Perfusor® Space

Service Manual

Version 1.3 English

B BRAUN
SHARING EXPERTISE

This Service Manual is valid for:

Designation	Part No.
Infusion syringe pump Perfusor® Space	0871 3030

This Service Manual is available under the following part number:

Designation	Part No.
Service Manual Perfusor® Space, English	8713 9020

Languages of this Manual

The Service Manual for this unit can be supplied in the following languages:

Designation	Part No.
Service Manual Perfusor® Space, German	8713 9010
Service Manual Perfusor® Space, English (US)	8713 9020U
Service Manual Perfusor® Space, French	8713 9030

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Important Preliminary Remarks 0

Service Work

The present manual is for your information only. The possession of this manual does not authorize the performance of service work. Service tasks may only be executed by persons, who

- have received appropriate training on the system from B. Braun
- are included in the revision service
- possess the necessary test equipment and mechanical aids, and
- fulfill the personal requirements (training and knowledge).

Technical Safety Checks

The user is obliged to perform or to have performed the Technical Safety Checks on those medial products for which these checks have been prescribed by the manufacturer and to carry them out according to the indications of the manufacturer as well as the generally approved technical standards while adhering to the periods stated (§ 6 MP BetreibV).

B. Braun also recommends training on the Technical Safety Checks, or to perform at least the steps indicated in the current version of the manual, as:

- the TSC requires that the instructions in the manuals are observed
- the manuals are a reference for measurements
- depending on the unit type, the Service Program must be called which may lead to a dangerous unit condition in case of inappropriate operation. Furthermore, a special service connector may be necessary.

Current Versions

This manual version corresponds to the state when the manual was written. B Braun reserves the right to make technical modifications. The state of the revision is indicated by the index number in the footer of every page.

Revision Service

The possession of this manual does not automatically mean inclusion in the revision service. You will be included in the revision service after:

- technical training by B. Braun Melsungen or
- a written order placed with the sales department of B. Braun (fee required).

Responsibility of the Manufacturer

The manufacturer, person who assembles, installs or imports the device can only be held responsible for safety, reliability and performance if

- mounting, enhancements, new settings, changes or repairs are carried out by duly authorized persons,
- the electrical installation in the corresponding room meets the requirements of the VDE 0107, VDE 0100 part 710 or IEC 60364-7-710 and the national standards,
- the device is used in accordance with the instructions for use and the Service Manual,
- the Technical Safety Checks are performed at regular intervals,
- a current manual which corresponds to the revision state is used when carrying out maintenance, repair and service,
- the service technician takes part in the revision service,
- the technician has participated in a technical training course for the specific B. Braun unit.

Quality Management

B. Braun is certified in accordance with DIN EN ISO 9001 and ISO 13485. This certification also includes maintenance and service.

The unit has the CE label. The CE label confirms that the device corresponds to the "Directive of the Council for Medical Products 93/42/EC" of June 14, 1993.

Checks and Repair

Training may only be performed by B. Braun. The possession of the manual does not authorize the performance of repairs. The instructions on electrostatic sensitive components (ESD standards) must be observed.

After repair a device check or diagnosis is to be carried out.

Notes on ESD

Semiconductors can be destroyed by electrostatic discharge. Especially MOS components can be damaged by interference from electrostatic fields, even without discharge via contact. This type of damage is not immediately recognizable. Unit malfunctions can even occur after a longer period of operation.

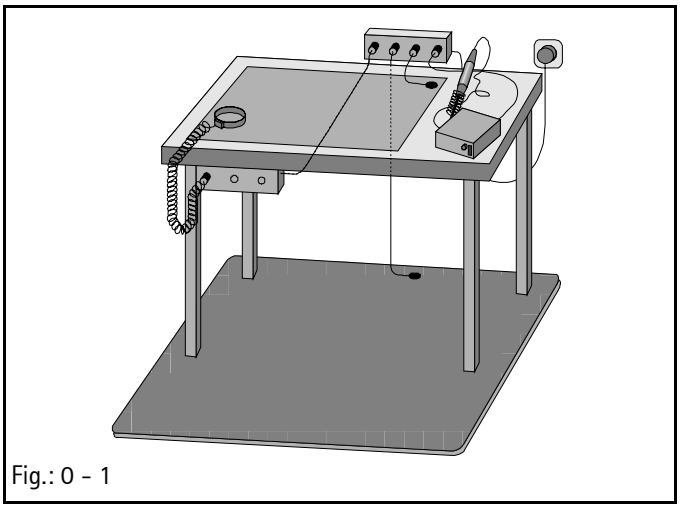


Fig.: 0 - 1

Each workstation must be equipped according to the recommendations with the necessary static protective measures, if ESD components or boards are handled.

Each workstation must be equipped with a conductive table surface. The conductive surface, the soldering iron or the soldering stations must be grounded via protective resistors.

Chairs must be of antistatic design. The floor or floor mats should be of electrically conductive material.

Personnel must wear conductive wristbands which are connected to a central ground potential via protective resistors, e.g. the ground contact of a wall outlet. Furthermore it is recommended that personnel wear cotton clothing and electrically conductive shoes to prevent electrostatic charge.

Spare Parts and Test Equipment

Only use original spare parts from the manufacturer. Do not tamper with assembly groups which can only be exchanged completely. The spare parts required are listed in the repair descriptions.

Service personnel are responsible for the calibration of their test equipment. Original test equipment can be calibrated at the works of B. Braun. Further information is available upon request.

Setting Off

Additional notes and warnings are set off as follows:

Note

Is used for additional or special notes concerning information and working steps.

CAUTION

Is used for working steps which may result in damage to the unit, system or to a connected device.

WARNING

IS USED FOR WORKING STEPS WHICH MAY RESULT IN PERSONAL INJURY.

References to chapters are shown as follows
(see "Setting Off" pg. 0 - 7)

References to figures and tables are shown as follows
Fig.: 2 - 3 or Table 2 - 1

References to item numbers in figures are shown as follows
(Fig.: 1 - 1 / Item 1)
In this case "Fig.: 1 - 1" is the figure number and "Item 1" the item number within the figure.

When the Service Manual is stored as pdf-file, these references are displayed green. Click with the mouse button on a reference to jump to the corresponding source.

Menu commands are described as:
Menu *File*.

List of Abbreviations

Abbreviations which are not generally known, but are used in this manual, are listed below.

CAN	Controller Area Network
CE	Communauté Européenne (European Communities)
CS	Calibration Step
DIN	Deutsche Industrie Norm (German Industrial Standard)
EN	European Standard
ESD	Electrostatic Discharge
FuP	Function Microprocessor
IEC	International Electrotechnical Commission
ISO	International Standardization Organization
ISP	Infusomat® Space
ISPS	Infusomat® Space, Silicon
ISPP	Infusomat® Space, PVC
KuP	Monitoring Microprocessor
LCD	Liquid Crystal Display
MOS	Short for the following company name: MOS Technology, Inc. (Commodore Semiconductor Group)
PCA	Patient-Controlled Analgesia
PSP	Perfusor® Space
SP	Space (System)
SPC	SpaceCover
SPCC	SpaceCover comfort
SPCS	SpaceCover standard
SPCO	SpaceCom
SPCT	SpaceControl
SPS	SpaceStation
TEMP	Temperature
TS	Troubleshooting Step
TSC	Technical Safety Checks

UTS	Unit Test Step
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik e.V. (German electrical engineering association)

Contact Persons 0

Technical Training	Via local representative.
Entry for Technical Training	Application for a technical training course must be made via the responsible representative.
Ordering of Spare Parts and Test Equipment	Please contact your local B. Braun subsidary. **International Technicians (Intercompany)** Nadja Machal Fax: +49 5661 / 75 - 47 89 e-mail: nadja.machal@bbraun.com
Service Hotline International	Karl Tippel, Tanja Kördel Fax: +49 5661 / 71 - 35 26 e-mail: karl.tippel@bbraun.com e-mail: tanja.koerdel@bbraun.com
Return of Spare Parts and Test Equipment	B. Braun Melsungen AG Schwarzenberger Weg 73-79 Wareneingang Werk C 34 212 Melsungen Germany
Safety Officer (§ 30 MPG)	Dr. Ludwig Schütz e-mail: ludwig.schuetz@bbraun.com
Translation	Cs2 Informatik GmbH & Co. KG, Germany

Contact Persons

For your notes:

System Overview 1

Description

The Perfusor® Space (PSP) is according to IEC/EN 60601 resp. IEC/EN 60601-2-24 a transportable infusion syringe pump for administrating fluids in the nutritional therapy and infusion technique as well as for home care applications.

The medical specialist must decide on suitability for application on the basis of the warranted properties and the technical data.

System Overview

The Space system is a modular design of modern infusion technology for stationary, mobile or private use. The key modules and their connection to the peripheral devices are shown in Fig.: 1 - 1.

All the pump types, Perfusor® Space, Infusomat® Space and Infusomat® Space P, as well as the other devices of the system are of modular design. Up to three pumps can be connected together mechanically using L rails on the bottom of the unit and grooves on the top. They can then be fastened to a drip stand or appropriate rail using the pole clamp.

The SpaceControl module can be used to extend operation. One single pump can be inserted onto this module. The pump is then connected via connectors to the module.

The SpaceStation module allows the set-up of a complete pump system with up to 24 pumps. Up to four pumps can be installed in every SpaceStation. The pumps are supplied with power via the integrated power supply and the built-in connectors. The pumps are connected to the optional SpaceCom via these connectors. SpaceControl can also be integrated into the system.

Up to six SpaceStations can be set-up as a column with a total of 24 pumps. SpaceStation placed next to each other can be connected via special connection cables, if the maximum number of 24 pumps in maximum three columns is not exceeded.

SpaceCover Standard or SpaceCover Comfort forms the top of each column. Alarms are signalled by a row of LEDs and a loudspeaker in the SpaceCover Comfort.

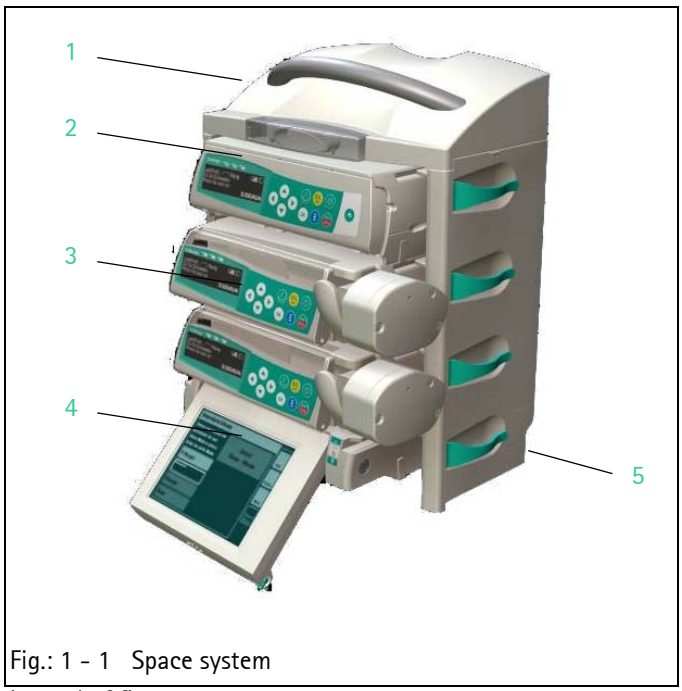


Fig.: 1 - 1 Space system

Legend of fig. 1 - 1:

Item	Designation
1	SpaceCover
2	Infusion pump Infusomat® Space
3	Infusion syringe pump Perfusor® Space
4	SpaceControl
5	SpaceStation

Physical Construction

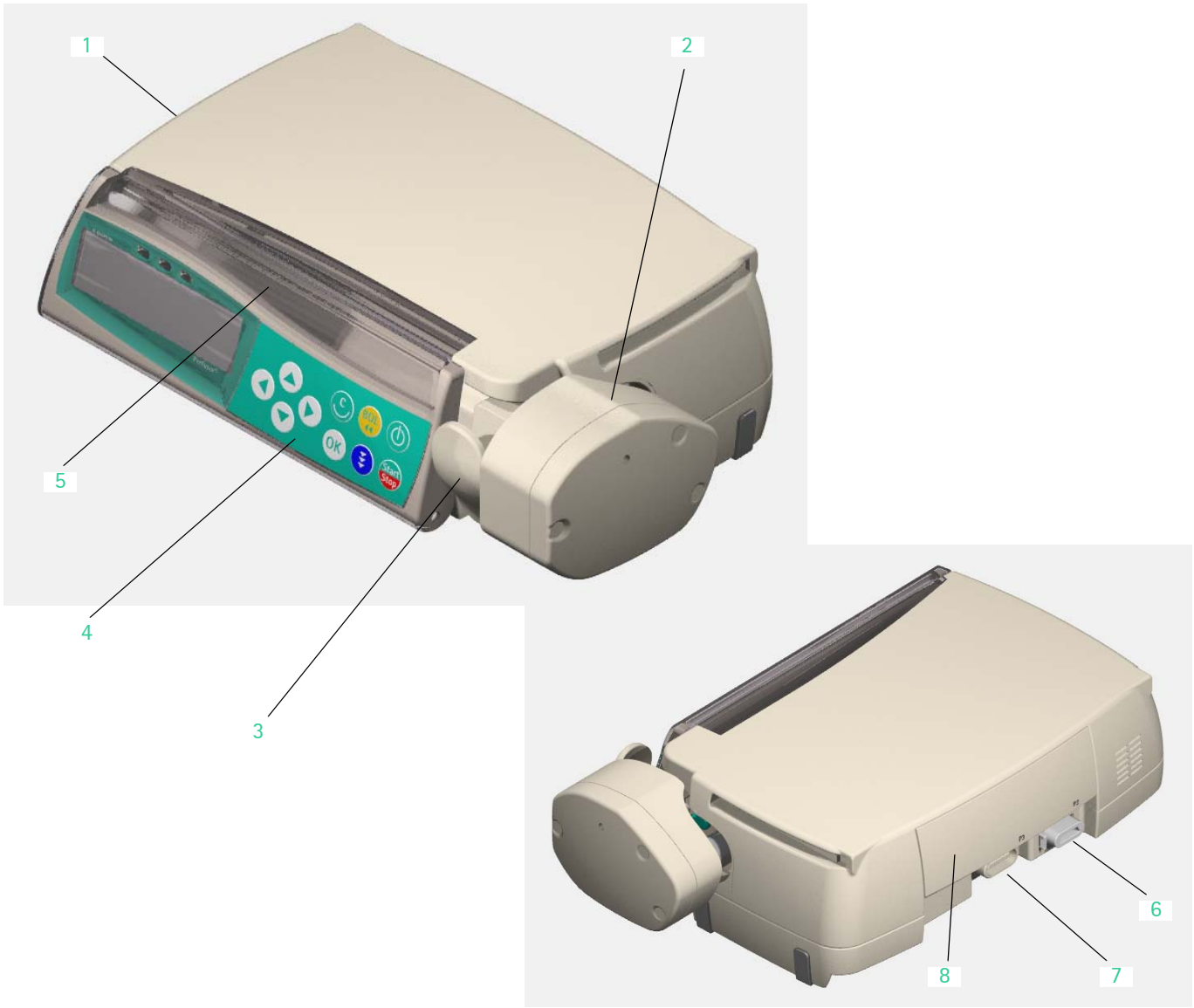


Fig.: 1 - 2 Perfusor® Space

Legend of fig. 1 - 2:

Item	Designation
1	Perfusor® Space
2	Drive head
3	Syringe holder with piston brake
4	Operating Unit
5	Syringe area
6	Connector "P2" for SpaceStation module, external 12 V DC and accessories
7	Connector "P3", connection to SpaceControl module
8	Battery compartment cover

The Perfusor® Space housing mainly consists of the bottom part and the upper part.

The battery module is inserted in the rear of the housing upper part. The opening is covered by the battery compartment cover.

The operating unit is attached to the front of the bottom part with two hinges. This operating unit covers the area for the syringes. The complete drive assembly, consisting of lead screw and drive head with driving tube is located directly behind the syringe area in the bottom part of the housing. The housing bushing for the driving tube is located in the side of the housing.

The syringe holder is mounted in the right side of the housing bottom part.

The processor PCB with the permanently connected external connectors "P2" and "P3" is located at the bottom of the housing bottom part.

Function

There are two power options for the Perfusor® Space:

- via the inserted battery module
- via an external 12 V DC power supply (e.g. SpaceStation, SpaceControl, an external power supply or from an ambulance car) connected to connector "P2"

The voltage supplied is converted to the internal voltages required through a voltage transforming and monitoring circuit on the processor PCB.

An independent circuit in the battery module monitors the battery cells and controls their charge condition.

The Perfusor® Space is connected to a SpaceControl by connector "P3".

The function processor controls all the functions of the Perfusor® Space. Data is stored in a non-volatile memory which also controls the external data transfer.

The control microprocessor monitors all important responses of the function processor to incoming information. If a response does not correspond with that expected by the control microprocessor, an error message is generated and the device is switched to a safe stop state.

The drive motor is monitored by a detector for speed and direction of rotation. The extended end position of the drive head is detected by a switch on the processor PCB.

The pressure in the infusion system is measured through a strain gauge measuring in the drive head and monitored in the device electronics. The data from the strain gauge is continuously compared with the limit values which are calculated dependent on the selected syringe type and the pressure settings. When the limit values are exceeded an alarm is automatically triggered and the pressure in the infusion system is reduced. The maximum pressure is additionally limited by a second, independent system. This maximum pressure limitation is performed using the motor current control.

The syringe size detection is performed via the syringe holder. The syringe holder is connected to a potentiometer. The syringe size is determined from the resistance of the potentiometer.

The syringe is fixed with the syringe holder and the axial fastening device. The syringe piston is fastened with two claws in the drive head. When a syringe is inserted the syringe piston is held by the piston brake, until the piston has been caught by the claws.

Keyboard and display as well as the syringe area are illuminated.

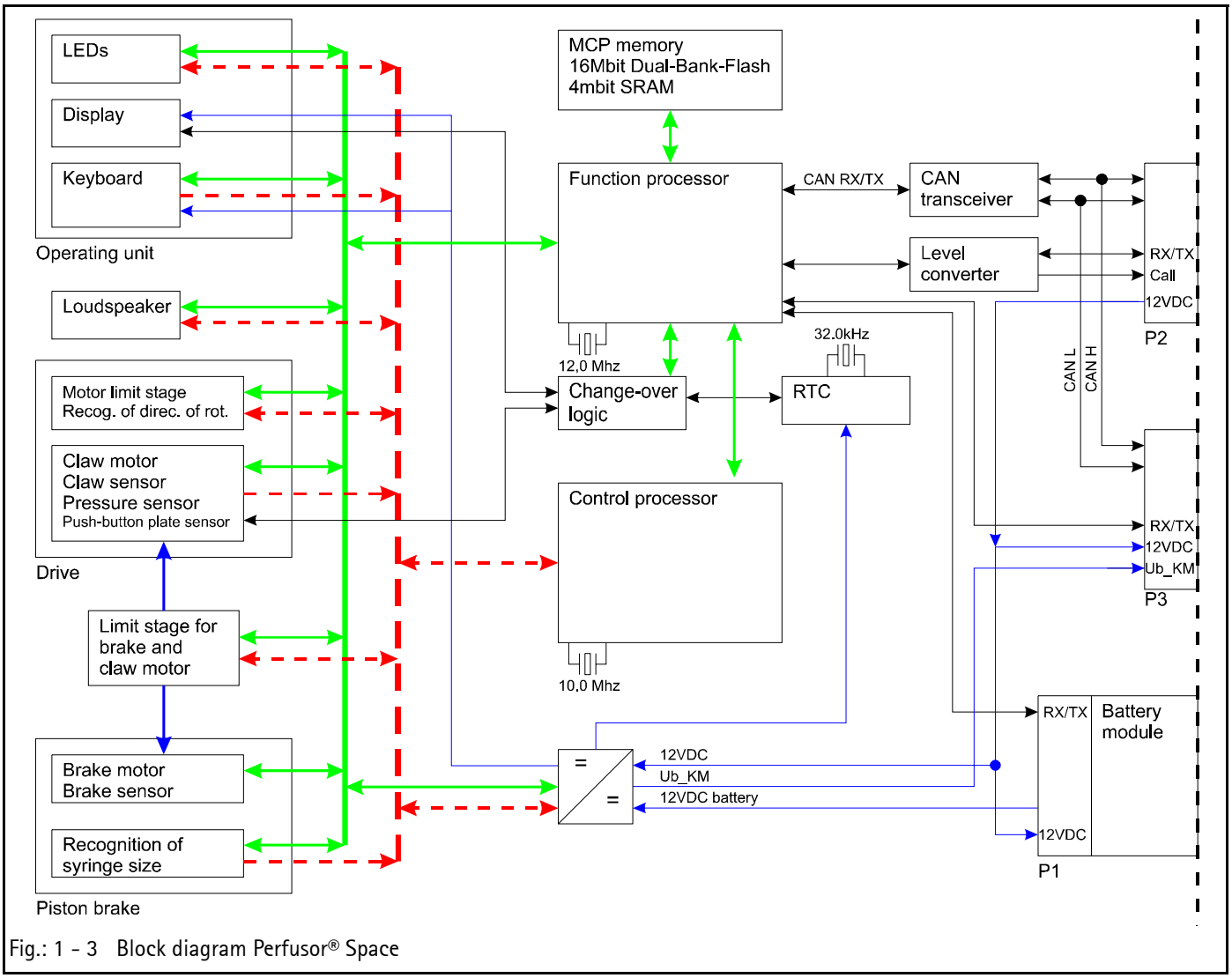


Fig.: 1 - 3 Block diagram Perfusor® Space

Unit Software

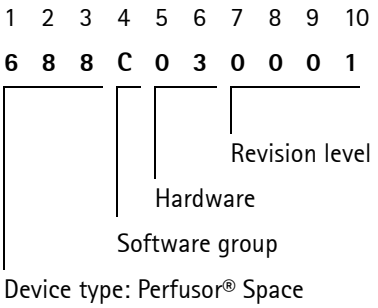


Fig.: 1 - 4

Approved Software Versions

688A030032

- Basic software

688A030035

- Improved functions

688A030040

- Improved functions
- Languages French and Swedish added

688B030002

- Improved functions

688B030003

- CAN bus functioning

688C030001

- Dose calculation
- Changed CAN log

688D030001

- Drug list data base
- Changed user language

688E030003

- Improved functions
- Piggyback
- Soft limits

688F030006

- PCA
- Changed claw configuration
- Optimized alarm handling

688G030002

- Improved functions

Software Update of the Unit

The instructions for updating the software are supplied with the software itself.

CAUTION

If the device is disconnected while the software is being updated or the device or PC is switched off, a component of the software may be seriously damaged so that repairs are no longer possible. In such a case the software cannot be updated via the PC and the device must be returned to B. Braun.

Service Program

Approved Version

Note

Please note that text and / or functions of the Service Program may change depending on the software version. The following screen illustrations are only examples and represent the state when the manual was printed.

- 0.0.28
- 1.0.0
- 1.1.2
- 1.1.3
- 1.1.4
- 1.2.1
- 1.3.5
- 1.5.0
- 2.0.1
- 3.1.0
- 4.0.0
- 5.1.0

Starting the Service Program

Note

Installation and further operation of the Service Program is described in its separate instructions for use.

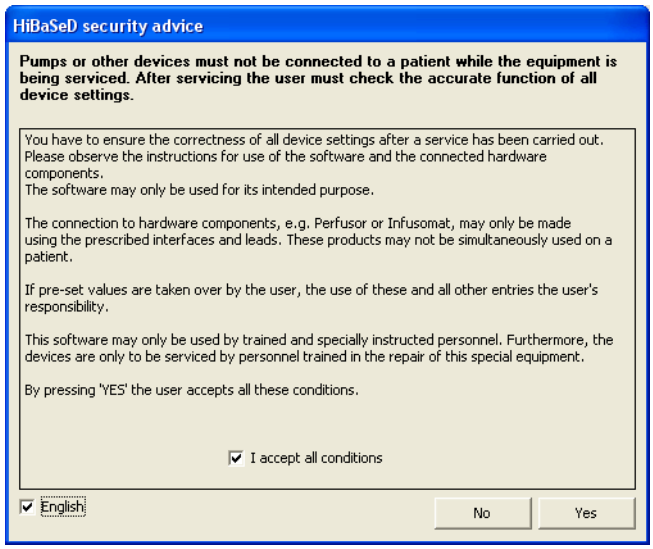


Fig.: 1 - 5

1. Start the "HiBaSeD.exe" program (History, Barcode, Service, Drug list) on the PC. The Service Program is loaded and started and the initial window of the Service Program is displayed.
2. Read the notes carefully.
3. Mark the field "I accept all conditions" and then the field "Yes" to confirm that you have read the notes.

Note

Click the field "English" to switch the language of the notes over to English.

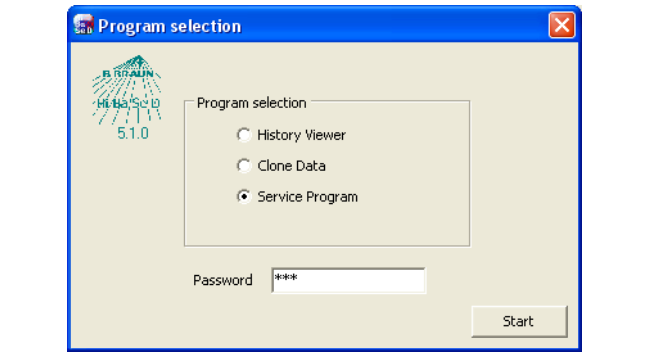


Fig.: 1 - 6

4. Enter the password and confirm it by clicking the field "Start".

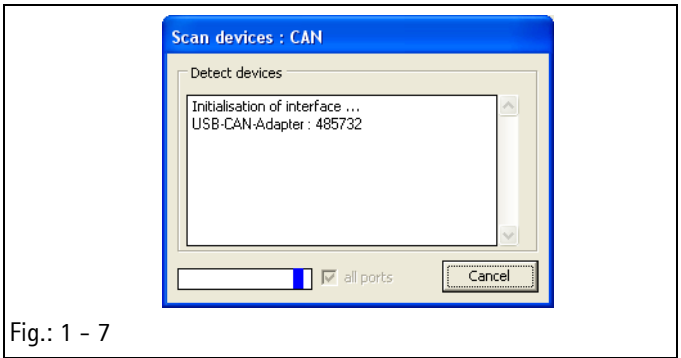


Fig.: 1 - 7

The Service Program checks the PC interfaces for connected devices of the Space system. Units that were found are displayed for a short moment on the screen.

The work window of the Service Program appears on the screen. All devices recognized are listed in the left column.

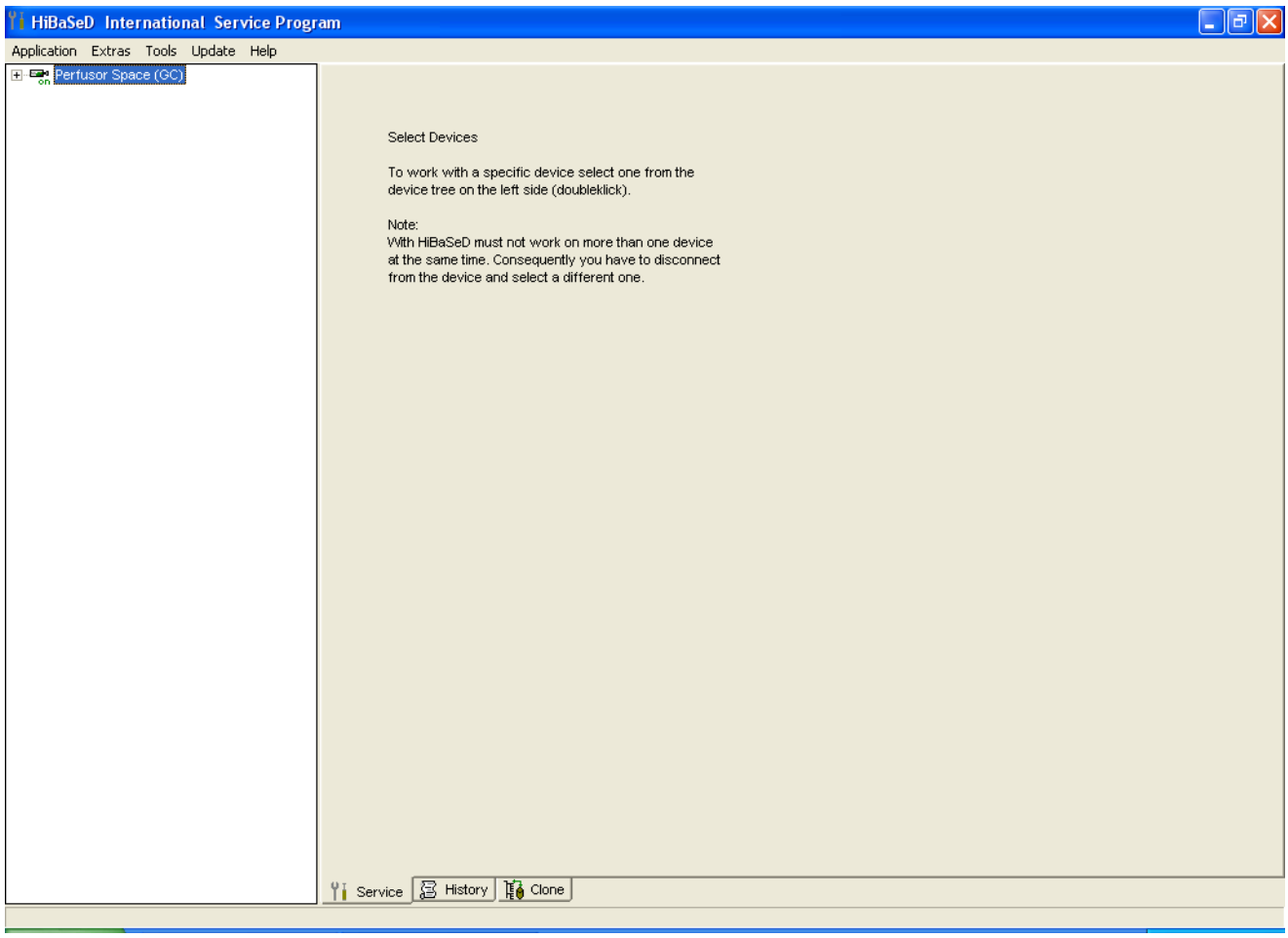


Fig.: 1 - 8

5. Activate the desired device from the list on the left in the work window with a double-click. The device data is then displayed below the device name.

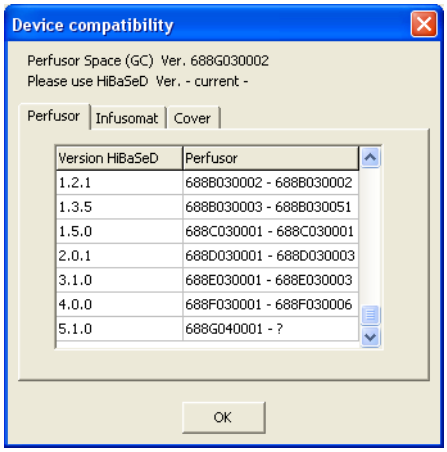


Fig.: 1 - 9

If the unit software version is not compatible with the Service Program version, a window opens prompting the operator to change the Service Program version. This window displays a compatibility list of the Service Program- and unit software versions.

If Service Program- and unit software versions are compatible, all the Service Program functions are activated.

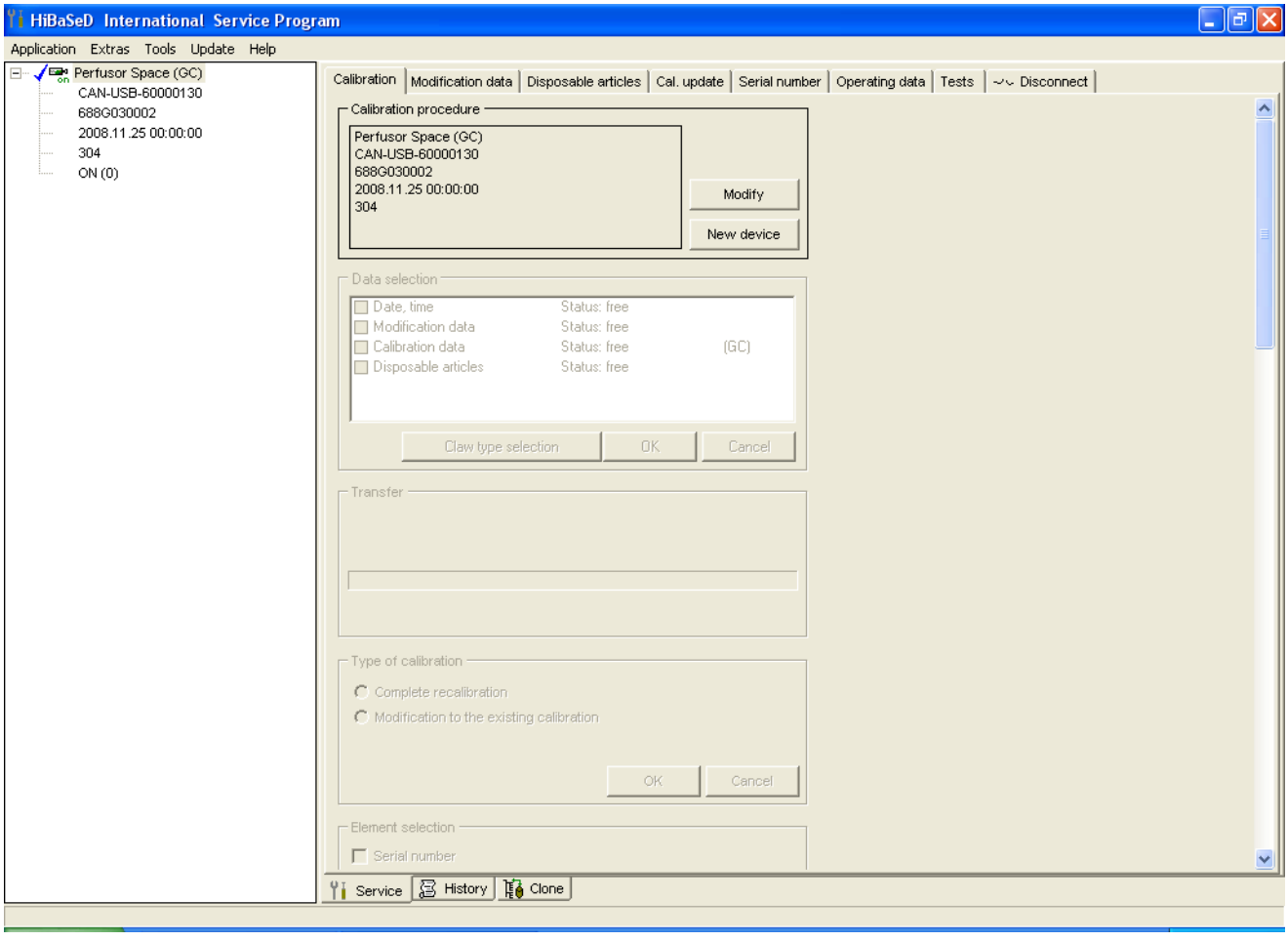


Fig.: 1 - 10

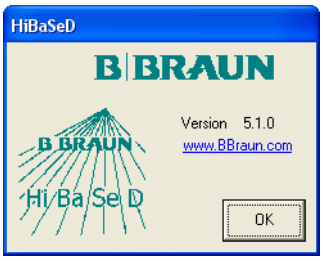


Fig.: 1 - 11

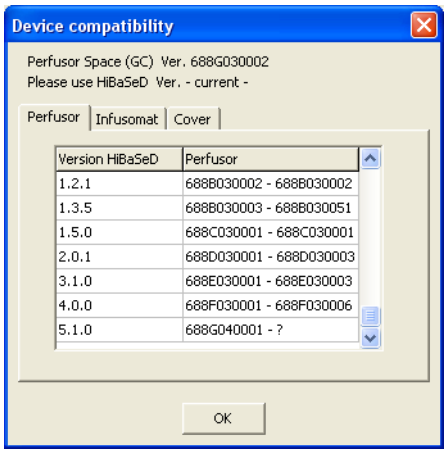


Fig.: 1 - 12

Service Program Version

1. Open the "HiBaSeD" window via *Help* *Info ...*. The current version of the Service Program is shown in this window.
2. Close the window by clicking "OK".

Compatibility List

1. Open the "Unit - Compatibility" window via *Help* *Compatibility*. This window displays the compatibility of the HiBaSeD-version and the unit software version.
2. Close the window by clicking "OK".

Quit the Service Program

1. Exit the Service Program via *Application* *Quit*.
2. Disconnect a power supply which might be connected from the unit.
3. Switch off the unit.
4. Remove the battery module.
5. The device can be restarted after appr. 10 seconds.

Technical Data

All technical data is indicated in the instructions for use.

Options

The functions of the individual options are detailed in the instructions for use.

Perfusor® Space

Designation	Part No.:
Power supply Euro	0871 3110A
Power supply UK	0871 3111A
Power supply USA / Japan	0871 3112A
Power supply Australia	0871 3113A
Power supply South Africa	0871 3115A

Accessories

Designation	Part No.:
Charger SP battery charging station	0871 3170
Connection cable staff call SP	0871 3232
Power supply cable 12 V for ambulance cars	0871 3231
CombiLead SP 12 V connection cable, pump - pump	0871 3133
InterfaceLead SP interface cable RS232	0871 3234
InterfaceLead SP interface cable CAN SP	0871 3230
SpaceClamp SP The SpaceClamp is a holder attached on beds for one or several Space system pumps.	0871 3130
Short stand SP	0871 3135
Space PCA kit (PCA button)	0871 3554
Syringe Anti Removal Cap PSP	0871 3556

Unit Diagnosis / Calibration 2

General

WARNING

WHILE TESTING THE UNIT AND TROUBLE SHOOTING THE OPERATOR/SERVICE TECHNICIAN MUST WORK WITH VOLTAGES UP TO 115 / 230 V AC. THESE VOLTAGES MAY CAUSE INJURIES WHICH ARE DANGEROUS TO LIFE AND LIMB. THE NATIONAL AND INTERNATIONAL SAFETY REGULATIONS ARE TO BE ADHERED TO.

Before each disassembly and assembly of a unit subsystem check the connectors, plug contacts and connections for corrosion and tight fit. These fault types are not described again in the following trouble shooting list.

The following equipment and gauges are necessary for testing the unit and/or performing troubleshooting:

- PC
- Service connector SP
- Service Program HiBaSeD
- Interface cable
- Syringe 2 ml / 3 ml
- Syringe 10 ml
- Syringe 30 ml
- Diameter gauge 32.0 mm
- Diameter gauge 23.4 mm
- Diameter gauge 15.7 mm
- Diameter gauge 9.0 mm
- Length gauge PSP
- Syringe gauge "#Lehre OPS 50"with push-button plate and motor power test adapter for Perfusor® Space

There are pictures of the gauges in Chapter "Special Tools" (pg. 8 - 3).

CAUTION

Take special care when carrying out measurements on an open and switched-on unit. Short circuits and wrong measuring methods can cause serious damage to or destroy the subsystems of the device.

The unit check, calibration and trouble shooting are subdivided into numbered working steps (Unit Test Step UTS, Calibration Step CS, Trouble Shooting TS) and are based on each other.

Beginning with UTS 1 the operation described here has to be executed. The consequences of the steps performed are listed in the "Function" column. If the result corresponds to the consequence, the working step must be carried out to which reference is made in the column "If yes". If the result does not correspond with the function described, the working step in column "If no" is to be executed.

One example is given in Fig.: 2 - 1.

UTS	Activity	Function	If yes	If no
1			UTS 2	
2			UTS 3	TS 1
3			UTS 4	
4			UTS 5	TS 4
5				

Model table 1

TS	Activity	Function		
1			UTS 3	TS 2
2			TS 3	TS 4
3			UTS 3	
4			UTS 4	TS 4
5			UTS 4	

Model table 2

Fig.: 2 - 1 Model tables

Steps for which additional information is required are described after the table in detail.

Alarms and Error Codes

The alarms of the Perfusor® Space are classified in 5 categories. These categories are listed hereafter according to their importance.

- Alarm advice
  In case of unacceptable inputs corresponding messages are displayed (e.g. "Caution! Rate out of range", "The parameter cannot be changed") and a beep sounds.
- Pre-alarm
  Pre-alarms are triggered several minutes (depending on the service settings) before the operating alarms.
- Reminder alarm
  A reminder alarm is triggered if the device is not operated for two minutes when input or operation was not finished.
- Operating alarm
  In case of an operating alarm the infusion is stopped. An audible signal is released, the red LED flashes and a staff call is triggered. The message "Alarm" and the cause of the alarm appear on the display.
- Device alarm

The most important alarms and error codes as well as their meaning and possible fault clearance are specified in the following lists.

Note

The device should be checked after every repair or service (see "Device Check" pg. 2 - 9).

Alarms

	Alarm	Possible Cause	Fault Clearance
1	Battery nearly discharged (type: pre-alarm)	The device was not connected to the mains long enough	Operate the device with battery until the message "Battery discharged" is displayed and the unit is switched off. Then connect the unit to the mains for at least 6 hours.
		Battery module defective or too old	Replace battery module
2	Battery discharged (type: operating alarm)	The device was not connected to the mains long enough	Connect the unit to the mains for at least 6 hours
		Battery module defective	Replace battery module
3	Battery cover open (type: operating alarm)	The battery compartment cover is not correctly closed	Insert the battery compartment cover correctly
		The magnet in the battery compartment cover is missing	Exchange the battery compartment cover
		The battery compartment cover is not recognized by the battery module	Replace battery module
4	Drive blocked (type: operating alarm)	The drive was manually blocked	Eliminate blockage
		Driving force too low	Connect the unit to the mains for at least 6 hours and charge battery
			Re-calibrate the device
		The drive is physically damaged	Replace drive.
5	Malfunction of claws (type: operating alarm)	The syringe piston was not recognized	Select or insert correct syringe type
			Loosen the syringe via the emergency release button in the drive head and insert again
			Re-calibrate the device
		The claws or the claw drive are/is damaged	Replace drive head
6	Push-button has no contact (type: operating alarm)	Negative pressure in the syringe system	See instructions for use
		Syringe was removed without opening the syringe holder	See instructions for use
		Push-button sensor defective	Replace drive head
7	Device alarm (type: device alarm)	A serious internal fault was detected in the system	Switch device off and on
			Carry out a device check (see "Device Check" pg. 2 - 9)

Table 2 - 1 Alarms

Device Alarms of the Function Processor

	Error Code	Definition	Possible Cause	Fault Clearance
1	1001 ... 1013	Internal Error		
2	1014	Loudspeaker not off	Loudspeaker connector	Check the loudspeaker connector
			Loudspeaker	Check the loudspeaker
3	1015	Loudspeaker lost	Loudspeaker connector	Check the loudspeaker connector
			Loudspeaker	Check the loudspeaker
4	1016	Loudspeaker shorted	Loudspeaker connector	Check the loudspeaker connector
			Loudspeaker	Check the loudspeaker
5	1017	KuP switchoff path defect (K_SM_CLK)	Switch off path	
6	1018	ADC pressure out of range	Pressure measurement in drive head	Carry out calibration
7	1019	Internal Error		
8	1020	FUP Flash Memory Error Software	Software	Update unit software
9	1021	FUP different version KuP to FuP	Software	Update unit software
10	1022	FUP pressure zero test fail	Pressure measurement in drive head	Carry out calibration
11	1023	FUP pressure offset test fail	Pressure measurement in drive head	Carry out calibration
12	1024	FUP EA key closed too long 20sec	Keyboard defective	Carry out device check
13	1025	Internal Error		

Table 2 - 2 Device alarms of the function processor

Device Alarms of the Control Microprocessor

	Error Code	Definition	Possible Cause	Fault Clearance
1	1100	Timebase too fast	Quartz of the processor PCB	Exchange processor PCB
2	1101	Timebase too slow	Quartz of the processor PCB	Exchange processor PCB
3	1102	Timebase fail	Quartz of the processor PCB	Exchange processor PCB
4	1103	Keyboard High	Keyboard defective	Carry out device check
5	1104	EA_KEY defect 25sec	Keyboard defective	Carry out device check
6	1105	No keydecode	Keyboard defective	Carry out device check
7	1106	ROM Romtest defect Software	Software	Update unit software
8	1107	ROM Program defect	Software	Update unit software
9	1108	CM State without set K_V_KM_ON		
10	1109	MPU_Test failed	Software	Update unit software
11	1110	RAM_Test failed	Software	Update unit software
12	1111	active reset	Voltage supply during operation interrupted	
13	1112 ... 1114	Internal Error		
14	1115	Drive too fast	Motor drive Recognition of direction of rotation	Exchange processor PCB
15	1116	Drive too slow	Motor drive Recognition of direction of rotation	Exchange processor PCB
16	1117 ... 1118	Internal Error		
17	1119	lcd backlight on defect	LC display defective	Exchange operating unit
18	1120	lcd backlight off defect	LC display defective	Exchange operating unit
19	1121	red led on defect	LC display defective	Exchange operating unit
20	1122	red led off defect	LC display defective	Exchange operating unit
21	1123	key pressed too long (without EA-Key) 60sec	Keyboard defective	Carry out device check
22	1124 ... 1127	Internal Error		
23	1128	Drive motion rightless forward	Motor drive Recognition of direction of rotation	Exchange processor PCB
24	1129	Drive motion rightless backward	Motor drive Recognition of direction of rotation	Exchange processor PCB
25	1130 ... 1200	Internal Error		

Table 2 - 3 Device alarms of the control microprocessor (Part 1 of 2)

	Error Code	Definition	Possible Cause	Fault Clearance
26	1201	different version FuP to KuP Software	Software	Update unit software
27	1202	E_ERROR_STEPMOTOR_1 Phase not ok	Drive motor, lead screw	Exchange processor PCB
28	1203	E_ERROR_STEPMOTOR_2 Current value not 0x55	Motor drive Recognition of direction of rotation	Carry out calibration
29	1204	E_ERROR_STEPMOTOR_3 K_SM_CLK defect	Motor drive Recognition of direction of rotation	Carry out calibration
30	1205	E_ERROR_STEPMOTOR_4 Phase not ok	Motor drive Recognition of direction of rotation	Carry out calibration
31	1206	E_ERROR_STEPMOTOR_5 Current value not 0	Motor drive Recognition of direction of rotation	Carry out calibration
32	1207	E_ERROR_STEPMOTOR_6 Current value not 0x55	Motor drive Recognition of direction of rotation	Carry out calibration
33	1208	E_ERROR_STEPMOTOR_7 Current value not 0xAA	Motor drive Recognition of direction of rotation	Carry out calibration
34	1209	E_ERROR_STEPMOTOR_8 Phases not 0	Motor drive Recognition of direction of rotation	Carry out calibration
35	1210	E_ERROR_DCMOTOR_1	Piston brake drive motor def. Claw drive in drive head defective Piston brake light barrier def.	
36	1211	E_ERROR_DCMOTOR_2		
37	1212	E_ERROR_DCMOTOR_3		
38	1213	E_ERROR_DCMOTOR_4		
39	1214	E_ERROR_DCMOTOR_5		
40	1215	no V_MOT	Voltage transformer defective	Exchange processor PCB
41	1216	overvoltage test fail		
42	1217	no V_MOT		
43	1218	undervoltage test fail		
44	1220	syringeholder defect	Syringe holder or potentiometer def.	Replace syringe holder Exchange processor PCB
45	1221	syringe change timeout		
46	1237 ... 1238	Internal Error		
47	1239	plunger plate sensor defect	Pressure measurement in drive head	Replace drive head
48	1240 ... 1254	Internal Error		

Table 2 - 3 Device alarms of the control microprocessor (Part 2 of 2)

The Most Important Error Modes

The following list specifies the most important error modes and their clearance.

Note

The device must be checked after every repair or service (see "Device Check" pg. 2 - 9).

	Error	Possible Cause	Fault Clearance
1	The battery module discharges too fast	The device was not used for a longer time. The battery module was not discharged and charged at regular intervals.	Discharge and charge battery module several times Replace battery module

Table 2 - 4

Device Check

UTS	Activity	Function	If yes	If no
1	The device is inserted in a SpaceStation or connected to a SpaceControl.		UTS 2	UTS 3
2	Remove the device.		UTS 4	
3	Loosen all connections from the device.		UTS 4	
4	Remove syringe and close syringe holder.		UTS 5	
5	Plug service connector SP on connector "P2".		UTS 6	
6	Connect power supply to the device via service connector SP.	All LEDs light up for a short moment.	UTS 7	TS 1
7		The battery charge state and the mains connection are displayed at the top left of the LC display (without lighting).	UTS 8	TS 5
8	Switch on unit.	All LEDs light up (from left: yellow, green, blue).	UTS 9	TS 5
9		A short deep and then a short high beep sound.	UTS 10	TS 7
10		The colour of the middle LED changes from green to red, then the LED goes out. The yellow and the blue LED remain on for a short moment.	UTS 11	TS 8
11		The message "Self-test active" and the current software version are displayed.	UTS 12	TS 8
12		Keyboard, LC display as well as the syringe area are illuminated.	UTS 13	TS 9
13		The drive head moves to the extended end position.	UTS 14	TS 11
14		The claws in the syringe head close and open.	UTS 15	TS 14
15		The message "Drive moves back / Syringe change" appears on the display.	UTS 16	TS 16
16		"Open syringe holder and insert syringe or press "C" to input parameters" is displayed.	UTS 17	TS 16
17	Open syringe holder.	"Syringe change / Please insert syringe ..." is displayed.	UTS 18	TS 17
18	Press the ">" key.	The service information: - Brake: not started or active - drivetest ok - Size: 35.4 KuP 35.4 FuP is displayed on the LC display.	UTS 19	TS 19
19	Insert syringe 30 ml.	The syringe piston is fastened with the syringe holder blade.	UTS 20	TS 21
20		On the LC display "Brake: stopped by current" appears in the line.	UTS 21	TS 21

Table 2 - 5 Device check (Part 1 of 5)

UTS	Activity	Function	If yes	If no
21	Insert 2 ml / 3 ml syringe.	On the LC display "Brake: stopped by holder" appears in the line.	UTS 22	TS 21
22	Open syringe holder and remove syringe.	On the LC display "Brake: stopped by light barrier" appears in the line.	UTS 23	TS 21
23		3.54 is shown for FuP on the LC display. The value displayed for FuP may have a maximum tolerance of ± 0.04.	UTS 24	CS 1
24	Close syringe holder.	The value for FuP changes to 7.0 ± 0.4.	UTS 25	CS 1
25	Insert diameter gauge 9.0 mm.	The value for FuP changes to 9.0 ± 0.4.	UTS 26	CS 1
26	Insert diameter gauge 15.7mm.	The value for FuP changes to 15.7 ± 0.4.	UTS 27	CS 1
27	Insert diameter gauge 23.4 mm.	The value for FuP changes to 23.4 ± 0.4.	UTS 28	CS 1
28	Insert diameter gauge 32.0 mm.	The value for FuP changes to 32.0 ± 0.4.	UTS 29	CS 1
29		The sum of the tolerances of UTS 23 to UTS 28 must not exceed 1.0.	UTS 30	CS 1
30	Insert 2 ml / 3 ml syringe.		UTS 31	
31	Press the ">" key.	The syringe selection is displayed.	UTS 32	
32	Select a syringe.	The drive head moves to the syringe piston, the claws in the drive head close and the message "Syringe is caught / Please wait" is displayed.	UTS 33	TS 26
33	Test all buttons on the operating unit during a functional check (carry out infusion).	When the buttons are pressed the desired reaction is carried out.	UTS 34	TS 29
34	Open syringe holder while the infusion is administered.	The red LED on the operating unit flashes and the red LED of the service connector SP lights up. The message "Alarm / Syringe holder" is displayed.	UTS 35	TS 31
35	Close syringe holder and continue infusion.		UTS 36	
36	Stop infusion.		UTS 37	
37	Open syringe holder.	"Syringe change / Initiate change? Yes / No" is displayed.	UTS 38	
38	Confirm with "Yes".	The claws in the drive head open and the drive head moves to the extended end position.	UTS 39	
39	Remove syringe.		UTS 40	

Table 2 - 5 Device check (Part 2 of 5)

UTS	Activity	Function	If yes	If no
40	Insert syringe gauge for the strain gauge measurement, close syringe holder and select syringe type „#Lehre OPS50". The syringe gauge must not be tipped. Therefore fix the syringe gauge so far into the syringe recess by hand that the piston brake moves back and the claws surrounds the pressure element. **WARNING** DURING THE STRAIN GAUGE MEASUREMENT WITH SYRINGE GAUGE THE SYRINGE HOLDER MUST NOT BE OPENED. THE SYRINGE GAUGE IS UNDER VERY HIGH PRESSURE AND MAY CAUSE INJURIES IF THE PRESSURE IS RELIEVED SUDDENLY.		UTS 41	
41	Input a delivery rate of 200 ml/h, select pressure stage 1 and start infusion.	When the maximum pressure of this pressure stage is reached, the delivery is stopped, the red LED on the operating unit flashes and the message "Alarm / Pressure too high" is displayed. The value read on the syringe gauge (in N) must match the value indicated for the strain gauge measurement of this pressure stage in the TSC.	UTS 42	CS 1
42	Confirm alarm.		UTS 43	
43	Select pressure stage 3 and start infusion.	When the maximum pressure of this pressure stage is reached, the delivery is stopped, the red LED on the operating unit flashes and the message "Alarm / Pressure too high" is displayed. The value read on the syringe gauge (in N) must match the value indicated for the strain gauge measurement of this pressure stage in the TSC.	UTS 44	CS 1
44	Confirm alarm.		UTS 45	
45	Select pressure stage 8 and start infusion.	When the maximum pressure of this pressure stage is reached, the delivery is stopped, the red LED on the operating unit flashes and the message "Alarm / Pressure too high" is displayed. The value read on the syringe gauge (in N) must match the value indicated for the strain gauge measurement of this pressure stage in the TSC.	UTS 46	CS 1
46	Confirm alarm and pull syringe holder briefly.		UTS 47	

Table 2 - 5 Device check (Part 3 of 5)

UTS	Activity	Function	If yes	If no
47	Confirm syringe change, release syringe gauge and remove gauge. **WARNING** WHILE CHECKING THE MOTOR POWER LIMITATION WITH THE SYRINGE GAUGE THE SYRINGE HOLDER MUST NOT BE OPENED. THE SYRINGE GAUGE IS UNDER VERY HIGH PRESSURE AND MAY CAUSE INJURIES IF THE PRESSURE IS RELIEVED SUDDENLY.		UTS 48	
48	Insert the motor power test adapter in the drive head to check the motor power limitation.		UTS 49	
49	Dismount the push-button plate from the syringe gauge and insert syringe gauge.		UTS 50	
50	Select syringe type "#Lehre OPS 50". The threaded end of the syringe gauge must be introduced in the opening of the motor power test adapter. To do this, hold on to the syringe gauge, if necessary by hand, in the syringe area.		UTS 51	
51	Select pressure stage 1 and start infusion.	When the maximum pressure of this pressure stage is reached, the delivery is stopped, the red LED on the operating unit flashes and the message "Alarm / Drive blocked" is displayed. The value read on the syringe gauge (in N) must match the value indicated for the motor power limitation in the TSC.	UTS 52	CS 1
52	Confirm alarm.		UTS 53	
53	Select pressure stage 3 and start infusion.	When the maximum pressure of this pressure stage is reached, the delivery is stopped, the red LED on the operating unit flashes and the message "Alarm / Drive blocked" is displayed. The value read on the syringe gauge (in N) must match the value indicated for the motor power limitation in the TSC.	UTS 54	CS 1
54	Confirm alarm.		UTS 55	

Table 2 - 5 Device check (Part 4 of 5)

UTS	Activity	Function	If yes	If no
55	Select pressure stage 6 and start infusion.	When the maximum pressure of this pressure stage is reached, the delivery is stopped, the red LED on the operating unit flashes and the message "Alarm / Drive blocked" is displayed. The value read on the syringe gauge (in N) must match the value indicated for the motor power limitation in the TSC.	UTS 56	CS 1
56	Confirm alarm and pull syringe holder briefly.		UTS 57	
57	Confirm syringe change, release syringe gauge and remove gauge. **WARNING** WHILE CHECKING THE MOTOR POWER LIMITATION WITH THE SYRINGE GAUGE THE SYRINGE HOLDER MUST NOT BE OPENED. THE SYRINGE GAUGE IS UNDER VERY HIGH PRESSURE AND MAY CAUSE INJURIES IF THE PRESSURE IS RELIEVED SUDDENLY.		UTS 58	
58	Insert syringe type 50/60 ml and lock PCA-lock with PCA-key.	The syringe holder cannot be opened.	UTS 59	TS 32
59	Open PCA-lock and remove syringe.		UTS 60	
60	Insert syringe type 10 ml and lock PCA-lock with PCA-key.	The syringe holder cannot be opened.	UTS 61	TS 32
61	Open PCA-lock and remove syringe.		UTS 62	
62	Switch device off.	The message "Pump is switched off in 3 .. 2 .. 1 sec" is displayed.	UTS 63	
63		"Drive is parked .../ Please wait ..." is displayed. The drive head moves to the retracted park position.	UTS 64	
64		The device switches off.	UTS 65	TS 35
65	Pull off the power supply.	The blue LED lights up for a short moment.	UTS 66	TS 35
66	Switch on unit.		UTS 67	
67	Open the battery compartment cover when the drive head has moved to the extended end position.	An alarm signal sounds, the red LED flashes and "Alarm / Battery cover open / Confirm with "OK" is displayed.	UTS 68	TS 36
68	Remove battery.	A permanent alarm is triggered.	UTS 69	TS 38
69	Insert battery, close battery compartment cover and switch on the device.	The message "Devicealarm / 1111" is displayed.	UTS 70	
70	Switch the device off, remove service connector SP and dismount test structure.		This step terminates the device check.	

Table 2 - 5 Device check (Part 5 of 5)

Calibration

CS	Activity	Function	If yes	If no
1	Connect unit to PC with interface cable.		CS 2	
2	Start Service Program on the PC (see "Starting the Service Program" pg. 1 - 7).	The desired device is found by the Service Program and then displayed.	CS 3	
3	Start calibrating the unit (see "Starting Calibration" pg. 2 - 14).		CS 4	
4	Carry out calibration of the claws (see "Claw Calibration" pg. 2 - 23).	Calibration of the claws was terminated successfully.	CS 5	
5	Carry out calibration of the syringe holder (see "Syringe Holder Calibration" pg. 2 - 23).	Calibration of the syringe holder was terminated successfully.	CS 6	
6	Carry out pressure calibration (see "Pressure Calibration" pg. 2 - 26).	Pressure calibration was terminated successfully.	CS 7	
7	Close the Service Program (see "Quit the Service Program" pg. 1 - 11).		UTS 23	

Table 2 - 6 Calibration

Procedural Instructions for Calibration

Starting Calibration

Note

Calibration must be carried out with power supply connected, since the calibration can be interrupted suddenly if the unit is battery-operated and the battery gets discharged so that the device is switched off.

Note

Please note that text and / or functions of the Service Program may change depending on the software version. The following screen illustrations are only examples and represent the state when the manual was printed.

1. Start the Service Program (see "Starting the Service Program" pg. 1 - 7).
2. Select the unit to be calibrated in the left column of the window with a double mouse-click. The blue and the yellow LED blinks in opposite with the red LED.
3. Select the register tab "Calibration".

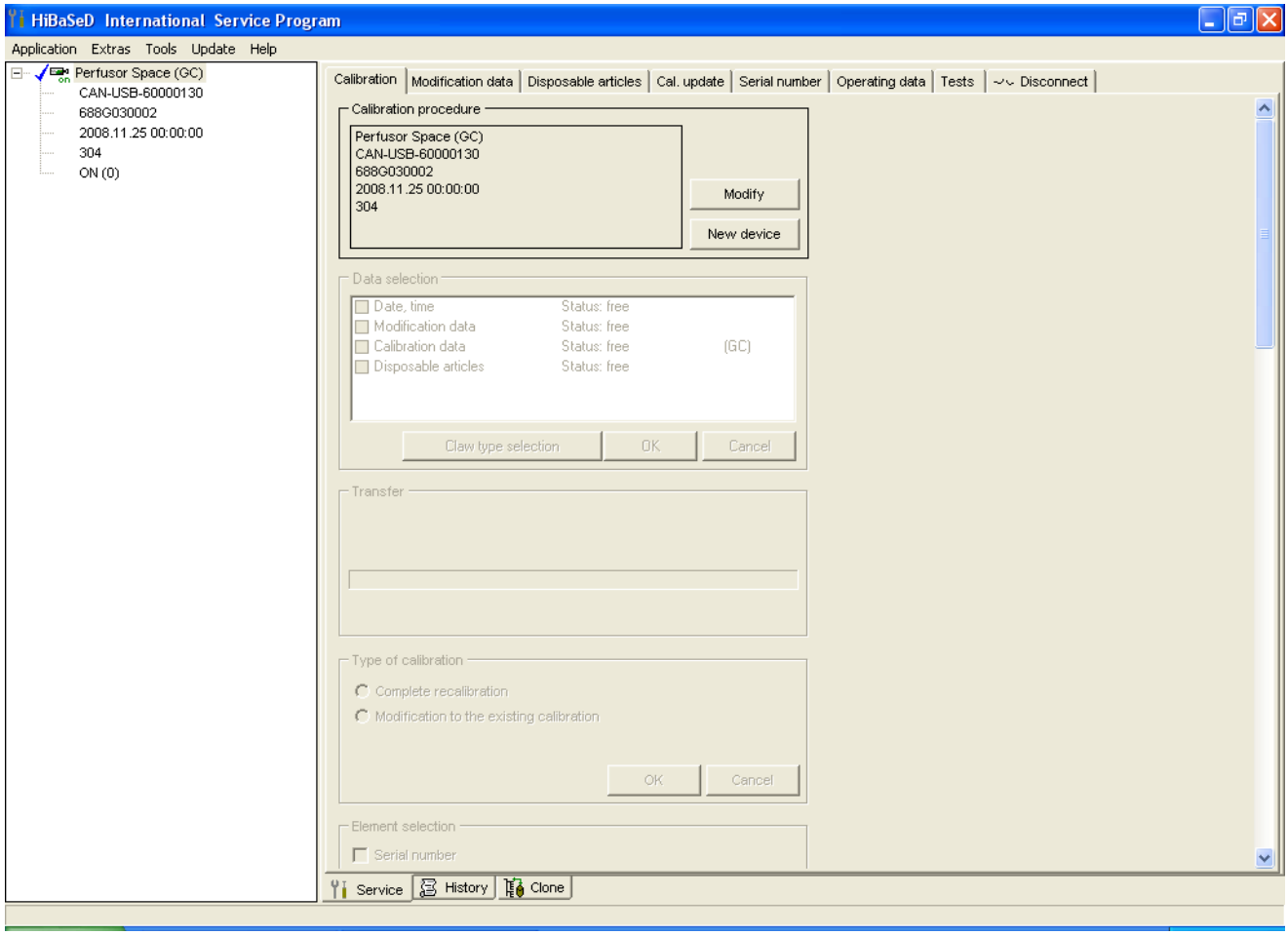


Fig.: 2 - 2

4. Press the "New device" button in the frame "Calibration procedure". The window "Worker ID" is opened.

Note

If you do not have an allocated worker id, enter "0001".

Fig.: 2 - 3

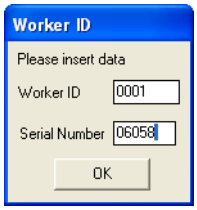


Fig.: 2 - 4

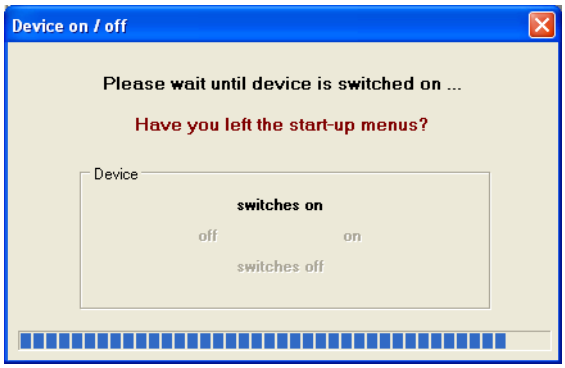


Fig.: 2 - 5

5. Input your user number in the window "Worker ID" as well as the six-digit serial number of the device, if necessary.
6. Confirm the input with "OK".

Note

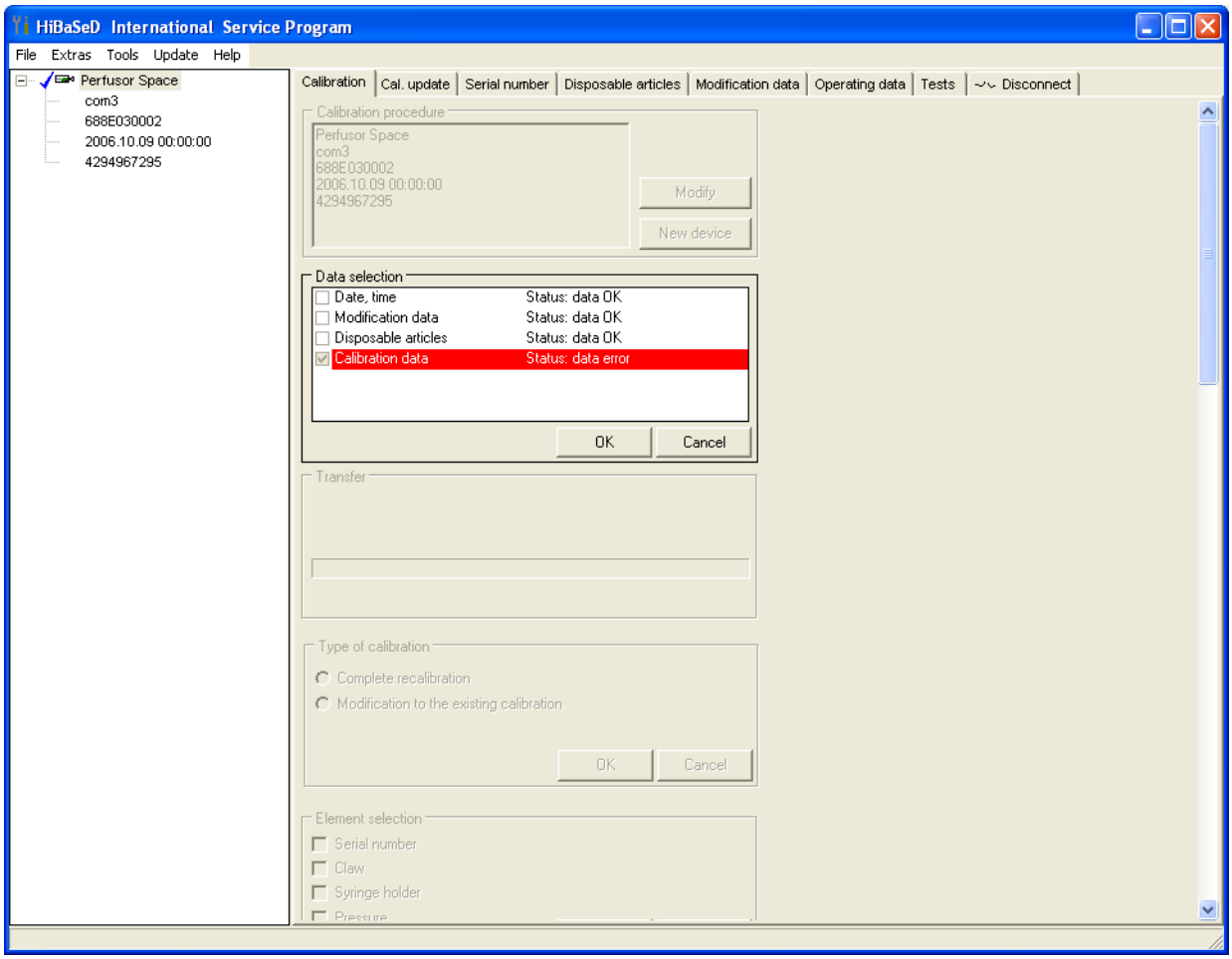
If HiBaSeD could not clearly read the device serial number, the number must be entered according to the rating plate.

If the unit is not yet switched on, the window "Device on/off" opens and the user is asked to select the desired language.

7. Select the desired language. The respective operating steps are explained in detail in the instructions for use.
   After the language was confirmed the unit switches on and the window "Device on/off" closes.

Note

If calibration is interrupted, data is written back to the device and marked as invalid if this is still possible. When the Service Program is started again the data is marked as faulty and highlighted red when the "Modify" button is selected in the "Calibration procedure" frame.


HiBaSeD International Service Program
File Extras Tools Update Help
Perfusor Space
com3
688E030002
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4294967295
Calibration
Cal. update
Serial number
Disposable articles
Modification data
Operating data
Tests
Disconnect
Calibration procedure
Perfusor Space
com3
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Modify
New device
Data selection
Date, time
Status: data OK
Modification data
Status: data OK
Disposable articles
Status: data OK
Calibration data
Status: data error
OK
Cancel
Transfer
Type of calibration
Complete recalibration
Modification to the existing calibration
OK
Cancel
Element selection
Serial number
Claw
Syringe holder
Pressure

Fig.: 2 - 6

8. The frame "Data selection" is now activated.

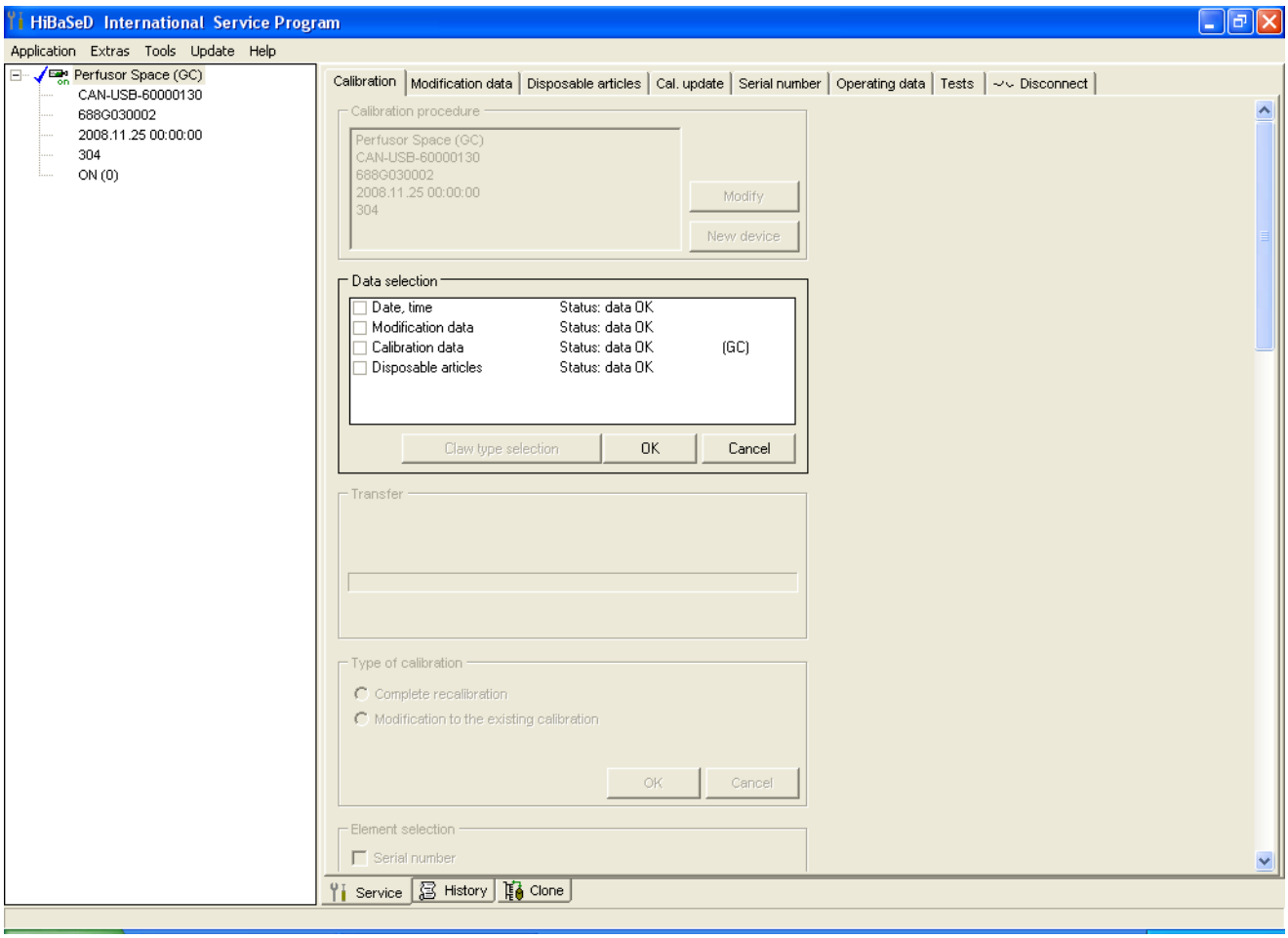

Fig.: 2 - 7

If the "Modify" button was pressed in the "Calibration procedure" frame, the desired data for editing and transmission can now be selected in the "Data selection" frame.

9. Mark at least the "Calibration data" field in this frame if you have not selected "New device" and confirm by clicking "OK". The device switches on and the drive head moves to the extended end position. You are prompted to press the blue connection key on the device.

Note

At the end of the line "Calibration data", the claw configuration is displayed by the abbreviation "(SC)" for silver claws and "(GC)" for green claws. If this setting does not match the claws really used, you can assign the correct claw type with the "Claw type selection" button.

10. Press the blue connection key on the device after the drive head has moved to the end position.

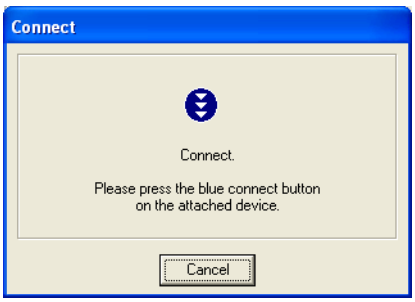

Fig.: 2 - 8

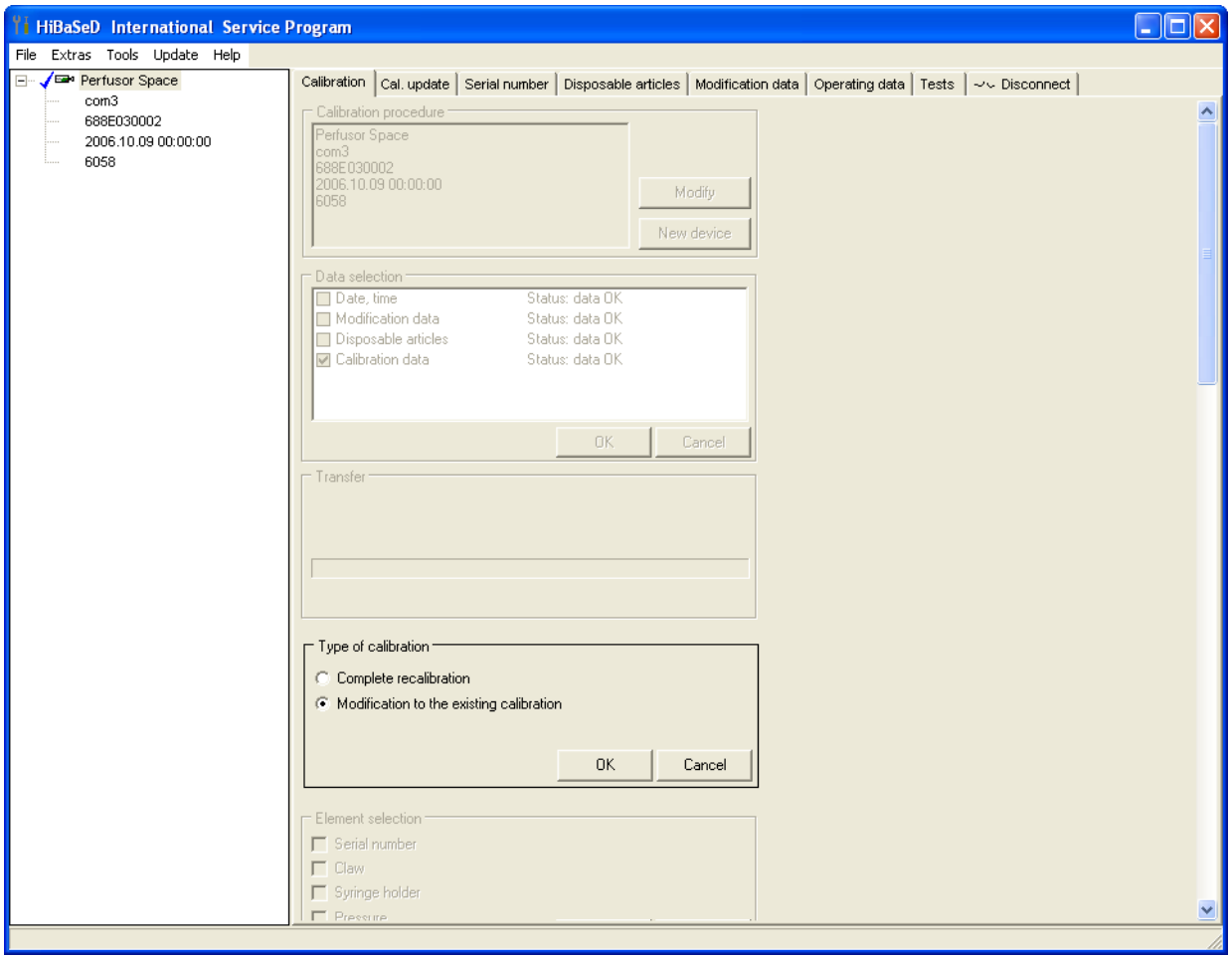

Fig.: 2 - 9

11. In the frame "Type of calibration" you can choose between a complete or a partial calibration. Select the desired calibration mode with the mouse pointer.

Note

The following description is applicable to a complete and a partial calibration. All possible calibrations are carried out one after the other if a complete calibration is selected. Interrupting the calibration may trigger an alarm in the device.

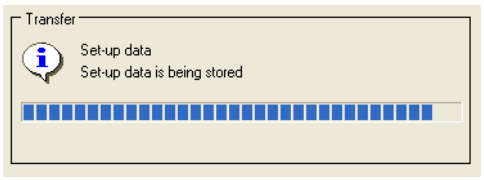

Fig.: 2 - 10

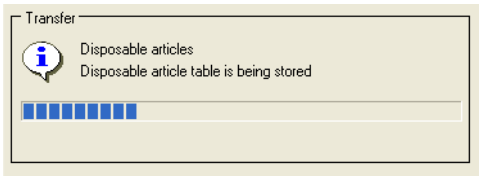

Fig.: 2 - 11

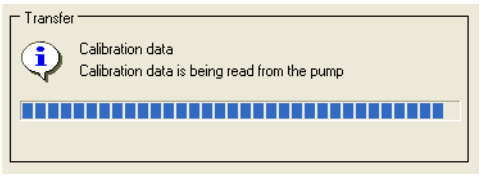

Fig.: 2 - 12

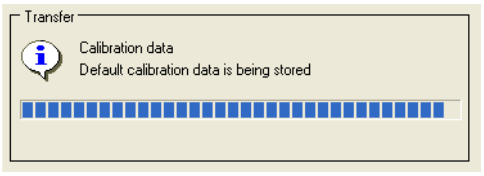

Fig.: 2 - 13

12. Press the "OK" button after you have selected the calibration elements. The necessary device data is read out and stored in the PC.

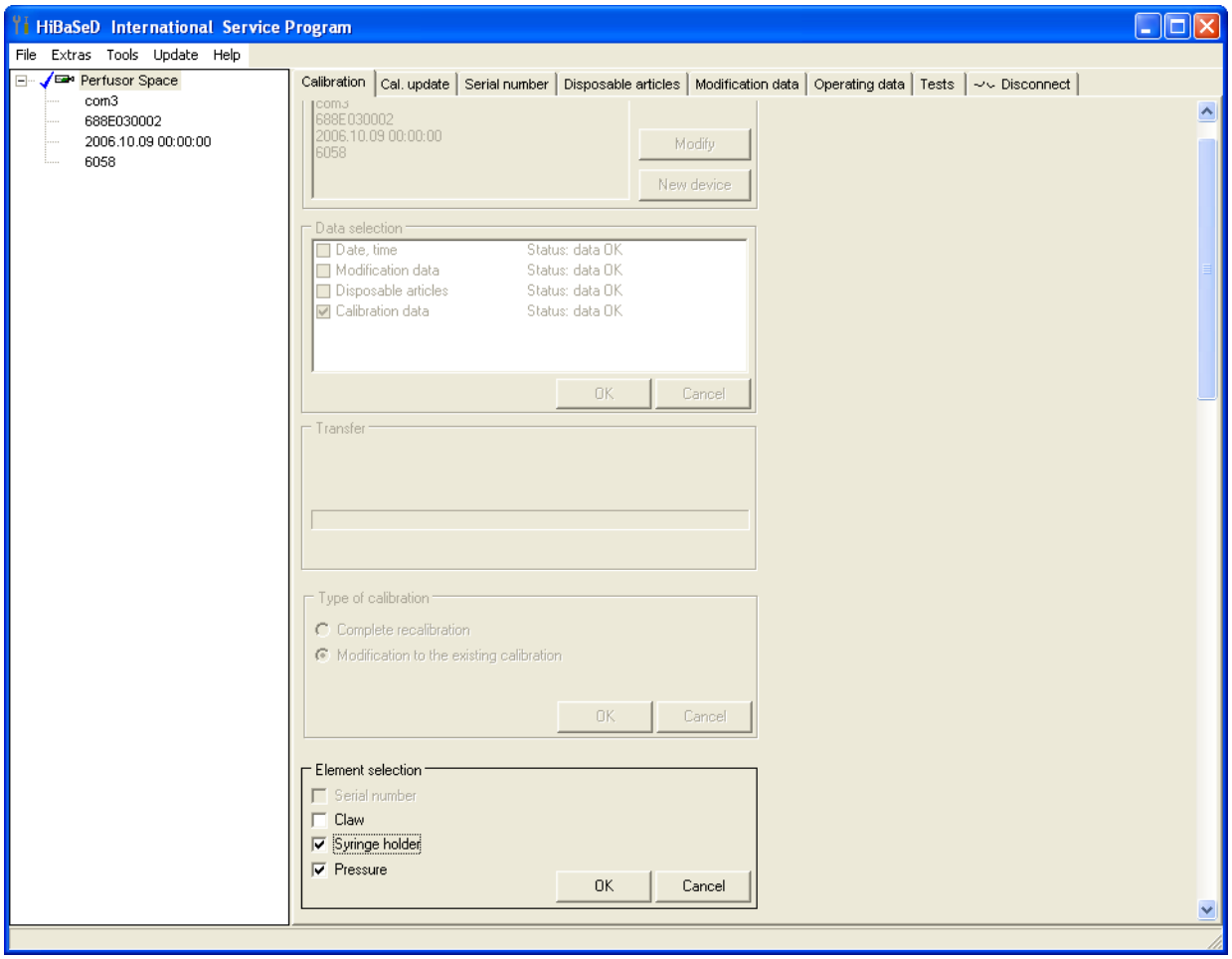

Fig.: 2 - 14

13. The frame "Element selection" is now activated.

    If you have selected a complete calibration in the "Type of calibration" frame, the individual calibration elements are already selected and cannot be changed. Actuate the "OK" button.

    If you have chosen a partial calibration in the frame "Type of calibration", you can click the calibration element "Claw", "Syringe holder" and "Pressure" with the mouse pointer. A multiple choice is possible. Press the "OK" button after you have selected the calibration elements.

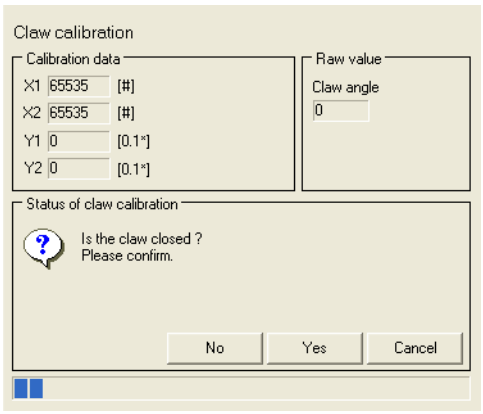

Fig.: 2 - 15

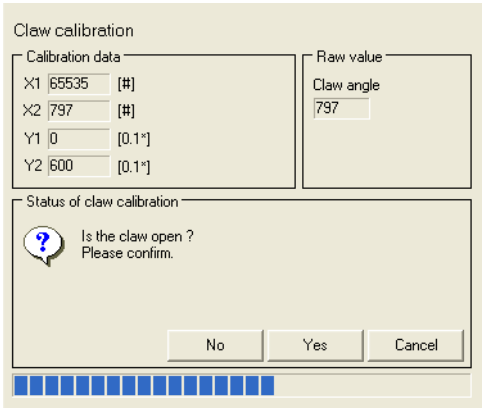

Fig.: 2 - 16

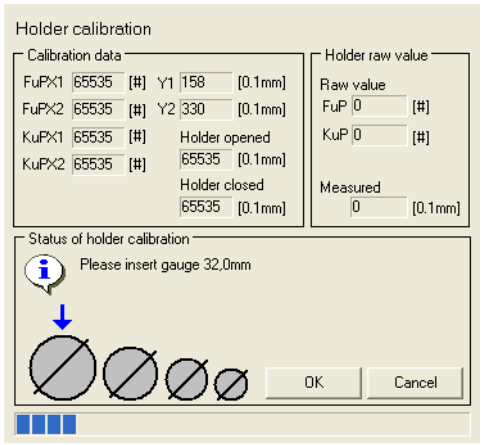

Fig.: 2 - 17

Claw Calibration

1. The frame "Claw calibration" is activated and calibration is started.
2. The claws in the drive head are closed and the query "Claw closed? Please confirm" is displayed in the frame "Claw calibration".
3. Check whether the claws are closed. Then actuate the "Yes" button.
4. The claws in the drive head are opened and the query "Claw open? Please confirm" is displayed in the frame "Claw calibration".
5. Check whether the claws are opened. Then actuate the "Yes" button.

Syringe Holder Calibration

1. The frame "Syringe holder calibration" is activated and calibration is started.
2. Insert diameter gauge 32.0 mm and close the syringe holder.

Note

The diameter gauge must not be held by the axial fastening of the housing side part. They must be inserted in such a way that the area of the diameter gauges touches the axial fastening edge.

3. Press the "OK" button.

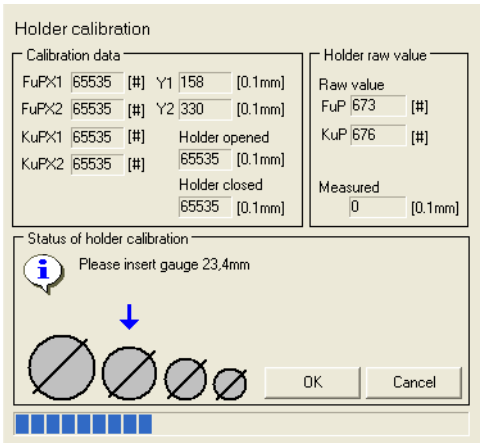

Fig.: 2 - 18

4. Insert diameter gauge 23.4 mm and close the syringe holder.
5. Press the "OK" button.

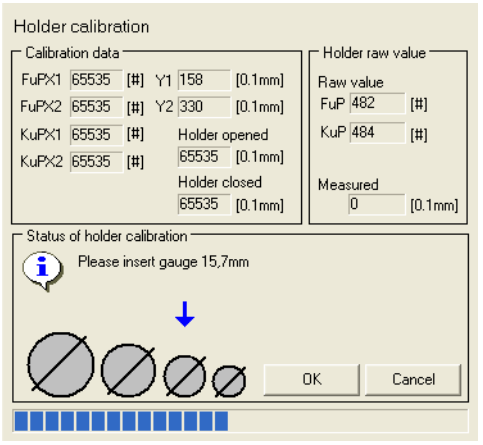

Fig.: 2 - 19

6. Insert diameter gauge 15.7 mm and close the syringe holder.
7. Press the "OK" button.

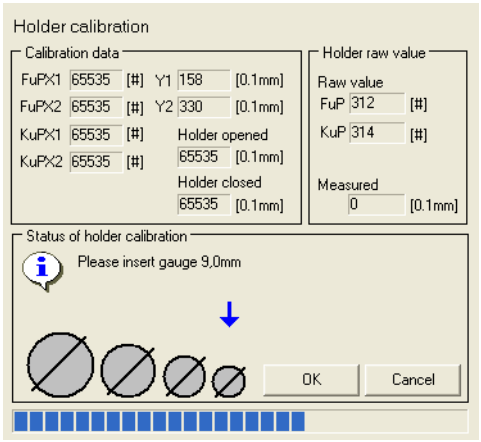

Fig.: 2 - 20

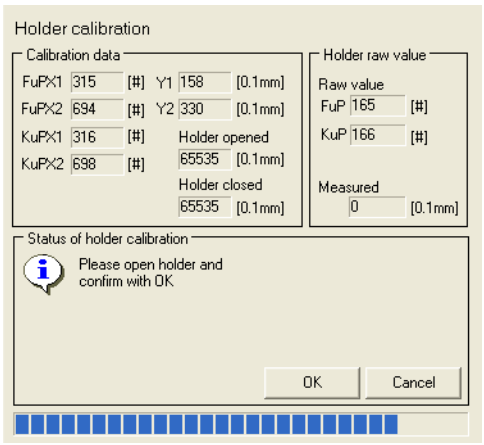

Fig.: 2 - 21

8. Insert diameter gauge 9.0 mm and close the syringe holder.
9. Press the "OK" button.

10. Open the syringe holder and remove the diameter gauge. Press the "OK" button.

Note

The syringe holder must always be completely turned and the axial fastening completely opened.

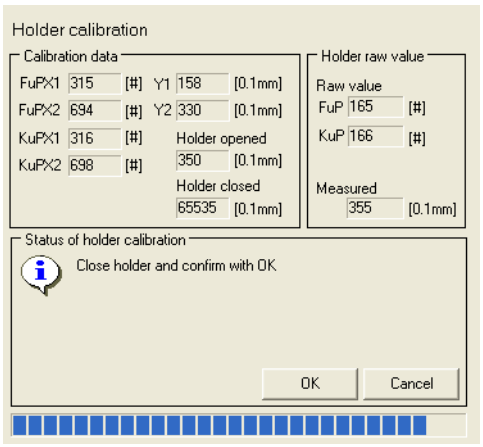

Fig.: 2 - 22

11. Close the syringe holder and actuate the "OK" button.

    If calibration was not terminated successfully, an error message is displayed on the PC screen.

Pressure Calibration

Note

The term "Power gauge" in the windows of the Service Program corresponds to the syringe gauge.

1. The frame "Pressure calibration/length/PWM" is activated and calibration is started.
2. Insert the length gauge and close the syringe holder.
3. Press the "OK" button.

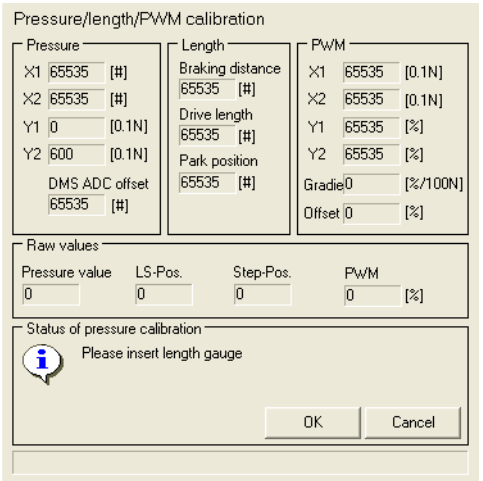

Fig.: 2 - 23

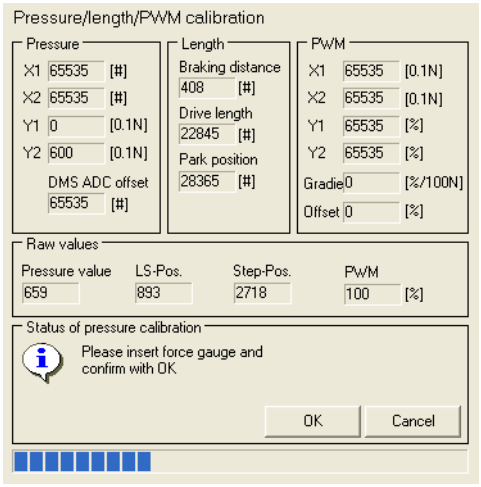

Fig.: 2 - 24

Fig.: 2 - 25

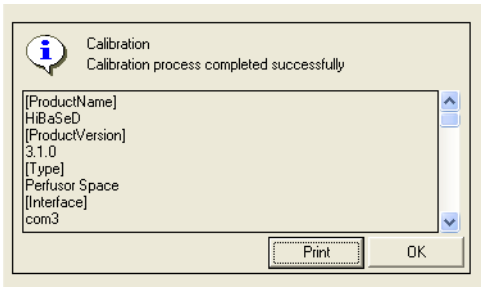

Fig.: 2 - 26

4. If "Insert power gauge and confirm with OK" is displayed in the frame "Pressure calibration/length/PWM", open the syringe holder and remove the length gauge.

WARNING

DURING PRESSURE CALIBRATION WITH THE SYRINGE GAUGE THE SYRINGE HOLDER MUST NOT BE OPENED. THE SYRINGE GAUGE IS UNDER VERY HIGH PRESSURE AND MAY CAUSE INJURIES IF THE PRESSURE IS RELIEVED SUDDENLY.

5. Insert the syringe gauge with the attached push-button plate for the Perfusor® Space and close the syringe holder.

Note

The syringe gauge must not be tipped. Therefore fix the syringe gauge so far into the syringe recess by hand that the piston brake moves back and the claws surrounds the pressure element.

6. Press the "OK" button.
7. The power calibration is carried out. When calibration is finished the syringe gauge is released.
8. When the drive head has moved to the extended end position, the syringe gauge can be removed.
9. Close the syringe holder. The device can now be switched off.

Note

If the device is switched off before calibration is terminated, the calibration is invalid and must be repeated.

Evaluation

1. At the end of calibration the result with all the values is displayed in the frame "Calibration process completed successfully".

This report can be printed out by pressing the "Print" button.

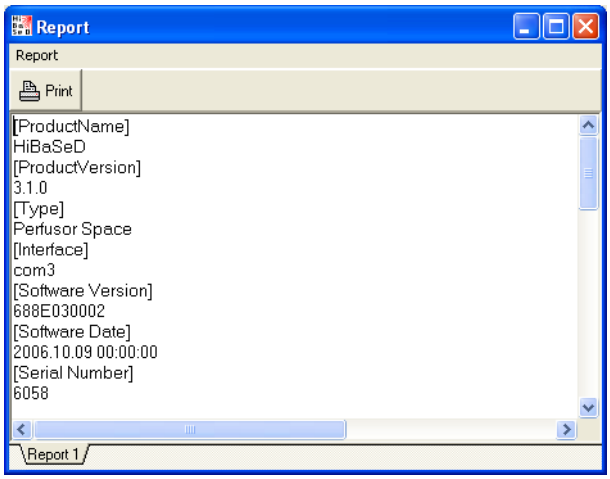

Fig.: 2 - 27

2. Actuate the "OK" button to finish the calibration process and to store the data in the device.

Trouble Shooting

Note

The following trouble shooting cannot be carried out independently. It is based on the precise observance of the steps for the device check (see "Device Check" pg. 2 - 9). From there reference is made to the corresponding trouble shooting steps.

TS	Activity	Function	If yes	If no
1	Replace power supply.	All LEDs light up for a short moment.	UTS 7	TS 2
2		At least one LED lights up for a short moment.	TS 3	TS 4
3	Replace the LC display.		UTS 7	
4		A message is displayed on the LC display.	TS 6	TS 5
5	Exchange processor PCB.	All LEDs light up for a short moment and a message is displayed on the LC display.	UTS 7	TS 6
6	Exchange operating unit.		UTS 8	
7	Exchange loudspeaker and switch on unit.	A short deep and then a short high beep sound.	UTS 10	TS 8
8	Exchange processor PCB.		UTS 10	
9	Exchange operating unit.	Keyboard, LC display as well as the syringe area are illuminated.	UTS 13	TS 10
10	Exchange processor PCB.		UTS 13	
11	Replace drive.		TS 12	
12	Switch on unit.	The drive head moves to the extended end position.	UTS 14	TS 13
13	Exchange processor PCB.		UTS 14	
14	Replace drive head.		TS 15	
15	Switch on unit.	The claws in the syringe head close and open.	UTS 15	TS 16
16	Exchange processor PCB.		UTS 15	
17	Replace syringe holder with piston brake.	"Syringe change / Please insert syringe ..." is displayed after the syringe holder has been opened.	UTS 18	TS 18
18	Exchange processor PCB.		UTS 18	
19	Exchange processor PCB and actuate the ">" button.	The service information: - Brake: stopped by _____ - drivetest ok - Size: 35.4 KuP 35.4 FuP is displayed on the LC display.	UTS 19	TS 20
20	Exchange operating unit.		UTS 19	
21	Replace syringe holder with piston brake.		TS 22	

Table 2 - 7 Trouble Shooting (Part 1 of 2)

TS	Activity	Function	If yes	If no
22	Switch on unit and insert syringe.	The syringe piston is fastened with the syringe holder blade and the default message is displayed on the LC display.	UTS 19	TS 23
23	Exchange processor PCB.		TS 24	
24	Switch on unit and insert syringe.	The syringe piston is fastened with the syringe holder blade and the default message is displayed on the LC display.	UTS 19	TS 25
25	Exchange piston brake ribbon cable.		UTS 19	
26	Exchange processor PCB.		TS 27	
27	Switch on unit, insert syringe and select.	The drive head moves to the syringe piston, the claws in the drive head close and the message "Syringe change active / Syringe is caught" is displayed.	UTS 33	TS 28
28	Replace drive head.		UTS 33	
29	Exchange operating unit.		TS 30	
30	Test all buttons on the operating unit during a functional check.	When the buttons are pressed the desired reaction is carried out.	UTS 34	TS 31
31	Exchange processor PCB.		UTS 35	
32	Exchange processor PCB. Exchange PCA-slide and lock PCA-lock with PCA-key.	The syringe holder cannot be opened.	UTS 59	TS 33
33	Exchange PCA eccentric and lock PCA-lock with PCA-key.	The syringe holder cannot be opened.	UTS 59	TS 34
34	Replace syringe holder with piston brake.		UTS 59	
35	Exchange processor PCB.		UTS 65	
36	Replace battery module.		TS 37	
37	Switch on unit and open the battery compartment cover when the drive head has moved to the extended end position.		UTS 67	TS 38
38	Exchange processor PCB.		UTS 67	
39	Disconnect power supply from the device and switch on device.	All LEDs light up for a short moment.	UTS 9	TS 41
40	Charge battery module for about 16 hours in the device with power supply connected.		TS 39	
41	Replace battery module.		UTS 9	

Table 2 - 7 Trouble Shooting (Part 2 of 2)

Disassembly / Assembly 3

3.1 General

Remarks on Disassembly / Assembly

Before disassembling the unit, the system must be checked (see "Device Check" pg. 2 - 9) to isolate the part to be exchanged.

The necessary steps to disassemble the complete unit, all its subsystems and spare parts are detailed in the following description. Steps that are not necessary can be skipped.

Move the drive head to the extended end position before starting disassembly.

1. Switch the unit on. The drive head moves to the extended end position.
2. Open the syringe holder.
3. Switch the device off when the syringe holder is opened. The drive head stays at the extended end position.

WARNING

PAY ATTENTION TO THE PISTON BRAKE BLADE WHEN WORKING ON THE PISTON BRAKE. THE BLADE IS SHARP AND MAY CAUSE INJURIES.

Note

Special screws for plastic housings are used in this unit. Pay attention to the corresponding notes when you fit the screws.

Preparations for Exchanging the Processor PCB

If the processor PCB is to be replaced a back-up of the pump settings is to be carried out, if this is still possible.

1. Start the Service Program (see "Starting the Service Program" pg. 1 - 7).
2. Select the register tab "Modification data".

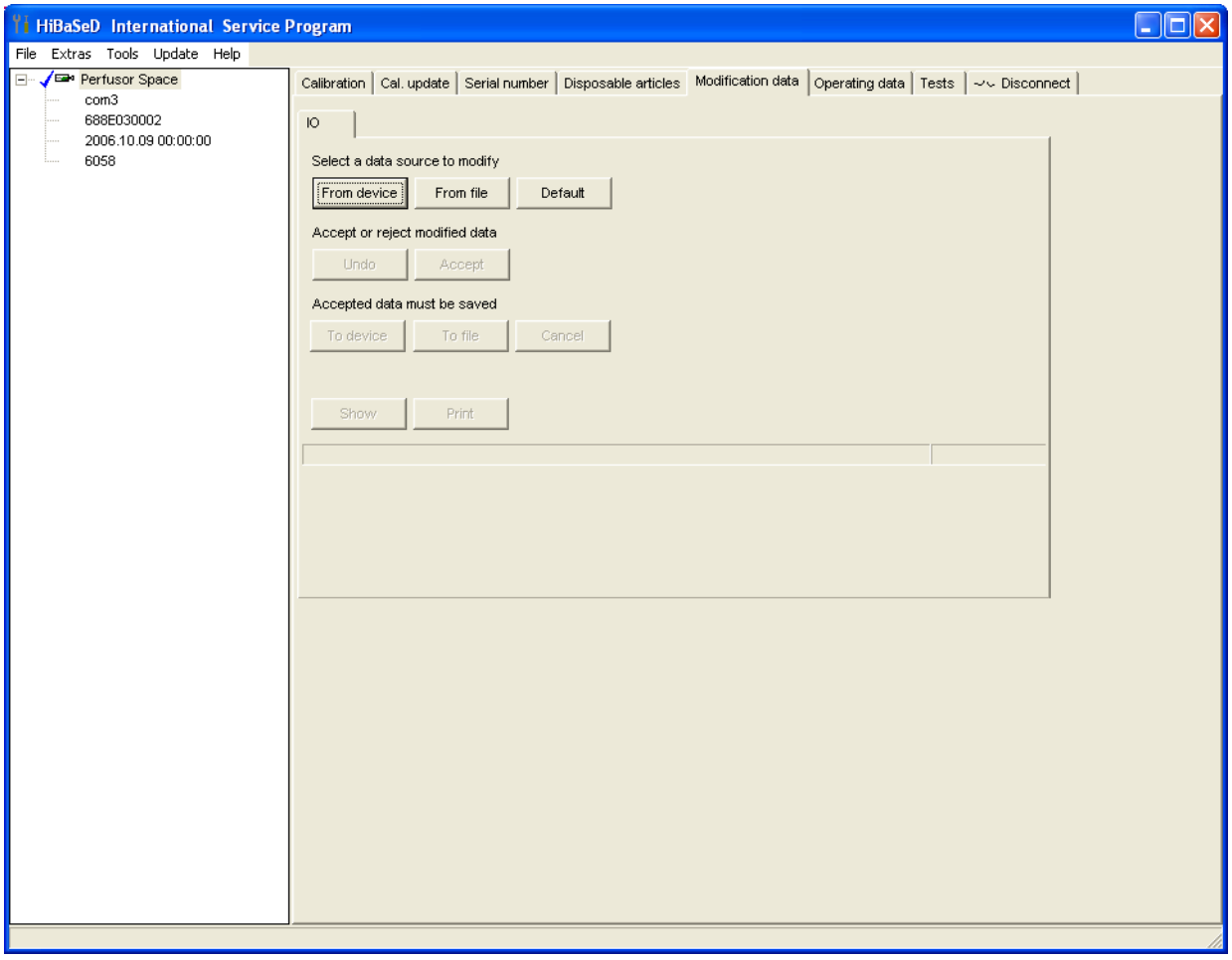

Fig.: 3 - 1

3. Press the "From device" button. The data is read from the pump.

4. Select the tab "IO".
5. Press the "To file" button.

   In the window which opens now you are asked for the storage position of the file on the PC hard disk and the file name.

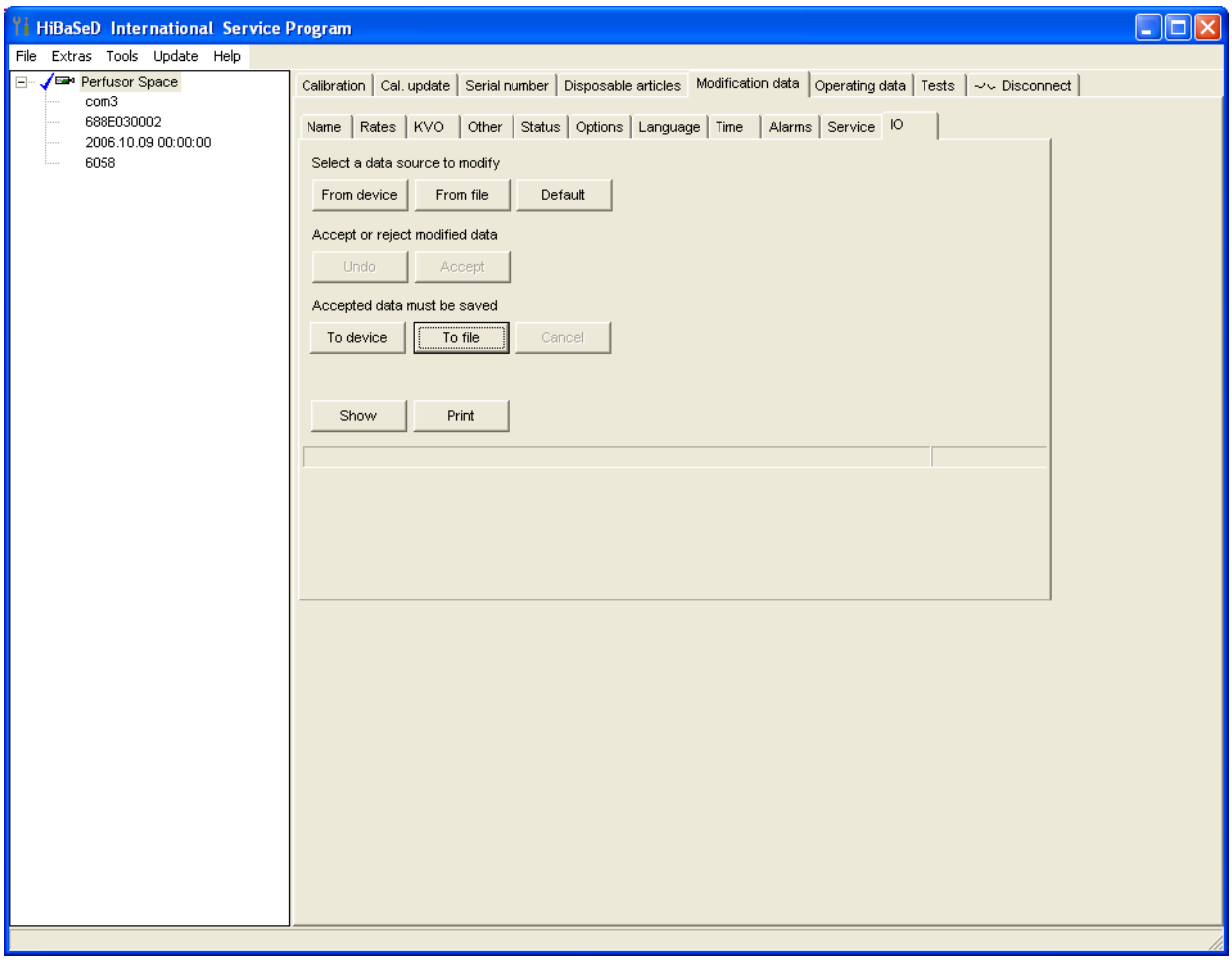

Fig.: 3 - 2

6. Press the "Print" button to transmit the device data to a printer.

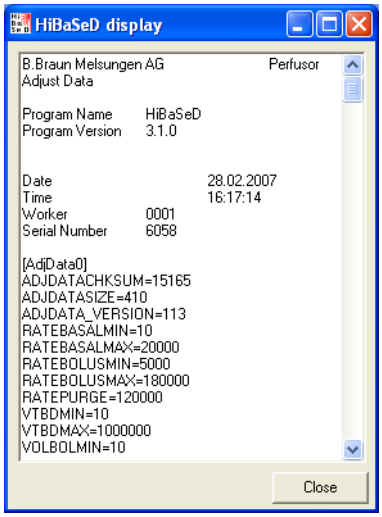

Fig.: 3 - 3

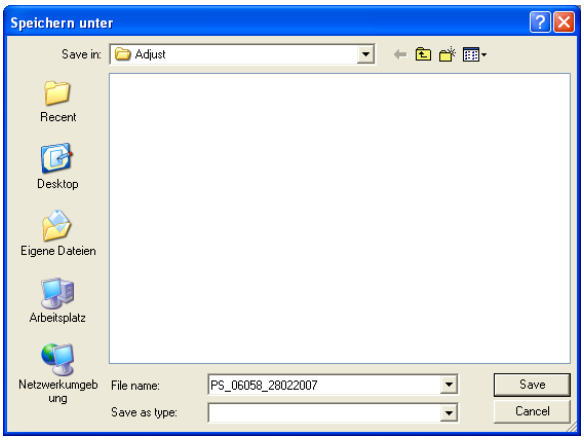

Fig.: 3 - 4

7. Actuate the "Display" button to display the device data on screen.

   With "Close" the window is closed again.

8. Select the storage position in the "Save as" window and input a unique file name.
9. Press the "Save" button. The data of the pump is saved on the PC hard disk.

10. Select the tab "Disposable articles".

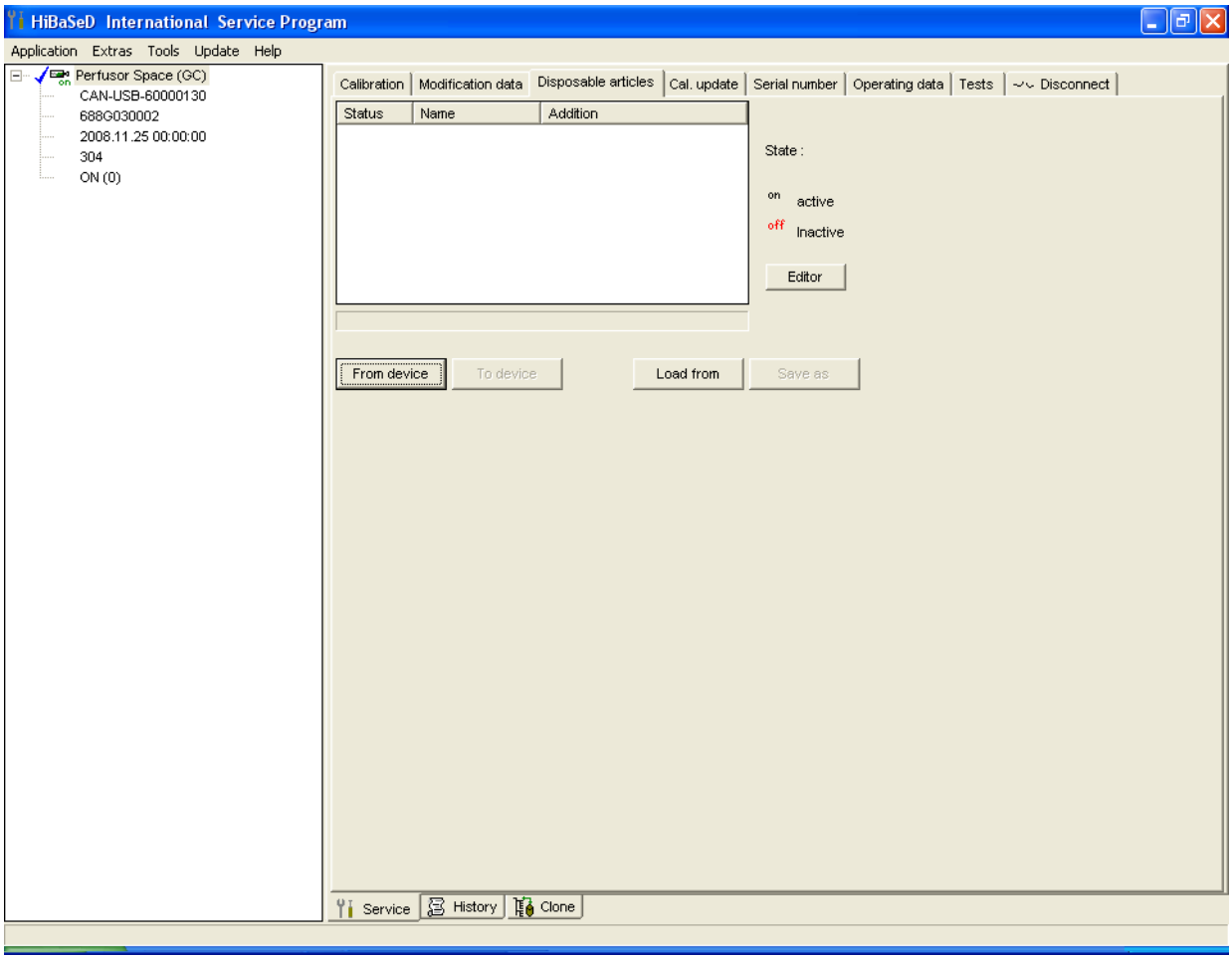

Fig.: 3 - 5

11. Actuate the "From device" button. The data is read from the pump.

    The data of the disposable articles read out is displayed on screen.

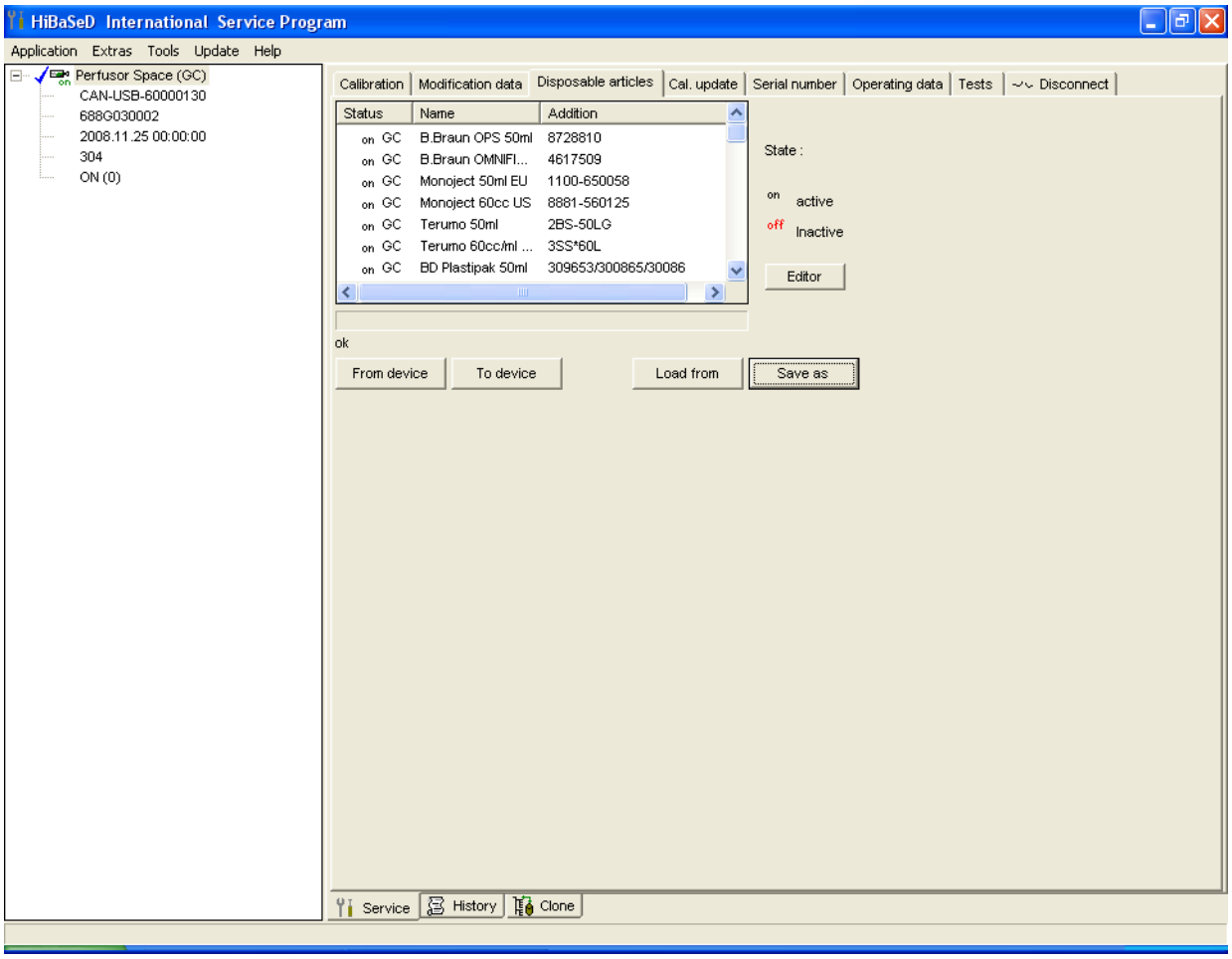

Fig.: 3 - 6

12. Press the "Save as" button.

    In the window which opens now you are asked for the storage position of the file on the PC hard disk and the file name.

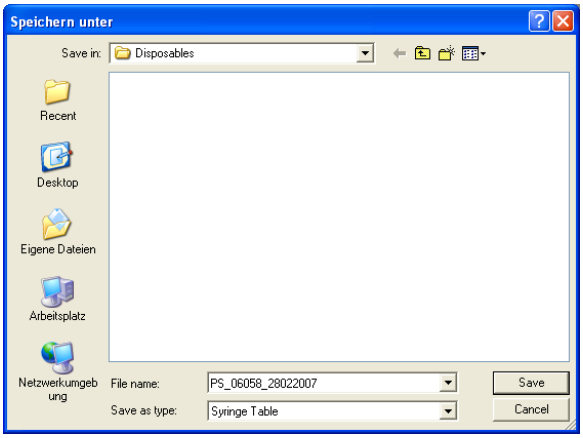

Fig.: 3 - 7

13. Select the storage position in the "Save as" window and input a unique file name.
14. Press the "Save" button. The data of the pump is saved on the PC hard disk.
15. Exit the Service Program (see "Quit the Service Program" pg. 1 - 11).

Note

When the new processor PCB has been installed the saved data must be transferred back to the device (see "Processor PCB" pg. 3 - 36).

Service Parts and Screw Kit

All small parts, such as cover caps, are contained in a Perfusor® Space service part kit.

Designation	Ord. No.
Service part kit Perfusor® Space	3477 4270
with:	
housing cover cap (40 pieces)	
cover caps for operating unit (10 pieces)	
cover cap for syringe holder (10 pieces)	
cover cap for drive head and claw (20 pieces)	
housing foot (20 pieces)	
sealing strip 40 x 4 x 2 (10 pieces)	
release button SP with leaf spring (2 pieces)	
wing sensor holder (1 pieces)	
locking clip for band PSP (10 pieces)	
Cover caps for housing SP (50 pieces)	3477 4386
Cover caps for operating unit PSP (10 pieces)	3477 3103
Integrated socket P2	3477 4355
Connector seal P2 (5 pieces)	3477 3102
Grease PSP	3452 1571
Set of adhesive labels Perfusor® Space	3477 0969
Claw set PSP (10 pieces), silver	3477 4378
Claw set PSP (10 pieces), green (from SW "F")	3477 4379

All screws used in the device are included in a Perfusor® Space screw kit.

Screw kit Perfusor® Space	3477 4289
with:	
screw EJOT 22x8 WN 5451 TORX 6IP (5 pieces)	
screw EJOT 25x7 WN 5451 TORX 8IP (5 pieces)	
screw EJOT 30x6 WN 5451 TORX 10IP (5 pieces)	
screw EJOT 30x8 WN 5451 TORX 10IP (10 pieces)	
screw EJOT 20x12 WN 5452 TORX 6IP (5 pieces)	
screw EJOT 20x14 WN 5452 TORX 6IP (5 pieces)	
screw EJOT 22x4.5 WN 5452 TORX 6IP (10 pieces)	
screw EJOT 25x10 WN 5452 TORX 8IP (5 pieces)	
screw EJOT 30x8 WN 5452 TORX 10IP (10 pieces)	
screw EJOT 30x12 WN 5452 TORX 10IP (10 pieces)	
screw EJOT 30x35 WN 5452 TORX 10IP (5 pieces)	
screw EJOT 22x8 WN 5454 TORX 6IP (5 pieces)	
locking ring (5 pieces)	

3.2 Battery Module

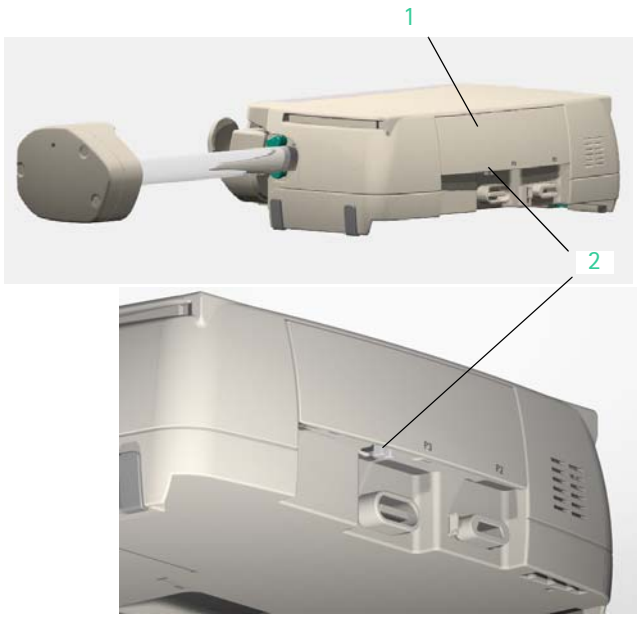

Fig.: 3 - 8

Legend of fig. 3 - 8:

Item	Designation
1	Battery compartment cover
2	Battery compartment cover lock

Designation	Ord. No.
Battery compartment cover PSP , cpl.	3452 0872
Battery pack SP (NIMH)	0871 3180

Disassembly

Note

Move the drive head to the extended end position before starting disassembly (see "General" pg. 3 - 1).

1. Press the lock (Fig.: 3 - 8 / Item 2) on the battery compartment cover (Fig.: 3 - 8 / Item 1) and remove the battery compartment cover.

Note

The battery compartment cover of more recent devices is shorter and can only be unlocked using a pointed object.

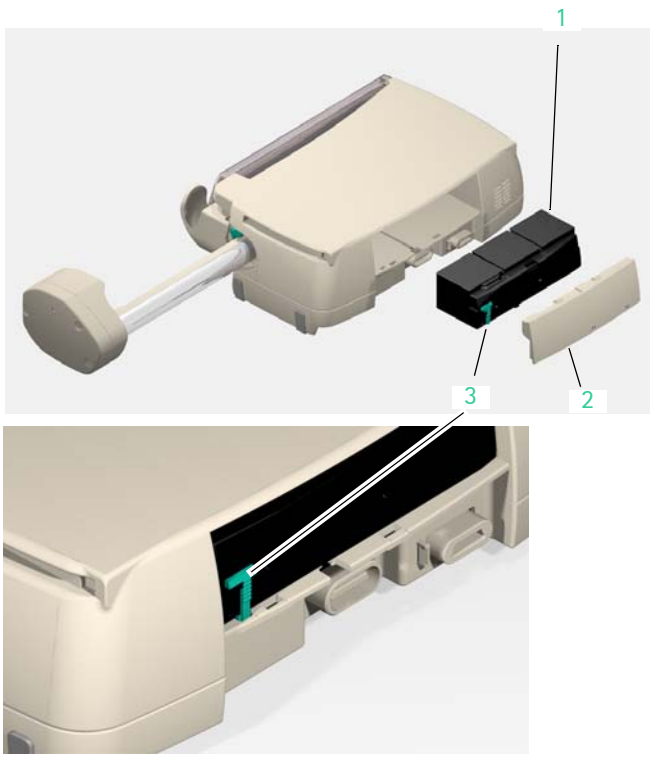

Fig.: 3 - 9

Legend of fig. 3 - 9:

Item	Designation
1	Battery pack
2	Battery compartment cover
3	Battery pack lock

2. Lift the lock (Fig.: 3 - 9 / Item 3) on the battery pack (Fig.: 3 - 9 / Item 1) and remove the battery pack out of the device.

3.3 Unit Foot

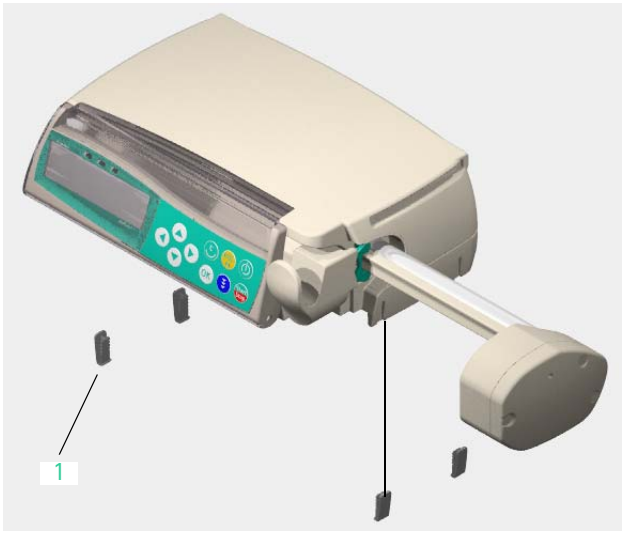

Fig.: 3 - 10

Legend of fig. 3 - 10:

Item	Designation
1	Unit Foot

Designation	Ord. No.
Unit foot (see "Service Parts and Screw Kit" pg. 3 - 8)	

Disassembly

1. Pull the unit foot (Fig.: 3 - 10 / Item 1) out of the housing.

3.4 Operating Unit

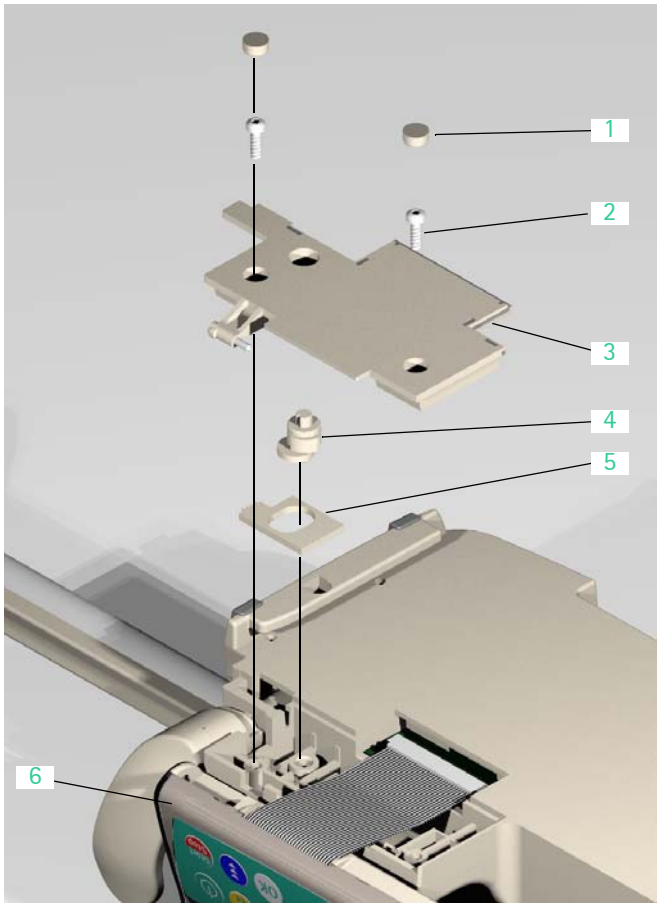

Fig.: 3 - 11

Legend of fig. 3 - 11:

Item	Designation
1	Cover cap
2	Screw EJOT 30x8 WN 5452 TORX 10IP A2
3	Hinge plate, right
4	PCA-eccentric
5	PCA-slide
6	Operating Unit

Designation	Ord. No.
Operating unit PSP, cpl.	3452 0970
Hinge plate PSP, left	3452 1011
Hinge plate PSP, right	3452 1020
PCA-slide PSP	3452 0899
PCA-eccentric PSP	3452 0902
Rear panel, operating unit PSP	3452 1003
LC display SP	3452 0988
Front flap with keyboard PSP	3452 0996
Screws and cover caps (see "Service Parts and Screw Kit" pg. 3 - 8)	

Note

Please pay attention to the corresponding notes during assembly and installation (see "Assembly / Installation" pg. 3 - 35).

Disassembly

1. Pierce two cover caps (Fig.: 3 - 11 / Item 1) with a small screwdriver and remove cover caps.
2. Unscrew two screws and remove the right hinge plate (Fig.: 3 - 11 / Item 3) carefully out of the bottom part of the housing and pull it off the (Fig.: 3 - 11 / Item 6) operating unit.

Note

When dismounting the operating unit pay attention to the length of the connection cable.

3. Remove the PCA-slide (Fig.: 3 - 11 / Item 5) and the PCA-eccentric (Fig.: 3 - 11 / Item 4) out of the housing bottom part.

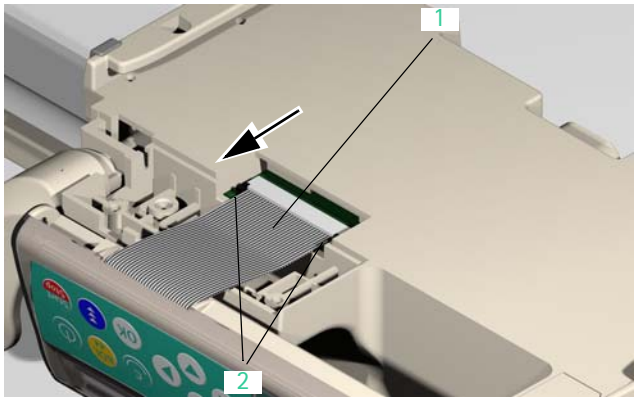

Fig.: 3 - 12

Legend of fig. 3 - 12:

Item	Designation
1	Operating unit connection cable
2	Connector lock

4. Push the right and left connector locks (Fig.: 3 - 12 / Item 2) carefully forward.
5. Disconnect the operating unit connection cable (Fig.: 3 - 12 / Item 1) from the connector.

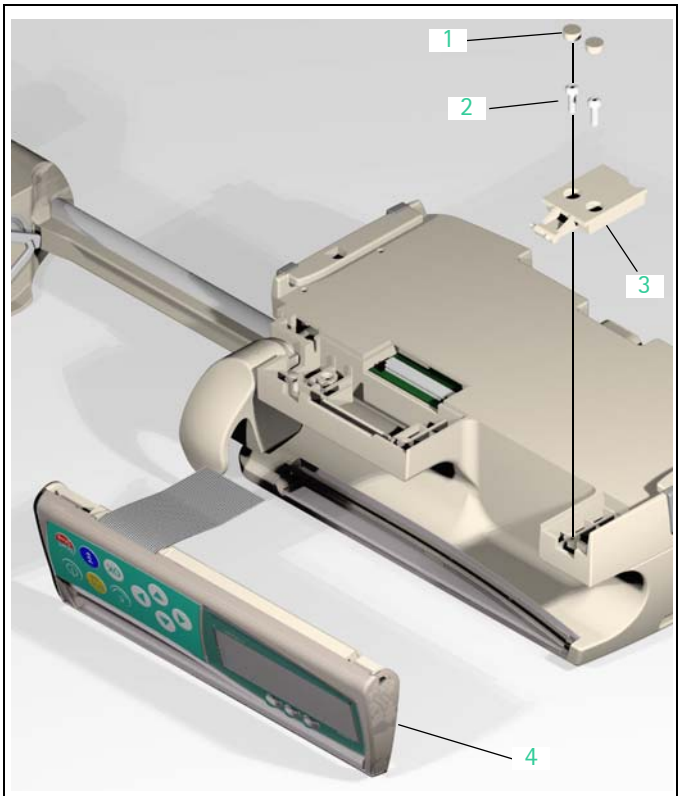

Fig.: 3 - 13

Legend of fig. 3 - 13:

Item	Designation
1	Cover cap
2	Screw EJOT 30x8 WN 5452 TORX 10IP A2
3	Hinge plate, left
4	Operating Unit

6. Pull the operating unit from the left hinge plate (Fig.: 3 - 13 / Item 3).
7. Pierce two cover caps (Fig.: 3 - 13 / Item 1) with a small screwdriver and remove cover caps.
8. Unscrew two screws and remove the left hinge plate.

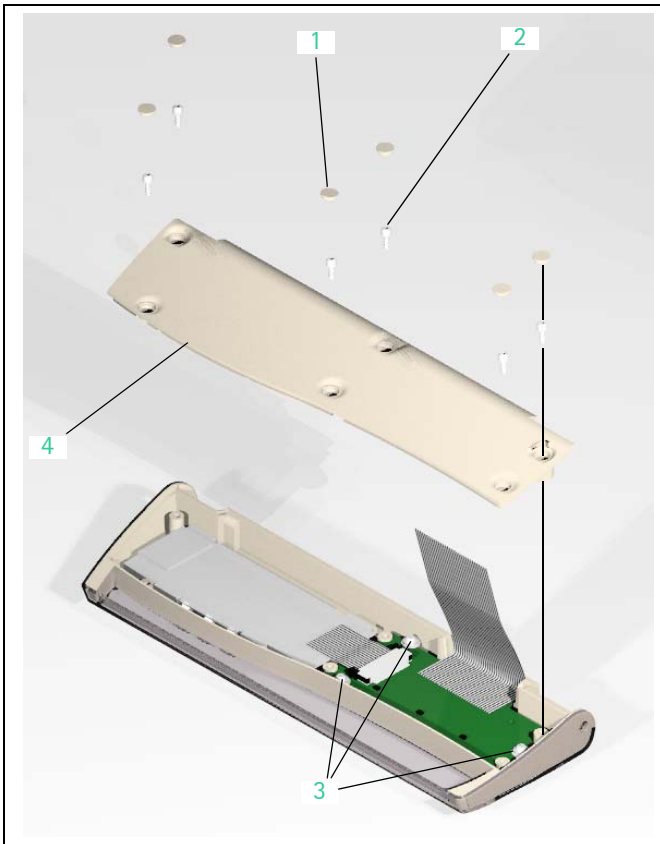

Fig.: 3 - 14

Legend of fig. 3 - 14:

Item	Designation
1	Cover cap
2	Screw EJOT 22x4.5 WN 5452 TORX 6IP A2
3	Screws for keyboard: **Do not loosen the screws**
4	Operating unit rear panel

Disassembly

1. Pierce six cover caps (Fig.: 3 - 14 / Item 1) with a small screwdriver and remove cover caps.
2. Unscrew six screws and remove the rear panel (Fig.: 3 - 14 / Item 4).

Note

The three screws of the keyboard must not be loosened. A uniform pressure point of all keys is only guaranteed when a special tool is used for assembly.

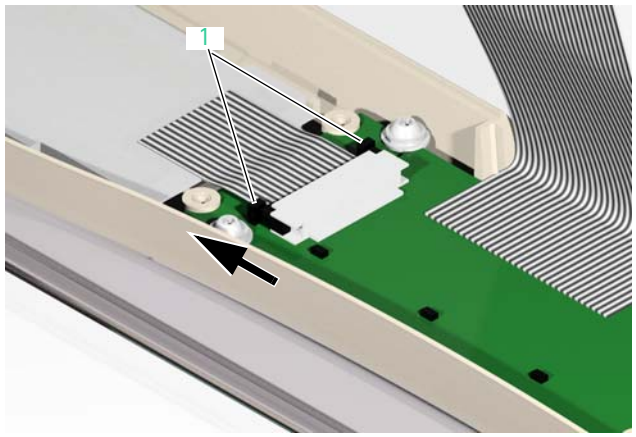

Fig.: 3 - 15

Legend of fig. 3 - 15:

Item	Designation
1	LC display connection cable lock

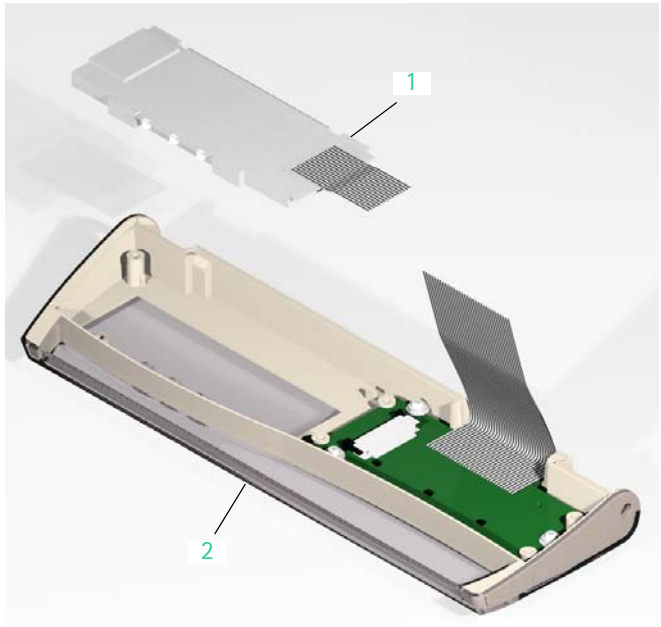

Fig.: 3 - 16

Legend of fig. 3 - 16:

Item	Designation
1	LC display
2	Front flap with keyboard

3. Push the right and left connector locks of the PCB keyboard carefully to the left.
4. Pull the LC display ribbon cable (Fig.: 3 - 16 / Item 1) out of the connector.
5. Lift the LC display out of the operating unit.

Note

The screws of the keyboard must not be loosened. A special procedure is required to install the keyboard, so that a uniform pressure point is guaranteed for all keys.

3.5 Upper Part of Housing

Designation	Ord. No.
Upper part of housing PSP	3452 0910
Screws and cover caps	
(see "Service Parts and Screw Kit" pg. 3 - 8)	

Note

Please pay attention to the corresponding notes during assembly and installation (see "Assembly / Installation" pg. 3 - 35).

Disassembly

1. Pierce five cover caps (Fig.: 3 - 17 / Item 4) with a small screwdriver and remove cover caps.
2. Unscrew five screws.
3. Loosen the locking tabs (Fig.: 3 - 17 / Item 1) of the upper part of the housing (Fig.: 3 - 17 / Item 2) carefully by pressing the left and rear outer edge of the housing upwards and remove the housing upper part.

Note

Pay attention to the length of the connection cable and to the connectors P2 and P3 when dismounting the housing. Do not pull the connectors together with the upper part out of the bottom part.

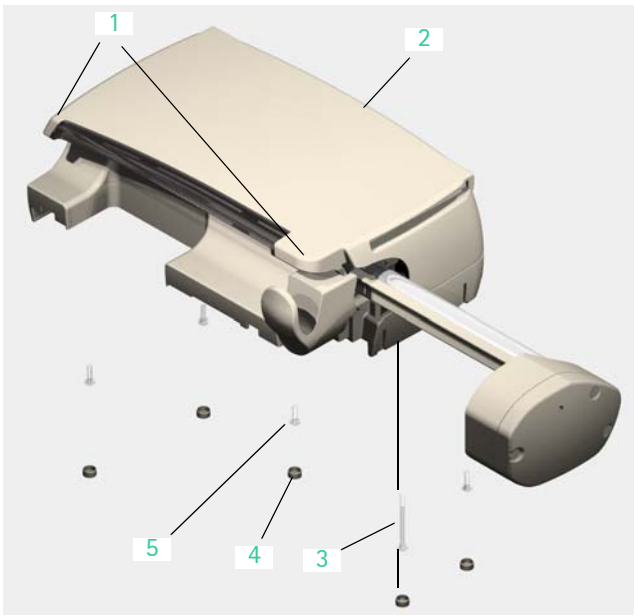

Fig.: 3 - 17

Legend of fig. 3 - 17:

Item	Designation
1	Locking tabs
2	Housing upper part
3	Screw EJOT 30x35 WN 5452 TORX 10IP A2
4	Cover cap
5	Screw EJOT 30x12 WN 5452 TORX 10IP A2

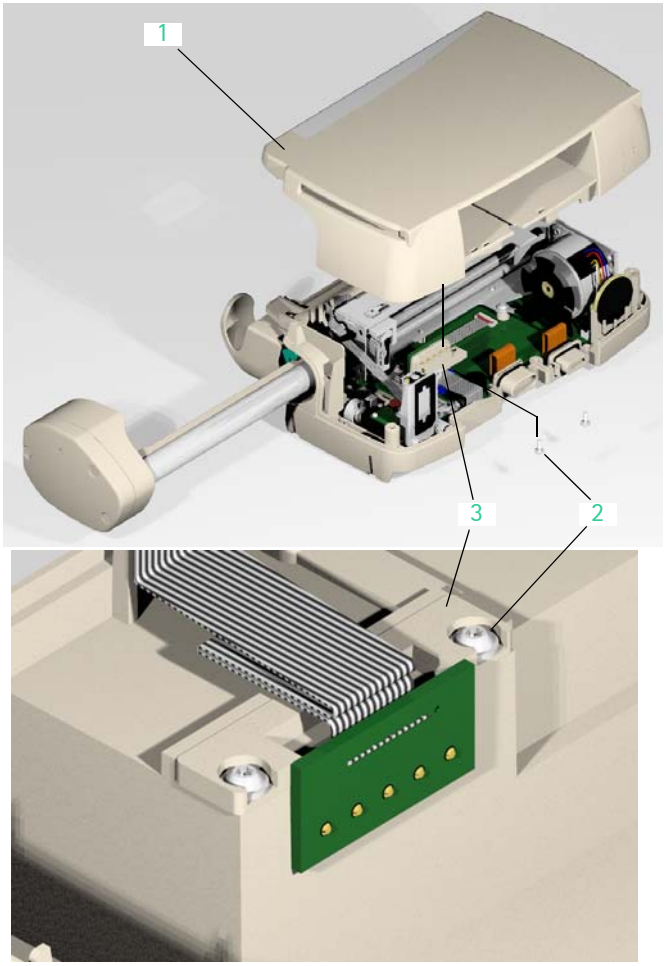

Fig.: 3 - 18

Legend of fig. 3 - 18:

Item	Designation
1	Housing upper part
2	Screw EJOT 25x7 WN 5451 TORX 8IP
3	Contact strip

4. Unscrew two screws and remove the contact strip (Fig.: 3 - 18 / Item 3) (Fig.: 3 - 18 / Item 1).

Note

If necessary, the spring-mounted contact pins must be carefully inserted when the contact strip is dismounted.

3.6 Release Button

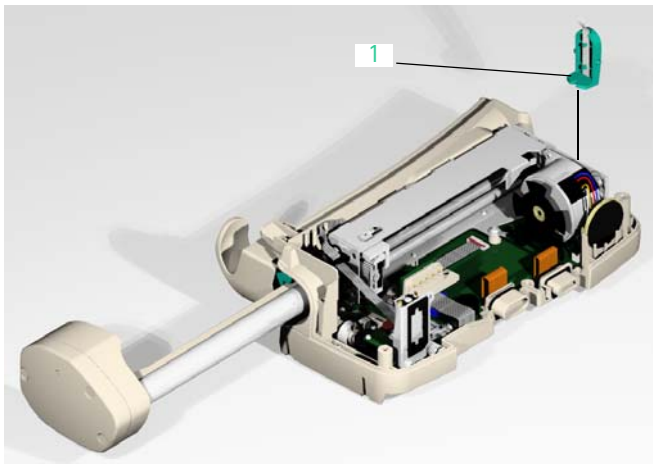

Fig.: 3 - 19

Legend of fig. 3 - 19:

Item	Designation
1	Release Button

Designation **Ord. No.**

Release button PSP with leaf spring
(see "Service Parts and Screw Kit" pg. 3 - 8)

Disassembly

1. Pull the release button (Fig.: 3 - 19 / Item 1) out of the housing bottom part.

3.7 Loudspeaker

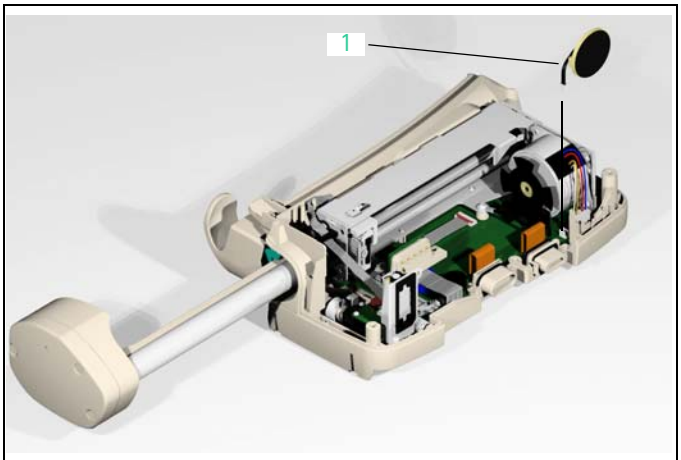

Fig.: 3 - 20

Legend of fig. 3 - 20:

Item	Designation
1	Loudspeaker

Designation **Ord. No.**

Loudspeaker SP 3452 0937

Disassembly

1. Pull the loudspeaker connector off (Fig.: 3 - 20 / Item 1) the processor PCB and remove the loudspeaker.

3.8 Drive

Fig.: 3 - 21

Legend of fig. 3 - 21:

Item	Designation
1	Drive connector lock

Fig.: 3 - 22

Legend of fig. 3 - 22:

Item	Designation
1	Left carrier

Designation	Ord. No.
Drive PSP, cpl.	
Silver claws	3452 1046
Green claws (as from unit software "F")	3452 1041
Drive head PSP (incl. driving tube)	
Silver claws	3452 1038
Green claws (as from unit software "F")	3452 1039
Drive head housing PSP	3452 1055
Claw mechanism PSP	3452 1550
Drive PCB, PSP	3452 1569
Side part of housing PSP, cpl.	3452 1054
Screws and claws	
(see "Service Parts and Screw Kit" pg. 3 - 8)	

Note

Please pay attention to the corresponding notes during assembly and installation (see "Assembly / Installation" pg. 3 - 35).

Disassembly

1. Tilt the lock (Fig.: 3 - 21 / Item 1) of the drive ribbon cable upwards and pull the cable out of the connector.
2. Loosen one screw (Fig.: 3 - 23 / Item 1) and lift the fastening angle (Fig.: 3 - 23 / Item 2) of the drive ribbon cable.
3. Unscrew one screw (Fig.: 3 - 23 / Item 3) and remove the screw together with the locking washer (Fig.: 3 - 23 / Item 4) from the drive.
4. Pull the left carrier (Fig.: 3 - 22 / Item 1) / (Fig.: 3 - 23 / Item 5) out of the drive slide.
5. Pull out the drive head (Fig.: 3 - 23 / Item 6) together with the driving tube and the guide rail carefully from the drive assembly.

CAUTION

Pay attention to the ribbon cable in the driving tube when dismounting the drive.

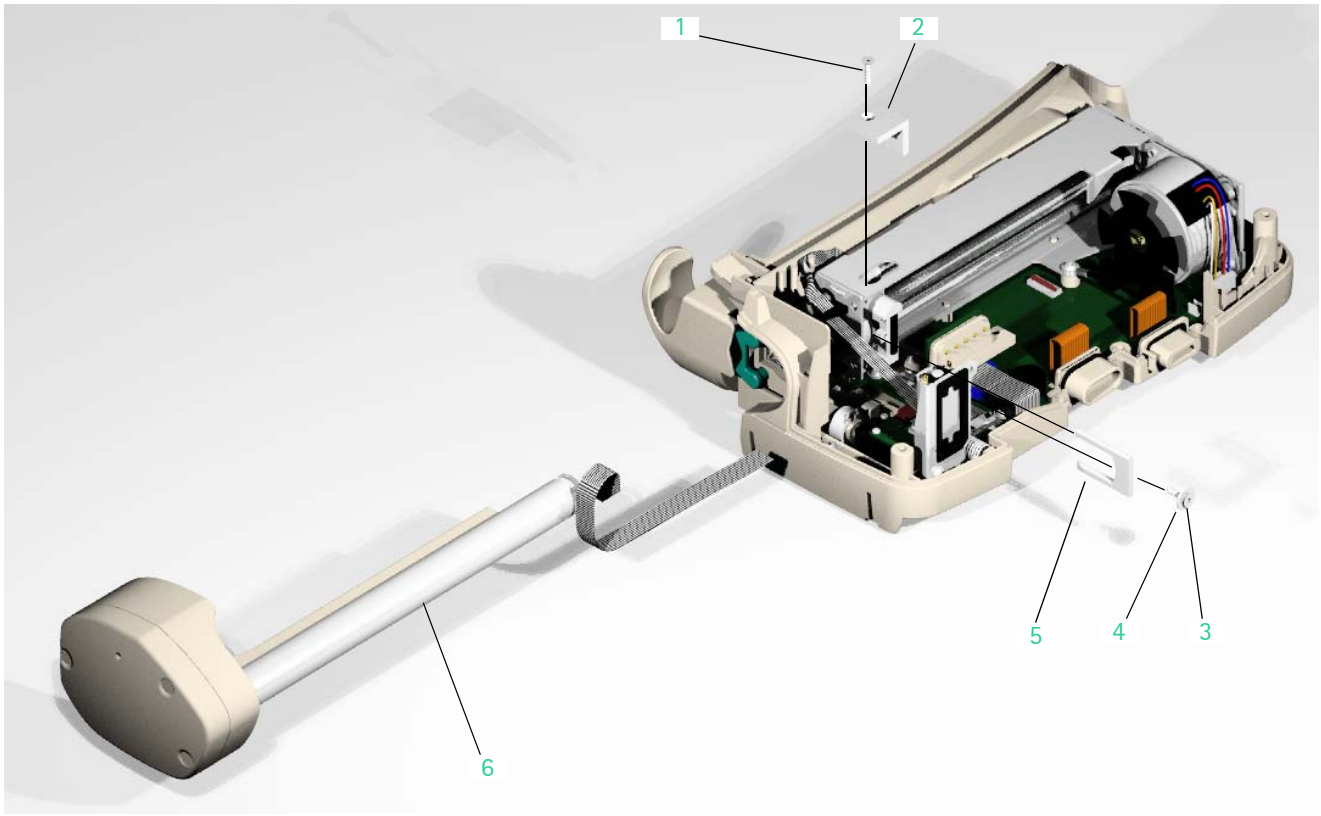

Fig.: 3 - 23

Legend of fig. 3 - 23:

Item	Designation	Item	Designation
1	Screw EJOT 22x8 WN 5451 TORX 6IP A2	4	Washer
2	Fastening angle	5	Carrier
3	Screw EJOT 22x8 WN 5451 TORX 6IP A2	6	Drive head

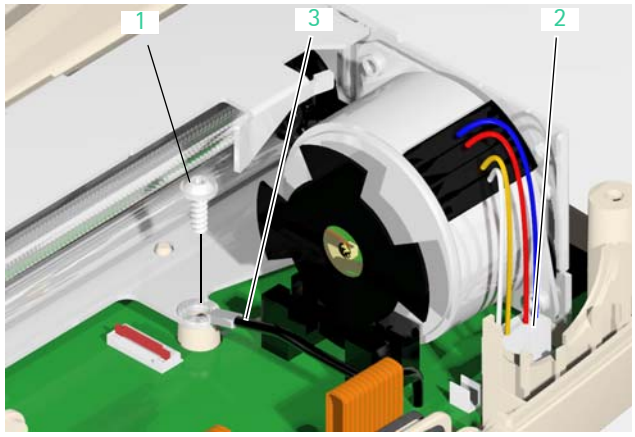

Fig.: 3 - 24

Legend of fig. 3 - 24:

Item	Designation
1	Screw EJOT 30x8 WN 5451 TORX 10IP
2	Drive motor connector
3	Processor PCB ground cable

6. Pull the drive motor connector (Fig.: 3 - 24 / Item 2) off the processor PCB.
7. Unscrew one screw (first temporary screw) and remove the processor PCB ground cable (Fig.: 3 - 24 / Item 3).

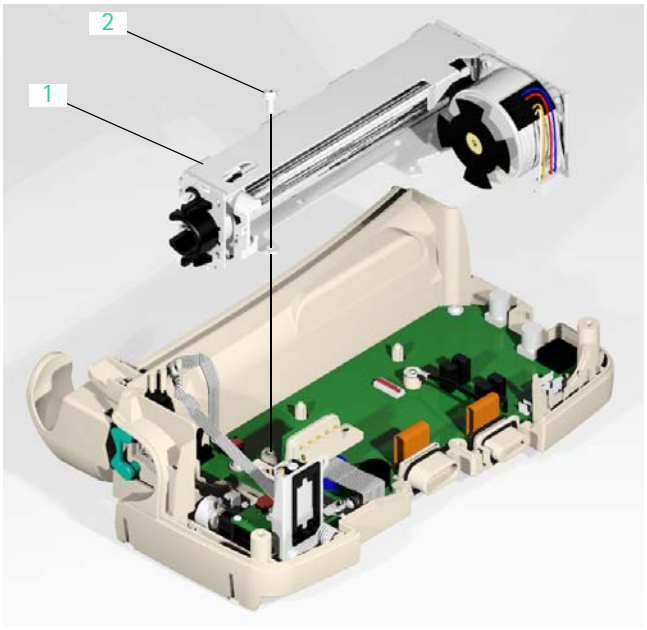

Fig.: 3 - 25

Legend of fig. 3 - 25:

Item	Designation
1	Drive assembly
2	Screw EJOT 30x8 WN 5451 TORX 10IP

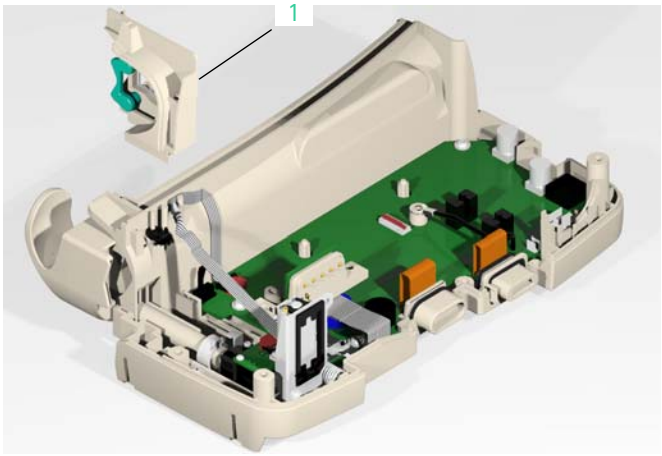

Fig.: 3 - 26

Legend of fig. 3 - 26:

Item	Designation
1	Side part of housing

8. Unscrew one screw (second temporary screw) and take the drive assembly (Fig.: 3 - 25 / Item 1) out of the housing.

Note

Please pay attention to the corresponding notes during assembly and installation (see "Assembly / Installation" pg. 3 - 35).

9. Pull the side part of the housing (Fig.: 3 - 26 / Item 1) out of the bottom part.

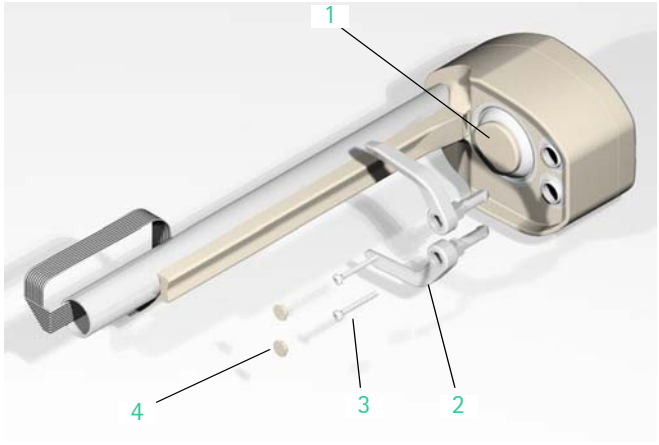

Fig.: 3 - 27

Legend of fig. 3 - 27:

Item	Designation
1	Membrane plate
2	Claws
3	Screw EJOT 20x18 WN 5452 TORX 6IP
4	Cover caps

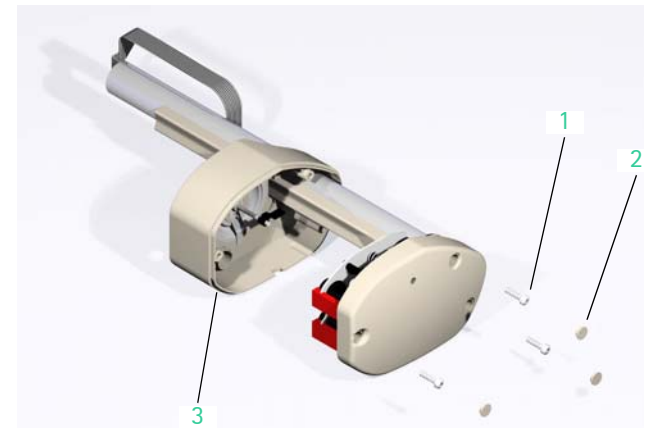

Fig.: 3 - 28

Legend of fig. 3 - 28:

Item	Designation
1	Screw EJOT 25x10 WN 5452 A2 TORX 6IP
2	Cover caps
3	Drive head housing

Disassembly of the Drive Head

1. Pierce two cover caps (Fig.: 3 - 27 / Item 4) with a small screwdriver and remove cover caps.
2. Unscrew two screws (Fig.: 3 - 27 / Item 3).
3. Remove claws (Fig.: 3 - 27 / Item 2) carefully out of the drive head.

CAUTION

The membrane plate (Fig.: 3 - 27 / Item 1) of the drive head must not be used as thrust bearing when removing the claws. If the force exerted on the membrane plate is too great the membrane plate and the accessory components are damaged.

4. Pierce three cover caps (Fig.: 3 - 28 / Item 2) with a small screwdriver and remove cover caps.
5. Unscrew three screws (Fig.: 3 - 28 / Item 1).
6. Pull the drive head housing (Fig.: 3 - 28 / Item 3) over the driving tube and off the drive head.

Note

Note cable or wire layout and sketch if necessary.

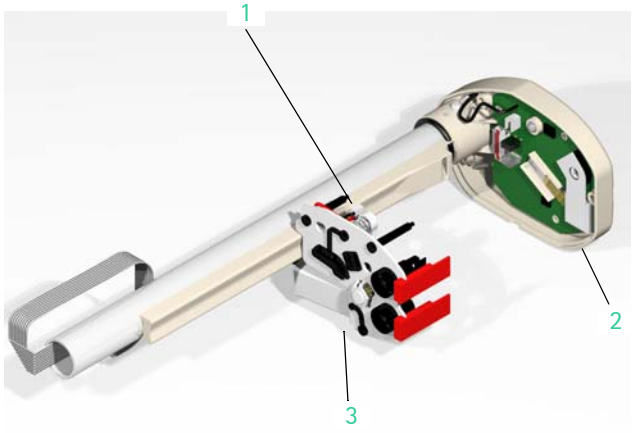

Fig.: 3 - 29

Legend of fig. 3 - 29:

Item	Designation
1	Connection cable, claw mechanism
2	Drive head cover
3	Claw mechanism

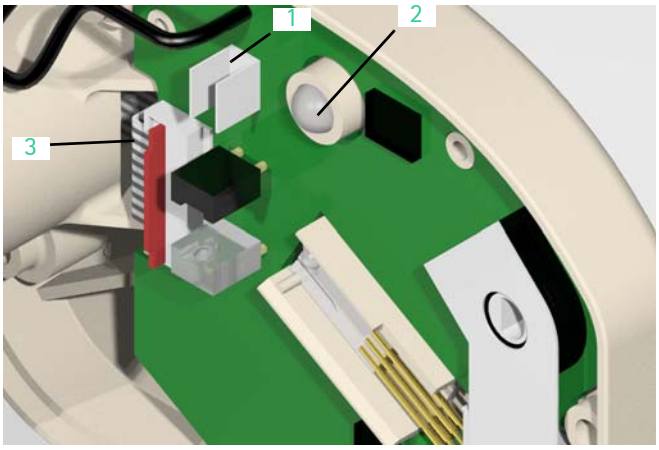

Fig.: 3 - 30

Legend of fig. 3 - 30:

Item	Designation
1	Connector of claw mechanism connection cable
2	Emergency release tappet
3	Ribbon cable, drive

7. Pull the claw mechanism (Fig.: 3 - 29 / Item 3) off the drive head cover (Fig.: 3 - 29 / Item 2) until the connection cable connector (Fig.: 3 - 30 / Item 1), (Fig.: 3 - 29 / Item 1) can be easily accessed.
8. Pull the connection cable of the claw mechanism off the drive head PCB and remove the claw mechanism.

9. Tilt the lock (Fig.: 3 - 30 / Item 3) of the drive ribbon cable upwards and pull the cable out of the connector.

Note

Pay attention to the emergency release tappet (Fig.: 3 - 30 / Item 2) during disassembly. The emergency release tappet can easily drop out of the guide.

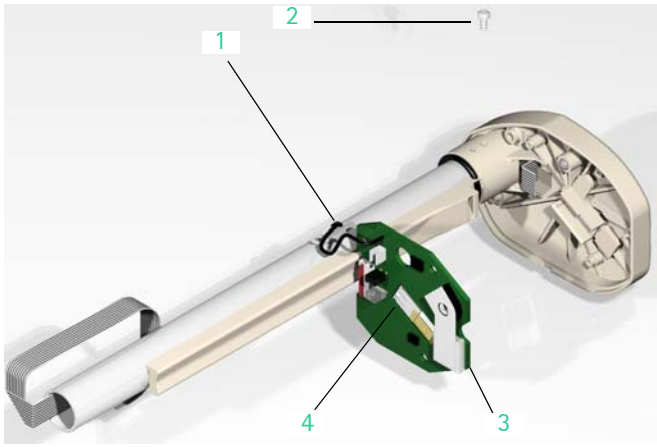

Fig.: 3 - 31

Legend of fig. 3 - 31:

Item	Designation
1	Ground wire
2	Screw EJOT-PT Type DG 22x5 WN 1552
3	Drive PCB
4	Strain gauge

10. Unscrew one screw (Fig.: 3 - 31 / Item 2) and remove the ground wire (Fig.: 3 - 31 / Item 1) of the drive PCB (Fig.: 3 - 31 / Item 3) from the driving tube.

CAUTION

Pay attention to the strain gauge (Fig.: 3 - 31 / Item 4) when dismantling the drive head PCB. The strain gauge must not be jammed or removed by force out of the drive head cover.

CAUTION

The PCB potentiometer of the drive head must not be turned by more than approx. 120°.

11. Take the drive PCB with the strain gauge carefully out of the drive head cover. The strain gauge and the PCB should be pulled vertically out of the holder.

3.9 Syringe Holder with Piston Brake

Designation	Ord. No.
Piston brake PSP ribbon cable	3452 0864
Syringe holder with piston brake PSP, cpl.	3452 0945
Syringe holder PSP spring	3452 0953
Piston brake PSP guide rail	3452 0961

Screws and cover caps

(see "Service Parts and Screw Kit" pg. 3 - 8)

Disassembly

WARNING

PAY ATTENTION TO THE PISTON BRAKE BLADE WHEN WORKING ON THE PISTON BRAKE. THE BLADE IS SHARP AND MAY CAUSE INJURIES.

1. Push the right and left connector lock (Fig.: 3 - 32 / Item 1) on the processor PCB carefully forward.
2. Pull the ribbon cable (Fig.: 3 - 32 / Item 2) out of the connector.

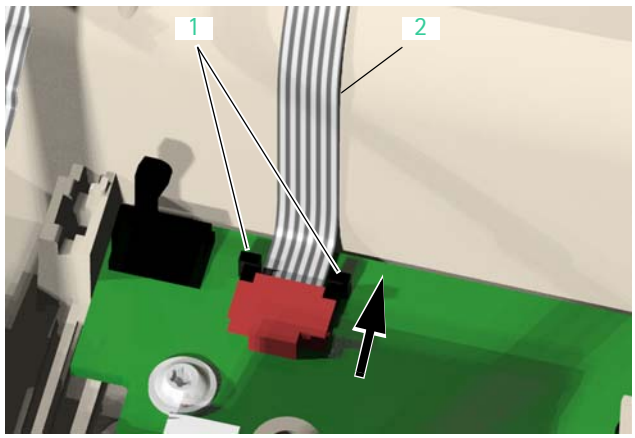

Fig.: 3 - 32

Legend of fig. 3 - 32:

Item	Designation
1	Processor PCB connector lock
2	Piston brake ribbon cable

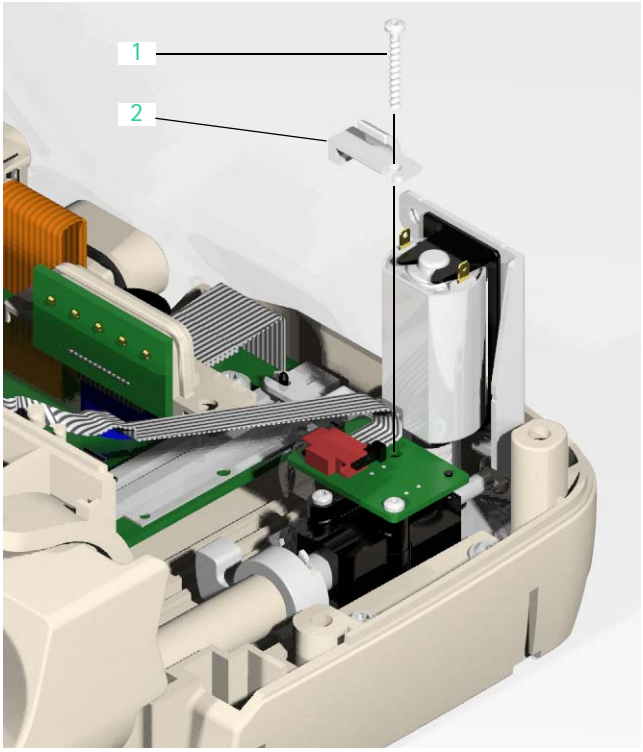

Fig.: 3 - 33

Legend of fig. 3 - 33:

Item	Designation
1	Screw EJOT 20x14 WN 5452 TORX 6IP
2	Locking clip

3. Unscrew one screw and remove the locking clip (Fig.: 3 - 33 / Item 2) from the piston brake PCB.

4. Open the right and left connector lock (Fig.: 3 - 34 / Item 1) on the piston brake PCB carefully.

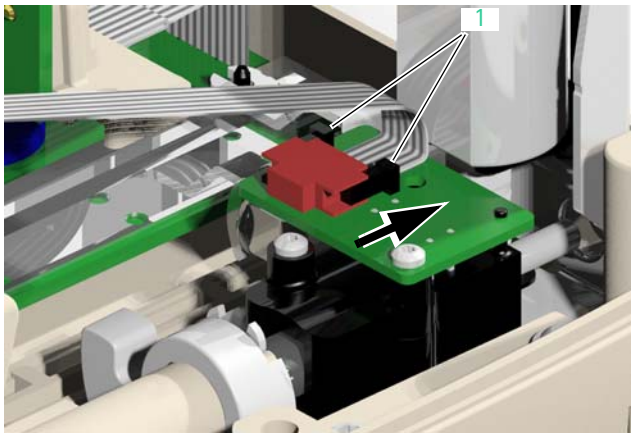

Fig.: 3 - 34

Legend of fig. 3 - 34:

Item	Designation
1	Piston brake connector lock

5. Pull the ribbon cable (Fig.: 3 - 35 / Item 1) out of the connector and remove the cable from the housing.

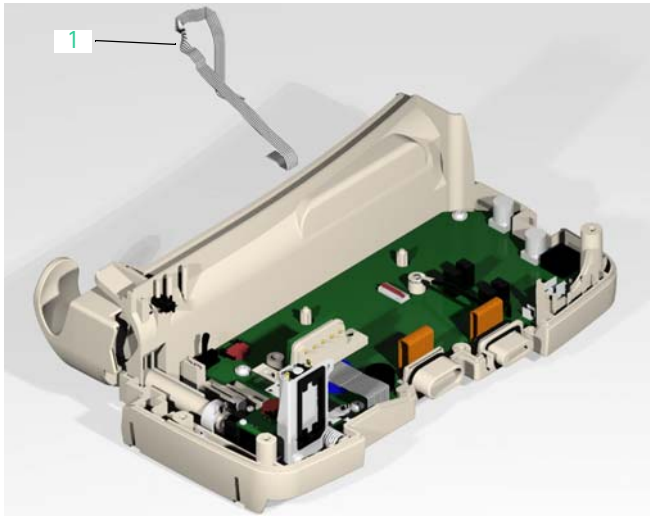

Fig.: 3 - 35

Legend of fig. 3 - 35:

Item	Designation
1	Piston brake ribbon cable

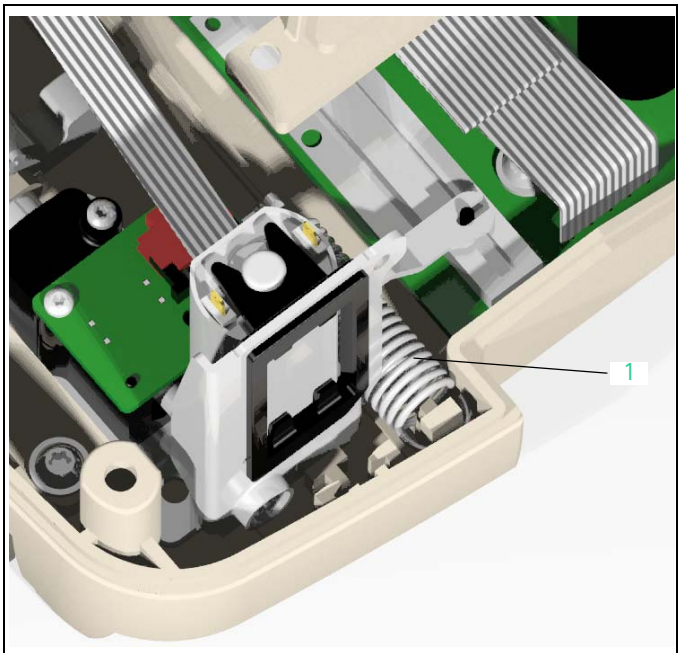

Fig.: 3 - 36

Legend of fig. 3 - 36:

Item	Designation
1	Syringe holder spring

6. Remove the syringe holder spring (Fig.: 3 - 36 / Item 1) from the post in the bottom part of the housing.

Note

The syringe holder spring can only be removed together with the piston brake drive.

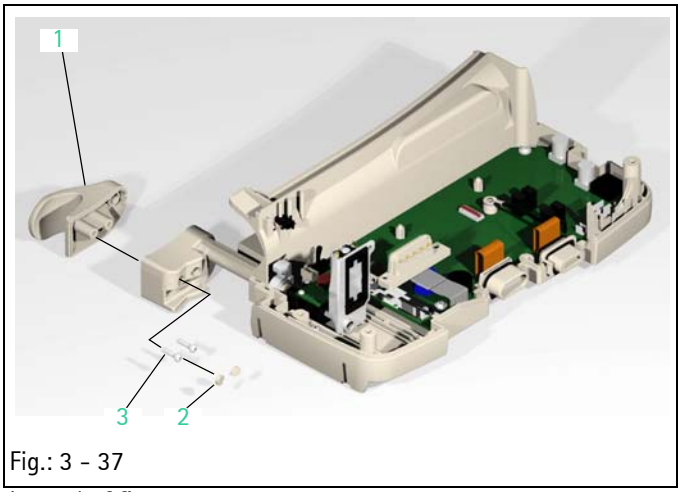

Fig.: 3 - 37

Legend of fig. 3 - 37:

Item	Designation
1	Syringe holder cover
2	Cover cap
3	Screw EJOT 25x10 WN 5452 TORX 8IP

7. Pull out the syringe holder and turn it clockwise.
8. Pierce two cover caps (Fig.: 3 - 37 / Item 2) in the syringe holder with a small screwdriver and remove cover caps.
9. Unscrew two screws and remove the cover from the syringe holder (Fig.: 3 - 37 / Item 1).
10. Turn and push in the syringe holder housing with piston brake.

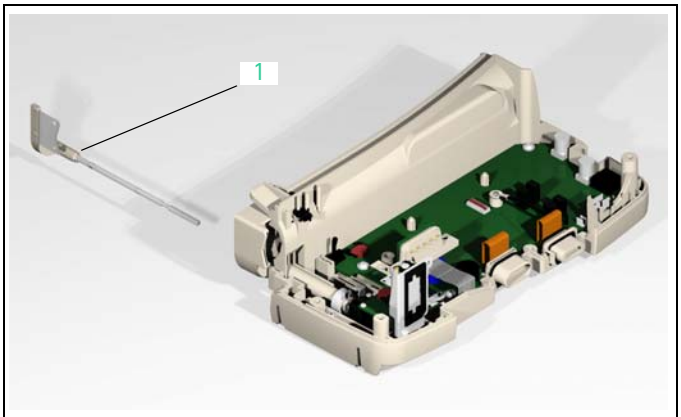

Fig.: 3 - 38

Legend of fig. 3 - 38:

Item	Designation
1	Piston brake blade

11. Drive the piston brake motor with maximum 3 V DC. The blade is moved out of the syringe holder housing.

Note

If the blade moves into the syringe holder housing, then the polarity on the piston brake motor must be changed.

12. Pull the blade out of the syringe holder housing.

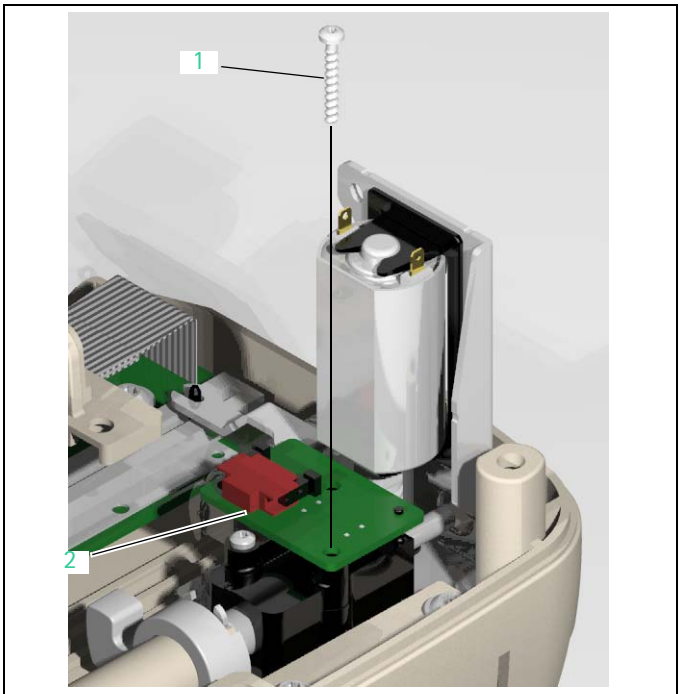

Fig.: 3 - 39

Legend of fig. 3 - 39:

Item	Designation
1	Screw EJOT 20x12 WN 5452 TORX 6IP
2	Piston brake PCB

13. Loosen one screw. Remove the piston brake PCB (Fig.: 3 - 39 / Item 2) and put it carefully aside. The connection wires must not be unsoldered.

Note

Pay attention to the light barrier components on the PCB underside and to the length of the connection wires to the piston brake motor when removing the printed circuit board.

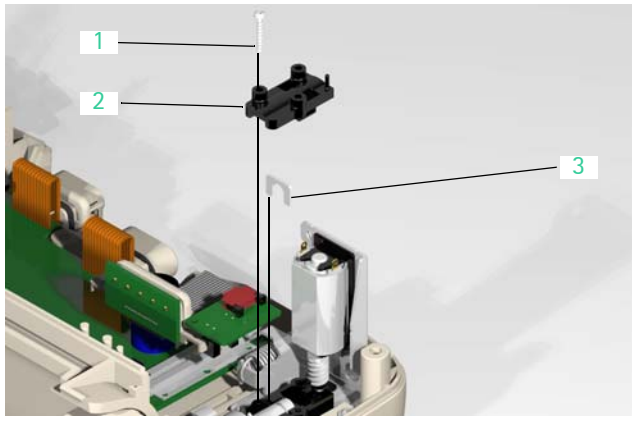

Fig.: 3 - 40

Legend of fig. 3 - 40:

Item	Designation
1	Screw EJOT 20x12 WN 5452 TORX 6IP
2	Bearing cover
3	Lock

14. Unscrew one screw and remove the bearing cover (Fig.: 3 - 40 / Item 2).
15. Take the lock (Fig.: 3 - 40 / Item 3) out of the bearing housing.

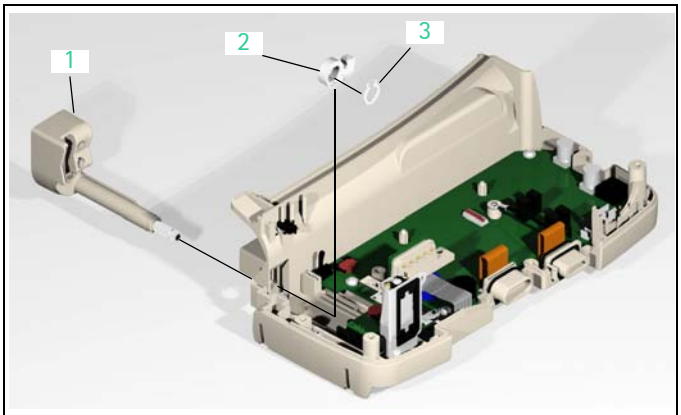

Fig.: 3 - 41

Legend of fig. 3 - 41:

Item	Designation
1	Syringe holder housing
2	Carrier
3	Circlip

16. Open the circlip (Fig.: 3 - 41 / Item 3) and pull it together with the carrier (Fig.: 3 - 41 / Item 2) off the syringe holder housing (Fig.: 3 - 41 / Item 1).
17. Pull the syringe holder housing out of the bottom part of the housing.

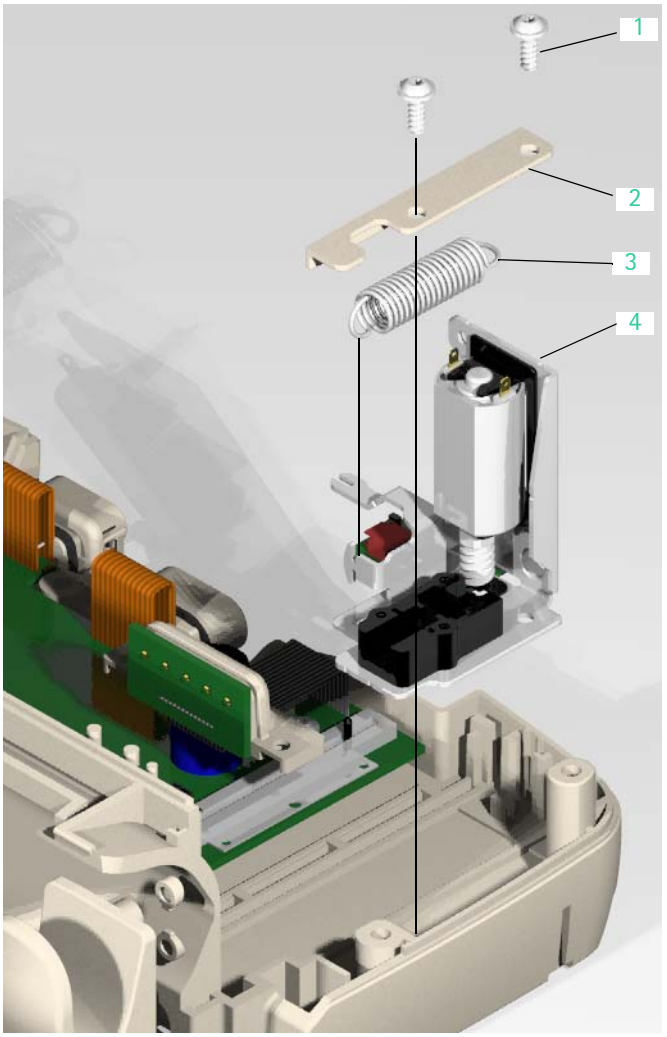

Fig.: 3 - 42

Legend of fig. 3 - 42:

Item	Designation
1	Screw EJOT 30x8 WN 5451 TORX 10IP
2	Guide rail
3	Syringe holder spring
4	Piston brake motor assembly

18. Unscrew two screws and remove guide rail (Fig.: 3 - 42 / Item 2) out of the bottom part of the housing.
19. Take piston brake motor assembly (Fig.: 3 - 42 / Item 4) out of the housing bottom part.
20. Remove syringe holder spring from the piston brake motor assembly.

3.10 Processor PCB

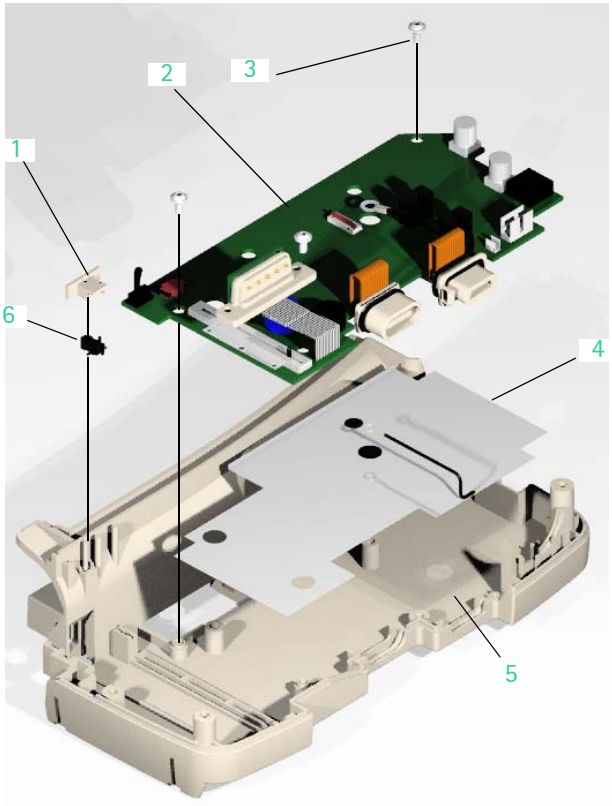

Fig.: 3 - 43

Legend of fig. 3 - 43:

Item	Designation
1	Syringe wing sensor holder
2	Processor PCB
3	Screw EJOT 30x6 WN 5451 TORX 10IP
4	Shielding plate with earthing wire
5	Housing bottom part
6	Syringe wing sensor

Designation	Ord. No.
Processor PCB PSP (incl. connectors and syringe wing sensor)	3452 0880
Housing bottom part PSP	3452 0929
Type plate PSP	Upon request
Screws and syringe wing sensor holder (see "Service Parts and Screw Kit" pg. 3 - 8)	

Note

Please pay attention to the corresponding notes during assembly and installation (see "Assembly / Installation" pg. 3 - 35).

Disassembly

1. Pull the syringe wing sensor holder (Fig.: 3 - 43 / Item 1) out of the housing.
2. Lift the syringe wing sensor (Fig.: 3 - 43 / Item 6) out of the housing bottom part (Fig.: 3 - 43 / Item 5).

Note

Pay attention to the connection cable to the syringe wing sensor when removing the processor PCB. The connection cable is not shown in Fig.: 3 - 43.

3. Unscrew three screws and remove screws together with the processor PCB (Fig.: 3 - 43 / Item 2) and the shielding plate (Fig.: 3 - 43 / Item 4) from the bottom part of the housing.

3.11 Assembly / Installation

Assembly or installation of the modules and subsystems is done in reverse order of disassembly. Special steps to be observed are described hereafter in detail.

Only new cover caps are to be used.

Special Screws

Special screws for plastic housings are used in this unit. The screws are not self-cutting but produce a thread in the plastic of the housing through deformation when fitted in for the first time.

If the beginning of the thread is not engaged when the screw is fitted, a new thread is produced and the old thread is destroyed so that the security of the fixing can no longer be guaranteed.

Proceed as follows to fit the special screws:

1. Put the screw on the thread.
2. Rotate screw anti-clockwise (loosen) until a faint click can be heard. This click is produced when the screw thread drops into the existing thread.
3. Screw in the screw and tighten with the defined torque.

Zero Force Insertion Connector

Note

Make sure that the ribbon cable is centered between the plug guides when the zero force insertion connector is locked. Check the lock and the ribbon cable for correct fit before any further installation.

Processor PCB

When the processor PCB is replaced all data of the pump except for the calibration data was probably saved on a PC (see "Preparations for Exchanging the Processor PCB" pg. 3 - 2). Carry out the following steps to transmit the data back to the device.

WARNING

WHEN DATA PREVIOUSLY SAVED IS TRANSFERRED BACK TO THE DEVICE, CALIBRATION DATA IS NOT TRANSFERRED. THEREFORE, A COMPLETE NEW CALIBRATION OF THE UNIT IS REQUIRED.

1. Start the Service Program (see "Starting the Service Program" pg. 1 - 7).
2. Select the register tab "Modification data".
3. Press the "From file" button. The window "Open" is displayed on screen.

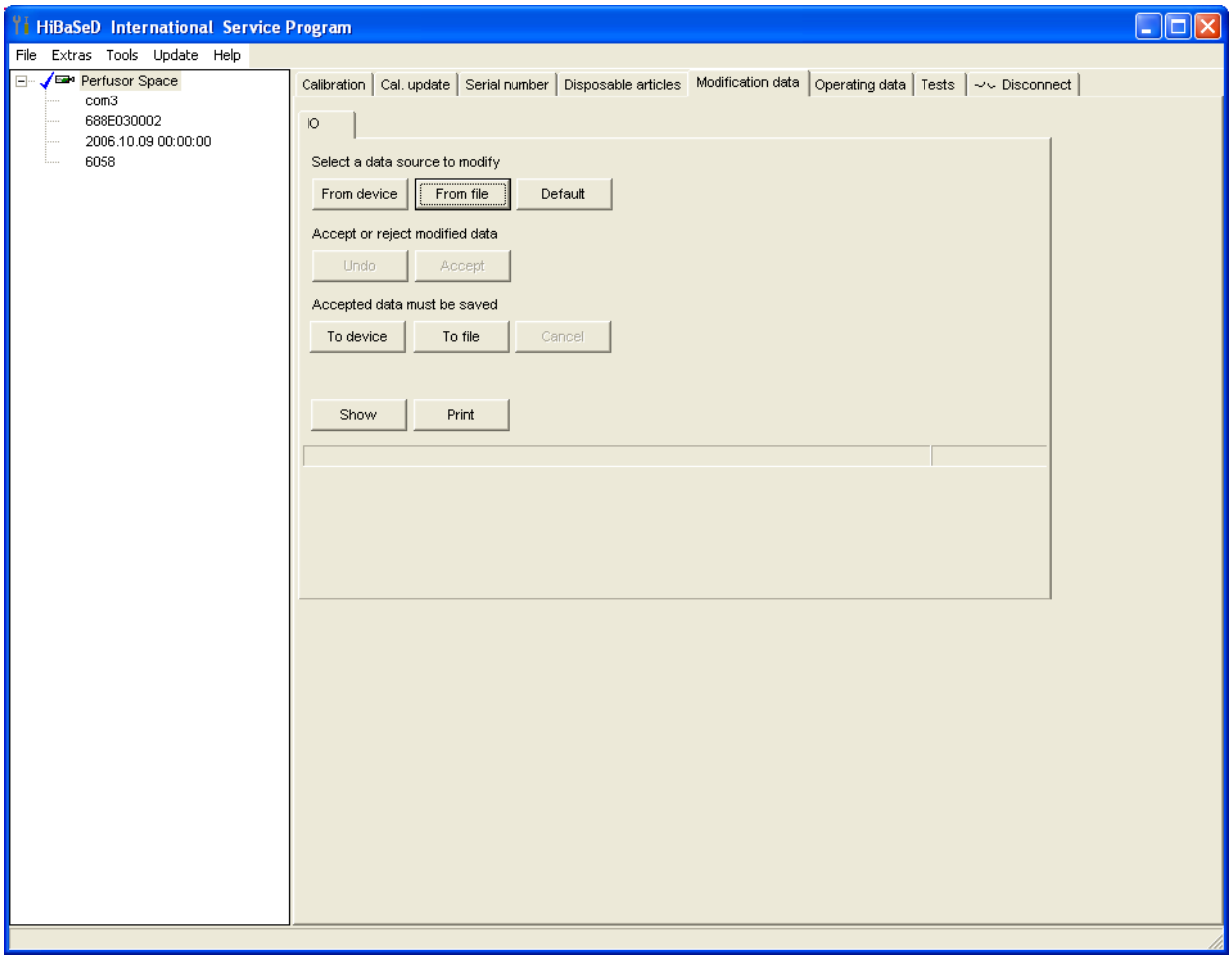

Fig.: 3 - 44

4. Select the desired file with the mouse pointer and press the "Open" button.

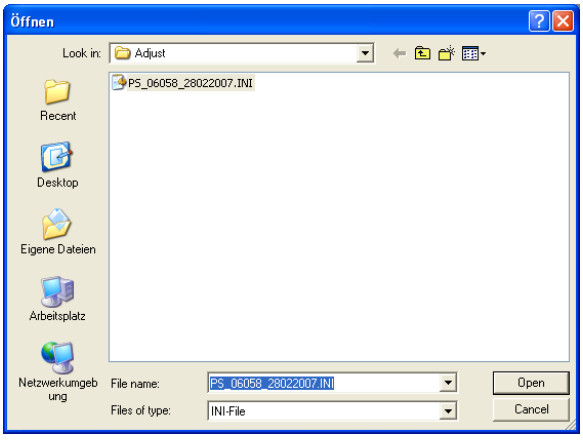

Fig.: 3 - 45

5. Change to the tab "IO" and actuate the "To device" button.

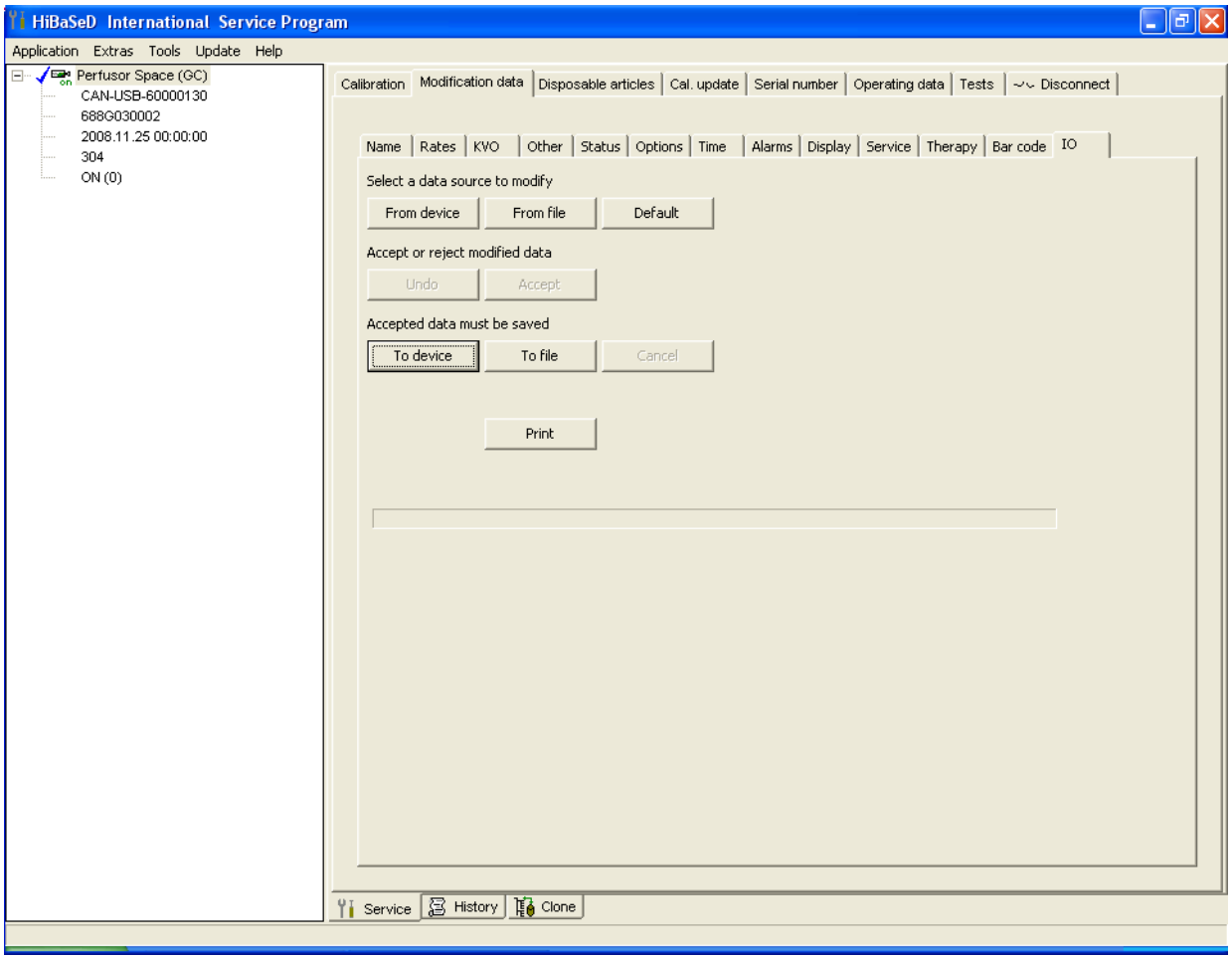

Fig.: 3 - 46

6. Press the "OK" button when the window "Confirmation" is displayed.

Fig.: 3 - 47

Fig.: 3 - 48

Fig.: 3 - 49

7. Enter your worker id in the window "Worker ID". Press the "OK" button to transmit the data to the device.

   A message is displayed that a change of the device data may affect the patients.

8. Select the tab "Disposable articles".

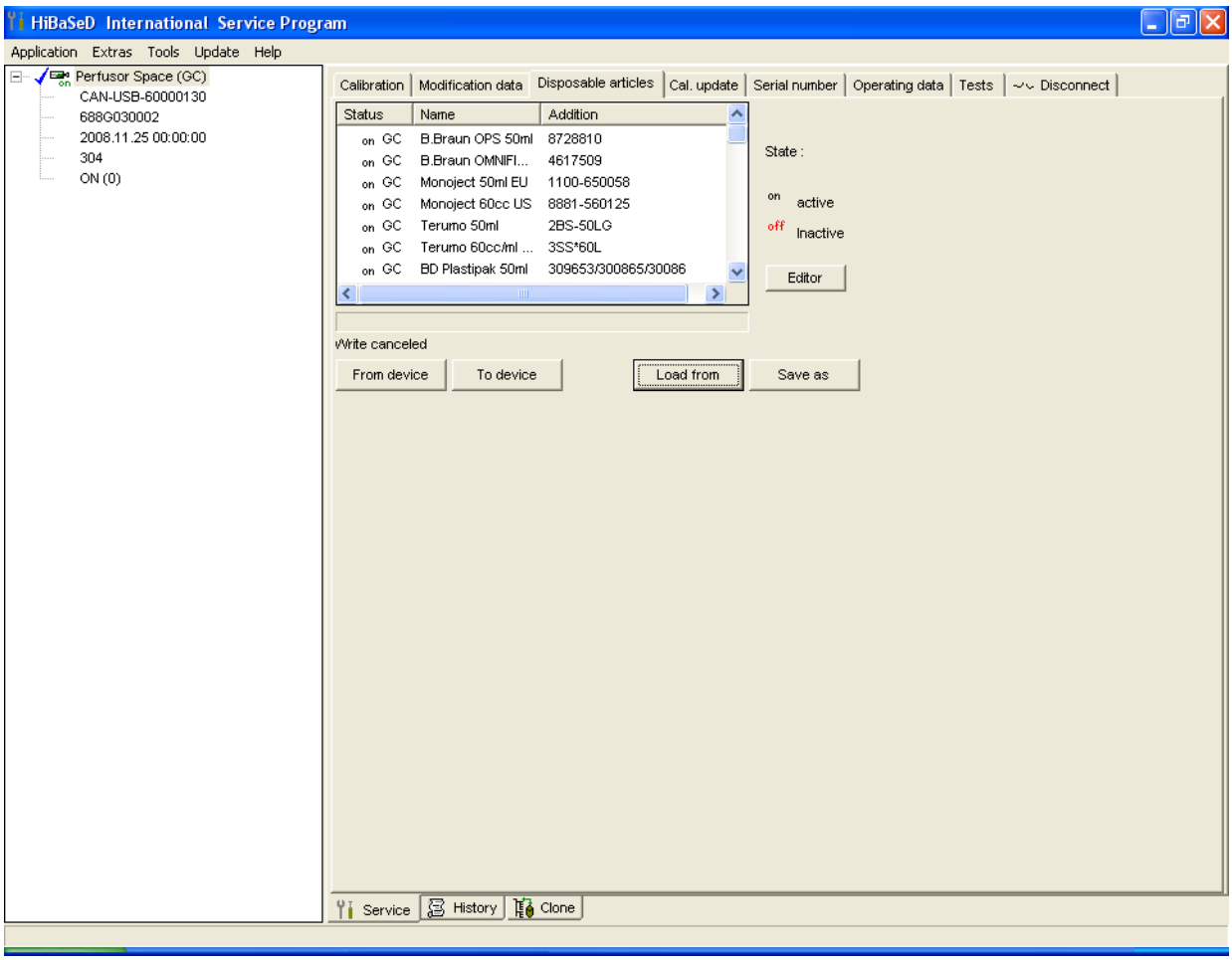

Fig.: 3 - 50

9. Press the "Load from" button. The window "Open" is displayed on screen.

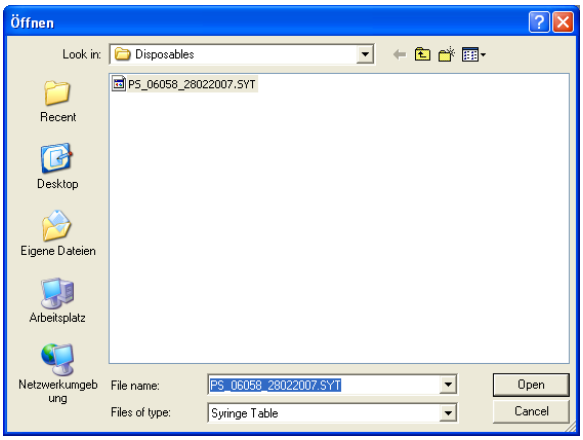

Fig.: 3 - 51

10. Select the desired file with the mouse pointer and press the "Open" button. The data loaded is displayed on screen.
11. Actuate the "To device" button.

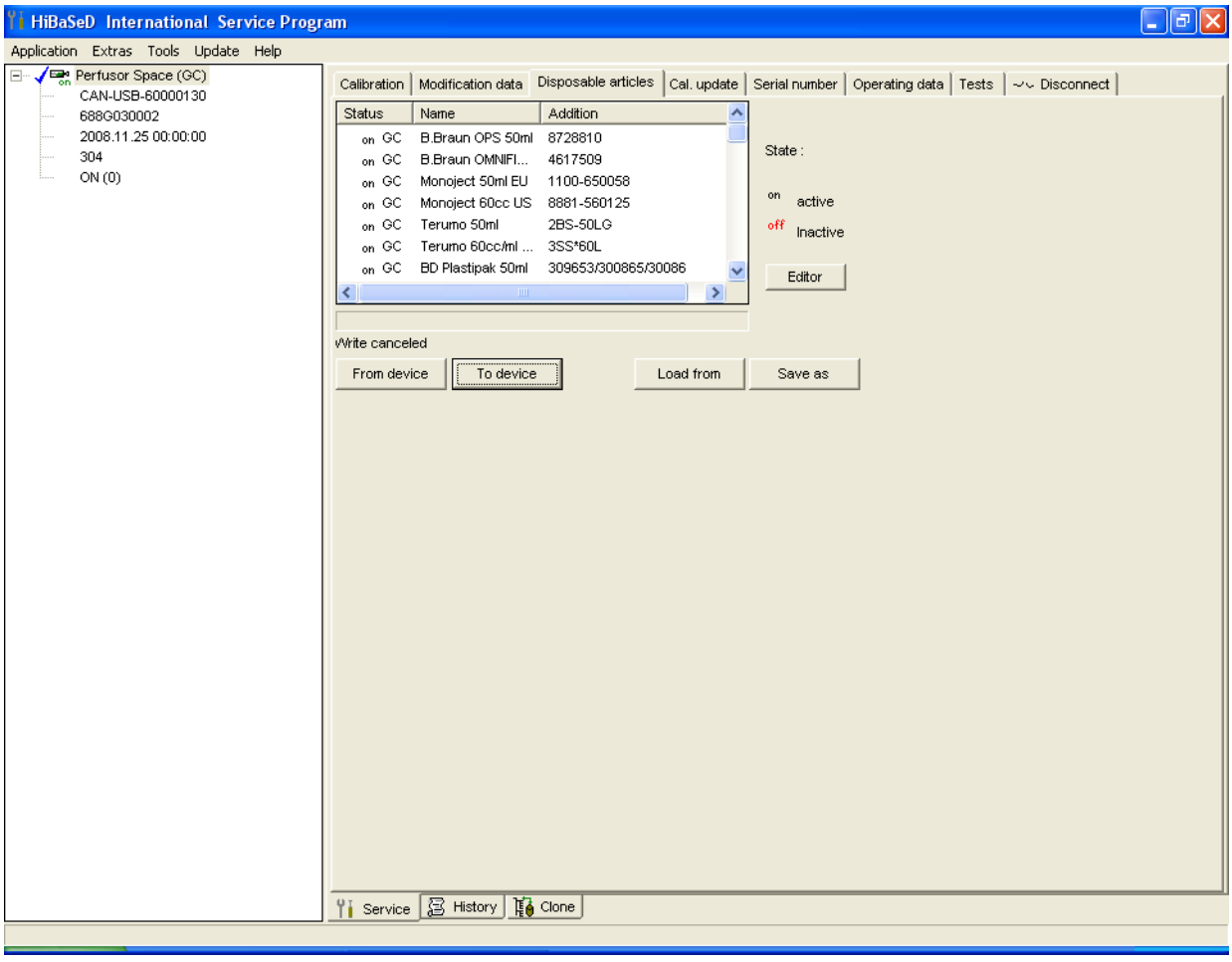

Fig.: 3 - 52

Fig.: 3 - 53

12. Press the "OK" button when the window "Confirmation" is displayed.

Fig.: 3 - 54

13. Enter your worker id in the window "Worker ID". Press the "OK" button to transmit the data to the device.

Fig.: 3 - 55

A message is displayed that a change of the device data may affect the patients.

14. Exit the Service Program (see "Quit the Service Program" pg. 1 - 11).

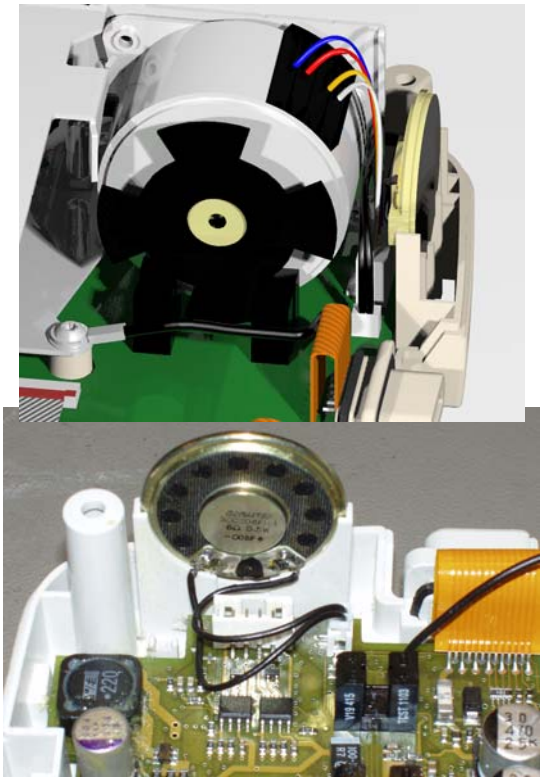

Fig.: 3 - 56

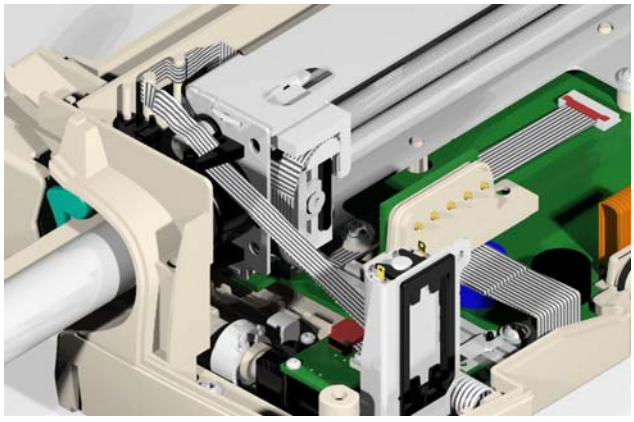

Fig.: 3 - 57

Loudspeaker

1. Route the loudspeaker connection cable between the drive motor and its connection wires, see Fig.: 3 - 56.

Piston Brake

WARNING

PAY ATTENTION TO THE PISTON BRAKE BLADE WHEN WORKING ON THE PISTON BRAKE. THE BLADE IS SHARP AND MAY CAUSE INJURIES.

Note

Pay attention to the light barrier components on the PCB underside when installing the piston brake PCB.

1. Insert the syringe holder spring on the piston brake drive and fit the drive.
2. Route the ribbon cable to the piston brake drive as shown in Fig.: 3 - 57.

Drive Head

1. Insert the drive head PCB with the strain gauge vertically in the drive head cover. Please note that the strain gauge must not get jammed in the guide.

Note

The three strain gauge tongues are level with the PCB upper side.

2. The ground wire is to be layed according to the notes or the draft which was prepared before disassembly.
3. Turn the potentiometer (Fig.: 3 - 58) of the drive head PCB before assembly in such a way that the operating square of the upper claw seat can be pushed in.

CAUTION

The PCB potentiometer of the drive head must not be turned by more than approx. 120°.

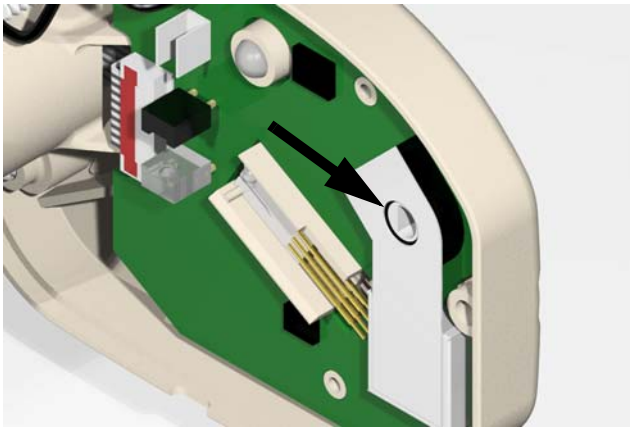

Fig.: 3 - 58

4. Position the two claw seats (Fig.: 3 - 58) before assembly in such a way that the marking (dot in material) on the upper claw seat points vertically upwards and the marking on the bottom claw seat points to the right, away from the driving tube.

Note

The motor connection wires and the ground wire must be laid between the claw mechanism bearing and the driving tube so that they cannot slip in the area of moving parts, e.g. the membrane tappet.

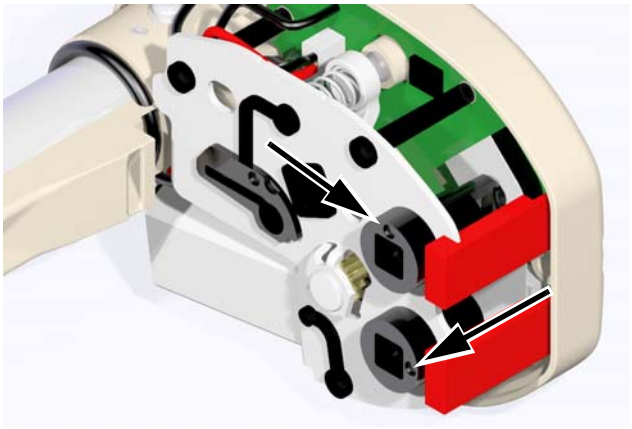

Fig.: 3 - 59

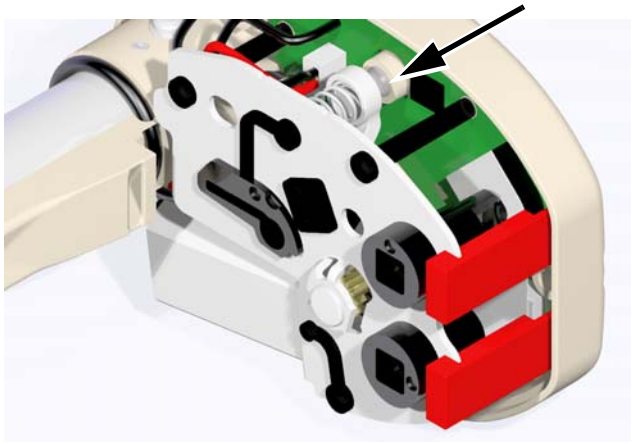

Fig.: 3 - 60

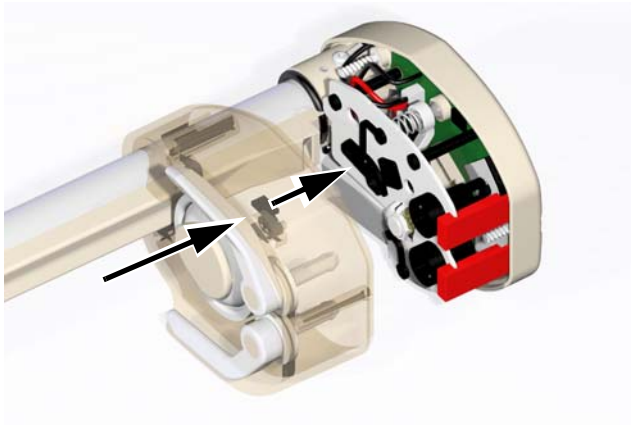

Fig.: 3 - 61

Note

Check the position of the emergency release tappet before mounting the drive head housing.

5. Push the drive head housing on to the driving tube until the switch flag of the membrane tappet is positioned just before the claw mechanism.
6. Turn the switch flag in such a way that it can be pushed in the switch flag guide.
7. Now mount the drive head housing. The membrane tappet must engage in the claw mechanism when the drive head housing is installed. For this purpose the membrane can be pressed during or after assembly.

Note

Pay attention that the membrane can be moved smoothly.

8. Install both claws and make sure that the sealing lips are not squeezed or damaged.

Drive / Side Part of Housing

Note

Take care not to damage the ribbon cable when inserting the driving tube into the drive assembly.

Note

Pay attention to the switch on the processor PCB when mounting the drive. The switch should be operated by the drive assembly slide.

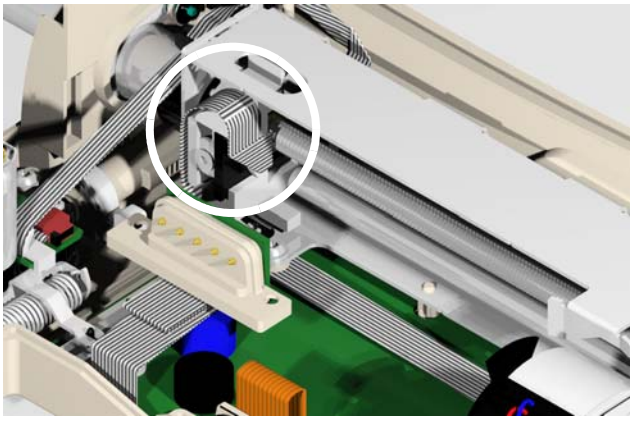

Fig.: 3 - 62

Note

Pay attention to the syringe wing sensor when inserting the side part of the housing and make sure that the sensor can be operated correctly.

1. Route the ribbon cable through the slide nut before pushing in the driving tube and then through the slide in front of the spindle nut when looking from the rear of the housing.
2. Fold the ribbon cable once through 90° upwards, see Fig.: 3 - 62, before mounting the fastening angle.
3. Run the drive motor connector over the loudspeaker connection cable. The loudspeaker connection cable must be positioned between the drive motor housing and the motor connection wires.

Note

Check that the two carriers in the drive slide are protected from falling out by the washer and screw.

Housing

Note

Take care that no cables are squeezed, and check that the connector seals at the back are correctly placed in the housing and that the loudspeaker is correctly located when the housing is fitted.

1. Before mounting check the silicone seals in the housing and grease with silicone high-vacuum grease (part No. 3450 7930).
2. Lower the upper part of the housing vertically and carefully on to the bottom part.
3. Press the upper and bottom parts of the housing carefully together so that the outer edges engage. The locking tabs must click together.

Operating Unit

Note

Before fitting the rear panel check the screw lengths. The screws may only be 4.5 mm long (without head). Longer screws must be exchanged.

Note

Before mounting the operating unit check the plastic foam gaskets in the housing opening for the connection cable to the operating unit.

1. Attach the left hinge plate to the operating unit, press it into the bottom part of the housing and install the hinge plate.
2. Push the operating unit connection cable into the processor PCB connector. Lock the connector.
3. Insert the PCA-slide and the PCA-eccentric in the bottom part of the housing.
4. Attach the right hinge plate to the operating unit and fit the hinge plate and the operating unit into the bottom part of the housing. Press the PCA-eccentric forward, as seen from the back wall, until it slides into the opening on the "right hinge plate".

3.12 Checks after Repair

Procedure

1. Carry out a calibration after having worked on the drive, the syringe holder with piston brake or the processor PCB while the device was opened (see "Calibration" pg. 2 - 14).
2. Check the device to ensure safe functionality of the unit (see "Device Check" pg. 2 - 9).
3. Depending on the work carried out the specific steps of the TSC must be performed (see "Technical Safety Check (TSC)" pg. 5 - 1).

Check List for Checks after Repair

Visual Inspection	Electrical Safety according to IEC/EN 60601-1 or VDE 0750 and VDE 0751	Functional Inspection
Cleanliness Completeness Damage and faults affecting safety Damage to and readability of the label Syringe Holder with Piston Brake Screw covers Connectors "P2" and "P3"	The patient and housing leakage current of the Perfusor® Space is caused exclusively by the operating voltage supply (Power Supply SP or SpaceStation). The Technical Safety Checks of the power supply SP (drawing No. M001 32 10 05 F04) or of the SpaceStation (drawing No. M690 00 00 46 F04) serve to check whether both limit values are met.	Locking with second unit Operating unit magnets Battery compartment cover Switch on unit with power supply Self-test Indicator lamps (LEDs) Audible alarm Status display Lighting of syringe compartment Operation Syringe fastening Syringe recognition Infusion Staff call Bolus PCA lock Switch on unit without power supply Self-test Magnetic function of the battery compartment cover Alarm function on removal of battery module (alarm for at least 3 min) Charge state of the battery module

(Part 1 of 2)

Visual Inspection	Electrical Safety according to IEC/EN 60601-1 or VDE 0750 and VDE 0751	Functional Inspection
		Pressure cut off according to TSC Syringe type: "#Lehre OPS50" Delivery rate: 200 ml/h **WARNING** REMOVE SYRINGE GAUGE ONLY WHEN RELEASED. DANGER OF INJURY! Strain gauge pressure measurement Pressure stage 1 _____ N Pressure stage 3 _____ N Pressure stage 8 _____ N Motor power limitation (convert syringe gauge) Pressure stage 1 _____ N Pressure stage 3 _____ N Pressure stage 6 _____ N

(Part 2 of 2)

For your notes:

Servicing the Unit 4

Cleaning

Clean and disinfect the Perfusor® Space with a humid cloth at regular intervals. To clean the system we recommend mild soap-suds.

WARNING

WHILE CLEANING AND DISINFECTING THE PERFUSOR® SPACE, DISCONNECT THE UNIT FROM THE MAINS SUPPLY.

CAUTION

Take care that no water or liquid enters the device along the syringe holder or the driving tube.

For disinfection by wiping, you should use for example Meliseptol® from B. Braun. Allow the unit to dry for at least one minute. When you disinfect the device by spraying, make sure not to spray in the system openings (such as interface sockets and connectors, loudspeaker opening).

Servicing the Battery

The instructions for use contain a detailed description on how to service the battery.

If a battery module is not discharged completely for more than 28 days, a servicing program for the battery module can be started on the unit.

4 Servicing the Unit

For your notes:

Technical Safety Check (TSC)

Index d
(Master - to be added to the documentation)

Checklist for Technical Safety Check – Every 24 Months

Unit: Perfusor® Space
Manufacturer: B. Braun Melsungen AG

Observe the Service Manual and the instructions for use. All measured values are to be documented. Accessories used should be included in testing. Make exclusive use of calibrated measuring equipment.

Article No.	Unit No.	Year of Procurement	User / Stock No.

Visual Inspection	Electrical Safety according to IEC/EN 60601-1 or VDE 0750 and VDE 0751	Functional Inspection
Perfusor® Space: Cleanliness, completeness, damage and faults affecting safety, damage and readability of the label. Particularly: Syringe holder with blade Syringe fastening Membrane in drive head Axial clearance of drive Screw covers Connectors "P2" and "P3" Accessories: Cleanliness, completeness, damage and faults affecting safety, damage and readability of the label Check the unit and the accessories for compatibility	The patient and housing leakage current of the Perfusor® Space is caused exclusively by the operating voltage supply (Power Supply SP or SpaceStation). The Technical Safety Checks of the power supply SP (drawing No. M001321005F04) or of the SpaceStation (drawing No. M690000046F04) serve to check whether both limit values are met.	Locking with second unit Operating unit magnets Battery compartment cover Switch on unit with power supply Self-test Indicator lamps (LEDs) Audible alarm Visual alarm Status display Lighting Operation Syringe fastening Syringe recognition Infusion Buttons on the operating unit Staff call Trigger bolus at the device Trigger bolus by pressing the PCA button PCA lock (bottom side of pump) with inserted 50/60-ml syringe PCA lock Syringe Anti Removal Cap PSP with the 50/60-ml syringe inserted Switch on unit without power supply Self-test Magnetic function of the battery compartment cover

(Part 1 of 2)

Technical Safety Check (TSC)

Index d
(Master - to be added to the documentation)

Visual Inspection	Electrical Safety according to IEC/EN 60601-1 or VDE 0750 and VDE 0751	Functional Inspection
		Pressure cut-off Syringe type: "#Lehre OPS50" Delivery rate: 200 ml/h - Strain gauge pressure measurement Pressure stage 1 (9 ... 15 N) _____ N Pressure stage 3 (25 ... 33 N) _____ N Pressure stage 8 (63 ... 76 N) _____ N Error message "Alarm / pressure too high" at every pressure stage - Motor power limitation Pressure stage 1 (11 ... 28 N) _____ N Pressure stage 3 (30 ... 49 N) _____ N Pressure stage 6 (58 ... 80 N) _____ N Error message "Alarm / drive blocked" at every pressure stage

(Part 2 of 2)

Mechanical Aids and Measuring Equipment Used	Accessories Used	
Syringe gauge, serial No. _____ Calibrated on_____ Service connector SP _____ _____	Power Supply SP _____ Battery module_____ Staff call lead _____ Space PCA kit (PCA button) Syringe Anti Removal Cap PSP _____	

Test result:

Defects found which could endanger patients, users or third parties: ☐ Yes ☐ No

Measures to be taken: ☐ Repair
☐ _____

Special features / documentation:

Inspection performed by:

Unit handed over on:

To:

Date / Signature:

Next deadline for TSC:

B BRAUN SHARING EXPERTISE

M688 70 01 05 F04 / 3891 7319 (GB)
Perfusor® Space, 1.3 gb

Technical Safety Check (TSC)

Index d
(Master - to be added to the documentation)

Checklist for Technical Safety Check – Every 24 Months

Unit: Power Supply SP
Manufacturer: B. Braun Melsungen AG

Observe the Service Manual and the instructions for use of the respective device. All measured values are to be documented. Make exclusive use of calibrated measuring equipment.

Article No.	Unit No.	Year of Procurement	User / Stock No.

Visual Inspection	Electrical Safety according to IEC/EN 60601-1 or VDE 0750 and VDE 0751	Functional Inspection
Power Supply SP: Cleanliness, completeness, damage and faults affecting safety, damage and readability of the label Connecting line Cleanliness, damage and faults affecting safety	Mains voltage _____ V~ (AC) Leakage current ≤ 7 µA _____ µA Measurement is to be carried out with service adapter SP between primary and secondary circuit. **Note** This measurement ensures that the admissible limit values regarding the patient and housing leakage current of the Perfusor® Space or the Infusomat® Space are met.	Connector locking After connecting the power supply the respective unit displays that it is operated in mains operation Check of power supply with ord. nos. 3310 2694 and 3310 2708: Check lock of primary adapter with power supply. The adapter must engage on both sides.

Mechanical Aids and Measuring Equipment Used		
Perfusor® Space, serial No.: _____ Infusomat® Space, serial No.: _____ _____		

Test result:

Defects found which could endanger patients, users or third parties: ☐ Yes ☐ No

Measures to be taken:
☐ none
☐ Dispose of power supply SP

Special features / documentation:

Inspection performed by:
Unit handed over on:
To:
Date / Signature:
Next deadline for TSC:

For your notes:

Procedural Instructions on the TSC 7

Visual Inspection

Perfusor® Space

1. Check the Perfusor® Space and accessories for cleanliness.
2. Check the Perfusor® Space and accessories for completeness and check configuration.
3. Check the Perfusor® Space and its accessories for damage and the labels for readability. Pay special attention to the following parts:
   a) Syringe holder with piston brake
   b) Piston brake blade in syringe holder
   c) Membrane in drive head (cracks, porous)
   d) Axial play of drive
   e) Screw covers
   f) Connectors “P2” and “P3”

Power Supply SP

1. Check the Power Supply SP and connecting line for cleanliness.
2. Check the Power Supply SP incl. connecting line for damage and the labels for readability.

Electrical Safety according to IEC/EN 60601-1 or VDE 0750 and VDE 0751

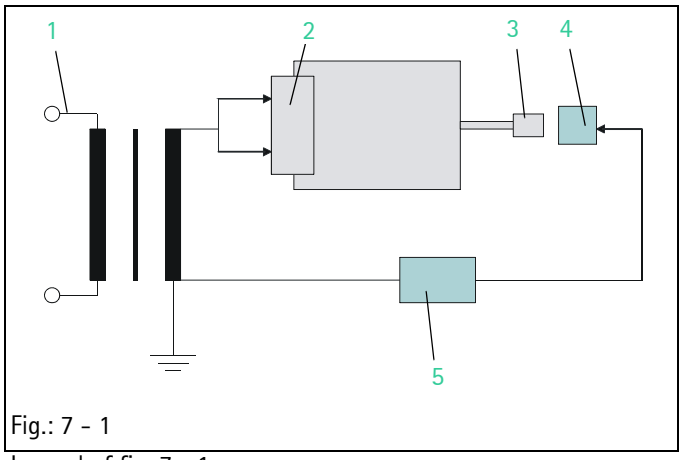

Fig.: 7 - 1

Legend of fig. 7 - 1:

ItemDesignation

1 Mains connection

2 Primary of the power supply

3 Secondary of the power supply

4 Service adapter SP with probe

5 Leakage current measuring device

Perfusor® Space

The patient and housing leakage current of the Perfusor® Space is caused exclusively by the operating voltage supply (Power Supply SP or SpaceStation).

The Technical Safety Checks of the power supply SP (drawing No. M001 32 10 05 F04) or of the SpaceStation (drawing No. M690 00 00 46 F04) serve to check whether both limit values are met.

Power Supply – Leakage Current

Note

The values to be measured are indicated in the TSC (see "Technical Safety Check (TSC)" pg. 5 - 1).

The leakage current is to be measured between primary and secondary circuit using the service adapter SP.

Designation	Ord. No.
Service adapter SP	0770 5174

Check

1. Select leakage current on the testing equipment.
2. Bridge pins 6, 7 12 and 13 with service adapter SP at the connector to the unit.
3. Measure value.
4. Measure value with reverse polarity of the mains connection.
5. Document the largest value.

Functional Inspection Perfusor® Space

Mechanical Inspection

1. Fit the unit to be tested on top of another Space device and check the proper functioning of the lock.
2. Fit the unit to be tested under another Space device and check the proper functioning of the lock.
3. Hold the device with the operating unit downwards. The operating unit must not open.
4. Check the battery compartment cover lock for proper operation.

Functional Check

Note

Carry out the check with power supply connected.

1. Switch on unit and check the following details:
   - Self-test
     Display on the LC display
   - Indicator lamps
     LEDs (yellow, green, blue) light up for a short moment
   - Visual alarm
     Red LED lights up for a short moment
   - Audible alarm
     A deep and a high sound
   - Status display
     Battery capacity, mains operation (service connector SP)
   - Lighting
     Illumination of syringe compartment, LC display and buttons
2. Syringe fastening
   a) Axial fastening holds syringe wing
   b) Syringe holder blade fixes syringe piston
   c) Both claws in drive head catch the syringe piston plate

3. Check syringe recognition.
   a) Insert approved 2 ml / 3 ml syringe.
      The syringe size is recognized.
   b) Insert approved 50 ml / 3 ml syringe.
      The syringe size is recognized.
4. Carry out infusion and bolus with any syringe and press all buttons at least once.
   Infusion and bolus are performed and all buttons trigger the function desired.
5. Staff call
   a) Plug service connector SP on connector "P2".
   b) Open syringe holder while the infusion is administered.
      The red LED on the service connector SP lights up.
6. PCA lock on the Perfusor® Space
   a) Check the PCA lock with an approved 50/60ml syringe.
7. PCA lock of the Syringe Anti Removal Kit PSP
   a) Place on the drive head and lock.
   b) Check the Syringe Anti Removal Kit PSP with an approved 50/60ml syringe.
   c) Unlock and remove from the drive head.

Battery Check

1. Switch device off.
2. Pull off the power supply.
3. Switch on unit.
   Self-test is carried out.
4. Open battery compartment cover during operation.
   An alarm is activated.
5. Remove battery.
   An alarm sounds with the piezo buzzer for at least 3 minutes.

Pressure Cut-Off (Strain Gauge Pressure Measurement)

WARNING

DURING THE STRAIN GAUGE MEASUREMENT WITH SYRINGE GAUGE THE SYRINGE HOLDER MUST NOT BE OPENED. THE SYRINGE GAUGE IS UNDER VERY HIGH PRESSURE AND MAY CAUSE INJURIES IF THE PRESSURE IS RELIEVED SUDDENLY.

1. Plug service connector SP on connector "P2".
2. Insert syringe gauge and select syringe type "#Lehre OPS 50".

Note

The syringe gauge must not be tipped. Therefore fix the syringe gauge so far into the syringe recess by hand that the piston brake moves back and the claws surrounds the pressure element.

3. Input a delivery rate of 200 ml/h.
4. Select pressure stage according to the TSC and start infusion. Read off value on the syringe gauge upon an alarm and compare with the specifications in the TSC.

Pressure Cut-Off (Motor Power Limitation)

WARNING

WHILE CHECKING THE MOTOR POWER LIMITATION WITH THE SYRINGE GAUGE THE SYRINGE HOLDER MUST NOT BE OPENED. THE SYRINGE GAUGE IS UNDER VERY HIGH PRESSURE AND MAY CAUSE INJURIES IF THE PRESSURE IS RELIEVED SUDDENLY.

1. Plug service connector SP on connector "P2".
2. Insert motor power test adapter at drive head.

3. Disassemble push-button plate for Perfusor® Space from syringe gauge, insert syringe gauge and select syringe type "#Lehre OPS50".

Note

The threaded end of the syringe gauge must be introduced in the opening of the motor power test adapter. Hold on to syringe gauge – if necessary by hand – in the syringe area, until the threaded end of the syringe gauge is inserted in the opening of the motor power test adapter.

4. Input a delivery rate of 200 ml/h.
5. Select pressure stage according to the TSC and start infusion. Read off value on the syringe gauge upon an alarm and compare with the specifications in the TSC.

Functional Inspection Power Supply SP

Mechanical Inspection

1. Connect power supply to a Space system device and check the lock for proper function.

Functional Check

1. The device connected operates correctly after being switched on.

Test Equipment and Special Tools 8

Test equipment

Designation	Ord. No.
For Device Check	
Syringe 2 ml / 3 ml	
Syringe 10 ml	
Syringe 30 ml	
Service connector SP	3452 1062
HiBaSeD Service-CD	0871 3301
Diameter gauge kit PSP	0770 5166
Diameter gauge 32.0 mm	
Diameter gauge 23.4 mm	
Diameter gauge 15.5 mm	
Diameter gauge 9.0 mm	

Fig.: 8 - 1 Diameter gauges

Length gauge PSP	0770 5190

Fig.: 8 - 2 Length gauge

Fig.: 8 - 3 Syringe gauge

Fig.: 8 - 4 Motor power test adapter

Syringe gauge PSP 0770 5204
"#Lehre OPS 50" with push-button plate and motor power test adapter for Perfusor® Space

For the TSC

Syringe 2 ml / 3 ml

Syringe 30 ml

Measuring instrument for electrical safety

Service adapter SP 0770 5174
for electrical safety

Service connector SP 3452 1062

Syringe gauge PSP 0770 5204
"#Lehre OPS 50" with push-button plate and motor power test adapter for Perfusor® Space

Special Tools

Designation	Ord. No.
For Repairs	
TORX screwdriver kit 5 - 10, 25	
TORX plus screwdriver kit 5 - 10, 25	
Screwdriver 6IPx60 TORX plus	4002 4806
Screwdriver 8IPx60 TORX plus	4002 4814
Screwdriver 10IPx60 TORX plus	4002 4822
Screwdriver T10x80 TORX	4002 4903
Screwdriver T25x80 TORX	4002 4903

For your notes:

Spare Parts List 9

Item Designation	Ord. No.
Perfusor® Space	
Service part kit Perfusor® Space	3477 4270
with:	
housing cover cap (40 pieces)	
cover caps for operating unit (10 pieces)	
cover cap for syringe holder (10 pieces)	
cover cap for drive head and claw (20 pieces)	
housing foot (20 pieces)	
sealing strip 40 x 4 x 2 (10 pieces)	
release button SP with leaf spring (2 pieces)	
wing sensor holder (1 pieces)	
locking clip for band PSP (10 pieces)	
Cover caps for housing SP (50 pieces)	3477 4386
Cover caps for operating unit PSP (10 pieces)	3477 3103
Integrated socket P2	3477 4355
Connector seal P2 (5 pieces)	3477 3102
Grease PSP	3452 1571
Set of adhesive labels Perfusor® Space	3477 0969
Claw set PSP (10 pieces), silver	3477 4378
Claw set PSP (10 pieces), green (from SW "F")	3477 4379
Screw kit Perfusor® Space	3477 4289
with:	
screw EJOT 22x8 WN 5451 TORX 6IP (5 pieces)	
screw EJOT 25x7 WN 5451 TORX 8IP (5 pieces)	
screw EJOT 30x6 WN 5451 TORX 10IP (5 pieces)	
screw EJOT 30x8 WN 5451 TORX 10IP (10 pieces)	
screw EJOT 20x12 WN 5452 TORX 6IP (5 pieces)	
screw EJOT 20x14 WN 5452 TORX 6IP (5 pieces)	
screw EJOT 22x4.5 WN 5452 TORX 6IP (10 pieces)	
screw EJOT 25x10 WN 5452 TORX 8IP (5 pieces)	
screw EJOT 30x8 WN 5452 TORX 10IP (10 pieces)	
screw EJOT 30x12 WN 5452 TORX 10IP (10 pieces)	
screw EJOT 30x35 WN 5452 TORX 10IP (5 pieces)	
screw EJOT 22x8 WN 5454 TORX 6IP (5 pieces)	
locking ring (5 pieces)	

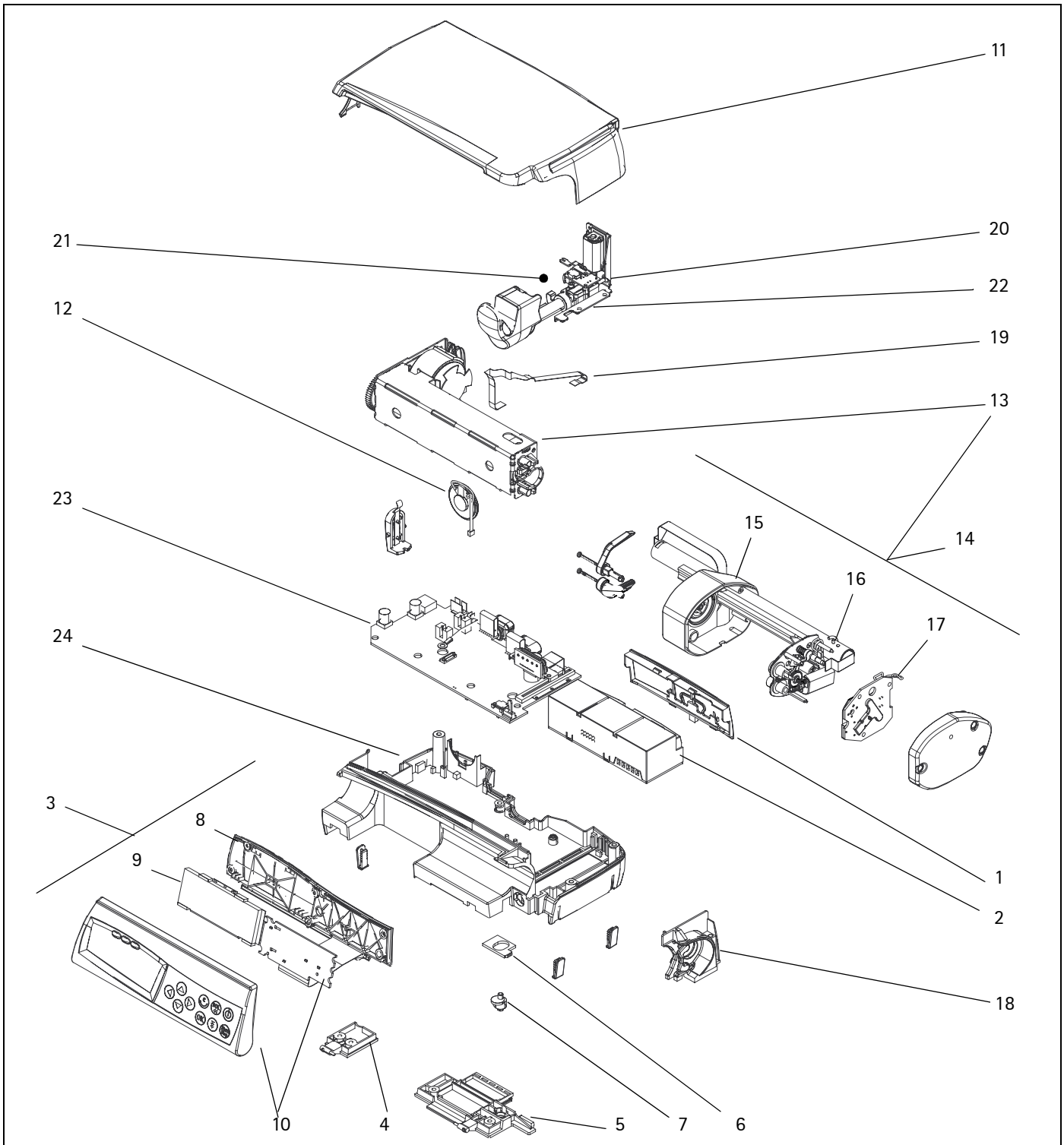

Fig.: 9 - 1 Exploded drawing Perfusor® Space

1	Battery compartment cover PSP , cpl.	3452 0872
2	Battery pack SP (NIMH)	0871 3180
3	Operating unit PSP, cpl.	3452 0970
4	Hinge plate PSP, left	3452 1011
5	Hinge plate PSP, right	3452 1020
6	PCA-slide PSP	3452 0899
7	PCA-eccentric PSP	3452 0902
8	Rear panel, operating unit PSP	3452 1003
9	LC display SP	3452 0988
10	Front flap with keyboard PSP.	3452 0996
11	Upper part of housing PSP	3452 0910
12	Loudspeaker SP	3452 0937
13	Drive PSP, cpl.	
	Silver claws	3452 1046
	Green claws (as from unit software "F")	3452 1041
14	Drive head PSP (incl. driving tube)	
	Silver claws	3452 1038
	Green claws (as from unit software "F")	3452 1039
15	Drive head housing PSP	3452 1055
16	Claw mechanism PSP	3452 1550
17	Drive PCB, PSP.	3452 1569
18	Side part of housing PSP, cpl.	3452 1054
19	Piston brake PSP ribbon cable	3452 0864
20	Syringe holder with piston brake PSP, cpl.	3452 0945
21	Syringe holder PSP spring	3452 0953
22	Piston brake PSP guide rail	3452 0961
23	Processor PCB PSP (incl. connectors and syringe wing sensor)	3452 0880
24	Housing bottom part PSP	3452 0929
	Type plate PSP	Upon request

9 Spare Parts List

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Description of Version

Version 1.0 (Base Version)

- First edition of this Service Manual
- Release date: 07.01.05.

Version 1.1

- Description for disassembly of the drive head added.
- Claw mechanism and drive head PCB added as new spare parts.
- Description of the Service Program HiBaSeD changed to new version 1.5.0.
- Release date: 20.03.06

Version 1.2

- New kinds of power supplies.
- Changed TSC of the power supply.
- Changed service part kit and screw kit.
- Release date: 02.04.07

Version 1.3

- Addition of PCA
- Changed TSC of the unit
- Changed checklist after repair
- Changed claw geometry
- Changed service part kit and screw kit.
- Release date: 25.03.2009

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