TECHNICAL GUIDE

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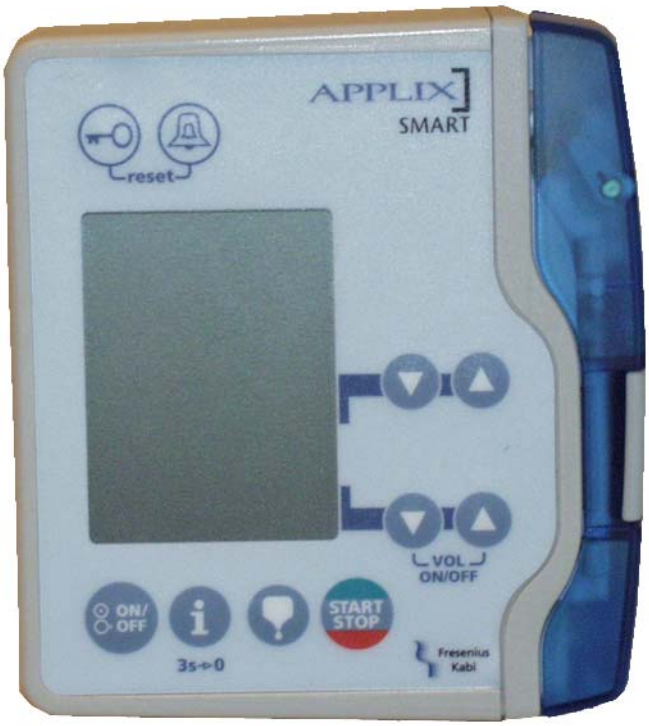
APPLIX SMART



Fresenius Kabi

1 Overview

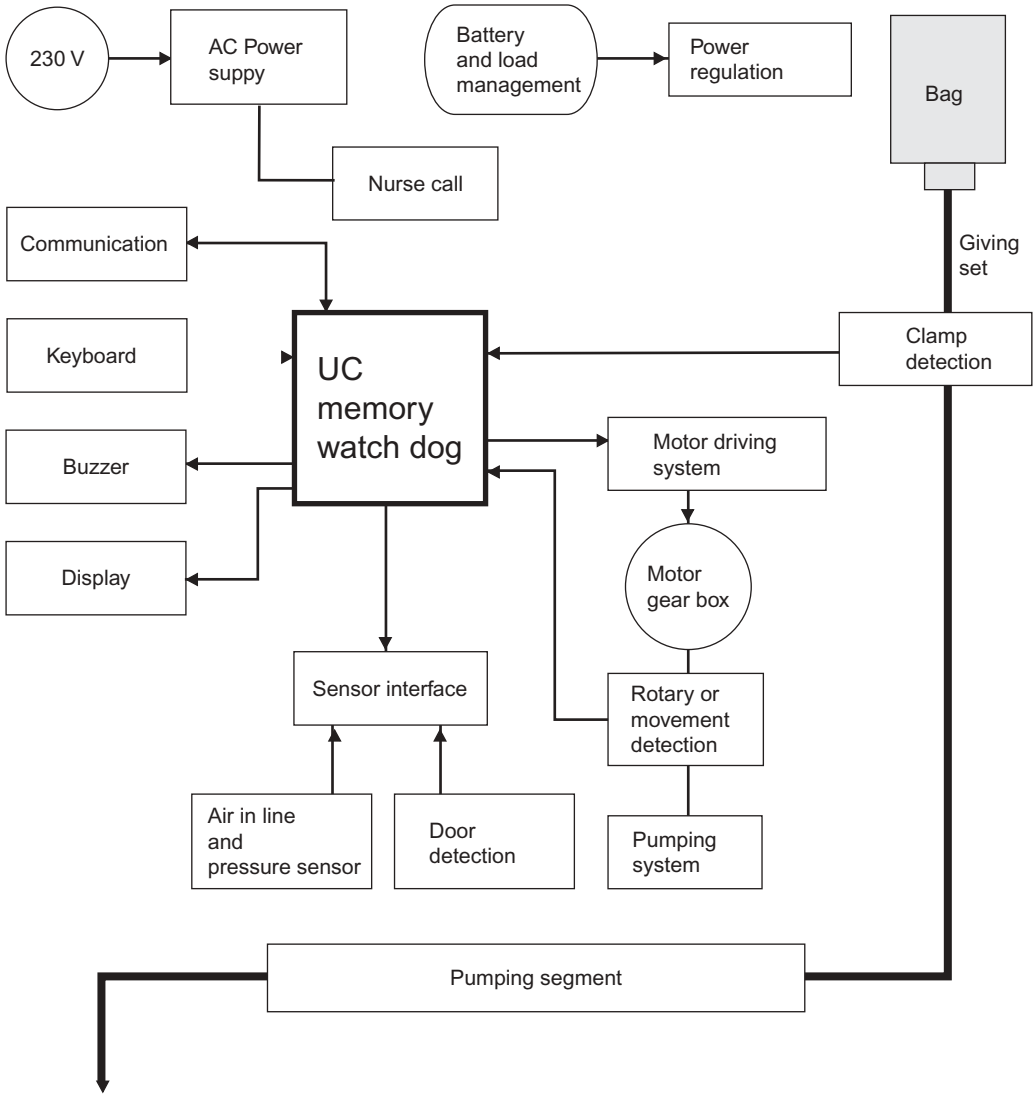
1.1 General

The **APPLIX Smart** is intended exclusively for enteral feeding.

It can be used with both home patients and hospital patients and is a very simple pump to operate.

The pump has a continous feeding administration programme and several functions for patient safety.

1.2 Operation diagram



1.3 Precaution for use

The manufacturer may in no case be held responsible for any medical or any other problem, resulting from a mis-use of the equipment.

Consult the technical guide for further information.

1.4 Safety features

The device has a continuous function inspection system as soon as it is switched ON. Any internal failure or any problem in the operating procedure is detected immediately. Nevertheless, abnormal operation of the equipment with no obvious cause must always be reported to the qualified person in your plant or our After Sales Service.

The **Applix Pump** is equipped with an internal battery which will supply power for normal operation to the equipment if there is an electrical disturbance in the mains network.

1.5 Technical data

1.5.1 Electrical

- Mains supply: 110-230 V ± 10% - 50-60 Hz.
- Pump holder output: 7.75 V - 800 mA.
- Pump battery mode: 24 h at 125 ml/h.

1.5.2 Mechanical

- Pump:
  - Dimensions H x L x P: 128 x 114 x 43 mm.
  - Weight: 480 g.

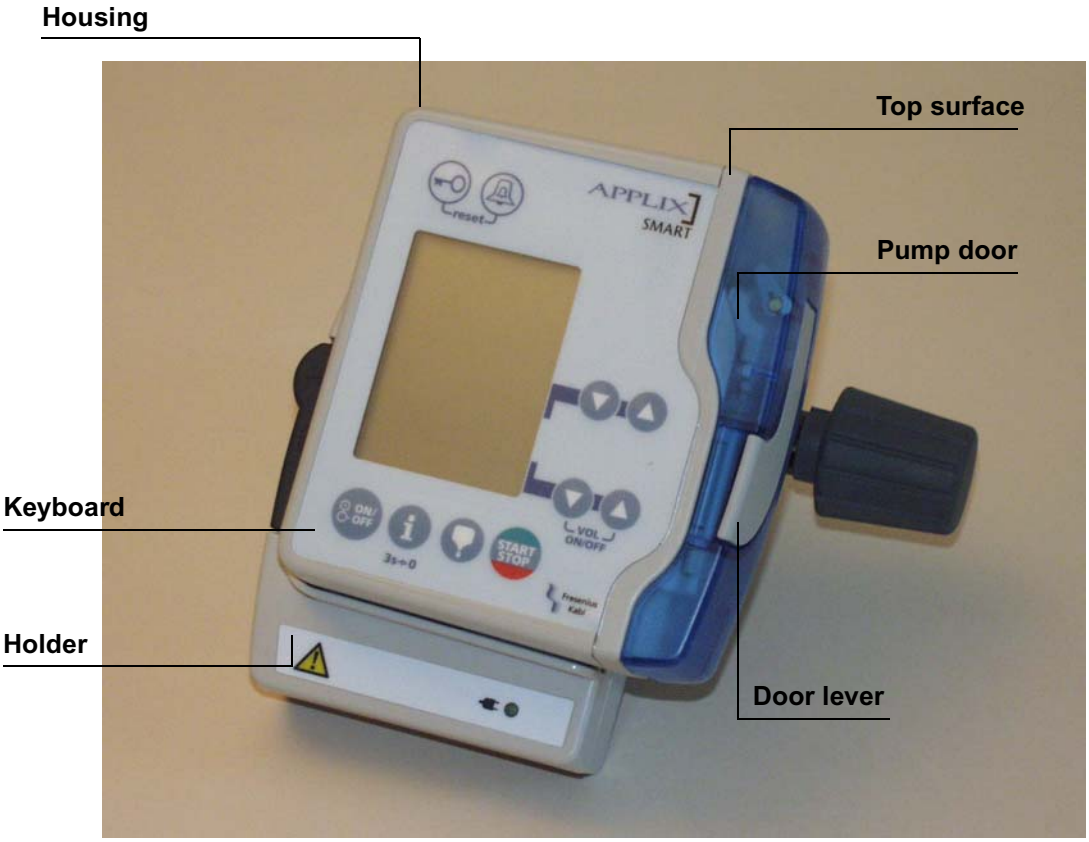
- Holder:
  - Dimensions H x L x P: 146 x 162 x 115 mm.
  - Weight: 450 g.

1.5.3 Conformity, standards

- IEC 601-1 edition 88 + amendment 1 + amendment 2.
- IEC 601-1-2 EMC.
- IEC 601-1-4 risk analysis.
- Protection against electric shock: Protection class II, symbol; type BF, symbol.
- Protection against moisture:
  - Pump: IP34 (splash-protected).
  - Holder: IP 31 (drip-protected).

2 Description and operation

2.1 Physical description of the Pump



The APPLIX is composed of a pump which can be mounted on a holder.

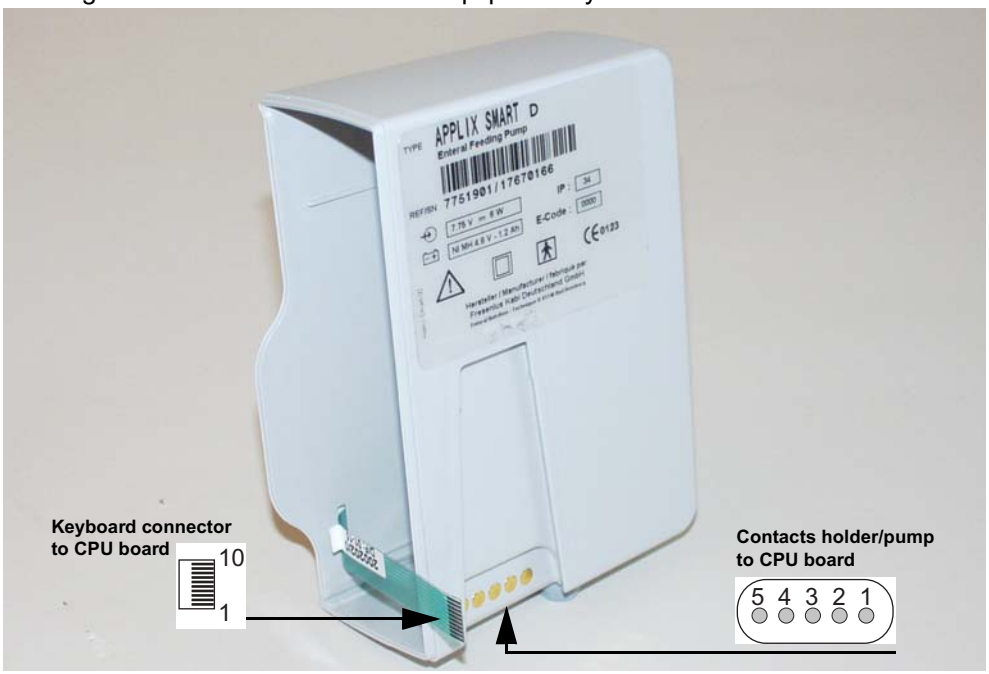
2.1.1 The pump

The Pump is composed of a top surface unit holding the mechanical and electronic assembly. A housing fastened on the top surface unit performs mechanical protection and tightness of equipment.

The housing is holding:

- A keyboard.
- Five contacts for connection of the pump to the holder.

The housing is connected to the different equipment by means of connectors and contacts.



Keyboard connector to CPU board

Pin	Description
1	ON/OFF
2	Column 5
3	Column 4
4	Column 3
5	Column 2
6	Column 1
7	Line 3
8	Line 2
9	Line 1
10	ON/OFF

Contacts holder/pump to CPU board

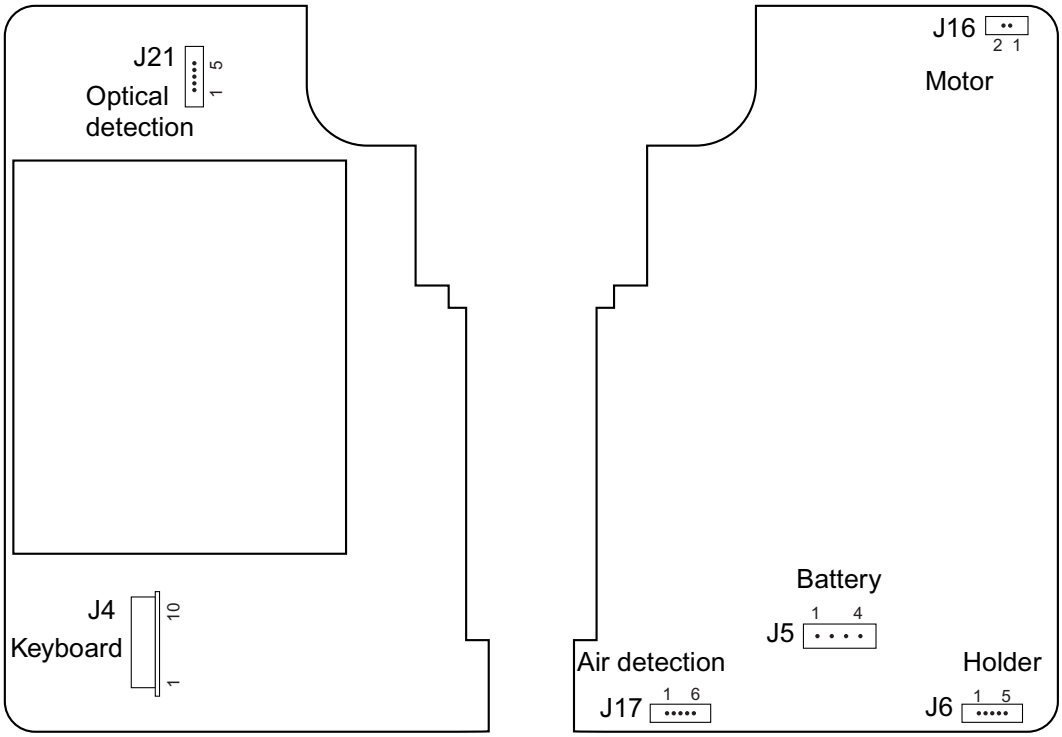
Pin	Description
1	GND
2	Alarm command ouput (nurse call)
3	Output Txd
4	Input Rxd
5	Power supply

The top surface unit is composed of:

- A CPU board.
- A pumping unit.
- A top surface.

The CPU board

The CPU board is holding the power and command electronics for the pump and the LCD screen required for man/machine interface.



CPU board

It is connected to the different equipment by means of connectors.

Connector J4, to keyboard

Pin	Description
1	ON/OFF
2	Column 5
3	Column 4
4	Column 3
5	Column 2
6	Column 1
7	Line 3
8	Line 2
9	Line 1
10	ON/OFF

Connector J5, to battery

Pin	Description
1	Battery (0 V)
2	CTN GND
3	CTN (+)
4	+ V Bat

Connector J6, to contacts holder

Pin	Description
1	GND
2	Alarm command ouput (nurse call)
3	Output Txd
4	Input Rxd
5	Power supply

Connector J16, to motor

Pin	Description
1	Motor -
2	Motor +

Connector J17, to air detection

Pin	Description
1	Transmitter (+) anode
2	Transmitter (-) cathode
3	GND
4	GND
5	Receiver (+) anode
6	Receiver (-) cathode

Connector J21, to optical board clamp/points valve detection

Pin	Description
1	GND
2	OUT 1 (***points valve***)
3	OUT 2 (***Clamp***)
4	INPUT
5	Power supply (V_FCY)

The pumping unit

The pumping unit is fastened on the top surface. It is composed of a frame holding the pumping mechanism, the motor driving system, the electronic board and the battery.

The top surface

The top surface is the interface between the internal and external parts of the pump.

It allows the giving set to be held in the right position and is also holding the door.

2.1.2 The holder

The holder is composed of a housing equipped with a clamp used to fasten it on a mast.

The holder includes a supply board which supplies 7,75 V AC mains to the **APPLIX Pump**. It also performs the loading of the 1.2 Ah battery included in the pump.

It is also equipped with:

- An RJ45 (RS232) plug for connection of the nurse call relay output or the connection to a PC.
- Five contacts for its connection to the pump :

Pin	Description
1	GND
2	Alarm command ouput (nurse call)
3	Output Txd
4	Input Rxd
5	Power supply

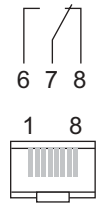
Front view of contacts

Connection of the nurse call alarm output

The nurse call alarm output can be connected by mean of a cable equipped with an RJ45 plug.

- Characteristics:
  - Plug: 8-pin male RJ45.
  - Length of cable: 2.5 m.
  - Cable: ref. MJ8 P8C SUNS-PUlow vlt computer.
  - External connection: 3 tinned wires.
- Connection:

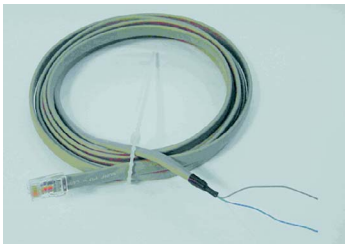
Pin	Description
1	Link with PC
2	
3	
4	
5	
6	Relay normally open
7	Common point
8	Relay normally closed



Plug male RJ45.

Note:

You can purchase this cable at:
Your Maintenance Department
(Address see enclosed)



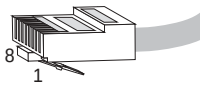
Article number ref. 7751761.

RS232 connection

- Characteristics:
  - Plug: 8-pin male RJ45.
  - Length of cable: 2.5 m.
  - Cable: ref. MJ8 P8C SUNS-PUlow vlt computer.
  - External connection: DB9 femal.

- Connection:

Pin RJ45	DB9 femal	
1	3 TxD	
2	7 RTS	
3	4 DTR	
4	2 RxD	
5	5 GND	
6		
7		
8		



Plug male RJ45.

Note:

You can purchase this cable at:
Your Maintenance Department
(Address see enclosed)

Article number ref. 200991.

2.2 Functional description

The **APPLIX Pump** is composed of three functional subassemblies:

- A subassembly of holding and control of giving set.
- A pumping subassembly.
- A holder subassembly with external connections.

2.2.1 Subassembly of holding and control of giving set

The giving set is installed on the top surface and maintained in position by the door.

The top surface is equipped with three detection systems:

- A sensor to control the closed door position (UC board).
- An optical sensor to detect the type of the installed giving set.
- An ultrasonic sensor to detect air bubbles presence in the giving set.

2.2.2 Pumping subassembly

The pumping subassembly includes the peristaltic mechanism of pumping.

This mechanism is composed of a camshaft performing the alternative travel of three pushers. The travel of these pushers, managed by the CPU board, performs the liquid displacement at the flow-rate.

A DC motor with a gear-box subassembly drives in rotation the camshaft by means of an indexed belt.

An optical disc fastened at the camshaft end performs the rotation control.

The occlusion detection is carried out by the measurement of motor current.

2.2.3 Holder subassembly with external connections

The presence of the pump on the holder is detected by a sensor mounted on the holder and associated to a magnet fastened inside the pump.

The holder is equipped with an RJ45 connector used for nurse call alarm or communication with a PC.

3 Calibration menu

The calibration menu is used to perform tests and consult the different parameters recorded in the pump.

The modification of these parameters can only be performed from a PC equipped with the **APPLIX control** software. The software can be ordered by approved and qualified technicians who have been trained.

For access to the different parameter readout, refer to "Control" chapter.

The calibration menu gives access to twenty-one sub-menus. Only thirteen are necessary for the maintenance technician. Others are not detailed in this guide.

- 49, not detailed.
- 50, battery temperature.
- 51, battery voltage.
- 52, not detailed.
- 53, not detailed.
- 54, not detailed.
- 97, mains presence or not.
- 98, buzzer.
- 100, door position detection.
- 101, optical ***clamp*** detection.
- 102, not detailed.
- 103, optical background signal.
- 107, keypad.
- 108, LCD.
- 110, nurse call relay.
- 112, not detailed.
- 113, not detailed.
- 114, air detection .
- 119, motor command test.
- 122, not detailed.

Calibration menu

4 Preventive maintenance

4.1 Recommendations

The **APPLIX Pump** can only be inspected, maintained or repaired by an approved and qualified service. Any abnormal operation of the equipment must be signaled to the qualified maintenance person in your plant or to our After Sales Service.

If a repair is necessary, send the pump (in its original packaging if possible) with a precise description of the observed fault, to the official service department.

Please call our After Sales Service or our Sales Department for any information about the repair and use of the equipment.

The manufacturer cannot be held responsible if the equipment is lost or damaged during transport to our After Sales Service.

4.2 Maintenance

We recommand the following maintenance intervals

Periodicity	Designation
12 months	Carry out a periodical control.
2 years	Replace the battery (refer to “battery” intervention procedure).

4.3 Checks

In order to carry out a tracking of the equipment within the limits of a preventive maintenance, a periodic control is recommended every 12 months (refer to "Periodic control procedure").

Before the control procedure, perform a preliminary loading of the battery (5 Hours).

4.3.1 Access to calibration menu

Keyboard description.

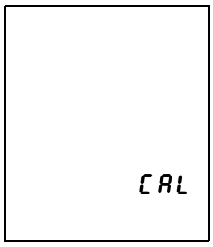
Key	Function
ON/OFF	**ON/OFF**, to switch on and off the equipment (to go out from the calibration mode if pressing more than 3 seconds).
i	**Info key**, first step for accessing calibration mode.
+ START STOP	**Automatic priming**, second step for accessing calibration mode.
START STOP	**START STOP**, to start any test.
	SET RATE, RATE for selection of calibration number.
VOL ON/OFF	**VOL ON/OFF**, for selection of any values.

Activation of calibration menu.

- Press down "ON/OFF".
- Press down "INFO KEY" before the end of the down counting and keep this position.

- When the version and checksum number appear, press down simultaneously "AUTOMATIC PRIMING" and "START STOP" keys, then release "INFO KEY".

CAL is displayed:

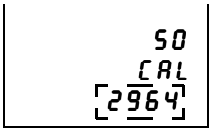


- The transition from one calibration to an other is carried out by the "SET RATE" keys.

4.3.2 Battery temperature

The battery temperature is displayed in arbitary units.

- Calibration 50.
  - ☐ The value of the battery temperature is displayed in arbitrary units.
  - ☐ Check that this value complies with the range **0°C < T° < 60°C.**



Correspondence table:

Value in arbitrary units	Temperature (°C)
3 934	0
3 773	4
3 611	8
3 450	12
3 289	16
3 127	20
2 966	24
2 804	28
2 643	32
2 482	36
2 320	40
2 159	44
1 997	48
1 836	52
1 675	56
1 513	60

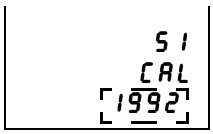
If the value is out of tolerances, change the battery or CPU board.

- Press "SET RATE" to carry out the next calibration.

4.3.3 Battery voltage

This display in points the battery voltage is displayed in arbitrary units.

- Calibration S 1.
  - ☐ The value of the battery voltage is displayed in arbitrary units.
  - ☐ Check that this value complies with the range **0 V < U < 6 V.**



Correspondence table:

Value in arbitrary units	Voltage (V)
1 115	4,00
1 189	4,10
1 264	4,20
1 338	4,30
1 412	4,40
1 487	4,50
1 561	4,60
1 635	4,70
1 710	4,80
1 784	4,90
1 859	5,00
1 933	5,10
2 007	5,20
2 082	5,30
2 156	5,40
2 230	5,50
2 305	5,60
2 379	5,70
2 453	5,80
2 528	5,90
2600	6.00

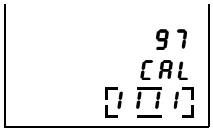
If the value is out of tolerance, change the battery or CPU board.

- Press "SET RATE" to carry out the next calibration.

4.3.4 Mains presence or not

This test display the power source mains or battery.

- Calibration 97
  - ☐ 1111, battery power supply.
  - ☐ 8888, mains power supply.

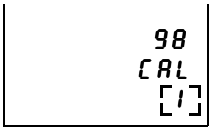


- Press "SET RATE" to carry out the next calibration.

4.3.5 Buzzer test

This test enables to test the three sound levels of the buzzer.

- Calibration 98.
- Press down "START" to carry out from a level to another :
  - 0, no sound.
  - 1, minimum level.
  - 2, middle level.
  - 3, maximum level.
  - 4, maximum level.

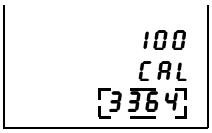


- Press "SET RATE" to carry out the next calibration.

4.3.6 Door position

The sensor level for the door position is displayed in arbitrary units.

- Calibration 100.
  - ☐ Close the door.
  - ☐ Check that the displayed value complies with the range **2800 < U < 3800 .**
  - ☐ Open the door.
  - ☐ Check that this value complies with the range **2000 < U < 3000 .**



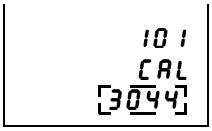
If the value is out of tolerance, calibrate the sensor calibration (see **3 calibration menu**).

- Press "SET RATE" to carry out the next calibration.

4.3.7 Optical *clamp* detection

The ***clamp*** detection is displayed in arbitrary units.

- Calibration 101.
  - ☐ Without giving set.
  - ☐ Check that this value complies with the range **$0 < U_1 < 700$.**
  - ☐ Set the ***clamp*** in its housing.
  - ☐ Check that this value U_2 complies with the range:



U_1	U_2 value
$0<U_1<239$	$1500<U_2<4000$
$240<U_1<299$	$1800<U_2<4000$
$300<U_1<349$	$2250<U_2<4000$
$350<U_1<699$	$2500<U_2<4000$
$U_1>700$	Error

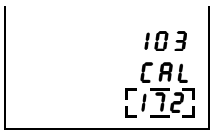
If the value is out of tolerance, calibrate the optical sensor (see **3 calibration menu**).

- Press "SET RATE" to carry out the next calibration.

4.3.8 Optical background signal

The optical background signal which can disturb the sensor operation, is displayed in arbitrary units.

- Calibration 103.
  - ☐ Open the door and keep empty the ***clamp/points valve*** location.
  - ☐ Check that this value complies with the range **0 < X < 500 .**



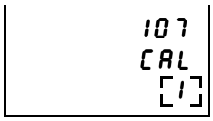
If the value is out of tolerance, calibrate the sensor (see **3 calibration menu**).

- Press "SET RATE" to carry out the next calibration.

4.3.9 Keypad

This test checks the good operation of keyboard.

- Press down "START STOP" to start the test is display.



  - ☐ Press down in sequence on the key corresponding to the number displayed on the screen (refer to the table below).
  - ☐ Pressing the "ON/OFF" key end keyboard test.

This test is incrementing one by one until the last one.

At the end of test, on "9" key, finish the test by pressing "0" key.

N°	Key	Description	N°	Key	Description
1	START STOP	Start/Stop	6		Up3
2		Lock	7		Down3
3		Loudness	8	START STOP	Start/Stop
4		Up1	9		Fill
5		Down1	0		Info

If one key is not operating, change the housing.

- Press "SET RATE" to carry out the next calibration.

4.3.10 LCD

This test enables to control the good operation of the LCD.

■ Calibration 108.

□ Press "START STOP" to start the test.

□ Check if the LCD is functioning correctly.
□ Press down "START STOP" to leave the test and carry on the following.

If LCD is damaged, change the CPU board.

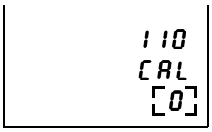
■ Press "SET RATE" to carry out the next calibration.

4.3.11 Nurse call relay

This test enables to control the good operation of nurse call relay.

Put the pump on the holder, with main supply.

■ Calibration 110.



□ The relay status is displayed.
□ Press down "START STOP" to drive the output:
- 0, deactivate relay.
- 1, activate relay.

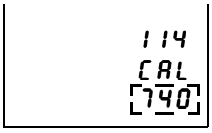
(see connection § 2.1.2)

■Press "SET RATE" to carry out the next calibration.

4.3.12 Air detection

The signal level of the air bubble sensor is displayed in arbitrary units.

■ Calibration 114.



□ Insert the giving set full of water without bubble (door closed):
- The measured value is displayed in arbitrary units.
- Check that this value complies with the range **2000 < X < 4000**.

□ Install the giving set full of air (door closed):
- The measured value is displayed in arbitrary units.
- Check that this value complies with the range **0 < X < 1000**.

□ Remove the giving set (background):
- The measured value is displayed in arbitrary units.
- Check that this value complies with the range **0 < X < 1100**.
-

If the value is out of tolerancces, calibrate the air bubble sensor (see **3 calibration menu**)

■ Press "SET RATE" to carry out the next calibration.

Preventive maintenance

4.3.13 Motor command test

This test enables to control the motor command.

■ Calibration 119.
- ☐ Insert a giving set (door closed).
- ☐ Close the door.
- ☐ Press down "START STOP" to start the test.

Motor command	80
Time measurement (ms)	CAL 845

- ☐ Press down the "VOL" keys to select the value of the motor command (from 0 to 100).
  - The measured value is displayed in point.
  - Check that this value complies with the range **±300 ms**.

Correspondence table**:**

Value (PWM)	Time per revolution (ms)
50	1200
70	900
90	700

If the value is out of tolerances, calibrate the motor (see **3 calibration menu**).

■ Press "SET RATE" to carry out the next calibration.

4.3.14 Door alarm test

To perform this test, exit test mode.

■ Insert a giving set with a ***clamp***.
■ Without closing the door, press "START STOP".
- ☐ Check the presence of the door alarm.

■ Close the door, press down "START STOP".
■ Open the door during pumping.
- ☐ Check the presence of the door alarm.

4.3.15 Optical detection alarm test

To perform this test, exit test mode.

■ Insert a giving set with a ***clamp***.
■ Close the door, press down "START STOP".
- ☐ Check the infusion start.

■ Insert giving set alone.
■ Close the door, press down "START STOP".
- ☐ Check the presence of the giving set alarm.

4.3.16 Occlusion alarm test

To perform this test, exit test mode.

- Insert a giving set with a ***clamp***.
- Connect a manometer to the giving set outlet.
- Close the door.
  - Set the flow rate at 300 ml/h.
  - Press "START STOP" to start the infusion.
  - Check the presence of occlusion alarm when the pressure is 0.7 bar < p <1.3 bar.

- Release the occlusion.
  - Set a flow rate at 125 ml/h.
  - Press "START STOP" to start the infusion.
  - Check the presence of occlusion alarm when the pressure is 0.7 bar < p <1.3 bar.

4.3.17 Air detection alarm test

To perform this test, exit test mode.

- Place a giving set with a ***clamp*** in the cavity of the pump.
- Close the door, set the flow rate at 300 ml/h and press "START STOP".

- Create a small air bubble (3 cm).
  - Check the absence of alarm.
- Create a big air bubble (12 cm).
  - Check the presence of alarm.

To start again the test, select a 25 ml/h flow rate.

4.3.18 Periodic control procedure

Use this table to note the results of the different tests.

Equipment type:	Code:	Serial number of equipment:

N°	Procedure	Obtained value	Conformity Yes	Conformity No
1	■ Check the general aspect of the pump and of the labels.			
2	■ Display the battery temperature, CAL 50: ☐ Check that **0 < T°< 60**: **********			
3	■ Display the battery voltage, CAL 51: ■ Check that **0 < U < 6**: **********			
4	■ Display the supply type, CAL 97: ☐ 1111, battery supply: ********** ..... ☐ 8888, mains supply: **********			
5	■ Buzzer test, CAL 98.			
6	■ Door test, CAL 100: ☐ Open door, **2000 < U < 3000**: ********** ..... ☐ Closed door, **2800 < U < 3800**: **********			
7	■ Optical ***clamp*** test, CAL 101: ☐ Noise, **0 < U_1 <700**: ********** ..... ☐ ***clamp*** in position: . if 0 < **U_1** < 239, **1500 < U_2 < 4000**: ********** ..... . if 240 < **U_1** < 299, **1800 < U_2 < 4000**: ********** ..... . if 300 < **U_1** < 349, **2250 < U_2 < 4000**: ********** ..... . if 350 < **U_1** < 699, **2500 < U_2 < 4000**: ********** ..... . if **U_1** > 700, **error**: **********			
8	■ Optical background test, CAL 103: ☐ Clamp in position, **0 < U < 500**: **********			
9	■ Keypad test, CAL 107.			
10	■ LCD test, CAL 108.			
11	■ Nurse call relay test, CAL 110: ☐ 0, deactivated relay: ********** ..... ☐ 1, activated relay: **********			
12	■ Air detection test, CAL 114: ☐ Without air, **2000 < U < 4000**: ********** ..... ☐ With air, **0 < U < 1000**: ********** ..... ☐ Without giving set, **0 < U < 1100**: **********			

Preventive maintetance

N°	Procedure	Obtained value	Conformity Yes	Conformity No
13	■ Motor command test, CAL 119: ☐ ± **300 ms**: ********** ..... **PWM** | **Time revolution (ms)** 50 | 1200 70 | 900 90 | 700			
14	■ Door alarm test: ☐ Presence of alarm with open door when start pumping: ***** ..... ☐ Presence of alarm at the opening of the door during pumping:			
15	■ Optical detection alarm test: ☐ Infusion start if ***clamp***: ********** ..... ☐ Presence alarm if only giving set: **********			
16	■ Occlusion alarm test: ☐ Flow rate at 300 ml/h: Presence alarm if occlusion 0.7 bar < p < 1.3 bar: ..... ☐ Flow rate at 125 ml/h: Presence alarm if occlusion 0.7 bar < p < 1.3 bar:			
17	■ Air bubble alarm test: ☐ Absence of alarm if small bubble < 3 cm: ********** ..... ☐ Presence of alarm if large bubble > 12 cm: **********			
18	■ Rate/battery test: ☐ Recharge the battery. ☐ Operate the pump for 10 h at a flow rate of 600 ml/h: ********			
19	■ Flow rate test: ☐ ±10%, 600 ml/hr: **********			
20	■ Pump + holder checking on mains: ☐ Connect the pump to the holder and check the mains indicator is on. ..... ☐ Disconnect the pump and check the battery indicator is on. *			

Actions:

Observations:

Name:	**Date:**	**Signature:**

Preventive maintetance

4.4 Flow rate control

4.4.1 Measurement with scales

Equipment required

- Stop clock.
- Scales.

Flow rate value	Scales sensitivity
x ≤ 5 ml/hr	1/10000th
5 ml/hr < x ≤ 30ml/hr	1/1000th
x > 30 ml/hr	1/100th

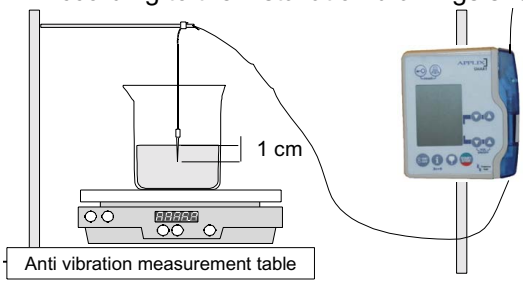
- Test tube or beaker with 1 ml graduating.
- Liquid: distilled water and oil.
- Canula:

Flow rate value	Canula type
x < 30ml/hr	G26
x > 30 ml/hr	G18 or G21

- Giving Set: APPLIX Smart/Vision Bag Article no: 7751 711.

Installation

- According to the installation drawings shown below.



Make sure the horizontal installation plane is respected.

- Fill the container with 600 ml or more of distilled water.
- Connect a giving set with the container.
- Connect the canula with the distal end of the giving set.
- Fit the giving set on to the pump.
- Fill the giving set with water. Take care that no air is in the tube before the measurement is started.
- Fill the test tube or the beaker with some water ensuring the canula is dipped in the water (> 1 cm).
- Add several drops of oil to create a greasy film on the surface of the water. This way the user will avoid any measurement error due to evaporation of the water.
- Place the test tube or the beaker in the centre of the scales platform.
- Place the canula inside the test tube or the beaker ensuring that it is dipped in the water.

The giving set must not rest on the scales/test tube assembly.

Operating mode

- Select a flow rate.
- Set the scales at 00.00 g.
- Start the pumping (if necessary make a note of the stop clock start value).
- Press the "STOP" key to stop the test after a time interval T.
- Note the value in grams of the “infused” liquid.
- Transform the measured weight into a volume:

1 gram = 1 ml.

- Calculate the feeding rate error as follows:

Feeding rate error [%] =

$$\left[\frac{\dfrac{\text{measured volume [\%]} \times 60 \left[\frac{\text{min}}{\text{h}}\right]}{\text{T [min]}} - \text{selected feeding rate} \left[\frac{\text{ml}}{\text{h}}\right]}{\text{selected feeding rate} \left[\frac{\text{ml}}{\text{h}}\right]} \right] \times 100$$

4.4.2 Measurement using a test tube

Equipment required

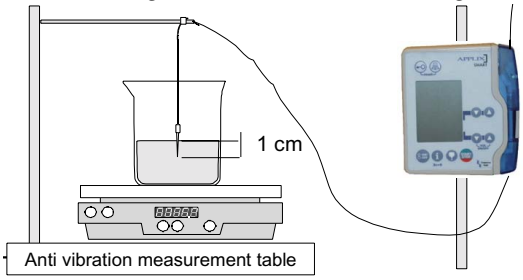
- Stop clock.
- Test tube or beaker with 1 ml graduating.
- Liquid: distilled water and oil.
- Canula:

Flow rate value	Canula type
x < 30ml/hr	G26
x > 30 ml/hr	G18 or G21

- Giving Set: APPLIX Smart/Vision Bag, Article no: 7751711.

Installation

- According to the installation drawings shown below.



Make sure the horizontal installation plane is respected.

- Fill the container with 600 ml or more of distilled water.
- Connect a giving set with the container.
- Connect the canula with the distal end of the giving set.
- Fit the giving set on to the pump.
- Fill the giving set with water. Take care that no air is in the tube before the measurement is started.
- Fill the test tube or the beaker with some water ensuring the canula is dipped in the water (> 1 cm).
- Add several drops of oil to create a greasy film on the surface of the water. This way the user will avoid any measurement error due to evaporation of the water.
- Place the canula inside the test tube on the beaker ensuring that it is dipped in the water.

Operating mode

- Select a flow rate.
- Start pumping and start the stop clock at the same time.
- After a time interval T stop the pump.
- Measure the volume that is pumped into the test tube or beaker within the time interval T.
- Calculate the feeding rate error as follows.

Feeding rate error [%] =

$$\left[\frac{\frac{\text{measured volume [\%]} \times 60 \left[\frac{\text{min}}{\text{h}}\right]}{\text{T [min]}} - \text{selected feeding rate} \left[\frac{\text{ml}}{\text{h}}\right]}{\text{selected feeding rate} \left[\frac{\text{ml}}{\text{h}}\right]} \right] \times 100$$

4.5 Cleaning and desinfection

The pump forms a part of the patient's immediate environment. It is advisable to clean and desinfect the device's external surface on a daily basis, in order to protect patient and staff.

- Disconnect the mains cable from the wall socket before starting cleaning.
- Do not place in an AUTOCLAVE, nor IMMERGE the device, and do not allow liquids to enter either the device's casing, or it's main supply cover.
  - For cleaning and desinfection we recommend a previously with water diluted alcoholic solution (ethanol < 80%).
  - Avoid abrasive scrubbing which could scratch the casing.
  - Neither rinse, nor wipe surfaces.
- If the equipment is used in a department with severe contamination risks, after disinfecting by wiping with a damp cloth, equipment should be left in the room during serial desinfection.

4.6 Storage

The storage of the equipment must be done in a dry and moderated location.

The recommended environment condition for a storage of the equipment is between -20°C and +45°C.

Relative humidity : 85% maximum without condensation.

Fully recharge the battery before using the equipment to avoid any risk caused by micro power cuts in the mains supply and to ensure maximum autonomy.

5 Diagnosis

5.1 Troubleshooting

Problem	Cause	Action
■ Unjustified door alarm.	■ Wrong calibration.	■ Re-calibrate the door position.
	■ Sensor out of order.	■ Replace the door and re-calibrate the pump.
■ Unjustified optical detection alarm.	■ Damaged ***clamp***	■ Replace the ***clamp***.
	■ Wrong calibration.	■ Re-calibrate the pump.
	■ Out of order sensor.	■ Replace the top surface and re-calibrate the pump.
■ Unjustified occlusion alarm.	■ Wrong calibration.	■ Re-calibrate the pump.
	■ Pressure limit out of range.	■ Replace the pump body.
■ Unjustified air bubble alarm.	■ Wrong calibration.	■ Re-calibrate the pump.
	■ Out of order sensor.	■ Replace the top surface and re-calibrate the pump.

5.2 Error messages

Error code	Description	Recommanded action
E 0	■ Value of A/D-converter 0 out of range.	■ Check air detection (see §4 air detection " 1 14").
E 1	■ Value of A/D-converter 1 out of range.	■ Check the door position (see §4 door position " 100").
E 2	■ Value of A/D-converter 2 out of range.	■ Check the optical detection (see §4 optical ***clamp*** detection, optical background detection " 10 1/ 103/").
E 3	■ Value of A/D-converter 3 out of range.	■ Replace the CPU board.
E 4	■ Value of A/D-converter 4 out of range.	■ Replace the CPU board or the battery.
E 5	■ Value of A/D-converter 5 out of range.	■ Check battery voltage (see §4 battery voltage "5 1"). ■ Replace the CPU board or the battery.
E 6	■ Value of A/D-converter 6 out of range.	■ Check battery temperature (see §4 battery temperature "50"). ■ Replace the CPU board or the battery.
E 7	■ Value of A/D-converter 7 out of range.	■ Replace the CPU board (reference voltage).
E 8	■ Rotor of pump mechanism isn't moving.	■ Check the motor command (see §4 commande moteur " 1 19").
E 9	■ Image of pressure has risen too far.	■ Re-calibrate the pump.
E 10	■ KEY_ERROR: □ Key combination stable for too long time. □ Unused key 16 has been evaluated (keypad distur-bed).	■ Check the keypad (see §4 keypad " 107").
E 11	■ Current of pump motor is too high for valid stop state (> 10 mA, for example if motor hasn't stopped or is running while pumping is not active).	■ Check the absence of short-circuit. ■ Check the motor command (see §4 commande moteur " 1 19"). ■ Replace the CPU board.
E 12	■ US detector for air detection is defective. □ Too high signal level without pulse. □ Signal is higher than alarm threshold that has been adjusted via RS232.	■ Check air detection (see §4 air detection " 1 14"). ■ Replace the top surface.

Error code	Description	Recommanded action
E 13	■ WATCH_DOG: Internal watchdog of controller has attacked.	■ Write down the error adresses then press down"ON". ■ Replace the CPU board.
E 14	■ Battery charger defective.	■ Replace the CPU board.
E 15	■ Pump motor can not be synchronized by light barrier wheel.	■ Check the optical disk. ■ Replace the CPU board.
E 16	■ Watchdog of motor control failed test.	■ Replace the CPU board.
E 17	■ EEPROM defect (failed read/ write test).	■ Replace the CPU board.
E 18	■ *Only APPLIX Vision.*	■ **None.**
E 19	■ *Only APPLIX Vision.*	■ **None.**
E20	■ Door sensor is defective (signal out of range).	■ Check the door (see §4 door position " 100 ").
E21	■ Giving set detection is defective (signal too high when both light emmitters are off).	■ Check the optical detection (see §4 optical ***clamp*** detection, optical background detection " 101/103 "). ■ Replace the top surface. ■ Replace the CPU board.
E22	■ Motor is too slow. □ Motor needed too much time to complete revolution (more than 30 % longer than it should). □ Motor had not been switched off when it had to be switched on again in pulsed mode.	■ Check the motor command (see §4 commande moteur " 119 "). ■ Re-calibrate the pump. ■ Replace the gear motor or the pumping unit.
E23	■ Motor is too fast. □ Motor has been more than 30 % faster than it should have been.	■ Check the motor command (see §4 commande moteur " 119 "). ■ Re-calibrate the pump. ■ Replace the gear motor or the pumping unit.
E24	■ CRC of EEPROM not OK.	■ Change the CPU board.
E25	■ CRC of calibration parameters in RAM not OK.	■ Change the CPU board.
E26	■ A pumping has been launched with a pump that has not been set to calibrated state.	■ Calibrate the pump.
E27	■ Measured current too low to calculate occlusion.	■ Change the CPU board. ■ Check mechanical system.

Error code	Description	Recommanded action
E28	■ Measured current low to calculate occlusion.	■ Change the CPU board. ■ Check mechanical system.

6 Intervention procedure

This chapter lists all of the procedures of disassembly and reassembly.

Service shall be done by approved and qualified technicians who have been trained.

N°1, Procedure: Housing

Safety:

For safety reasons, the technician should not carry out any maintenace when the equipment is voltage supplied.

Disconnect the mains power supply cable.

Required tools

- 1 Z1 Posidriv screwdriver.
- 1 flat screwdriver (small).
- 1 antistatic band.

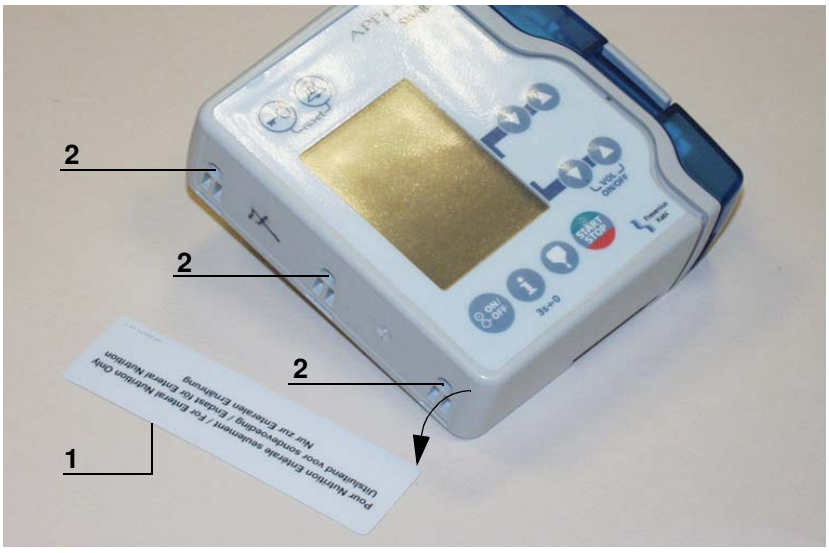
Maintenance level

Level #2, specialised technician (refer to documentation on biomedical technical training).

Procedure

Access

- Remove the **APPLIX Pump** from the holder.
- Remove the label (tag #1).
- Unscrew the 3 cross-pointed screws (tag #2) located at the left of the housing; they connect the housing to the top surface.

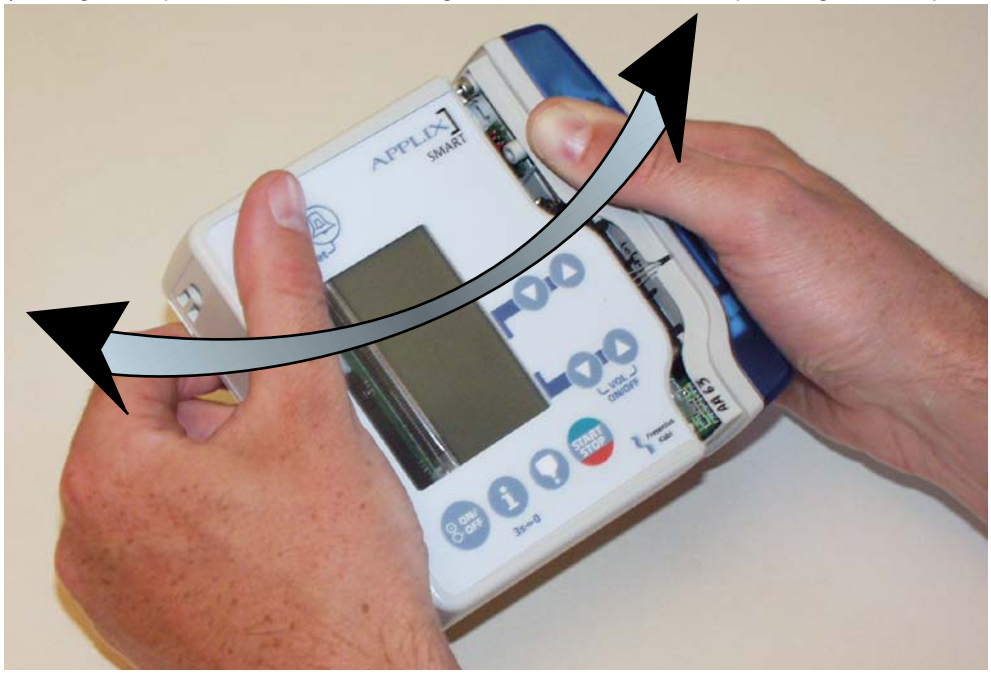


Do not put hands on the electronic boards (especially the LCD).

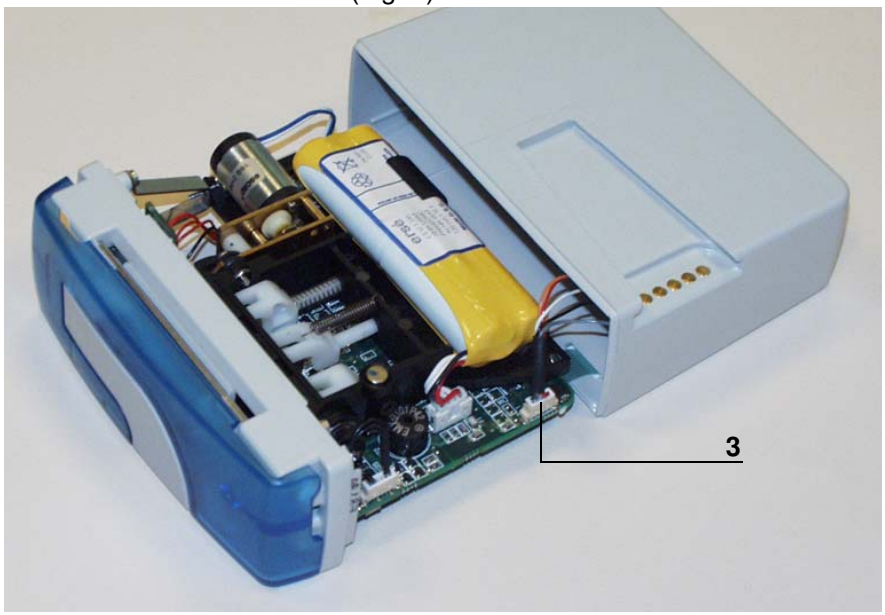
Disassembly

During interventions on electronic components, it is recommended to hold a ground-connected antistatic band and to work on an antistatic foam mat.

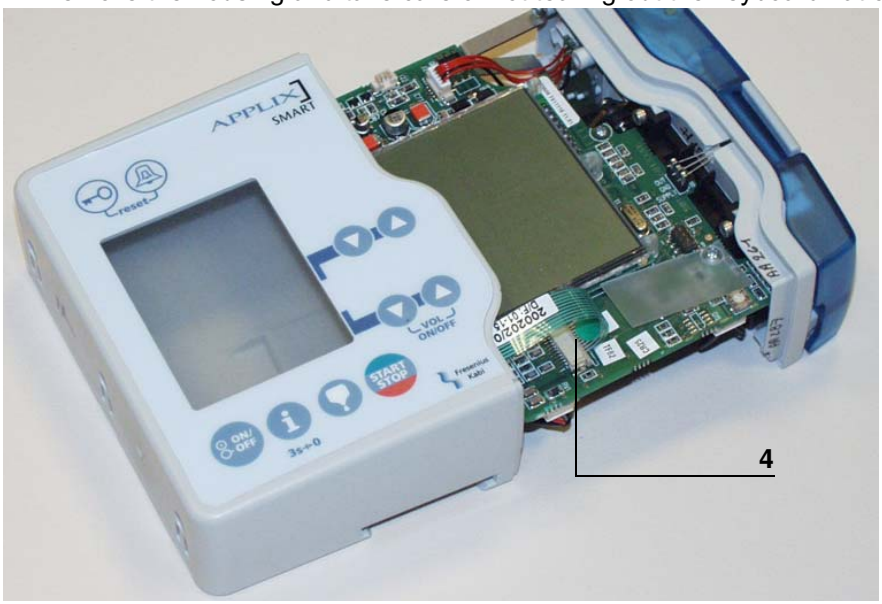
- Gently uncouple the front face/housing assembly, bending it to prevent LCD to scrape on the housing windows. Do not entirely remove the housing.
(During this operation, it is normal to get a resistance when separating the two parts).



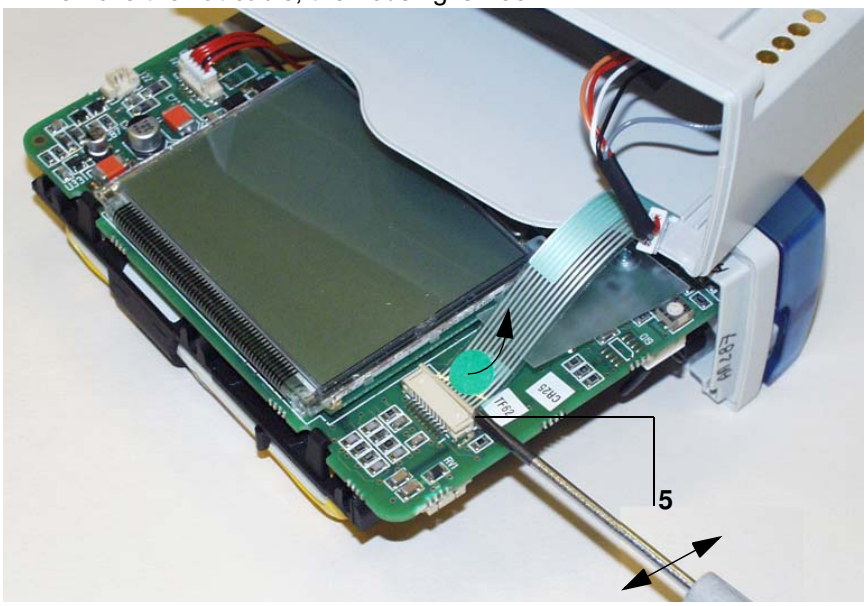
- Return it on the "keyboard" face (housing to the right).
- Finish uncoupling the assembly, until seeing the white connector (tag#3).
- Disconnect the connector (tag#3)



- Maintain the **APPLIX Pump** in this position and return it on the "contact" face (housing to the left).
- Remove the housing and take care of not tearing out the keyboard flat cable (tag#4)..



- With a small flat screwdriver, loosen the connector (tag#5).
- Remove the flat cable, the housing is free.



Re-assembly

Carry out the reverse operations of disassembly taking care of correctly positioning the flat cables and the strands.

N°2, Procedure: Rechargeable batteries

Safety:

For safety reasons, the technician should not carry out any maintenance when the equipment is voltage supplied.

Disconnect the mains power supply cable.

Required tools

- 1 Z1 Posidriv screwdriver.
- 1 flat screwdriver (small).
- 1 antistatic band.

Maintenance level

Level #2, specialised technician (refer to documentation on biomedical technical training).

Procedure

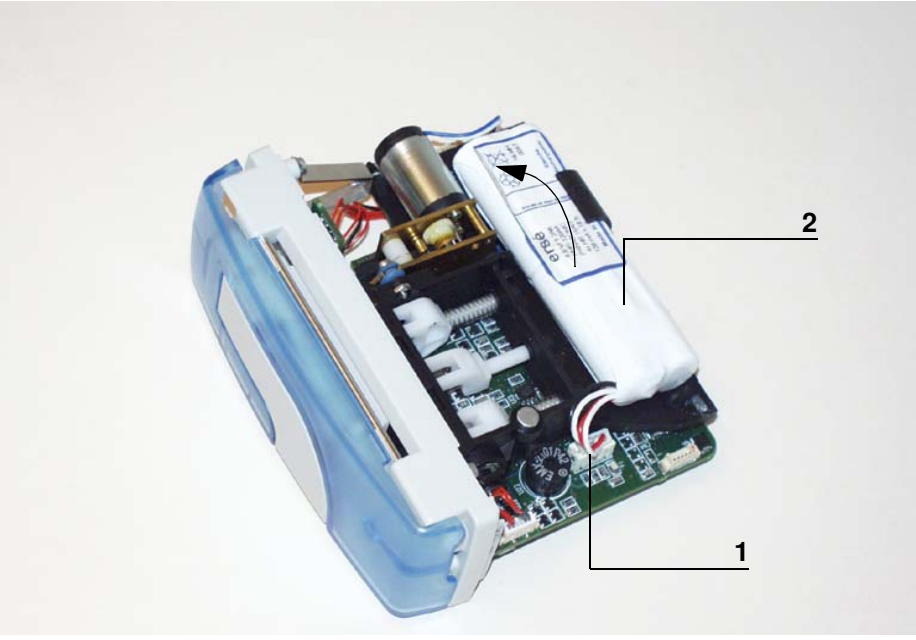
Access

- Open the housing (see n°1 procedure).

Disassembly

Do not put hands on the electronic boards.

- Turn the **APPLIX Pump**.
- Disconnect the connector (tag#1) and remove the rechargeable battery (tag #2).



For environmental protection, do not throw the batteries in the housewaste. Remove the battery from the device prior to destruction and as during normal maintenance replacement, return it to a competent recycling organisation.

Re-assembly

Only replace with the same model of battery recommended by the manufacturer.

Carry out the reverse operations of disassembly taking care of the correct positioning of the flat cables and the strands.

Useful addresses

SALES DEPARTMENT

Fresenius Kabi Nederland B.V. Goudsboemvallei 62 5237 MK 's-Hertogenbosch	Tel.: 073-684 88 00 Fax: 073-648 88 48
Fresenius Kabi France 5, place du Marivel 92310 Sèvres	Tel.: 01 41 14 26 00 Fax: 01 41 14 26 01
CUSTOMER SERVICE	Tel.: 02 32 09 39 50 Fax: 02 32 09 39 57
Fresenius Kabi N.V. Molenberglei 7 2627 Schelle	Tel.: 03/880.73.02 Fax: 03/880.73.03
CUSTOMER SERVICE	Tel.: 03/880.73.08 Fax: 03/880.73.09
Fresenius Kabi Norge AS Gjerdrums vei 12 0486 Olso	Tel.: 22 58 80 00 Fax: 22 58 80 01
Fresenius Kabi AB 751 74 Uppsala	Tel.: 018-64 40 00 Fax: 018-64 49 20
Fresenius Kabi AB Rajatorpandie 41C 01640 Vantaa	Tel.: 09 85 20 21 05
Fresenius Kabi Bredgade 71 1260 København K.	Tel.: 33 18 16 00 Fax: 33 18 16 14
Fresenius Kabi Ltd. Hampton Court, Manor Park Rancorn, Cheshire WA7 1UF	Tel.: 01928 594200 Fax: 01928 571065
Fresenius Kabi Italia SpA Via Camagre, 41 37063 Isola della Scala (VR)	Tel.: +39 045 6649 321 Fax: +39 045 6649 444

TRAINING DEPARTMENT

Fresenius Kabi France Le Grand Chemin, F-38590 Brézins	Tel. +33 (0)4 76 67 10 76 Fax: +33 (0)4 76 67 11 22
Fresenius Kabi N.V. Molenberglei 7 2627 Schelle	Tel.: 03/880.73.02 Fax: 03/880.73.03
Fresenius Kabi Ltd. Hampton Court, Manor Park Rancorn, Cheshire WA7 1UF	Tel.: 01928 594200 Fax: 01928 571065

AFTER SALES SERVICE

After Sales Service Division GRENOBLE **Fresenius Vial** Le Grand Chemin, 38590 Brézins	Tel.: 04 76 67 10 04 Fax: 04 76 67 11 22
After Sales Service for UK Pump Maintenance Departement **Fresenius Kabi Ltd.** Melbury Park, Clayton Road Birchwood, Chesire WA3 6FF	Tel.: 01925 898168