7 are intended to prevent occurrence of over-voltage and under-voltage at the +5V supply circuit in the case of failure of voltage regulator or short circuits within pump electronics.

Voltage in the VccNS circuit is approximately +11V when pump is connected to the mains, and approximately +7V when disconnected (powered from the internal battery). Vcc voltage is +5V when pump is switched on, and 0 when switched off. The +5V regulator (U2) is switched on when VccNS voltage is applied to its “ON/OFF” input (pin 2), which occurs when the operator presses the pump’s ON/OFF key. The regulator is switched off by means of the “SHDN” signal, which is generated by microcontroller when the operator depresses the ON/OFF key for 3 seconds.

The T8 transistor key is used for switching mains supply off in the course of the accumulator battery test.

The controller U1 initiates fast charge of accumulator battery each time the pump is connected to the mains. Detecting a negative battery voltage slope, which occurs when charge is completed, normally terminates fast charge. For safety reasons termination of the fast charge is provided by means of the thermistor within the battery pack detecting over-temperature. Additionally, termination of fast charge is provided on elapsing of established fast charge time. After termination of fast charge the controller switches to trickle charge mode.

A socket is located on the pump for powering from an external 12VDC source. This circuit comprises a connector on the rear side of pump and fuses F2, F3, and filter components L1, L2, C21, C22 mounted on the power supply unit’s PCB. Diode D10 prevents pump from damaging in case of wrong polarity of external 12 VDC source.

2.5. IRDA/RS232/NURSE CALL INTERFACE

2.5.5. IRDA interface

Serial infrared data communication is operating in accordance with the IRDA standard using modulator-demodulator U4 and transceiver U5 located on the power supply’s PCB.

The transceiver is mounted on the rear of the PCB, in front of the window at the back of the pump. The window is covered with dark IR-transparent plastic.

2.5.6. RS232 interface

The technical specification of the RS232 Interface is listed in table 2 below:

Table 2

Connector	D Type –9 Pin, female
TXD Output Voltage Range	Minimum: -5V(mark), +5V(space) Typical: -5.4V(mark), +5.4V(space) with 3kohm load to ground
RXD Input Voltage Range	-25V - +25V maximum
RXD Input Thresholds	Low: 0.8V minimum/ High: 2.4V maximum
RXD Input Resistance	3 kohm minimum
Isolation Socket/pump	4 kV
Baud Rate	115 kBaud
Bit Format	1 start, 8 data, no parity, 1 stop

RS232 connections data:
1 - Not used
2 - Transmit Data (TXD) Output
3 - Received Data (RXD) Input
4 - Power Input (DTR)
5 - Ground (GND)
6 - Not used
7 - Power Input (RTS)
8 - Not used
9 - Not used

2.5.7. Nurse Call Interface

Nurse call interface is implemented using relay RL1 located on the power supply's PCB. Contacts are rated at 1A at 50VAC or 1 A at 30VDC. Relay contacts are accessible at the connector on the rear of the pump.
After detecting an alarm condition the microcontroller sets a logic "1" at its P2.5 output (pin 52), which opens transistor T3 on the power supply's PCB and the relay is activated. If a failure of the microcontroller is detected an output signal from the watchdog circuits activated the relay.

2.6. BOOTSTRAP LOADER UNIT

A bootstrap loader unit is used for downloading bootstrap into the Flash memory U10 on the Electronic board, utilizing microcontroller's U12 internal bootstrap loader, when the Flash memory's software does not contain bootstrap or it does not work. Bootstrap loader unit is connected to the JP6 connector of the Electronic board. It allows launching the U12 microcontroller by means of manual reset signal, maintains Power Supply Unit active, commutates UART via the RS232 interface and configures the microcontroller so as to launch its internal bootstrap loader.

3. USER CONFIGURATION MENU

Depressed the ◈ key and turn the pump on. Enter code **237** using the numerical keypad. Press **OK** to confirm the code. The User Configuration Menu will be displayed. Use the ▼ ▲ softkeys to select the required parameter (see Operator's Manual).

4. SERVICE MENU

While keeping pressed the ◈ key turn the pump on. Enter code **751** using the numerical keypad. Press **OK** to confirm the code. The Service Menu will be displayed. Use the ▼ ▲ softkeys to select the required parameter.

4.1. MAINTENANCE MENU

Select the **MAINTENANCE MENU** from the Service menu and press the **OK** softkey. Use the ▼ ▲ softkeys to select the required parameter. Press the **OK** softkey:

- to modify the NEXT SERVICE DATE
- to view the selected LOG (event, use, key or service)
- to set TIME FORMAT (24h or 12h)
- to set DATE FORMAT (dd-MM-yyyy or MM-dd-yyyy)
- to set DEFAULT PARAMETERS
- to set ALARM PITCH
- to set ALERT PITCH
- to view serial number
- to select INTERFACE type (RS232 or IRDA). (Only one of these interfaces may be active at a time.)

Press the **QUIT** softkey to return to Service menu.

4.2. LOADING PROGRAM

4.2.1. Loading program

In order to check the program version, keep the 🔔 key depressed while turning the pump on.
To perform a programming operation, the following is required:
- Flo-Gard GSP Firmware Upload Utility must be installed and configured on the computer that is being used.
- Either RS232 extension cable must be connected between the COM port of the computer and the 9-way 'D' connector in the rear of the pump.

Select the LOADING PROGRAM and press the **OK** softkey. The pump is ready for loading the program.

Note. When the ERROR: PR02 message (incorrect program CRC) is displayed, the pump also is ready for loading the program.

Programming sequence:
Start Flo-Gard GSP Firmware Upload Utility application by clicking on the appropriate icon.
Select which COM port is going to be used.
Click on  (*Load configuration Set)* in order to load program.
Click on Firmware  key to start the programming operation.

Note. When the ERROR: OTH01 message is displayed set DEFAULT PARAMETERS.
Having loaded new program it is necessary to execute full testing (see Section 4.4.1).

4.2.2. Loading Bootstrap

In order to perform a programming operation, the following should be in place:

- Flo-Gard GSP Firmware Upload Utility should be installed and configured on the computer that is being used.

- Having opened the pump housing, Bootstrap Loader Unit should be connected to the Electronic board connector JP6 (Bootstrap Loader Unit switch should be in ON position).

- RS232 extension cable connected between the COM port of the computer and the 9-way 'D' connector in the rear of the pump.

Switch on the pump. Press the Reset key on the Bootstrap Loader Unit. The pump is now ready to download a Bootstrap.

Programming sequence:

Start Flo-Gard GSP Firmware Upload Utility application by clicking on the appropriate icon.

Select which COM port is going to be used.

Click on  (*Load configuration Set)* in order to load Bootstrap.

Click on Bootloader  key to start the programming operation.

After Bootstrap downloading process is completed, it is necessary to switch Bootstrap Loader Unit switch into OFF position and to press the Reset key.

4.3. CALIBRATION

Select the **CALIBRATION** from the Service menu and press the **OK** softkey. Select item to be calibrated using the  softkeys and press the **OK** softkey.

4.3.1. Syringe size sensor calibration

The syringe size detection system stores the characteristics of the syringe clamp assembly, including the travel of the linear potentiometer in non-volatile memory.
Equipment:

- Spacer (gauge) SP1 (B8640037-01) or old (B8640022-01);
- Spacer (gauge) SP2 (B8640037-02) or old (B8640022-02);
- Spacer (gauge) SP3 (B8640037-03) or old (B8640022-03);
- Spacer (gauge) SP4 (B8640023).

Select the **Syringe size sensor** from calibration menu and press the **OK** softkey. With the syringe clamp at the lowermost position press the **OK** softkey. One after another insert spacers from 1 to 4, each time closing the syringe clamp and pressing the **OK** softkey to acknowledge. Finally fix the syringe clamp at the uppermost position and again press the **OK** softkey.

4.3.2. Pusher position sensor calibration

Equipment:

- Calibration spacer (gauge) SP1 (B8640037-01) or old (B8640022-01).

Select the **Pusher position sensor** from calibration menu and press the **OK** softkey. When display reads the message **Insert spacer SP1,** insert the spacer SP1 and slide the drive pusher to the spacer SP1. Press the **OK** softkey. Syringe pusher moves backwards and afterwards returns to the spacer SP1. Following question will be indicated on display:

Is pusher contacting the spacer?

If pusher is not contacting the spacer, press the **NO** softkey and repeat the calibration. If pusher is contacting the spacer, press the **YES** softkey. Following message will be indicated on display:

Offset XX mm,

where XX value shall be (10-13) mm. Press the **QUIT** softkey to exit.

4.3.3. Force sensor calibration

Equipment:

- Digitron pressure meter, model: 2022P (0-1500 mmHg);
- 50 ml BD PLASTIPAK or 60 ml BD syringe with extension line.

Select the **Force sensor** from calibration menu and press the **OK** softkey. The “0 cm Hg >XXXmV<” message should appear on the screen.

First step is to be performed without loading syringe. Make sure that plunger retainer lever is released and plunger grippers are in idle position, and pushing surface of the retainer is not in contact with any part of pump or extraneous object. Leave the pump at rest for at least 15 min, then press and release the retainer lever a few times. Make sure that actual output value of the force sensor displayed on the pump screen is (1100±400) mV; if necessary, adjust it by means of the R2 potentiometer on the Drive Unit board. Press the **OK** softkey, and the “Insert 60 ml BD or 50 ml BD PLASTIPAK” message should appear.

Fill syringe with 10-20 ml of water, and fit it to the pump. Connect syringe to the pressure meter by means of the extension line. Locate the pressure meter at the same height as the syringe. Press the RUN softkey and keep it depressed, allowing the transmission to run until the pressure meter reads (148±1.5) cmHg. When approaching the target value, it is recommended to run transmission in short steps, since if you fail to stop transmission timely and target value is

overridden, calibration procedure must be repeated from the beginning. When pressure is adjusted as required, press the **OK** softkey, then press retainer lever and move the retainer away from the plunger.

Leave the pump at rest for at least 15 min, then press and release the retainer lever a few times and check the values displayed on the pump screen to make sure the following:

- difference between actual output value and **V1** value is not greater than ±10 mV, otherwise this calibration procedure shall be repeated from the beginning (a few times, if necessary),
- difference between **V2** and **V1** values is within range of 1500-2900 mV. Wrong readings may indicate malfunction of the force sensor or the Drive Unit.

Press the **QUIT** softkey to exit.

4.3.4. Battery calibration

Battery calibration cycles the battery through a charge, discharge, re-charge sequence during which the fuel gauge within Battery Unit will be updated with a measurement of the current capacity of the cells.
This calibration allows the fuel gauge to monitor accurately the charge in the pack. Over time the estimate of capacity may drift from the actual cell capacity, which generally decreases with time.

Recalibration will update the fuel gauge with the measured capacity of the cells.

Remove the battery pack lid to ensure a stable pack environment during calibration. It is recommended that the pack is removed from the battery compartment and placed behind the pump.

Connect the pump to the mains.

Extend the plunger drive arm to the maximum as it will automatically move during the discharge phase. Select the **Battery** from calibration menu and press the **OK** softkey. Leave pump in calibration mode for up to 14 hours. The cycle should run passing automatically three phases one by one:

- Initial charge phase – 0 to 3 hours
- Measured discharge phase. Pack is discharged using typical load down to 1.1 V per cell to determine how much charge is available from the pack – up to 10 hours
- Final charge phase. Pack is fully recharged ready for use. Early in this phase the measured discharge value is transferred to the pack gas gauge to be stored as the new capacity (mAh).

While the calibration cycle is active the battery related information is displayed on the pump screen. At the end of the cycle the screen should show CALIBRATION COMPLETED. Press the QUIT softkey to exit.

4.4. TESTING

Select the **TESTING** from the Service menu and press the **OK** softkey. Select the item to be tested using the  softkeys and press the **OK** softkey.

4.4.1. Full testing

This section provides a complete pump test procedure. During test it is possible to review and modify following parameters: language, date, time, next service date. Follow each stage test and follow the instructions on the display use the **QUIT** softkey to move to the other test.

4.4.2. Program testing

This test is intended to calculate program and bootstrap CRC. Select the **Program** from testing menu and press the **OK** softkey. Software version, bootstrap version and calculated CRC values are indicated in the display. Press the **QUIT** softkey to return to TESTING menu.

4.4.3. Drive sensors test

This test enables checking of the following sensors: syringe barrel, plunger grippers, push lever and drive disengaged.
Select **Drive Sensors** from the testing menu and press the **OK** softkey. Loading and removing the syringe will cause the sensors status to changes indicated on the pump display.
Drive engagement sensor can not be activated if nut and lead screw threads come “tooth on tooth”. In such case slide the syringe pusher to another position and repeat the checking.
Once complete press the **QUIT** softkey to return to TESTING menu.

4.4.4. Syringe size sensor test

This test is enables checking the operation of syringe size sensor.
Select **Syringe size sensor** from the testing menu and press the **OK** softkey. Slowly lift the syringe clamp. Check if syringe size sensor value changes (mV and mm). Having finished testing press the **QUIT** softkey to return to TESTING menu.

4.4.5. Pusher position sensor test

This test is enables checking the operation of pusher position sensor. Select **Pusher position sensor** from the testing menu and press the **OK** softkey. Insert the spacer SP1and slide the drive pusher to the spacer SP1. Press the **OK** key. Syringe pusher moves backwards and afterwards returns to the spacer SP1. Pusher position distance (22 ± 0.5)mm should be indicated on the display. Having finished testing press the **QUIT** softkey to return to TESTING menu.

4.4.6. Motor test

This test enables checking of the motor operation. During test no syringe should be installed.
Select **Motor** from the testing menu and press the **OK** softkey. Having finished testing press the **QUIT** softkey to return to TESTING menu.

4.4.7. Display test

This test checks that all of the display pixels (240x64) illuminate. Select **Display** from testing menu and press the **OK** softkey. Observe “chess-board” structure fields that appear in the display. All the rectangles should be same shaped and evenly filled. Having finished testing press the **QUIT** softkey to return to TESTING menu.

4.4.8. Nurse call test

Equipment:

- Nurse call cable (B6650012);
- Ohmmeter.

This test checks the nurse call circuit operation. Select **Nurse call** from testing menu and press the **OK** softkey. Using a meter check the circuit between the Nurse call contact 3 (com) and contacts 1 (NO), 5 (NC). The contacts should toggle each time the CHANGE softkey is pressed, as indicated on the display. Press the **QUIT** softkey to return to TESTING menu.

4.4.9. Piezotransducer (speaker)/buzzer test

This test checks the piezotransducer (speaker) and buzzer operation. Select **Speaker**/**buzzer** from the testing menu and press the **OK** softkey. Check for the alternating volume and pitches sound from the speaker. Check for the sound from the buzzer. Press the **QUIT** softkey to return to TESTING menu.

4.4.10. Keyboard test

This test enables checking the keypad operation. Select **Keyboard** from the testing menu and press the **OK** softkey. You will be prompted to press keys on the display (flashing) in sequence.

4.4.11. LEDs test

This test is intended to check the LED operation. Select **LEDs** from testing menu and press the **OK** softkey. The following LEDs should activate one after another: ALARM, ALERT, INFUS. and BATTERY. In order to check the operation of BATTERY LED it is necessary to connect the power cable. In order to check the operation of MAINS LED it is necessary to remove and reconnect the power cable. Press the **QUIT** softkey to return to TESTING menu.

4.4.12. Watch-dog test

This test enables checking of the watch-dog circuit operation. Select **Watch-Dog** from testing menu and press the **OK** softkey. Initially the watch-dog circuit is applied with an over frequency signal and later with an under frequency signal. When test completed switch off the pump using the OFF key.

5. RECOMMENDED ROUTINE MAINTENANCE AND TESTING

It is recommended that routine maintenance be carried out at least once a year. This should include:

- AC Mains / Battery operational checks (section 5.1).
- General cleaning and inspection for damage (section 5.2).
- Battery test (section 5.3).
- Infusion rate check (section 5.4).
- Occlusion pressure level check (section 5.5).
- Full test (sections 4.4.1-4.4.12).

5.1. AC MAINS / BATTERY OPERATION CHECK

Switch the pump on and plug pump into the mains. Observe that the MAINS indication LED becomes illuminated. Remover the mains supply and observe that the MAINS LED switches off. Observe that the battery indication LED becomes illuminated as the mains supply is removed.

5.2. GENERAL CLEANING AND INSPECTION FOR DAMAGE

To ensure that this pump remains in good operating condition, it is important to keep it clean and carry out the routine procedures described below. Servicing should be performed only by a qualified service engineer, with reference to this manual. The following routine maintenance procedures should be carried out as required but at least once per year:

Thoroughly clean external surfaces of the pump before and after prolonged periods of storages by wiping a lint-free cloth lightly dampened with warm water and standard disinfectant/detergent solution.

Disinfectants known to be corrosive to metals and plastics must not be used.

Before cleaning always switch OFF and disconnect from the AC power supply.

Never allow liquid to enter the casing and avoid excessive 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 sterilize or immerse this pump in any fluid.

Check Labels should be flat and legible. Replace as required

Case components must be checked for damage that may affect function, present fluid ingress routes and present a user hazard must be replaced as necessary.

Check the operation of the pole clamp screw. Check it is not loose and that the threads are not damaged. Check that it folds away correctly.

Inspect the AC power supply inlet and cable for sings of damage.

5.3. BATTERY TEST

Perform battery calibration in accordance with 4.3.4. When calibration is completed and the battery is fully charged (at least 2 hours 30 minutes on charge) disconnect the pump from the mains. Load 50 ml BD Plastipak or 60ml BD syringe with the plunger at 60.0 ml position on the syringe barrel scale.
Set the 5.0 ml/h rate and start infusion (see the Operator's Manual for further information on starting the pump).
Normally pump should be able to work on battery for about 10 hours. If this time is significantly less battery should be replaced.

After completion of the test the pump should be recharged for a minimum of 2 hours 30 minutes.

5.4. INFUSION RATE CHECK

Equipment:

- stop-watch;
- graduated glass test-tube (one point equals to 0.1 ml, volume 60ml or more).

Take the BD Plastipak 50 ml or 60 ml BD syringe with extension set and fill it with distilled water up to point of 60ml. Program the following infusion parameters:

- VTBI 50 ml;
- Rate 50 ml/h.

Insert the free end of extension set into the test-tube and start the infusion. Measure infusion time with the stop-watch and read the volume of water delivered into the test-tube. Calculate the infusion rate. It shall be 50ml/h ±1ml/h (±2%).

5.5.OCCLUSION PRESSURE LEVEL CHECK

Equipment:

- Digitron pressure meter, model: 2022P (0-1500mmHg).

Fill the 50 ml BD Plastipak or 60 ml BD syringe with 20-30 ml of the distilled water and connect it to the pressure meter using the extension set. Switch on the pressure meter and set the max/min pressure recording mode.

Set pump occlusion alarm level to L-5 and launch infusion at 5 ml/hr rate (for pump operation details refer to the Operator's Manual).

When pump will stop and indicate OCCLUSION read the maximum pressure recorded by pressure meter. Readings shall be within (63 - 107) cmHg range.

If recorded value is outside this range, re-calibrate the force sensor in accordance with 4.3.3 and repeat this test.

6. TROUBLE-SHOOTING

6.1.SAFETY WARNINGS

- Use extreme caution when pump whilst it is connected to the AC mains. Hazardous voltages are present at the mains inlet and on the power supply even the pump is switched off.
- Disconnect the battery and AC power whenever removing or inserting PCBs or other connectors.
-  This pump contains static-sensitive components. Wherever the ESD symbol appears observe strict precaution for the protection of static-sensitive components when attempting to service and repair the pump.

- Always visually inspect the pump, power cord and plug for damage. If the power cord or plug is damaged they should be replaced.
- Should further technical assistance be required call your local BAXTER Service Centre.

6.2. PUMP HAS BEEN DROPPED OR DAMAGED

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

During inspection, careful attention should be paid to the front and rear case halves, for signs of drop damage. Also check the pump drive, syringe pusher, syringe pusher drive, syringe size sensor.

6.3. PUMP HAS BEEN EXPOSED TO FLUIDS

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

If fluid ingress is suspected the pump should be inspected internally.

Clean and dry out the pump.

Take care to ensure dried deposits do not remain on the PCBs or other electrical components. Replace any damaged PCBs or components.

6.4. TROUBLE-SHOOTING BY FAULT SYMPTOM

SYMPTOM	CHECK	CORRECTIVE ACTION
MAINS LED does not light when plugged into a known good AC outlet. BATTERY LED lights, when pump is powered up. MAINS LED lights when powered from 12VDC.	Check mains cord Check switching power supply	Replace mains cord. Replace switching power supply if necessary.
MAINS LED does not light when plugged into a known good AC or 12VDC outlet. BATTERY LED lights when pump is powered up.	Check the MAINS LED of the keypad K1 and keypad connection with the Electronic board connector JP12. Check Electronic board.	Replace keypad K1 if necessary. Replace Electronic board if necessary.
MAINS LED is light. Pump does not switch on.	Check fuse F1 in the Supply Unit.	Replace fuse F1 with identical one.
Pump is unplugged. BATTERY LED does not light when pump is powered up.	Check the BATTERY LED of the keypad K1 and keypad connection with the Electronic board connector JP12.	Replace keypad K1 if necessary.
One or more keypad key presses are not accepted.	Perform keypad test.	Replace keypad if necessary.
Too high or too low contrast level.	Check contrast setting. Check the voltage of the Electronics Board test point TP9. The value should be (-8,0±0,1)V, when contrast is set to level 6.	Adjust the contrast as described in Operator's Manual. Adjust voltage by means of R52, if the problem persists – replace the Electronic board.
Backlight does not operate when pump is powered on.	Check backlight setting. Check backlight circuit interconnection on Electronic board Check Display Unit and its connection with the Electronic board connector JP13.	Adjust the backlight as described in Operator's Manual. If necessary replace Electronic board. If necessary replace Display Unit.

Red alarm LED does not light when alarm occurs.	Check red alarm LED (D1) in the Electronic board.	Replace faulty red alarm LED (D1).
Yellow alert LED does not light when alert occurs.	Check yellow alert LED (D3) in the Electronic board.	Replace faulty yellow alert LED (D3).
Green infusion LED does not light while pump is running.	Check green infusion LED (D2) in the Electronic board.	Replace faulty green infusion LED (D2).
Second (long) audible alarm does not sound after power on.	Check buzzer (Z1) in the Electronic board.	Replace faulty buzzer (Z1).
After power up the pump display empty or horizontal lines illuminated only, no backlight and watchdog activated.	Check for the presence of VCC of +5V on Electronic board. Check if reset duration is (TP4) > 100ms. Check if quartz oscillator (Q1) is working.	If necessary load bootstrap and afterwards load program.
Syringe gripper sensor does not activate when syringe is loaded.	Check syringe gripper (retainer) sensor signal (see section 2.1.5).	If necessary replace syringe pusher with syringe gripper sensor.
Pusher lever sensor does not activate when syringe is loaded.	Check pusher lever (retainer) sensor signal (see section 2.1.5).	If necessary replace syringe pusher with pusher lever sensor.
Syringe barrel sensor does not activate when syringe is loaded.	Check syringe barrel sensor and its connection on the Electronic board.	If necessary replace syringe barrel sensor.
Drive engaged sensor does not activate when syringe is loaded.	Check drive engaged sensor and its connection with Drive Unit board. Check the circuit starting from drive engaged sensor to the Electronic board.	If necessary replace drive with drive engaged sensor.
Syringe size sensor does not determine syringe size.	Calibrate syringe size sensor (see section 4.3.1). If the problem persists - check syringe size sensor.	If necessary replace syringe size sensor.
Pusher position sensor calculates time to end of infusion (syringe) incorrectly.	Calibrate pusher position sensor (see section 4.3.2). If the problem persists - check pusher position sensor.	If necessary replace encoder ruler. If necessary replace sensors unit B6660032.
Stepper motor is not rotating when it should.	Check encoder unit. Check stepper motor. Check Drive Unit board. Check motor belt.	If necessary replace encoder unit. If necessary replace stepper motor. If necessary replace Drive Unit board. If necessary replace motor belt.

Occlusion pressure level incorrect.	Calibrate syringe force sensor (see section 4.3.3) If the problem persists - check syringe force sensor. Check syringe force sensor amplifier circuit.	If necessary replace syringe pusher with syringe force sensor. If necessary replace Drive Unit board.
Too short operation time on battery.	Calibrate battery unit (see section 4.3.4).	If necessary replace battery unit.
Pump does not operate from external 12 VDC (MAINS LED does not operate). Pump operates from the AC power supply.	Check 12VDC & Nurse call connector unit. Check fuses F2, F3 in Supply Unit.	If necessary replace 12VDC & Nurse call connector unit. If necessary replace fuses F2, F3 with identical ones.
Nurse Call does not operate.	Perform Nurse Call test. Check nurse call circuit interconnection on Supply Unit.	If necessary replace 12VDC & Nurse call connector unit. If necessary replace Supply Unit.
RS232 interface does not operate (communication via the RS232 interface enabled in maintenance menu).	Check RS232 connector unit. Check RS232 cable. Check RS232 circuit interconnection on Electronic board.	If necessary replace RS232 connector unit. If necessary replace RS232 cable. If necessary replace Electronic board.
IRDA interface does not operate (communication via the IRDA interface enabled in maintenance menu).	Check IRDA circuit interconnection on Supply Unit. Check Supply Unit connection with the Electronic board connector JP3. Check IRDA circuit interconnection on Electronic board.	If necessary replace Supply Unit. If necessary replace Supply Unit. If necessary replace Electronic board.
Versatile clamp does not fix to the pump.	Check versatile clamp.	If necessary replace versatile clamp.

6.5 TROUBLE-SHOOTING BY FAILURE CODES

CODE	DESCRIPTION	CORRECTIVE ACTION
BT01	Communications with the battery fuel gauge has failed.	Inspect cables between Battery Monitoring, Drive Unit board and Electronic board.
BT02	The battery cell voltage is low (less than 1.05V per cell).	Charge battery, if failure code recurs, replace Battery Unit.
BT03	The battery cell voltage is high (greater than 1.75V per cell).	Check battery charge circuit and replace power supply unit if necessary.
BT04	The battery temperature is high (greater than 60°C).	Check battery charge circuit and replace power supply unit if necessary.
BT05	The battery charging current is high (greater than 1.5A).	Check battery charge circuit and replace power supply unit if necessary.
BT06	The battery discharging current is high (greater than 1.5A).	Disconnect one by one all the connectors, find current leakage place and replace faulty unit.
BT07	The battery charging current is low (less than 50mA)	Inspect cables between battery Monitoring and Power Supply Unit. Check battery charge circuit and replace Power Supply Unit if necessary.
BT08	The battery fast charge time is longer then 3 hours 30 minutes	Check battery charge circuit and replace Power Supply Unit if necessary.
BT09	The battery is discharging whilst the pump is on the mains.	Inspect cables between battery Monitoring and Power Supply Unit. Check battery charge circuit and replace Power Supply Unit if necessary.
BT10	The battery monitor software module has failed.	Power off then on. If failure code recurs, replace software.
BT11	Incorrect CRC of the battery capacity	Calibrate the battery
RT01	Accuracy of the real time clock or microcontroller quartz clock is out of spec. (±1%).	Replace SRAM on the Electronic board. Replace Electronic board.
RT02	Real time clock software module has failed.	Power off then on. If failure code recurs, replace software.
RT03	Incorrect date and time settings.	Set date and time.
KY01	Keypad key has been depressed for 5 minutes.	Replace keypad.
KY02	Keypad monitor software module has failed.	Power off then on. If failure code recurs, replace software.
WD01	W-D circuit failed	Replace Electronic board
WD02	W-D circuit failed	Replace Electronic board
WD03	W-D circuit failed	Replace Electronic board or Drive

		Unit board
WD04	W-D circuit failed	Replace Electronic board or Drive Unit board
WD05	W-D circuit failed	Power off then on. If failure code recurs, replace Electronic board
WD06	W-D circuit failed	Power off then on. If failure code recurs, replace Electronic board
WD07	Watch-Dog circuit activated	Power off then on. If failure code recurs, replace software or Electronic board.
WD08	Watch-Dog circuit activated	Power off then on. If failure code recurs, replace software.
WD09	Watch-Dog circuit activated	Power off then on. If failure code recurs, replace software.
EE01	Cannot read data from external EEPROM	Replace Electronic board.
EE02	Cannot write data to external EEPROM	Replace Electronic board.
EE03	External EEPROM software module has failed.	Power off then on. If failure code recurs, replace software.
PR01	Incorrect soft Bootstrap CRC	Power off then on. If failure code recurs, replace Bootstrap software.
PR02	Incorrect program CRC	Power off then on. If failure code recurs, replace software.
PR03	A certain program task not responding	Power off then on. If failure code recurs, replace software.
BSxx	Internal soft Bootstrap errors	Power off then on. If failure code recurs, replace Bootstrap software.
SM01	Stepper motor software module has failed.	Power off then on. If failure code recurs, replace software.
SM02	Momentarily stepper motor rotation speed is high in comparison of inputs steps and encoder.	Check Encoder Unit and replace it if necessary. Check Drive Unit board and replace it if necessary.
SM03	Momentarily stepper motor rotation speed is low in comparison of input steps and encoder, or is not rotating when it should.	Check Encoder Unit and replace it if necessary. Check Drive Unit board and replace it if necessary. Check Stepper Motor and replace it if necessary. Check Motor Belt and replace it if necessary.
SM04	Accumulated stepper motor rotation speed is low or high in comparison of input steps and encoder.	Check Encoder Unit and replace it if necessary. Check Drive Unit board and replace it if necessary. Check Stepper Motor and replace it if necessary. Check Motor Belt and replace it if necessary.
BAR01	Barrel sensor is damaged.	Check barrel sensor and replace it if necessary.

AB01	During antibolus motor has exceeded the step count limit.	Power off then on. If failure code recurs, replace software. If the problem persists, replace Electronic board if necessary.
AB02	During antibolus pusher position travel has exceeded the limit.	Power off then on. If failure code recurs, replace software. If the problem persists, replace Electronic board if necessary.
AB03	Antibolus duration has exceeded the limit.	Power off then on. If failure code recurs, replace software. If the problem persists, replace Electronic board if necessary.
PS02	Pusher drive travel deviated from expected position based upon motor control.	Check pusher position sensor and replace encoder ruler or sensors unit B6660032 if necessary.
PS03	Incorrect CRC of the pusher position table.	Calibrate pusher position sensor.
PS04	Pusher position sensor readings out of range for the inserted syringe.	Calibrate pusher position and syringe size sensors. If the problem persists, check and replace encoder ruler, sensors unit B6660032 or syringe size sensor if necessary.
PS05	Pusher position sensor has failed.	Check pusher position sensor and replace encoder ruler or sensors unit B6660032 if necessary.
PS06	Invalid pusher position codes.	Check pusher position sensor and replace encoder ruler or sensors unit B6660032 if necessary.
IO01	Input-output software module has failed.	Power off then on. If failure code recurs, replace software.
SS01	Syringe size sensor readings out of range.	Calibrate syringe size sensor. If the problem persists, check syringe size sensor and replace it if necessary.
SS02	Incorrect CRC of the syringe table in EEPROM	Calibrate syringe size sensor.
SS03	Incorrect CRC of the syringe table in SRAM	Power off then on. If failure code recurs, replace SRAM.
SRE01	Syringe gripper and push lever (retainer) sensors readings out of range (>1.4V).	Check syringe gripper and push lever sensors and replace syringe pusher if necessary.
SRE02	Pusher lever or drive engaged sensors are damaged.	Check push lever sensor and drive engaged sensor. Replace syringe pusher or drive if necessary.
SRE03	Syringe retainer (pusher lever, syringe gripper) or drive engaged sensors are damaged.	Check push lever sensor, syringe gripper sensor and drive engaged sensor. Replace syringe pusher or drive if necessary.
SF01	Syringe force sensor reading out of range.	Calibrate syringe force sensor. If the problem persists: Check syringe force sensor and replace syringe pusher with syringe

		force sensor if necessary. Check syringe force sensor amplifier circuit and replace Drive Unit board if necessary.
SF02	Syringe force test reading out of range.	Calibrate syringe force sensor. If the problem persists: Check syringe force sensor and replace syringe pusher with syringe force sensor if necessary. Check syringe force sensor amplifier circuit and replace Drive Unit board if necessary.
SF03	Syringe force 0 reference reading out of range.	Calibrate syringe force sensor. If the problem persists: Check syringe force sensor and replace syringe pusher with syringe force sensor if necessary. Check syringe force sensor amplifier circuit and replace Drive Unit board if necessary.
SF04	Incorrect CRC of the force (pressure) table.	Calibrate syringe force sensor.
SF05	Syringe force sensor reading not change	Clean syringe pusher, check syringe force sensor and replace syringe pusher if necessary
SF06	Syringe force reference voltage drift	Calibrate syringe force sensor. If the problem persists: Check syringe force sensor Uref and replace Drive Unit board if necessary.
SF07	Incorrect occlusion pressure level value in EEPROM.	Power off then on. Set the default occlusion pressure level. If failure code recurs, replace Electronic board if necessary.
SR01	SRAM test failed.	Power off then on. If failure code recurs, replace Electronic board.
SC01	Interrupted piezotransducer circuit.	Check piezotransducer unit and replace it if necessary. Check piezotransducer drive circuit and replace Electronic board if necessary.
SC02	Shorted piezotransducer circuit.	Check piezotransducer unit and replace it if necessary. Check piezotransducer drive circuit and replace Electronic board if necessary.
SC03	Sound control software module has failed.	Power off then on. If failure code recurs, replace software.
LED01	LEDs control software module has failed.	Power off then on. If failure code recurs, replace software.
AL01	Alarm manager software module has failed.	Power off then on. If failure code

		recurs, replace software.
OFF1	Software OFF module has failed.	Replace software.
LOG1	Software Log module has failed.	Power off then on. If failure code recurs, replace software.
LOG2	Cannot read log (from flash).	Replace Electronic board.
LOG3	Cannot write log (to flash).	Replace Electronic board.
EV01	Software Event module has failed.	Power off then on. If failure code recurs, replace software.
LCD01	LCD display software module has failed	Power off then on. If failure code recurs, replace software.
LCD02	Software graph plotting on display module has failed.	Power off then on. If failure code recurs, replace software.
EOI01	Incorrect x ml near EOI settings.	Set x ml near EOI value.
EOI02	Incorrect x min near EOI settings.	Set x min near EOI value.
BR01	Incorrect basal rate limit.	Set basal rate limit.
KOR01	Incorrect KVO rate.	Set KVO rate.
MOD01	Incorrect infusion mode settings.	Select infusion mode.
RES01	Incorrect residual volume.	Set residual volume.
OCL01	Incorrect restart count of after occlusion.	Set restart count after occlusion.
PUR01	Incorrect purge volume limit.	Set purge volume limit.
PUR02	Incorrect purge rate for 10 ml syringe.	Set purge rate for 10 ml syringe.
PUR03	Incorrect purge rate for 20 ml syringe.	Set purge rate for 20 ml syringe.
PUR04	Incorrect purge rate for 30 ml syringe.	Set purge rate for 30 ml syringe.
PUR05	Incorrect purge rate for 50 ml syringe.	Set purge rate for 50 ml syringe.
PUR06	Incorrect purge rate for 100 ml syringe.	Set purge rate for 100 ml syringe.
PUR07	Incorrect purge rate for 5 ml syringe.	Set purge rate for 5 ml syringe.
BOL01	Incorrect bolus volume limit.	Set bolus volume limit.
BOL02	Incorrect max bolus rate for 10 ml syringe.	Set max bolus rate for 10 ml syringe.
BOL03	Incorrect max bolus rate for 20 ml syringe.	Set max bolus rate for 20 ml syringe.
BOL04	Incorrect max bolus rate for 30 ml syringe.	Set max bolus rate for 30 ml syringe.
BOL05	Incorrect max bolus rate for 50 ml syringe.	Set max bolus rate for 50 ml syringe.
BOL06	Incorrect max bolus rate for 100 ml syringe.	Set max bolus rate for 100 ml syringe.
BOL07	Incorrect max bolus rate for 5 ml syringe.	Set max bolus rate for 5 ml syringe.
TR01	Internal microcontroller TRAP activated	Power off then on. If failure code recurs, replace software.
TR02	Internal microcontroller TRAP activated	Power off then on. If failure code recurs, replace software.
TR03	Internal microcontroller TRAP activated	Power off then on. If failure code recurs, replace software.
TR04	Internal microcontroller TRAP activated	Power off then on. If failure code recurs, replace software.
ID01	Incorrect drug name or pump ID in EEPROM.	Power off then on. Set default parameters. If failure code recurs, replace Electronic board if necessary.
IF01	Pump software not compatible with hardware revision	Replace software
OTH01	Other failures	Check log, if necessary replace software

7. REPAIR

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

 The pump contains static-sensitive components. Wherever the ESD symbol appears observe strict precautions for the protection of static-sensitive components when attempting to service and repair the pump.
Refer to section 7.4 for torque guidelines. Components may fail or be damaged if not tightened to correct torque level.
During servicing components found to be damaged will require replacement. Follow the instructions below together with the assembly drawings in section 9 for further information.
Battery should be disposed of as outlined by the local country regulation. Do not send back to the manufacturer.
For additional technical assistance, contact your local BAXTER Service Centre.

7.1 ACCESS TO THE PUMP

In order to replace any label (85, 87, 88, 90, 91, 93, 95), the clip (84) or the leg (83) there is no need to disassemble the pump. Carefully using knife peel the old label, the old clip (84) or the old leg (83). Using isopropyl alcohol clean the case where the label, the clip or the leg will be positioned ensuring all old adhesive residue is removed. Stick the label (85, 87, 88, 90, 91, 93, 95) by pressing it firmly with a soft cloth. Stick the clip (84) by pressing it. Stick the leg (83) by pressing it.
Place the pump on an anti-static grounded surface. Remove the versatile clamp (44). Remove the 2 battery covers screws (61), remove the battery compartment lid (43), disconnect the battery unit cable and withdraw the battery unit (42). Remove the six case retaining screws (60) located on the back of the pump.
Turn the pump upside-down. Carefully separate the front and rear case halves and disconnect the power supply to the Electronic board cable, the piezotransducer cable, the RS232 cable and IrDA cable. It may be necessary to remove some of the connectors by applying gentle force to the cable.
Reassemble the pump in the reverse order. When reassembling ensure that the seal (45) under the battery compartment lid (43) and the seal (45) between the front and rear cases are correctly positioned.

7.2 FRONT CASE AND SUB-ASSEMBLIES

7.2.1 Removal instructions

7.2.1.1 Syringe barrel sensor cover removal

It is not necessary to disassemble the pump in order to replace syringe barrel sensor cover (28). Use a knife to find the edge of the syringe barrel sensor cover (28) and carefully peel it back.

7.2.1.2 Keypads removal

Detach the flexi-cables of the keypad K1(25), K2(26) from the Electronic board (23). Carefully access the edge of the keypad, peel it back.

7.2.1.3 SRAM removal

In order to remove SRAM (24) from the Electronic board (23), carefully insert a small screwdriver under the SRAM (24) case at alternate edges and lift free.

7.2.1.4 Electronic board and display unit removal

Remove the five retaining screws (61) and disconnect all flexi-cables and cable connections. Carefully withdraw the Electronic board (23) with display unit (22) from the front case.
Using pincer squeeze one by one all four standoff (79) snap locks and detach display unit (22) from the Electronic board (23). Disconnect the display unit (22) cables. If necessary loosen the screws (64) and withdraw standoffs (79) from display unit (22).
Ensure that the display panel and case panel remain protected from dust and scratches until the display is refitted.
Having removed the Electronic board (23) it is possible to remove and replace the red LED D1, green LED D2, yellow LED D3 or buzzer Z1 as required.

7.2.1.5 Syringe clamp removal

It is not necessary to disassemble the pump in order to replace the syringe clamp. Lift the syringe clamp (20) to the upper position and hold it in this position. Unscrew the syringe clamp screw (59) and remove the syringe clamp (20).

7.2.1.6 Syringe size sensor removal

Remove the syringe clamp. Disconnect the syringe size sensor (19) cable. Remove the syringe sensor retainer screws (62) and carefully withdraw the syringe size sensor (19).

7.2.1.7 Drive Unit board removal

Disconnect the Drive Unit's board flexi-cable and cable connections. Remove the retaining screws (63, 64). Carefully withdraw the Drive Unit board (17) from the front case.

7.2.1.8 Syringe pusher drive removal

Slide the syringe pusher to the right approx. 20mm from the extreme right position, to gain access to the drive fastening screws (57, 61). Remove the four retaining screws (55, 56). Carefully withdraw the syringe pusher drive (15) and the shaft (18). Carefully withdraw the plastic screen (16).

7.2.1.9 Syringe pusher removal

Disconnect flexi-cables. Remove syringe pusher (12) from the stops (13) by pushing it to the left. Remove stops (13) from the tube using a screwdriver. Remove syringe pusher (12).

7.2.1.10 Syringe support removal

Remove the two retaining screws (49). Remove the syringe support (11).

7.2.1.11 Drive removal

Remove the syringe pusher drive, syringe pusher and syringe support. Remove the ring (9). Disconnect the Drive Unit board(17) cables from Electronic board (23). Remove the three retaining screws (57,61). Carefully withdraw the drive (10) from the front case.

7.2.1.12 Encoder ruler removal

Remove the drive. Remove the retaining screw (67) and nut (58). Remove the encoder ruler (7).

7.2.1.13 Sensors unit B6660032 removal

Remove the drive. Remove the encoder ruler. Disconnect the sensors unit B6660032 (8) cable from Drive Unit board (17). Remove the retaining screw (61). Remove the sensors unit B6660032 (8).

7.2.1.14 Motor belt removal

Remove the drive. Remove the screw (66) and nut (70). Loosen the screw (63) and nut (70). In order to loosen the motor timing belt, rotate motor unit (5) relative to the screw (63). Pull off timing belt (6) from the bigger pulley. Rotate motor unit (5) relative to the screw (63) to the position, allowing remove of the belt (6). Remove the motor belt (6).

7.2.1.15 Motor unit removal

Remove the drive. Remove the motor belt. Disconnect the motor unit (5) cable from Drive Unit board (17). Remove the screw (63) and nut (70). Remove motor unit (5).

7.2.1.16 Encoder unit removal

Disconnect the encoder unit (3) cable from Drive Unit board (17). Remove the screw (69), the nut (70) and remove encoder unit (3).

7.2.1.17 Syringe barrel sensor removal

Remove the Electronic board. Remove the drive. Remove the screw (61) and remove syringe barrel sensor (1).

7.2.2 Installation instructions

7.2.2.1 Syringe barrel sensor fitting

Fit the syringe barrel sensor (1) and secure with screw (61). Barrel sensor (1) is adjusted as follows:

1. Drive (10), syringe support (11) and syringe size sensor (19) should be fitted.
2. Using multimeter check the circuit between contacts 1 and 2 of the barrel sensor's (1) connector. The circuit should be open.
3. Load the 5 ml BD syringe and close the syringe clamp. Circuit between the contacts 1 and 2 should be short. If not, adjust position of the barrel sensor (1) by means of the screw (68), until required result is reached.
4. Load the 5 ml BD syringe incorrectly so that syringe barrel lays on the syringe support (11) and close the syringe clamp. Circuit between contacts 1 and 2 should be open. If not, adjust barrel sensor with screw (68) until the required result is reached and repeat step 3.
5. Execute steps 3 and 4 with the 140 ml MONOJECT syringe. If this procedure required manipulation of the screw (68), then afterwards it is necessary to repeat checking with 5 ml BD syringe.
6. Fasten the screw (68) using adhesive.

7.2.2.2 Encoder unit installation

Fit encoder unit (3) and secure with screw (69) and the nut (70). Connect the encoder unit (3) cable to the Drive Unit board (17).

7.2.2.3 Motor unit and motor belt installation

Fit the motor unit (5) and fasten (not too tight) it with the screw (63), nut (70), via two dampers (71) and two washers (75). Fit the two dampers (71) to the designated places between the motor and drive (10) wall. Rotate motor unit (5) relative to the screw (63) to the position, allowing fitting of the timing belt (6) on the pulley of the motor unit (5). Fit the belt (6) on the motor unit (5) pulley.

Timing belt teeth should be directed to inside. Rotate the motor unit (5) relative to the screw (63) to the position allowing to fitting the timing belt (6) on the larger pulley.

Fix the motor unit (5) using screw (66) and nut (70) via dampers (71) and washer (75). Tighten timing belt as much, when it is pressed with a force of 1,5 N it should bend for a 2…3 mm. Finally fix screw (63). Connect the motor unit (5) cable to the Drive Unit board(17).

7.2.2.4 Sensors unit B6660032 installation

Fit the sensors unit B6660032 (8) and secure with the screw (61). Connect the sensors unit B6660032 (8) cable to Drive Unit board (17).

7.2.2.5 Encoder ruler installation

Fit the encoder ruler (7) and secure with the screw (67) and the nut (58) via washer (72). Perform pusher position sensor calibration procedure in accordance with the 4.3.2.

7.2.2.6 Drive installation

Install the drive (10) to the front case and secure with three screws (57,61). Connect the Drive Unit board (17) cables to the Electronic board (23). Perform pusher position sensor calibration procedure in accordance with the 4.3.2.

7.2.2.7 Syringe support installation

Fit the ring (9). Fit the syringe support (11) and secure with two screws (49).

7.2.2.8 Syringe pusher installation

Fit the syringe pusher (12) on the tube and move it to the left. Fit the stops (13) on the tube. Moving the syringe pusher to the right fit it on the stops (13). Connect the flexi-cables.

NOTE. Pusher reassembling always entails necessity of syringe force sensor calibration. Perform it at the final stage of pump reassembling prior to joining front and rear cases, since it may be necessary to adjust trimmer potentiometer R2 on the Drive Unit board.
Restore 16-way electrical connection between front and rear cases of the pump and put the cases vertically on the table as far apart as the length of cable allow.
Perform force sensor calibration procedure in accordance with the 4.3.3.

7.2.2.9 Syringe pusher drive installation

Turn the pusher lever to the position shown in the picture B. Gear tooths “b” and “c” should be placed so as to be in contact with a second groove of the rack bar “a” (see. Picture A). Carefully insert the plastic screen (16) into the syringe pusher (12). Carefully fit the shaft (18) and the syringe pusher drive (15) on drive arm. Ensure the seal (48) between the syringe pusher (12) and syringe pusher drive (15) is correctly positioned. Secure the syringe pusher drive (15) with four screws (55,56).

7.2.2.10 Drive Unit board installation

Carefully insert the Drive Unit board (17) into the front case. Secure the retaining screw (64) and the retaining screw (63) using spacer (74). Connect all flexi-cable and cable connections.

NOTE. Drive unit board replacement entails necessity of syringe force sensor calibration. Perform it at the final stage of pump reassembling prior to joining front and rear cases, since it may be necessary to adjust trimmer potentiometer R2 on the Drive Unit board.
Restore 16-way electrical connection between front and rear cases of the pump and put the cases vertically on the table as far apart as the length of cable allow.
Perform force sensor calibration procedure in accordance with the 4.3.3.

7.2.2.11 Syringe size sensor installation

Carefully insert the syringe size sensor (19). Secure with 2 screws (62). Connect the syringe size sensor (19) cable to the Electronic board (23). Perform syringe size sensor calibration procedure in accordance with the 4.3.1.

7.2.2.12 Syringe clamp installation

Fit the syringe clamp (20) and secure with the screw (59).

7.2.2.13 Keypad installation

Using isopropyl alcohol clean the case where the keypad will be positioned ensuring all old adhesive residue is removed.
Remove the protective film from the keypad. Insert the keypad K1 (25) flexi-cable through the appropriate case slot. Align the bottom edges and corners of the keypad K1 (25) with the recess in the case. Stick the keypad K1 (25) by pressing it firmly with a soft cloth, starting from bottom edge working to the top. Seal the keypad edges using silicon coating.

Insert the keypad K2 (26) flexi-cable through the appropriate case slot. Align the keypad K2 (26) with the recess in the case. Stick the keypad K2 (26) to the case as previously with keypad K1. Seal the keypad edges using silicon coating.

Connect the keypad K1, K2 (25, 26) flexi-cable to the Electronic board (23).

7.2.2.14 Electronic board and Display unit installation

Fix the four standoffs (79) to display unit (22) using screws (64) and washers (76).
Fit the display unit (22) on the Electronic board (23). Connect all cables assemblies. Remove the protective film from the display.

Carefully insert the Electronic board (23) with display unit (22) into the front case. Fit the washers (77, 75), fix the five retaining screws (61) and connect all flexi-cables and cable connections to the Electronic board (23).

Perform syringe size sensor calibration procedure in accordance with the 4.3.1. Perform pusher position sensor calibration procedure in accordance with the 4.3.2. Perform force sensor calibration procedure in accordance with the 4.3.3. Perform date and time setting procedure in accordance with the 3.8.

7.2.2.15 SRAM installation

Fit the SRAM (24) on the Electronic board (23), following the orientation by the mark on the SRAM case (24). Perform date and time setting procedure in accordance with the 3.8.

7.2.2.16 Syringe barrel sensor cover installation

Using isopropyl alcohol clean the case surface ensuring all old adhesive residue is removed where the syringe barrel sensor cover (28) will be positioned. Glue the syringe barrel sensor cover (28) using instant glue.

7.3 REAR CASE AND SUB-ASSEMBLIES

7.3.1 Removal instructions

7.3.1.1 Power supply unit and switching power supply removal

Remove the two battery cover screws (61), remove the battery compartment lid (43), disconnect the power supply unit (40) cable and withdraw the battery unit (42).

Remove the cable from the battery unit compartment. Disconnect the mains filter unit (37) and 12VDC & Nurse call unit (35) connection. Unscrew the nut (50) and disconnect power supply unit (40) grounding wire from the potential equalization connector. Remove the six power supply unit (40) retaining screws (61). Carefully withdraw the power supply unit (40) from the rear case.

Disconnect power supply unit (40) connection from the switching power supply (41). Remove the four switching power supply (41) retaining screws (53) and nuts (70). Remove the switching power supply (41).

7.3.1.2 Mains filter unit removal

Detach the mains filter unit (37) connector from the switching power supply (41). Remove the retaining clips screws (52). Carefully withdraw the mains filter unit (37) from the rear case.

7.3.1.3 12VDC & Nurse call unit removal

Remove the 12VDC & Nurse call unit (35) retainer screw, disconnect the 12VDC & Nurse call unit (35) cable from power supply unit (40) and withdraw the 12VDC & Nurse call unit (35). In order to detach strings of the RS232 connector cap (46) and 12 VDC&Nurse call connector cap (47), unscrew the screw (69) with the nut (70).

7.3.1.4 RS232 connector unit removal

Remove the RS232 connector unit screws (51) and carefully withdraw the RS232 connector unit (34).

7.3.1.5 Piezotransducer unit removal

The piezotransducer (30) is glued to the rear case. Using the small knife carefully remove the piezotransducer (30) from the rear case.

7.3.2 Fitting instructions

7.3.2.1 Piezotransducer unit installation

Clean the case surface where the piezotransducer (30) should be positioned. Glue the piezotransducer (30) using instant adhesive.

7.3.2.2 RS232 connector unit installation

Fit the RS232 connector unit (34) and secure with the screws (51).

7.3.2.3 12VDC & Nurse call unit installation

Fit the 12VDC & Nurse call unit (35) and secure with the retainer screw via washer (82). Connect the 12VDC & Nurse call unit (35) cable into the power supply unit (40). Fix the strings of the RS232 connector cap (46) and 12 VDC&Nurse call connector cap (47) using screw (69) washer (75) and nut (70).

7.3.2.4 Mains filter unit installation

Insert the mains filter unit (37) into the rear case and secure with retaining clips screws (52) via washers (81) and fix the retaining clips (52). Connect the mains filter unit (37) connector to the switching power supply unit (41).

7.3.2.5 Power supply unit and switching power supply installation

Fix the switching power supply (41) to the supply unit (40) using four screws (53), nuts (70), spacers (74) and washers (78). Connect power supply unit (40) cable to the switching power supply (41).
Carefully insert the power supply unit (40) into the rear case. Fix the six retaining screws (61) and connect the mains filter unit (37) and 12VDC & Nurse call unit (35) connections. Fix the power supply unit (40) grounding wire to the potential equalization connector using nut (50) and washer (80). Insert the power supply unit (40) wire into the battery unit (42) compartment. Insert the battery unit (42) and connect the power supply unit (40) wire. Ensure that the seal (45) between the battery compartment lid (43) and the rear case is correctly positioned. Fit the battery compartment lid (43) and secure with the two screws (61). Perform battery calibration procedure in accordance with the 4.3.4.

7.4 Torque guide

The following list outlines the torque levels established during product manufacture. NOTE: These values are for the first insertion of screws and fasteners. When selecting a torque for servicing activity, be aware that refastening will require slightly less torque than the initial manufacture.

Over-tightening of screws and fasteners can cause damage. The manufacturer cannot be held responsible for such damage caused.

Front Case Assembly:

Stage Description	Component Description	Part No	Qty	Established Process Torque
Secure Electronic board	Screw ISO 7049 ST2,9x9,5-F-Z	B1000219	5	40cNm
Secure display unit	Screw ISO 7045 M3x6	B1000041	4	30cNm
Secure syringe clamp	Screw ISO 7046 M2,5x10	B1000108	1	50cNm
Secure syringe size sensor	Screw ISO 7049 ST2,9x6,5-F-Z	B1000217	2	40cNm
Secure Drive Unit board	Screw ISO 7045 M3x12	B1000050	1	50cNm
	Screw ISO 7045 M3x6	B1000041	1	50cNm
Secure pusher drive	Screw ISO 1580 M3x20	B1000057	2	30cNm
	Screw ISO 1580 M3x25	B1000059	2	30cNm
Secure syringe support	Screw ISO 1207 M3x12	B1000051	2	30cNm
Secure drive	Screw ISO 7049 ST2,9x9,5-F-Z	B1000219	1	40cNm
	Screw ISO 7049 ST2,9x13-F-Z	B1000220	2	40cNm
Secure motor unit	Screw ISO 7046 M3x12	B1000123	1	40cNm
	Screw ISO 7045 M3x16	B1000013	1	50cNm
	Nut ISO 4032 M3	B1001030	2	50cNm
Secure encoder ruler	Screw ISO7045 M2x8	B1000012	1	40cNm
	Nut ISO4032 M2	B1001010	1	40cNm
Secure sensors unit B6660032	Screw ISO7049 ST2,9x9,5-F-Z	B1000219	1	40cNm
Secure encoder unit	Screw ISO 7045 M3x8	B1000043	1	40cNm
	Nut ISO 4032 M3	B1001030	1	40cNm
Secure barrel sensor	Screw ISO7049 ST2,9x9,5-F-Z	B1000219	1	40cNm

Rear Case Assembly:

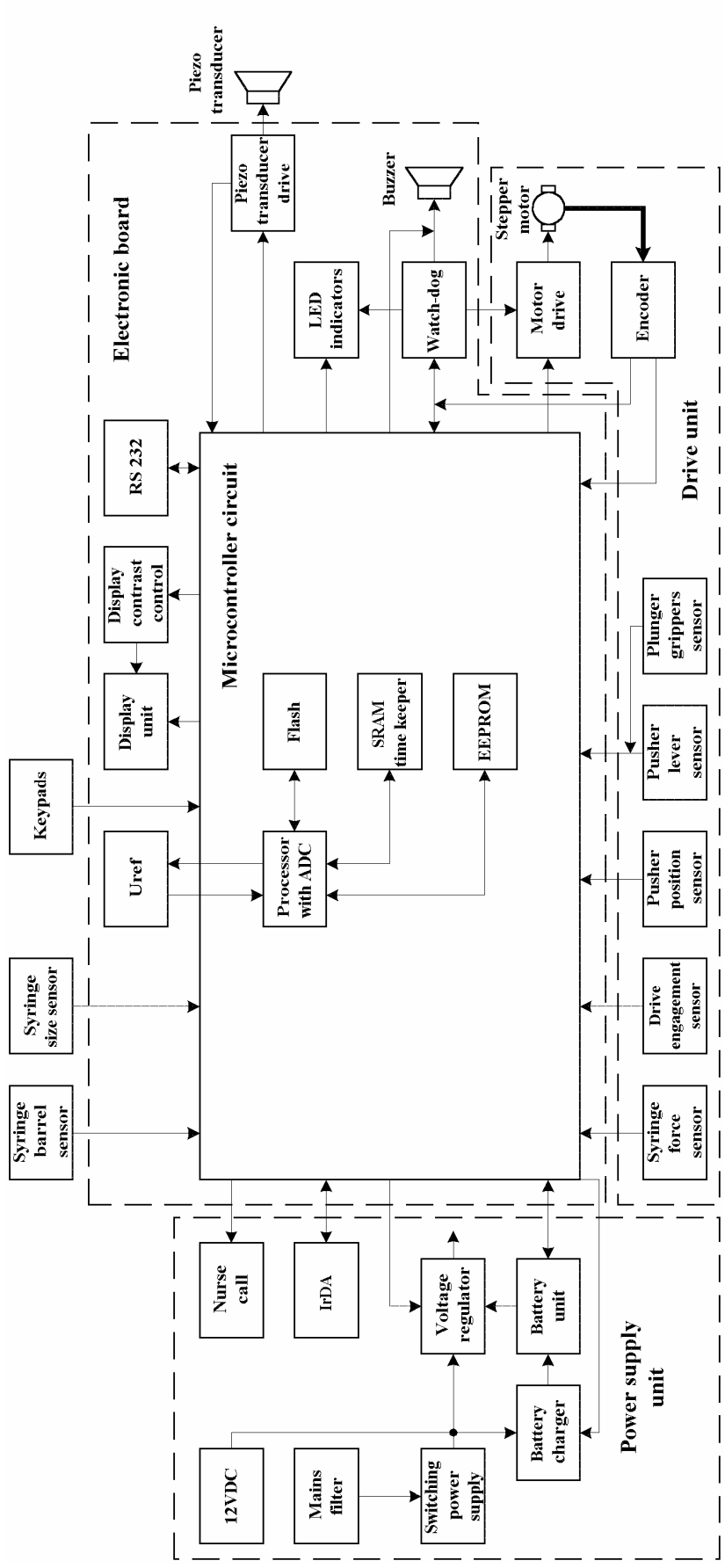
Stage Description	Component Description	Part No	Qty	Established Process Torque
Secure power supply unit	Screw ISO7049 ST2,9x9,5-F-Z	B1000219	6	40cNm
Secure mains filter unit	Nut S5 (1KT0006)	L5555022	2	50cNm
Secure RS232 connector unit	Nut S4,5 (FCN770-A07)	L5555023	2	50cNm
Secure switching power supply	Screw ISO 7046 M3x16	B1000125	4	50cNm
	Nut ISO 4032 M3	B1001030	4	50cNm
Secure power supply unit grounding wire	Nut ISO 4032 M6	B1001060	1	1Nm

Final Assembly:

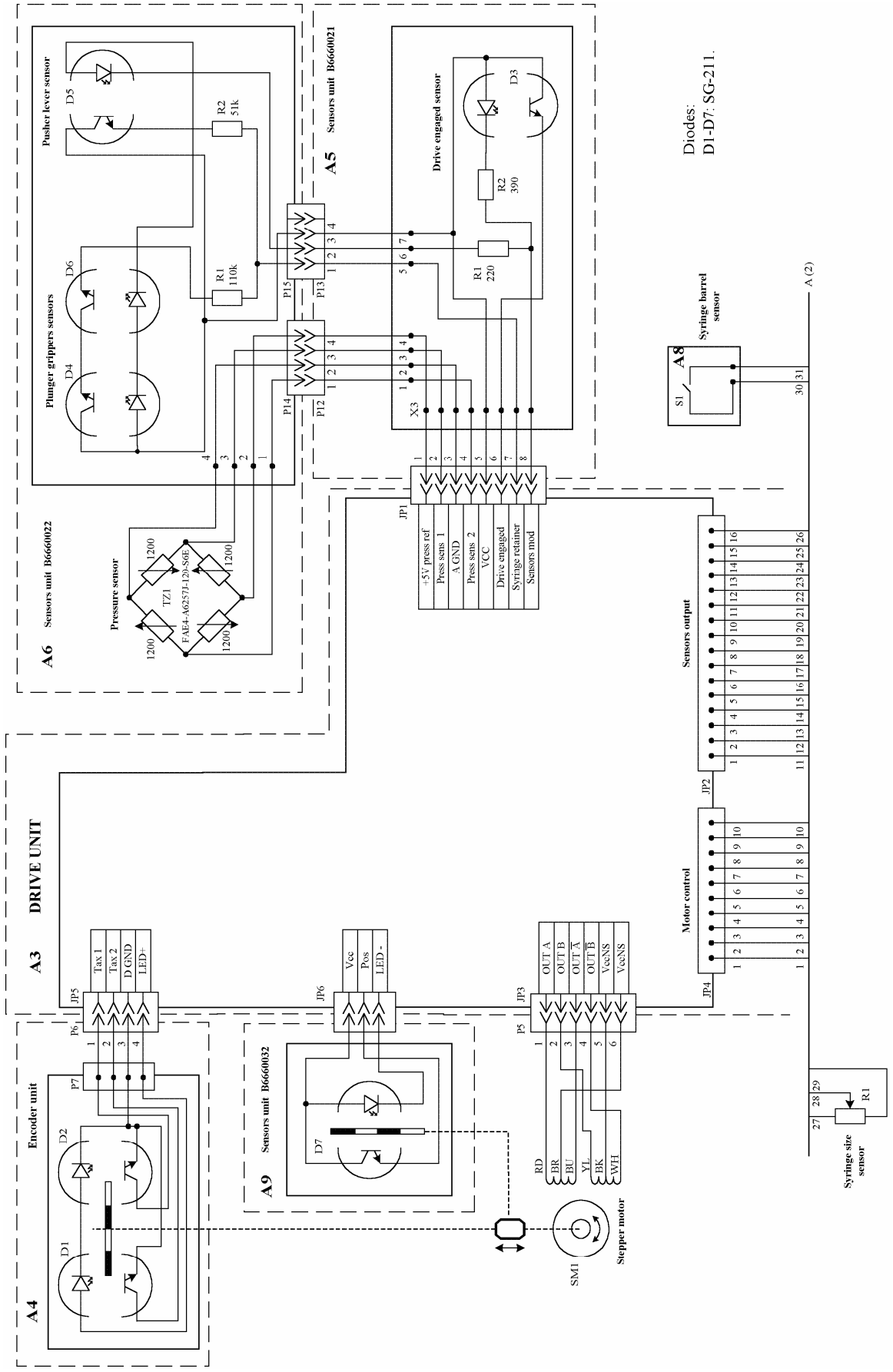
Stage Description	Component Description	Part No	Qty	Established Process Torque
Secure battery compartment lid	Screw ISO 7049 ST2,9x9,5-F-Z	B1000219	2	40cNm
Secure Front Case to Rear case	Screw ISO7045 M4x10	B1000062	6	1Nm

8. ELECTRICAL SCHEMATIC DIAGRAMS, COMPONENT LOCATION DIAGRAMS

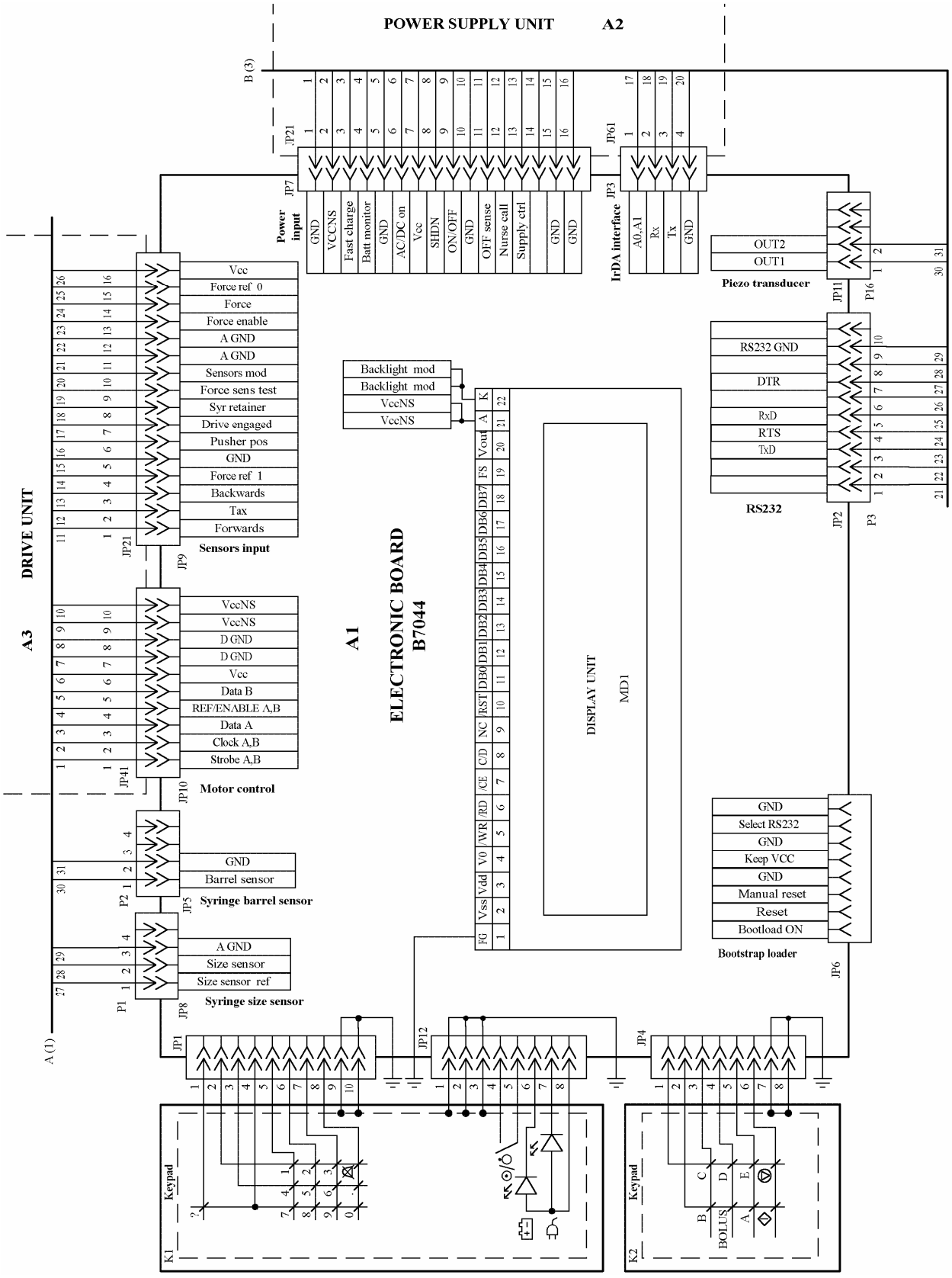
8.1. ELECTRICAL BLOCK DIAGRAM OF THE PUMP



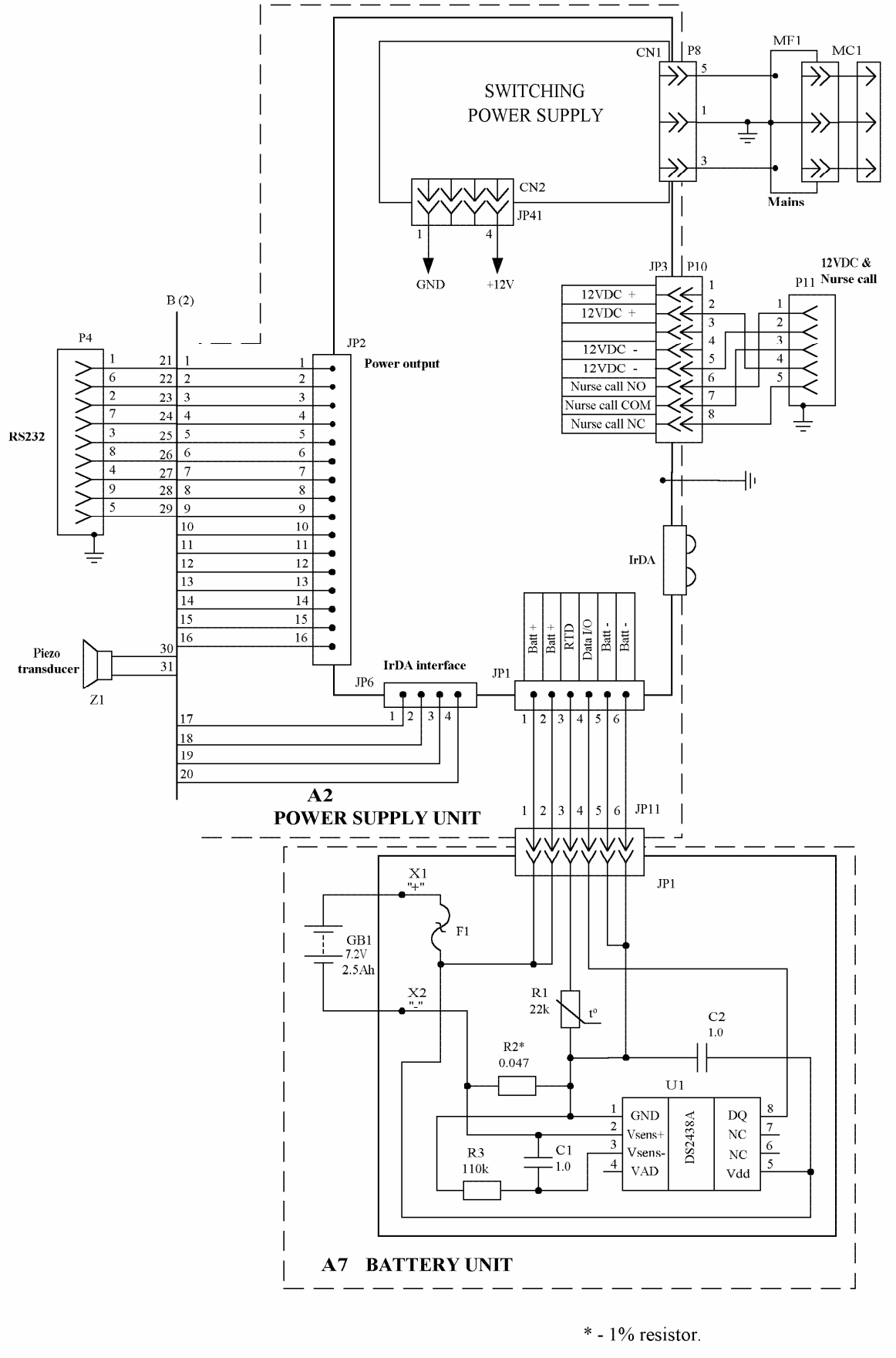
8.2. ELECTRICAL SCHEMATIC DIAGRAM OF THE PUMP



ELECTRICAL SCHEMATIC DIAGRAM OF THE PUMP (CONTINUED)

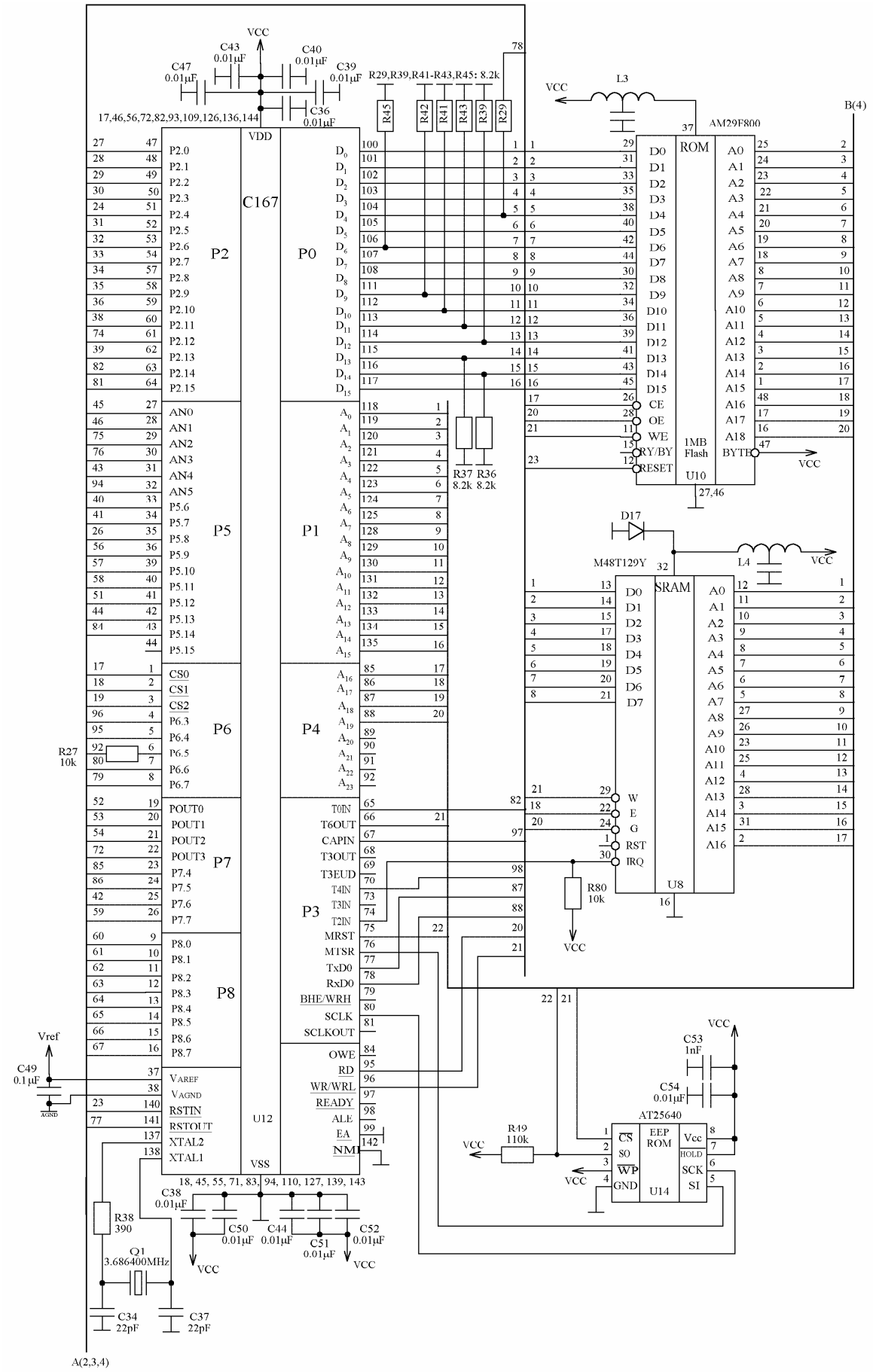


ELECTRICAL SCHEMATIC DIAGRAM OF THE PUMP (CONTINUED)

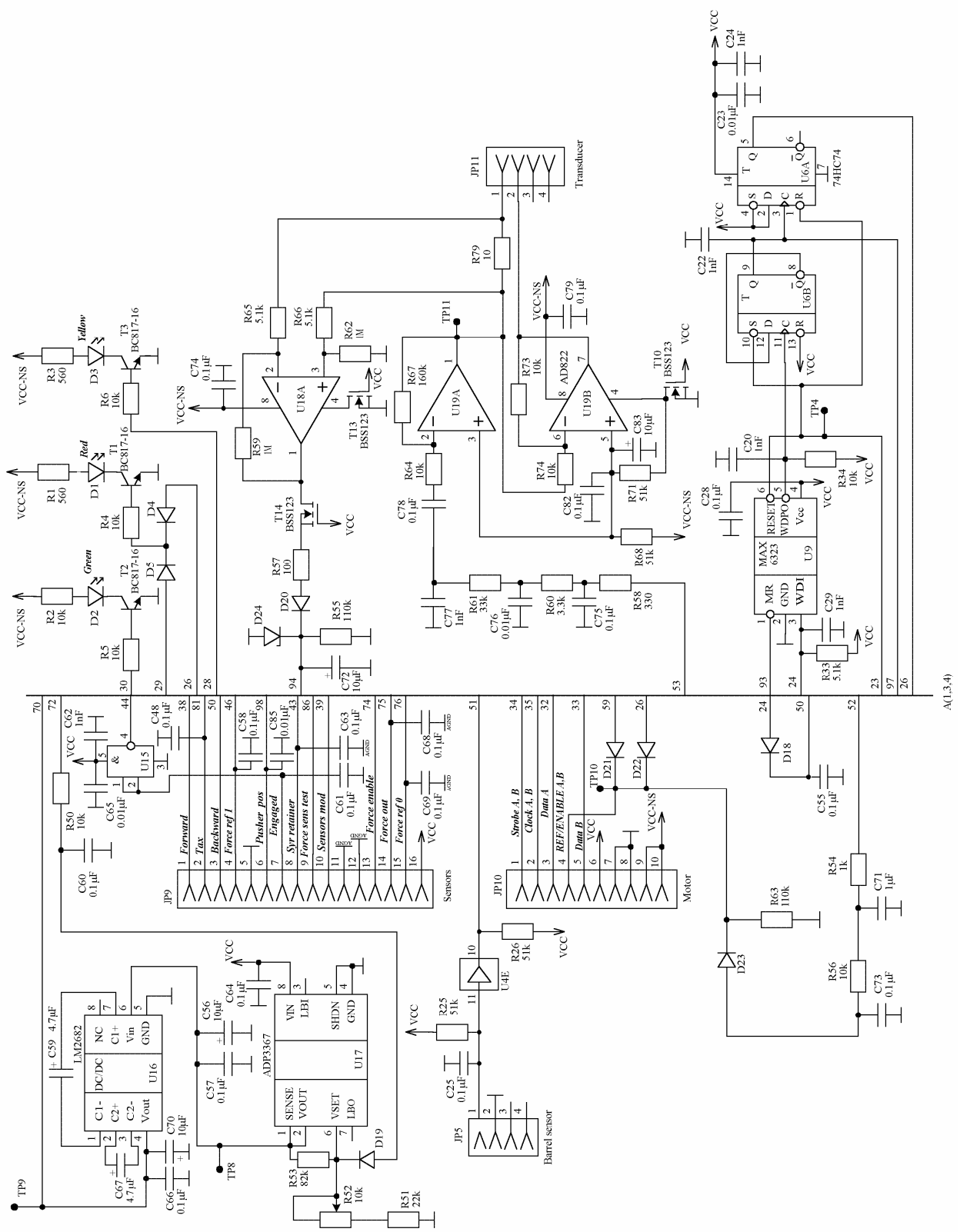


* - 1% resistor.

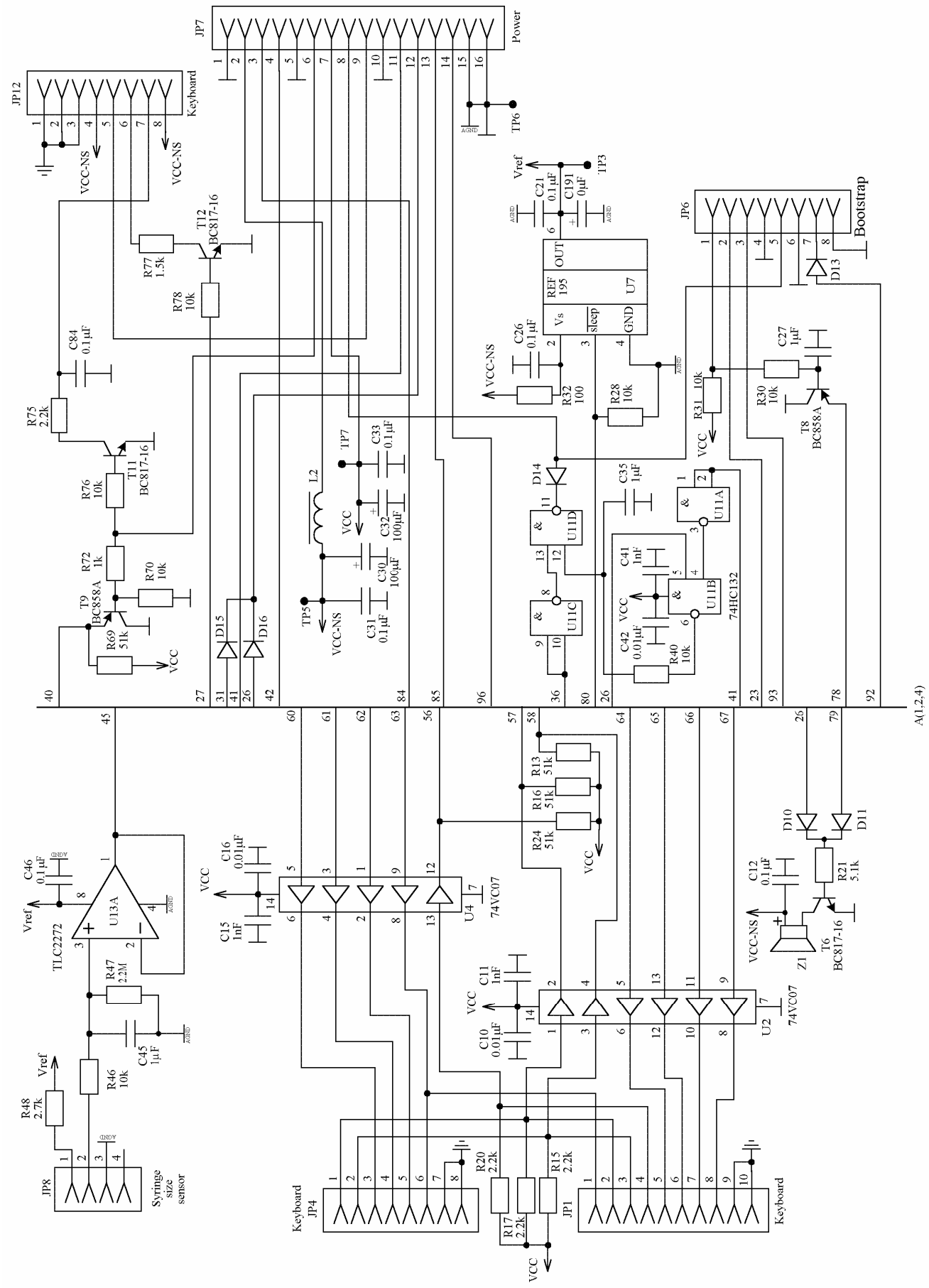
8.3.ELECTRONIC BOARD SCHEMATIC DIAGRAM



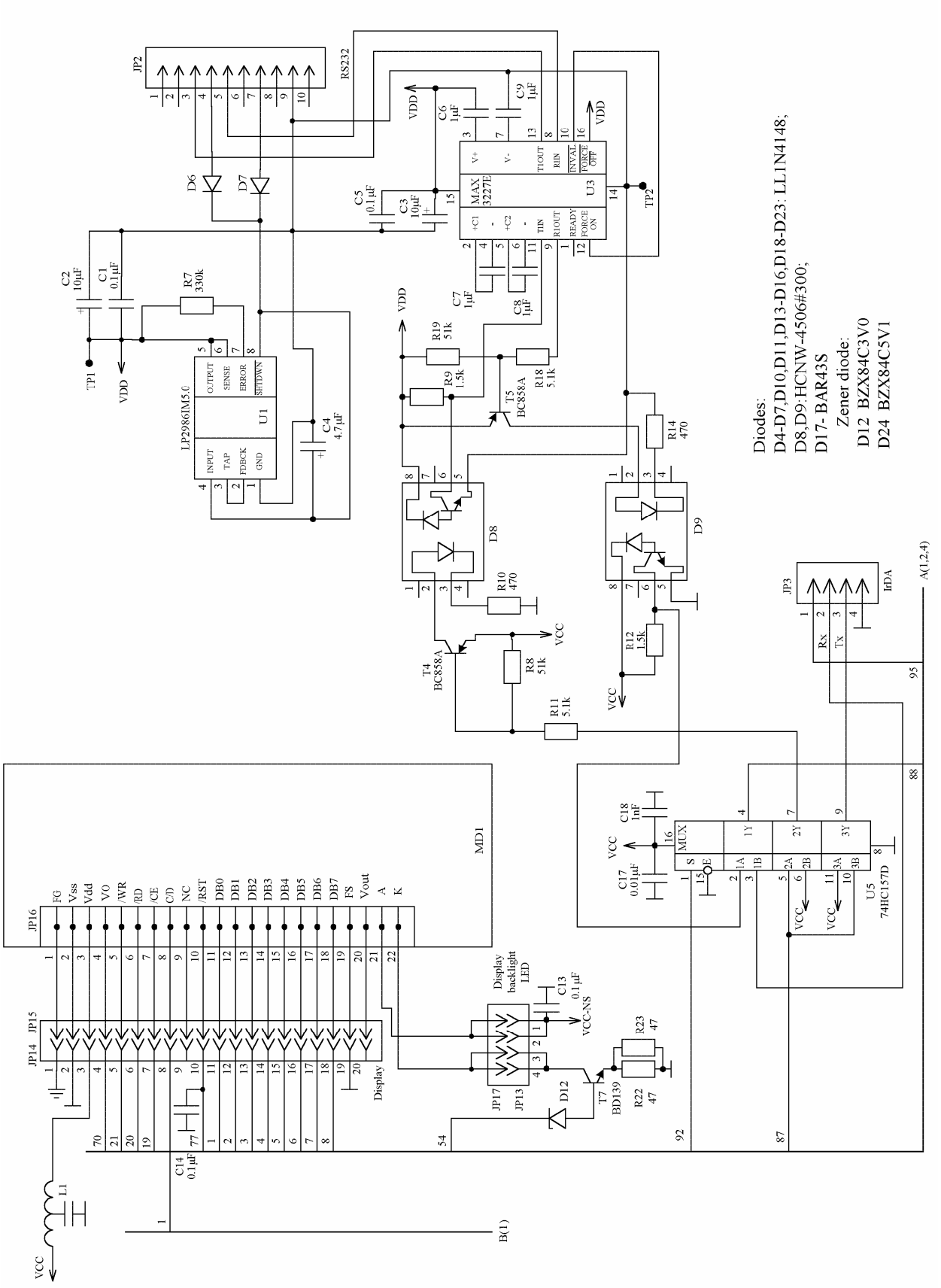
ELECTRONIC BOARD SCHEMATIC DIAGRAM (CONTINUED)



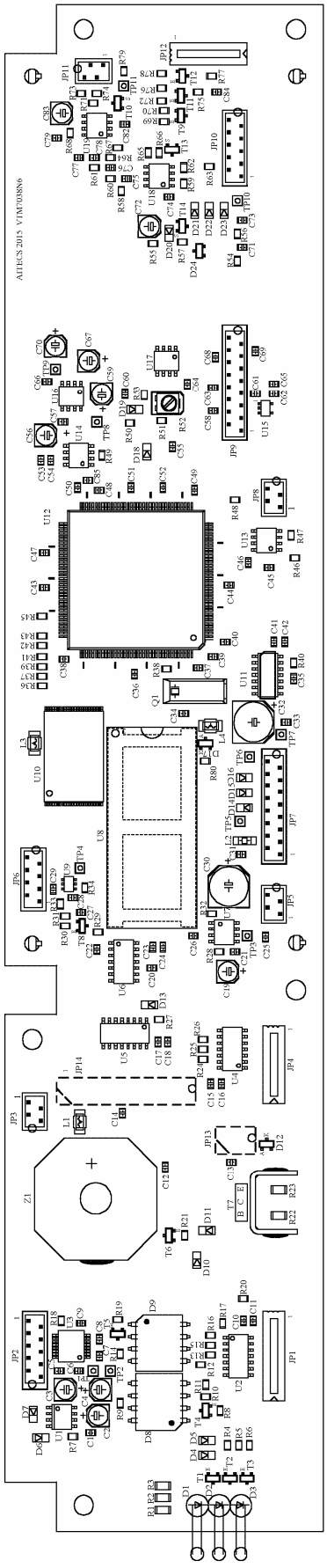
ELECTRONIC BOARD SCHEMATIC DIAGRAM (CONTINUED)



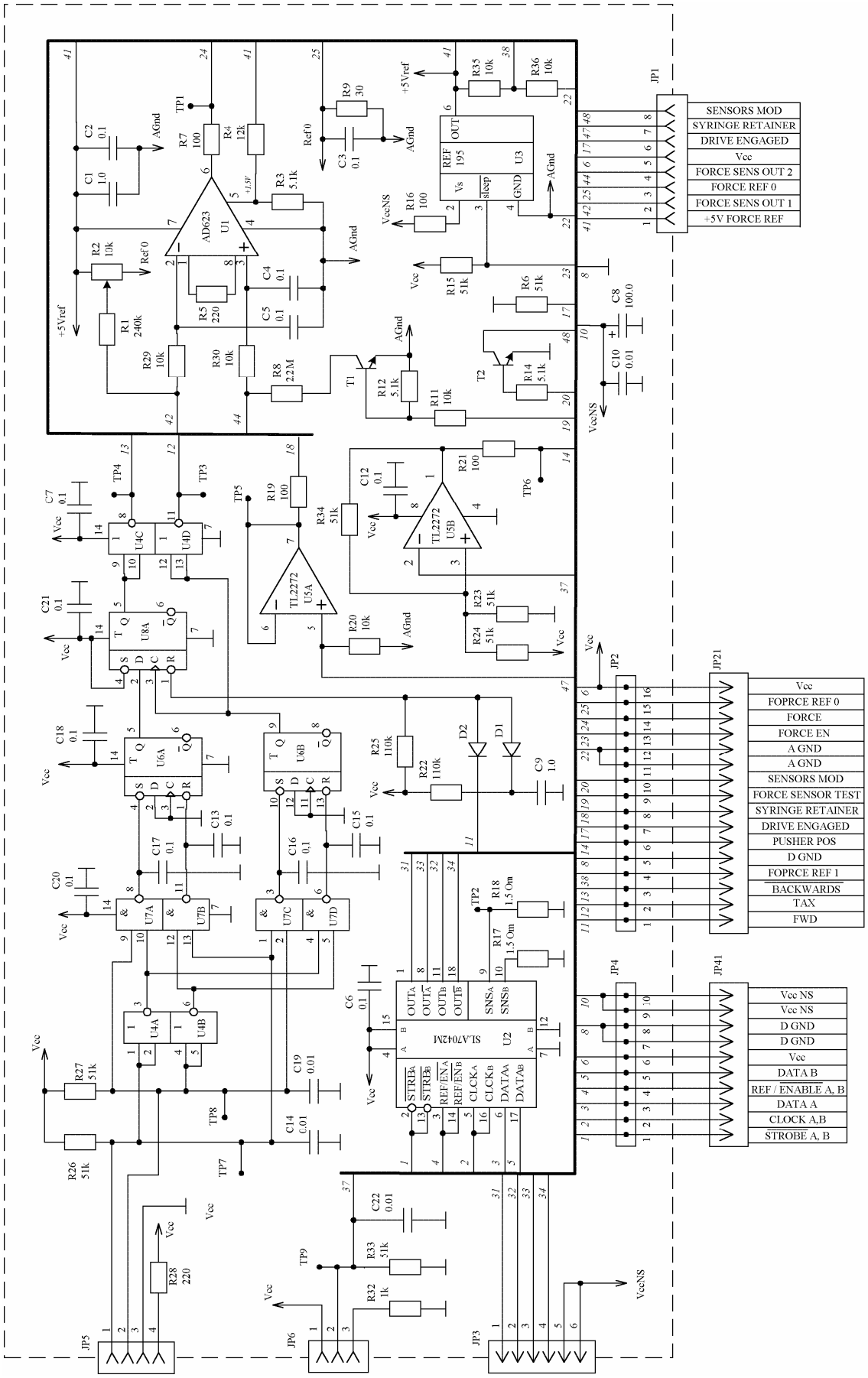
ELECTRONIC BOARD SCHEMATIC DIAGRAM (CONTINUED)



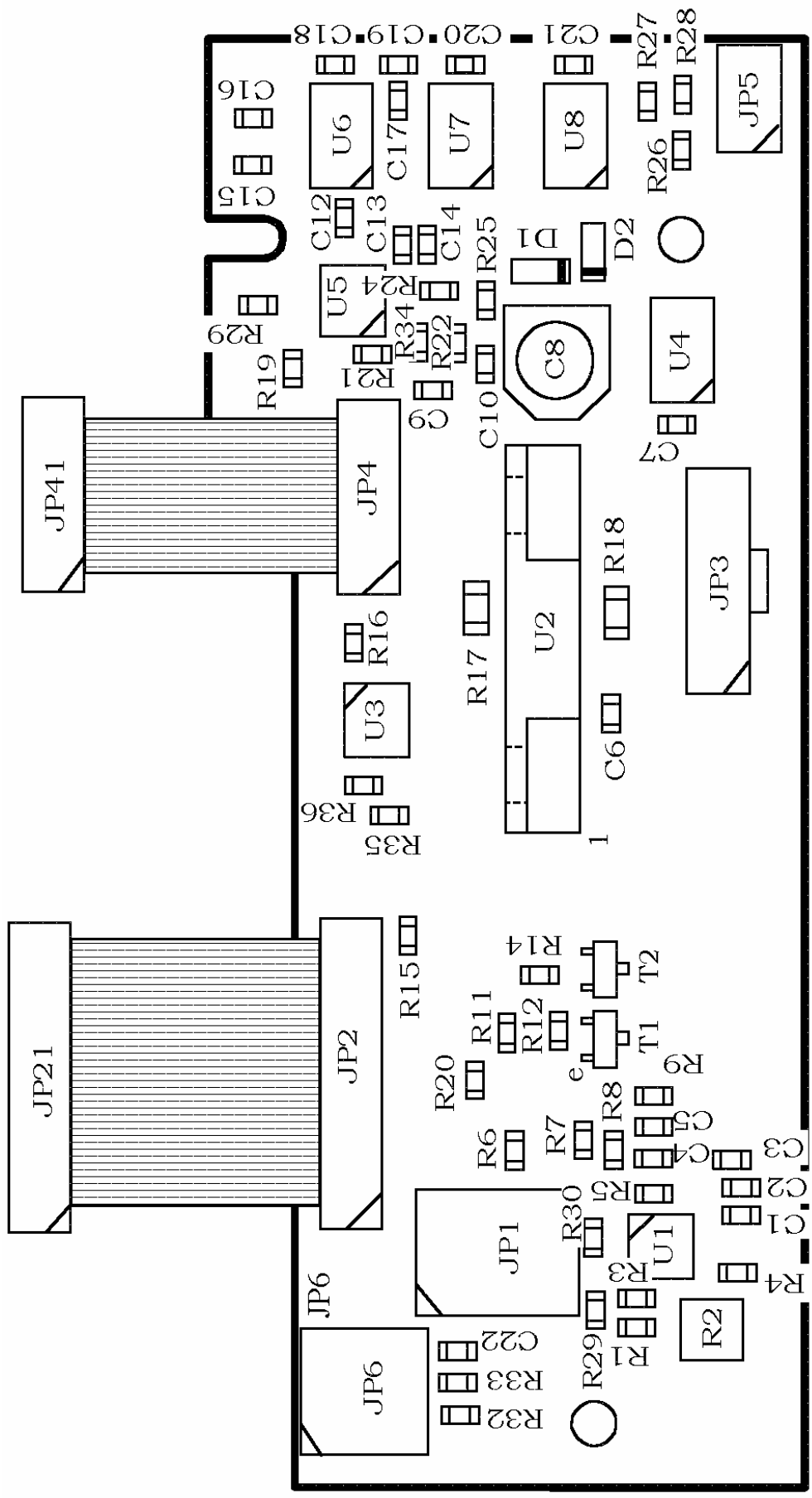
8.4.ELECTRONIC BOARD COMPONENT LOCATION DIAGRAM



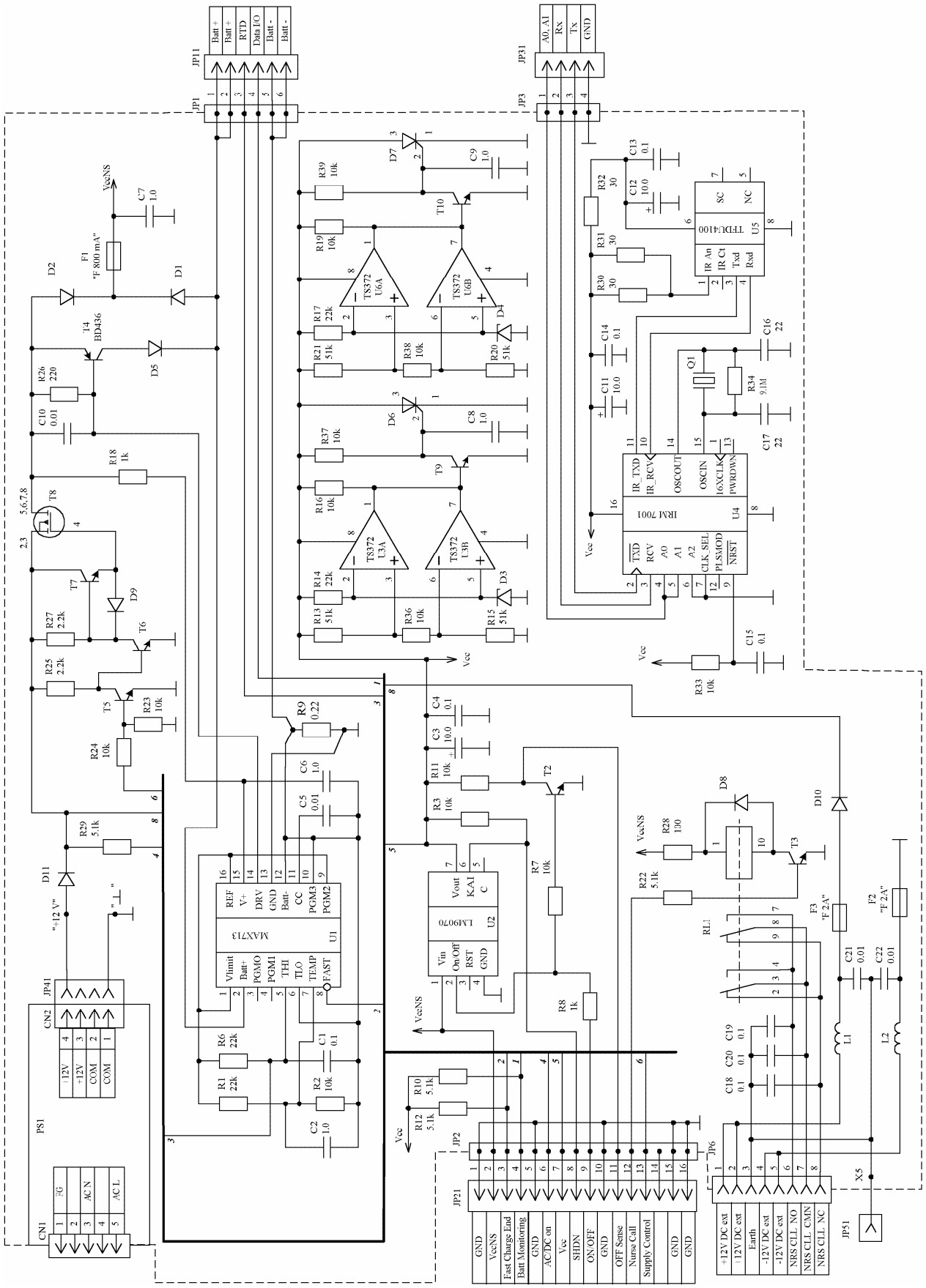
8.5.DRIVE UNIT BOARD SCHEMATIC DIAGRAM



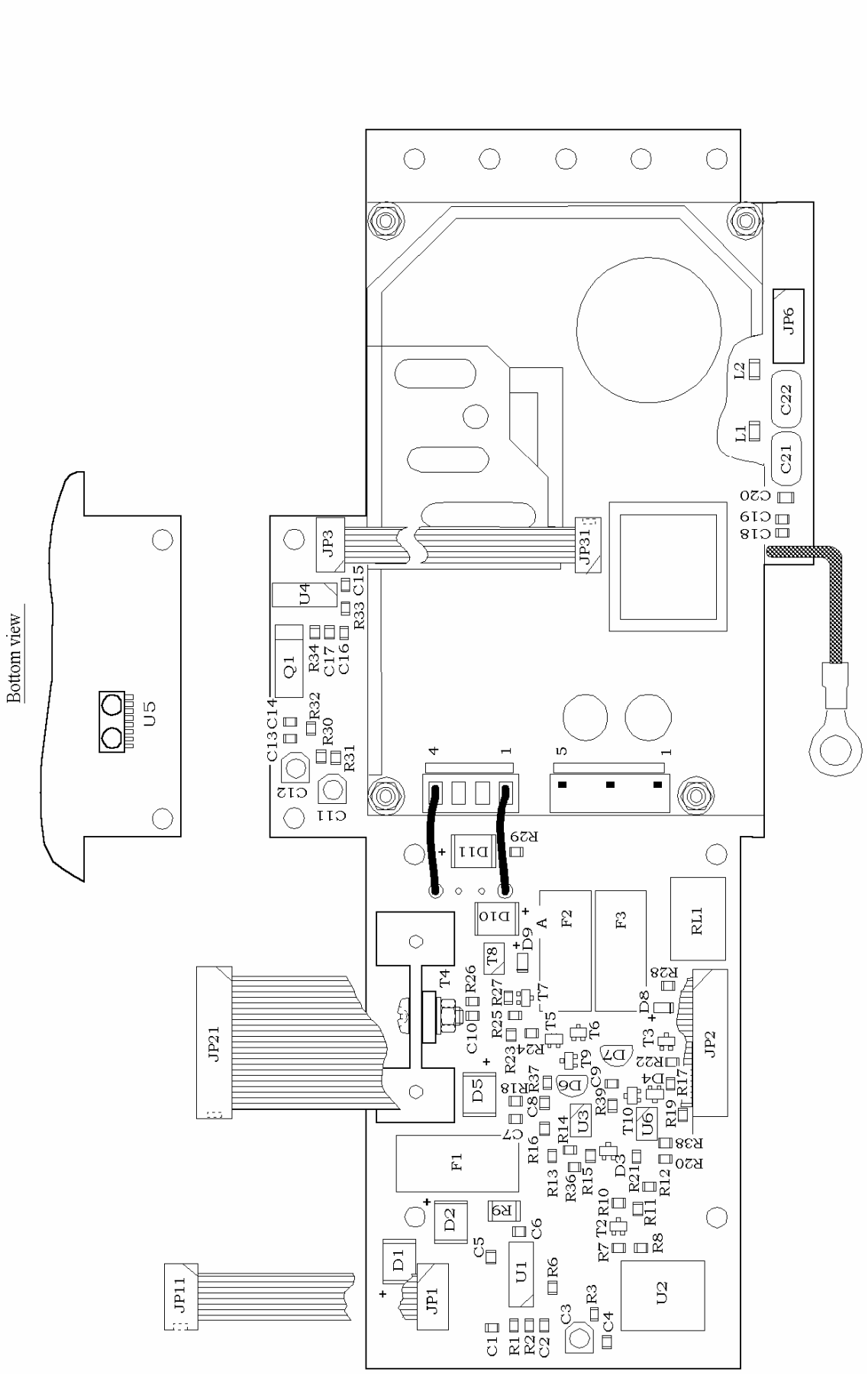
8.6. DRIVE UNIT BOARD COMPONENT LOCATION DIAGRAM



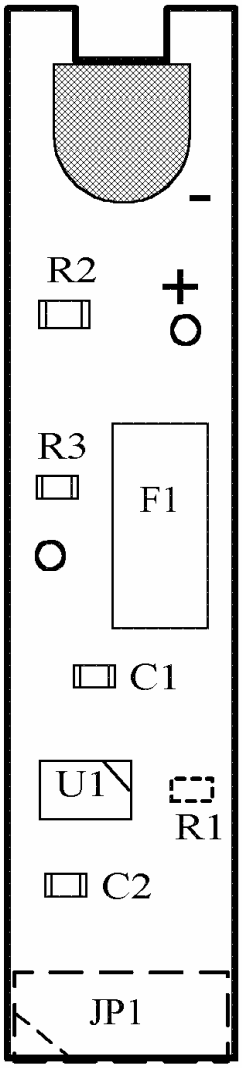
8.7.POWER SUPPLY UNIT SCHEMATIC DIAGRAM



8.8.POWER SUPPLY UNIT COMPONENT LOCATION DIAGRAM



8.9.BATTERY MONITORING UNIT COMPONENT LOCATION DIAGRAM



9. MECHANICAL ASSEMBLY DRAWINGS AND PART LIST

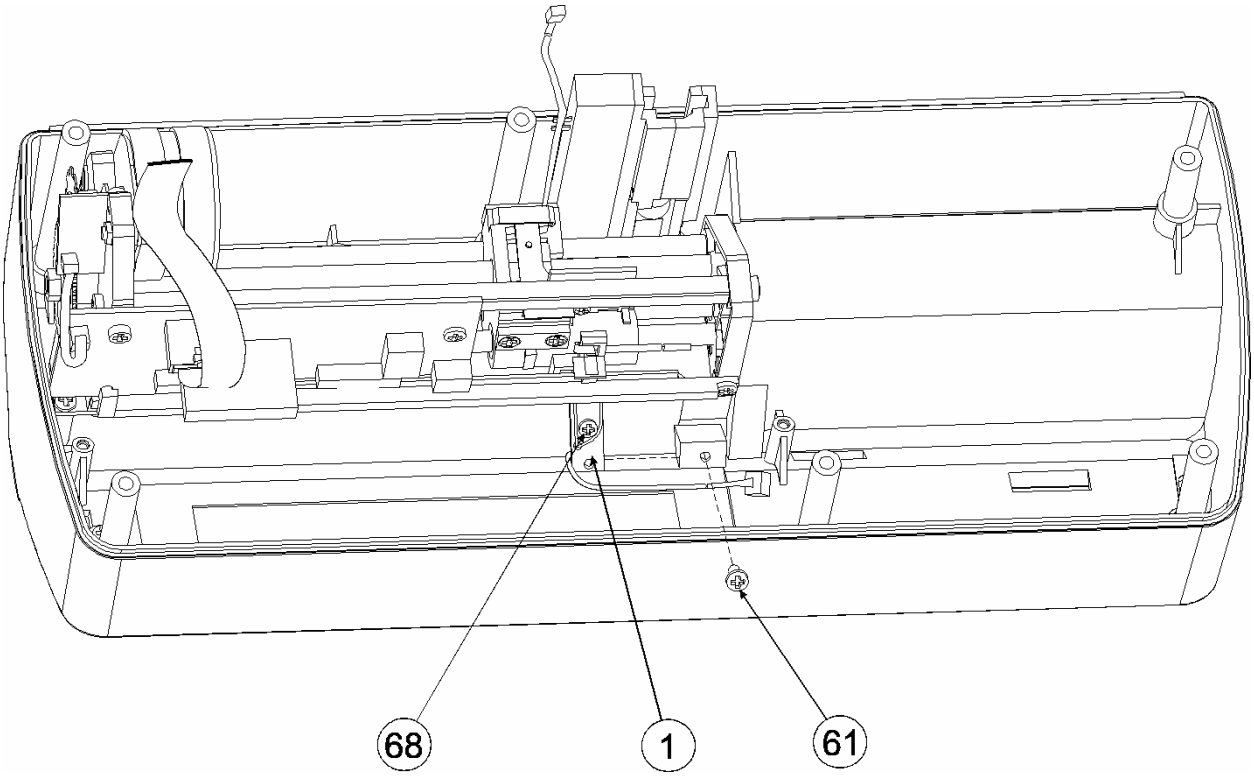
9.1. PART LIST

REFERENCE	PART NUMBER	DESCRIPTION	QUANTITY
1	B6660024	Syringe barrel sensor	1
3	B6660026	Encoder unit	1
5	B6670007	Motor unit	1
6	V8413101	Motor belt	1
7	B6290002	Encoder ruler	1
8	B6660032	Sensors unit	1
9	B8247019	Ring	1
10	B6337021	Drive	1
11	B8126037	Syringe support	1
12	B6678003	Syringe pusher	1
13	B8074050	Syringe pusher support	2
15	B6337019	Syringe pusher driver	1
16	B8110033	Plastic screen	1
17	B6900002	Drive Unit board	1
18	B8280007	Shaft	1
19	B6210004	Syringe size sensor	1
20	B8127005	Syringe clamp	1
22	B6800002	Display unit	1
23	B3087044-01	Electronic board (without display unit)	1
24	V5202704	SRAM	1
25	V6675047	Keyboard K1	1
26	V6675048	Keyboard K2 (narrow)	1
28	B8703025	Syringe barrel sensor cover	1
30	B6710007	Piezotransducer unit	1
34	B6680015	RS232 connector unit	1
35	B6680016	12VDC&Nurse call unit	1
37	B6730007	Mains filter unit	1
40	B6340012-01	Power supply unit (without switching power supply)	1
41	V5500700	Switching power supply MPS30-12	1
42	B6341001	Battery unit	1
43	B8178015	Battery compartment lid	1
44	B6400001	Versatile clamp	1
45	V6300310	Silicon gasket (length 1.2m)	1
46	V5511152	Cap RS232	1
47	V5511153	Cap 12VDC&Nurse call	1
48	V6300312	Silicon gasket (length 0.2m)	1
49	B1000051	Screw ISO 1207 M3x12	2
50	B1001060	Nut ISO 4032 M6	1
51	L5555023	Screw kit (FCN770-A07)	1
52	L5555022	Retaining clips with screw kit (1KT0006)	1
53	B1000125	Screw ISO7046 M3x16	4
55	B1000059	Screw ISO 1580 M3x25	2
56	B1000057	Screw ISO 1580 M3x20	2

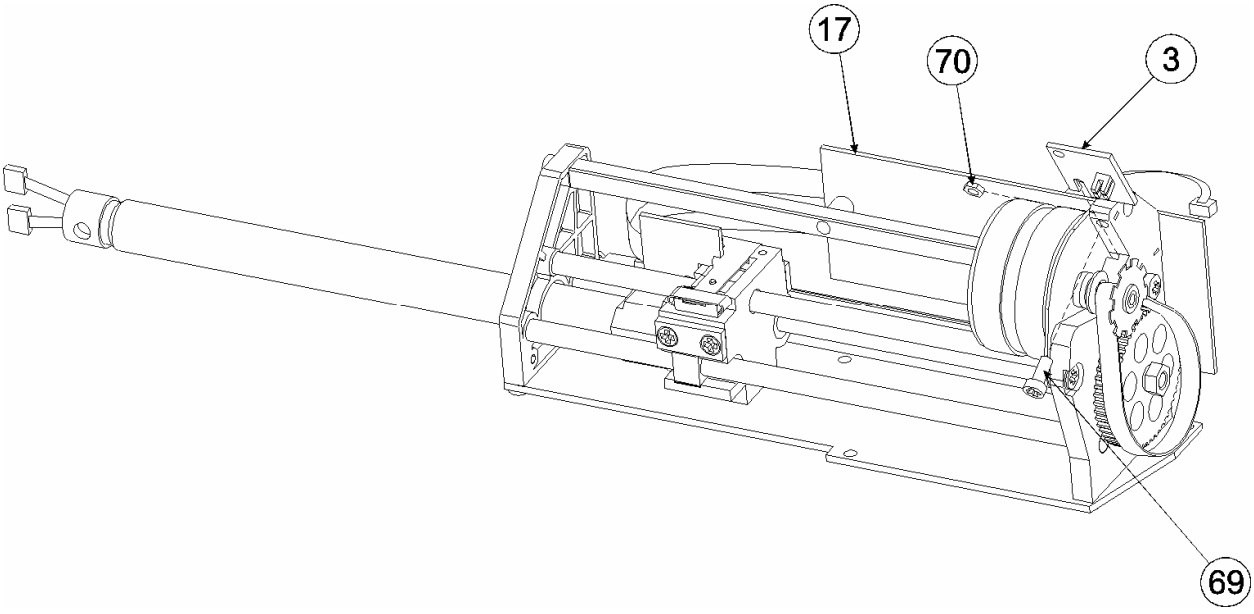
57	B1000220	Screw ISO 7049 ST2,9x13-F-Z	2
58	B1001010	Nut ISO4032 M2	1
59	B1000108	Screw ISO 7046 M2,5x10	1
60	B1000062	Screw ISO7045 M4x10	6
61	B1000219	Screw ISO 7049 ST2,9x9,5-F-Z	16
62	B1000217	Screw ISO 7049 ST2,9x6,5-F-Z	2
63	B1000050	Screw ISO 7045 M3x12	2
64	B1000041	Screw ISO 7045 M3x6	5
66	B1000013	Screw ISO 7045 M3x16	1
67	B1000012	Screw ISO 7045 M2x8	1
68	B1000121	Screw ISO 7046 M3x10	1
69	B1000043	Screw ISO 7045 M3x8	2
70	B1001030	Nut ISO 4032 M3	8
71	B8917003	Damper	6
72	B1002010	Washer ISO 7089 ∅2,2-140HV	1
74	V6300504	Spacer SS6-2	5
75	B1002020	Washer ISO 7089 ∅3.2-140HV	9
76	V8947015	Washer	4
77	B8947028	Washer	5
78	V8947015	Washer ISO 7089 ∅3,2-7	4
79	L5580040	Standoff TCBN-T1-M3-6-7	4
80	B1002260	Washer DIN6798 – A6,4 Fst	1
81	B1002220	Washer DIN6798 – A3,2 Fst	2
82	B8947032	Washer ∅12/18 thickness 0.3	1
83	V6300400	Leg	4
84	L5555024	Clip	1
85	B8180123	Label (serial number)	1
87	B8180125-P01	Label (WARNING, syringes 10-140ml)	1
87	B8180227	Label (WARNING, syringes 5-140ml)	1
88	B8180126	Label (BAXTER LOGO)	1
90	B8180127	Label (RS232)	1
91	B8180136	Label (Do not disassemble)	1
93	B8180139	Label (instruction)	1
94	B8180152	Label (clip)	1
95	B8180205	Label (alignment)	1
96	V8180082	Label (electrostatic)	1
97	V8180085	Label (ground)	1

9.2 FRONT CASE ASSEMBLY

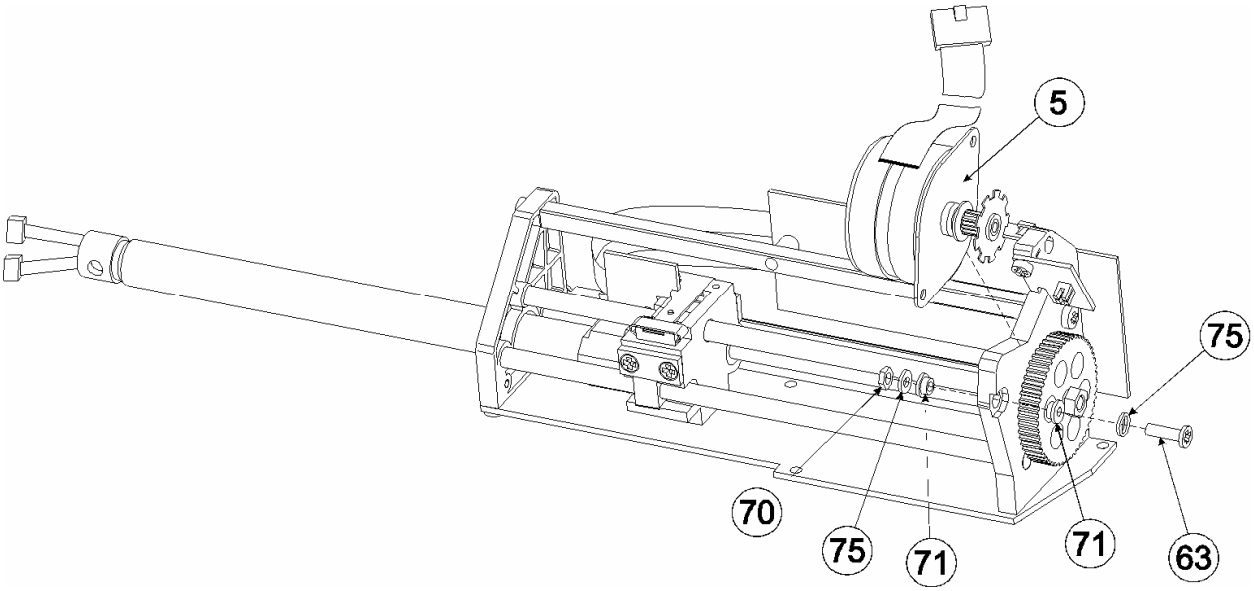
9.2.1 Syringe barrel sensor



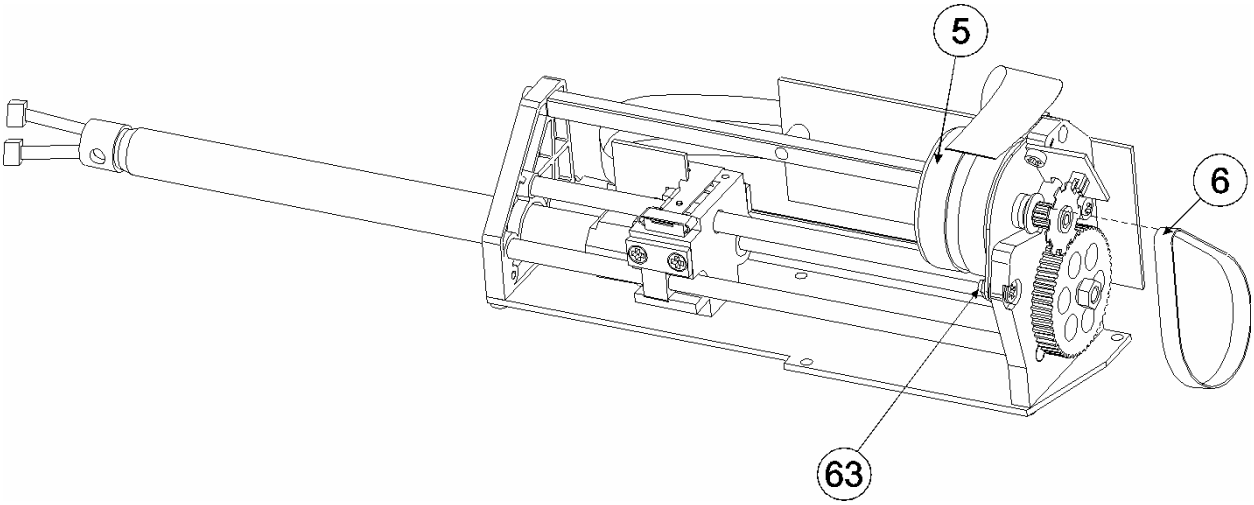
9.2.2 Encoder Unit



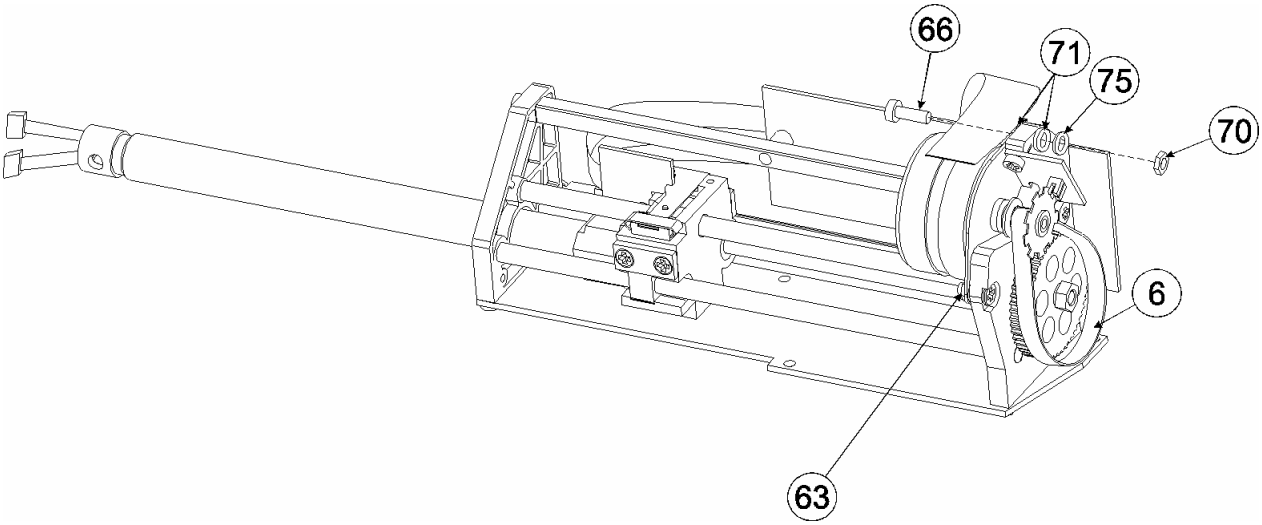
9.2.3 Motor Unit



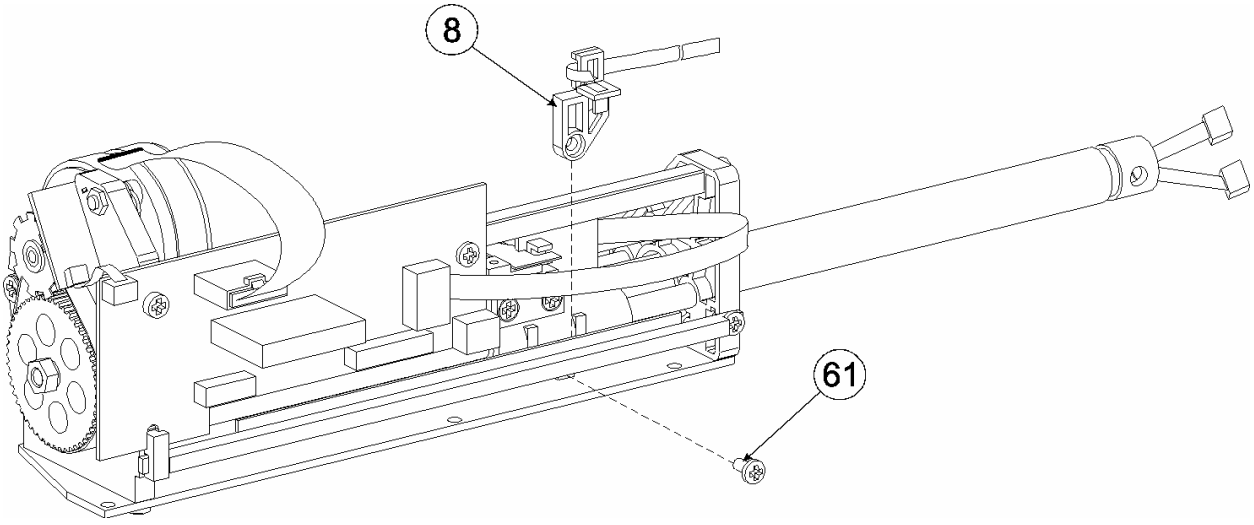
9.2.4 Motor belt



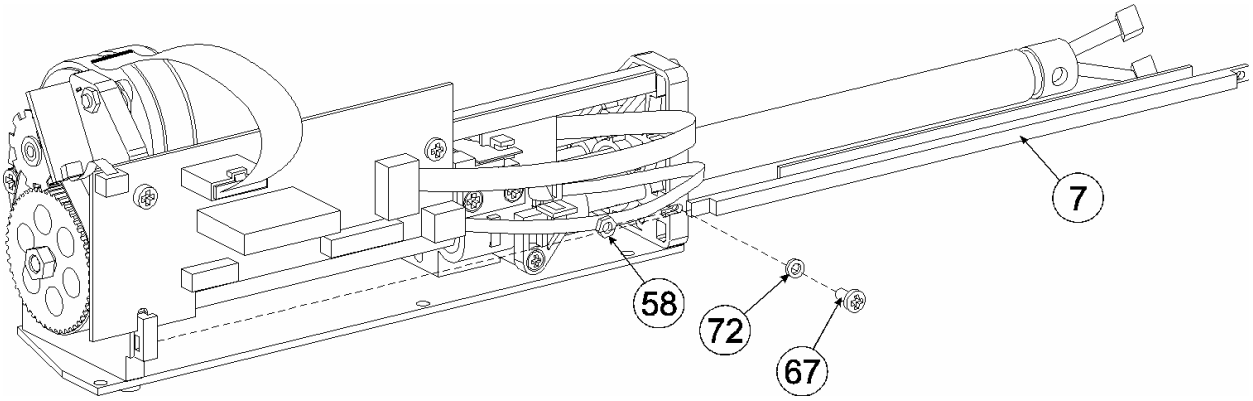
Motor belt (continuation)



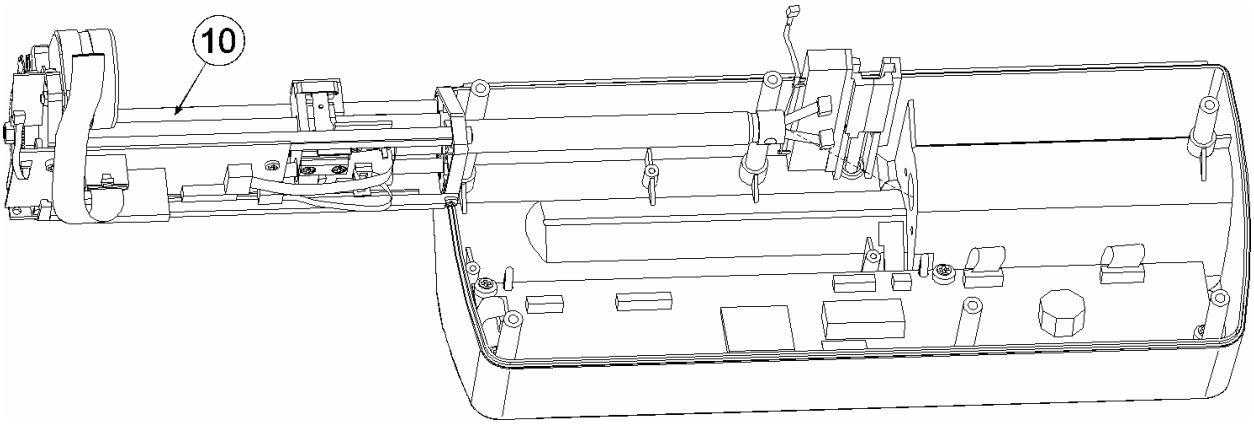
9.2.5 Sensor unit B6660032



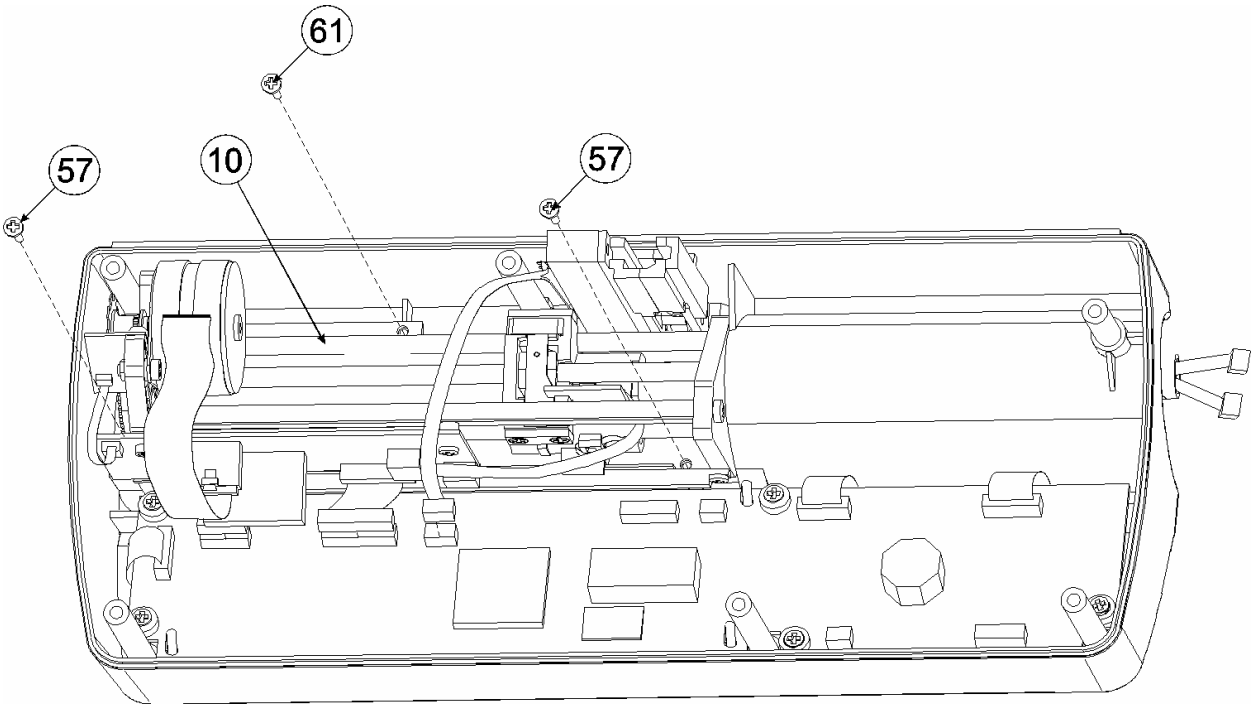
9.2.6 Encoder ruler



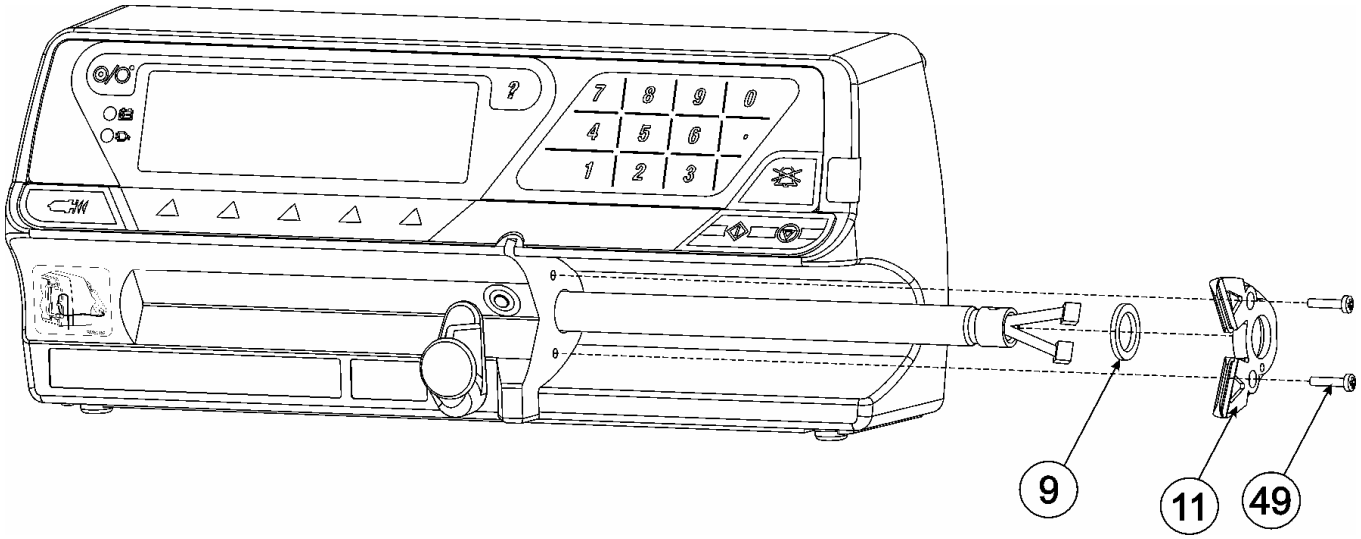
9.2.7 Drive



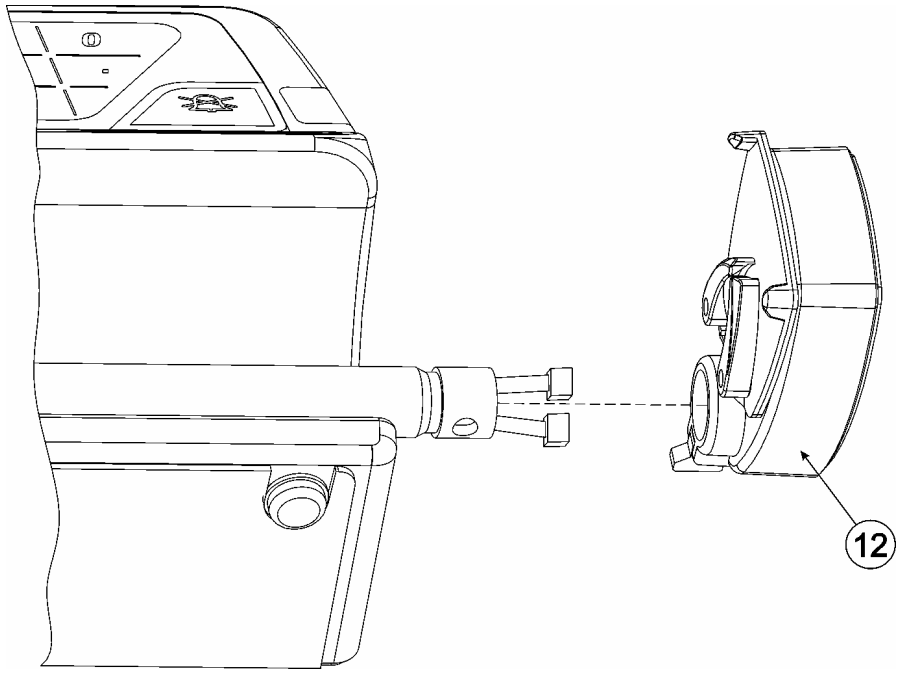
Drive (continuation)



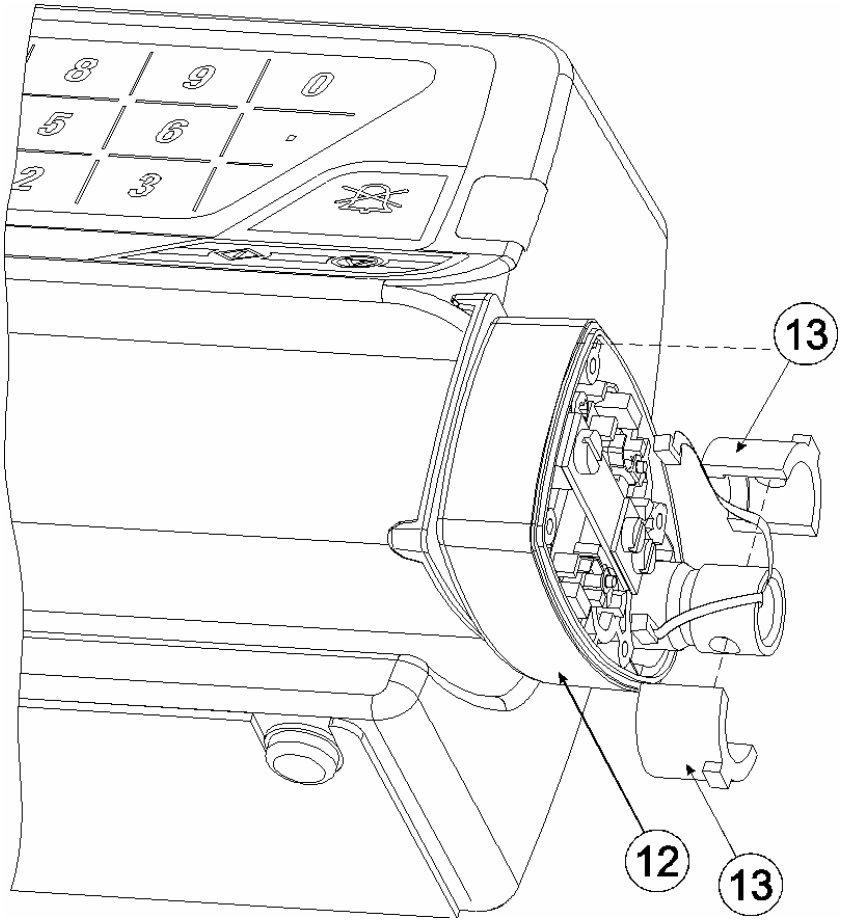
9.2.8 Syringe support



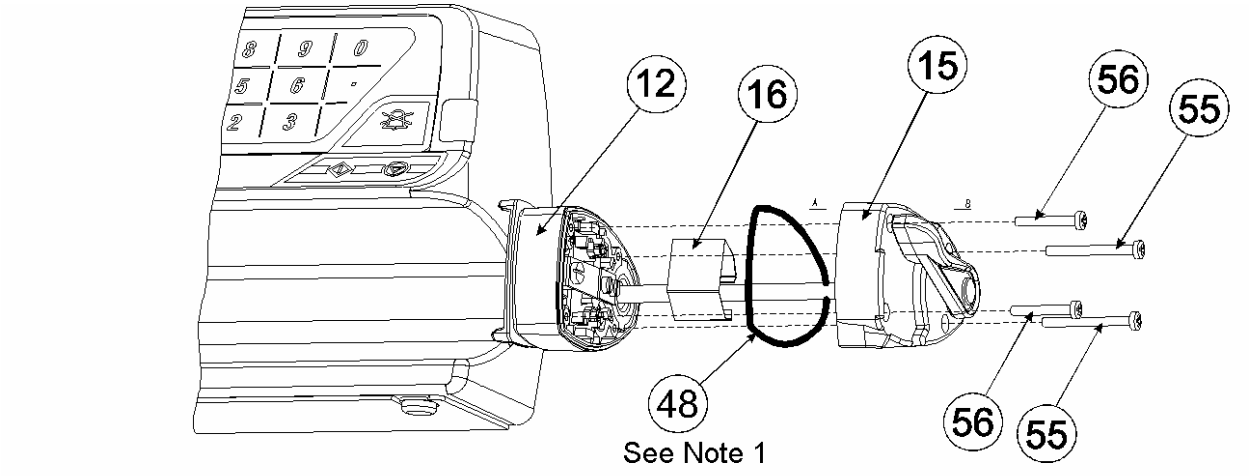
9.2.9 Syringe pusher



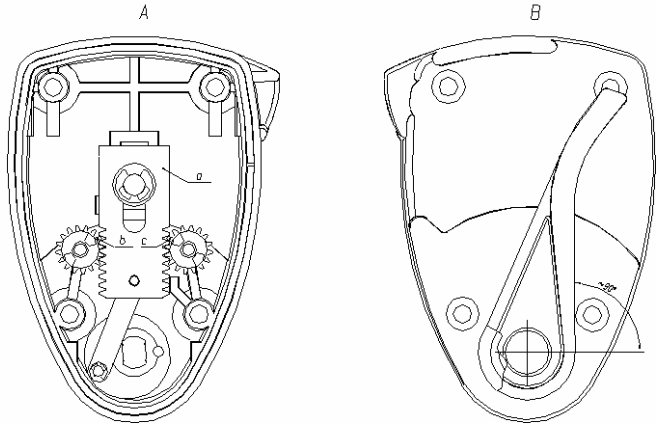
Syringe pusher (continuation)



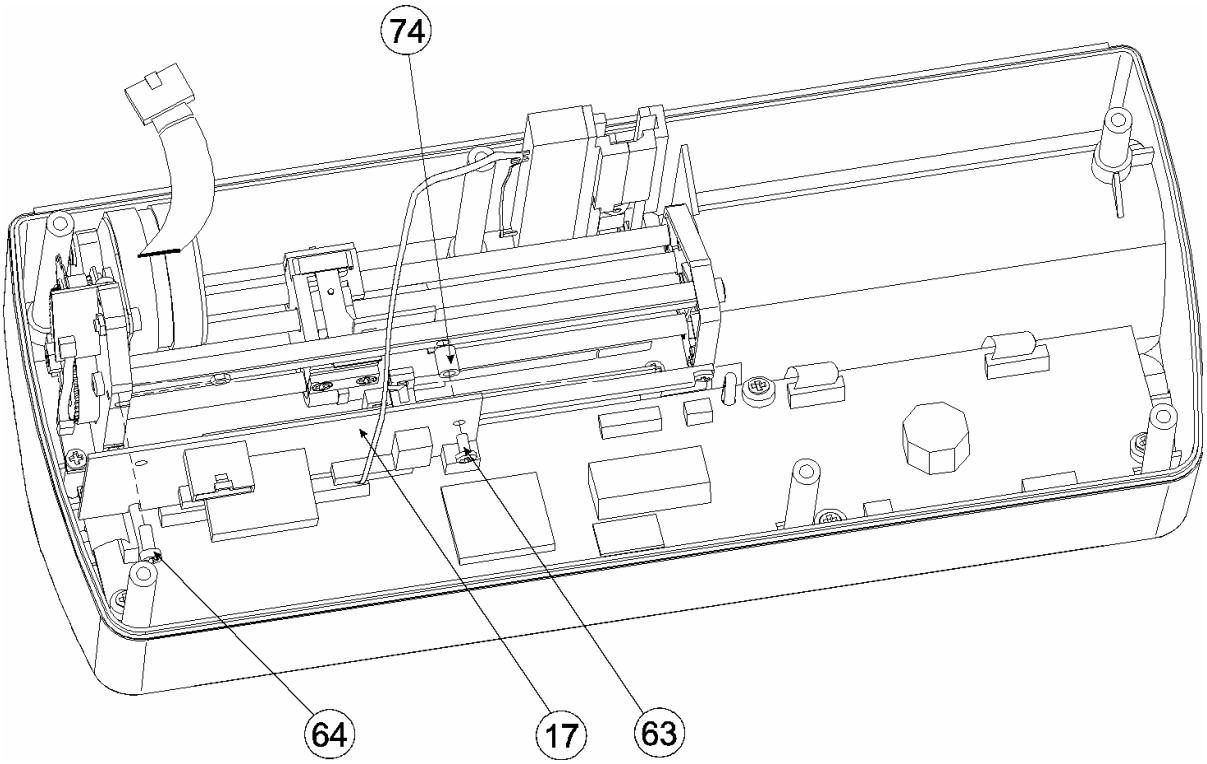
9.2.10 Syringe pusher drive



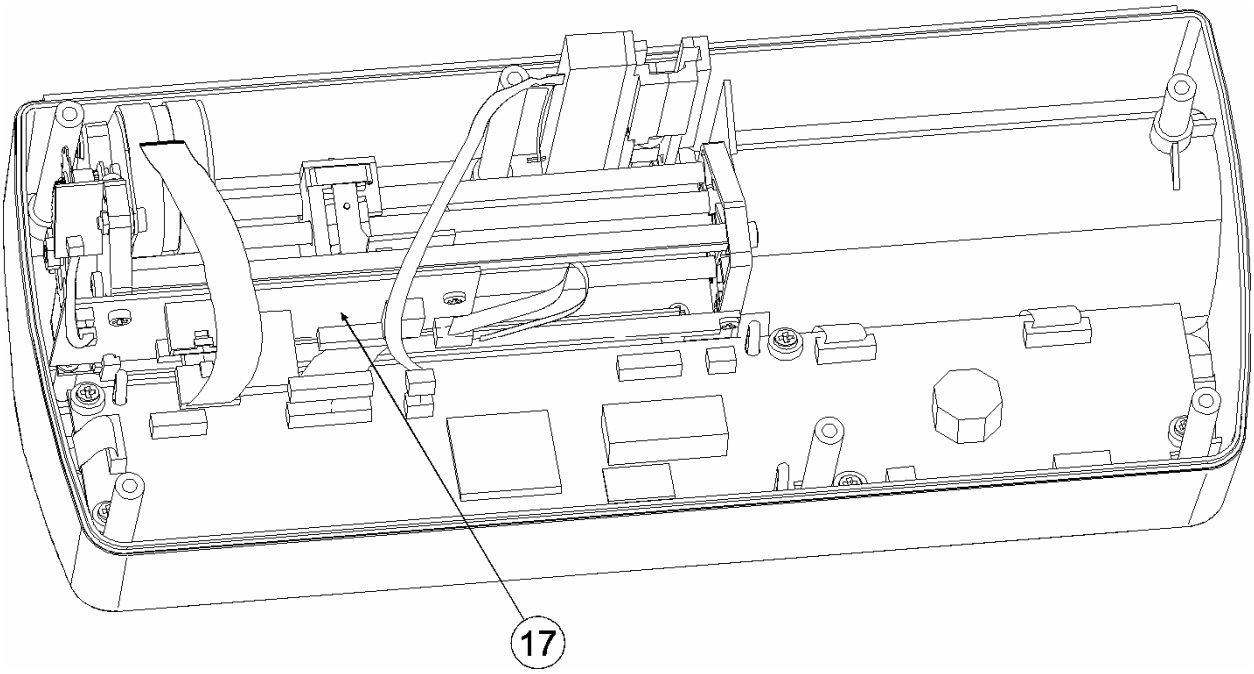
NOTE:
1. Ensure the seal (48) is properly positioned



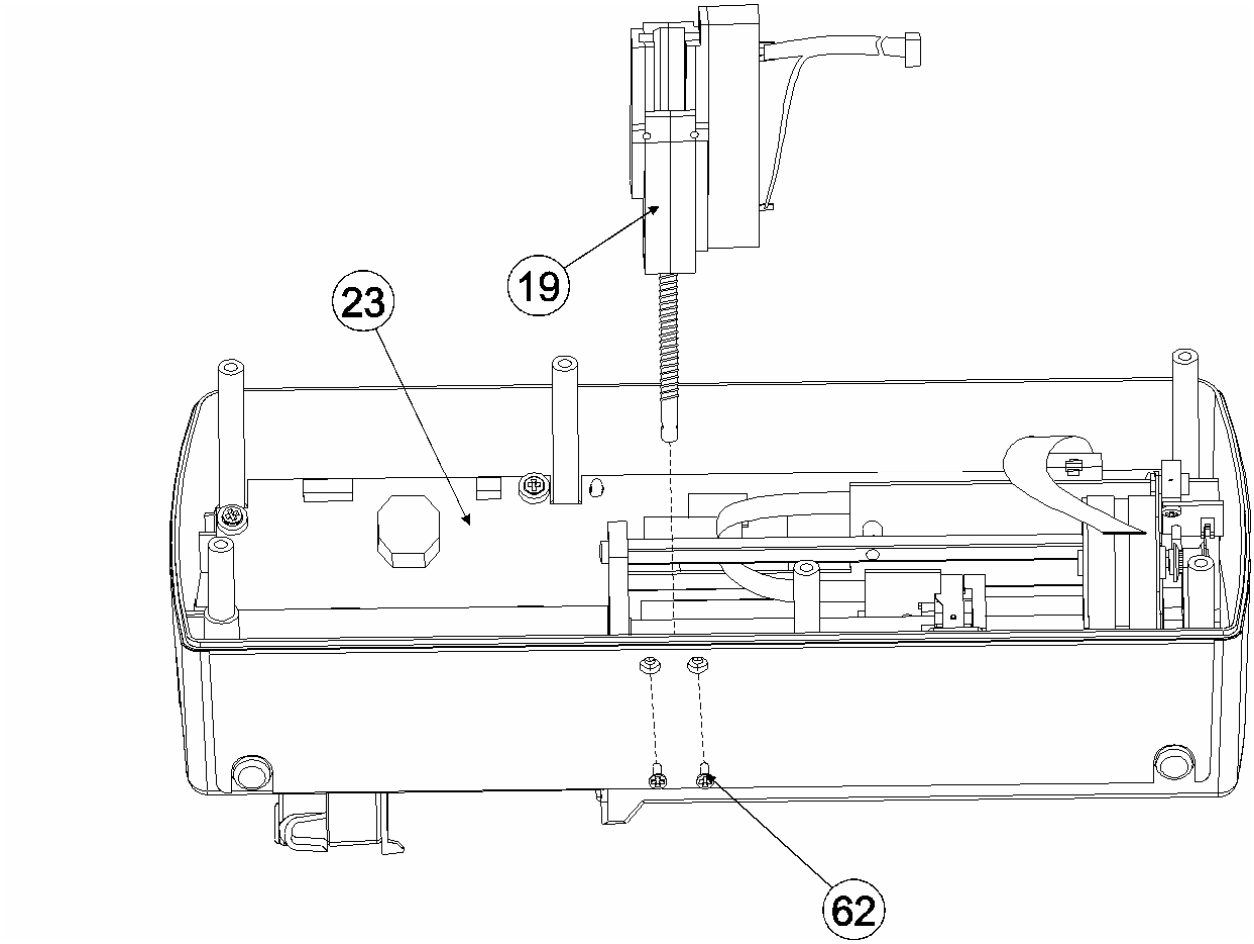
9.2.11 Drive Unit board



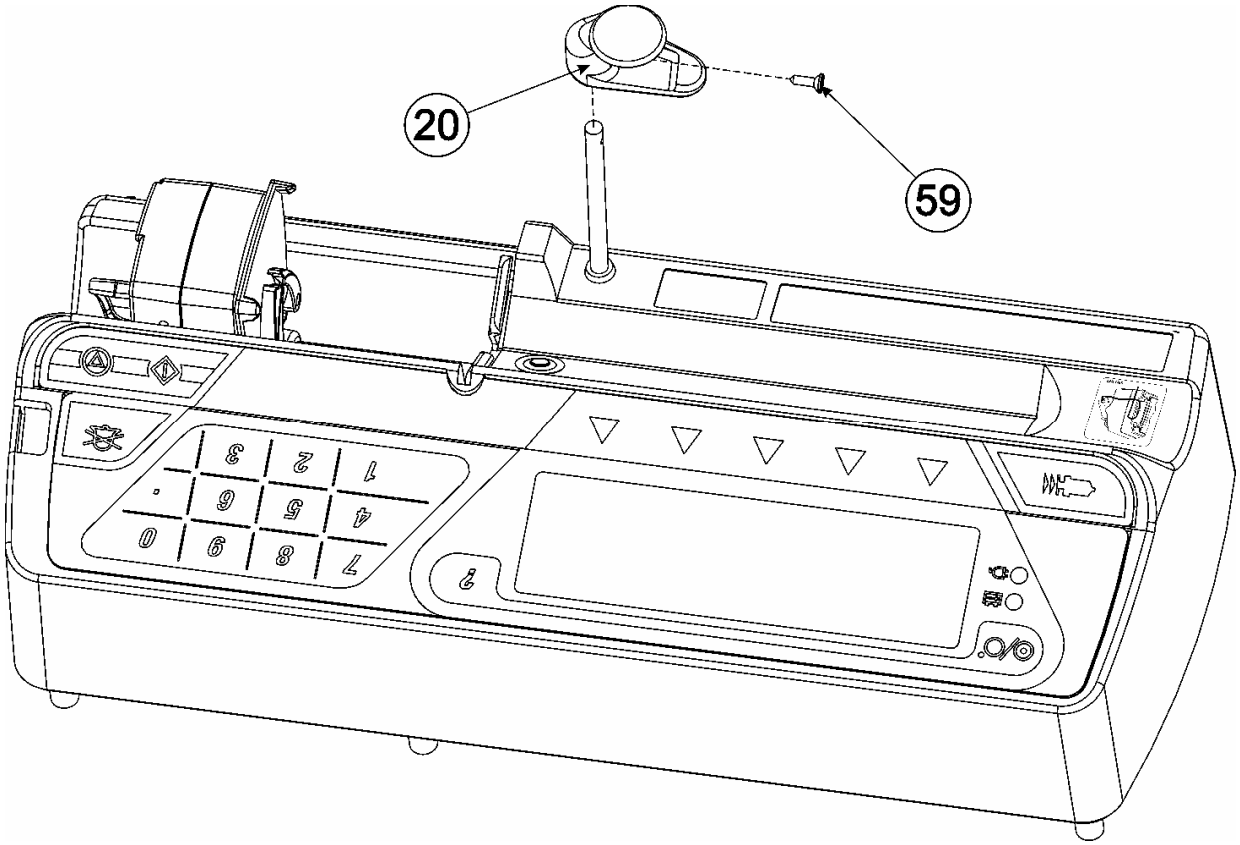
Drive Unit board (continuation)



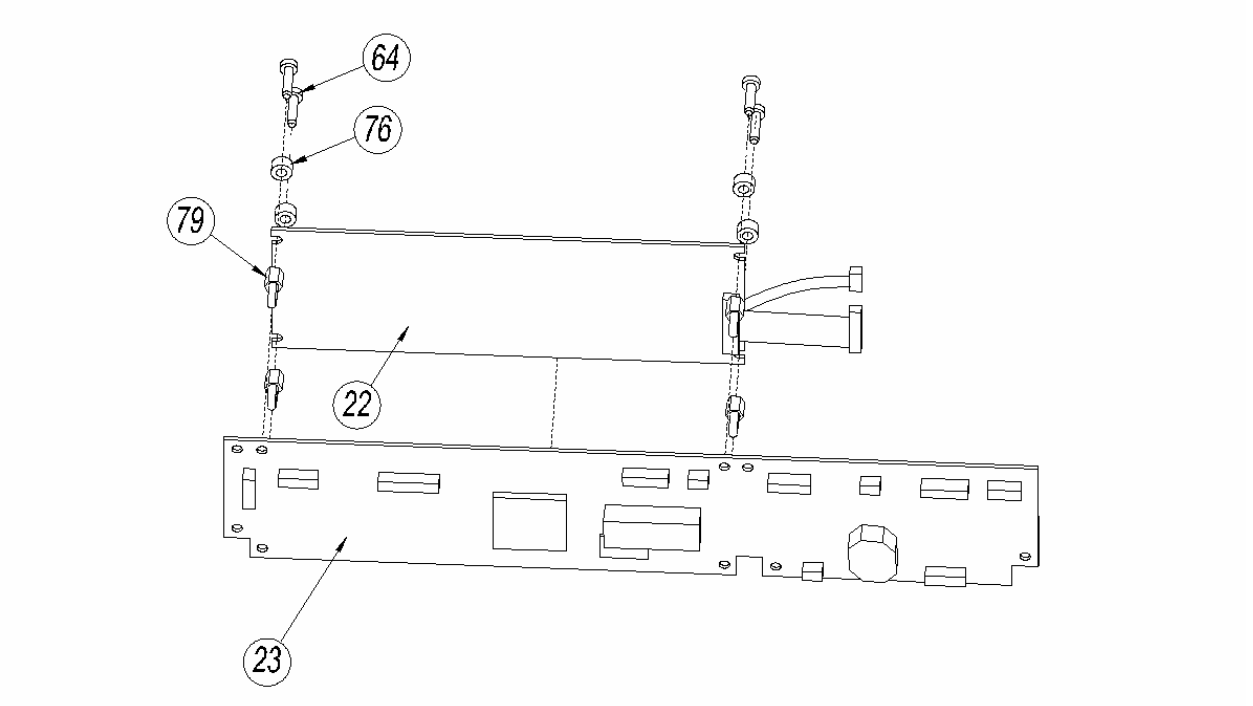
9.2.12 Syringe size sensor



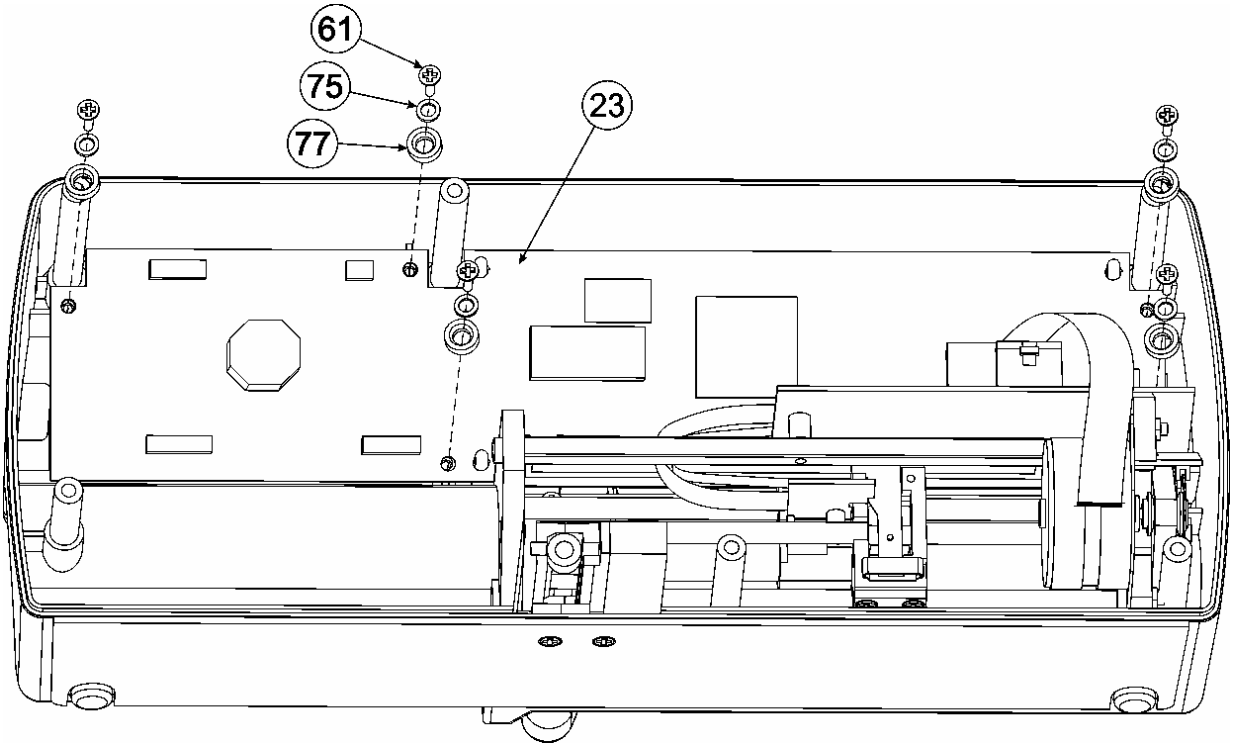
9.2.13 Syringe clamp



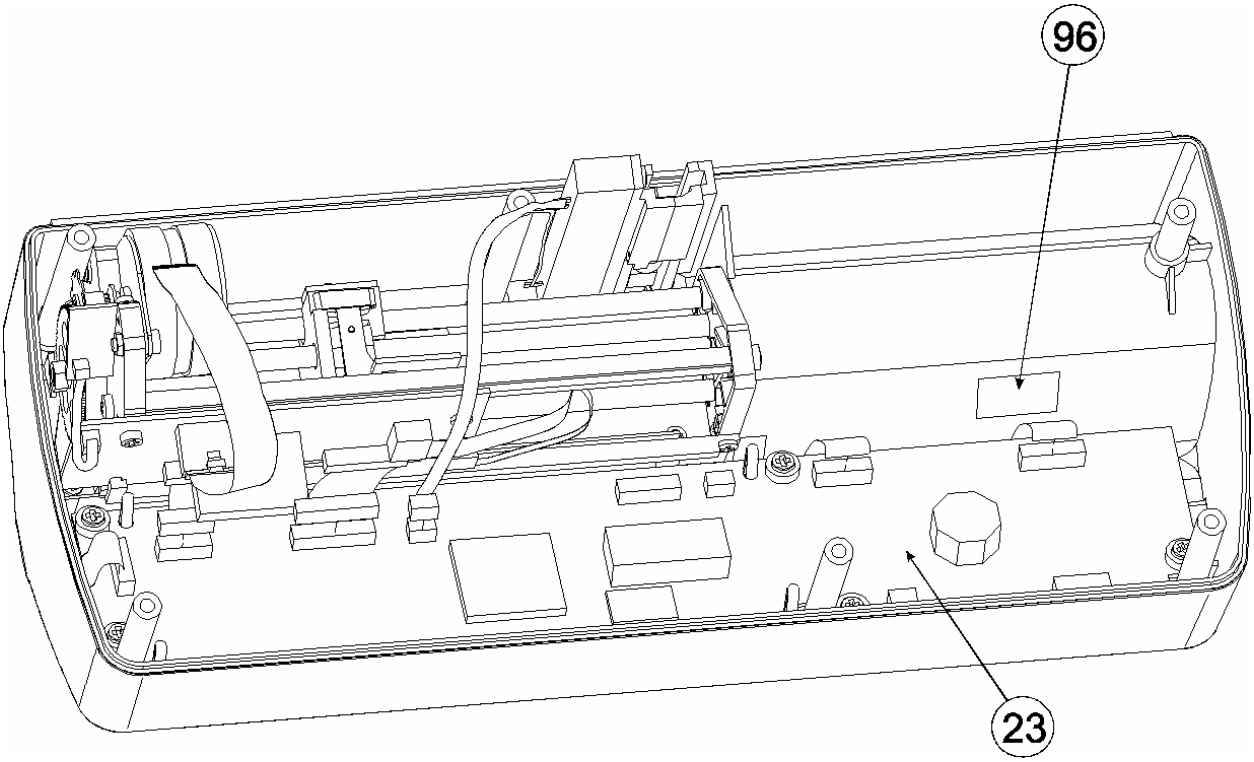
9.2.14 Display Unit



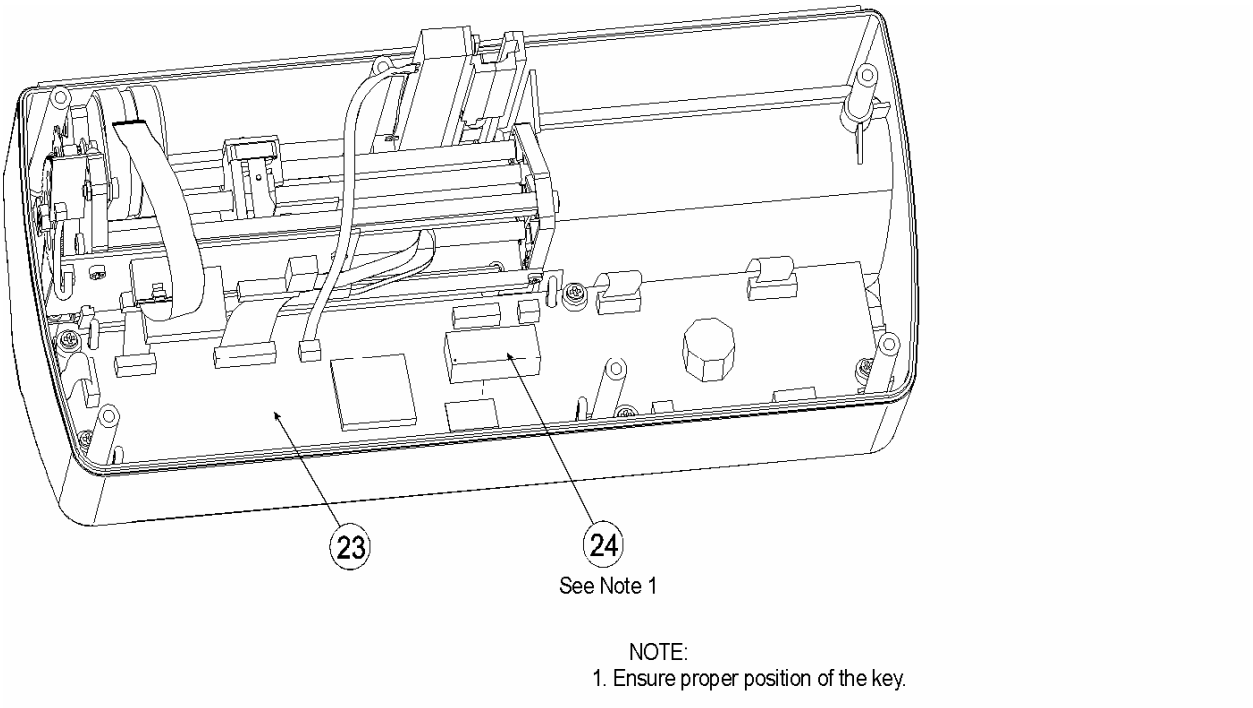
9.2.15. Electronic board



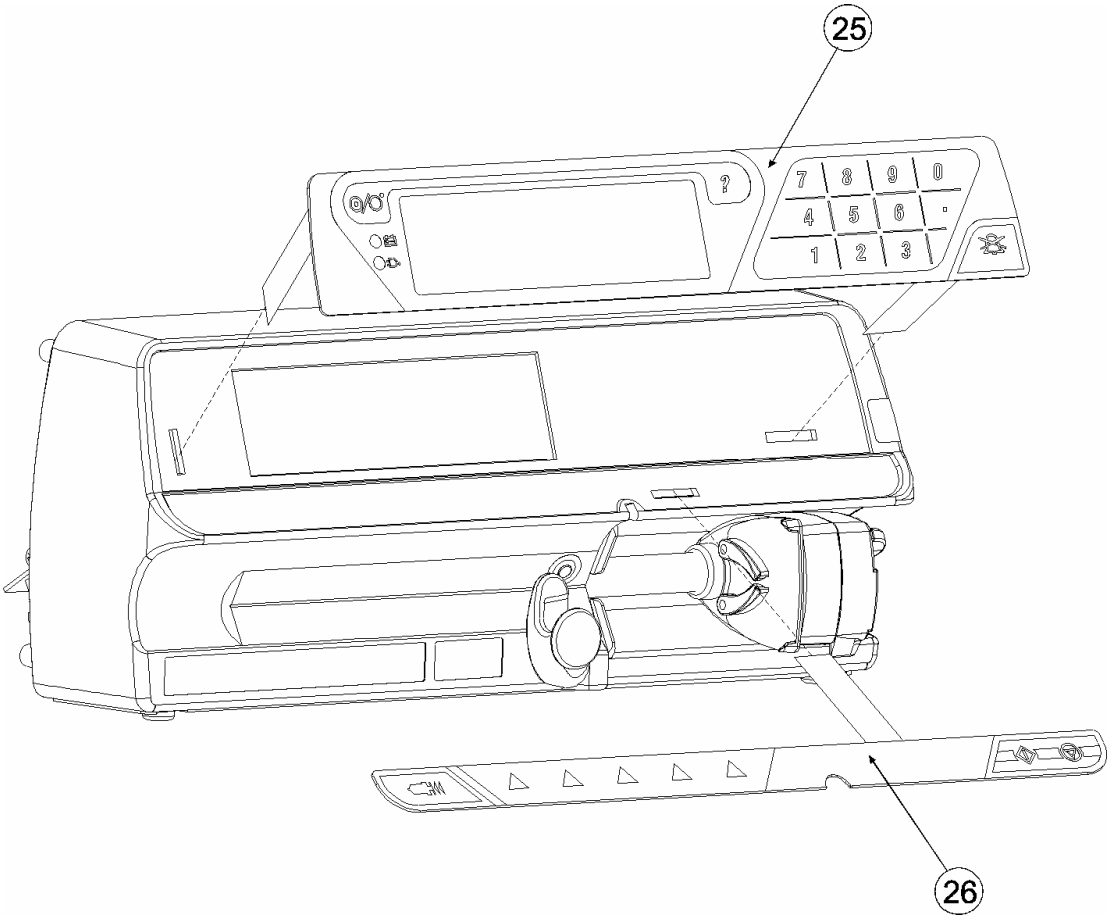
Electronic board (continuation)



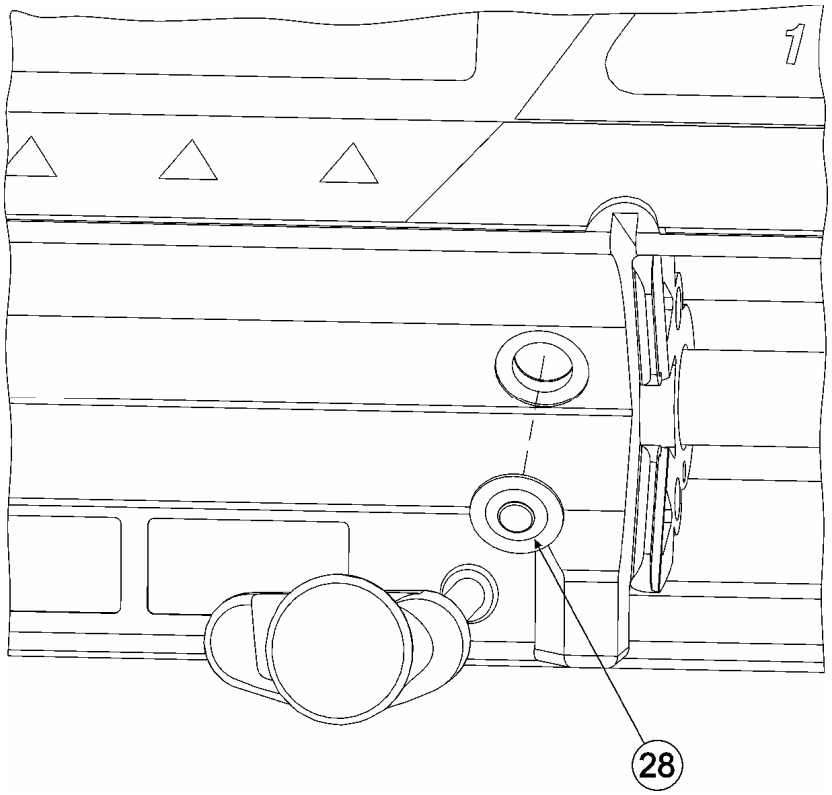
9.2.16. SRAM



9.2.17. Keypads

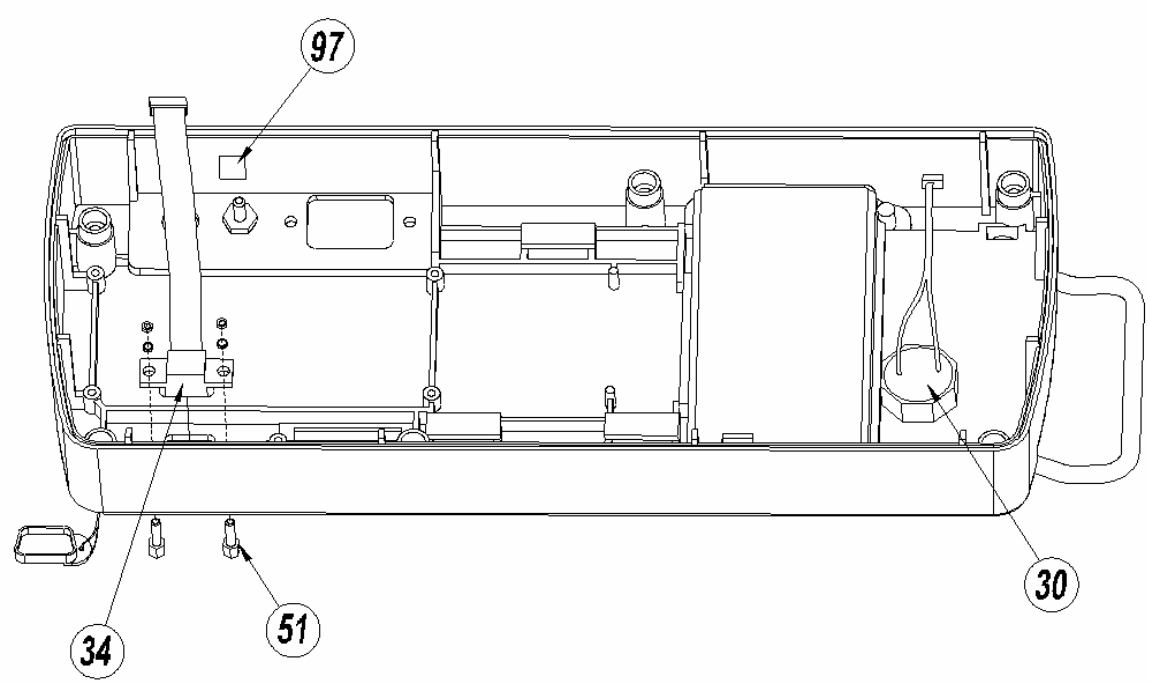


9.2.18. Syringe barrel sensor cover

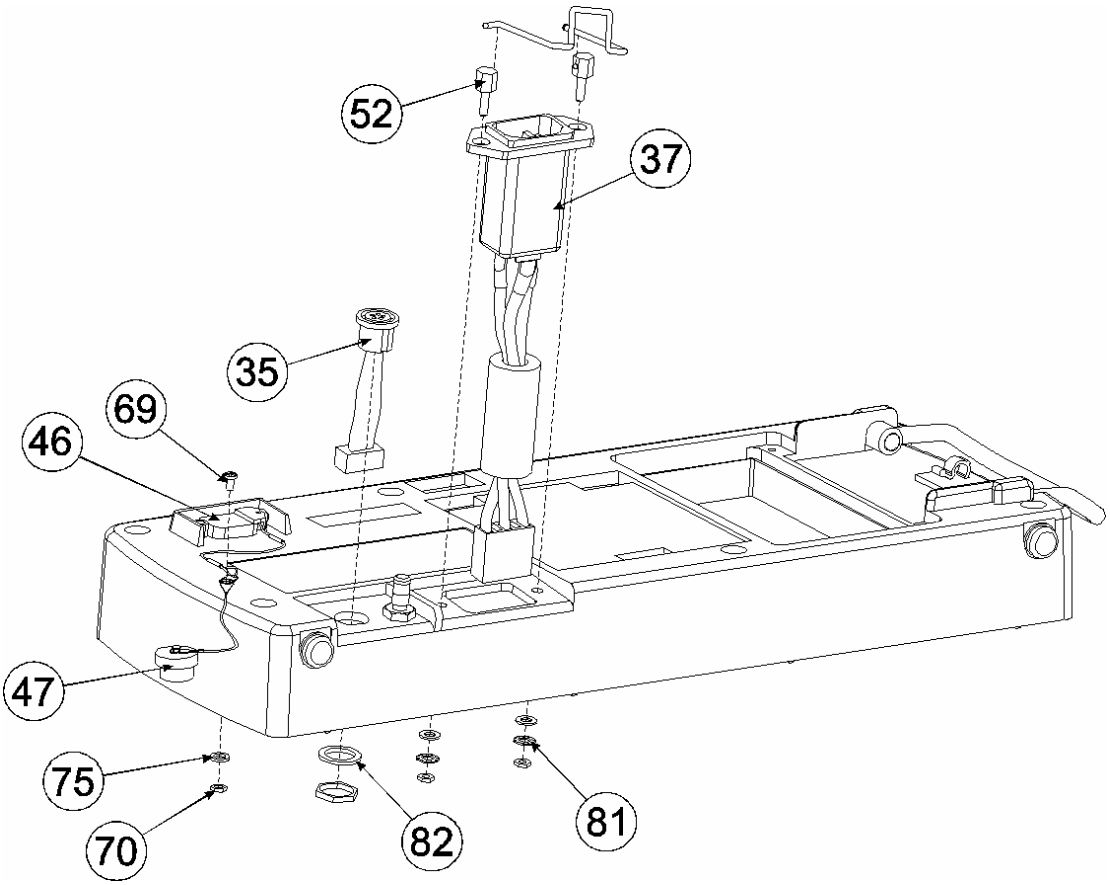


9.3 REAR CASE ASSEMBLY

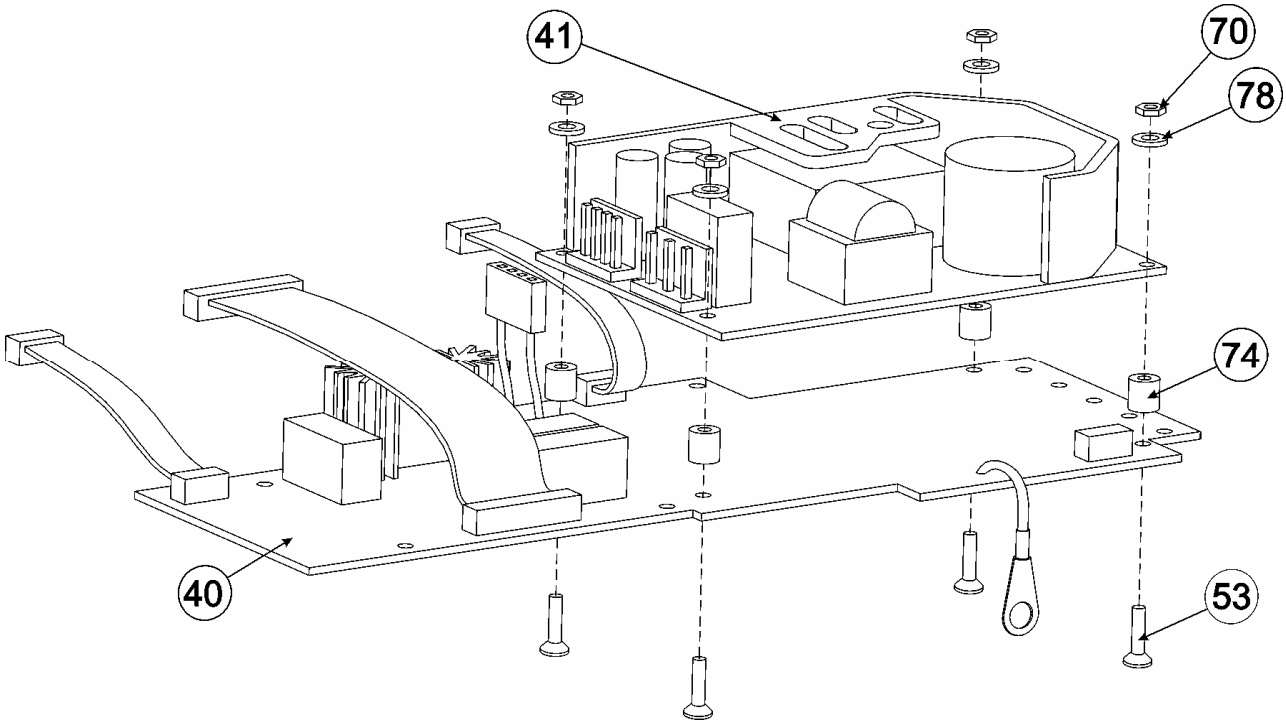
9.3.1 RS232 connector unit and piezotransducer unit



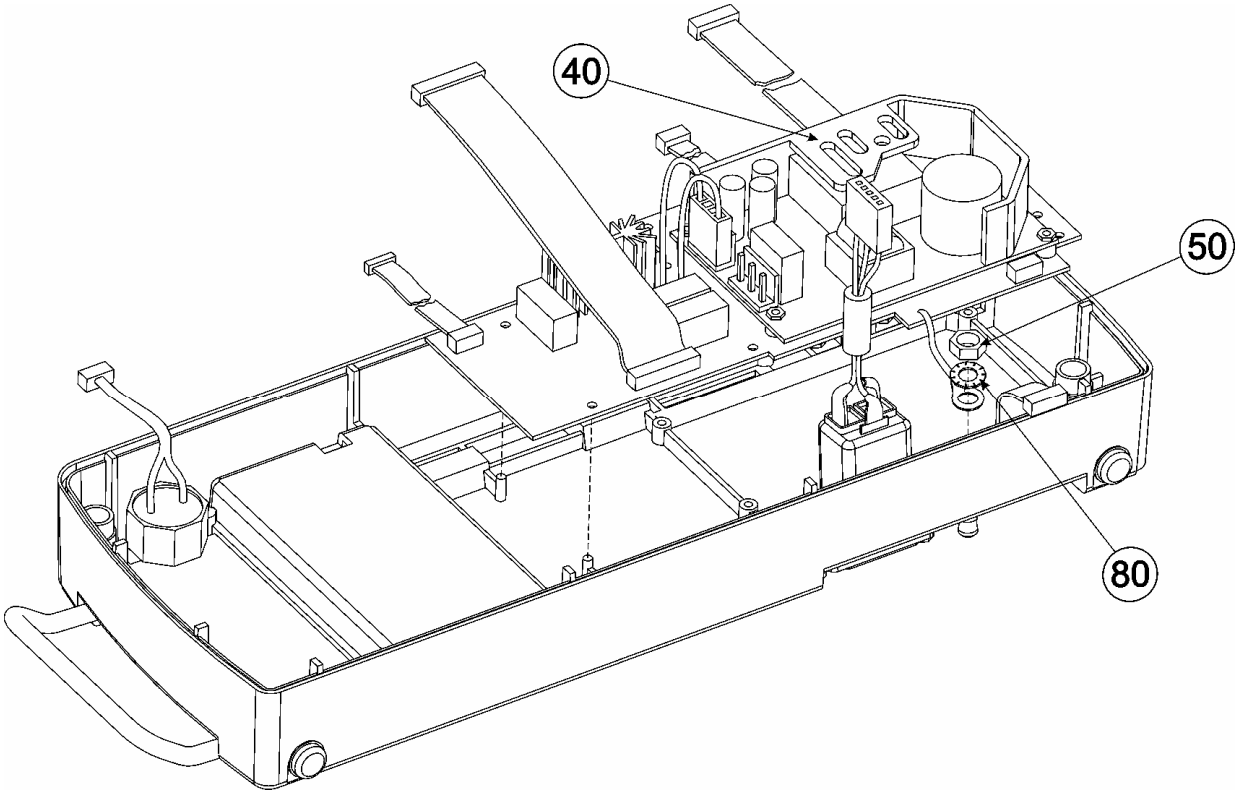
9.3.2 Mains filter unit and 12VDC&Nurse call unit



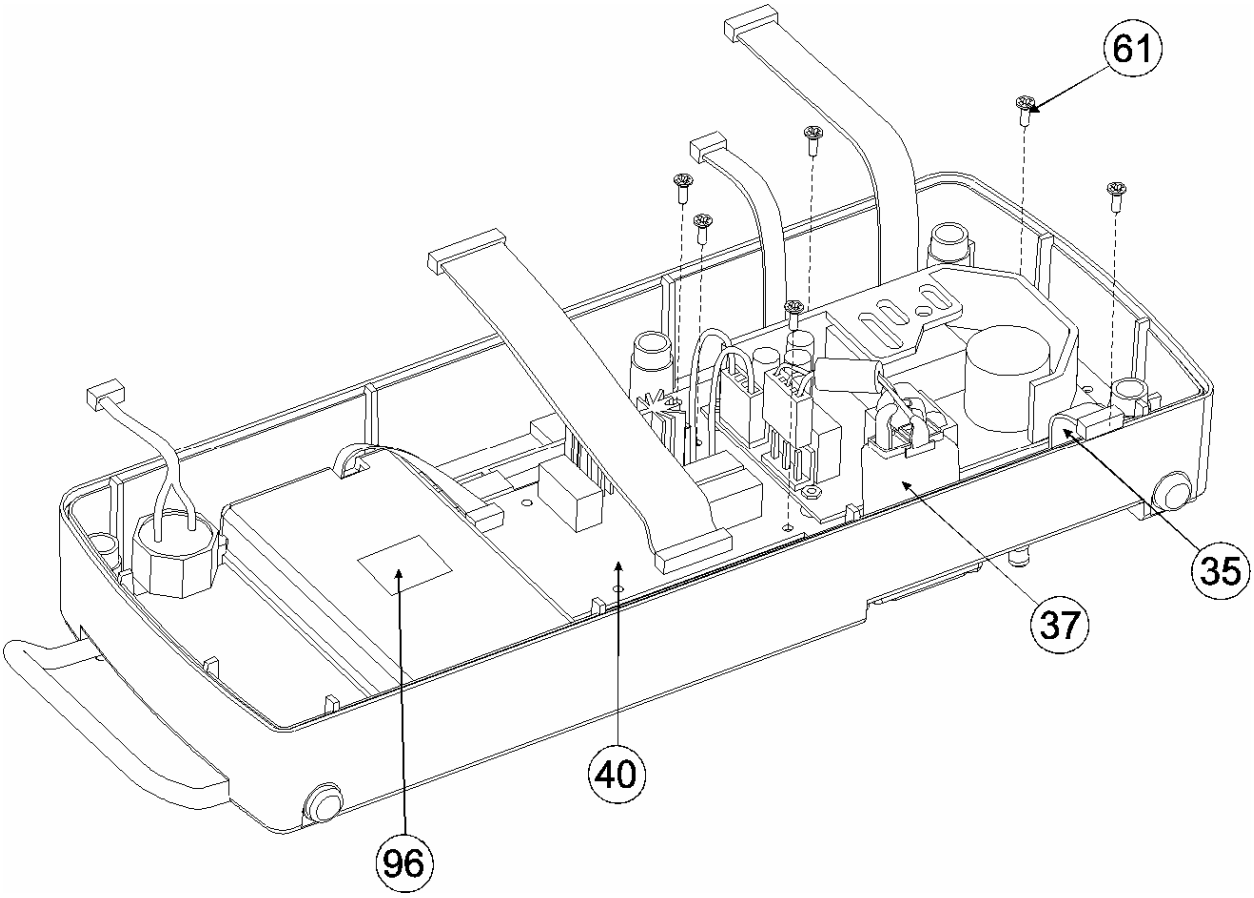
9.3.3 Switching power supply



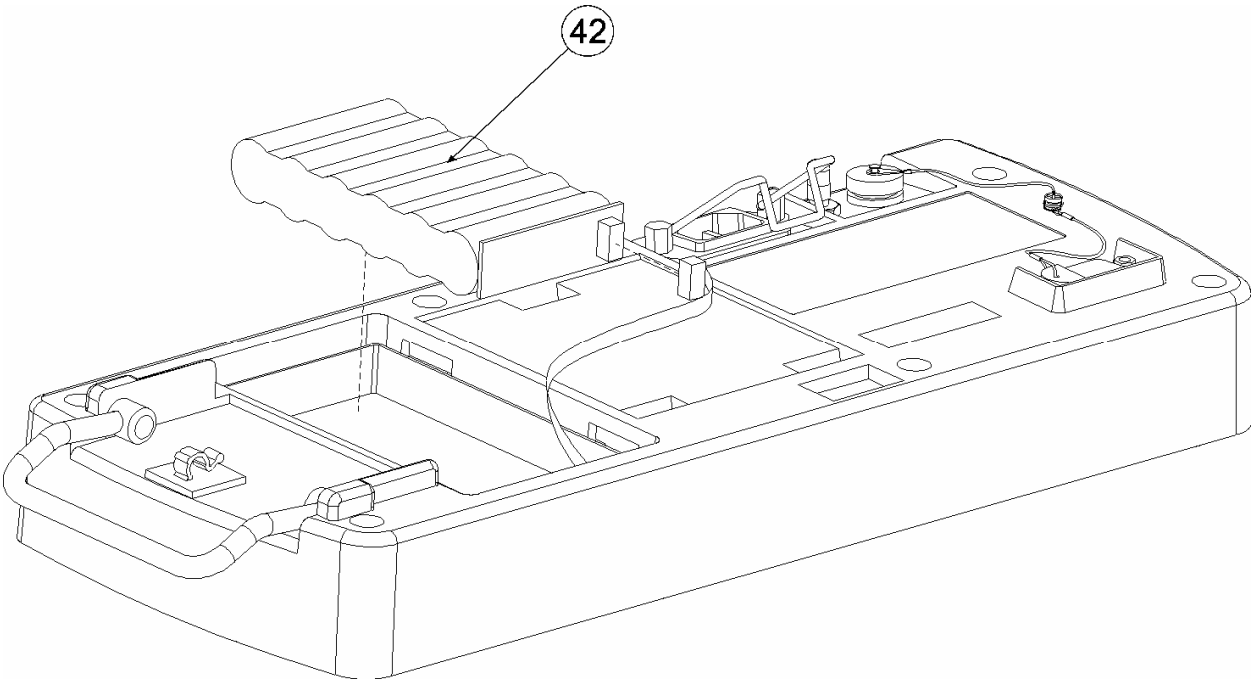
9.3.4 Power supply unit



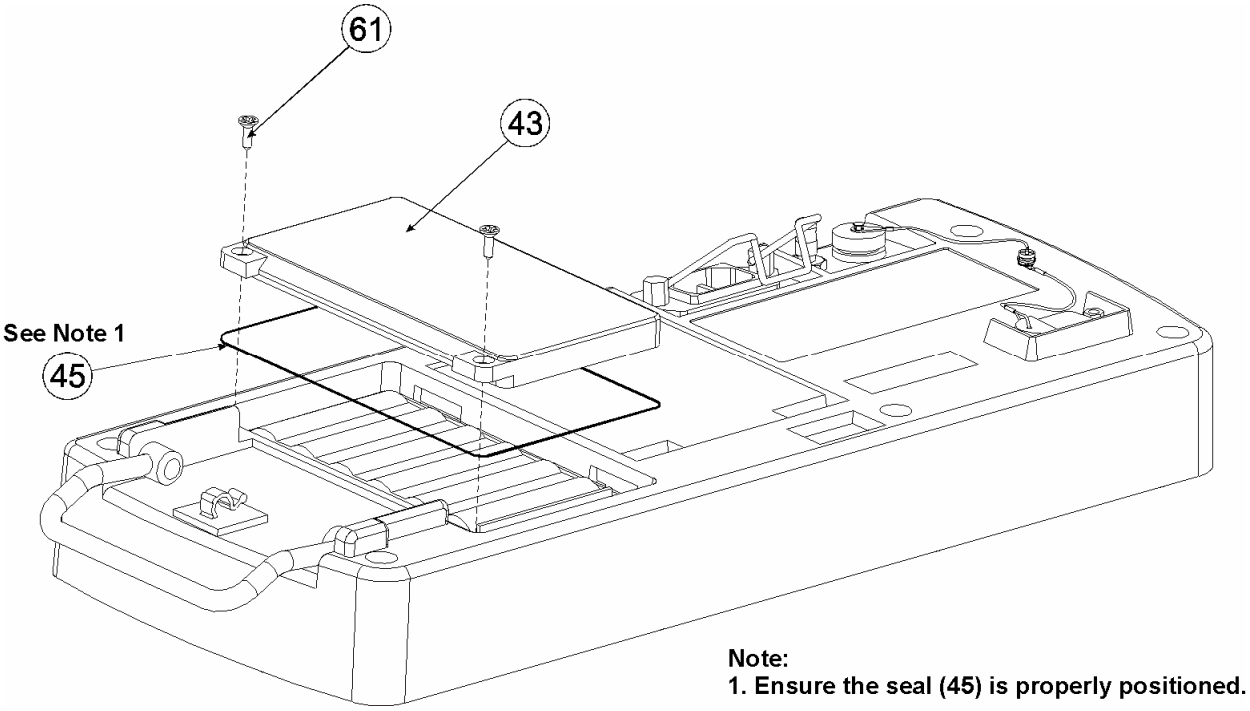
Power supply unit (continued)



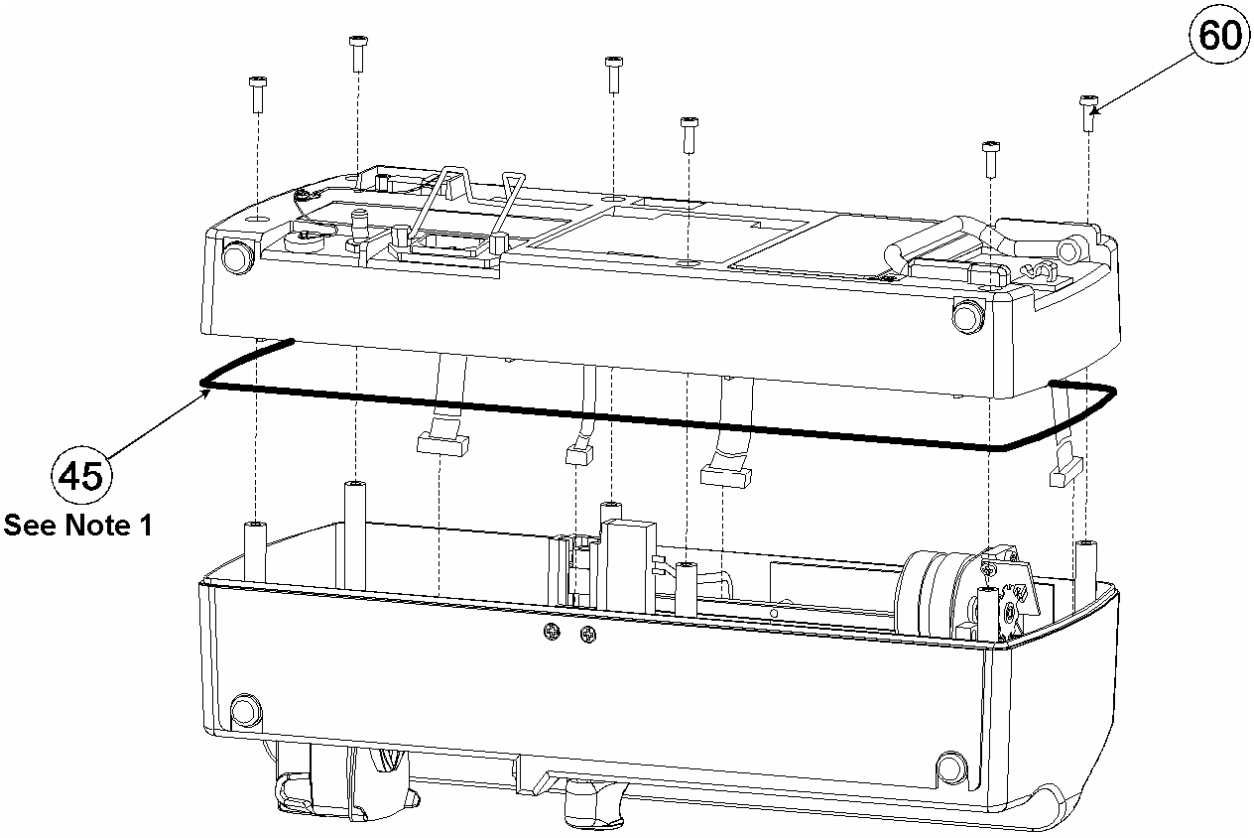
9.3.5 Battery unit



Battery unit (continuation)

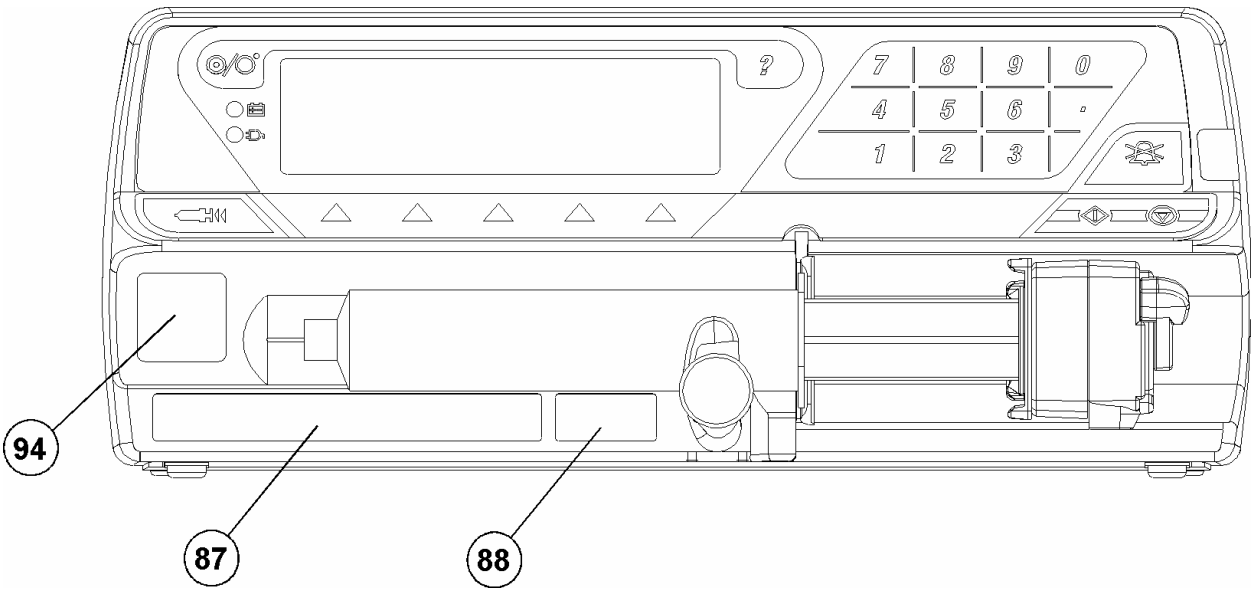


9.4. FINAL ASSEMBLY

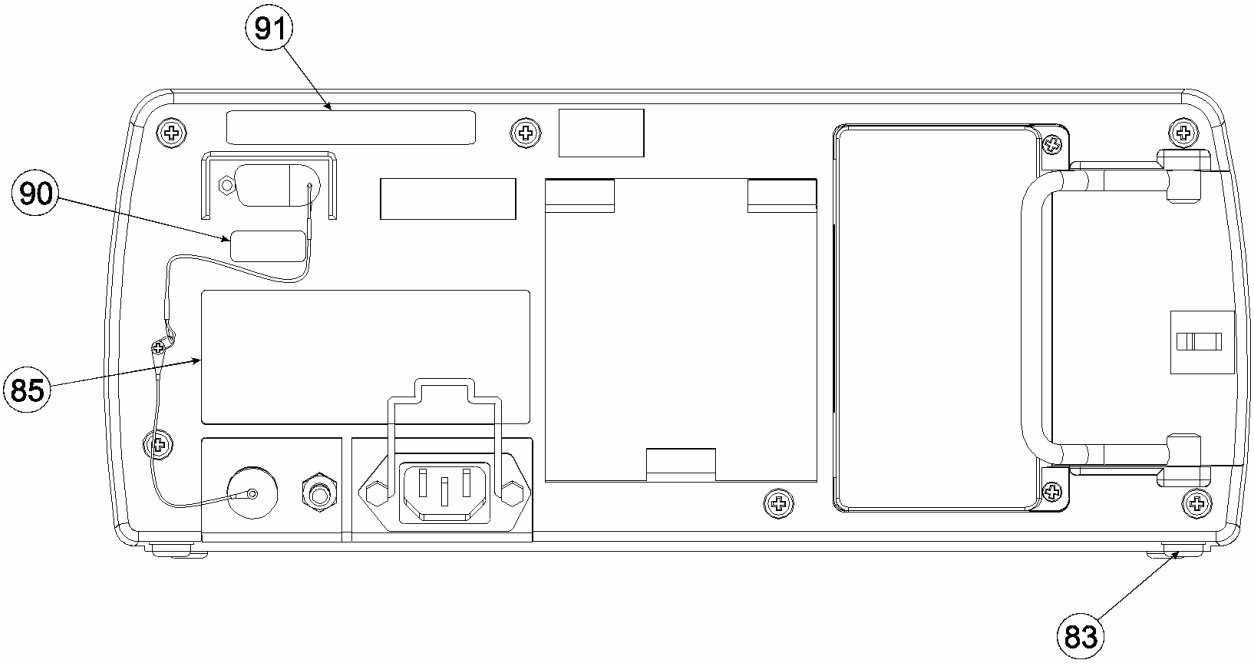


Note
1. Ensure the seal (45) is properly positioned.

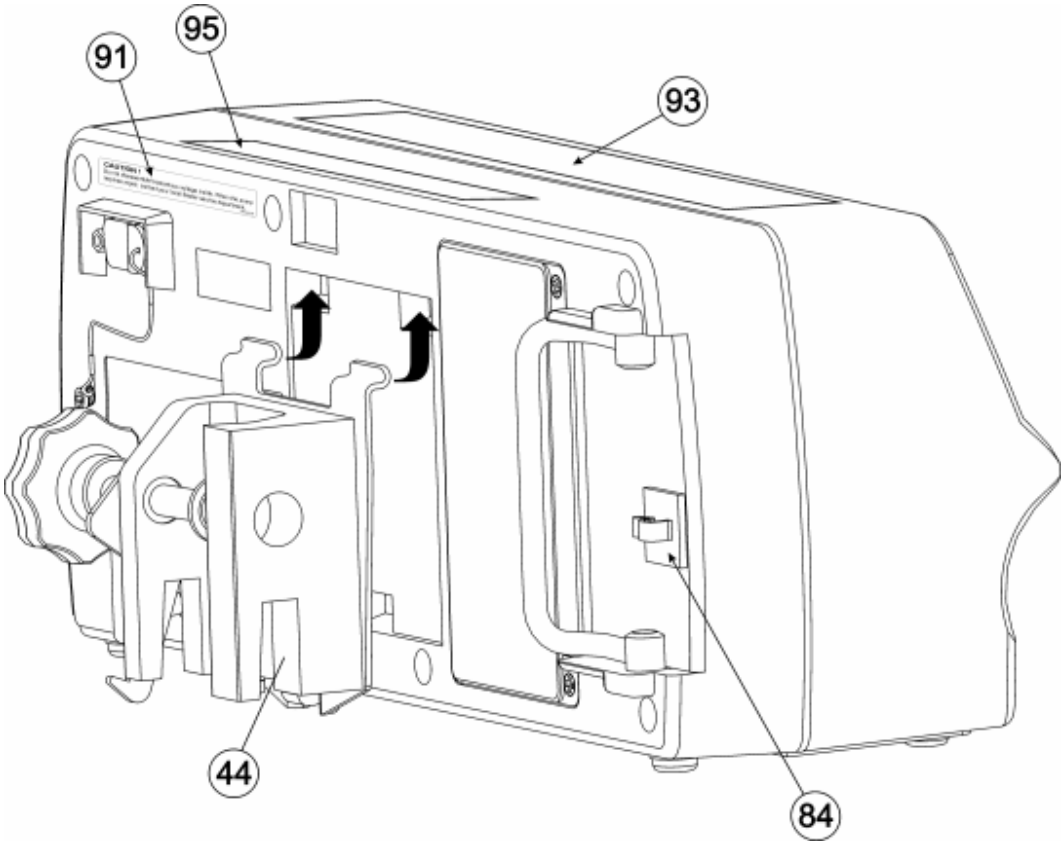
Final assembly (continuation)



Final assembly (continuation)



Final assembly (continuation)



10. SPARE PARTS LISTING

10.1. SPARE ACCESSORIES

PART NUMBER	DESCRIPTION
B8640037-01 (old B8640022-01)	Spacer (gauge) SP1
B8640037-02 (old B8640022-02)	Spacer (gauge) SP2
B8640037-03 (old B8640022-03)	Spacer (gauge) SP3
B8640023	Spacer (gauge) SP4
	Digitron pressure meter, model: 2022P (0-1500 mmHg)
P322009	Flo-Gard GSP Firmware Upload Utility
B6690006	Bootstrap Loading Unit

10.2. SPARE LABELS / PUBLICATIONS

PART NUMBER	DESCRIPTION
BS036010EN	Service Manual Flo-Gard GSP Syringe Infusion Pump
BN036011XX	Operator's Manual Flo-Gard GSP Syringe Infusion Pump
B8180123	Label (serial number)
B8180125XX-P01	Label (WARNING, syringes 10-140ml)
B8180227XX	Label (WARNING, syringes 5-140ml)
B8180126	Label (BAXTER LOGO)
B8180127	Label (RS232)
B8180136	Label (Do not disassemble)
B8180139XX	Label (instruction)
B8180152	Label (clip)
B8180205	Label (alignment)

XX- language name codes:

Language name	Code (XX)
Danish	DA
Dutch	NL
English	EN
Finnish	FI
French	FR
German	DE
Italian	IT
Norwegian	NO
Spanish	ES
Swedish	SV
Greek	EL

10.3. SPARE ELECTRICAL COMPONENTS

PART NUMBER	DESCRIPTION
B6341001	Battery unit
B6340013-01	Power supply unit (without switching power supply)
V5500700	Switching power supply MPS30-12
B6730007	Mains filter unit
B6800002	Display Unit
B3087044-01	Electronic board (without display unit)
B6660026	Encoder unit
B6660032	Sensor unit
B6900002	Drive Unit board
B6670007	Motor unit
B6660027	Syringe barrel sensor
V6675047	Keypad K1
V6675048	Keypad K2 (narrow)
B6710007	Piezotransducer unit
V5570010	AC power lead - European
V5570011	AC power lead- UK
V5570013	AC power lead- USA
V5570015	AC power lead- Danish
V5501041	Fuse F800mA
V5501042	Fuse F2A
V5570020	RS232 extension cable
B6650012	Nurse call cable
B6650013	12VDC cable
V5430312	Red LED (D1)
V5430213	Green LED (D2)
V5430112	Yellow LED (D3)
V5500202	Buzzer SMA-24 (Z1)

10.4 SPARE MECHANICAL COMPONENTS

PART NUMBER	DESCRIPTION
B6678003	Syringe pusher
B6337019	Syringe pusher drive
B6210004	Syringe size sensor
V8413101	Motor timing belt
B8703025	Syringe barrel sensor cover
B8127005	Syringe clamp
B8126037	Syringe support
B6400001	Versatile clamp
B6290002	Encoder ruler

B6337021	Drive
V5511152	Cap RS232
V5511153	Cap 12VDC&Nurse call
L5555024	Clip
B8280007	Shaft
V6300400	Leg