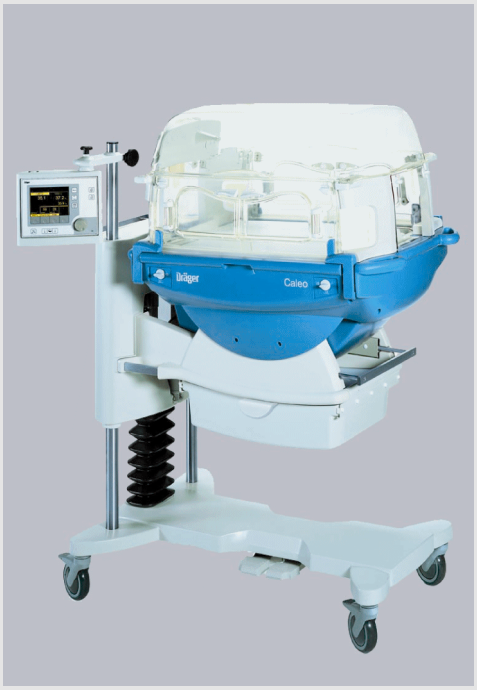
Dräger medical
A Dräger and Siemens Company

Technical Documentation

Caleo®
Neonatal incubator



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General

1 Symbols and Definitions

WARNING

A WARNING statement provides important information about a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

A CAUTION statement provides important information about a potentially hazardous situation which, if not avoided, may result in minor or moderate injury to the user or patient or in damage to the equipment or other property.

NOTE

A NOTE provides additional information intended to avoid inconvenience during operation.

Definitions according to German standard DIN 31051:

Inspection	=	examination of actual condition
Maintenance	=	measures to maintain specified condition
Repair	=	measures to restore specified condition
Servicing	=	inspection, maintenance, and repair

2 Notes

This Technical Documentation conforms to the IEC 60601-1 standard.

Read each step in every procedure thoroughly before beginning any test. Always use the proper tools and specified test equipment. If you deviate from the instructions and/or recommendations in this Technical Documentation, the equipment may operate improperly or unsafely, or the equipment could be damaged.

It is our recommendation to use only Dräger parts and supplies.

The maintenance procedures described in this Technical Documentation may be performed by qualified service personnel only. These maintenance procedures do not replace inspections and servicing by the manufacturer.

The information in this Technical Documentation is confidential and may not be disclosed to third parties without the prior written consent of the manufacturer.

This Technical Documentation is for the purpose of information only. Product descriptions found in this Technical Documentation are in no way a substitute for reading and studying the Instructions for Use/Operating Manual enclosed with the product at the time of delivery.

Know-how contained in this Technical Documentation is subject to ongoing change through research and development and Dräger Medical reserves the right to make changes to this Technical Documentation without notice.

NOTE
Unless otherwise stated, reference is made to laws, regulations or standards (as amended) applicable in the Federal Republic of Germany for equipment used or serviced in Germany. Users or technicians in all other countries must verify compliance with local laws or applicable international standards.

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Function Description

1 Function Description

Caleo consists of a canopy, a display housing, a basic housing, an aggregate housing, and a trolley.

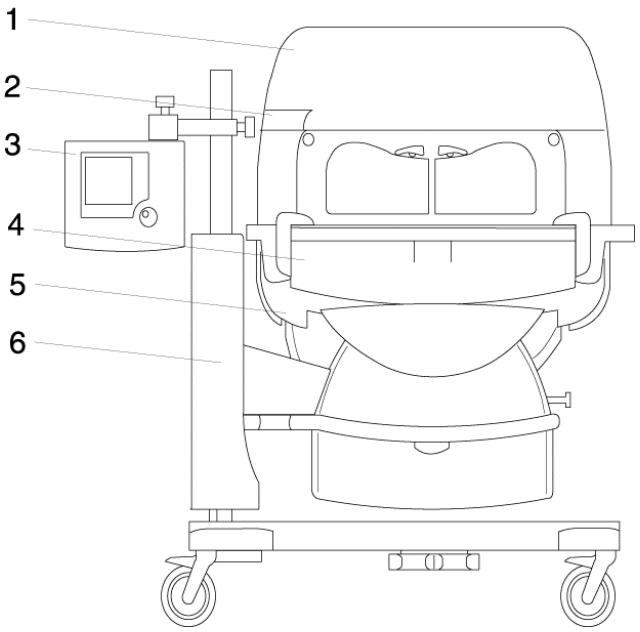

Figure 1 Front view of the Caleo

Legend

1	Canopy
2	Display housing
3	Basic housing
4	Aggregate housing
5	Drawer (option)
6	Trolley - non-adjustable trolley - electrically adjustable trolley (optional)

1.1 Canopy

The canopy is a transparent acrylic cover. It is designed to sustain the set patient's environment. The canopy is mounted on column elements.

When the front door or the hand ports are open, a warm air "curtain" ensures that the air temperature in the patient compartment does not decrease.

The canopy comprises the canopy cover, a catch borehole, a double-wall (option) and holders.

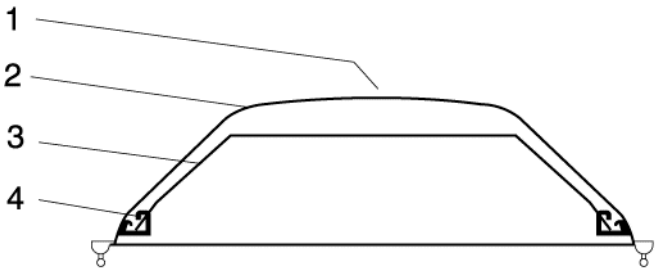

Figure 2 Front view of the Caleo canopy

Legend

1	Catch borehole
2	Canopy cover
3	Double wall (optional)
4	Holders

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1.2 Sensor unit

The sensor unit is mounted on two column elements. The sensor unit measures the environment inside the patient compartment.

The sensor unit (Figure 3/1) contains the following subassemblies:

– Housing
– WT2 Sensor PCB
– Integrated O2 Monitor PCB
– Alarm PCB with alarm light

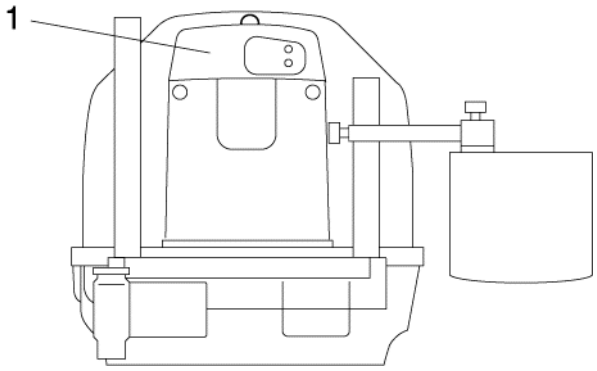

Figure 3 Left view of the Caleo

The sensor unit contains the following sensors:

– Air-temperature sensors
– Oxygen sensor(s) (optional)
– Second oxygen sensor for oxygen regulation (optional)
– Humidity sensor (optional)

1.2.1 WT2 Sensor PCB

The WT2 Sensor PCB measures the air temperature, skin temperature, humidity, and oxygen. These values are transmitted to the microcontroller of the WT2 Actuator PCB.

The WT2 Sensor PCB has the following subassemblies:

– Measurement of the patient's skin temperature
– Measurement of the air temperature and independent excess temperature monitoring
– Communication, A/D conversion, and electrical isolation

Measurement of the skin temperature

The control signals from the shift registers switch the individual skin-temperature measuring channels to the temperature hybrids. For the multiplexer to be able to test the skin-temperature measuring channels, it switches a parallel resistor to the respective skin-temperature measuring channel during operation.

The microcontroller of the WT2 Sensor PCB tests the accuracy of the temperature hybrids during the 10-minute test. To do so, a control signal is transmitted to a FET. Thus, the 36 °C resistor is switched to the input of the temperature hybrids.

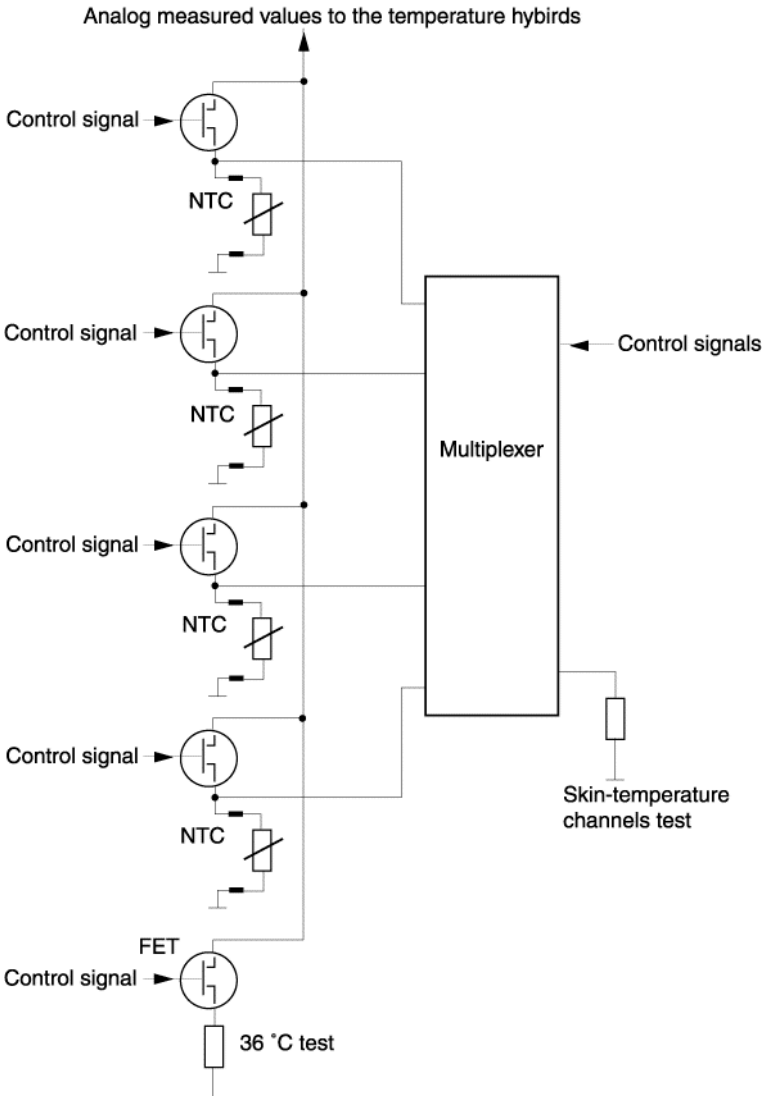

Figure 4 Block diagram of the WT2 Sensor PCB, skin-temperature measurement

Measurement of the air temperature and independent excess temperature monitoring

The analog measured values of the air temperature reach temperature hybrid 1. The downstream excess-temperature comparator makes sure the air temperature in the patient compartment does not exceed 40.2 °C. If the air temperature is higher, a logic circuit on the WT2 Actuator PCB switches off the air heater.

During the 10-minute test, the excess-temperature test circuit simulates a temperature of 40.2 °C. During this period, the microcontroller monitors the function of the excess-temperature monitoring. An additional test circuit monitors also the air-temperature sensor 1.

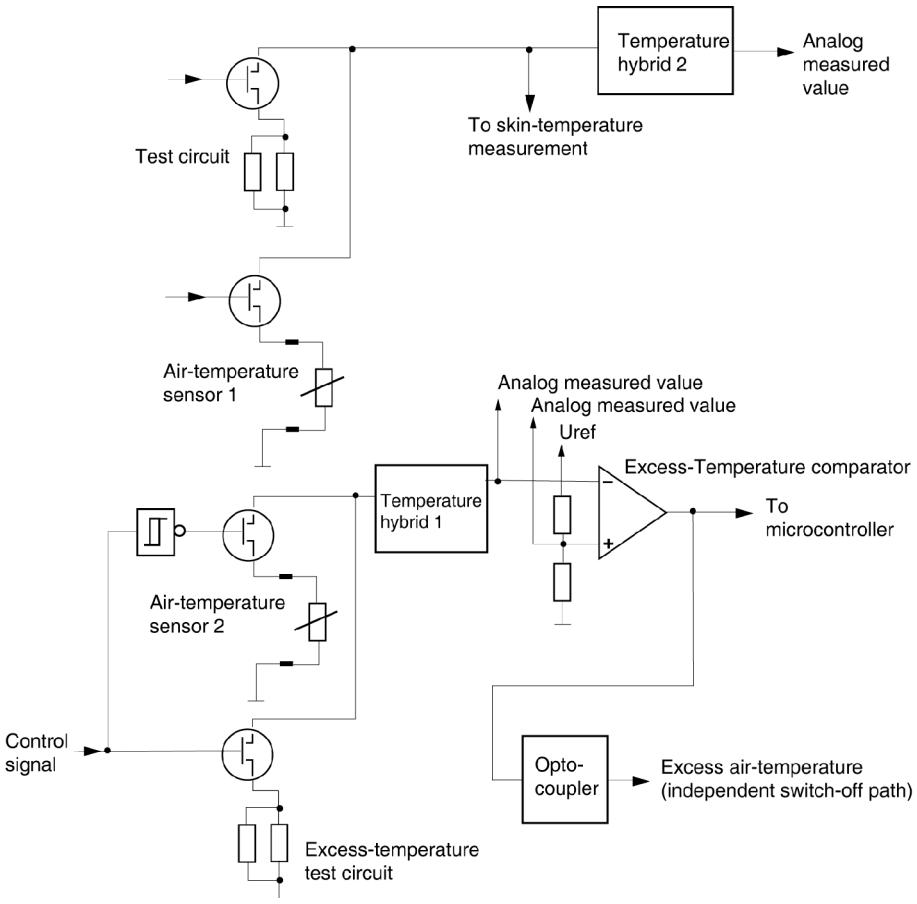

Figure 5 Block diagram of the WT2 Sensor PCB, air-temperature measurement and independent excess-temperature monitoring

Communication, A/D conversion, and electrical isolation

The microcontroller controls and monitors the WT2 Sensor PCB functions.

A quartz clocks the microcontroller (with integrated CAN/RS232 interface) with a frequency of 8 MHz.

Shift registers use the SPI bus to control non-time-critical input and output connections.

The microcontroller has serial connections, input/output connections, interruptible connections, and analog input connections for measurement. Optocouplers electrically isolate the input and output signals. The integrated RS232 interface of the microcontroller connects the WT2 Sensor PCB with the O2 Sensor PCB. The microcontroller can switch on/off the O2 Sensor PCB.

The CAN bus driver connects the microcontroller with the WT2 Actuator PCB.

The DC/DC converter generates the 5 VISO voltage from the 5V operating voltage.

An EEPROM stores board-specific data. A/D converter and EEPROM are controlled with the SPI bus. The A/D converter integrated in the microcontroller receives the signal from the independent excess-temperature monitoring.

The A/D converter measures the analog measuring signals (humidity (optional feature), air temperature, skin temperature, and 5 VISO voltage).

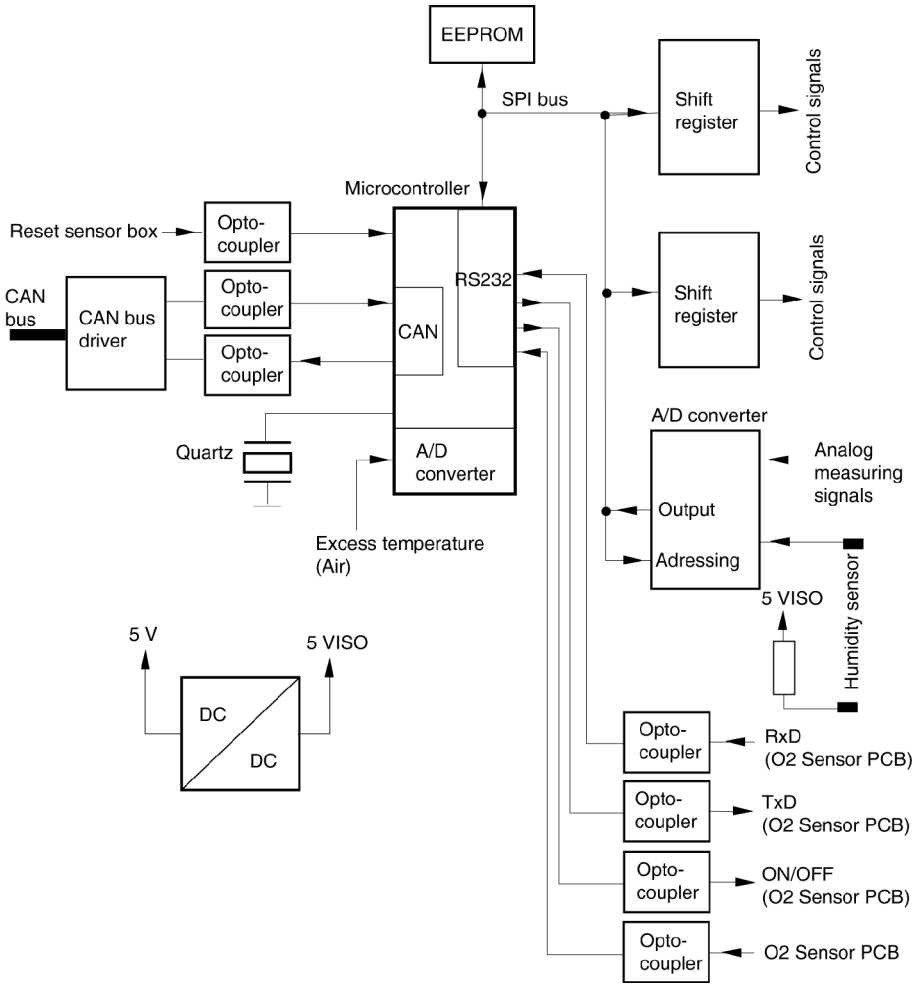

Figure 6 Block diagram of the WT2 Sensor PCB (communication, A/D conversion, and electrical isolation)

1.2.2 Integrated O2 Monitor PCB

The Integrated O2 Monitor PCB receives the converted voltage from the oxygen sensor.

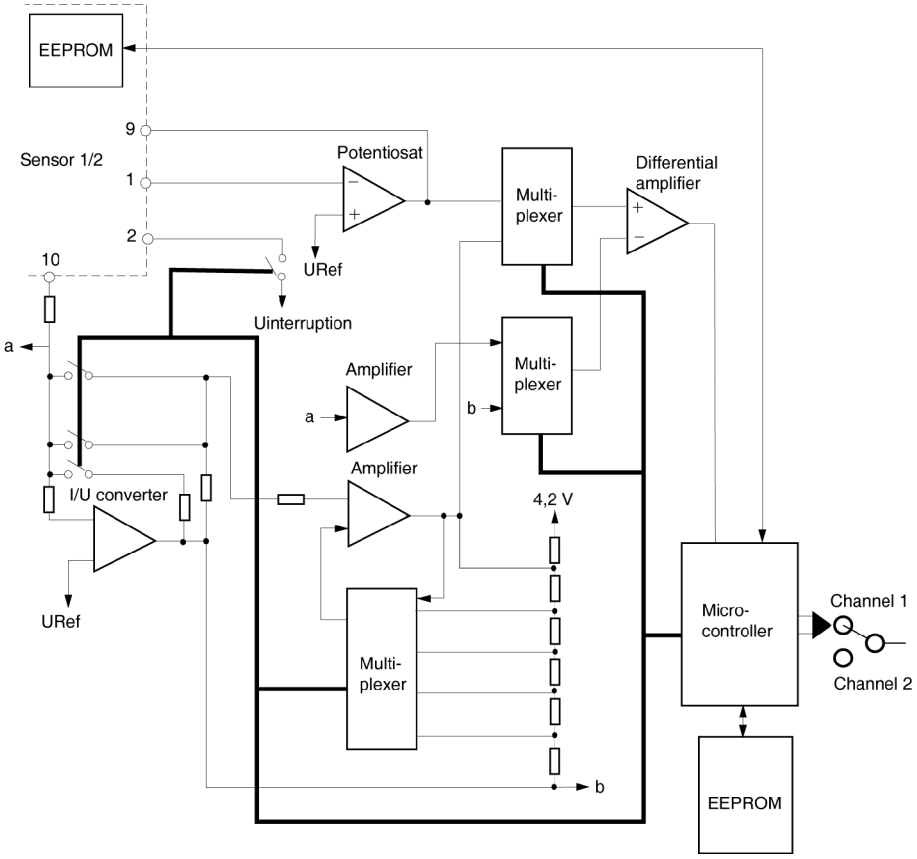

Figure 7 Block diagram of the Integrated O2 Monitor PCB

Skin-temperature sensor socket

The skin-temperature sensor connectors are connected to the skin-temperature sensor sockets.

Skin-temperature sensors

Disposable skin-temperature sensors measure the patient's skin temperature.

Oxygen Measurement (optional)

Caleo is provided with an oxygen sensor for measurement of the oxygen content. The oxygen measurement range is 19 vol.% O2 to 99 vol.% O2. The microcontroller does not regulate the set oxygen value. Alarm limits can be adjusted or disabled completely.

Oxygen Regulation (optional)

The microcontroller compares the set oxygen value with the actual oxygen value. The microcontroller automatically adapts the actual oxygen value to the set oxygen value.

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Humidity sensor (optional)

The humidity sensor is mounted on the sensor unit. The humidity sensor measure the air humidity in the patient compartment.

Humidity Control (optional)

The performance value of the water boiler can be adjusted. However, the microcontroller does not readjust these performance values.

Humidity Regulation (optional)

The microcontroller compares the set performance values with the actual performance values of the water boiler. The microcontroller automatically adapts the actual performance values of the water boiler to the set performance values.

1.2.3 Alarm PCB with alarm light

The alarm light is mounted on the sensor unit. If an alarm occurs, the microcontroller on the WT2 Controller PCB triggers the alarm light.

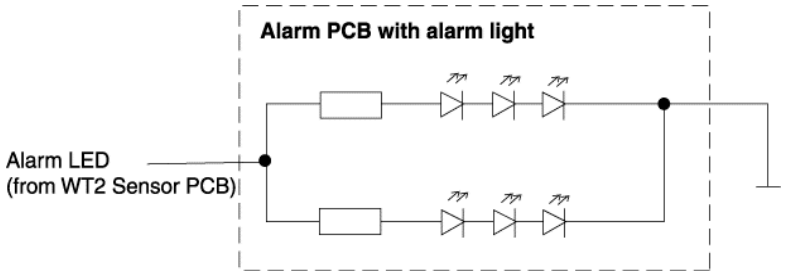

Figure 8 Block diagram of Alarm PCB with alarm light

1.3 Display housing

The display housing (Figure 9/1) is Caleo's display and control unit.

Figure 9 Front view of the display housing

The display housing contains the following subassemblies:

- Housing
- Membrane keypad
- EL display (electroluminescent display)
- WT2 Controller PCB
- Lithium battery
- Shaft encoder with control knob
- Loudspeaker
- WT Interface PCB (optional)

1.3.1 Housing

The housing contains the membrane keypad, the EL display, the WT2 Controller PCB, the lithium battery, the shaft encoder with control knob, the loudspeaker, and the WT2 Interface PCB (optional).

1.3.2 Membrane keypad

The membrane keypad has 12 keys and 7 LEDs. The membrane keypad is used to enter patient parameters. The LEDs on the keys indicate which function is currently selected.

Figure 10 Membrane keypad

1.3.3 EL display (electroluminescent display)

The EL display shows plain text messages. The EL display has a resolution of 320 x 240 pixels and adapts automatically to lighting conditions (brightness and contrast).

The EL display consists of an electroluminescent glass plate and the control electronics. An integrated DC/DC converter generates the operating voltages 5 VDC and 12 VDC.

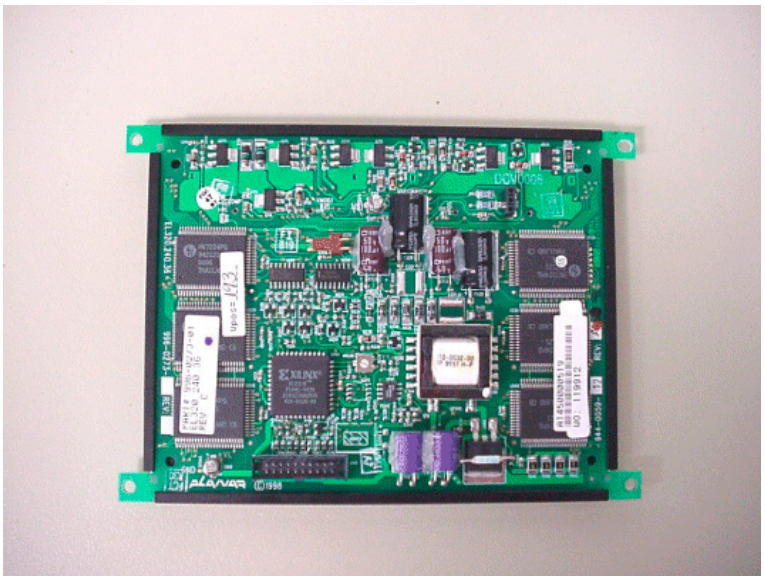

Figure 11 EL display

1.3.4 WT2 Controller PCB

The WT2 Controller board, hereinafter called WT2 Controller PCB, controls and monitors Caleo's functions. The CAN interface connects the microcontroller with the WT2 Actuator PCB.

In the event of a fault, the WT2 Controller PCB switches off consumers and an audible alarm sounds.

The WT2 Controller PCB comprises the following sub-assemblies/components:

- Microcontroller
- Quartz
- Read-only memory (ROM)
- EEPROM
- Flash PROM
- Random access memory (RAM)
- GoldCap evaluation
- Real-time clock (RTC)
- Lithium battery
- Powerfail Oscillator
- Display Controller
- LED Control
- Keypad Driver
- CAN Controller and CAN Driver
- Loudspeaker Control
- Piezo Alarm Generator
- Counter (Watchdog)
- Service interface
- Service LEDs

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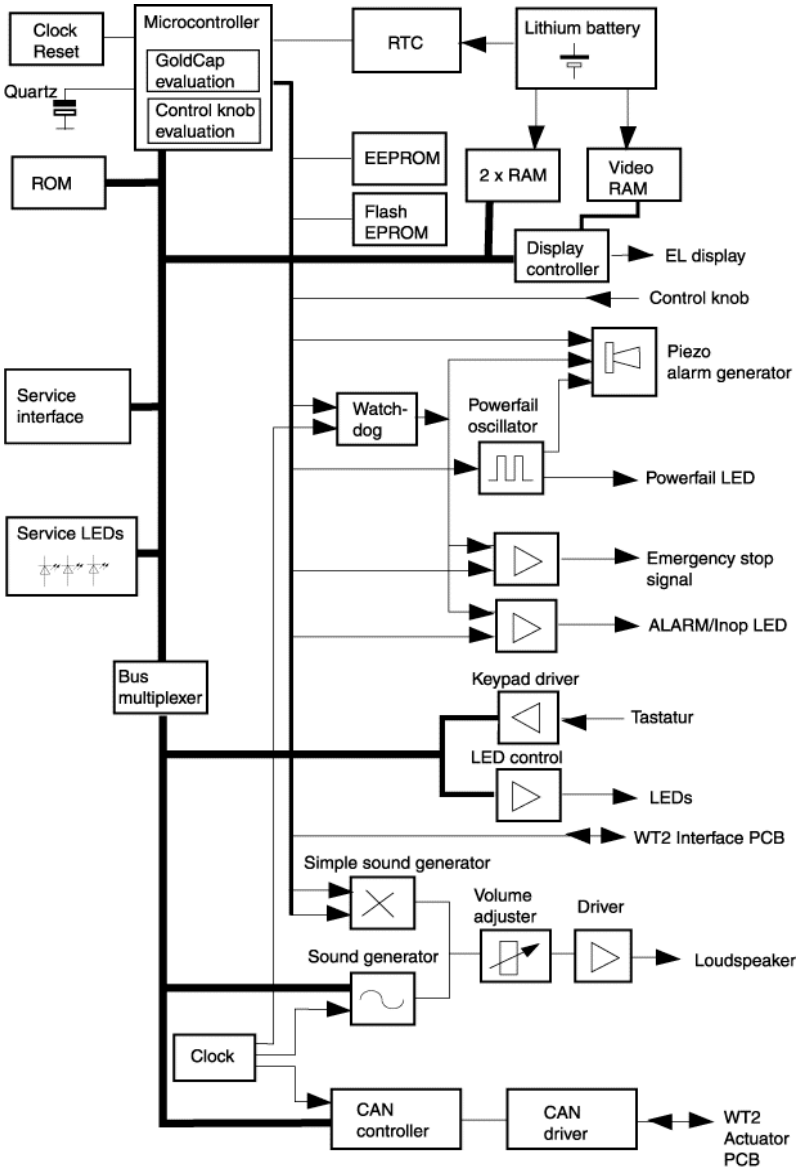

Figure 12 Block diagram of the WT2 Controller PCB

Microcontroller

The microcontroller controls Caleo's functions. A quartz clocks the microcontroller with 32.768 kHz. The random-access memory (RAM) temporarily stores parameters for the microcontroller. The flash PROM contains the software program. The EEPROM contains the configuration data of the device. The microcontroller uses the control knob evaluation to read in the settings selected with the control knob. The microcontroller monitors that no voltage drop of the GoldCap capacitor occurs due to contact resistances in the wiring.

Real-Time Clock (RTC)

The RTC displays the correct time and date on the EL display.

Lithium battery

When the device is switched off, the lithium battery powers the random-access memories (2x RAM and video RAM) and the RTC.

Powerfail Oscillator

The GoldCap capacitor powers the powerfail oscillator. If the mains voltage fails during operation, the powerfail oscillator generates an alarm and triggers the piezo alarm generator.

Display Controller

The display controller controls the EL display. The display controller consists of a programmable module, a display control module, and a data bus driver. The microcontroller provides the display controller with current data. In addition, trend data can be read out of the video RAM.

LED Control

The microcontroller controls the LEDs using transistors.

Keypad Driver

The microcontroller uses a driver module to read in keypad entries.

CAN Controller and CAN Driver

The CAN controller and the CAN bus driver connect the microcontroller with the WT2 Actuator PCB.

Loudspeaker control

The microcontroller uses the sound generator to generate control signals. A series-connected driver preprocesses the signals for the loudspeaker. The software makes it possible to adjust the sound volume.

Piezo Alarm Generator

The operating voltage of the piezo alarm generator is +5 V. If the mains voltage fails, the GoldCap capacitor powers the piezo alarm generator. The piezo alarm generator makes it possible to generate audible alarms should the mains power or the device fail.

Counter (Watchdog)

The counter (watchdog) monitors the software program sequence of the microcontroller. The microcontroller resets the counter module at regular intervals (250 ms).

Service interface socket

A laptop computer can be connected to the service interface socket for servicing purposes.

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Service LEDs

The service LEDs indicate the function of the microcontroller and of the keypad.

1.3.5 Loudspeaker

In the event of a failure, the loudspeaker emits an audible signal.

1.3.6 Shaft encoder with control knob

Turning the control knob will change the set patient parameters. Pressing the control knob will store the selected values or the device configurations.

1.3.7 WT2 Interface PCB (option)

The WT2 Interface PCB makes it possible to create a connection between Caleo and a laptop computer. Integrated modules adjust the levels and isolate the connection.

1.4 Basic housing

The basic housing is mounted on the wheeled frame. The mattress tray and the mattress are placed inside the basic housing.

The basic housing consists of the following parts: top side, base, drawer, intermediate element, air duct with sealing, and scales (optional).

1.4.1 Scale (option)

Scales are used for weighing premature infants. The scales are operated from the display housing.

The scales comprise four weighing elements (1), which are located underneath the mattress tray, and the measuring and evaluation electronics.

The microcontroller stores the measured weight and displays it on the EL display. The trend display shows the measured weight of at least the last 5 days. The most recent weight is displayed in numerical format including the date of measurement. The weighing range is 0 to 10 kg.

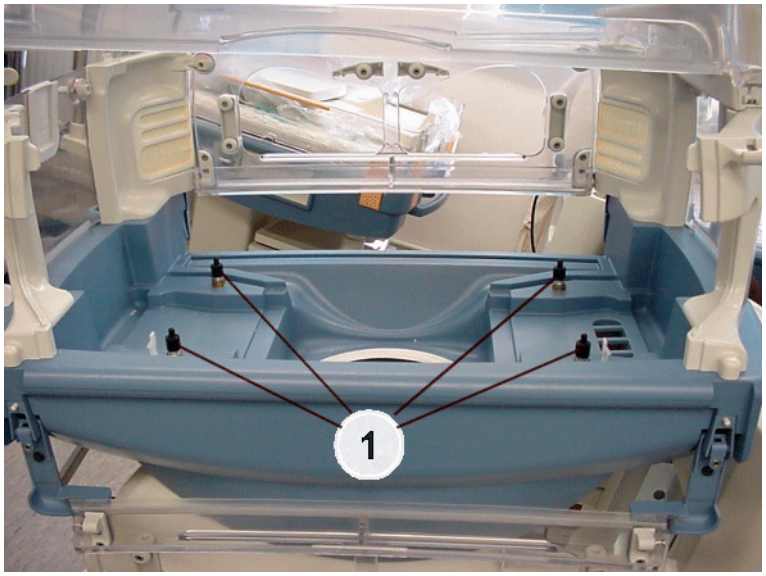

Figure 13 Front view of Caleo, weighing elements

1.4.2 Mattress tray

The mattress tray is made of plastic. The mattress tray is placed inside the basic housing.

Mattress

Caleo without mattress heater is equipped with a standard mattress.

1.4.3 Mattress tray with heating foil

The mattress tray is provided with a heating foil. When the mattress tray heater is on, the heating foil is supplied with 24 V operating voltage. The heating foil heats up.

WARNING

Always use a gel mattress when operating the unit with a mattress heater.

Mattress

Caleo with mattress heater is equipped with a gel mattress.

1.5 Water container

The water container is mounted on the basic housing and has a filling volume of 2.3 L. The water container has specific colors which allow to see the current water level from the outside.

1.6 Aggregate housing

The aggregate housing is located underneath the basic housing; it contains actuators and internal control elements.

The aggregate housing contains the following subassemblies:

– Toroidal transformer
– E-box
– Water boiler with float and thermo switches (option)
– Air heater with heating element and thermo switches
– Air-temperature sensor
– Hall sensor
– Fan
– Filter box
– Pneumatics for O2 control (optional)

1.6.1 Toroidal transformer

The toroidal-core transformer transforms the mains input voltage into the following mains output voltages:

– 24 VAC
– 12 VAC

1.6.2 E-box

The E-box comprises the E-box housing, the WT2 Actuator PCB and the WT2 Mattress PCB (optional feature).

E-Box Housing

The E-box housing protects the printed circuit board from external damage. The E-box housing contains the WT2 Actuator PCB and the WT2 Mattress PCB (optional feature).

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WT2 Actuator PCB

The WT2 Actuator PCB controls and monitors functions.

The WT2 Actuator PCB comprises the following subassemblies:

– Communication
– Power Pack for Low Voltages
– Control and switch-off of air heater and water boiler
– Feedback signals from air heater and water boiler
– Monitoring and testing of air heater and water boiler
– Control and monitoring of adjustable column height and bed inclination
– Fan
– O2 pneumatics
– Temperature measuring circuit

Communication

The microcontroller controls and monitors the WT2 Sensor PCB functions. A quartz clocks the microcontroller with 8 MHz. Shift registers use the SPI bus to control non-time-critical input and output connections. The EEPROM stores board-specific data. The memory area of the EEPROM is 1 kB.

The input and output connections (ports) of the microcontroller are assigned as follows:

– Serial input and output connections to the shift registers
– Input/output connections (Tx, Rx, CAN)
– Interruptible input connections (feedback signals)
– Analog measuring inputs

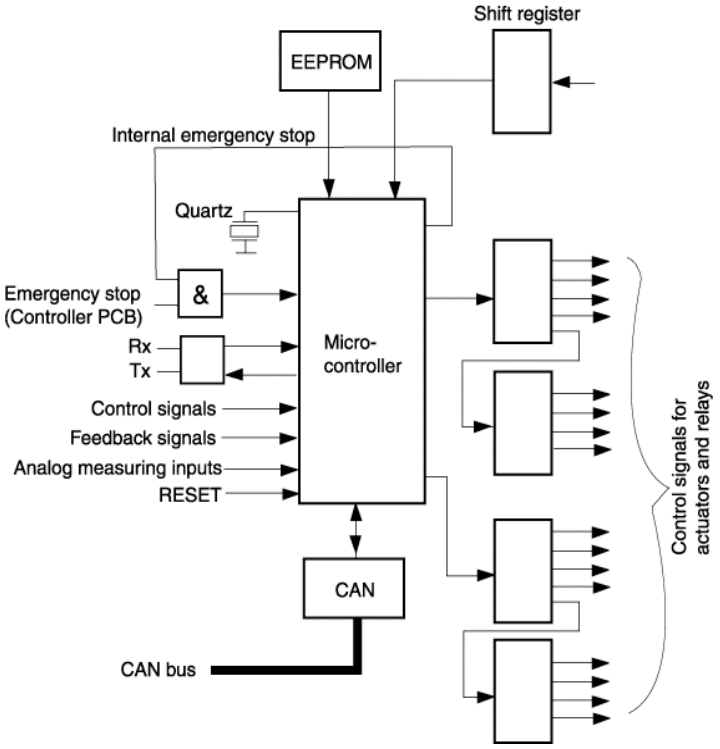

Figure 14 Block diagram 2 of the WT2 Actuator PCB (communication)

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Power Pack for Low Voltages

The secondary voltages of the toroidal-core transformer are present at the input of the WT2 Actuator PCB. Bridge-connected rectifiers rectify the secondary voltages. Capacitors filter and smooth the voltages. Voltage regulators stabilize the operating voltages.

The power pack generates the following operating voltages:

– 24 VACa and 24 VACb (external monitors)
– +24 VMOT (pulsating direct voltage for the height-adjustable column)
– +24 Vbr (unregulated direct voltage)
– +24 V (regulated direct voltage for O2 valve and fan)
– +12 VMOT (unregulated direct voltage for the bed inclination drive)
– +12 Vel (15 V limited direct voltage for EL display; closing delay)
– +12 Vbr (unregulated direct voltage for relays)
– +5 V (regulated direct voltage for logic circuits)
– + 5 V sensor (regulated direct voltage for sensors, power-limited: maximum current 0.35 A)
– GoldCapVCC (voltage for mains voltage failure alarm with GoldCap capacitor)

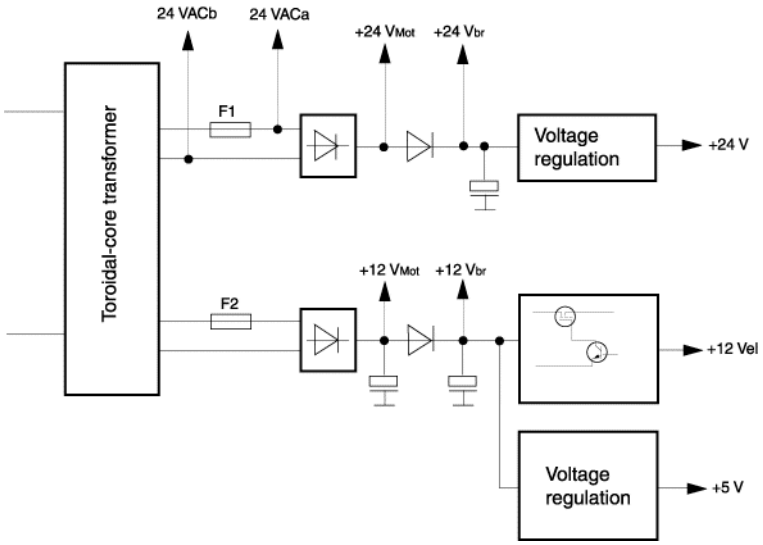

Figure 15 Block diagram of the WT2 Actuator PCB (power pack for low voltages)

Air Heater Control, Switch-Off, and Feedback

The air heater is a mains-voltage-operated consumer (actuator).

A mains voltage relay switches one terminal of the mains voltage to the air heater. A triac at zero passage switches the other terminal of the mains voltage to the air heater. In the event of a fault, the mains voltage relay switches the mains voltage to the air heater off.

The control signal "Safety Relay (air heater)" and the signal "Excess Temperature (Air)" from the sensor box are logically connected by an AND gate. In the event of excess temperature in the patient's compartment of Caleo, the signal blocks the AND gate. The mains voltage relay is de-energized. No mains voltage is present at the air heater.

The mains voltage half waves present at the air heater generate pulses. The pulses reach an optocoupler. The optocoupler uses the pulses to generate a "Feedback Signal (air heater)" for the microcontroller.

A resistor-capacitor circuit is connected in parallel to the triac. When the safety relay is switched on and the air heater is no longer supplied with mains voltage, the resistor-capacitor circuit generates the signal "Feedback Signal (air heater)" in a test case.

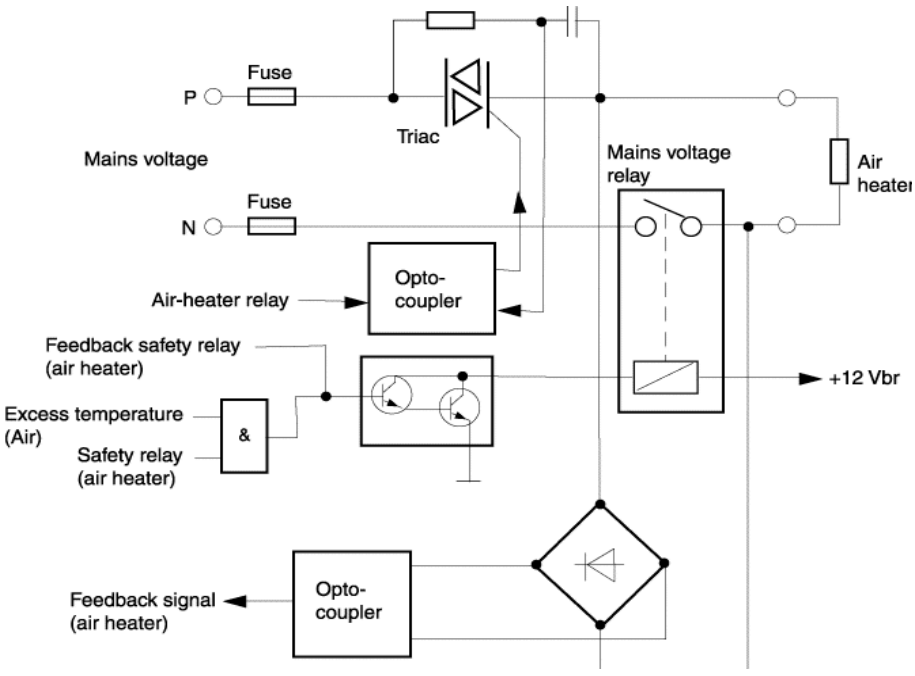

Figure 16 Block diagram of the WT2 Actuator PCB (air heater control, switch-off, and feedback)

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Water boiler control, switch-off, and feedback

The water boiler is a mains-voltage-operated consumer (actuator).

A mains voltage relay switches one terminal of the mains voltage to the water boiler; a triac at zero passage switches the other terminal of the mains voltage to the water boiler. In the event of a fault, the mains voltage relay switches the mains voltage to the water boiler off.

The control signal "Safety Relay (water boiler)" and the signal "Excess Temperature (Air)" from the sensor box are logically connected by an AND gate. In the event of excess temperature in the patient's compartment of Caleo, the signal blocks the AND gate. The mains voltage relay is de-energized. No mains voltage is present at the water boiler.

The mains voltage half waves present at the water boiler generate pulses. The pulses reach an optocoupler. The optocoupler uses the pulses to generate a "Feedback Signal (water boiler)" for the microcontroller.

A resistor-capacitor circuit is connected in parallel to the triac. When the safety relay is switched on and the water boiler is no longer supplied with mains voltage, the resistor-capacitor circuit generates the signal "Feedback Signal (water boiler)" in a test case.

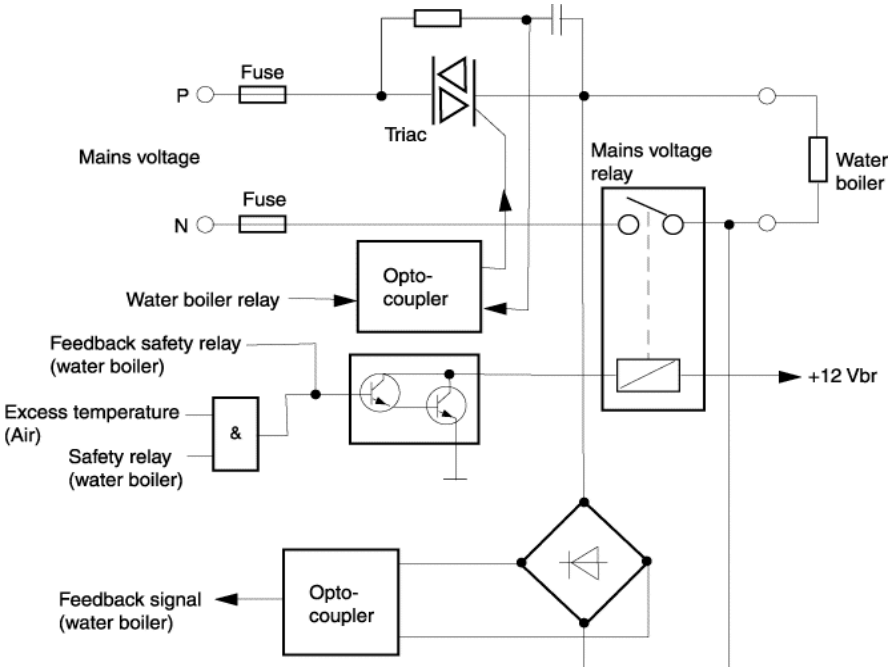

Figure 17 Block diagram of the WT2 Actuator PCB (water boiler control, switch-off, and feedback)

Monitoring of the air temperature and testing of the air-temperature measuring circuit

The microcontroller uses a temperature measuring circuit to monitor the maximum air temperature of the air heater. The temperature measuring circuit consists of two thermistors (NTC 1 + NTC 2; NTC = negative temperature coefficient). Series-connected field-effect transistors (FET NTC1 + FET NTC2) and operational amplifiers transmit the measured resistance changes to the microcontroller. The temperature range of the thermistors is 0 to 100 °C.

The microcontroller uses the transistor V1 to test the temperature measuring circuit. To do so, the microcontroller transmits the Signal "Test NTC1" to the transistor V1. The transistor V1 switches to passage and connects the test resistors to ground. The voltage drop is present at the microcontroller as analog value. This measurement allows the microcontroller to detect which channel is currently measuring. The reference resistors 1 to 3 make it possible to balance the circuit.

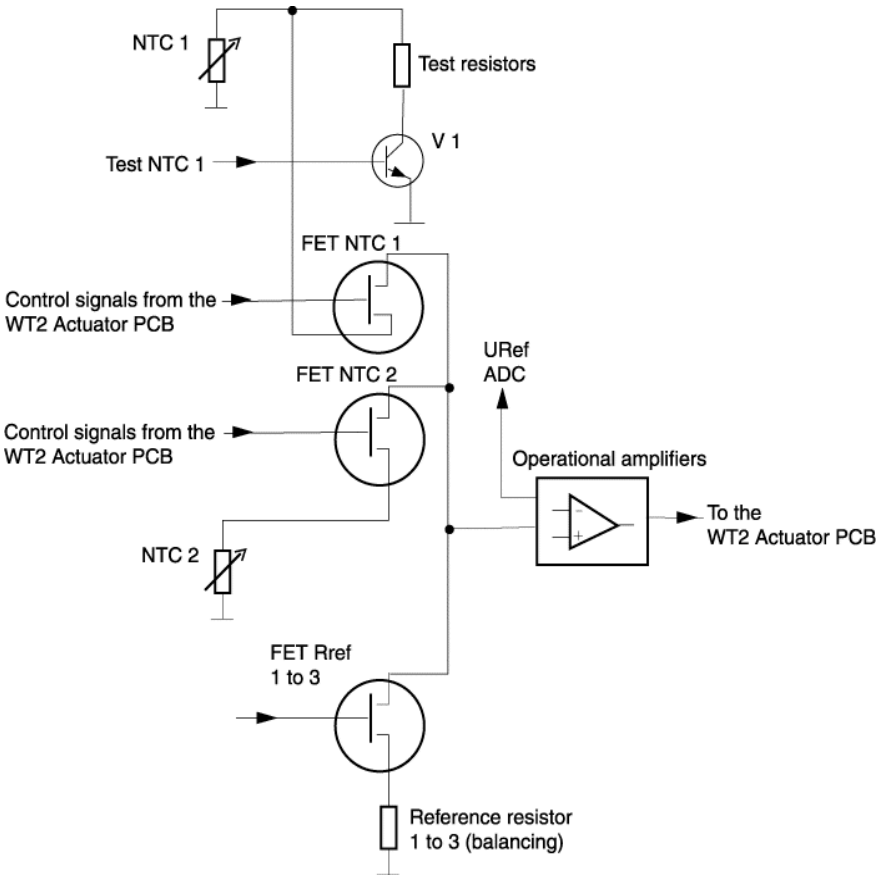

Figure 18 Block diagram of the WT2 Actuator PCB (monitoring of the air temperature and testing of the air-temperature measuring circuit)

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Monitoring of the water boiler (water failure)

The excess-temperature switch of the water boiler is connected to the microcontroller by means of an input connection. The microcontroller monitors the water failure thermo switch by scanning it at any time for its status (open/closed).

Fan Control and Monitoring

The FET (field-effect transistor) controls the fan with a +24 V operating voltage.

The fan wheel (contains two magnets) rotates a speed of 1500 rpm. A Hall sensor monitors the function. The two magnets on the fan wheel generate magnetic pulses. The Hall sensor converts these magnetic pulses to electrical signals. The output signal of the Hall sensor is switched to a counter module which is connected to an interruptible input connection of the microcontroller.

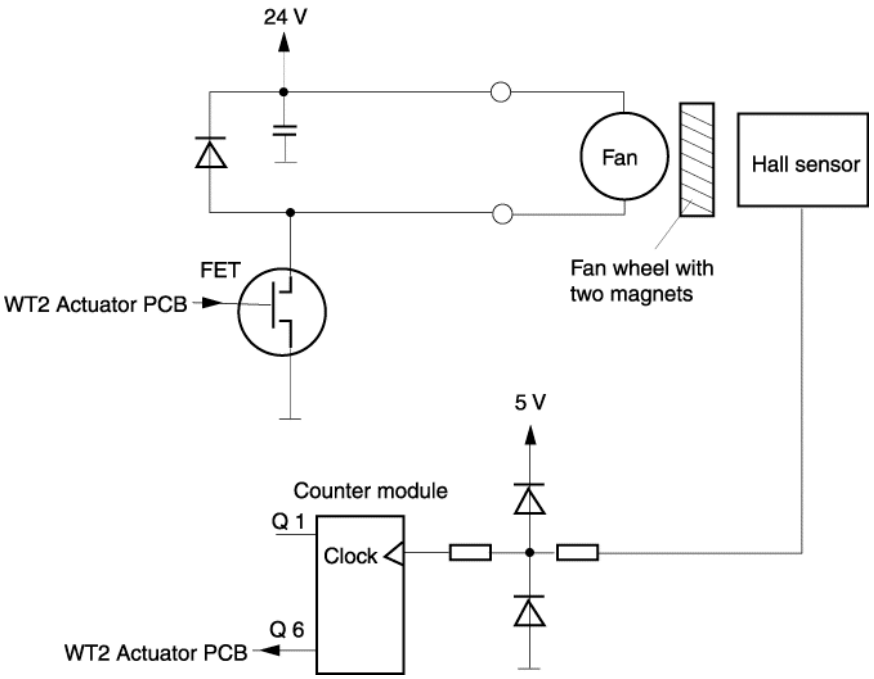


Figure 19 Block diagram of the WT2 Actuator PCB (fan control and monitoring)

Bed Inclination Control and Monitoring

A measuring circuit measures the current which flows through the direct voltage motor. The microcontroller needs the analog output signal from the measuring circuit to monitor the direct voltage motor.

The comparator uses the analog output signal from the measuring circuit and the reference signal "Ref. Signal" from the microcontroller to generate the overload signal of the direct voltage motor. If the current present at the direct voltage motor is too high, an overload current circuit is stripped and the direct voltage motor is switched off. The signal "Inclination on" is logically connected to the overload signal of the direct voltage motor. The output signal is present at the FET 1 (field-effect transistor). The FET 1 activates the direct voltage motor. The bed is inclined to the left or right depending on which key is pressed. Two relays allow reversing the direction of the direct voltage motor.

Height-Adjustable Column (optional feature) Control and Monitoring

A measuring circuit measures the current which flows through the direct voltage motor. The microcontroller needs the analog output signal from the measuring circuit to monitor the direct voltage motor.

The comparator uses the analog output signal from the measuring circuit and the reference signal "Ref. Signal" from the microcontroller to generate the overload signal of the direct voltage motor. If the current present at the direct voltage motor is too high, an overload current circuit is stripped and the direct voltage motor is switched off. The signal "Height on" is logically connected to the overload signal of the direct voltage motor. The output signal is present at the FET 2 (field-effect transistor). The FET 1 activates the direct voltage motor. The work area moves up or down depending on the pedal used. Two relays allow reversing the direction of the direct voltage motor.

Version 2.2_ Released_Printed on_24.10.07_F6150000_Function_description.fm

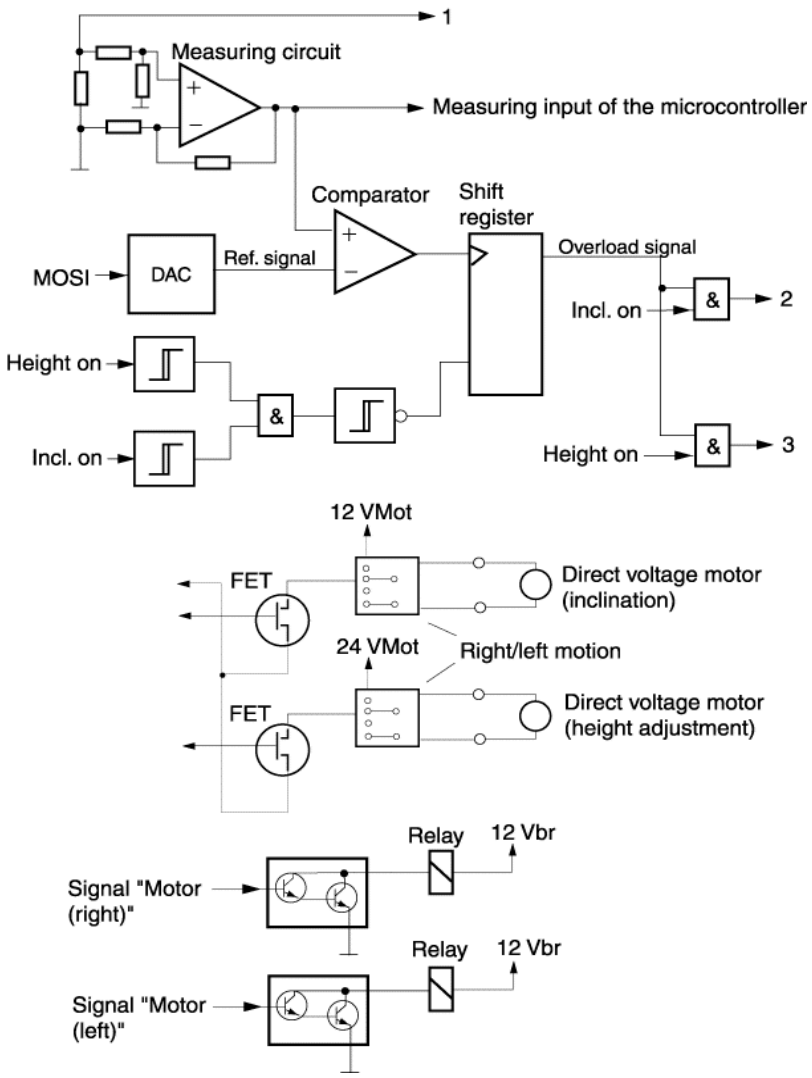


Figure 20 Block diagram of the WT2 Actuator PCB (bed inclination/height adjustment control and monitoring)

Control and monitoring of pneumatics for O2 control (optional feature)

In the event of an oxygen demand, the microcontroller controls the FET (field-effect transistor). The FET becomes conductive and resistors to switch the O2 solenoid to ground. The O2 solenoid switches. Oxygen flows to the patient.

The voltage drop at the resistors is the feedback signal for the microcontroller. The voltage drop corresponds to a current flow through the O2 valve. Too high or too low a current flow is recognized as a fault by the microcontroller.

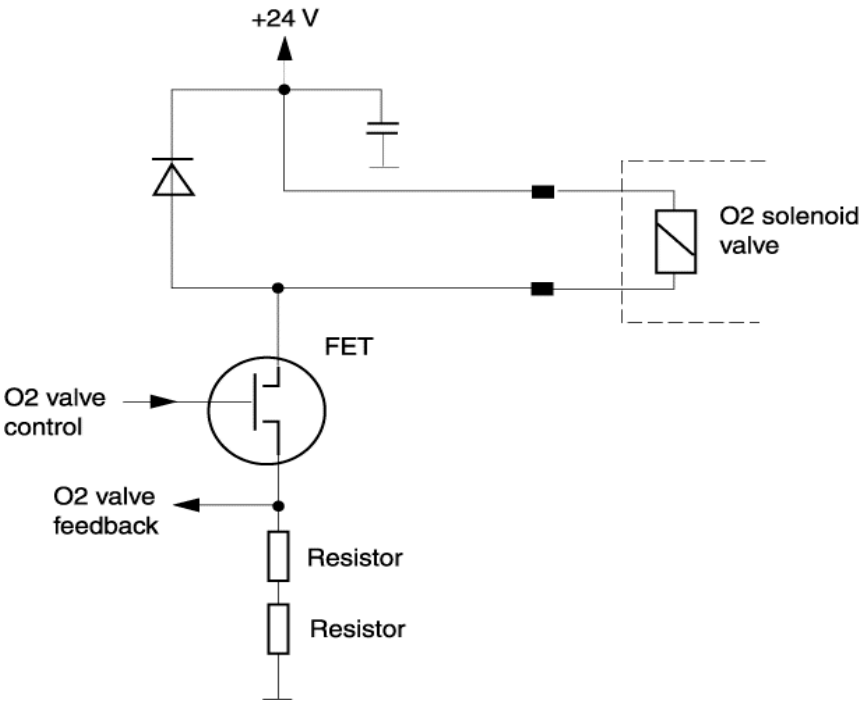


Figure 21 Block diagram of the WT2 Actuator PCB (control and monitoring of pneumatics for O2 control (optional feature))

Version 2.2_ Released_Printed on_24.10.07_F6150000_Function_description.fm

GoldCap and cold start/warm start detection

The on-off switch auxiliary contact closes after switching on the device. The GoldCap capacitor voltage is fed to the microcontroller through the on-off switch auxiliary contact. The microcontroller evaluates the voltage and detects whether the device has been switched on by a cold start or a warm start.

During operation, a charging circuit charges the GoldCap capacitor.

The microcontroller uses the Darlington transistor to switch off the charging circuit at defined intervals in order to check the GoldCap capacitor voltage. To do so, the microcontroller transmits the signal "GodCap Test Signal" to the transistor. The transistor becomes conductive and switches the GoldCap voltage to ground using a resistor. The microcontroller inputs the voltage drop "GoldCap Measuring Signal" resulting at one resistor.

If the voltage drop is too low, the microcontroller shows an error message on the EL display.

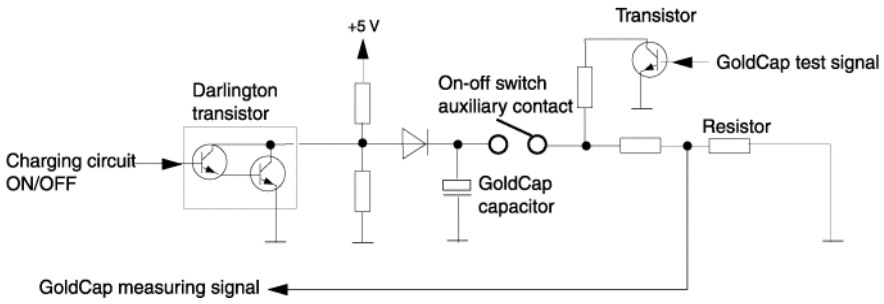


Figure 22 Block diagram of the WT2 Actuator PCB (GoldCap and cold start/warm start detection)

Current regulation and testing of +5 V sensor voltage

The current regulating circuit measures the current that flows to the sensors. The current regulating circuit limits the current to a maximum of 350 mA.

To test the sensor voltage, the microcontroller deactivates FET 3 and activates FET 1 with the control signal. FET 1 switches to passage and generates a voltage drop at the resistor. The voltage drop is present at an analog input connection of the microcontroller. The microcontroller uses the re-input +5 V sensor voltage to test the circuit.

In the event of failure, the microcontroller uses the activation signal to switch FET 3 thereby switching off the +5 V sensor voltage.

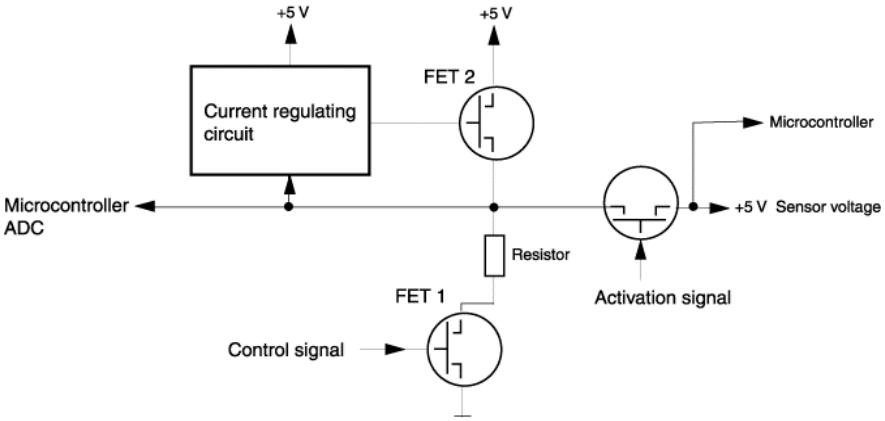


Figure 23 Block diagram of the WT2 Actuator PCB (current limitation and testing of the +5 V sensor voltage)

1.6.3 Water boiler with float and thermo switches (option)

The water boiler consists of the water level control, the boiler including heating cartridge, and three thermo switches (2x thermo soldering switches, 1x thermo switch).

The water boiler humidifies the air inside the patient compartment of Caleo. The connected mains voltage powers the water boiler.

The water boiler is fused with two-pole fuses.

A resistor/capacitor circuit is connected in parallel to the triac. This makes it possible to carry out an earth leakage current measurement.

1.6.4 Air heater with heating element and thermo switches

Air heater with heating element and thermo switches The air heater with heating element has two soldering thermo switches. The air heater has a circular form. Lamellar heating elements allow a good heat distribution. The connected mains voltage powers the air heater.

The air heater is fused with two-pole fuses.

A resistor/capacitor circuit is connected in parallel to the triac. This makes it possible to carry out an earth leakage current measurement.

1.6.5 Air-temperature sensor

The air-temperature sensor measures the temperature of the air heater. The microcontroller switches the air heater off as soon as it reaches the maximum permissible temperature.

1.6.6 Hall sensor

The Hall sensor converts the magnetic signals from the fan wheel with magnets into electrical signals.

1.6.7 Fan

The operating voltage of the fan is +24 V. Power input during operation is 0.25 A. The fan is mounted in the center of the aggregate housing. Surrounded by the air heater, the fan wheel moves the heated air into the patient compartment of Caleo.

The motor is mounted on four silicone supports. The silicone supports hold the fan in a fixed position. Due to their special design, the silicone supports make sure the noise is kept at a low level. The speed of the fan is approximately 1500 rpm.

1.6.8 Filter box

The filter box filters the ambient air taken in. The filter box consists of the filter frame, the filter mount, and the fresh-air filter.

1.6.9 Water connection pipe (optional)

The water connection tube connects the water container and water tube with the body of the water level controller.

1.6.10 Pneumatics for O2 control (optional)

The pneumatics for the O2 control comprises the O2 valve and the O2 pressure regulator. Oxygen control (O2 control) is ensured by O2 sensors. The O2 sensors are installed in the sensor box.

The O2 valve is a solenoid. The operating voltage of the solenoid is +24 V. The holding voltage of the solenoid is 16 V.

1.6.11 O2 adapter DISS/NIST

The compressed-gas tube is connected to the O2 adapter DISS/NIST.

1.7 Trolley

Caleo is available with different trolleys:

– non-adjustable trolley
– electrically adjustable trolley (optional)

1.7.1 Permanently set trolley

The size of the mattress tray of the non-adjustable trolley (height) is 85/95/105 cm.

DC motor for tilt adjustment

The direct current motor for the inclination function is mounted between the trolley and the basic housing. The direct current motor (for tilt function) is powered with an operating voltage of +12 V.

Trolley electronics

The trolley electronics comprises the integrated multiple socket-outlet, mains voltage fuses, sockets for non-heating apparatus, on/off switch, and WT2 Mains PCB.

The WT2 Mains PCB has the following subassemblies:

– ON/OFF switch
– Mains filter
– Autotransformer circuitry

1.7.2 Electrically adjustable trolley (optional feature)

The mattress tray height can be adjusted. The lift speed is 8 to 12 mm/s. The start and stop behavior is without shock.

DC motor for tilt adjustment

The direct current motor for the inclination function is mounted between the trolley and the basic housing. The direct current motor (for tilt function) is powered with an operating voltage of +12 V.

Direct voltage motor for height adjustment

The height adjustment direct current motor is powered with an operating voltage of +24 V.

Pedals

Pedals with integrated switches (optional) on the front and on the back can be used to move the mattress tray up or down.

Trolley Electronics

The trolley electronics comprises the integrated multiple socket-outlet, mains voltage fuses, sockets for non-heating apparatus, on/off switch, and WT2 Mains PCB.

1.8 Secretion suction device

The secretion suction device is supplied with compressed gas (oxygen or air). The display on the display housing shows the vacuum value. The switch for the secretion suction device is located on the basic housing.

The secretion suction device has the following connections

– NIST for oxygen
– DISS for oxygen (with DIN/NIST adapter): Air/O2

The secretion suction power is 0.5 bar.

1.9 Oxygen cylinder holder

The oxygen cylinder holder is mounted on the bottom plate. The oxygen cylinder holder holds the oxygen cylinder in place on the trollery.

The oxygen cylinder is used for the following:

– secretion suction
– oxygen enrichment
– operation with a separate ventilator (manual breathing bag)

Version 2.2_ Released_Printed on_24.10.07_F6150000_Function_description.fm

1.10 Monitor supporting plate

The monitor supporting plate has a load-carrying capacity of 11 kg. It has a surface of 25 cm x 25 cm.

The monitor supporting plate can be mounted at two different heights:

– monitor supporting plate at mattress tray level
– monitor supporting plate above the upper edge of the canopy

1.11 Interfaces

Caleo has the following interfaces:

– Service interface to download new software
– 2x RS232 for printer (CWP) or ext. monitor and telephone diagnosis (option)
– Nurse call outlet port (optional)

Version 2.2_ Released_Printed on_24.10.07_F6150000_Function_description.fm

Maintenance Procedures

1 General notes

WARNING

Observe maintenance intervals (see "Maintenance Intervals" chapter in the Instructions for Use/Operating Instructions).

Replace the following consumable items with new ones as specified in the Instructions for Use/Operating Instructions under "Maintenance Intervals".

– Grommets, tubing port
– O-ring for water connection pipe
– Fresh-air filter

NOTE

The device must be inspected and serviced by trained service personnel (see Instructions for Use/Operating Instructions for intervals).

Version 2.1_ Released_Printed on_24.10.07_W6150000_Maintenance_procedures_general.fm

2 Tubing port/tubing grommet

2.1 General information about tubing port/tubing grommet

If required, have tubing ports and tubing grommets replaced by medical and technical personnel (see “Maintenance Intervals” chapter in Instructions for Use/Operating Instructions").

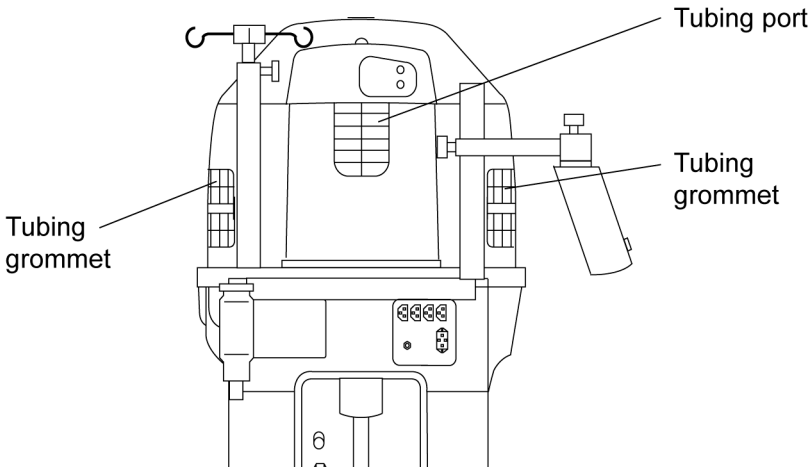


Figure 1 Side view of the Caleo

2.1.1 Replacing tubing port/tubing grommet

1. Open flap located next to the damaged tubing port/tubing grommet.
2. Slide damaged tubing port/tubing grommet out of the pillar element.
3. Dispose of damaged tubing port/tubing grommet according to local waste disposal regulations.
4. Slide new tubing port/tubing grommet into the pillar element.
5. Close the flap.

Version 2.0_ Released_Printed on_24.10.07_W6150000_Tubing_port_tubing_grommet.fm

3 Water connecting pipe

Have O-ring of water connecting pipe replaced by medical and technical personnel at regular intervals (see “Maintenance Intervals” chapter in Instructions for Use/Operating Instructions").

3.1 Replacing the O-ring of the water connecting pipe

1. Plug the power plug of the Caleo into the mains socket.
2. Switch on Caleo at the ON/OFF switch.
3. Tilt the bed to the left.

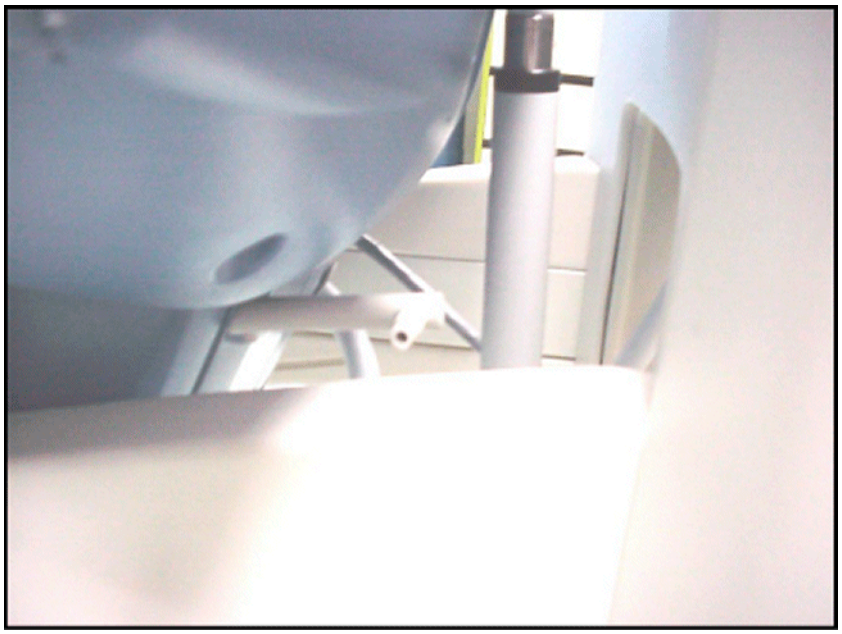


Figure 2 Bed tilted

4. Turn the water connecting pipe 90° upwards and pull the water connecting pipe out of the Caleo (Figure 3).

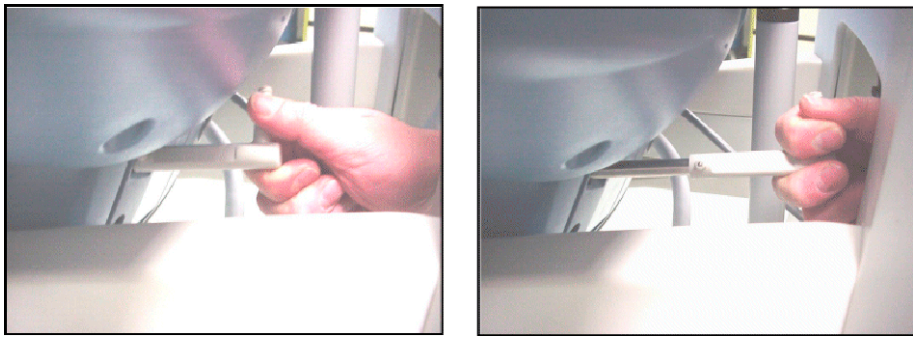


Figure 3 Removing the water connecting pipe

5. Remove old O-ring (Figure 4/1) from the water connecting pipe using a small screwdriver and dispose of the old O-ring according to local waste disposal regulations.

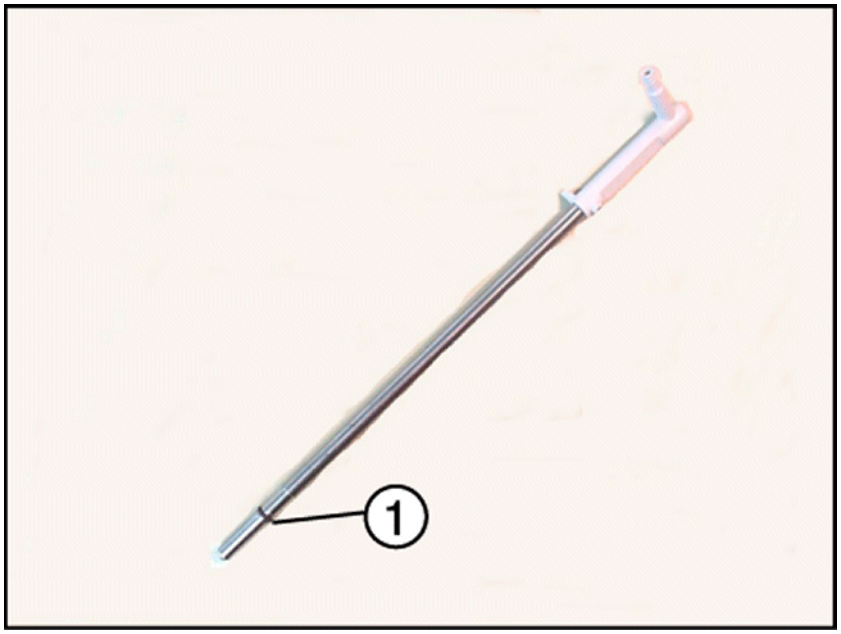


Figure 4 Water connecting pipe

6. Push new O-ring (Figure 4/1) into the groove of the water connecting pipe.
7. Push the water connecting pipe (hose connector points upwards) into the Caleo and turn the water connecting pipe 90° downwards (Figure 5).

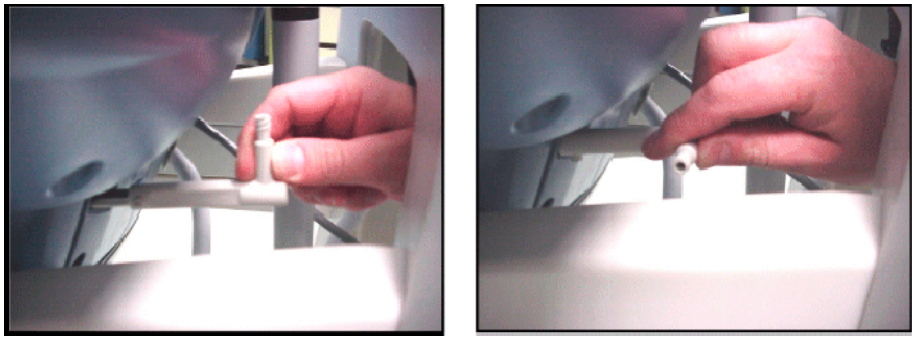


Figure 5 Mounting the water connecting pipe

The water connecting pipe is now locked in the Caleo.

4 Fresh-air filter

Have the fresh-air filter replaced by medical and technical personnel (see “Maintenance Intervals” chapter in Instructions for Use/Operating Instructions").

4.1 Replacing the fresh-air filter

1. Plug the power plug of the Caleo into the mains socket.
2. Switch on the Caleo at the power switch.
3. Tilt the bed to the left (Figure 6).

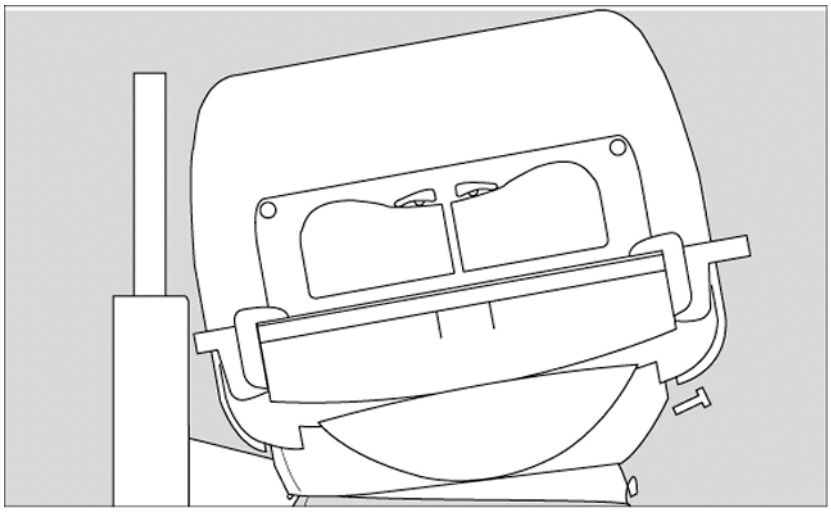


Figure 6 Front view of the Caleo

4. Switch off the Caleo at the ON/OFF switch.
5. Hold the fresh-air filter holder (Figure 7/1) by the recessed grip, pull the fresh-air filter holder downwards and remove.

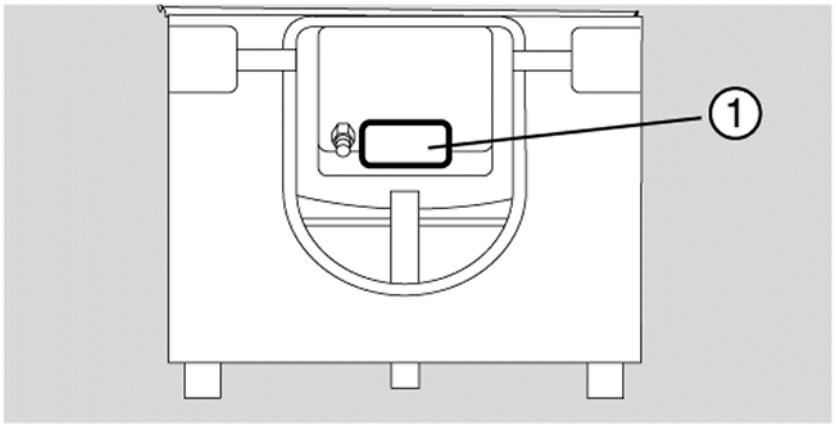


Figure 7 Side view of the Caleo

6. Hold the fresh-air filter holder (Figure 8/3) , remove the filter frame (Figure 8/1) and place it aside.

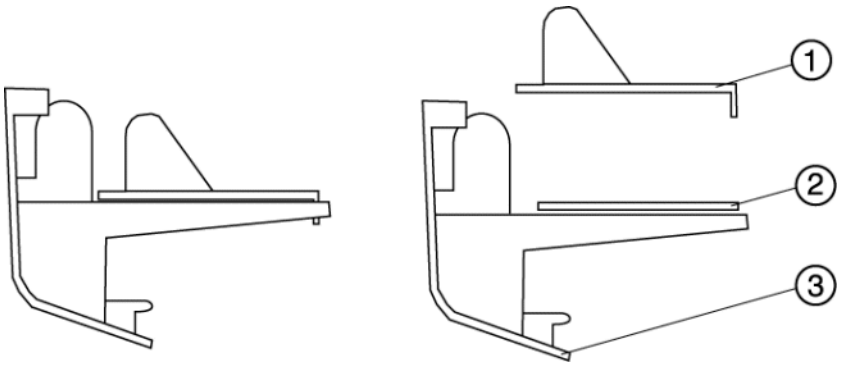


Figure 8 Fresh-air filter holder

7. Remove the spent fresh-air filter (Figure 8/2) from the fresh-air filter holder and dispose of (with household waste).
8. Mount the new fresh-air filter (Figure 8/2) into the fresh-air filter holder.
9. Mark the date of first use on the label of the new fresh-air filter and affix the label to the edge of the fresh-air filter.
10. Press the filter frame (Figure 8/1) onto the fresh-air filter holder (Figure 8/3).
11. Push the fresh-air filter holder (Figure 8/3) into the Caleo.

Schematics and Diagrams

1 Schematics and diagrams

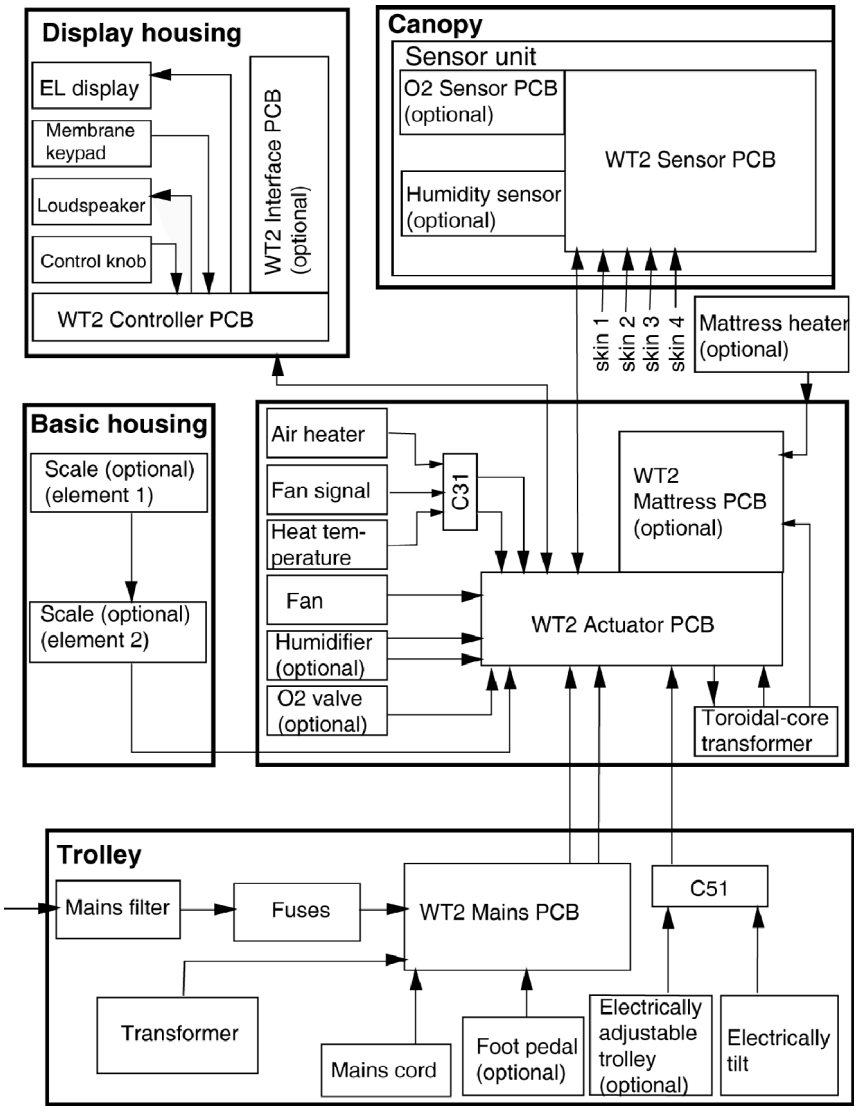


Figure 1 Caleo block diagram

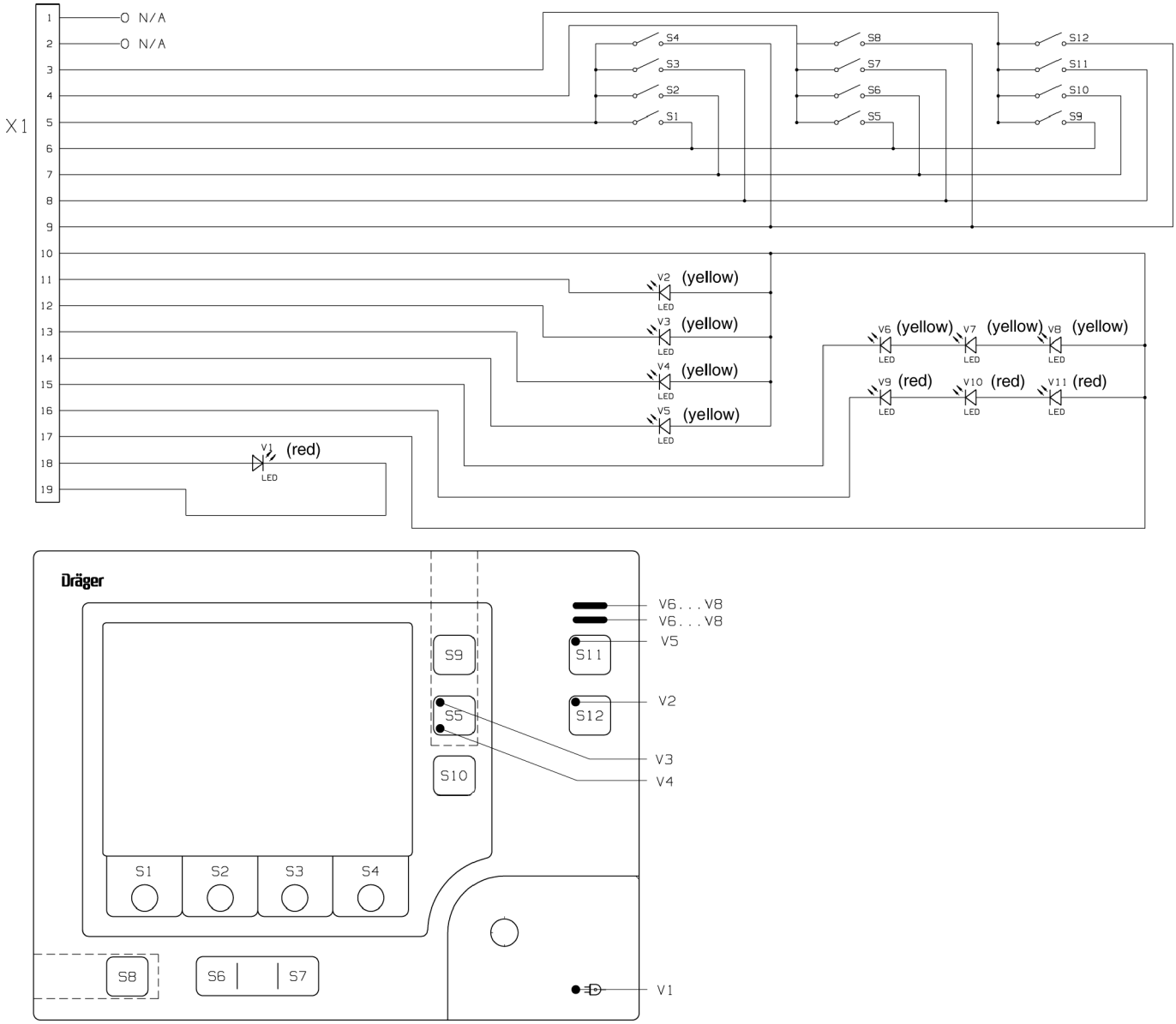


Figure 2 Membrane keypad

Annex

Parts catalog

Test List

Technical Information

Dräger medical
A Dräger and Siemens Company

Parts catalog

Caleo

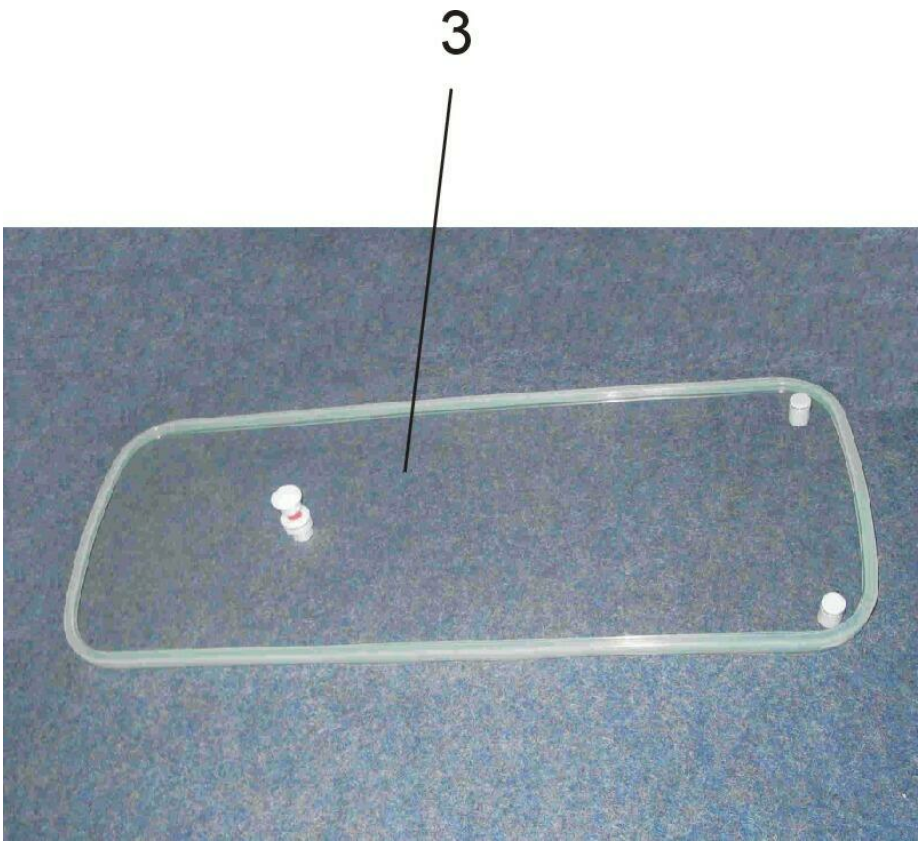
Revision: 2006-01

6150.000

Because you care

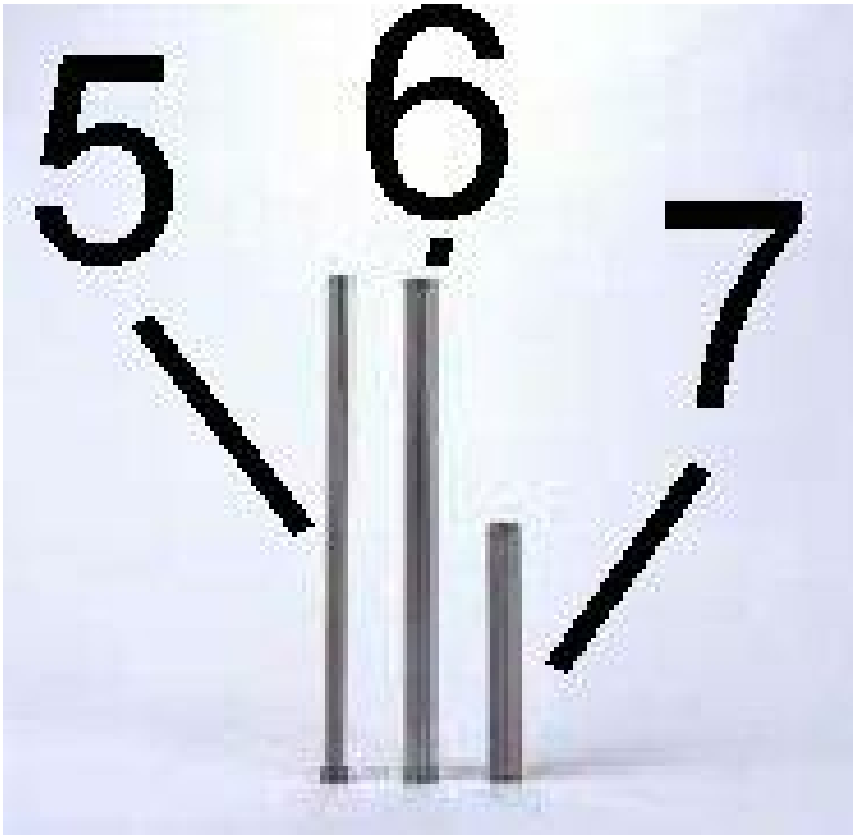
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
	2M50000	Caleo	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty. unit	Remark
3	2M51150	Double wall, compl. Caleo	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

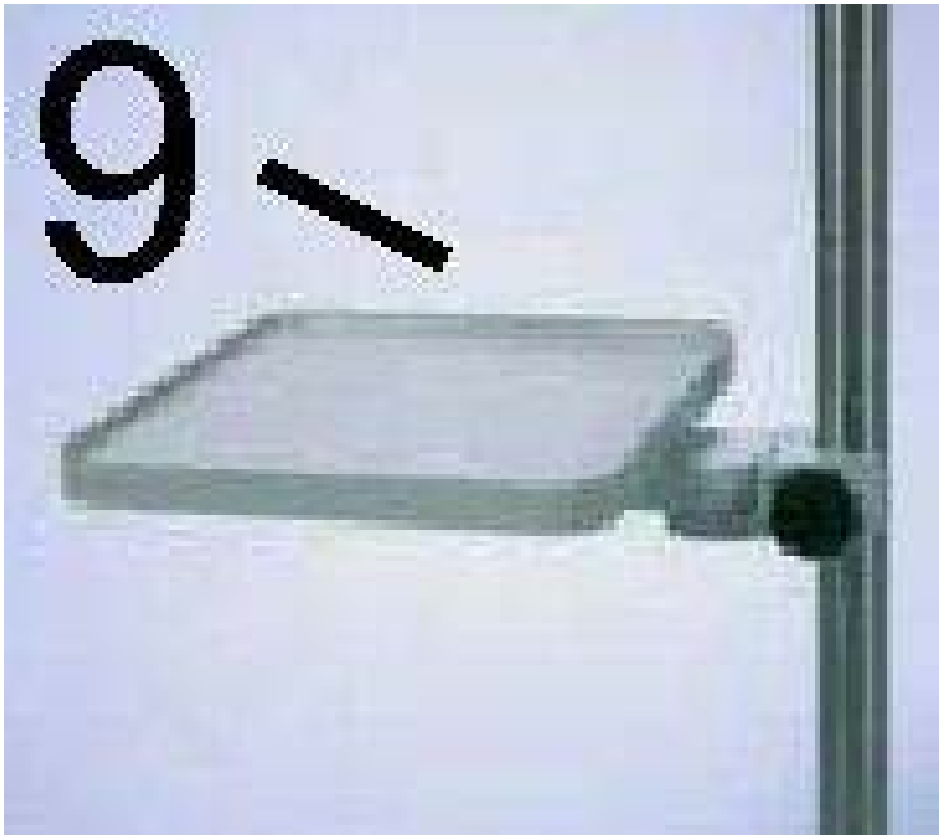


Item No.	Part No.	Description	Qty.	Qty. unit	Remark
5	2M50689	Pole 25mm/600	1.000	St	
6	2M50691	Pole 38mm/600	1.000	St	
7	2M50688	Pole 38mm/310	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

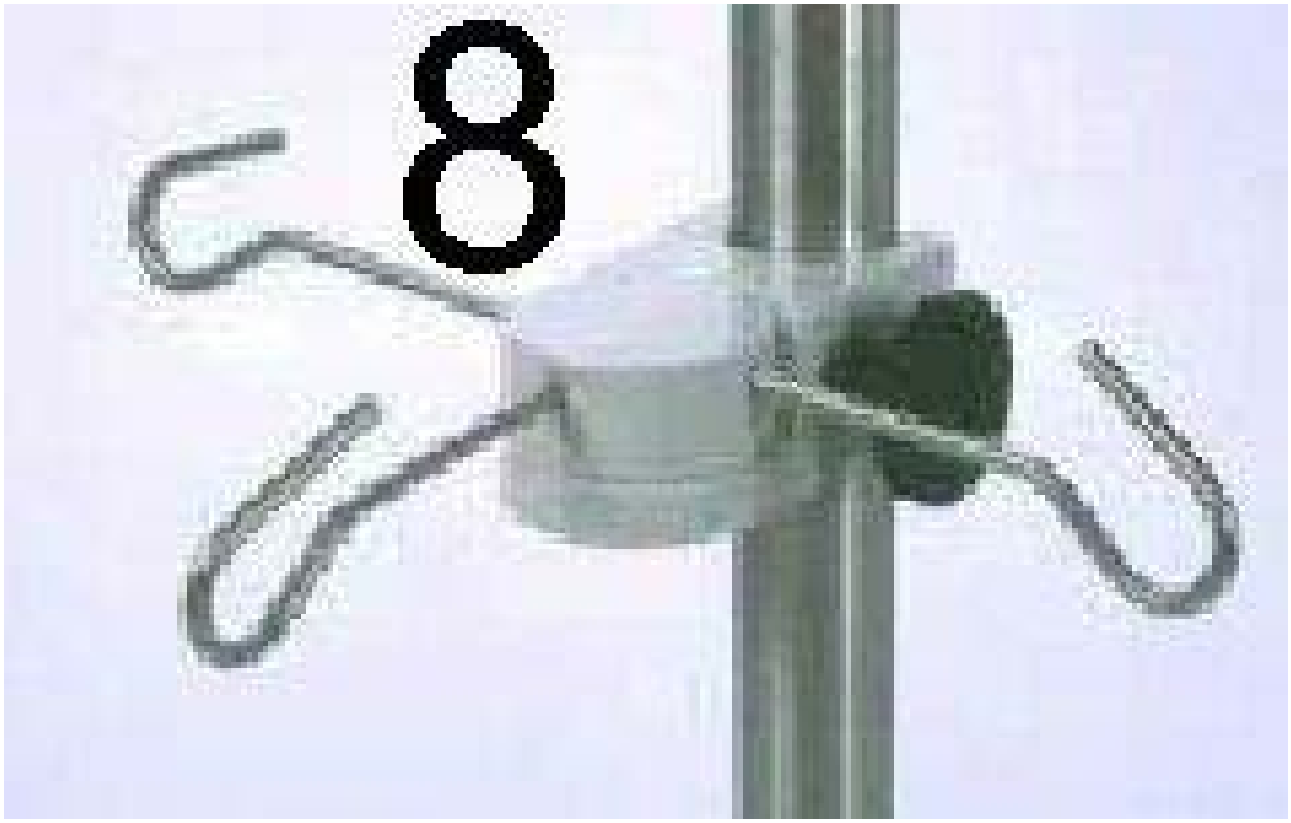
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
4	2M50680	Basic pole	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty. unit	Remark
9	2M21186	TABLE INCLINABLE,COMPLET	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty. unit	Remark
8	2M21514	Infusion support	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Item No.	Part No.	Description	Qty.	Qty. unit	Remark
13	2M50565	SWIVEL CUPBOARD CALEO	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Item No.	Part No.	Description	Qty.	Qty. unit	Remark
21	2M85125	Bronchial aspirator Paediatric	1.000	St	Accessories for secretion aspiration

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Item No.	Part No.	Description	Qty.	Qty. unit	Remark
15	2M85337	COMPACT RAIL	1.000	St	Shelves, holders, infusion accessories

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Item No.	Part No.	Description	Qty.	Qty. unit	Remark
18	8411075	VENTILATION HOSE HOLDER	1.000	St	Accessories for bed area

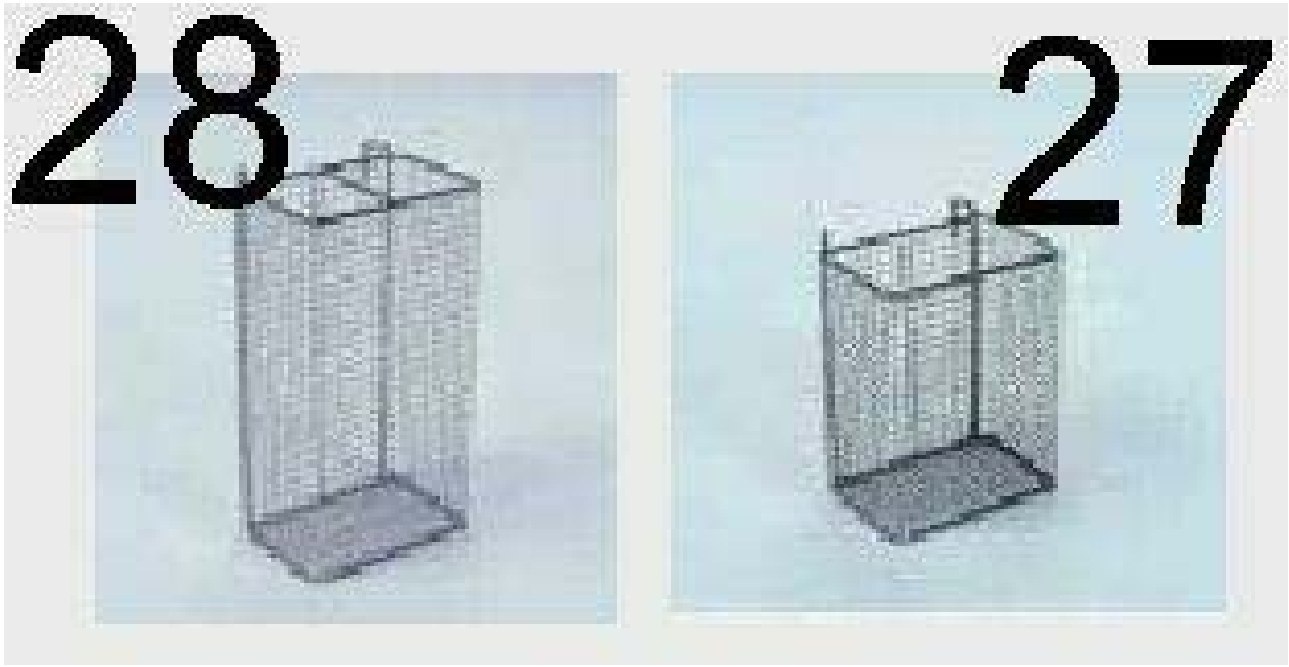
Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Item No.	Part No.	Description	Qty.	Qty. unit	Remark
17	2M22171	NOTEBOOKHOLDER	1.000	St	Shelves, holders, infusion accessories

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Item No.	Part No.	Description	Qty.	Qty. unit	Remark
16	M24678	Tray 3020	1.000	St	Shelves, holders, infusion accessories

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

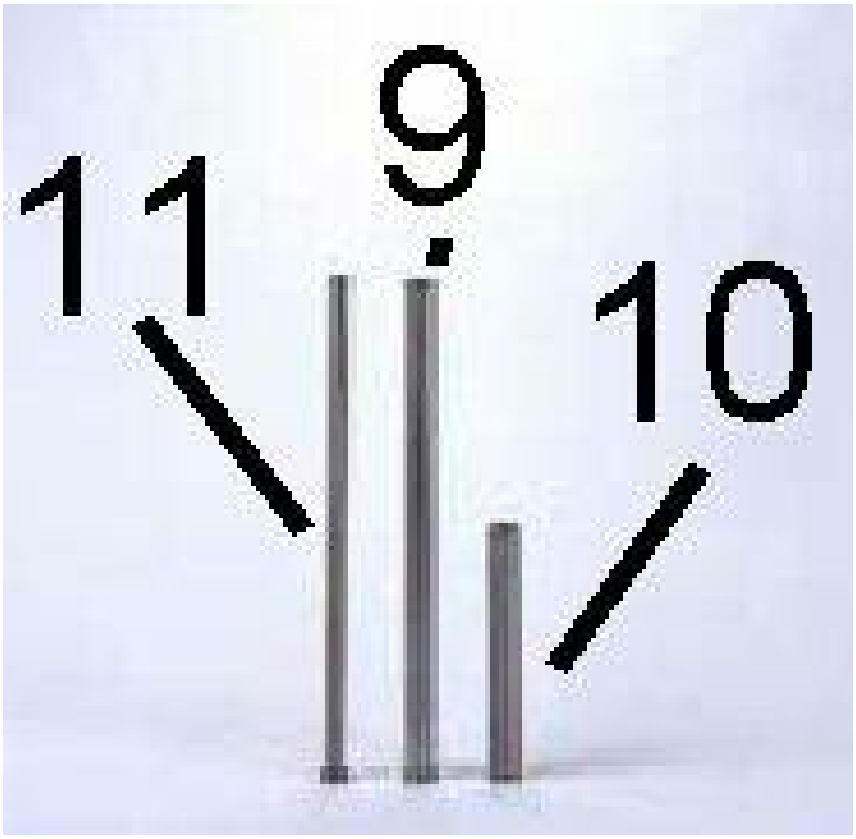


Item No.	Part No.	Description	Qty.	Qty. unit	Remark
27	M26145	Basket 300	1.000	St	Accessories for secretion aspiration
28	M25121	Basket 600	1.000	St	Accessories for secretion aspiration

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Item No.	Part No.	Description	Qty.	Qty. unit	Remark
29	M24695	Holder for litter bags	1.000	St	Accessories for secretion aspiration
30	M26240	SET OF WASTE BAGS	1.000	St	Accessories for secretion aspiration

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

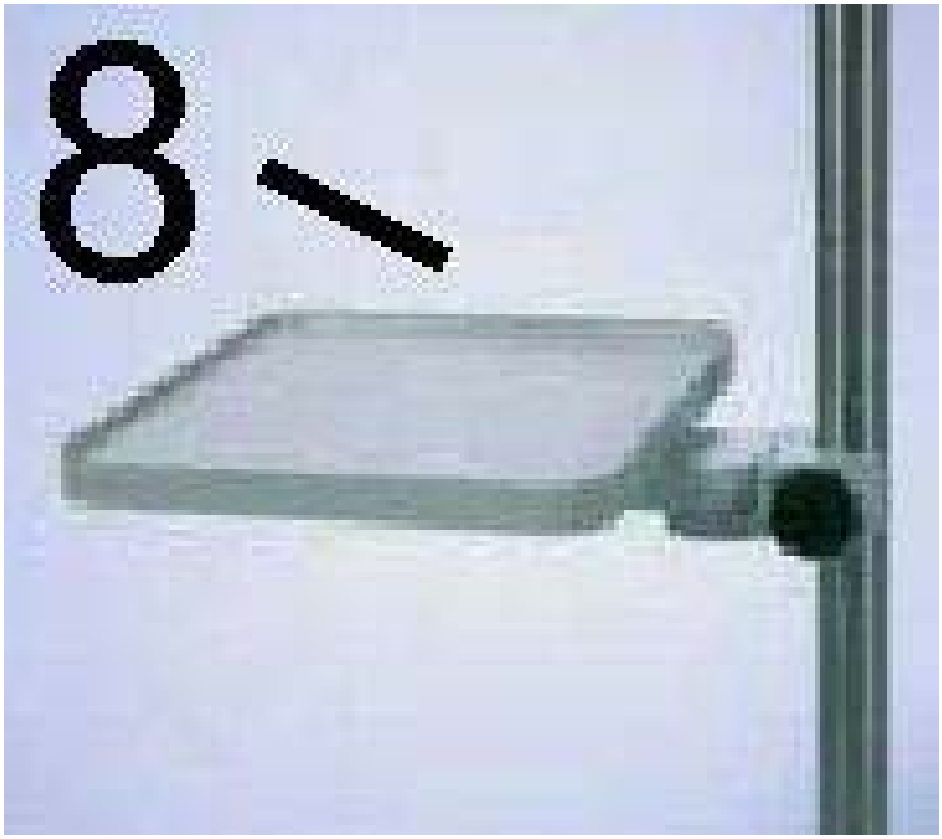


Item No.	Part No.	Description	Qty.	Qty. unit	Remark
9	2M50691	Pole 38mm/600	1.000	St	Shelves, holders, infusion accessories
10	2M50688	Pole 38mm/310	1.000	St	Shelves, holders, infusion accessories
11	2M50689	Pole 25mm/600	1.000	St	Shelves, holders, infusion accessories

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

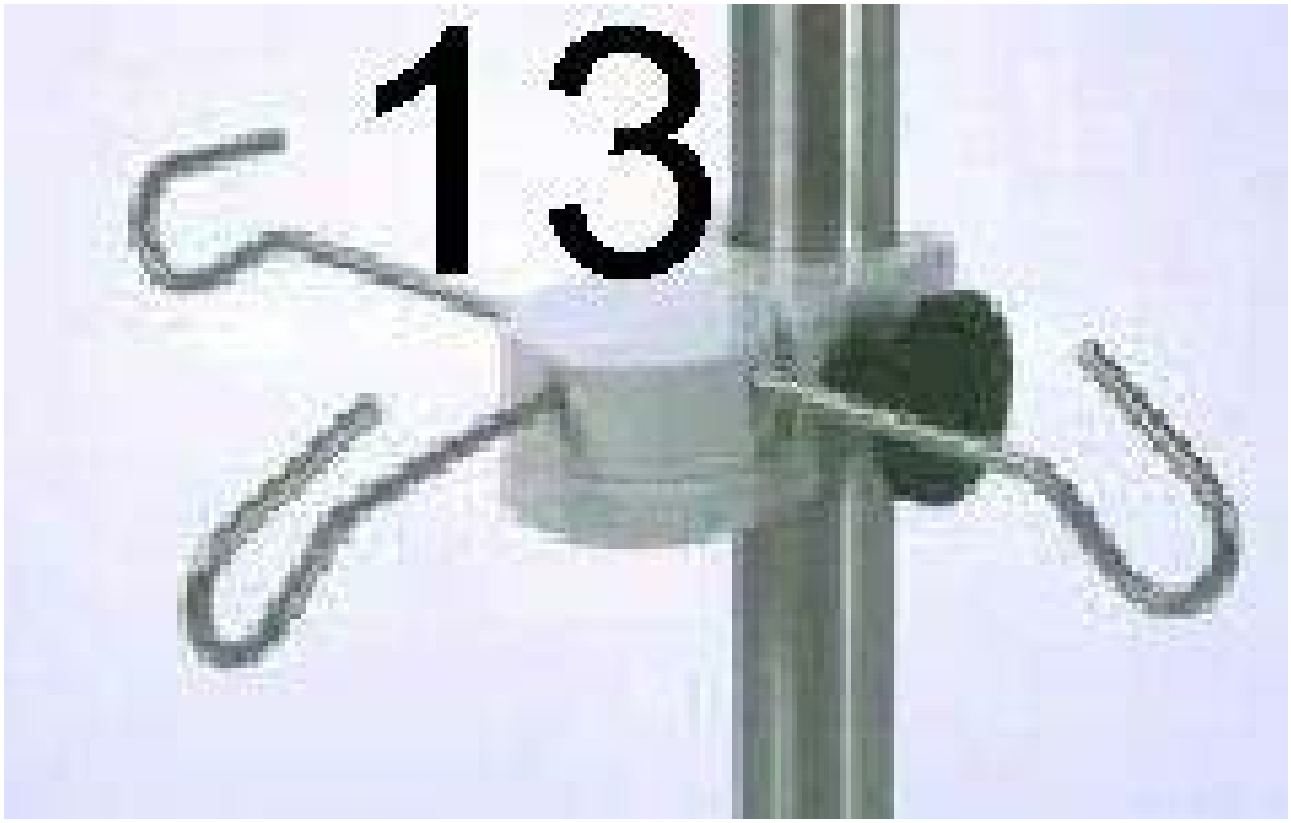
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
12	2M50680	Basic pole	1.000	St	Shelves, holders, infusion accessories

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty. unit	Remark
8	2M21186	TABLE INCLINABLE,COMPLET	1.000	St	Shelves, holders, infusion accessories

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

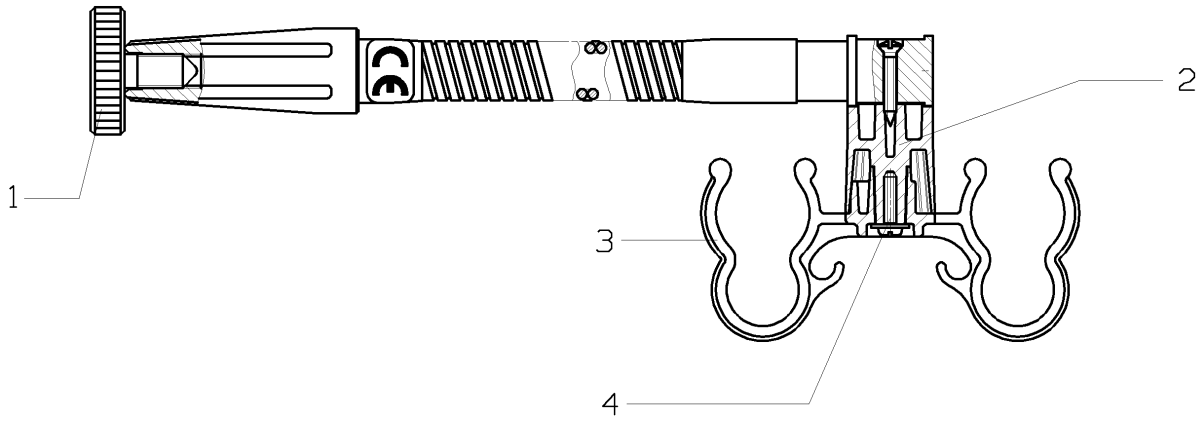


Item No.	Part No.	Description	Qty.	Qty. unit	Remark
13	2M21514	Infusion support	1.000	St	Shelves, holders, infusion accessories

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

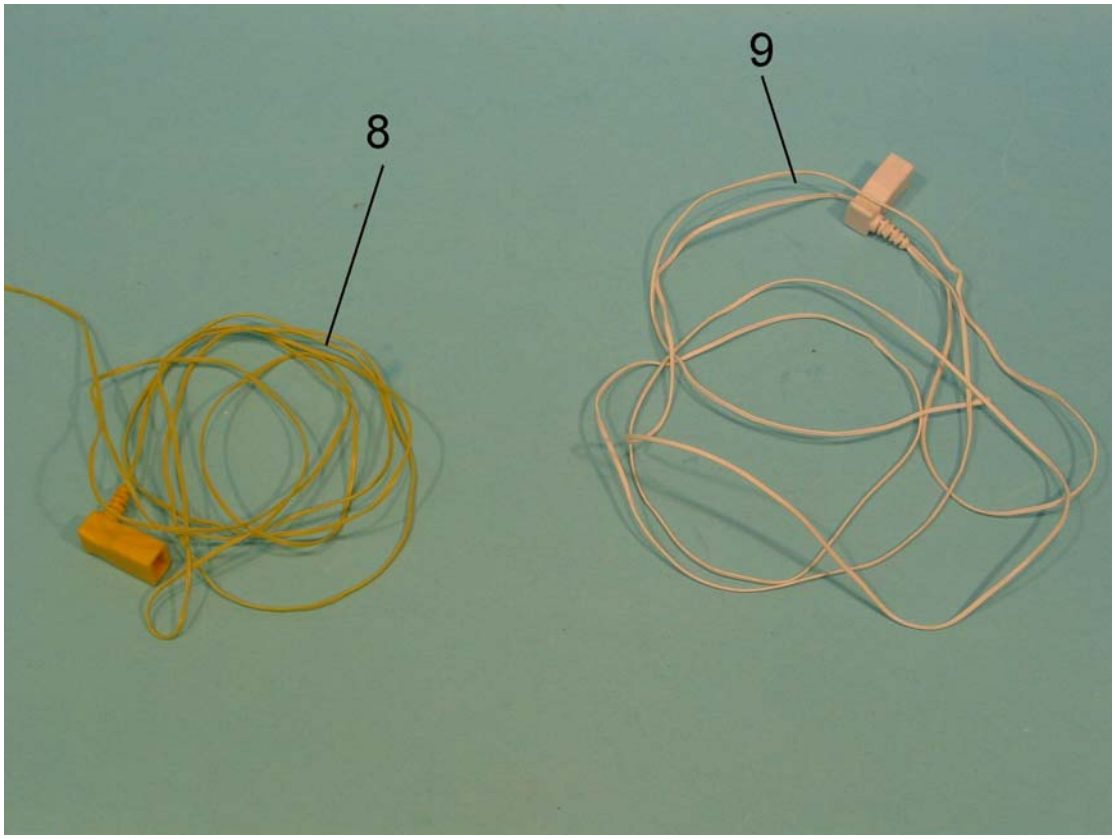
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
19	MX17012	SoftBed Draeger Caleo	1.000	St	Accessories for bed area

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



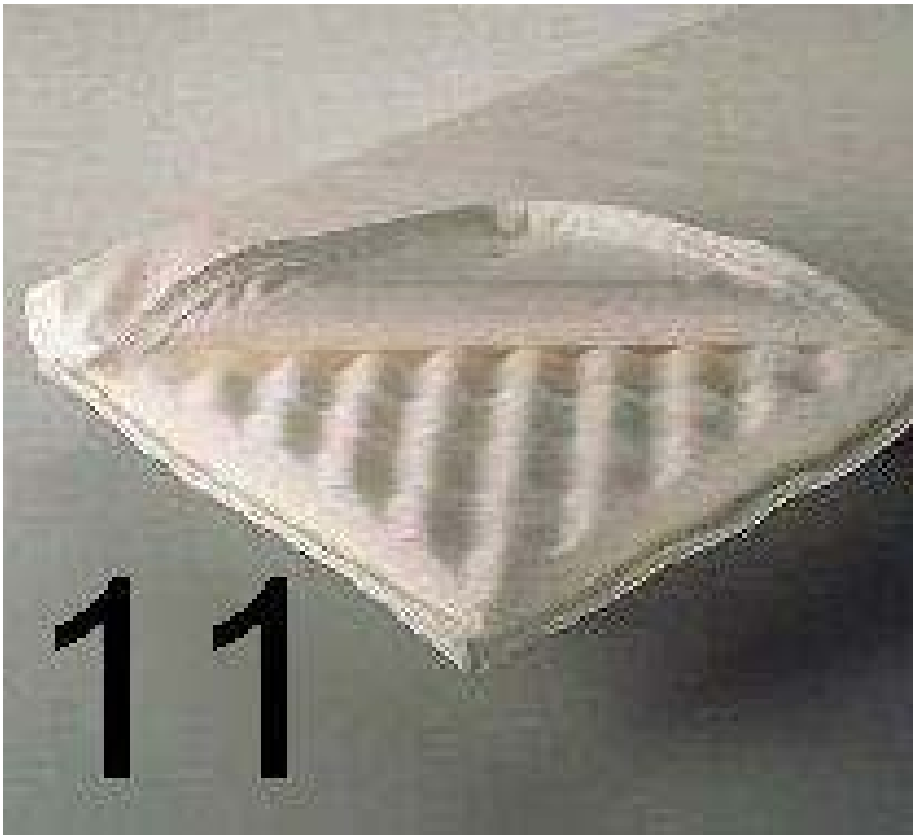
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
1-4	8411075	VENTILATION HOSE HOLDER	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



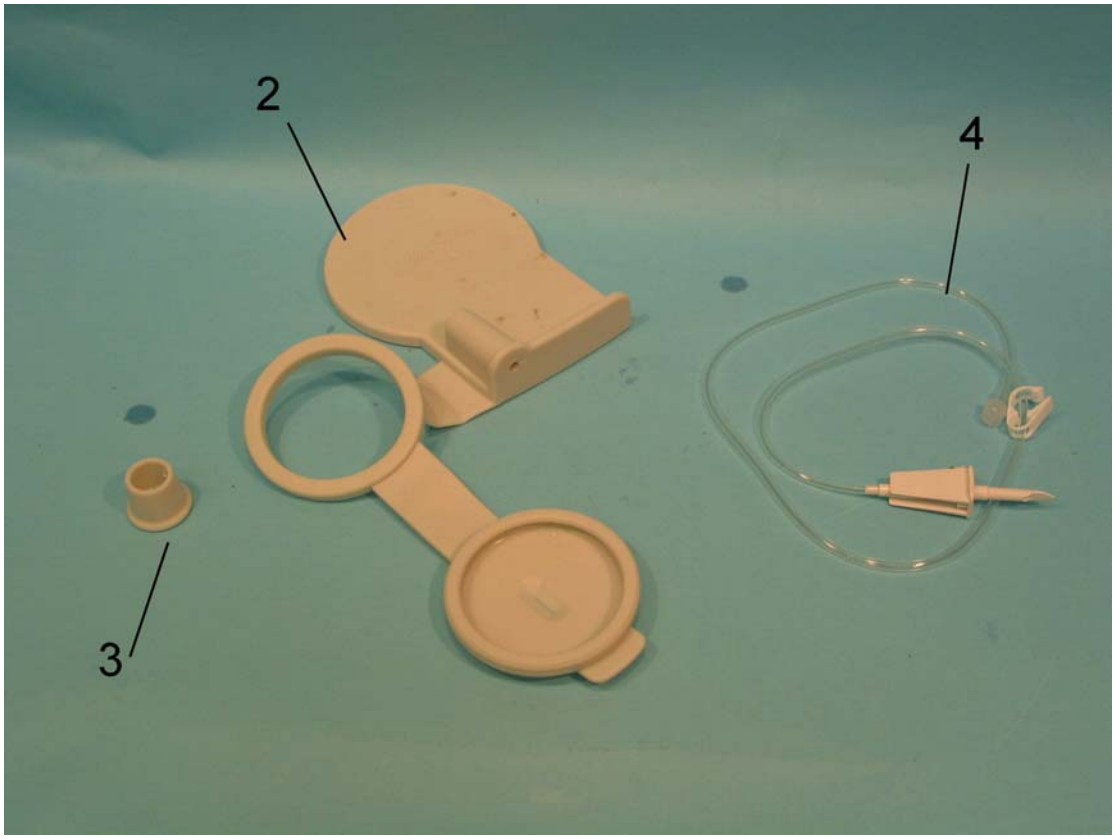
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
8	MX11000	ThermoTrace Core (5pc)	1.000	St	
9	MX11001	ThermoTrace Peripheral (5pc)	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



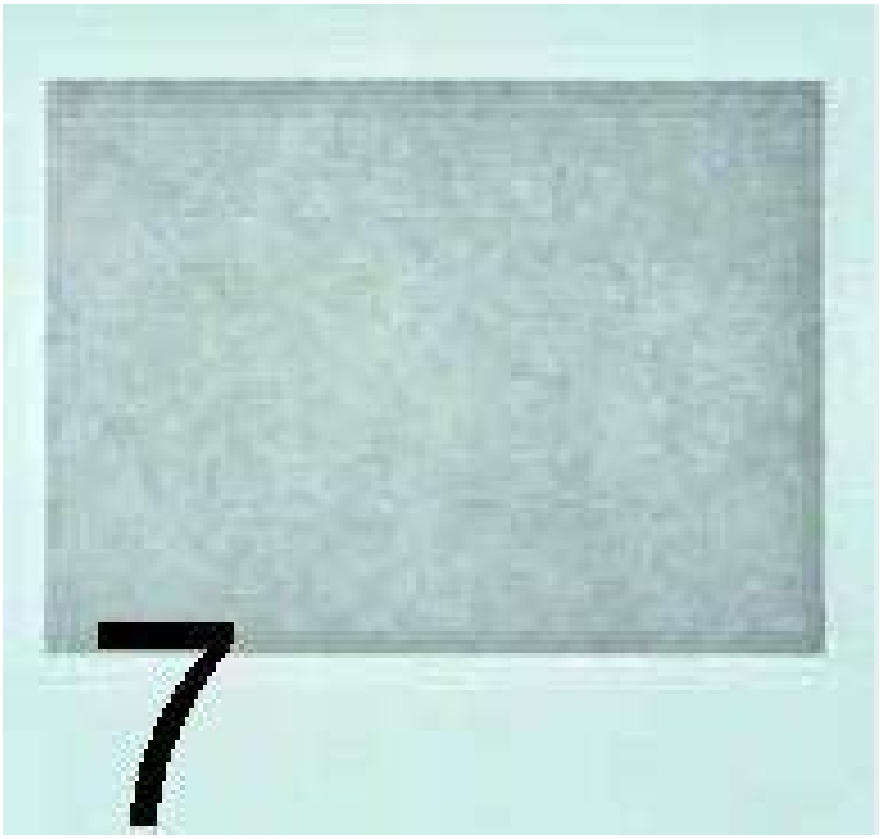
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
11	MX17012	SoftBed Draeger Caleo	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty. unit	Remark
2	2M50042	CAP	1.000	St	
3	2M50039	SOCKET	1.000	St	
4	MX17018	Supply tubing set Caleo(20pc.)	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty. unit	Remark
7	MX17015	Air filter Caleo (20pc.)	1.000	St	

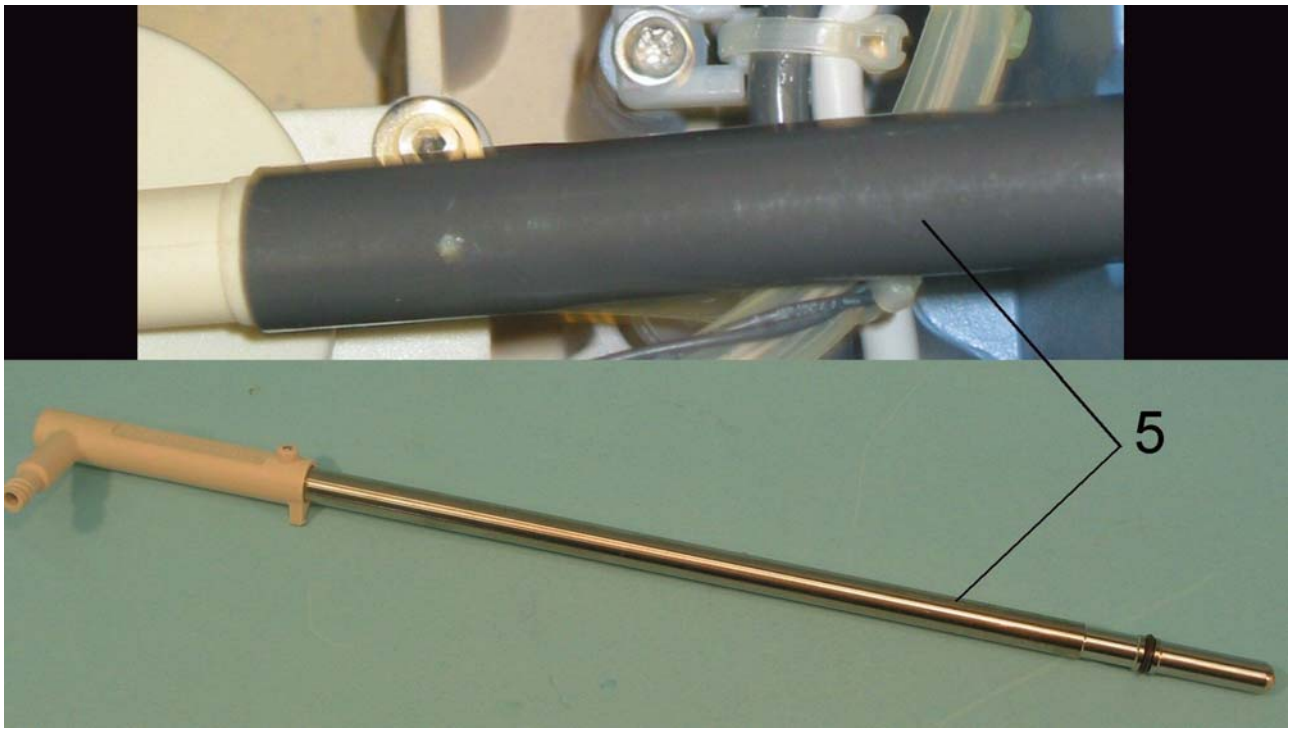
Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Item No.	Part No.	Description	Qty.	Qty. unit	Remark
15	2M51109	Cap feeding drill-hole	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

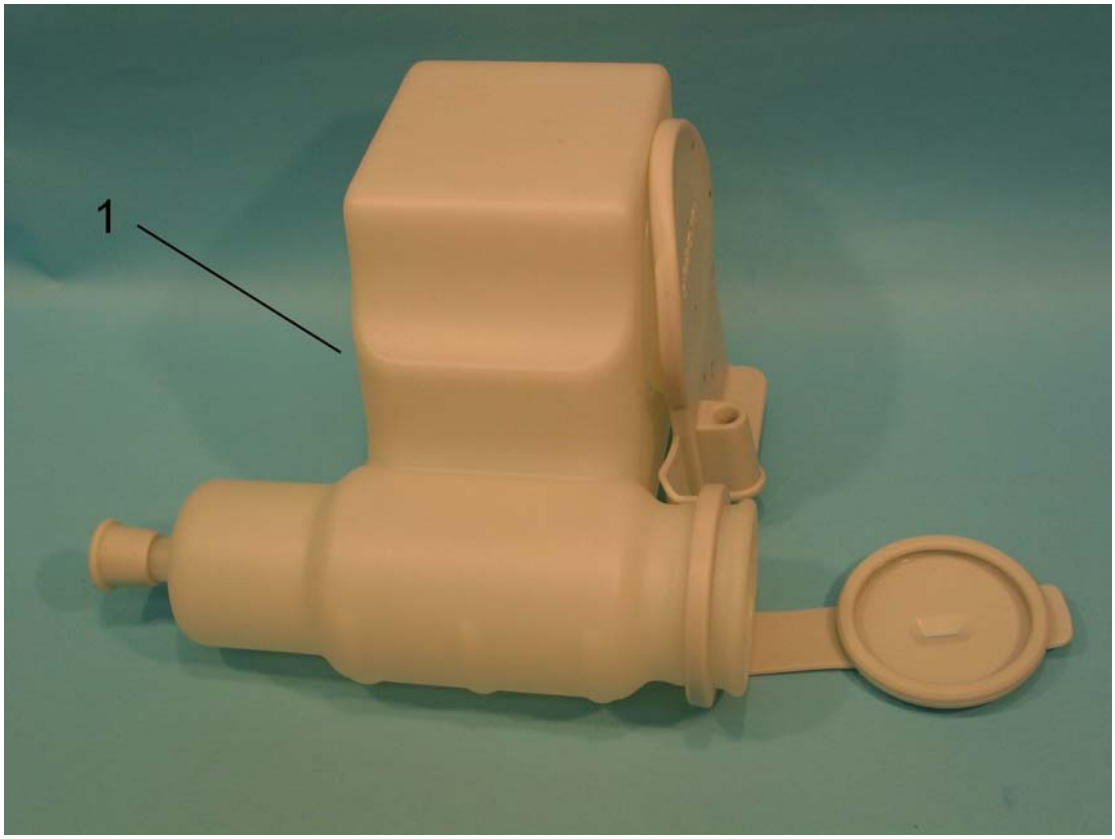
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
13	2M50385	TUBING GROMMET, LARGE	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty. unit	Remark
5	2M50237	WATER-CONNECTION,CPL.	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

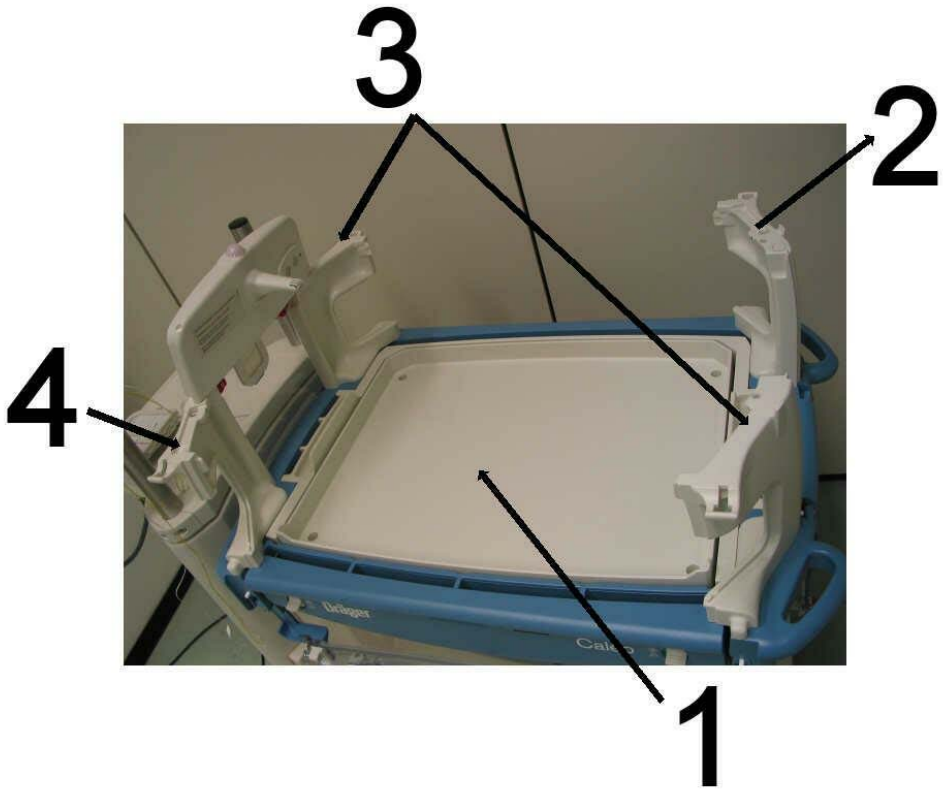


Item No.	Part No.	Description	Qty.	Qty. unit	Remark
1	2M50040	WATER CONTAINER SET, COMPL.	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Item No.	Part No.	Description	Qty.	Qty. unit	Remark
6	2M50346	O-RING SEAL	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

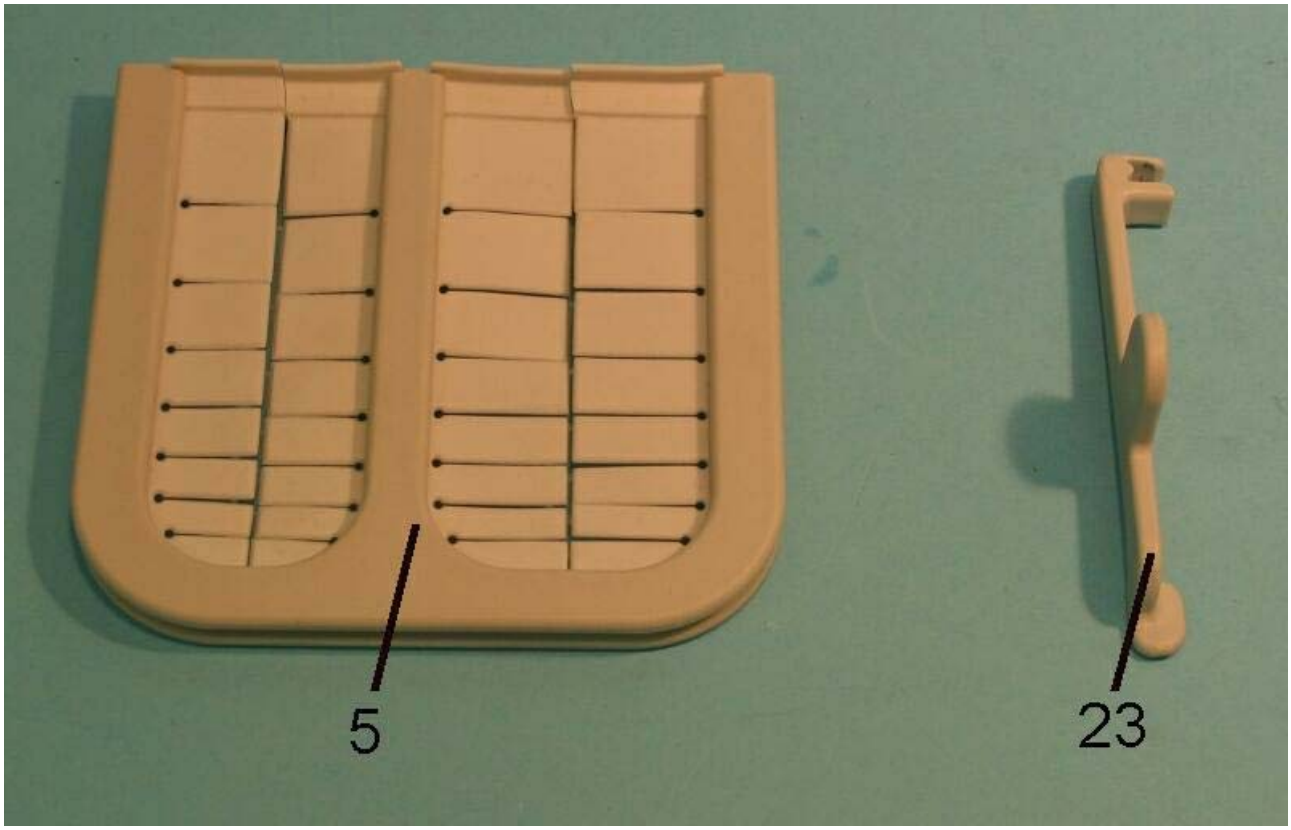


Item No.	Part No.	Description	Qty.	Qty. unit	Remark
1	2M50226	BED AREA CALEO	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

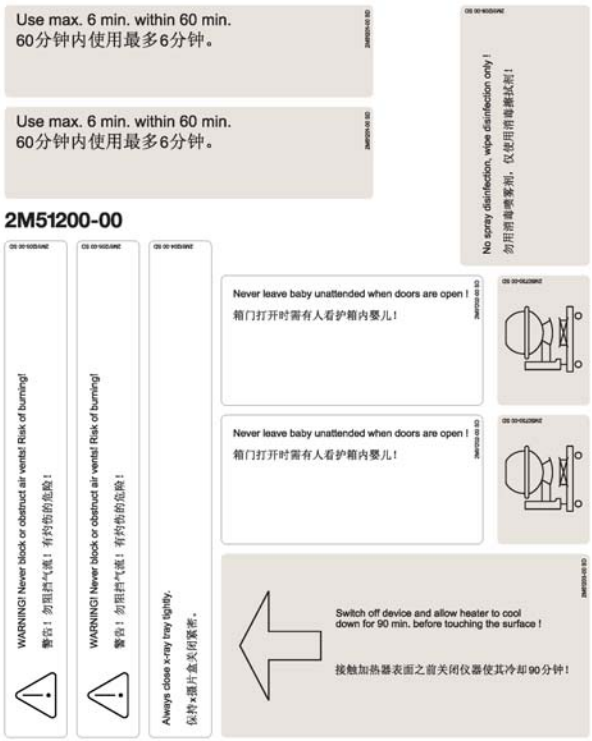
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
13	1851683	SUPPLY MAIN, 3m, 10A	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



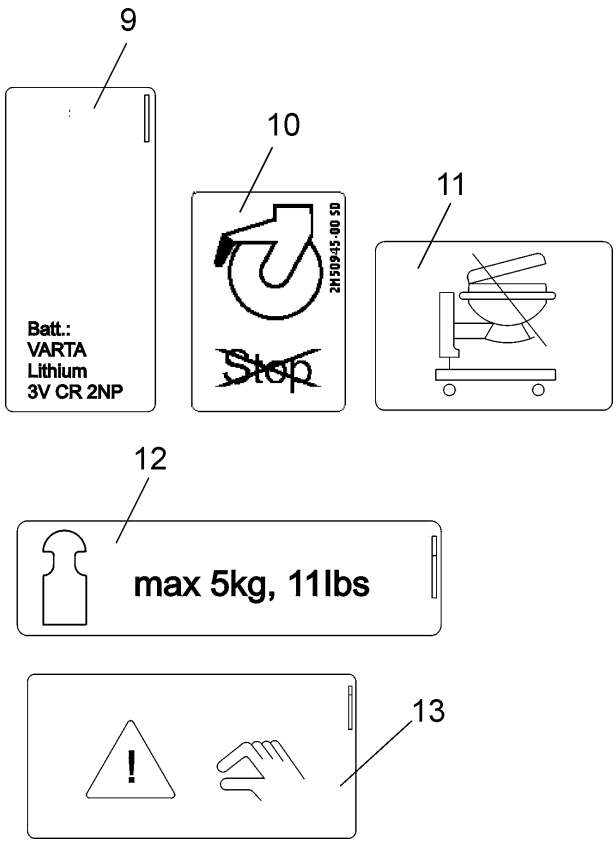
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
5	2M50385	TUBING GROMMET, LARGE	1.000	St	
23	2M50397	Support	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



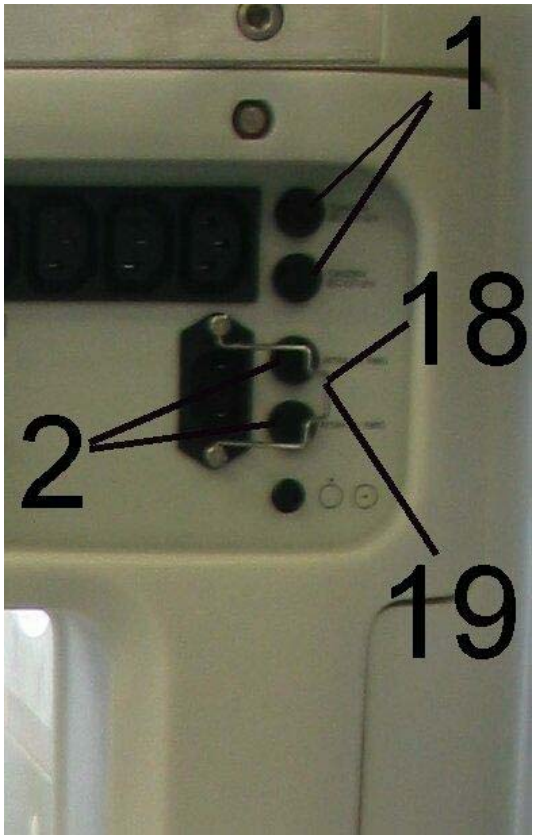
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
1	2M50590	SET OF LABELS Caleo de fr it n	1.000	St	
2	2M50591	SET OF LABELS Caleo da sv no f	1.000	St	
3	2M50592	SET OF LABELS Caleo en es pt e	1.000	St	
4	2M50593	SET OF LABELS Caleo pl cs hu r	1.000	St	
5	2M50594	SET OF LABELS Caleo en ja	1.000	St	
6	2M50595	SET OF LABELS Caleo enUS fr es	1.000	St	
7	2M51200	Set of labels Caleo en zh	1.000	St	
8	2M51230	SET OF LABELS Caleo en tr	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



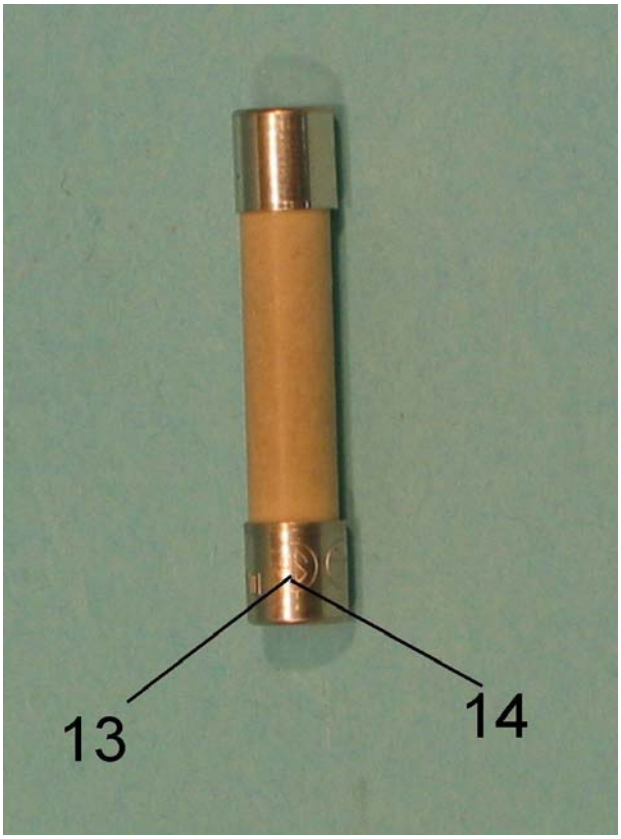
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
9	2M50709	Label Battery	1.000	St	
10	2M50945	LABEL FIXING CASTOR	1.000	St	
11	2M50705	Label-Hood_TO TIP OVER	1.000	St	
12	2M50732	LABEL 5kg	1.000	St	
13	2M50734	Label Hand	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



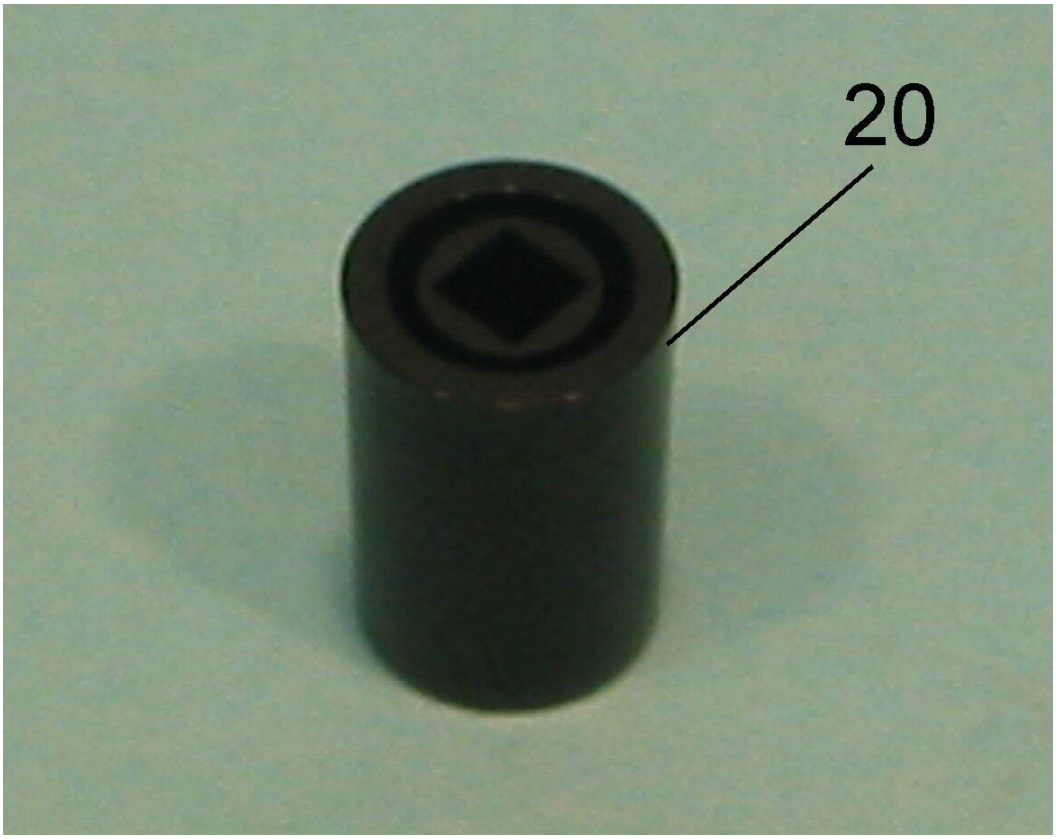
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
18	1843788	Locking clamp	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



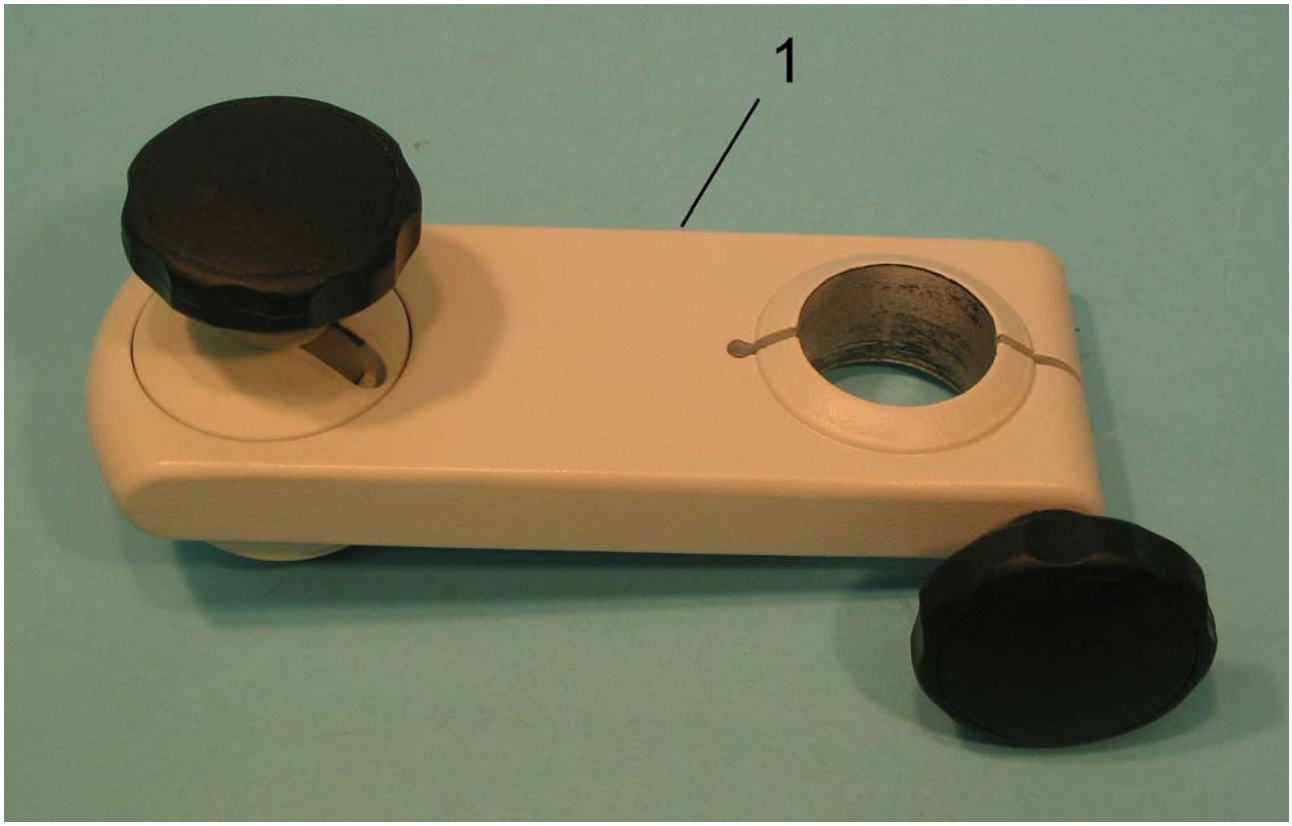
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
13	1840568	FUSE LINK T2H IEC127-2/V	1.000	St	
14	1843168	Fuse-link F10A 6,3X32	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



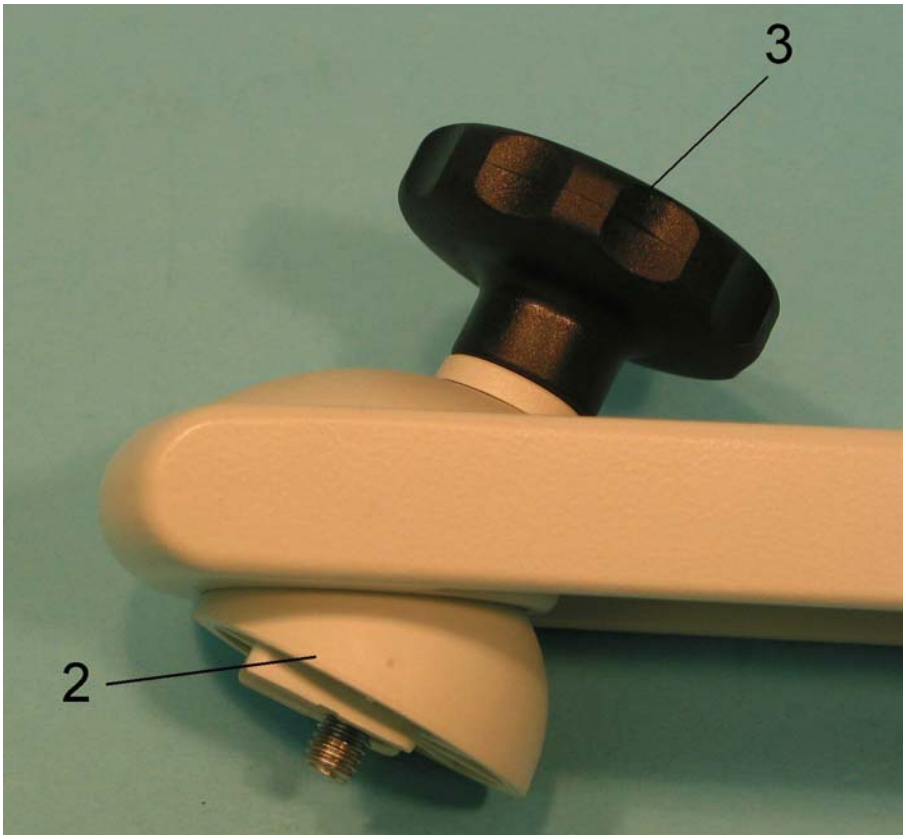
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
20	2M50503	CAP	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



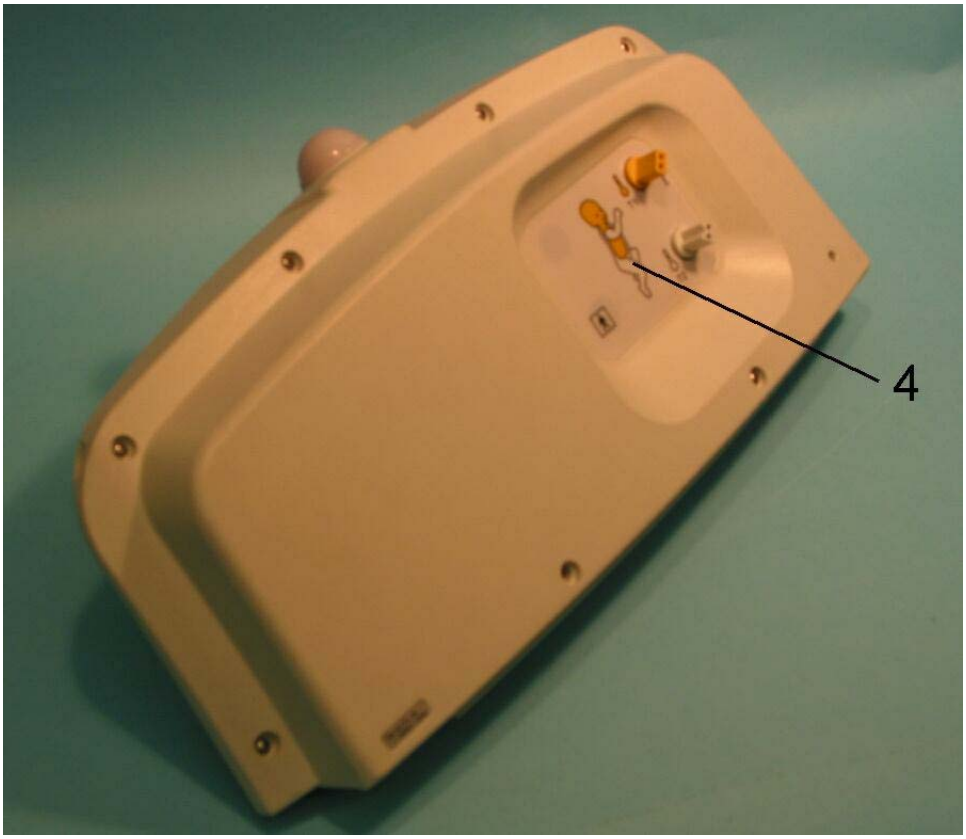
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
1	2M50149	DISPLAY HOLDER	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



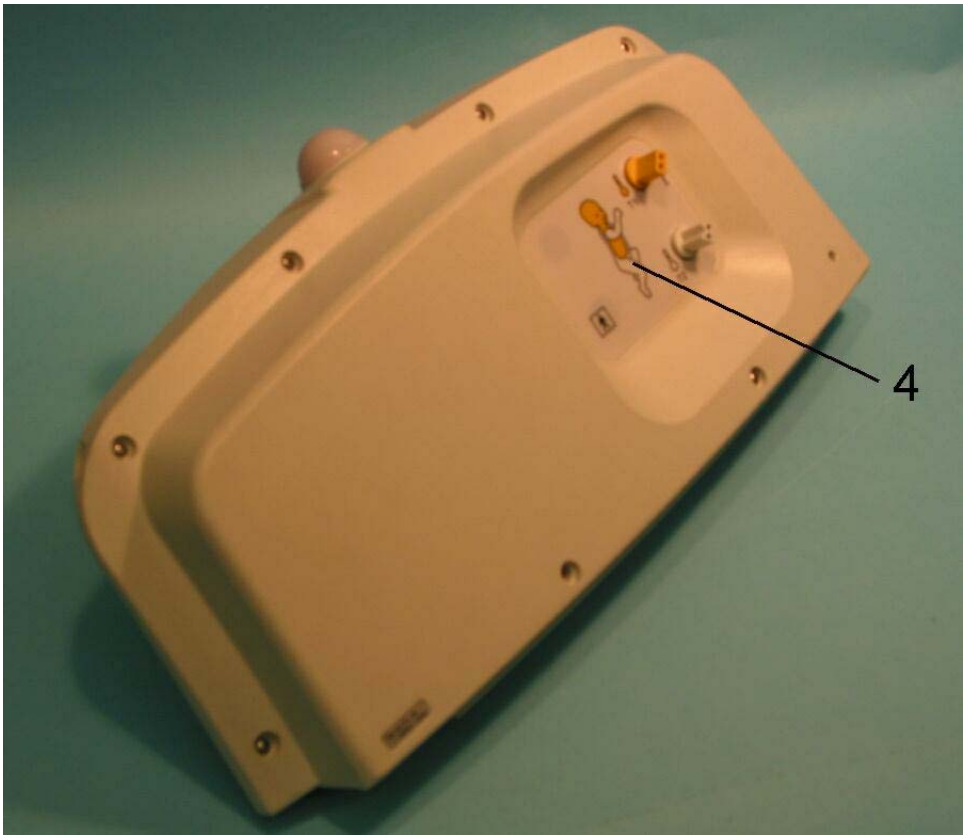
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
2	2M50122	BALL HINGE	1.000	St	
3	2M50128	GRIP SCREW	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



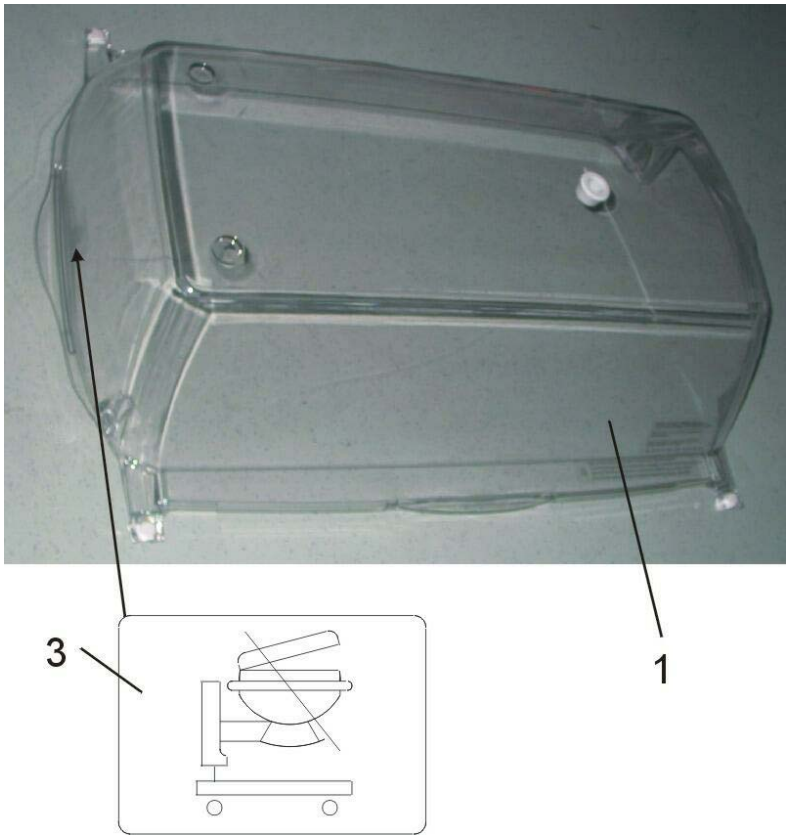
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
4	2M50725	LABEL HT Sensor	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



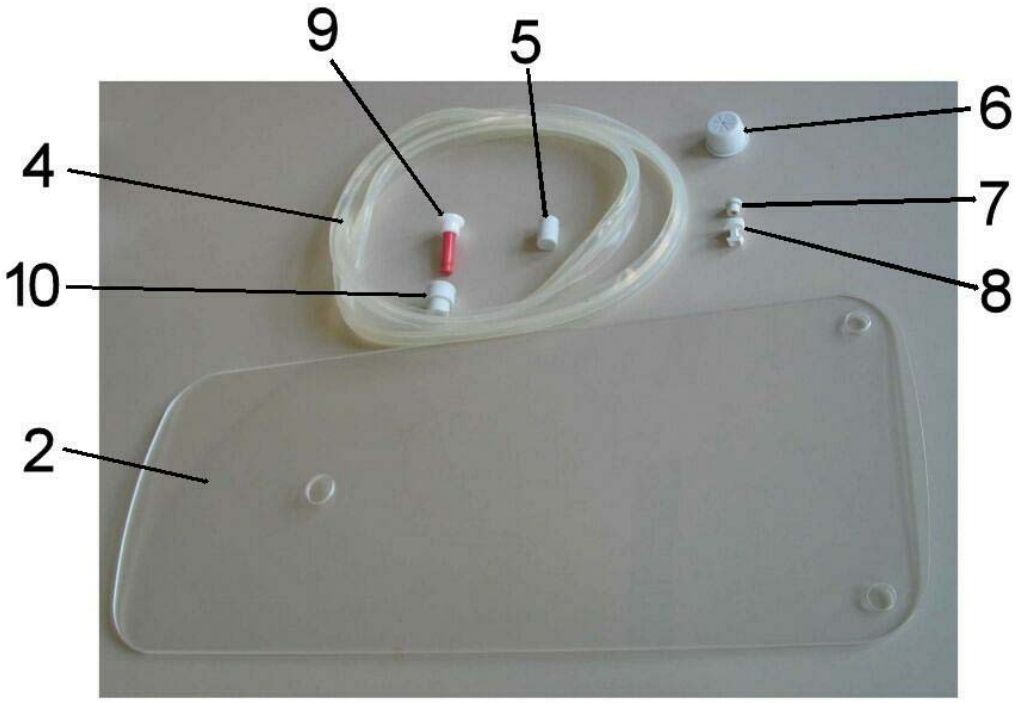
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
4	2M50725	LABEL HT Sensor	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



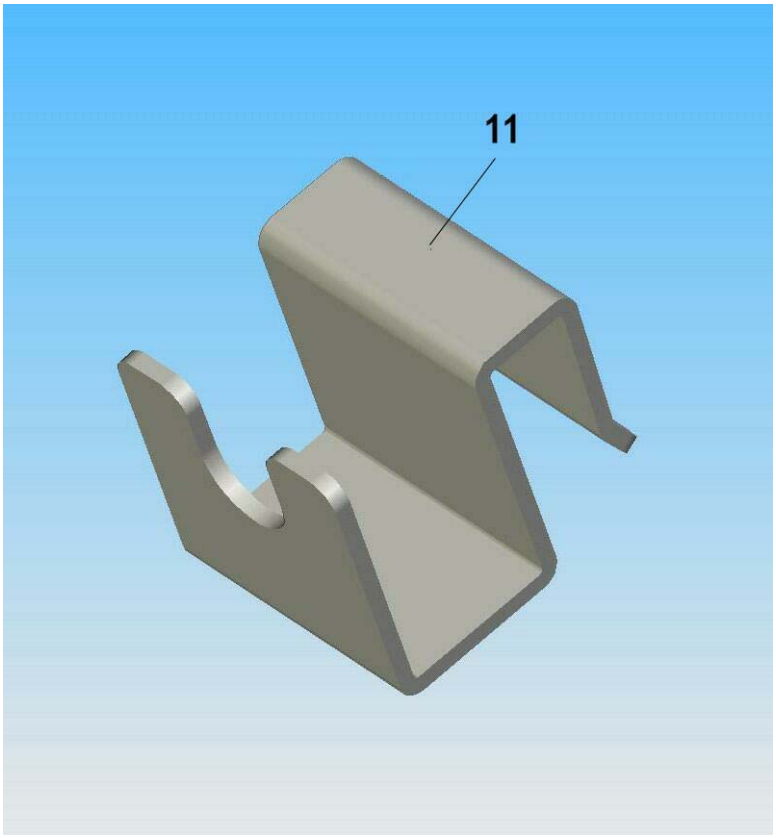
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
1	2M51108	Canopy Caleo	1.000	St	Set of label in the national language must be ordered sepaeratly
3	2M50705	Label-Hood_TO TIP OVER	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



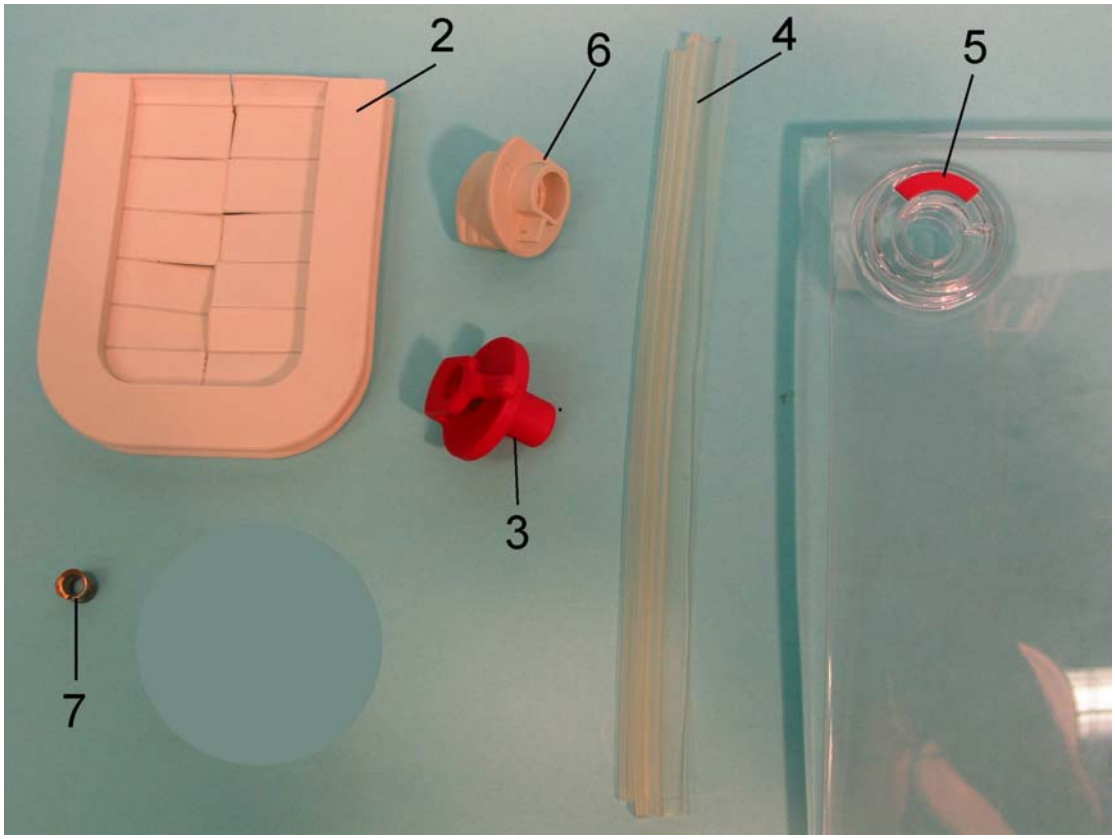
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
2	2M51136	Double wall Caleo	1.000	St	
4	2M51101	Seal hood Caleo	1.000	St	
5	2M51119	Centring lugs	1.000	St	
6	2M51109	Cap feeding drill-hole	1.000	St	
8	2M51032	Guide	1.000	St	
9	2M51153	Slider, complete	1.000	St	
10	2M51116	Sleeve hood Caleao	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



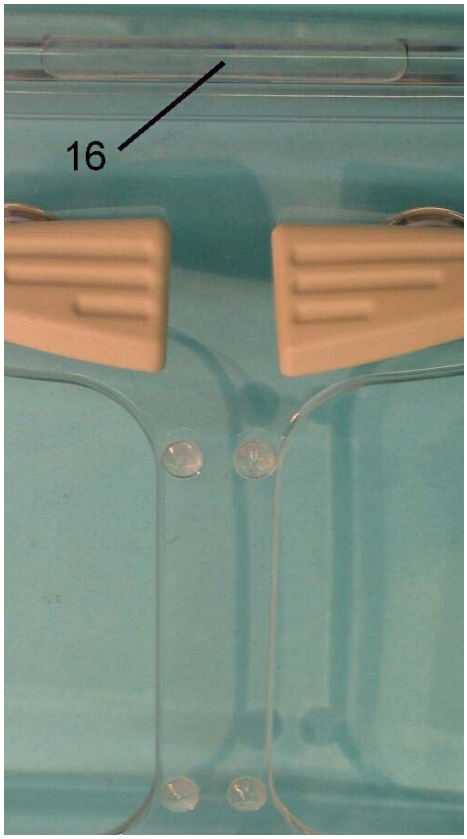
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
11	2M51152	Clamp Caleo	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



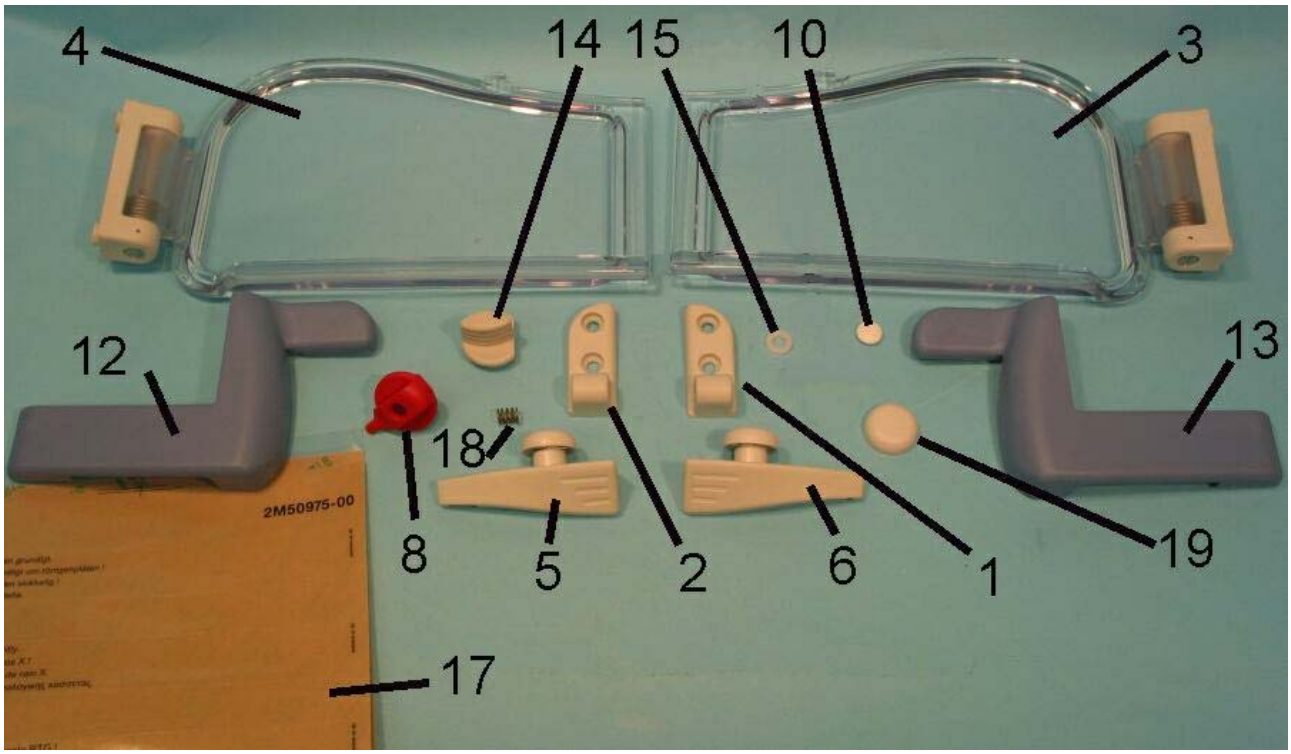
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
2	2M50412	TUBING PORT	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



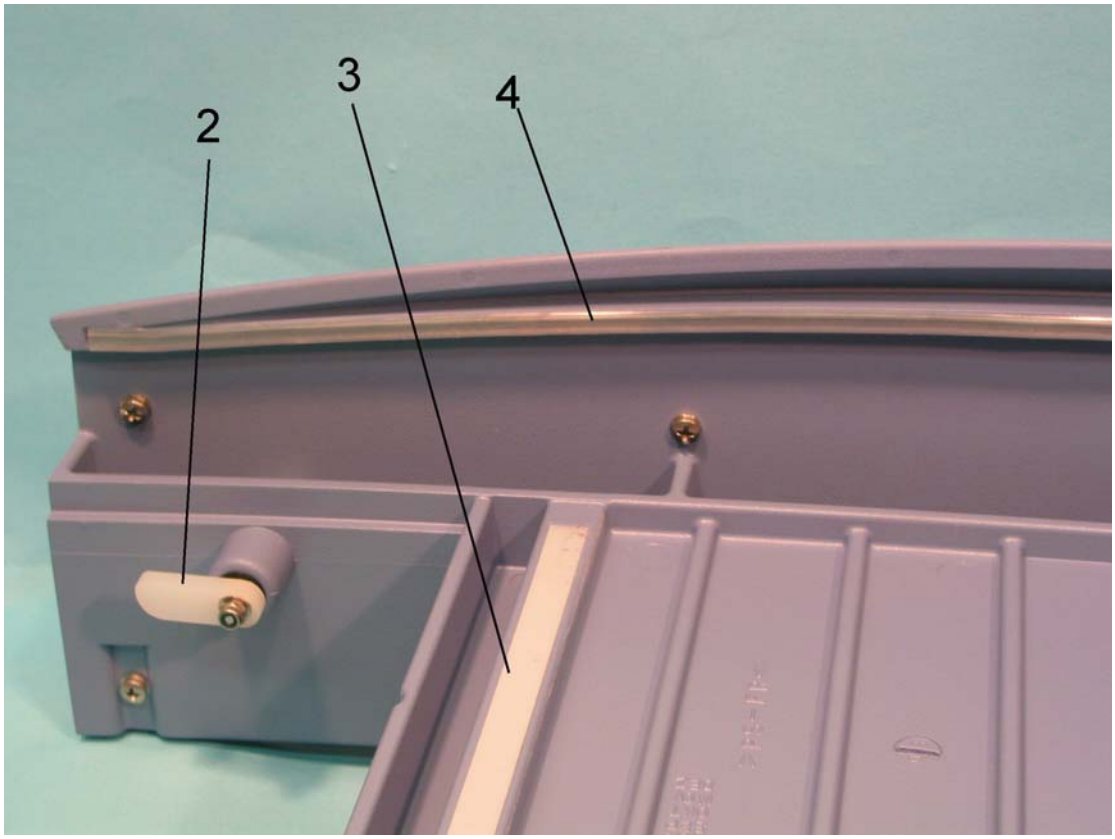
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
16	2M50958	DAMPER	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



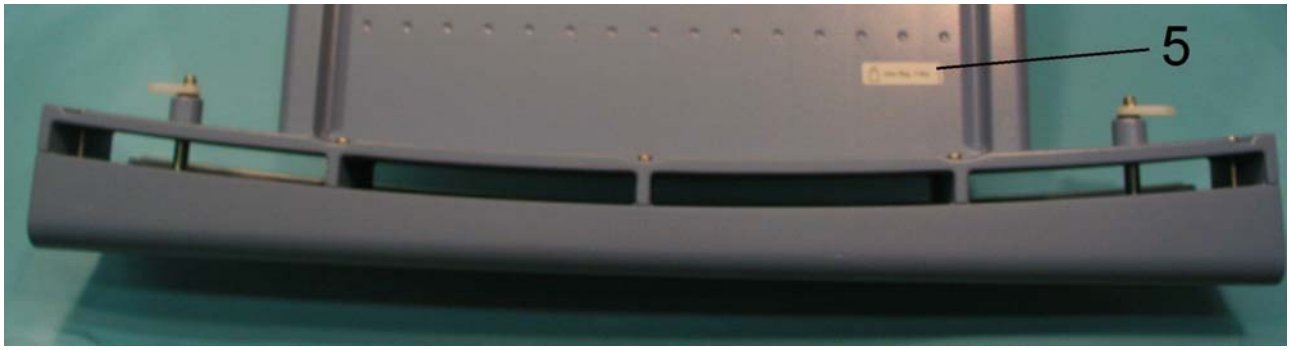
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
10	1344161	CAP	1.000	St	
17	2M50975	Set of lable, big flap	1.000	St	
19	2M50991	Cap	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



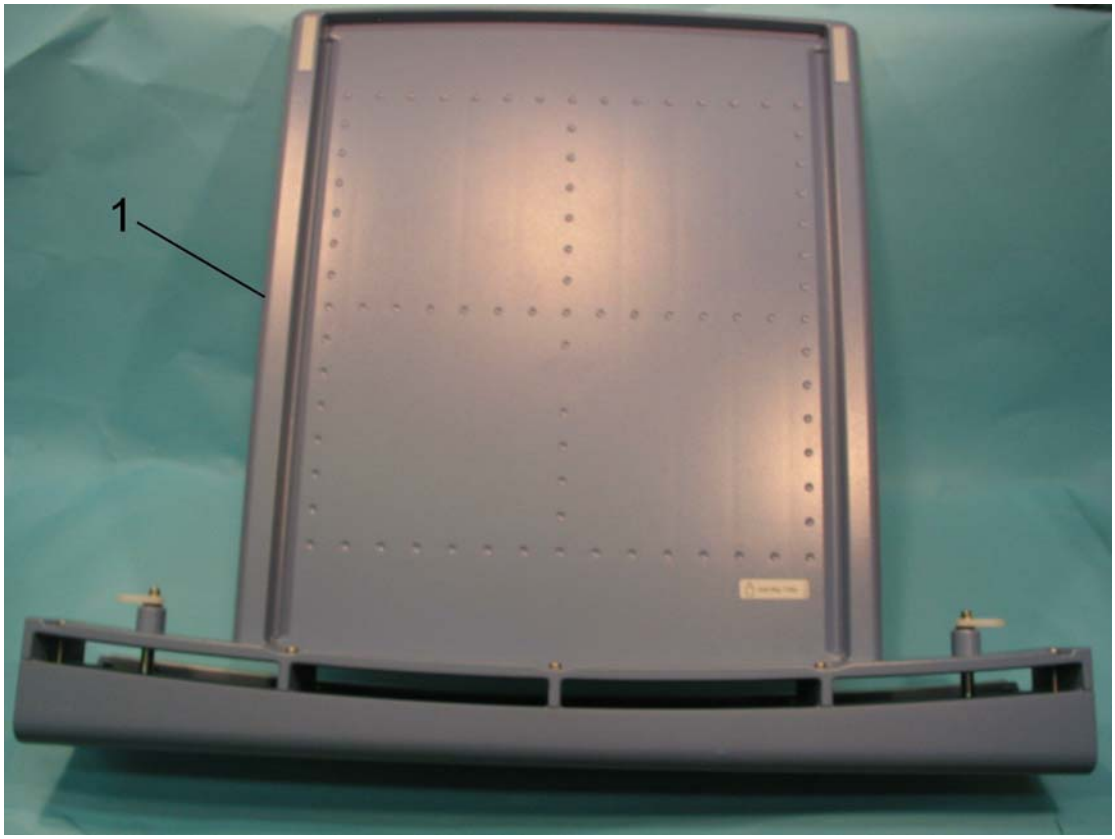
Item No.	Part No.	Description	Qty.	Qty. unit	Remark
3	2M20916	PTFE Adhesive film	1.000	m	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty. unit	Remark
5	2M50732	LABEL 5kg	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty. unit	Remark
1	2M50230	DRAWER, CPL.	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Item No.	Part No.	Description	Qty.	Qty. unit	Remark
1	2M50204	INTERMEDIATE ELEMENT	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Assembly	Description	Part No.
Accessories Caleo		
	02/AIR-CONNECTING HOSE 3M	M29243
	02-CONNEC.HOSE 5M NO PROBE	M30873
	Basic pole	2M50680
	Basket 300	M26145
	Basket 600	M25121
	Bronchial aspirator Paediatric	2M85125
	Catheter receptacle 510	M24670
	COMPACT RAIL	2M85337
	Fixation set, France	2M50080
	Holder for litter bags	M24695
	HOSE 5X2SI 60SHA NF M25779	1203606
	Infusion support	2M21514
	Infusionholder	M20719
	MiniOx3000 oxygen monitor	2M22464
	NOTEBOOKHOLDER	2M22171
	O2-AIR CONNECT.HOSE 3M(BLACK)	M29245
	O2-AIR CONNECT.HOSE 5M (BLACK)	M29265
	O2-AIR CONNECTING HOSE 5M	M29263
	O2-CONNECT.HOSE 3M (BLACK)	M29233
	O2-CONNECT.HOSE 5M (BLACK)	M29253
	O2-FLOWM,32L,RAIL	2M85506
	PHOTO-THERAPY 4000/110V/127V	2M21700
	PHOTO-THERAPY 4000/230V	2M21000
	Pole 25mm/600	2M50689
	Pole 38mm/310	2M50688
	Pole 38mm/600	2M50691
	SET OF WASTE BAGS	M26240
	Shelf	2M50085
	SoftBed Draeger Caleo	MX17012
	SUPPORT PHOTOTHERAPY UNIT 4000	2M21190
	TABLE INCLINABLE,COMPLET	2M21186
	Tray 3020	M24678
	VENTILATION HOSE HOLDER	8411075

Assembly	Description	Part No.
Accessories for servo controll		
	02-CONNEC.HOSE 5M NO PROBE	M30873
	ADAPTER O2 (DIN/NIST)	M32366
	CS-HOSE O2 5M, NO PROBE	M34416
	MiniOx3000 oxygen monitor	2M22464
	O2-CONNECT.HOSE 3M (BLACK)	M29233
	O2-CONNECT.HOSE 5M (BLACK)	M29253
	O2-CONNECTING HOSE 5M	M29251
	O2-CONNECTION HOSE 3M	M29231
	O2-HOSE 5M NIST BL., NO PROBE	M32037
	O2-HOSE NIST 3M DIN PROBE	M34402
	O2-HOSE NIST 5M DIN PROBE	M34403
	O2-ZV-HOSE 5M NIST EN-COLOR	8602515
	O2-ZV-HOSE3M NIST EN-COLOR	8602514
Basic Housing with Scale		
	CABLE CLIP (2,4X92)	8712007
Basic Unit		
	BED AREA CALEO	2M50226
	Cable Australia,3m,10A,C13	1851705
	CABLE CLIP (2,4X92)	8712007
	Cable Great Britian,3m,10A	1851713
	Cableholder	2M50907
	Mains cable Swiss ,3m,10A	1851691
	Power cable 10A, 3m, grey, USA/J	1841793
	Power cable DK, 3 m, 10 A	1851721
	SUPPLY MAIN, 3m, 10A	1851683
	Support	2M50397
	TUBING GROMMET, LARGE	2M50385
Big Flap,cpl		
	Cap	2M50991
	CAP	1344161
	DAMPER	2M50958
	Set of lable, big flap	2M50975

Assembly	Description	Part No.
Consumbles Caleo		
	Air filter Caleo (20pc.)	MX17015
	CAP	2M50042
	Cap feeding drill-hole	2M51109
	MATTRESS-CLOTH/BT8000	2M21272
	O-RING SEAL	2M50346
	SOCKET	2M50039
	SoftBed Draeger Caleo	MX17012
	Supply tubing set Caleo(20pc.)	MX17018
	ThermoTrace Core (5pc)	MX11000
	ThermoTrace Peripheral (5pc)	MX11001
	TUBING GROMMET, LARGE	2M50385
	VACUUM MATTRESS 5400	2M17909
	WATER CONTAINER SET, COMPL.	2M50040
	WATER-CONNECTION,CPL.	2M50237
Drawer		
	DRAWER, CPL.	2M50230
	LABEL 5kg	2M50732
	PTFE Adhesive film	2M20916
Electronic of the Trolley		
	CAP	2M50503
	FUSE LINK T2H IEC127-2/V	1840568
	Fuse-link F10A 6,3X32	1843168
	Locking clamp	1843788
Holder		
	BALL HINGE	2M50122
	DISPLAY HOLDER	2M50149
	GRIP SCREW	2M50128
Hood		
	Canopy Caleo	2M51108
	Cap feeding drill-hole	2M51109
	Centring lugs	2M51119
	Clamp Caleo	2M51152
	Double wall Caleo	2M51136
	Guide	2M51032
	Label-Hood_TO TIP OVER	2M50705
	REP:-SET GUIDE	2M51078
	Seal hood Caleo	2M51101
	Sleeve hood Caleao	2M51116
	Slider, complete	2M51153

Assembly	Description	Part No.
INTERMEDIATE ELEMENT		
	INTERMEDIATE ELEMENT	2M50204
Label-sets		
	LABEL 5kg	2M50732
	Label Battery	2M50709
	LABEL FIXING CASTOR	2M50945
	Label Hand	2M50734
	Label-Hood_TO TIP OVER	2M50705
	SET OF LABELS Caleo da sv no f	2M50591
	SET OF LABELS Caleo de fr it n	2M50590
	SET OF LABELS Caleo en es pt e	2M50592
	SET OF LABELS Caleo en ja	2M50594
	SET OF LABELS Caleo en tr	2M51230
	Set of labels Caleo en zh	2M51200
	SET OF LABELS Caleo enUS fr es	2M50595
	SET OF LABELS Caleo pl cs hu r	2M50593
Maintanance Parts/ServSets		
	Air filter Caleo (20pc.)	MX17015
	BACTERIA FILTERS	CH00102
	O-RING SEAL	2M50346

Assembly	Description	Part No.
Manuals/ Techn.documentation		
	GA Caleo SW 2.n cs	9037750
	IfU Caleo SW 2.n da	9037755
	IfU Caleo SW 2.n ja	9037714
	TD Caleo de	9036115
	TD Caleo en	9036116
	TD Caleo es	9036117
	TD Caleo fr	9036118
	UM Caleo SW 2.n cs	9037604
	UM Caleo SW 2.n da	9037578
	UM Caleo SW 2.n de	9037570
	UM Caleo SW 2.n en	9037571
	UM Caleo SW 2.n enUS	9037572
	UM Caleo SW 2.n es	9037574
	UM Caleo SW 2.n fi	9037713
	UM Caleo SW 2.n fi	9037580
	UM Caleo SW 2.n fr	9037573
	UM Caleo SW 2.n hu	9037592
	UM Caleo SW 2.n it	9037575
	UM Caleo SW 2.n ja	9037584
	UM Caleo SW 2.n nl	9037577
	UM Caleo SW 2.n no	9037579
	UM Caleo SW 2.n no	9037715
	UM Caleo SW 2.n pl	9037603
	UM Caleo SW 2.n pl	9037773
	UM Caleo SW 2.n pt	9037581
	UM Caleo SW 2.n pt	9037749
	UM Caleo SW 2.n ru	9037583
	UM Caleo SW 2.n sk	9037605
	UM Caleo SW 2.n sv	9037576
	UM Caleo SW 2.n zh	9038021

Assembly	Description	Part No.
Modification kits/Options		
	ADAPTER O2 (DIN/NIST)	M32366
	ADAPTOR-O2,DISS-NIST	M34875
	Basic pole	2M50680
	Double wall, compl. Caleo	2M51150
	Infusion support	2M21514
	O2 Adapter NIST / NF-coupler	M35336
	Pole 25mm/600	2M50689
	Pole 38mm/310	2M50688
	Pole 38mm/600	2M50691
	Shelf	2M50085
	Supply tubing set Caleo(20pc.)	MX17018
	SWIVEL CUPBOARD CALEO	2M50565
	TABLE INCLINABLE,COMPLET	2M21186
	WATER CONTAINER SET, COMPL.	2M50040
	WATER-CONNECTION,CPL.	2M50237
Products concerned		
	Caleo	2M50000
Sensor box,O2- Contr, Humidity		
	LABEL HT Sensor	2M50725
	Sealing plug	2M50168
Sensorbox Humidity		
	LABEL HT Sensor	2M50725
	Sealing plug	2M50168
Small Flap,cpl		
	TUBING PORT	2M50412
Tools		
	MiniOx3000 oxygen monitor	2M22464
	Test weight, 1000 g	7911115
	THERMOMETER	2M11111
Ventilation hose holder		
	VENTILATION HOSE HOLDER	8411075

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Test List

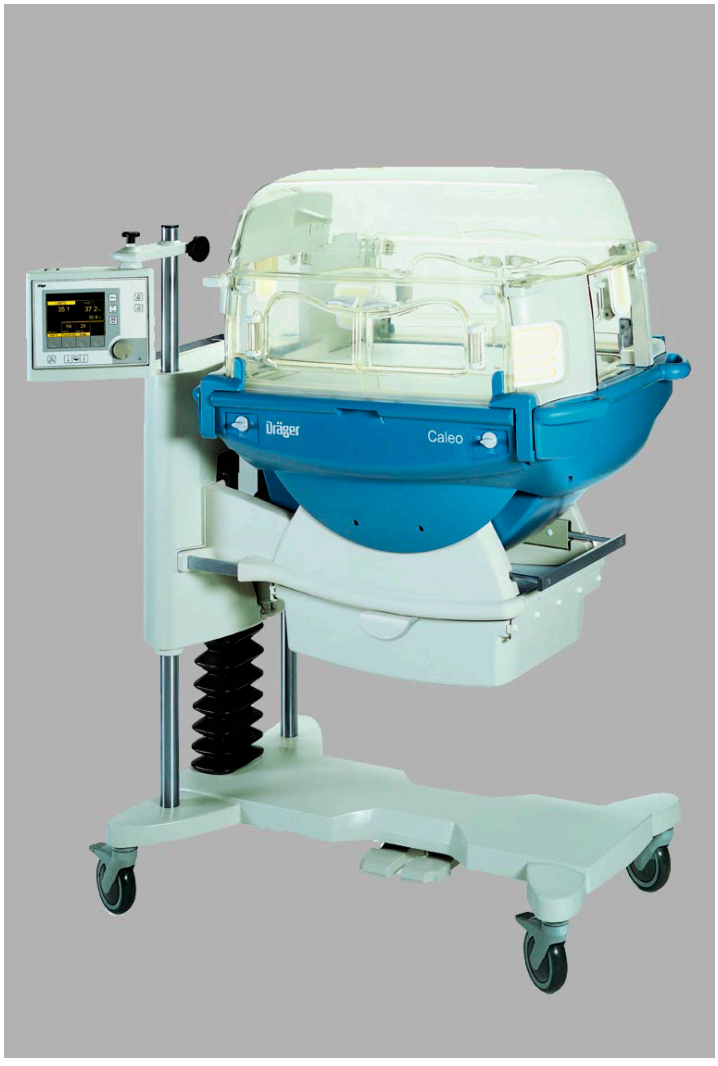
Caleo

Serial no.: _____

Installation site: _____

File no.:
6150.000

Edition:
11/2000



This test list can be processed with standard commercially available test aids and tools, but does not replace the inspections and maintenance work carried out by the manufacturer.

This test list can be processed with standard commercially available test aids and tools, but does not replace the inspections and maintenance work carried out by the manufacturer.

Contents

Contents

1 Checking accompanying documents (Follow national regulations!)

Caleo Instructions for Use/Operating Instructions ☐

Equipment master record ☐

Instructions for Use/Operating Instructions to special accessories ☐

2 Checking the general condition of the Caleo

1. Assemble the Caleo ready for use.
2. Pull the power plug of the Caleo out of the mains socket.
3. Check the following assemblies/subassemblies/components for visible damage (and proper functioning, if necessary):

- Power cord ☐
- Power plug ☐
- Integrated multiple socket outlet ☐
- Canopy ☐
- Double wall (optional) ☐
- Front door ☐
- Large doors including hinges and interlocks ☐
- Small doors including hinges and interlocks ☐
- Hand ports including levers and hinges ☐
- Sensor unit ☐
- Sensor cable ☐
- Sensor cable connector ☐
- Mattress ☐
- Mattress tray ☐
- X-ray drawer ☐
- Hose ducts ☐
- Rating plate ☐
- Display housing ☐
- Trolley ☐

This test list can be processed with standard commercially available test aids and tools, but does not replace the inspections and maintenance work carried out by the manufacturer.

- Corrugated hose of height adjustment (optional) ☐
- Trolley castor ☐
- Drawer ☐
- Ventilator hoses support ☐
- Fresh-air filter ☐
- Mains fuse links
  (Check that fuse links match specifications on rating plate) ☐
- Monitor holder/ventilator holder (optional) ☐
- Water connection set (optional) ☐
- O_2 enrichment with O_2 control (optional) ☐
- Tilt adjustment (optional) ☐
- Height adjustment (optional) ☐
- Bronchial suction device (optional) ☐
- Napkin tray (optional) ☐
- Scale (optional) ☐
- O_2 cylinder holder (optional) ☐
- O_2 connection hose (optional) ☐

WARNING

Make sure the color coding of the gas cylinder hoses complies with the national regulations!

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3 Electrical safety tests

General

The following steps describe the safety checks according to VDE 0751 and IEC 60601 (or UL 2601). The decision whether to carry out safety checks according to VDE 0751 or IEC 60601 must be based on national regulations (VDE 0751 applies to region "Germany").

3.1 Electrical safety check according to VDE 0751.

3.1.1 Checking the protective conductor resistance

1. Switch off the Caleo at the ON/OFF switch.
2. Pull the power plug of the Caleo out of the mains socket.
3. Prepare a test set-up as shown below.

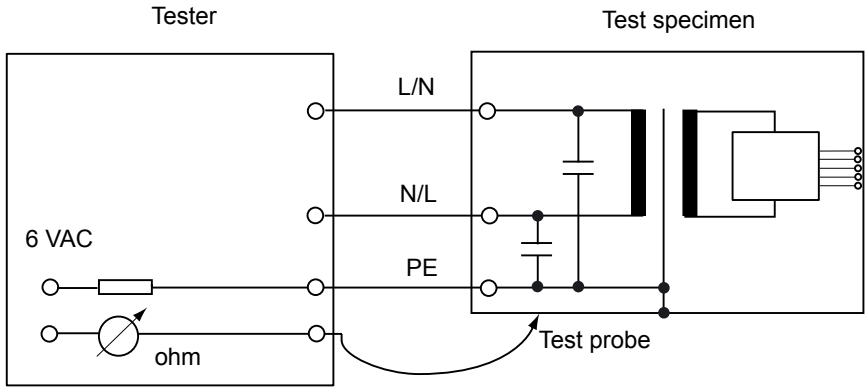

Fig. 1: Protective conductor test set-up

Explanation of the illustration: The test a.c. voltage of the current limiting circuit (approx. 6 VAC) is applied to the test probe. The conductive parts of the test specimen are scanned with the test probe. The tester calculates the protective conductor resistance from the current flow. The protective conductor current should be at least 10 A.

4. Hold the test probe against the ground stud (Note: The ground stud is located on the voltage distributor).

Target value with plug for non-heating apparatus at the mains voltage distributor: The protective conductor resistance should be less than or equal to 0.2 ohms.

3.1.2 Equivalent device leakage current measurement

1. Prepare a test set-up as shown below.

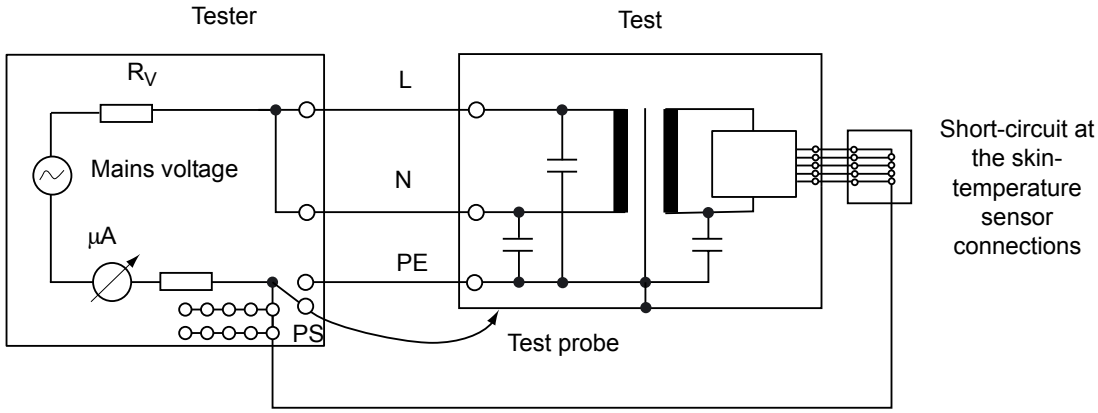

Fig. 2: Equivalent device leakage current test set-up

Explanation of the illustration: A test voltage the same level of the mains voltage is present at the short-circuited power plug of the test specimen. The current that flows from the live parts through the insulation, the capacitors, and the short-circuited application part sockets to the protective conductor is the equivalent device leakage current.

2. Connect the tester to Caleo using the power plug.
3. Switch on Caleo at the ON/OFF switch.

Subsequent measurements may exceed the initial value by max. 50%, but must remain less than or equal to 750 mA.

Initial value

I_{leak} less than/equal to 750 mA | µA |

The actual value is less than/equal to 750 mA ☐

4. Switch off the Caleo at the ON/OFF switch.

3.1.3 Equivalent patient leakage current (skin-temperature module)

1. Prepare a test set-up as shown below.

WARNING

During the following test, a test voltage of 242 VAC is applied to the shorting jumper of the skin-temperature sensor connections. To avoid serious injury, DO NOT TOUCH the shorting jumper during the test procedure!

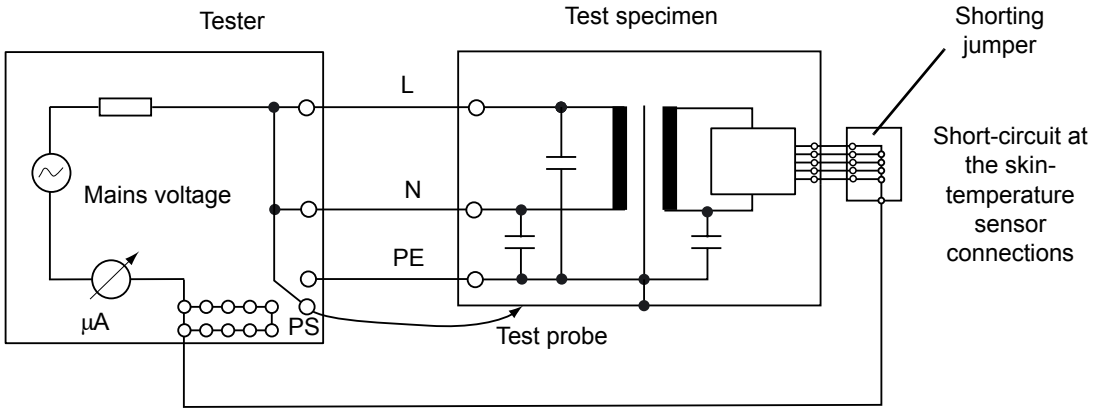

Fig. 3: Equivalent patient leakage current test set-up

Explanation of the illustration: The mains voltage is present as test voltage at the power plug of the test specimen. The current that flows from the live parts through the capacitors, the insulation, and the connected user connections is the equivalent patient leakage current.

Subsequent measurements may exceed the initial value by max. 50%, but must remain less than or equal to 120 mA.

With initial values less than 20 mA, subsequent measurements may deviate by up to 10 mA.

Initial value [µA]

The test value I_{leak} should be less than/equal to 120 mA. ☐

2. Remove test set-up.

This test list can be processed with standard commercially available test aids and tools, but does not replace the inspections and maintenance work carried out by the manufacturer.

3.2 Electrical safety check according to IEC 60601

Checks according to IEC 60601 also cover checks according to UL 2601. Differing limit values are marked.

3.2.1 Checking the protective conductor resistance

1. Switch off the Caleo at the ON/OFF switch.
2. Pull the power plug of the Caleo out of the mains socket.
3. Prepare a test set-up as shown below.

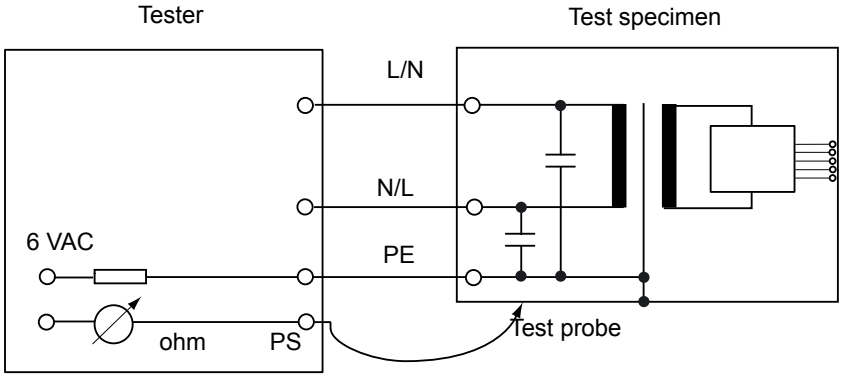

Fig. 4: Protective conductor test set-up

Explanation of the illustration: A test a.c. voltage of a current limiting circuit (approx. 6 VAC) is applied to the protective conductor of the test specimen. The conductive parts of the test specimen are scanned with the test probe. The tester calculates the protective conductor resistance from the current flow. The protective conductor current should be at least 10 A.

Measurement is taken with a test voltage of U = 6 VAC and a test current of I = 10 A.

4. Connect the test cable for protective conductor contact resistance 7900882 to the tester (Note: The black conductor of this test cable is wired to the grounding contacts of the three-pin plug (mount country-specific plug, if necessary).
5. Using the test probe of the tester measure the resistance to the metal parts of the Caleo. Record the protective conductor contact resistance value.
6. Hold the test probe against the ground stud (Note: The ground stud is located on the voltage distributor).

Target value with plug for non-heating apparatus at the mains voltage distributor: The protective conductor resistance should be less than/equal to 0.1 ohms.

3.2.2 Earth leakage current

1. Prepare a test set-up as shown below.

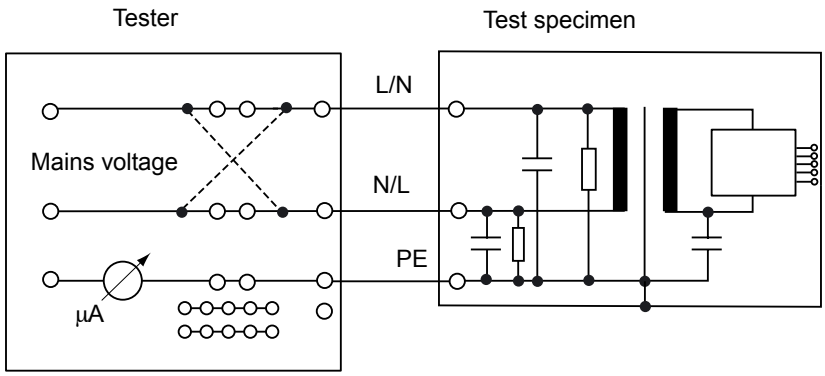

Fig. 5: Earth leakage current test set-up

Explanation of the illustration: The mains voltage is present as test voltage at the power plug of the test specimen. The test specimen is in operating state. The current that flows from the live parts through the insulation or capacitors to the protective conductor is the earth leakage current.

NOTE
The protective conductor is interrupted in the event of a single-fault condition (SFC).

Prerequisite: For the subsequent test, the Caleo and the tester are connected with a power plug.

Normal condition

Target value: I_{earth} less than/equal to 500 mA (Note: according to UL 2601: I_{earth} less than/equal to 300 mA).

Single fault condition (SFC): Power conductor interrupted.

Target value: I_{earth} less than/equal to 1000 mA (Note: (according to UL 2601: I_{earth} less than/equal to 300 mA).

In the following steps the earth leakage current test is repeated, but with the power plug turned over. This condition can be created internally in some types of testers (for example, Secutest).

The Caleo and the tester are connected with a turned-over power plug.

Normal condition

Target value: I_{earth} less than/equal to 500 mA (Note: according to UL 2601: I_{earth} less than/equal to 300 mA).

Single fault condition (SFC): Power conductor interrupted.

Target value: I_{earth} less than/equal to 1000 mA (Note: according to UL 2601: I_{earth} less than/equal to 300 mA).

3.2.3 Patient leakage current (type BF)

1. Prepare a test set-up as shown below.

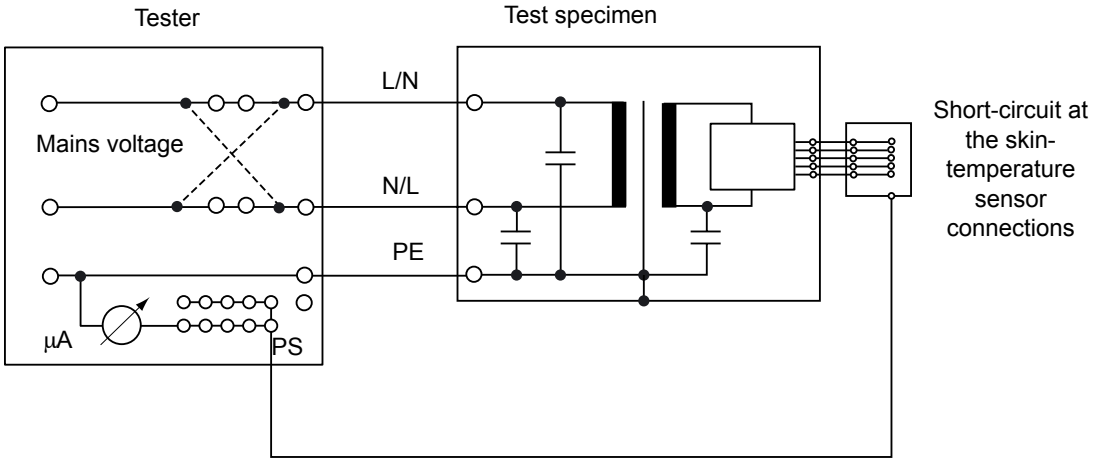

Fig. 6: Patient leakage current test set-up

Explanation of the illustration: The mains voltage is applied as test voltage to the mains connection of the tester. The current that flows from the connected connections of the applied part to the protective conductor is the patient leakage current.

NOTE
The protective conductor is interrupted in the event of a single-fault condition (SFC).

2. Connect the test socket of the tester to the shorting jumper of the skin-temperature sensor connections.

Normal condition

Target value: I_{pat} less than/equal to 100 mA

Single fault condition (SFC): Power conductor interrupted.

Target value: I_{pat} less than/equal to 500 mA

3. Repeat the patient leakage current test is, but with the power plug turned over.

Normal condition

Target value: I_{pat} less than/equal to 100 mA

Single fault condition (SFC): Power conductor interrupted.

Target value: I_{pat} less than/equal to 500 mA

4 Functional tests

4.1 Checking readiness for operation

- Check readiness for operation of the Caleo (see "Checking readiness for operation" chapter in the Instructions for Use/Operating Instructions). ☐
- Then continue with the following tests:

4.2 Checking the air-temperature control

1. Plug the power plug of the Caleo into the mains socket.
2. Switch on Caleo at the ON/OFF switch.

The Caleo runs through its self-test.

3. Use the control knob to set the air-temperature target value to 31 °C.
4. Press the control knob to activate the selected target value.

The Caleo should reach the selected target value. ☐

4.3 Checking the skin-temperature control (optional)

1. Place the skin-temperature sensors into the patient compartment of the Caleo.
2. Plug the skin-temperature sensors into the skin-temperature sensor connections of the sensor unit.
3. Switch on the skin-temperature control at the display housing.
4. Use the control knob to set the skin-temperature target value to 35 °C.
5. Press the control knob to activate the selected target value.

The EL display should show the skin-temperature values. ☐

6. Switch off the skin-temperature control at the display housing.

4.4 Checking the humidity control (optional)

1. Switch on the humidity control at the display housing.
2. Use the control knob to set the humidity target value to 50%.
3. Press the control knob to activate the selected target value.

The Caleo should reach the selected target value. ☐

4. Switch off the humidity control at the display housing.

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4.5 Checking the "water failure" alarm

1. Remove the water container from the Caleo and drain the water.
2. Push the empty water container into the Caleo.

The Caleo generates the following alarms:

- The EL display shows a "water failure" message and prompts the user to refill the container. ☐
- The measured value blinks. ☐
- The intermittent audible alarm sounds. ☐

3. Refill the water container according to the filling method and filling capacity, refer to the Instructions for Use/Operating Instructions for details.

4.6 Checking the scale

1. Switch on the scale function at the display housing.
2. Place the test weight on the mattress tray.

The EL display shows "1000 g" (when using a 1000 g test weight).

3. Switch off the scale function at the display housing.

4.7 Checking the oxygen control (optional)

1. Connect the O_2 hose to the Caleo.
2. Plug the O_2 connector into the pipeline system or into an O_2 cylinder.
3. Switch on the oxygen control at the display housing.
4. Use the control knob to set the oxygen target value to 30 vol.%.
5. Press the control knob to activate the selected target value.

The Caleo should reach the selected target value. ☐

6. Switch off the oxygen control at the display housing.

5 Handover

- Supply fully functional unit to user/owner. ☐

Date: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ Name: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

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2005-11-16

Technical Documentation for Caleo according to EMC standard IEC/EN 60601-1-2: 2001

General Information

The EMC conformity includes the use of following external cables, transducers and accessories (see the following table):

Designation	Order no.
ThermoTrace, skin-temperature sensor, yellow	MX11000
ThermoTrace, skin-temperature sensor, white	MX11001
Optional interface card	2M50671
MEDIBUS cable	8306488

The Caleo should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is inevitable, the Caleo should be observed to verify normal use in the configuration in which it will be used. Other equipment which can be used adjacent to or stacked with the Caleo are listed in the Instructions for Use manual, in the Order List chapter.

Electromagnetic Emissions

Electromagnetic Emissions		
The Caleo is intended for use in the electromagnetic environment specified below. The user should assure that is used in such an environment.		
Emissions	**Compliance according to**	**Electromagnetic environment**
RF emissions (CISPR 11)	Group 1	The Caleo uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
	Class A	The Caleo is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions (IEC 61000-3-2)	Not applicable	Not applicable because RF emissions are class A.
Voltage fluctuations / flicker (IEC 61000-3-3)	Not applicable	Not applicable because RF emissions are class A.

Information re electromagnetic emissions (IEC 60101-1-2: 2001, table 201)

Electromagnetic Immunity

Electromagnetic Immunity			
The Caleo is intended for use in the electromagnetic environment specified below. The user should assure that is used in such an environment.			
Immunity against	**IEC 60601-1-2 test level**	**Compliance level (Caleo)**	**Electromagnetic environment**
electrostatic discharge, ESD (IEC 61000-4-2)	contact discharge: ± 6 kV air discharge: ± 8 kV	± 6 kV ± 8 kV	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
electrical fast transients / bursts (IEC 61000-4-4)	power supply lines: ± 2 kV longer input / output lines: ± 1 kV	± 2 kV Not applicable	Mains power quality should be that of a typical commercial or hospital environment.
surges on AC mains lines (IEC 61000-4-5)	common mode: ± 2 kV differential mode: ± 1 kV	± 2 kV ± 1 kV	Mains power quality should be that of a typical commercial or hospital environment.
power frequency magnetic field 50/60 Hz (IEC 61000-4-8)	3 A/m	3 A/m	In close vicinity to the Caleo, no equipment with extraordinary power frequency magnetic fields (power transformers, etc.) should be operated.
voltage dips and short interruptions on AC mains input lines (IEC 61000-4-11)	dip >95%, 0.5 periods dip 60%, 5 periods dip 30%, 25 periods dip >95%, 5 seconds	>95%, 0.5 per. 60%, 5 per. 30%, 25 per. >95%, 5 sec.	Mains power quality should be that of a typical commercial or hospital environment. If user requires continued operation during power mains interruptions, it is recommended to power the Caleo from an uninterruptible supply or a battery.
radiated RF (IEC 61000-4-3)	80 MHz – 2.5 GHz: 10 V/m	10 V/m	Recommended separation distance from portable and mobile RF transmitters with transmission power P_{EIRP} to the Caleo including its lines: 1.84 m * $\sqrt{P_{EIRP}}$ [X1]
RF coupled into lines (IEC 61000-4-6)	150 kHz – 80 MHz: 10 V within ISM bands, 3 V outside ISM bands [X2]	10 V 3 V	Recommended separation distance from portable and mobile RF transmitters with transmission power P_{EIRP} to the Caleo including its lines: 1.84 m * $\sqrt{P_{EIRP}}$ [X1]

Information re electromagnetic immunity (IEC 60601-1-2: 2001, tables 202, 203, 204)

[X1]: For P_{EIRP} the highest possible "equivalent isotropic radiated power" of the adjacent RF transmitter has to be inserted (value in Watt). Also in the vicinity of equipment marked with the symbol  interference may occur. Field strengths from fixed, portable or mobile RF transmitters at the location of the Caleo should be less than 3 V/m in the frequency range from 150 kHz to 2.5 GHz and less than 1 V/m above 2.5 GHz.

[X2]:ISM bands in this frequency range are: 6.765 MHz - 6.795 MHz, 13.553 MHz - 13.567 MHz, 26.957 MHz - 27.283 MHz, 40.66 MHz - 40.70 MHz.

Recommended separation distances

Recommended separation distances between portable and mobile RF telecommunication devices and the Caleo			
max. P_{EIRP} (W)	**3 V/m distance* (m)**	**1 V/m distance* (m)**	**Note**
0.001	0.06	0.17	
0.003	0.10	0.30	
0.010	0.18	0.55	
0.030	0.32	0.95	e.g. WLAN 5250 / 5775 (Europe)
0.100	0.58	1.73	e.g. WLAN 2440 (Europe), Bluetooth
0.200	0.82	2.46	e.g. WLAN 5250 (not in Europe)
0.250	0.91	2.75	e.g. DECT devices
1.000	1.83	5.48	e.g. GSM 1800- / GSM 1900- / UMTS- mobiles, WLAN 5600 (not in Europe)
2.000	2.60	7.78	e.g. GSM 900 mobiles
3.000	3.16	9.49	

Information re separation distances (IEC 60601-1-2: 2001, tables 205 and 206)

* 3 V/m distance to transmitters with frequencies from 150 kHz to 2.5 GHz, otherwise 1 V/m distance.

Manufacturer:
Dräger Medical AG & Co. KG
Moislinger Allee 53 – 55
D-23542 Lübeck
Germany

Phone: (+49) (0) 1805-3723437
Fax: (+49) 451/882 - 3779

CE 0123

Directive 93/42/EEC
concerning Medical Devices

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