

Dornier *Medilas H*

Service Manual

WARNING

The Dornier *Medilas H* may only be serviced and maintained by authorized persons. Authorized persons are persons trained by Dornier MedTech GmbH or by companies entrusted from Dornier MedTech GmbH only.

Service and maintenance measures performed by unauthorized persons can cause life-threatening injuries and/or serious damages on the Dornier *Medilas H*.

Order number: K2011036 de
K2011037 en

All rights reserved. No part of this service manual may be reproduced or transmitted in any form without permission in writing from Dornier MedTech Laser GmbH.

All rights reserved in case of patent issue or design registration.

Manufacturer

Dornier MedTech GmbH
Argelsrieder Feld 7
D-82234 Wessling

Factory

Dornier MedTech Laser GmbH
Argelsrieder Feld 7
D-82234 Wessling

Dornier Service

Dornier MedTech Europe GmbH - Service department - Argelsrieder Feld 7 D-82234 Wessling Hotline: +49-(0)180-3258621 +49-(0)700-27126699 Office: +49-(0)8153-888-361 Fax: +49-(0)8153-888-359	Dornier MedTech Asia Pte. - Service Department - 2 Corporation Road #05-11/12 Corporation Place Singapore 618494 Hotline: +65-6665-5922 Office: +65 6665 5788 Fax: +65 6665 6711
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Table of Contents

Chapter 1: Safety	page5
General Safety .....	.7
Safety Regulations .....	.7
Laser Safety .....	.8
Protective Goggles .....	.9
Explosion and Fire Hazard .....	.10
Safety Checks .....	.10
Liability .....	.11
Warning and Identification Labels .....	.11
Chapter 2: Specifications	page13
Technical Data .....	.15
Chapter 3: Installation	page17
Packaging .....	.19
Scope of delivery .....	.21
Installation / first start-up .....	.23
Adjustment of mains voltage .....	.23
Filling up the coolant .....	.24
Installing of fiber holder .....	.25
Inspection .....	.25
On-site Installation .....	.25
Deinstallation .....	.27
Draining coolant .....	.27
Chapter 4: Description	page29
Survey .....	.31
Connection diagram of Dornier Medilas H .....	.32
Connection diagram of Dornier Medilas H .....	.33
AC input circuit .....	.34
Power supply .....	.35
CPU board .....	.36
Control panel .....	.37
ACV board .....	.37
Laser safety chain .....	.37
Cooling system .....	.38
Laser head .....	.39
Service mode .....	.40
Menu enlargement in service mode .....	.41
Logbook .....	.42
Analyse .....	.43
Calibration .....	.45
Calibration of internal energy meter .....	.45
Calibration of energy values .....	.48
Peripheral devices calibration .....	.50
Chapter 5: Checking, replacement, adjustment	page59
Overall appliance (closed) .....	.61
Panel parts and their subassemblies .....	.63
Replacing side panel .....	.63

Replacing hood and/or its subassemblies	64
Replacing front panel and/or its subassemblies	68
Replacing rear panel	69
Overall unit (open)	70
Cooling system	72
Replacing subassemblies in the cooling system	72
Replacing pump	74
Replace ACV board	75
CPU board	76
Replacing CPU board	76
Replacing coin cell	77
Replacing PCB minimodul	78
Replacing laser power supply	79
Electricity complete	80
Laser head	81
Replacing shutter	83
Checking, adjusting Monitoring switch	84
Replacing resonator mirror	85
Replacing monitor board	86
Replacing pilot laser	87
Replacing cavity and/or its subassemblies	88
Adjusting resonator	94
Adjusting output coupler with regard to laser rod	95
Pre-setting reflector mirror	96
Fine adjustment of the reflector mirror	97
Adjusting pilot laser coaxially with regard to the therapy laser beam (units til serial number H20-079)	98
Adjusting pilot laser coaxially with regard to the therapy laser beam (units from serial number H20-080)	99
Adjust fiber coupler	100
Chapter 6: Maintenance	page103
Replacing ion exchanger	105
Replacing water filter	106
CPU - Software Upload	107
Chapter 7: Troubleshooting	page109
Errors with displayed error codes	111
Errors without displayed error codes	114
Laser cannot be switched on with key switch	114
Display remains dark or	
key pressing is recognized wrong or not at all	114
System reports overtemperature repeatedly (error code "1" in Logbook)	114
Pilot laser is not visible very well or not at all at distal end of fiber	115
No laser pulse is emitted	115
Laser pulse aborts prematurely	115
Therapeutic effect is too low	116
Status LED's of CPU	117
Chapter 8: Spare parts	page119
Spare parts list	121
Order list	123





1 Safety

General Safety	7
Safety Regulations	7
Laser Safety	8
Protective Goggles	9
Explosion and Fire Hazard	10
Safety Checks	10
Liability	11
Warning and Identification Labels	11

Lined writing area consisting of 25 horizontal lines.

Large grid area consisting of 25 columns and 25 rows.

Section 1 contains the safety regulations concerning the handling of the Dornier Medilas H.

In order to work on and with the Dornier Medilas H, the user must be familiar with and observe the safety regulations.

1.1 General Safety

The Dornier Medilas H is a medical laser belonging to class IV according to IEC 825. The unit emits high laser energy in the invisible spectral range of 2080 nm.

Do not expose eyes and skin to direct, reflected or scattered laser radiation. Laser radiation can cause irreversible damage to eyes and skin. The pilot laser can also damage the retina (when the eye is directed straight to the beam).

1.2 Safety Regulations

The following safety regulations must be observed when handling the Dornier Medilas H:

BGV B2	Regulations for prevention of accidents "laser emission"
VDE 0107	Electrical installation
DIN IEC 601, VDE 0750 Part 1, 0751	Electrical safety, medical products
DIN 57836 / VDE 0836	Electrical safety of laser devices
IEC 60825 / DIN VDE 0837	Laser safety regulations
MDD/MPG	European Medical Device Guidelines

The user must keep the operating manual accessible at all times.

1.3 Laser Safety

- All valid regulations concerning radiation protection must be observed when operating the Dornier Medilas H. In case of doubt regarding a regulation, get in touch with the laser safety officer appointed by your hospital or with a authorized service office.
- The Dornier Medilas H generates a high-energy laser beam. The direct or reflected laser beam can cause irreversible damage to the eyes (retina) and skin. Do not aim the laser beam directly to the eye or skin. The safety goggles provide only temporary protection from direct laser light.
- The laser area is the area in which the maximum allowed radiation can be reached or exceeded. The risk of an involuntary deflection of the laser beam must be taken into account when defining the laser area.
- Protective goggles according to the national valid standard must be worn within the laser area (L4). When hand applicators are used for open work, the whole operating room is considered as laser area.
- The laser area must be identified with door signs and red warning lights. The laser area must be kept as small as possible and secured against entry by unauthorized persons.
- The number of persons stationed within the laser area must be kept at a minimum.
- Ensure that there are no bright, reflecting or inflammable objects in the laser area. Remove all bright, reflecting or inflammable objects from the laser area.
- Laser radiation can alter substances. Take care to prevent the formation of gas, dust or mist caused by laser radiation. Endangered substances must be removed from the laser area or appropriately protected.
- During laser treatment, use only instruments which are appropriate for laser treatment. The surface quality and the form of the instruments appropriate for laser treatment prevent reflection of the laser beam.
- The appropriate protective equipment must be available in good condition and in sufficient quantity.
- When working with an endoscope without video camera, use the appropriate laser protection filter for the endoscope. When the laser protection filter is used, the operator does not need to wear safety goggles. All other persons present must wear safety goggles.
- When applying laser radiation in body areas which contain oxygenated air or in which inflammable gases or vapors are present or might form, take appropriate protective action to prevent combustion or explosion.
- Once a year, all persons who work in the laser area must be instructed in laser safety and device operation. Participation in the instruction must be confirmed in writing.

1.4 Protective Goggles

During laser operation with the Dornier Medilas H, all persons present must wear safety goggles with lateral protection and the following inscription:

The type designation of the safety goggles is as follows:

I	2080	L4	X	DIN	
I					Laser type (I stands for pulsed laser).
	2080				Wavelengths in nm; other metric units (e.g. μm) are also allowed, provided the unit is indicated in print.
		L4			Protective level according to: EN 207:2002
			X		Manufacturer's (X) identification

The safety goggles protect the wearer only from the reflected laser beam which has a wavelength corresponding to the inscription on the safety goggles.

Even when wearing safety goggles, do not look directly into the laser beam path.

The safety goggles protecting from the therapy laser beam do not protect from the pilot laser beam.

The power of the pilot laser at the fiber outlet is less than 1 mW. Do not look directly into the pilot laser beam. The visual perception of the reflected pilot laser beam does not present a risk.

WARNING

The recommended protection class is valid only for delivery systems without imaging optic, for example a fiber with bare tip. An effective protection for delivery systems with imaging optic (for example a focusing handpiece) is only guaranteed when it is used in accordance with the regulations of the user manual. Additionally the respective actual national laser safety standards (for example IEC 60825) have to be observed.

1.5 Explosion and Fire Hazard

Do not use the Dornier Medilas H in the vicinity of inflammable anesthetics or highly volatile mixtures such as alcohol or gasoline.

1.6 Safety Checks

Safety checks means maintenance and adjustment at regular intervals.

Safety checks guarantee the safe and reliable operation of the Dornier Medilas H.

The safety checks on Dornier Medilas H should be performed in intervals of 1 million pulses or every 12 months at least. If the interval is exceeded, a message appears on the display of the Dornier Medilas H.

A safety check is necessary after each repair and each change of location outside of the hospital or doctor's practice.

WARNING

Only authorized persons may perform safety checks on the Dornier Medilas H.

Authorized persons are exclusive persons who have been trained by Dornier MedTech Laser GmbH or by a company appointed by Dornier MedTech Laser GmbH.

Safety checks performed by non-authorized persons can result in critical injury to persons and/or serious damage to the Dornier Medilas H.

1.7 Liability

In accordance with the laser safety regulations under BGV B2 (consider national standards), the purchasing unit or the user must appoint a laser safety officer in writing. The laser safety officer is responsible for:

- the implementation of safety measures
- the instruction of all persons concerned as to safety measures and correct handling of the Dornier Medilas H
- the correct marking of the laser area
- the inspection of the warning lights
- the correct use of the Dornier Medilas H during treatment
- the safe custody of the key
- the safe custody of the Dornier Medilas H
- the correct connection of the Dornier Medilas H after a change in installation site

The following conditions must be fulfilled before activating the Dornier Medilas H for the first time:

- delivery in working condition by Dornier Service or by persons authorized by Dornier MedTech Laser GmbH
- acceptance by responsible purchasing unit
- appointment in writing of laser safety officer by purchasing unit or user
- registration of Dornier Medilas H with the employer's liability insurance association and the authority responsible for labor protection
- implementation of all safety measures
- control of operating sequences and procedures even in case of breakdown

1.8 Warning and Identification Labels

The position and content of the warning and identification labels are shown in the valid drawings, which are delivered with each set of labels. Observe the drawings when replacing, pasting over, removing or adding labels.

2 Specifications

Technical Data

15

Lined writing area consisting of 25 horizontal lines.

Grid writing area consisting of a 25x25 grid.

2.1 Technical Data

Parameter	Data
Connection data	
Voltage	115 or 208 or 230 VAC
Frequency	50/60 Hz
Power consumption with 115 VAC with 208 and 230 VAC	1850 VA max. 2200 VA max.
Climate	
Ambient temperature	+15° C to +30° C
Relative humidity	30% to 85% non-condensating
Atmospheric pressure	700 hPa to 1060 hPa
Size and Weight	
Height	1100 mm
Width	270 mm
Depth	730 mm
Weight	approx. 85 kg
Noise emission	
Noise emission max.	L < 65 dB
Typical noise emission	L < 55 dB
Therapy laser	
Wavelength	2080 nm
Laser energy	400 to 2500 mJ
Pulse duration	≤ 350 μs
Pulse repetition rate	3 to 12 Hz
Pilot laser	
Wavelength	532 nm
Laser power	< 1 mW



3 Installation

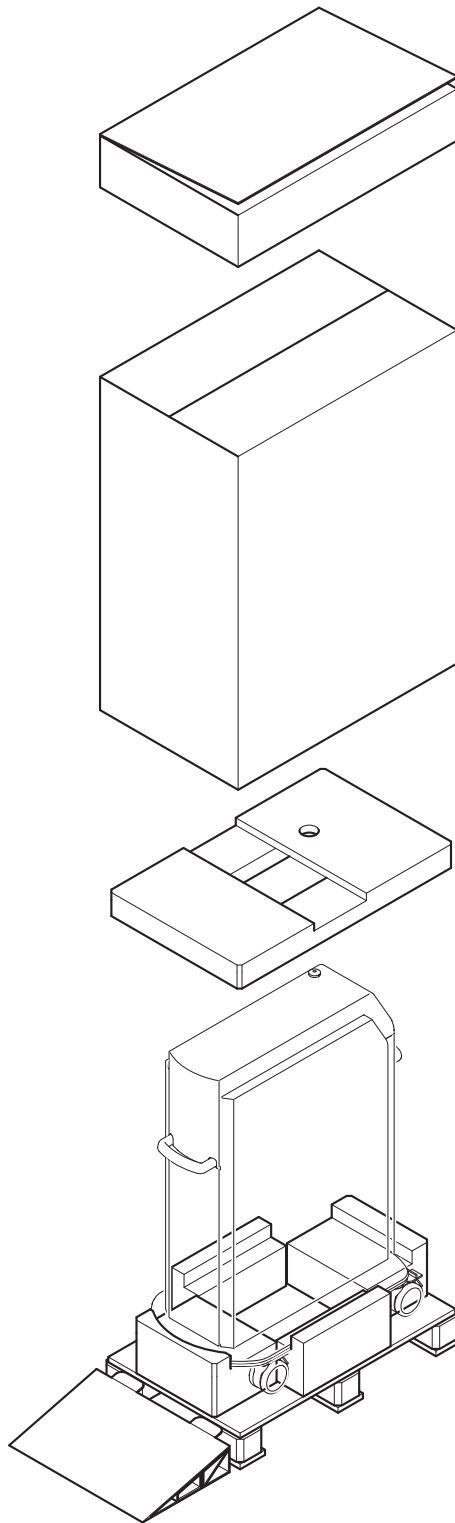
Packaging	19
Scope of delivery	21
Installation / first start-up	23
Adjustment of mains voltage	23
Filling up the coolant	24
Installing of fiber holder	25
Inspection	25
On-site Installation	25
Deinstallation	27
Draining coolant	27

Lined writing area consisting of 25 horizontal lines.

Large grid area consisting of 25 columns and 25 rows.

3.1 Packaging

Fig. 1
Packaging



Packaging, compl. K2010754

3.2 Scope of delivery

The following components are included in the delivery with the Dornier Medilas H:

- 1 foot switch
- 2 keys for the key switch
- 1 power cable
- 1 door-contact plug with bridge
- 1 fiber holder
- 1 operating manual
- 1 set of signs including a warning sign for OR door

3.3 Installation / first start-up

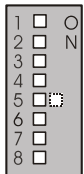
3.3.1 Adjustment of mains voltage

The Dornier Medilas H can be operated with 115VAC, 208VAC or 230VAC. A line with 4 wires comes from toroidal transformer RTO300. Two of this wires are connected to the transformer relay.

- 1 Dependent on mains voltage connect the corresponding wires to the transformer relay.
- 2 Dependent on mains voltage switch dip switch of CPU as shown below.

Fig. 2

AC input circuit
(new version; old
version see page 34)



DIP switches
5 OFF = 230VAC
5 ON = 115VAC

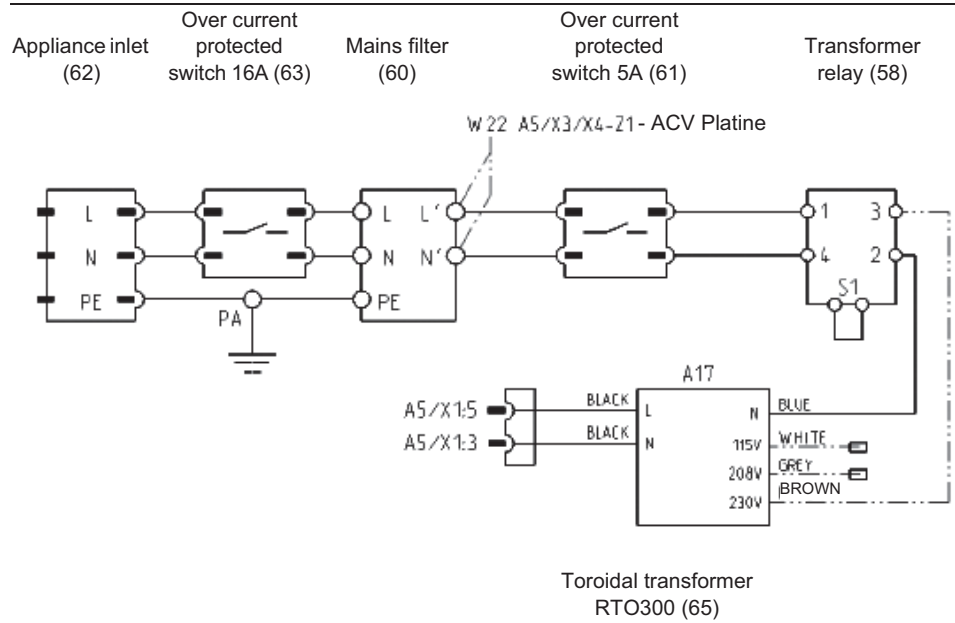
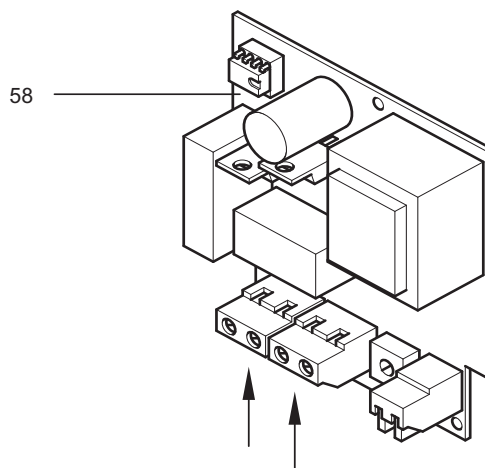


Fig. 3

Transformer relays



(58) Transformer relay K2010892

3.3.2

Filling up the coolant

WARNING High voltage

When the unit is switched on, housing of the pump, the heat exchanger, the laser power supply and the EMC hood are under tension (half mains voltage).

Preparation

- 1 Remove right side panel, see page 63.

Procedure

- 2 Fill 3 to 4 litre de-ionized water in the tank of the cooling system. For that please pay attention to fig. 40 on page 72 also.

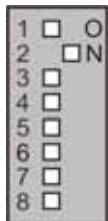
Caution

Absolutely take care not to spill any water while you are fill it in. Nevertheless, if water has been spilled, the Dornier Medilas H must not be operated and has to be sperated from mains until all liquid is eliminated.

With the following working step the cooling system ist ventilated for a short time. Thus the pump is filled with coolant and a dry running is prevented.

- 3 Open the water filter for a short time. As soon as the water is risen narrow below to the hose bend at the pressure side of the pump, close the water filter.

Fig. 4
screen: PERIPHERAL
DEVICES



DIP switch on CPU

PERIPHERAL DEVICES		
Act. Temp 20.4 °C Water	Pilot off min. Pilot med. Pilot max. Pilot	3.2 l/min Pump on/off Flow Ctrl off
20.4 °C ▲ Calibrate ▼	0.0 % ▲ Pilot ▼	0 ▲ Fan Step ▼
		Calibrate Fan Shutter Closed Exit

- 4 Set DIP switch 2 to ON-position (Fig. 4).
- 5 Switch on Dornier Medilas H.
- 6 Press key "Pump on/off" and switch on the pump.
- 7 Wait until the cooling system is bled (approx. 1 minute) and the water flow is 3.0 l/min.
- 8 Switch off Dornier Medilas H.
- 9 Fill tank with de-ionized water up to level indicator.
- 10 Insert the bag with the ion exchanger into the tank.
- 11 Set DIP switch 2 to OFF-position (Fig. 4).

3.3.3 Installing of fiber holder

- 1 Unpack the fiber holder and fix it into the fiber holder socket on the top of the hood (s. page 64).
- 2 Check fiber holder if it fits firmly.

3.3.4 Inspection

Perform the inspection according to the installation report (see appendix).

3.3.5 On-site Installation

The Dornier Medilas H may be used only in a medically used room where the installation complies with VDE 0107 or with the corresponding national installation standard. The Dornier Medilas H must be connected to a separately fused socket. The Dornier Medilas H is a device belonging to safety class 1 according to IEC 601. The Dornier Medilas H must therefore be grounded according to the regulations.

The Dornier Medilas H has to be positioned so that a sufficient cooling is ensured. For this there must be a minimum distance of 50 cm to objects with large surfaces. Installation in closed lockers is not permitted.

Do not use the Dornier Medilas H in the vicinity of inflammable anesthetics or highly volatile mixtures such as alcohol or gasoline.

WARNING

Ensure that there is a laser warning sign and a laser warning light, which indicate the operation of the laser (BGV.B.2/Germany), on each access door.

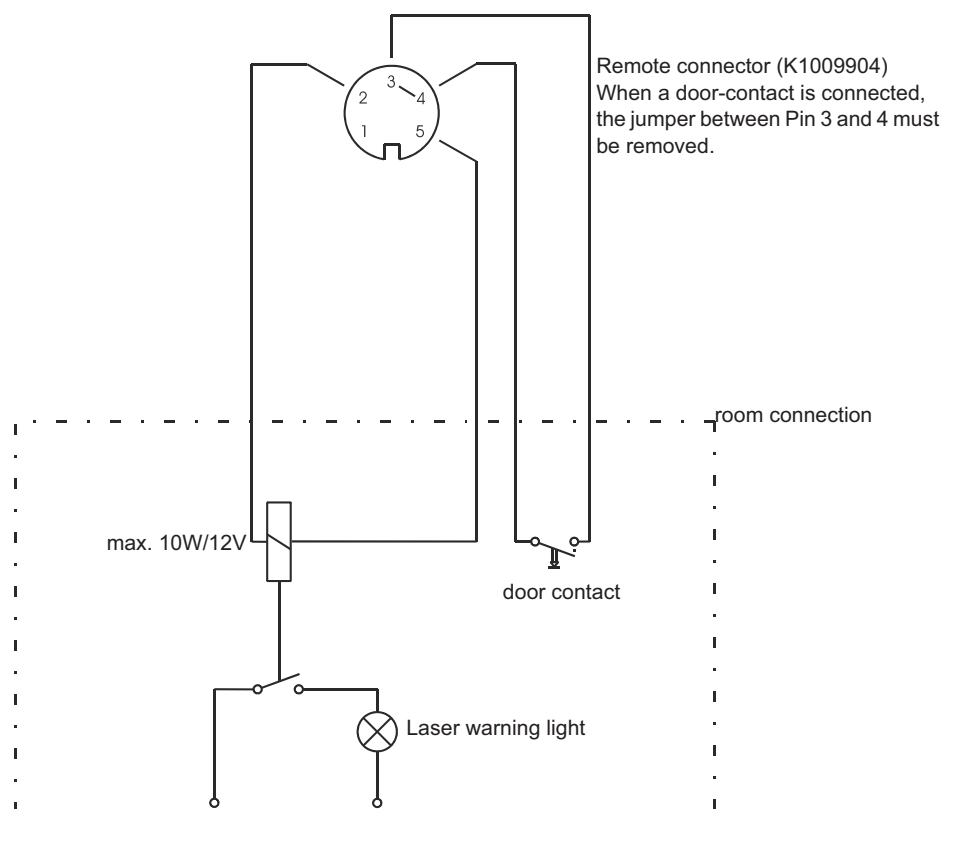
Note

The service technician must check the on-site installation before the initial startup.

The access doors can be equipped with door switches. In this case, the door switches must be series-connected. When a door is opened, the door-contact circuit is interrupted.

The door-contact circuit can be connected to "Remote connector" according to fig. 5.

Fig. 5
 Connection diagram for
 door contact and laser
 warning light



3.4 Deinstallation

Caution!

The Dornier Medilas H must not be exposed to temperatures of less than 5° C (41° F), because of the internal cooling water.

If the Dornier Medilas H should be transported or stored at temperatures less than 5° C (41° F), the Dornier Medilas H must be climatized by Dornier Service. Failure to climatize the Dornier Medilas H can damage it.

3.4.1 Draining coolant



WARNING:

It is to avoid the direct contact with the power supply housing and the laser cavity protection hood if the advice switched on, high leakage current can flow over the housing, protection hood, water pump and heat exchanger and cause a strong health damage.

WARNING High voltage

When the unit is switched on, housing of the pump, the heat exchanger, the laser power supply and the EMC hood are electrified (half mains voltage).

Preparation

- 1 Remove side panel parts, see pages 63.

Procedure

- 2 Place a flat container (vol. approx. 3 liters) under the Dornier Medilas H to catch the coolant.
- 3 Remove the seal from the drainage hose (s. page 73).
- 4 Place the drainage hose into the flat container.
- 5 Open the cap of the tank of the cooling system and let the cooling agent drain completely off.
- 6 Open the particle filter, take the cartouche out and drain the residual water off.

4 Description

Survey	31
Connection diagram of Dornier Medilas H (version < SN 80)	32
Connection diagram of Dornier Medilas H (version > SN 79)	33
AC input circuit	34
Power supply	35
CPU board	36
Control panel	37
ACV board	37
Laser safety chain	37
Cooling system	38
Laser head	39
<hr/>	
Service mode	40
Menu enlargement in service mode	41
Logbook	42
Analyse	43
<hr/>	
Calibration	45
Calibration of internal energy meter	45
Calibration of energy values	48
Peripheral devices calibration	50

The table consists of two main columns. The first column on the left contains 27 horizontal lines, serving as a list of items. The second column on the right is a large grid of 18 columns and 27 rows, corresponding to the items in the first column. Each cell in the grid is empty, providing space for a description of each item listed on the left.

4.1

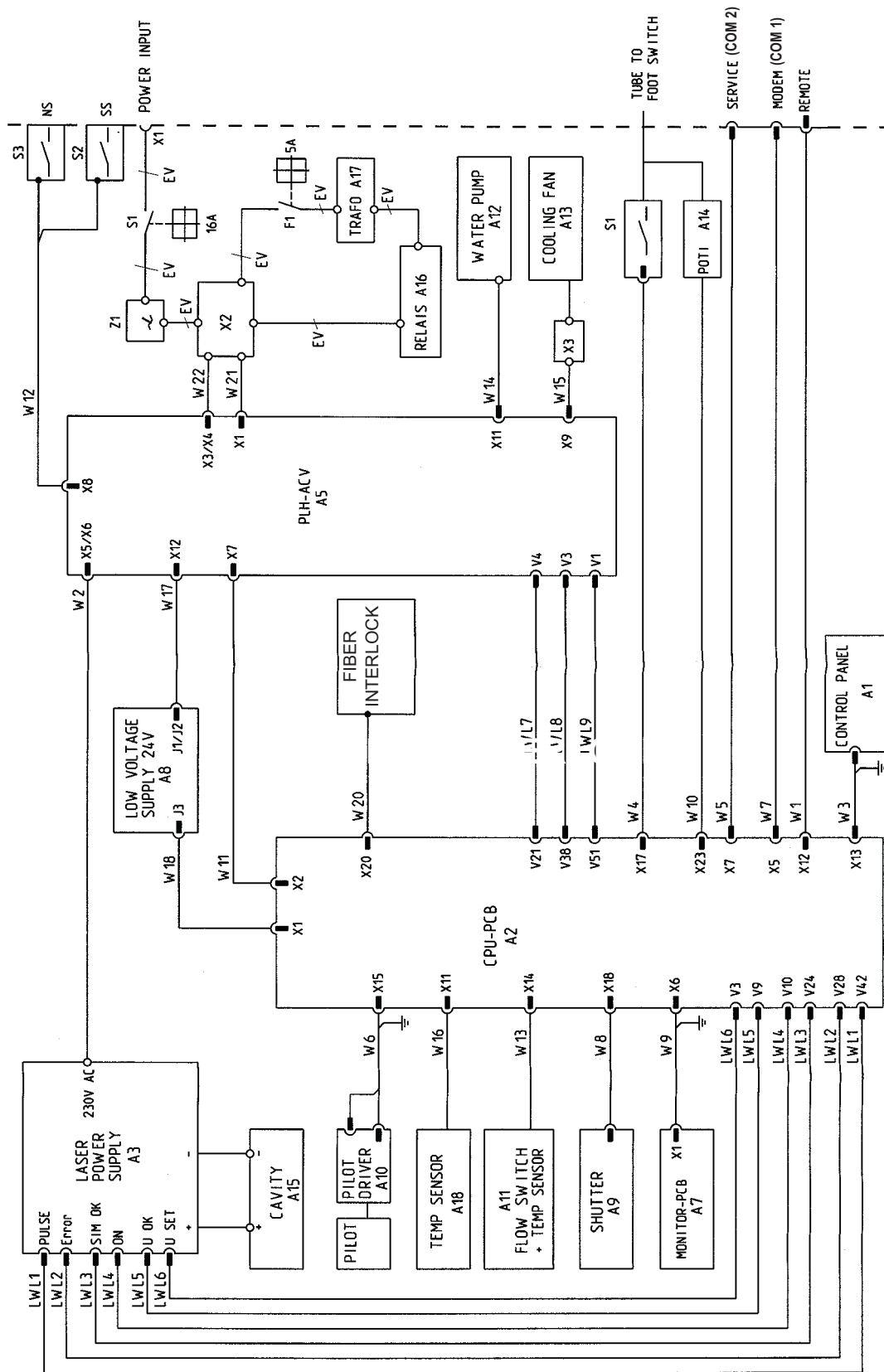
Survey

The Dornier Medilas H is designed in modular system. The identification and replacement of defective components is quick and easy.

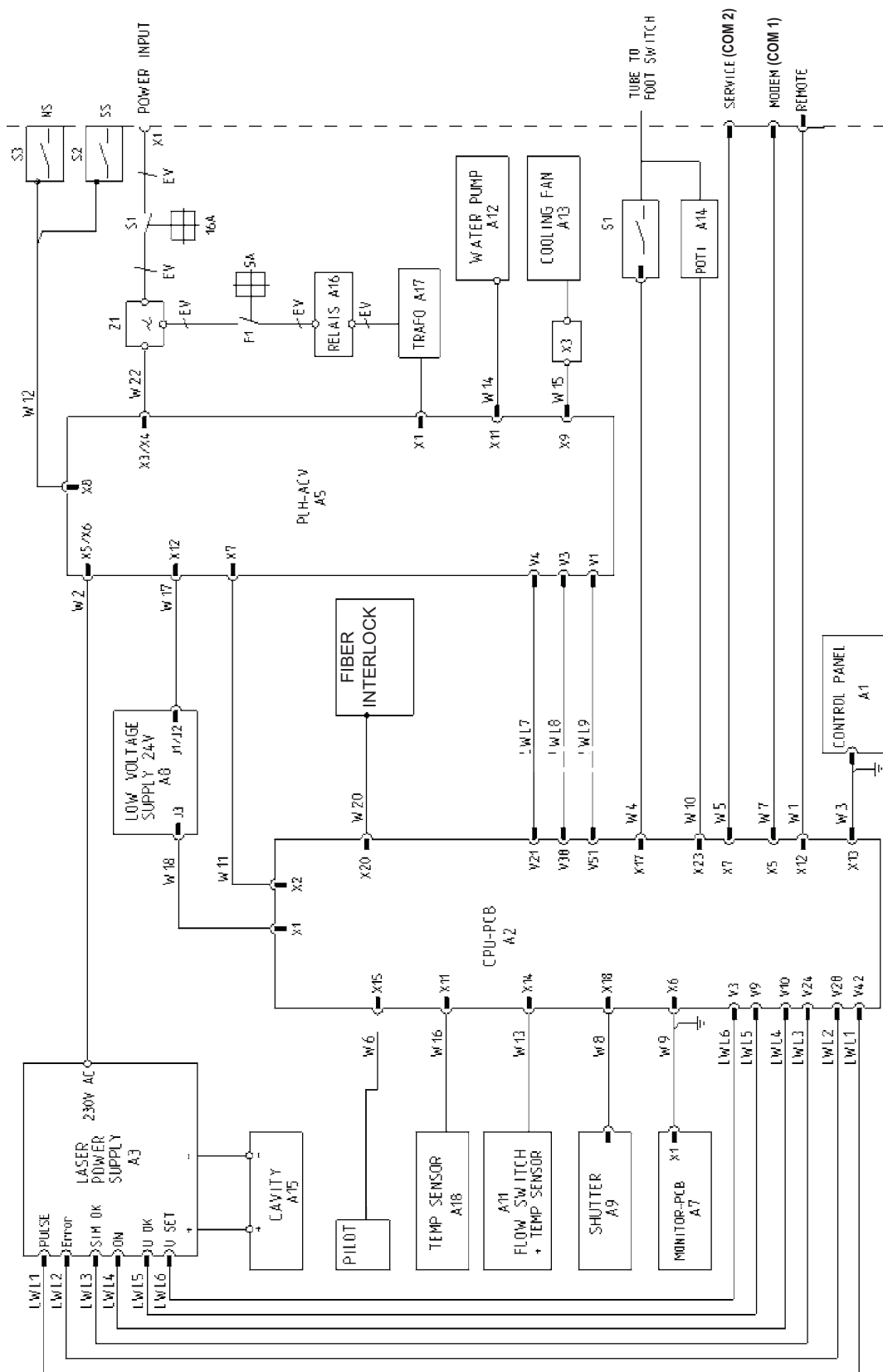
The Dornier Medilas H consists of the following main components:

- frame and housing
- AC input circuit
- control panel for entry and display of therapy parameters
- Power supply
- a cooling system which delivers the electric energy converted into heat to the ambient air
- internal security circuit for monitoring the functional safety
- control electronics, CPU with 16bit processor, for the electronic periphery such as power supplies, pump, fan, control panel e.t.c.
- laser head with resonator for generating the therapy laser beam and with fiber coupler.

4.1.1a Connection diagram of Dornier Medilas H (version < SN 80)



4.1.2b Connection diagram of Dornier Medilas H (version > SN 79)



4.1.3 AC input circuit

The AC input circuit is secured via a temperature fuse and an all-pole switch-off. The power supplies with wide range mains input are supplied from the mains power supply directly.

The pump and the fan (230VAC) are supplied via a toroidal-core transformer, which is configured in dependence on mains input voltage to 115/208/230V. This circuit is secured with an extra protection switch (5A). A so-called transformer relay (A16) limits the current by means of the inductive load of the transformer when the laser is connected to the power supply.

Fig. 6
AC input circuit
(old version)

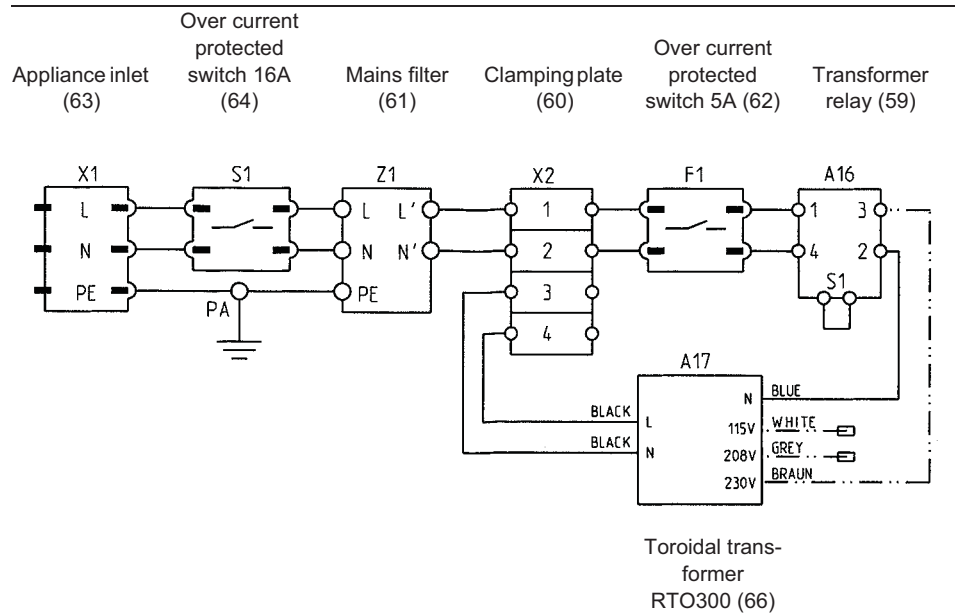
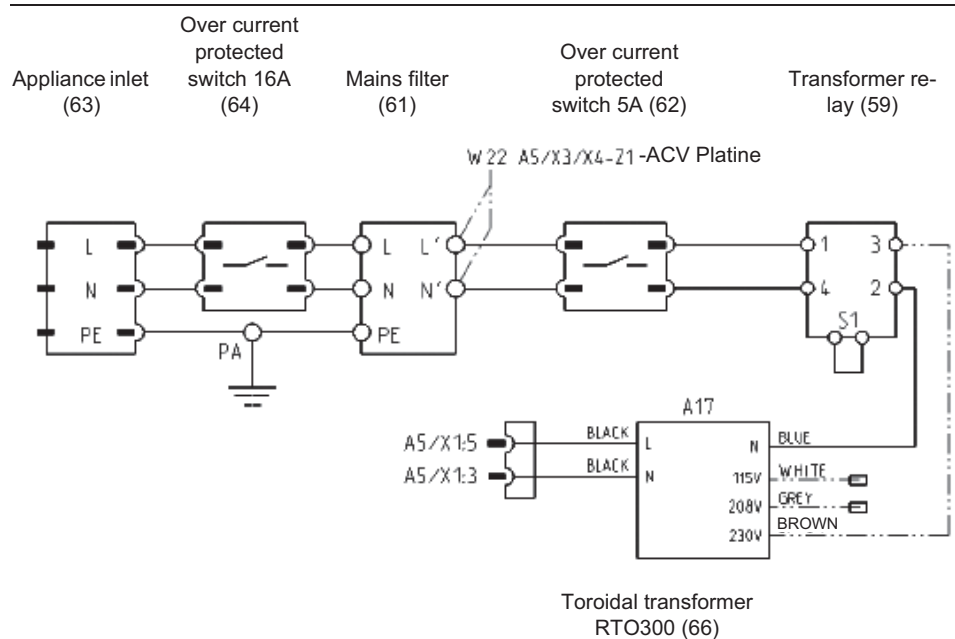


Fig. 7
AC input circuit
(new version)



4.1.4

Power supply

A low voltage power supply with a wide range mains input of 110-230V (J1) serves as energy supply for control electronic. J3 Pin 2 and 3 are supplied with the output voltage 24V/65W.

A 1.8KW power supply with wide range mains input serves as energy supply for flash lamp. The power supply is water-cooled and consists of a capacitor bank, a charger unit and a simmer circuit. A fiber interface serves as interface for controlling. The separate ignition unit is positioned externally and is attached directly to the cavity. When the voltage is increased to more than 10KV the ignition of the lamp gas is performed via the electromagnetic field of the cavity (parallel ignition). The power supply is equipped with a PFC as active filter against line interferences. Because of the electromagnetic radiation no earth conductor is used and the housing of the power supply is feeded with high voltage (half of the mains power supply).

4.1.5

CPU board

The CPU controls and monitors the Dornier Medilas H.

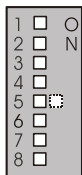
The main component of the CPU is a PCB minimodul with flash eprom, SRAM and EEPROM to store calibration data.

SRAM and the date functions of the real-time clock are battery-buffered. In this way the used settings are reusable after switching off the CPU.

Other functions:

- generation of 5V and 12V voltages from 24V
- controlling of the digital and analogue I/O's of the system (Interface)
- controlling and monitoring of voltage and pulse time of the laser power supply
- controlling of control panel
- controlling and monitoring of cooling system
- controlling of pilot light
- monitoring of shutter
- controlling of laser warning buzzer
- monitoring and controlling of safety chain with watchdog circuit
- monitoring of fiber interlock
- interface to download the software
- additional functions
- dip switch for configuration of system mode and variant type (see Fig. 8)

Fig. 8



DIP switches
Example:therapy
mode at 208/230VAC

1	OFF = Therapy mode	ON = Service mode
2	OFF = Therapy mode	ON = Pump mode
3	OFF = Therapy mode	ON =
4	OFF = Therapy mode	ON =
5	OFF = 208/230VAC	ON = 115VAC
6	OFF = Therapy mode	ON =
7	OFF = Therapy mode	ON =
8	OFF = Therapy mode	ON = Reset Software

4.1.6 Control panel

Operator input is pre-processed via an intelligent TFT touch panel, viewed on a graphic display (1/4 vga 320 x 240 dots characters) and transferred to the control computer via a serial interface.

4.1.7 ACV board

The ACV board is the connection between CPU and all AC IO's (fan, cooling water pump).

Additionally it contains the making current circuit. It monitors the key switch and the mushroom switch to separate both power supplies from mains power supply, if necessary.

The cooling circuit controls the cooling water pump and the fans. Via pulse width modulation the revolutions per minute of the fans can be regulated and switched off completely. To operate independently of frequency (50-60Hz) the phase zero crossing is detected and transmitted to the CPU as trigger signal. For galvanic isolation the triggering of the CPU is performed optoelectrically via fibers. AC- and DC-circuits are separated from each other by a 6.5mm clearance and creepage distance.

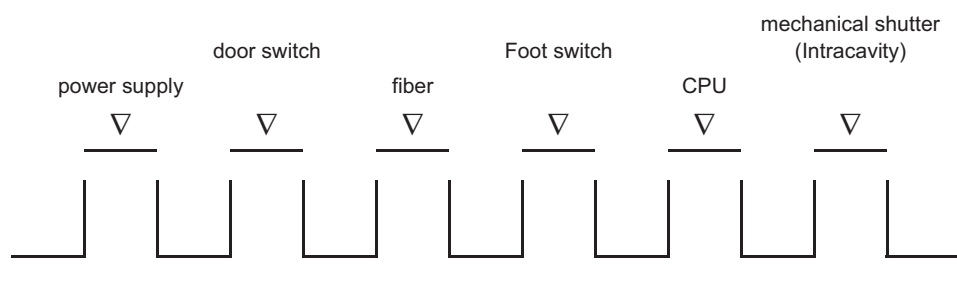
In making current circuit a 12V auxiliary voltage for triggering the relais is generated from mains power supply. When the key switch is open the 115VAC-230VAC mains supply is separated from laser power supply and extra-low voltage power supply. Varistors between phase - neutral conductor - protective earth serve for dissipation of over voltage impulses up to 5kV.

4.1.8 Laser safety chain

The Dornier Medilas H is equipped with an integrated safety chain which effectively prevents the unintentional release of laser radiation. The laser safety chain consists of several series-connected hardware switches.

If only one switch is open, i.e., one safety requirement is not fulfilled, laser radiation cannot be released.

Fig. 9
Laser safety chain



4.1.9 Cooling system

In the cooling system only de-ionized water may be used. Additionally a bag is located within the tank which serves as ion exchanger.

The aim is to keep the water absolutely clean. In this way losses of the optical effect during transition from flash lamp to laser rod are minimized.

In the cooling circuit the flow rate is adapted at 1 bars to 3.5l/min.

The controlling adjusts the fan speed gradually and automatically dependent on the temperature of the cooling water. In this way noise emission can be minimized. If the temperature exceeds approx. 45°C, an emission of laser pulses is prevented, until the water is cooled down sufficiently to achieve an appropriate service life. If the cooling water and the ambient temperature have nearly the same temperature, the fan is switched to its lowest level.

Fig. 10 Cooling system
(old version
< SN 80)

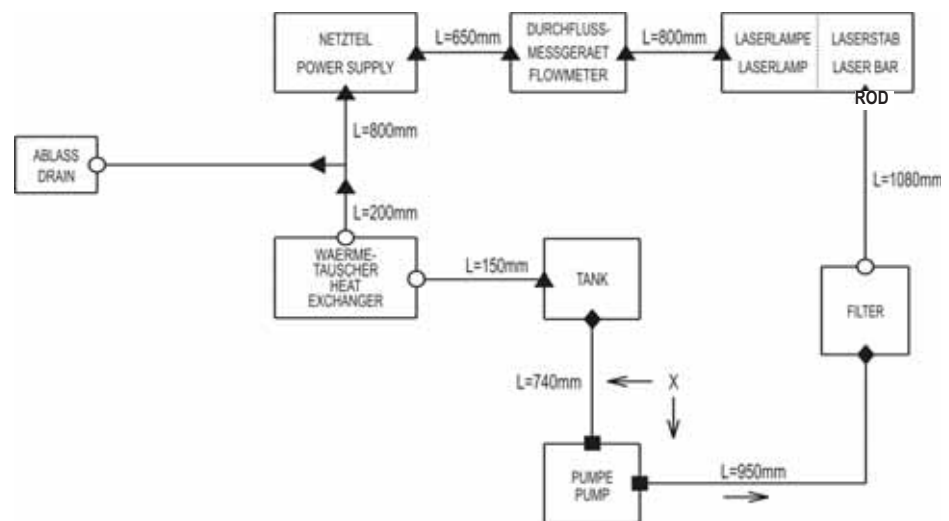


Fig. 11 Cooling system
(new version
> SN 80)

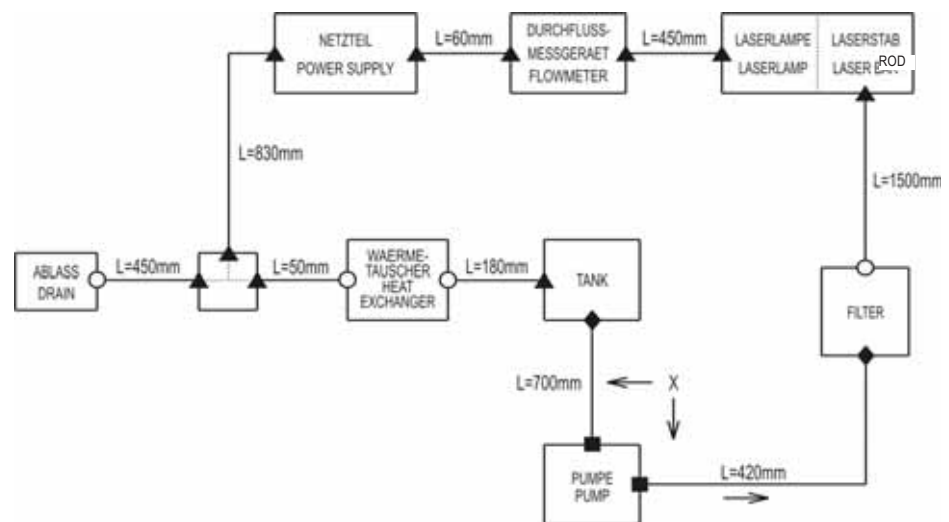


Fig. 12

▲	Hose clip SNP 10, Ø 14,5	B3505091	X	Hose D10x3MM	B3501775
○	Hose clip SNP 12, Ø 15,4	B3505092	I	Hose D13x3,5MM	B3501734
■	Hose clip SNP 18, Ø 21,4	K2011059			
◆	Hose clip SNP 14, Ø 18,1	K2011193			

4.1.10

Laser head

The laser head contains the resonator, which is designed corresponding to the known physical basic principles. Additionally it contains the output of a part of the laser beam for energy monitoring, the input of pilot laser and the fiber coupler. The electromagnetic radiations during discharging of flash lamp or power supply are shielded via a metal hood, which is feeded with high voltage (half of the mains voltage).

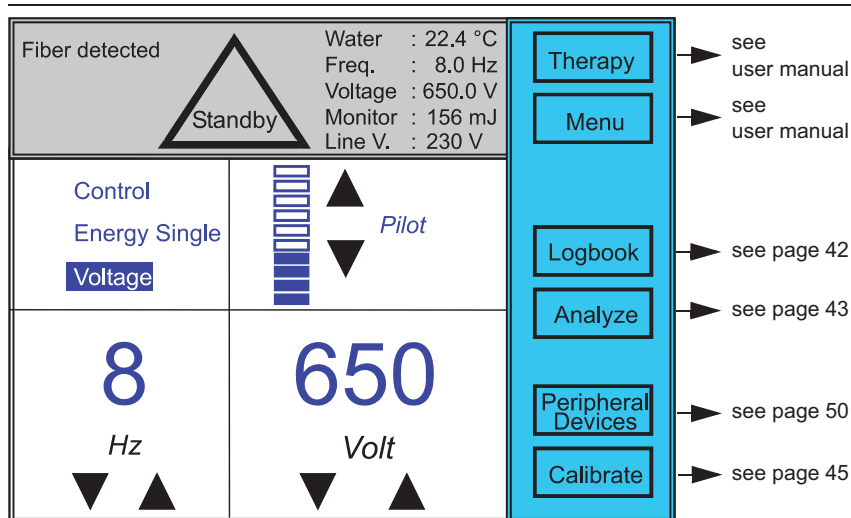
The mechanical shutter is located within the resonator at laser output side. It serves as a safety unit, for a thermal stabilising of the laser when the laser is used with a low pulse repetition rate and for speeding up the thermal stabilisation at the beginning of a pulse series. For that additionally pulses with low energy and closed shutter are emitted between or before the regular pulses.

4.2 Service mode 279

Fig. 13
screen: "Service mode"



DIP switch on CPU



Proceed as follows to call service mode when the device is open:

- 1 Switch off Dornier Medilas H.
- 2 Set DIP switches as shown in the figure above.
- 3 Switch on Dornier Medilas H.

Proceed as follows when the device is closed:

- 1 Switch on Dornier Medilas H.
- 2 Enter the 3-figure code number (request Dornier MedTech GmbH for the the code number).

In service mode the following parameters are displayed additionally:

Water	actual temperature in the cooling system
Freq.	Frequency of laser pulses (less than set frequency, in case of the laser power supply does not reach it's set value in time)
Voltage	set voltage value on laser power supply
Monitor	actually measured energy of the monitor board
Line V.	115V or 208/230V (set via DIP switch)

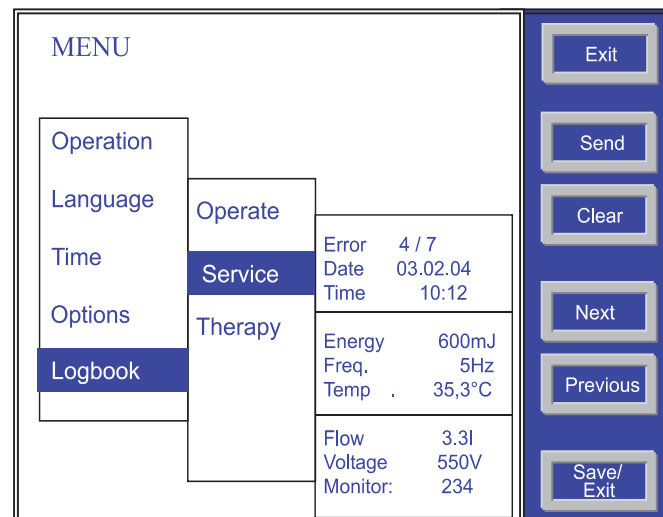
In service mode the following types of laser control are available:

Control	energy setting with active control
Energy	energy setting without control
Voltage	voltage setting at power supply
Single	emission of a single pulse with each pressing of foot switch

4.2.1 Menu enlargement in service mode

- 1 Switch unit to service mode(s. page 40).
- 2 Press key "Menu".

Fig. 14
screen: "Menu"



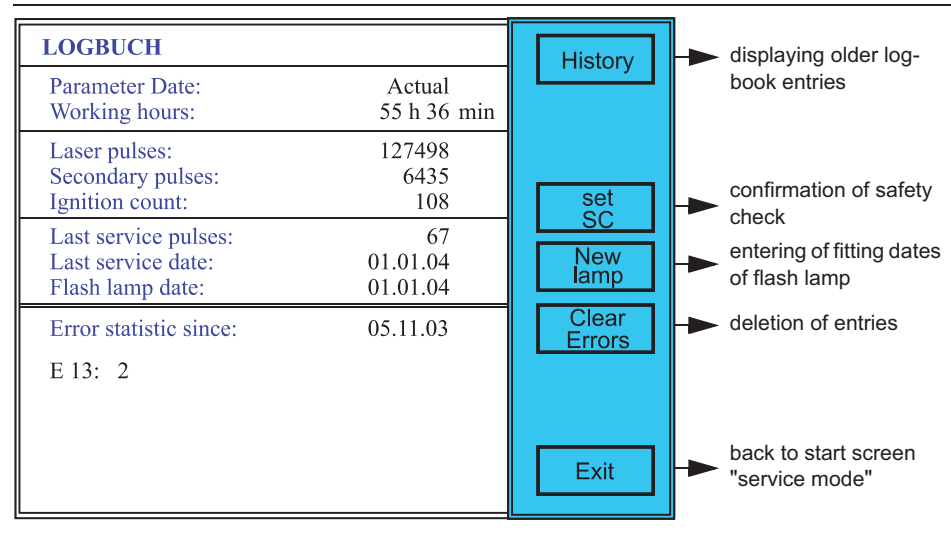
4.2.1.1 Deletion of logbook

With valid service code and shown service logbook or therapy logbook the key "Clear" is displayed additionally. Keep this key pressed to delete the corresponding logbook.

4.2.2 Logbook

The logbook can be entered only in service mode. It stores the operation datas and all occurred error codes and compiles these in statistics.

Fig. 15
screen: "Logbook"



In log book the following parameters are displayed:

Parameter Date	Date of validity of the actually displayed parameters - In the history the date of the last change is displayed - "actual" for actually valid parameters
Working hours	Duration, the Medilas H was switched on
Laser pulses	Totally emitted laser pulses, independently of a change of the flash lamp
Secondary pulses	Totally emitted laser pulses with closed shutter, independently of a change of the flash lamp + additionally pulses before and after the regular pulses
Ignition count	Totally performed ignitions of the flash lamp
Last service pulses	Number of emitted pulses at the last service
Last service date	Date of the last performed service
Flash lamp date	Date of the last fitting of flash lamp
Error statistic since	Date of the first error record

In the logbook the following actions can be performed:

History	Browsing of the service events up to now
Set SC	long depression of this key => safety control has been performed
New Lamp	long depression of this key => new flash lamp has been fitted
Clear Errors	long depression of this key => to reset error statistics

4.2.3 Analyse

In screen "Analyse" important system parameters and their status are displayed. This screens can be used for troubleshooting and for error diagnosis. By touching a signal name single signal monitorings can be activated or de-activated. The laser can be released with the parameters set in service mode.

Fig. 16 screen: "Analyse"

ANALYSE			
Signal name	Status		
FAN STEP		1	
PUMP		on	0.0 l/min
TEMP WATER	offset:	41	22.4 °C
TEMP DEVICE	offset:	41	26.0 °C
PWM_DELTA_U	duty:	50.0%	9.753 kHz
PWM_PILOT	duty:	61.4%	3.333 kHz
CHECK SUM	eeprom:	50	753
CPU LOAD		1.4%	
FTSW_ANALOG			5 digit
LINE FREQ			50.0 Hz
MONITOR	range:	1	0 digit

Monitor

→ selected signals update

Fix Range

→ Monitor measuring range

Exit

→ back to start screen "service mode"

In "Analyse" the following parameters are displayed:

FAN STEP	fan level (0 - 5)
PUMP	status of pump (on/off); flow rate
TEMP WATER	temperature in water cooling circuit with offset from adjustment
TEMP DEVICE	temperature at intake of fan with offset from adjustment
PWM_DELTA_U	voltage default setting on laser power supply (frequency and duty cycle)
PWM_PILOT	pilot triggering (frequency and duty cycle of control signal)
CHECK SUM	check value of EEPROM check sum of RAM
CPU LOAD	degree of utilization of CPU
FTSW_ANALOG	air pressure of pneumatic foot switch (0 - 1023 digits)
LINE FREQ	measured frequency of mains voltage
MONITOR	measuring range 1-3 and measuring value 0-1023 digits

In "Analyse" the following actions can be performed:

Monitor	key active: selected signals are updated permanently key not active: no update of the signals
---------	--------------------------------------------------------------------------------------------------

4.3 Calibration

4.3.1 Calibration of internal energy meter

Note

Before you calibrate the internal energy meter it must be absolutely guaranteed, that the points 3.2 and 3.3 of the installation report are fulfilled, consider thereby also chapter 7.2.7 (s. Seite 116).

For a calibration of the energy meter the internal energy meter is adjusted with an external measurement. For that two energy values for each measuring range are ascertained. The system linearizes between this both measuring values automatically. To reset all measuring values keep key "Reset" pressed (question marks will appear). A new calibration can be performed. To digit values which are out of tolerances and to energy values which are not entered yet a question mark will be added.

Preparation

- 1 Check the distal and proximal ends of calibration fiber (400 μm) for pollution and damages.

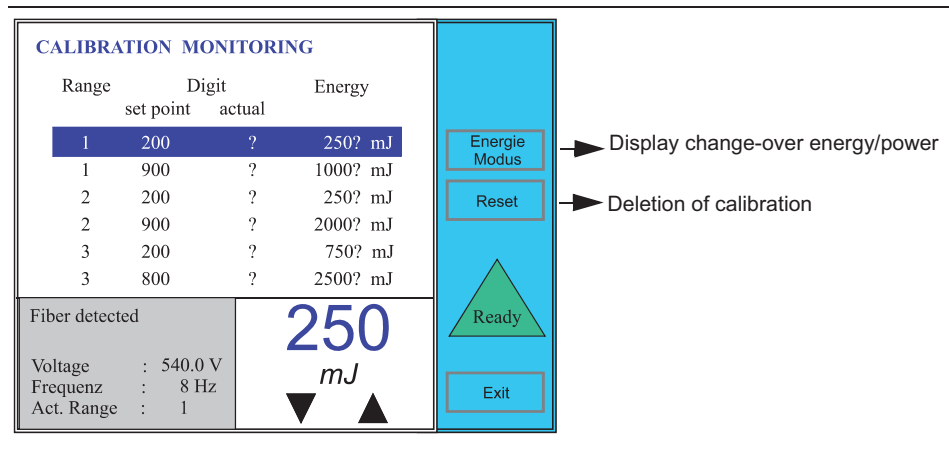
Note

Point the distal end of the light guide perpendicularly on to a white, flat surface and observe the pilot light spot. You should see a well-defined, circular spot with minimum distortions.

- 2 Connect fiber ends with the laser and an external energy meter.
- 3 Switch on Dornier Medilas H in service mode.
- 4 Enter the following settings:

Mode:	Voltage
Frequency:	8 Hz
Voltage:	600 V
- 5 Press the laserkey and switch laser to Ready status.
- 6 Press foot switch.
- 7 Change the set Voltage (600 V), till the measured external energy is about 750 mJ.
- 8 Press the key "Analyze" and change to screen Analyze (see page 43).
- 9 Loosen fastening screw of monitor tube (see fig. 54, page 86).
- 10 Put on laser safety goggles and take care that all persons present in the room wear safety goggles, too.
- 11 Press foot switch.
- 12 Change position of monitor tube, until the value: MONITOR range:3 230 digit is displayed in line "MONITOR" (tolerance: ± 40 digits).
- 13 Tighten fastening screw of monitor tube.
- 14 Press the key "Exit" and leave the screen Analyze.
- 15 Press the key "Calibrate" and enter calibration mode (illustrated in fig. 17).

Fig. 17
screen: CALIBRATION
MONITORING



16 Set external power meter to averaging.

17 Press the laserkey and switch laser to Ready status.

Calibration procedure

18 Press key "Reset" for two seconds.

The measuring values are marked with a question mark.

19 Select in the table on the control panel the first entry for measuring range 1.

20 Press foot switch.

21 Wait until the laser has adjusted to set value and the question mark "?" behind the actual measuring value extinguishes (voltage value in protocol remains constantly).

22 Release foot switch.

23 Read the average value of energy on external energy meter and set this value via Up-/Down keys.

24 Repeat steps 20 to 23 for each measuring range.

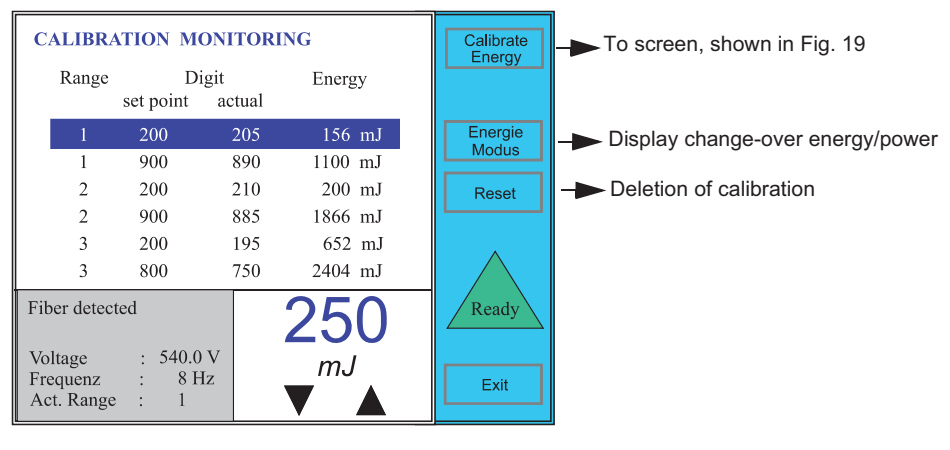
Note

If the calibration is completed successfully and if all values seem plausible the key "Calibrate Energy" is shown on the right and upper side. With this key you can change to energy calibration. Note that the step 23 is compellingly necessary.

Only by pressing of the key "Calibrate Energy" the values of the calibration of internal energy meter will be effected and all necessary keys for the following energy values calibration will be faded in.

25 Press key "Calibrate Energy".

Fig. 18
screen: CALIBRATION
MONITORING



Error possibilities:

Error symptom	Possible cause	Measure, error clearing
Key "Calibrate Energy" does not appear.	Not all values are calibrated.	Calibrate missed values.
	Some values are out of tolerances.	Re-calibrate wrong values.
	The first external energy value in one of the measuring ranges is not smaller than the second.	

4.3.2

Calibration of energy values

The calibration of the energy values is performed at several measuring points for each frequency. If Auto mode is active all uncalibrated values are calibrated automatically. The energy value is ascertained by the internal energy meter. An external energy meter is not necessary. If Auto mode is not active single calibration values can be re-calibrated manually. With key "Reset" all parameters are reset

Note

Before you calibrate the energy values, absolutely guarantee that "Calibration of internal energy meter" is completely accomplished (s. Seite 45).

Preparation

- 1 Connect a fiber ($\geq 400 \mu\text{m}$).

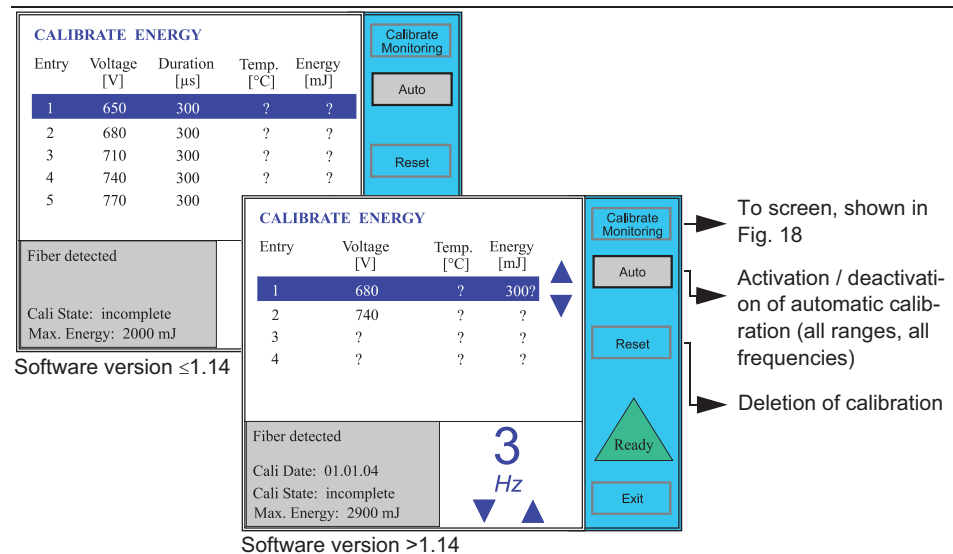
Note: Before that make sure with a magnifying glass that the distal and proximal ends of the fiber are undamaged.

Note

If continuer with the calibration of energy values just after "Calibration of the internal energy meter" is accomplished, the steps 2, 3 and 4 are not necessary.

- 2 Switch on Dornier Medilas H in service mode (s. page 40).
- 3 Press the key "Calibrate" and change to calibration mode (Fig. 17)
- 4 Press the key "Calibrate Energy" and enter energy calibration (Fig. 18).

Fig. 19
screen: CALIBRATE
ENERGY

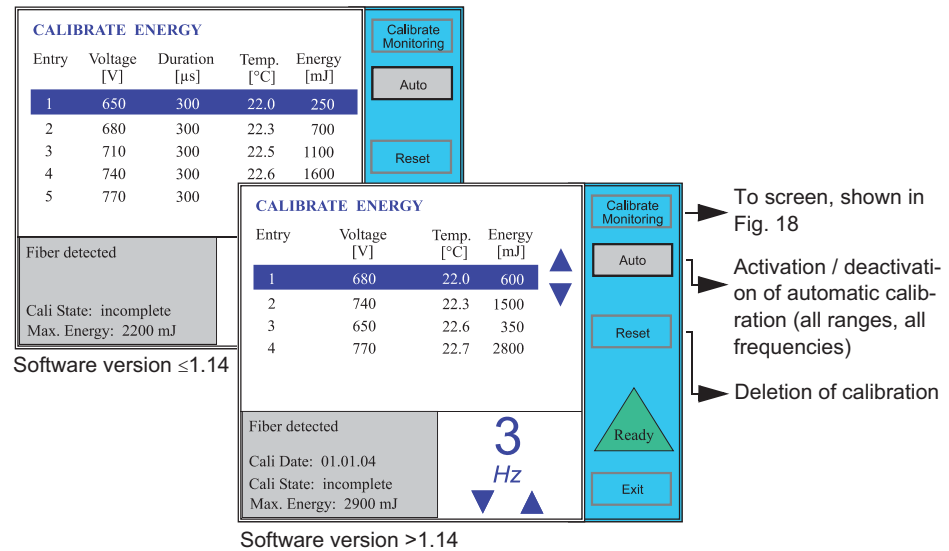


- 5 Press key "Reset" for approx. 2 seconds (measuring values are marked with a question mark).
- 6 Press the key "Auto" and activate AUTO mode - if not active yet.
- 7 Press the laserkey and switch laser to Ready status.

Calibration procedure

- 8 Press foot switch.
- 9 Wait until the system has recorded all measuring values completely.
- 10 Release foot switch.
- 11 When calibration is completed the message "Cali State:complete" appears.

Fig. 20
screen:CALIBRATE
ENERGY



Checking calibration

- 12 Change to service mode and switch laser to energy setting with active control mode (see page 40).
- 13 Measure the controlled laser energy for each frequency value with the settings 400mJ and 600mJ and with the last value of the setting range. Please note that the value is not reached before 30-50 pulses are emitted.
- 14 If the measured values for single frequencies are out of the tolerance of $\pm 20\%$ of the rated value, call again the energy calibration and deactivate the Auto mode.

Adjusting calibration

(only possible with software version 1.15 and higher)

- 15 Select the frequency of which you want to adjust the energy values.
- 16 Choose from the calibration table of the set frequency the first line and then activate the laser.
- 17 After approx. 30 pulses read the energy value at the external energy meter and release the foot switch.
- 18 Set the read energy value in the calibration table via the up/down keys.
- 19 For the other lines in the calibration table proceed as described above.
- 20 Repeat the calibration from step 15 for each frequency value of which the energy value has not been within the tolerance.
- 21 Check the adjusted energy values as described from step 12 on.

4.3.3 Peripheral devices calibration

- 1 Switch unit to service mode (s. Seite 40).
- 2 Press key "Peripheral Devices".

Fig. 21
screen: Peripheral
Devices
Software version 1.01



DIP switch on CPU

PERIPHERAL DEVICES			Calibrate Fan
Act. Temp 20.4 °C Water	Pilot off min. Pilot med. Pilot max. Pilot	3.2 l/min Pump off Flow Ctrl off	Set SN
20.4 °C ▲ Calibrate ▼	0.0 % ▲ Pilot ▼	0 ▲ Fan Step ▼	Shutter Closed
			Exit

→ Entering fan calibration
 → Entering pilot calibration
 → Opening/ closing of shutter/function check

Note

"Peripheral Devices" can also be selected before switching on via the DIP switch (Fig. 21). After that the laser starts directly in mode "Peripheral Devices".

Fig. 22
screen: Peripheral
Devices
from software version
1.10

PERIPHERAL DEVICES			Calibrate Fan
Act. Temp 20.4 °C Water	Pilot off min. Pilot med. Pilot max. Pilot	3.2 l/min Pump off Flow Ctrl off	Set SN
20.4 °C ▲ Calibrate ▼	0.0 % ▲ Pilot ▼	0 ▲ Fan Step ▼	Shutter closed (0)
			Exit

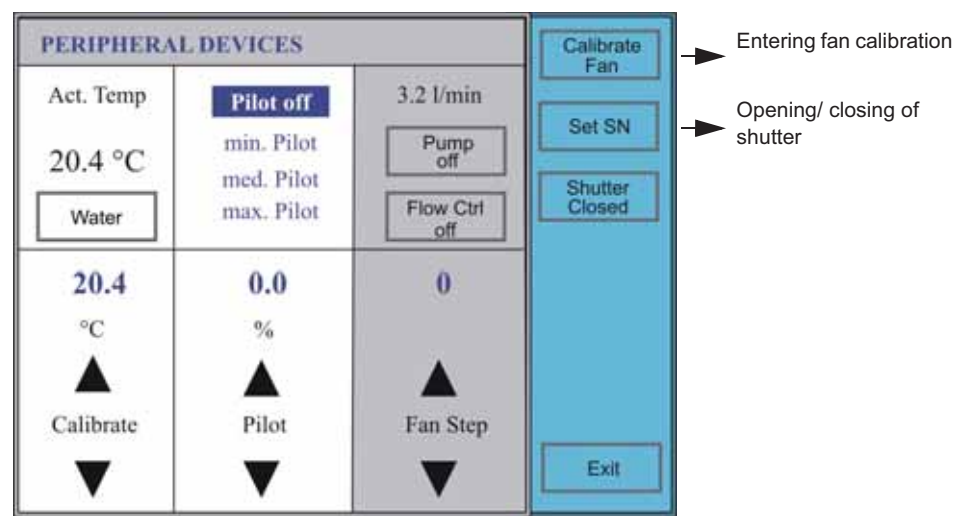
Note

Starting from software version 1.10 is the inscription of the key "Shutter..." changed. The number in the key gives additionally the information about the condition of the monitoring switch. Closer explanation see chapter Checking, adjusting Monitoring switch, siehe Seite 84.

4.3.3.1

Calibration of temperature sensors

Fig. 23
screen: PERIPHERAL
DEVICES

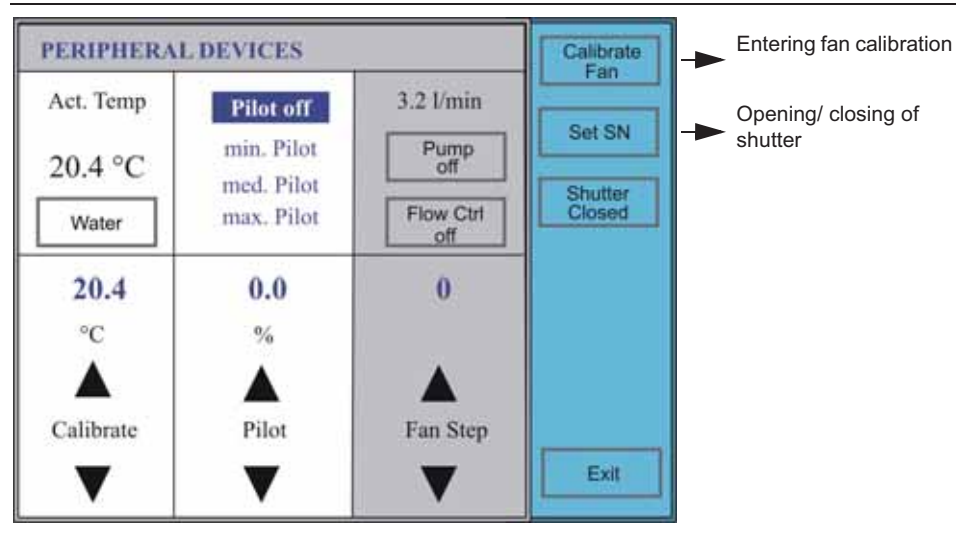
**Setting procedure**

- 1 Switch Medilas H to mode "PERIPHERAL DEVICES" (s. page 50).
- 2 Wait approx. one minute, until the water temperature in the cooling system is equal.
- 3 Measure the temperature of the water within the tank (s. Seite 105).
- 4 Set the measured water temperature via Up-/Down keys.
- 5 Press the key "Water" (the air temperature is displayed).
- 6 Measure the temperature at the air temperature sensor (s. Seite 71).
- 7 Set the measured air temperature via Up-/Down keys.

4.3.3.2 Setting of pilot laser

The power of the pilot laser can be calibrated via three measuring points. From that the system calculates automatically the increment of the 10 pilot levels.

Fig. 24
screen:PERIPHERAL
DEVICES



Preparation

- 1 Check the distal and proximal ends of calibration fiber for pollution and damages.

Note

Point the distal end of the light guide perpendicularly on to a white, flat surface and observe the pilot light spot. You should see a well-defined, circular spot with minimum distortions.

- 2 Connect the ends of the fiber to the laser and aim the fiber at a power meter (532nm).
- 3 Start Medilas H in service mode (see "service mode", page 40).
- 4 Switch Medilas H to mode "PERIPHERAL DEVICES" (s. page 50).

Calibration procedure

Setting minimum brightness:

- 5 Activate entry "min. Pilot".
- 6 Change duty cycle via Up-/Down keys, until the power meter measures 30-70 μW .

Setting average brightness:

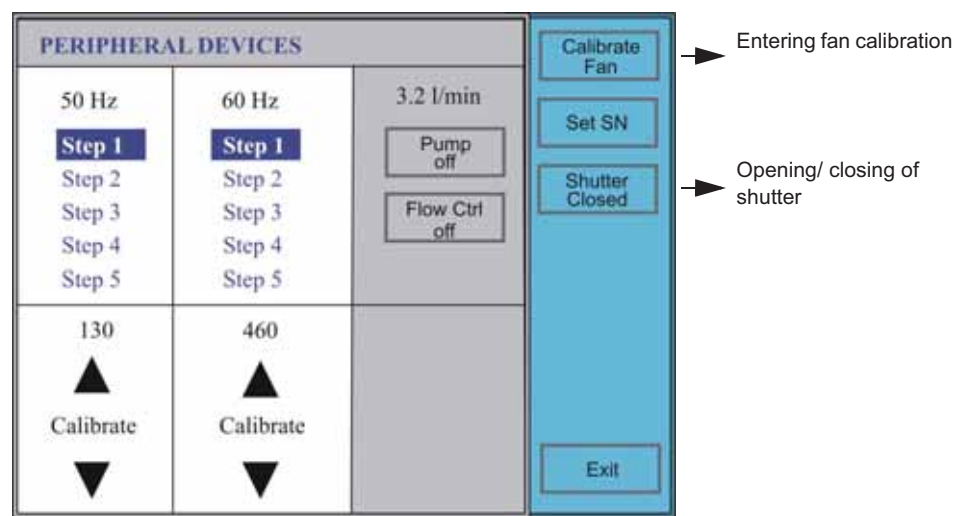
- 7 Activate entry "med. Pilot".
- 8 Change duty cycle via Up-/Down keys, until the power meter measures 75-150 μW .

Setting maximum brightness:

- 9 Activate entry "max. Pilot"
- 10 Change duty cycle via Up-/Down keys, until the power meter measures 150-600 μW .

4.3.3.3 Setting of fan level

Fig. 25
screen: PERIPHERAL
DEVICES



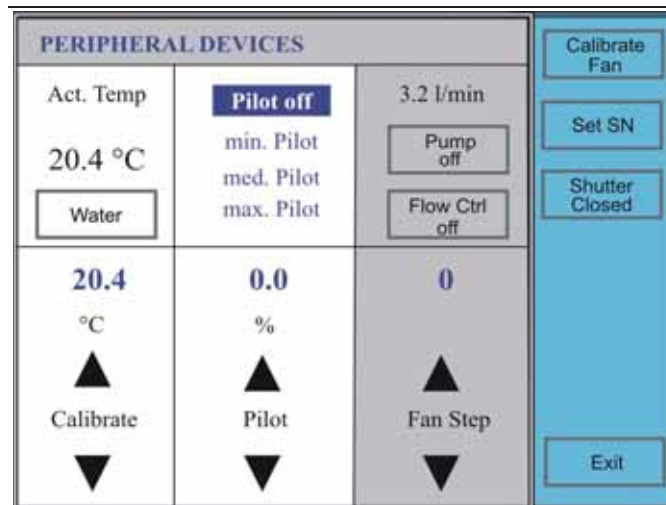
Setting procedure

- 1 Switch Medilas H to mode "PERIPHERAL DEVICES" (s. page 50).
- 2 Connect a voltmeter to plug X11 of ACV board (see page 75).
- 3 Press the key "Pump off" and switch on pump.
- 4 Press the key "Calibrate Fan".
- 5 According to the frequency, the Dornier Medilas H is operated with, touch "50 Hz/Step 1" or "60 Hz/Step 1".
- 6 Set the fan voltage on plug X11 by touching the appropriate key "Calibrate" according to the following table:

model with 3 fans (s. Seite 72)	at 50 Hz	fan voltage 105 VAC
	at 60 Hz	fan voltage 115 VAC
model with 4 fans (s. Seite 73)	at 50 Hz	fan voltage 160 VAC
	at 60 Hz	fan voltage 170 VAC

4.3.3.4 Checking the shutter

Fig. 26
screen: PERIPHERAL
DEVICES.
Software version 1.01



Preparation

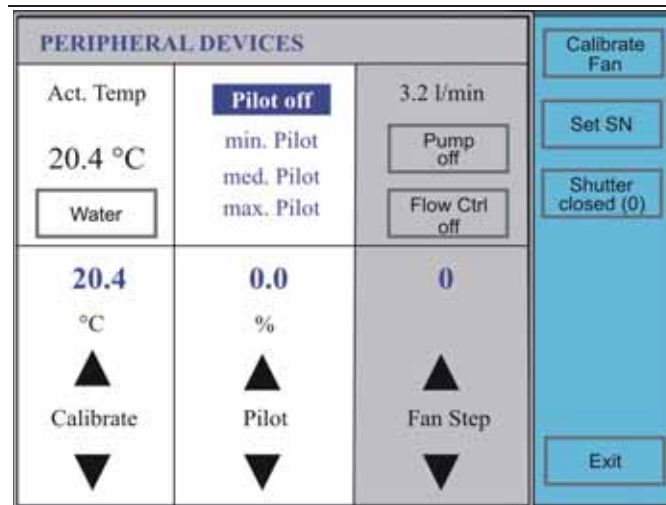
- 1 Switch unit to service mode (s. Seite 40).
- 2 Press key "Peripheral Devices".
- 3 Press key "Shutter closed" repeatedly.

Note

After pressing key "Shutter closed", the key is labelled anew - "Shutter open" (inverted).

The shutter must react to each key pressing. If the shutter does not react, it is defective.

Fig. 27
screen: PERIPHERAL
DEVICES.
from software version
1.10



Preparation

- 1 Switch unit to service mode (s. Seite 40).
- 2 Press key "Peripheral Devices".
- 3 Press key "Shutter closed (0)" repeatedly.

Note

After pressing key "Shutter closed (0)", the key is labelled anew - "Shutter open (1)" (inverted).

The key "Shutter closed (0)" and/or "Shutter open (1)" gives additionally the information about the condition of the monitoring switch:

(0) = monitoring switch is opened

(1) = monitoring switch is closed

Rated value:

Shutter is closed - monitoring switch is opened (0)

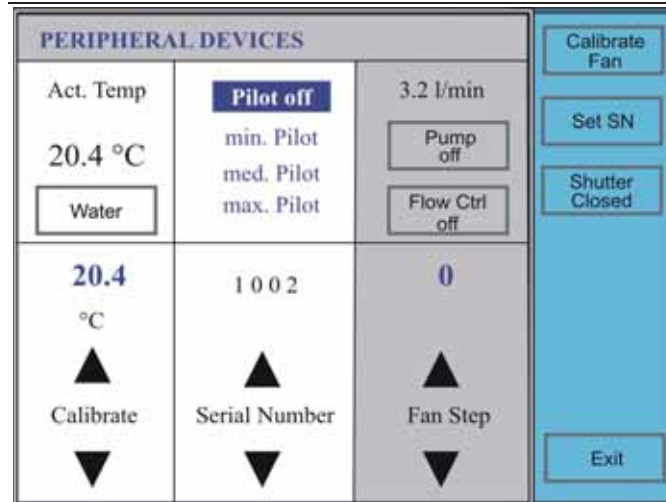
Shutter is opened - monitoring switch is closed (1)

The Shutter and the monitoring switch must change their condition after pressing of the key.

If the monitoring switch does not react in accordance with specified condition, the monitoring switch must be adjusted (s. page 84).

4.3.3.5 Entering serial number

Fig. 28
screen: PERIPHERAL
DEVICES.
Software version 1.01



- 1 Take the serial number from the identification plate of the unit.
- 2 Switch unit to service mode (s. Seite 40).
- 3 Press key "Peripheral Devices".
- 4 Press the key "Set SN"
- 5 Touch the serial number on the display and set the correct number with keys ▲▼.

Note

Calibration values/serial number are stored as soon as key "Exit" is pressed.

The page contains a large grid structure. On the left side, there are 30 horizontal lines, each corresponding to a row in the grid. The grid itself is composed of 26 columns and 30 rows. The first column is wider than the others, and the remaining 25 columns are of equal width. The grid is empty.

5 Checking, replacement, adjustment

Overall appliance (closed)	61
Panel parts and their subassemblies	63
Replacing side panel	63
Replacing hood and/or its subassemblies	64
Replacing front panel and/or its subassemblies	68
Replacing rear panel	69
Overall unit (open)	70
Cooling system	72
Replacing subassemblies in the cooling system	72
Replacing pump	74
Replace ACV board	75
CPU board	76
Replacing CPU board	76
Replacing coin cell	77
Replacing PCB minimodul	78
Replacing laser power supply	79
Electricity complete	80
Laser head	81
Replacing shutter	83
Checking, adjusting Monitoring switch	84
Replacing resonator mirror	85
Replacing monitor board	86
Replacing pilot laser	87
Replacing cavity and/or its subassemblies	88
Adjusting resonator	94
Adjusting output coupler with regard to laser rod	95
Pre-setting reflector mirror	96
Fine adjustment of the reflector mirror	97
Adjusting pilot laser coaxially with regard to the therapy laser beam (units til serial number H20-079)	98
Valid for the pilot laser with power supply and defelctor mirror (old version)	
Adjusting pilot laser coaxially with regard to the therapy laser beam (units from serial number H20-080)	99
Valid for the pilot laser without power supply and defelctor mirror (new version)	
Adjust fiber coupler	100

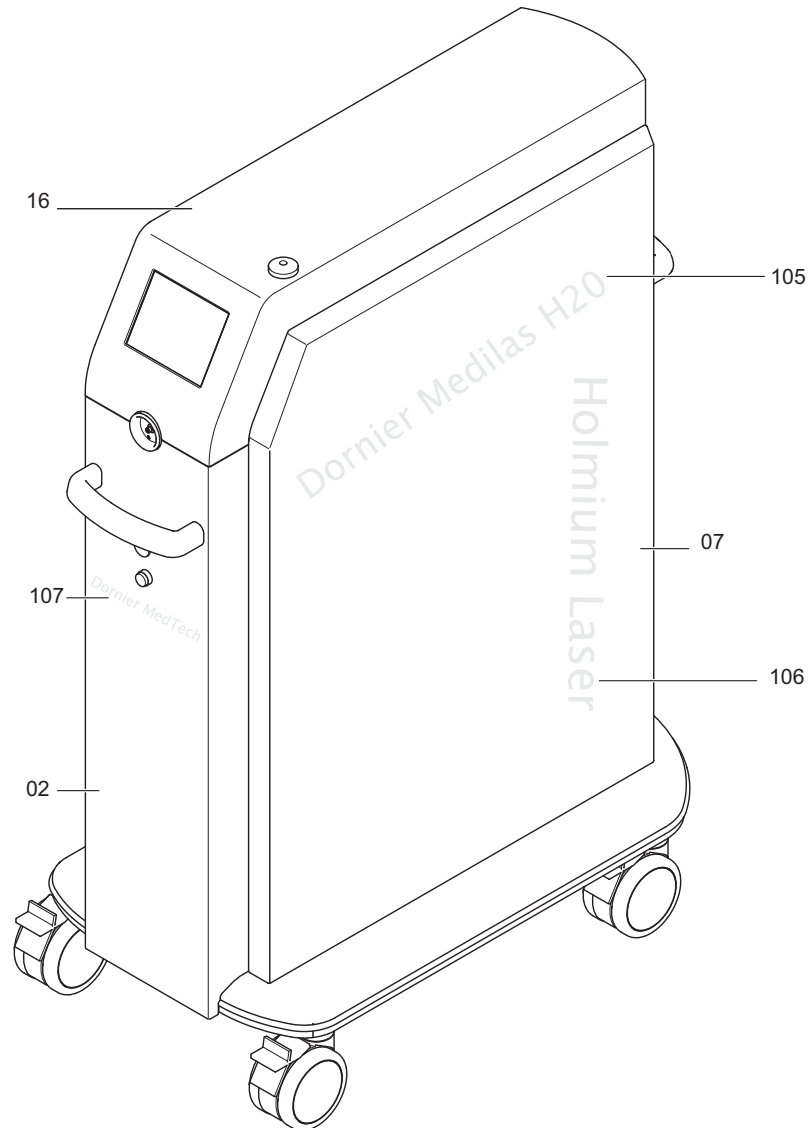
Lined writing area consisting of 25 horizontal lines.

Large grid area consisting of 25 columns and 25 rows.

5.1 Overall appliance (closed)

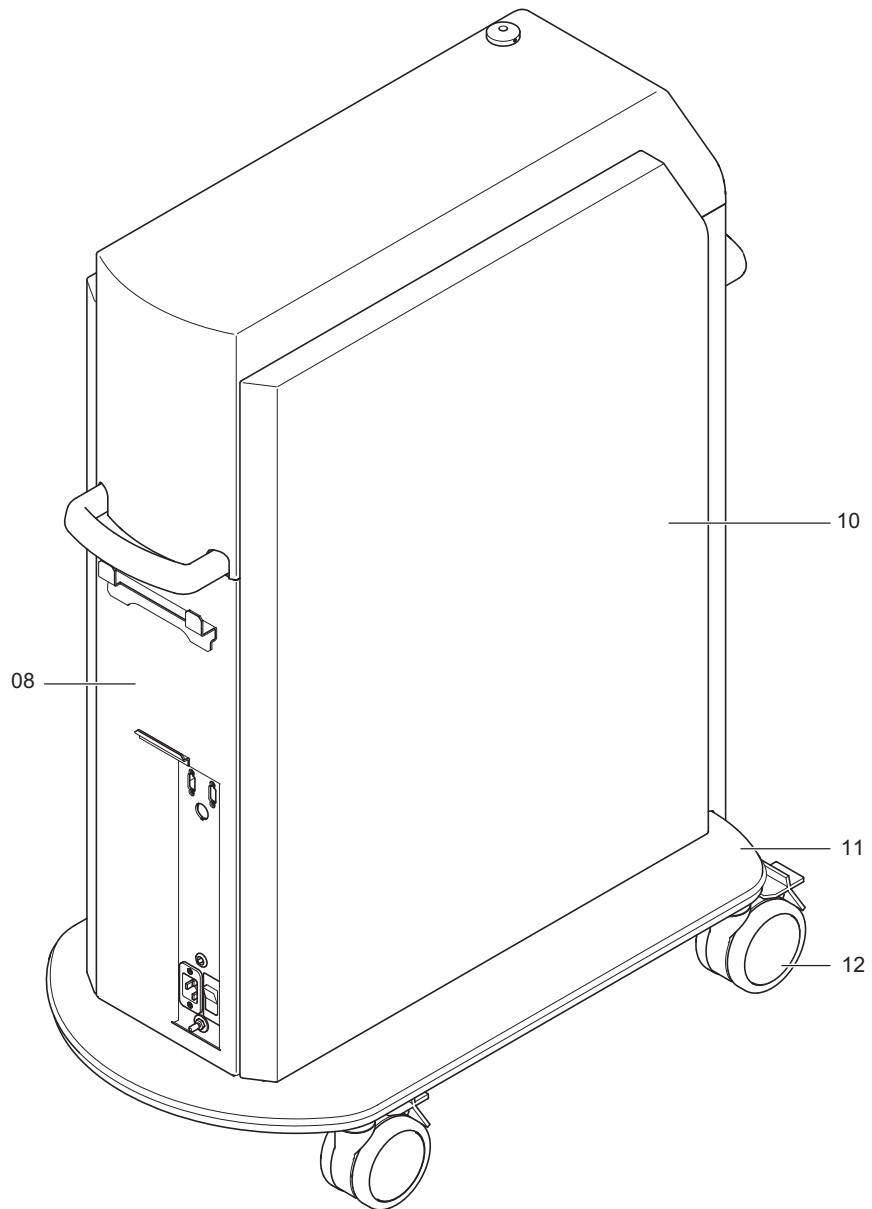
The two pictures which follow illustrate replaceable subassemblies. The key gives the subassembly description and refers to detailed sections on the respective subassemblies which must be read. If the order number is given next to the subassembly description, there is no detailed description.

Fig. 29
Overall appliance (closed)
Front view



(02) Front panel	s. page 68	(16) Hood	s. page 64
(07) Right-hand panel	s. page 63	(106) Equipment line Holmium Laser	K2010979
(105) Label Dornier Medilas H20	K2010937	(107) Manufactures name plate white	K2010980

Fig. 30
Overall appliance (closed)
Rear view



(08) Rear panel	s. page 69	(11) Plinth	-----
(10) Left-hand panel.....	s. page 63	(12) Steering roller	K2010932

5.2

Panel parts and their subassemblies

Removing panel parts

5.2.1

Replacing side panel

Removing side panel

To open the Dornier Medilas H for servicing, proceed as follows:

- 1 Disconnect Dornier Medilas H from mains power supply.
- 2 Carefully unfasten two allen screws on each side panel using a 3mm allen key. The screws are accessible through the two outer holes of the top row of holes.
- 3 Pull off the panel carefully and unfasten the connector of the ground wire.

Fig. 31
Side panel

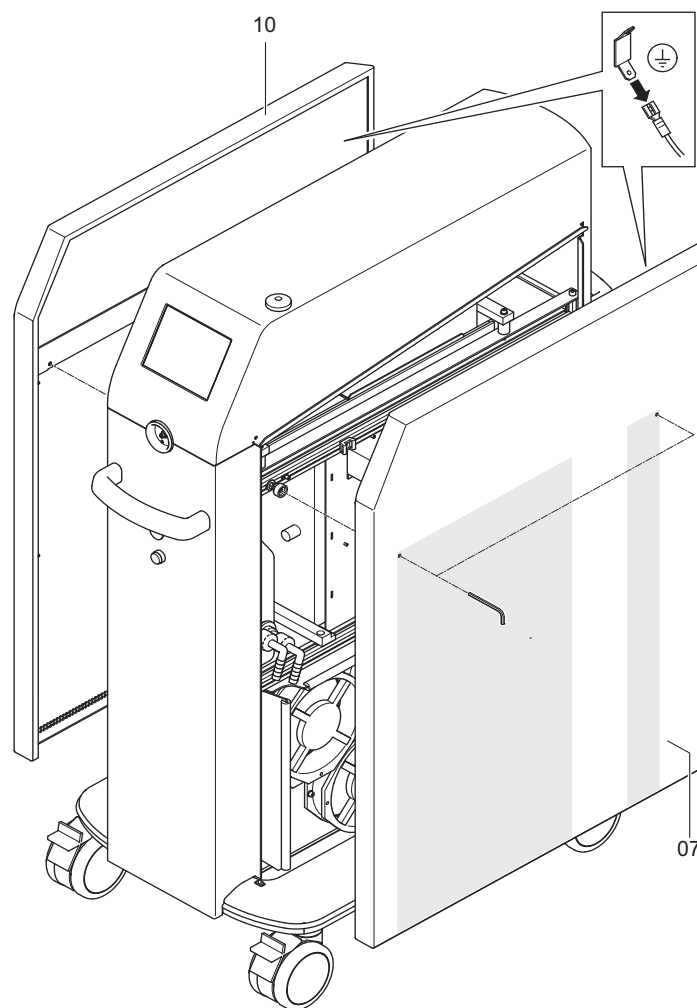


Warning:
High voltage!

For assembly jobs disconnect Dornier Medilas H from mains power supply.

When the unit is switched on, housing of the pump, the heat exchanger, the laser power supply and the EMC hood are under tension (half mains voltage).

Do not leave the appliance unsupervised when open!



(07) Right-hand panel K2010761 (10) Left-hand panel K2010762

5.2.2

Removing hood

Replacing hood and/or its subassemblies

Fig. 32 shows how to remove the hood and/or replace its subassemblies. These hood subassemblies must also be removed when the hood itself is to be replaced.

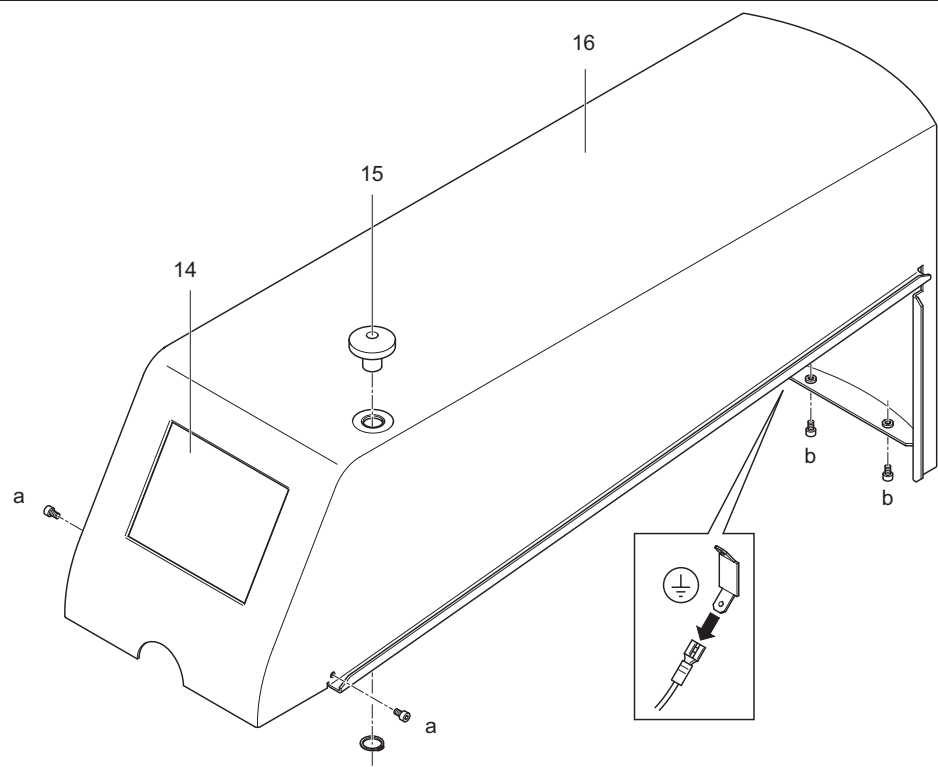
Preparation

- 1 Removing side panel, see page 63.

Procedure

- 2 Remove allen screws (a) and (b).
- 3 Lift off the hood carefully and detach the connector of the ground wire and the connection of control panel (14).

Fig. 32
Hood dismantled



(14) Control panel	s. page 66	(16) Hood	K2010759
(15) Fiber holder socket	K2010848		

After replacement proceed as follows:

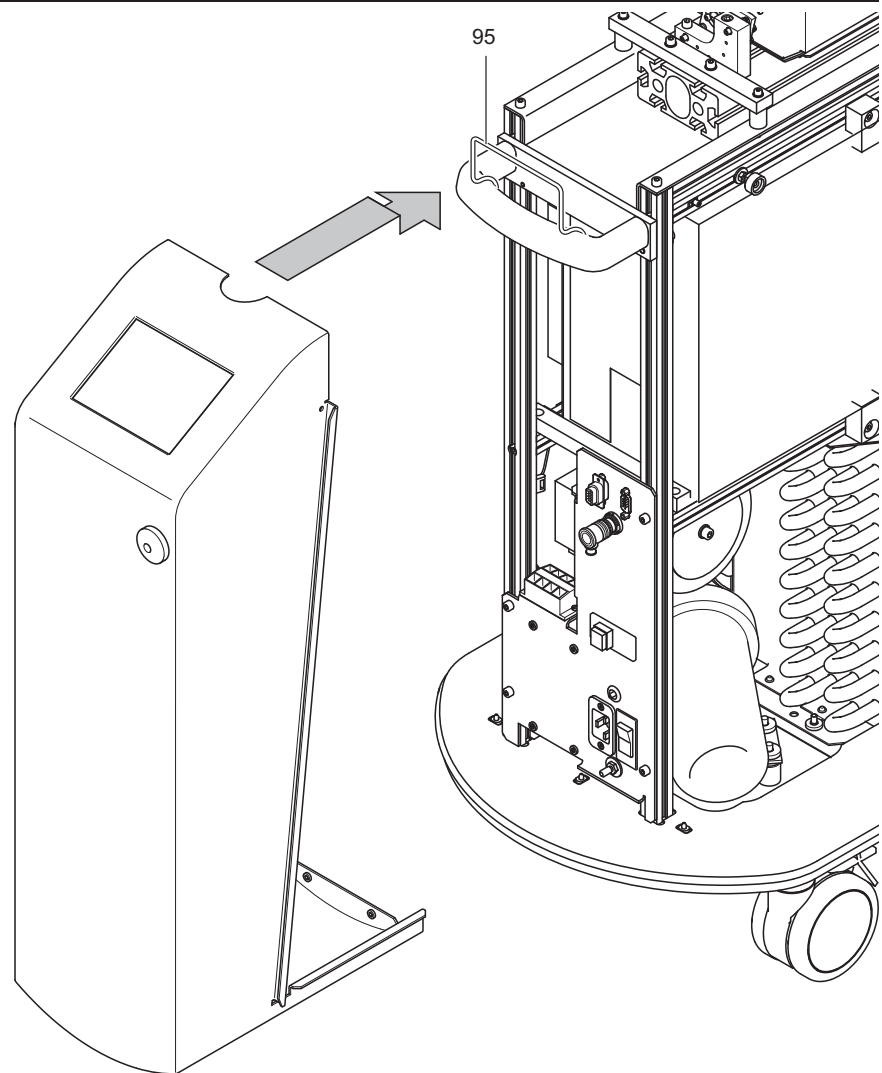
- 1 Reconnect the connector of the ground wire when re-assembling.
- 2 Check that the control panel is working properly after re-assembly.

5.2.2.1

Fixing the hood with control panel in service position

For servicing the Medilas H it is important to fix the dismantled hood securely with a special holder (see order no. below) at the rear handle of the Medilas H. This enables an operation of des Medilas H via the control panel without extension cable.

Fig. 33
Hood with control panel in
service position



(95) Holder for hood with control panel K2011033

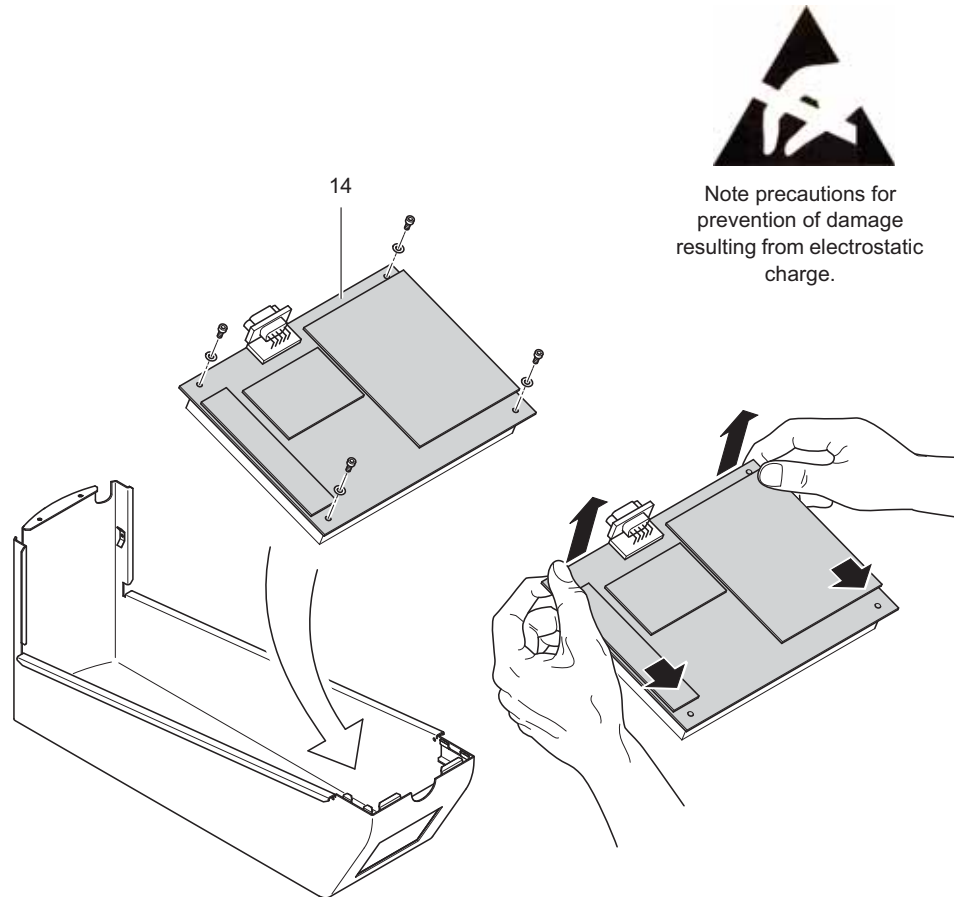
- 1 Mount the holder (95) as shown in Fig. 33 on the rear handle.
- 2 Carefully hang the hood on the holder (95). The hood is fixed correctly, if it hangs securely on the handle and is in contact with the plinth of the Medilas H.
- 3 Connect the control panel to the CPU board

5.2.2.2

Replacing control panel

Figs. 34 and 35 show how to replace the control panel.

Fig. 34
Disassembling control panel

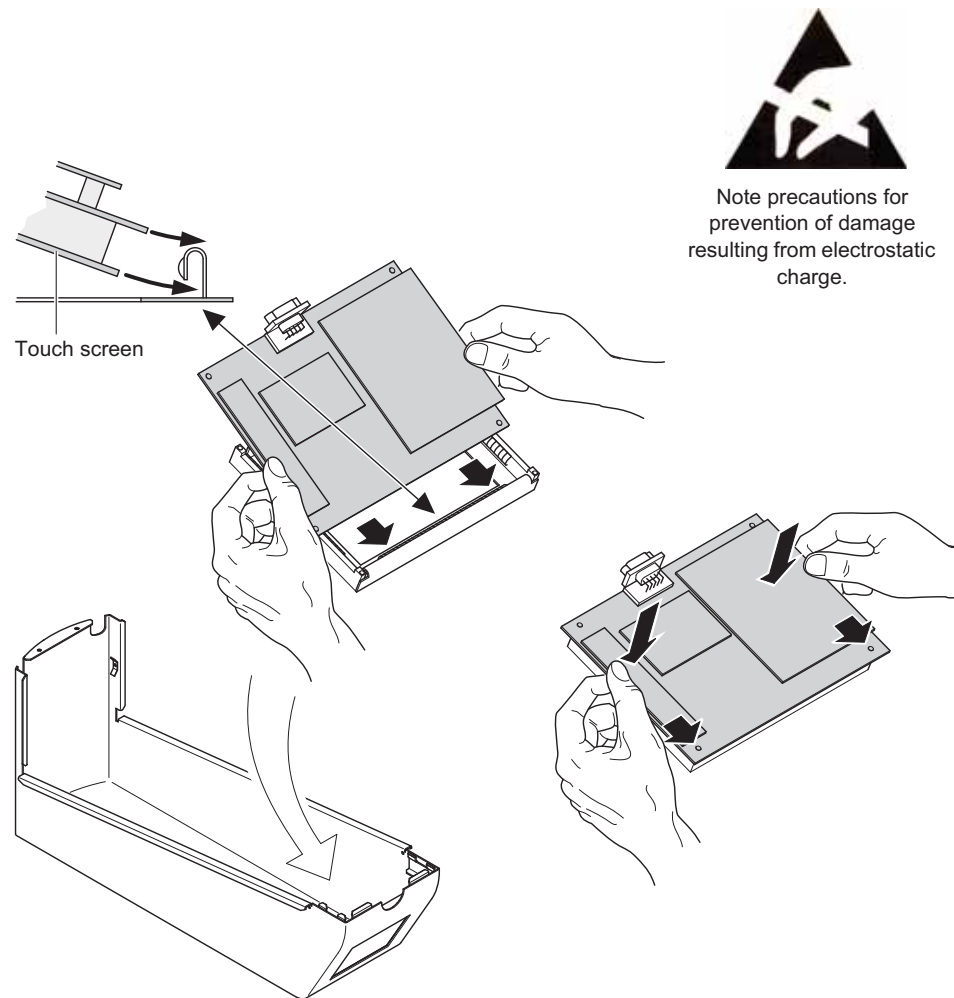


(14) Control panel..... K2011680

- 1 Note precautions for prevention of damage resulting from electrostatic charge.
- 2 Loosen the four fastening screws^{*)} of control panel (14).
- 3 Take hold of control panel on the side with the connection. Push the board slightly towards the bottom of the appliance and lift out the subassembly carefully, starting with the side with the connection. You will feel a slight spring resistance.
- 4 Lift out subassembly completely and take care to protect the glass of the control panel. There must be no pressure or mechanical stress on the control panel glass.

^{*)} Fastening nuts may also be used, depending on the hood design.

Fig. 35
Installing control panel



- 1 Insert lower edge of the control panel carefully until the glass pane of the control panel catches below the shield of the terminal strip (see fig. above).
- 2 Carefully push the board towards the bottom of the appliance until the bore-holes in the board coincide with the thread holes of the holding frame.
- 3 In this position, press the control panel into the frame. You will feel a slight spring resistance.
Do not apply force under any circumstances! Should the assembly jam while inserting, remove it and try again. There must be no pressure or mechanical stress on the glass pane of the control panel.

5.2.3

Removing front panel

Replacing front panel and/or its subassemblies

Fig. 36 shows how to remove the front panel and/or replace its subassemblies. The front panel subassemblies must also be removed if the front panel itself is to be replaced.

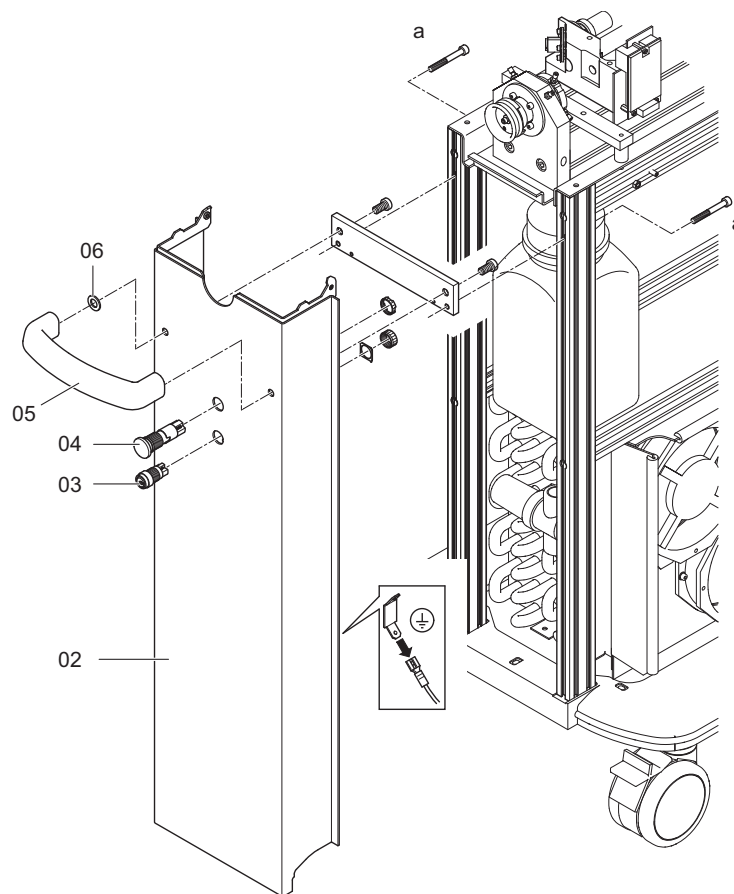
Preparation

- 1 Removing side panel, see page 63.
- 2 Removing hood, see page 64.

Procedure

- 3 Remove the allen screws (a).
- 4 Pull off the front panel (02) carefully and detach the connections and connector of the ground wire.

Fig. 36
Front panel dismantled



(02) Front panel	K2010760	(05) Front handle	K2010763
(03) Key switch	B3002710	(06) Contact washer	K0540606
(04) Mushroom switch	K1009602		

After replacement proceed as follows:

- 1 Reconnect the connector of the ground wire when re-assembling.
- 2 Check on and off switching after replacing the key switch or mushroom switch.

5.2.4

Removing rear panel

Replacing rear panel

Fig. 37 shows how to remove and/or replace the rear panel.

Preparation

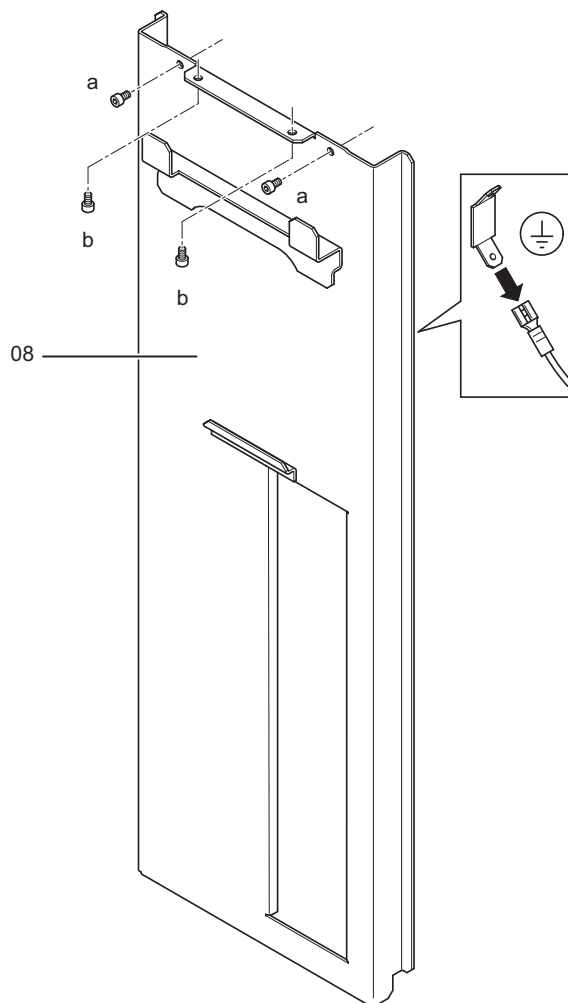
- 1 Removing side panel, see page 63.

Procedure

- 2 Remove allen screws (a) and (b).
- 3 Pull off the rear panel (08) carefully and disconnect the connector of the ground wire.

Fig. 37

Rear panel dismantled



(08) Rear panel K2010764

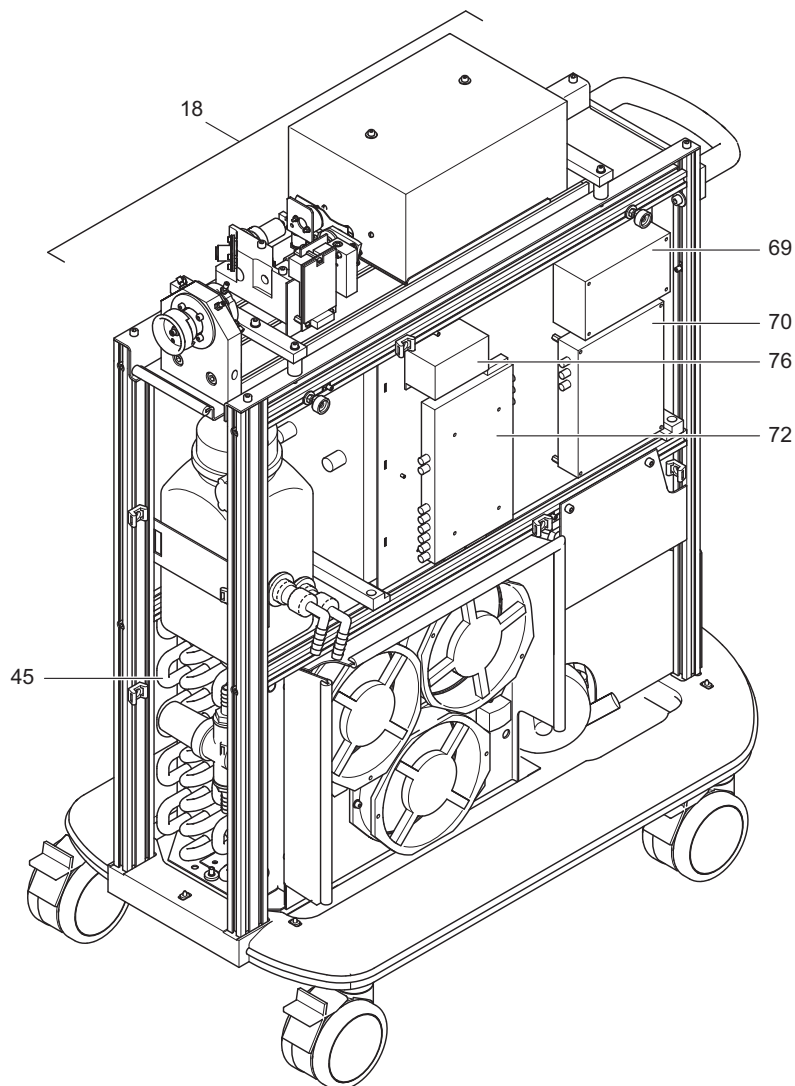
After replacement proceed as follows:

- 1 Reconnect the connector of the ground wire when re-assembling.

5.3 Overall unit (open)

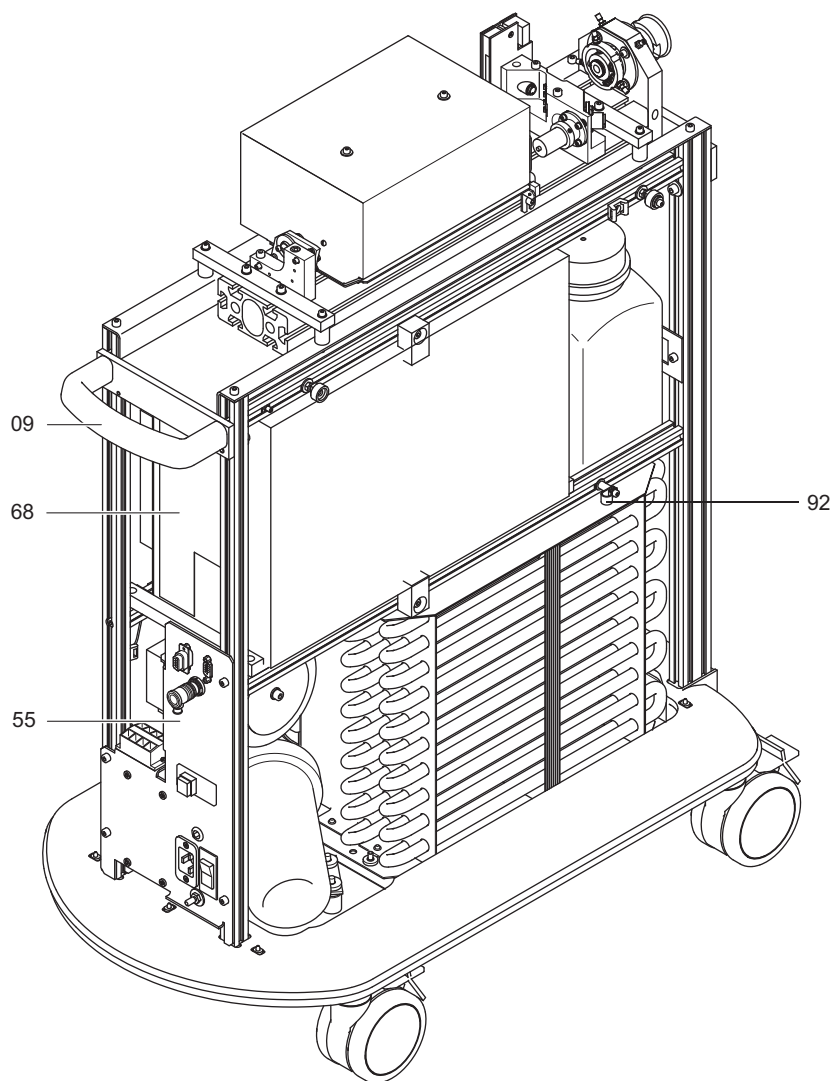
The following two figures illustrate replaceable subassemblies. The key gives the subassembly description and refers to detailed sections on the respective subassemblies which must be read. If the order number is given next to the subassembly description, there is no detailed description.

Fig. 38
Overall unit (open)
Front view



(18) Laser head	s. page 81	(70) ACV board	s. page 75
(45) Cooling system	s. page 72	(72) CPU	s. page 76
(69) 24V power supply	K2010571	(76) Laser diode driver	s. page 87

Fig. 39
Overall unit (open)
Rear view



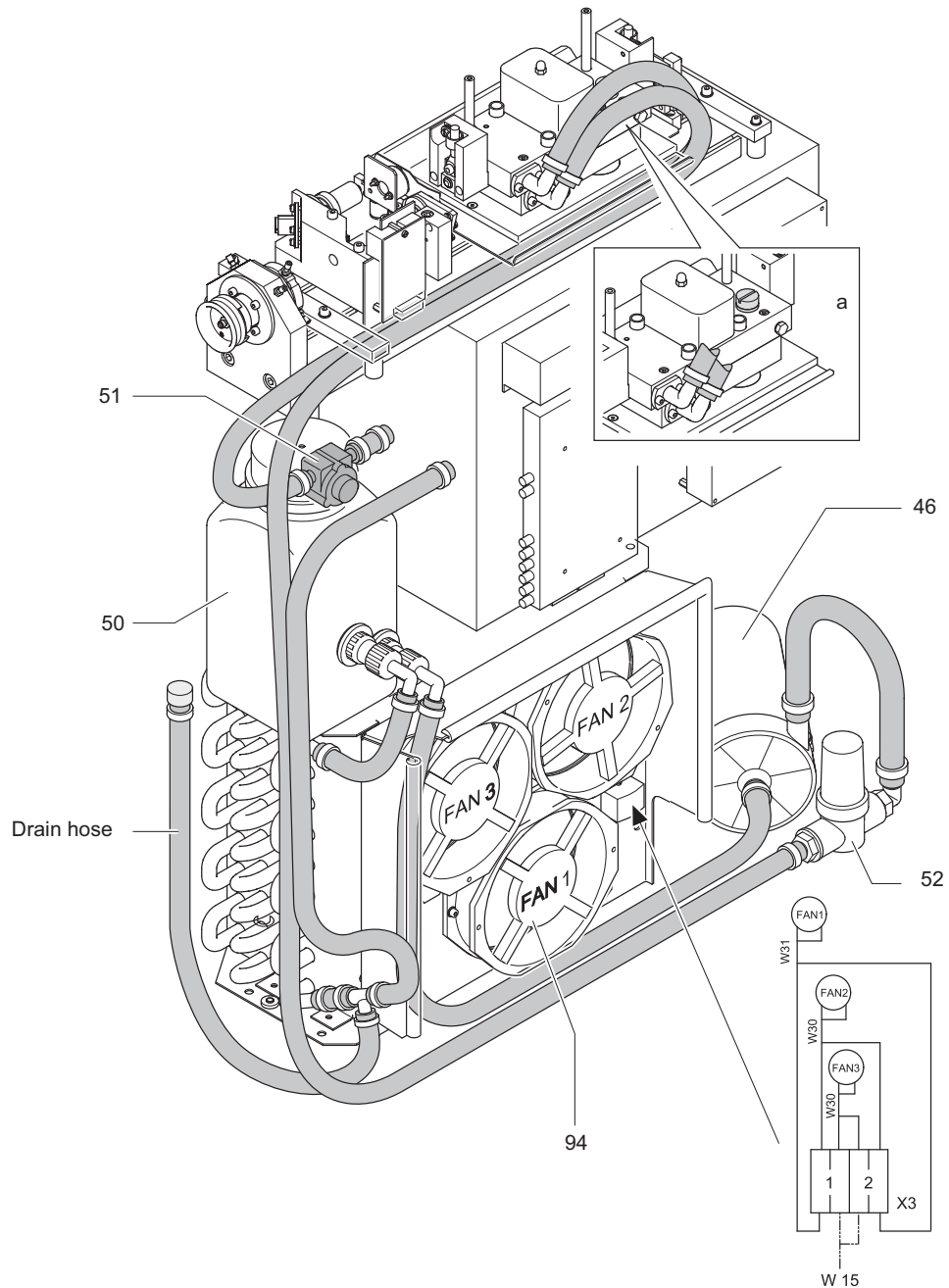
(09) Rear handle	K2010815	(68) Laser power supply	s. page 79
(55) Electricity complete	s. page 80	(92) Temperature sensor (A18) .	K2010783

5.4 Cooling system

5.4.1 Replacing subassemblies in the cooling system

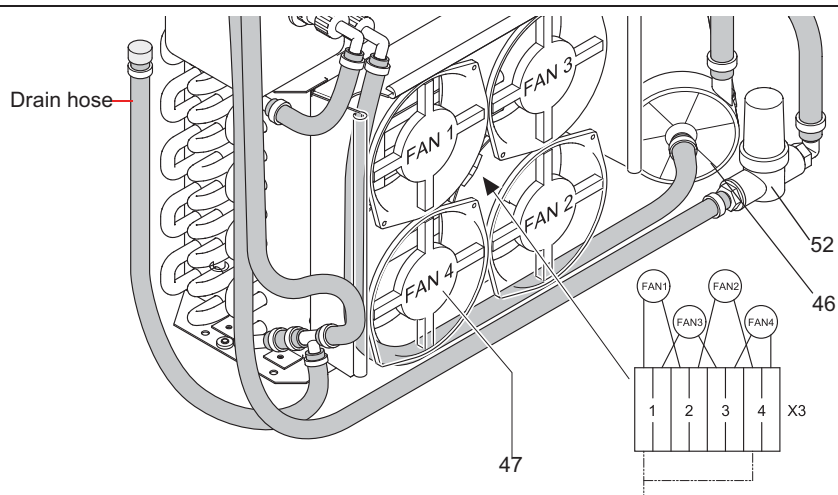
The following figure shows the subassemblies which can be changed in the field. Note also the schematic diagram on page 38.

Fig. 40
Cooling system,
model with 3 fans



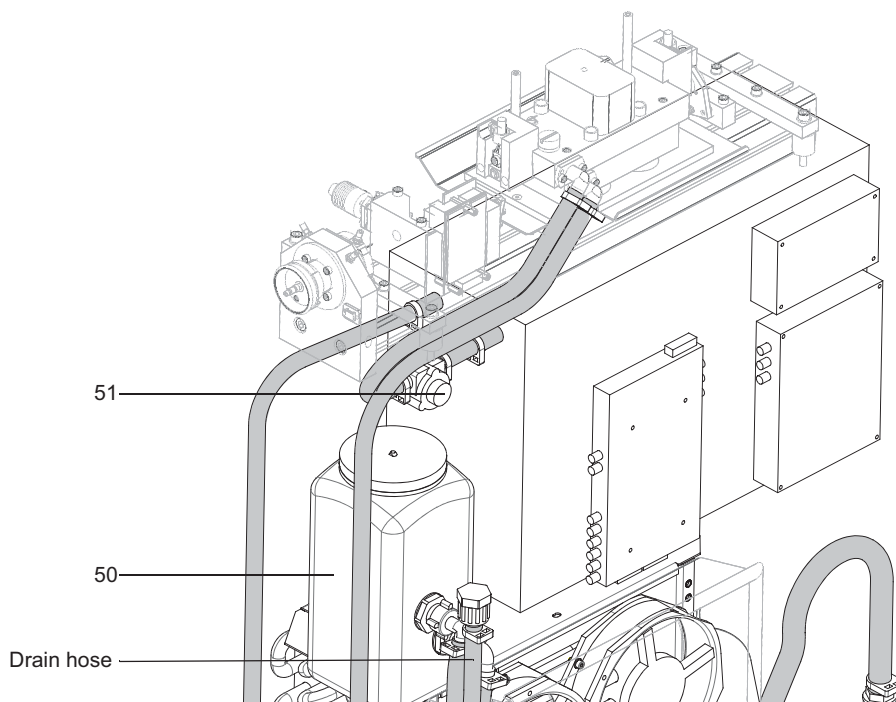
(94) Fan 130mm K2010939

Cooling system,
model with 4 fans



(47) Fan 142mm K2011075

Cooling system,
new model



(46) Pump s. page 74
 (50) Tank..... s. page 105
 (51)Flow meter + water temperature sensor..... K2011039
 (52) Water filter s. page 105

Preparation for exchange of assemblies of cooling system

- 1 Disconnect Dornier Medilas H from mains power supply.
- 2 Drain coolant off as in chapter "Draining coolant" is described (s. page 27).

After replacement proceed as follows:

- 1 Replace the damaged hose clips (s. page 36).
- 2 Filling up the coolant, see page 24.

5.4.2 Replacing pump

Preparation

- 1 Removing panel parts, see page 63-69.
- 2 Draining coolant, see page 27.

Procedure

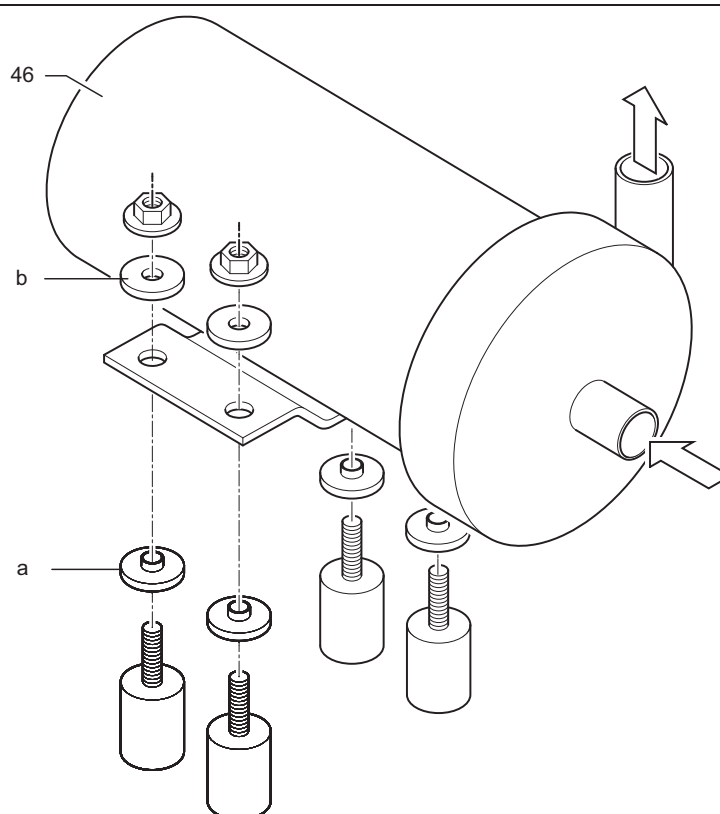
- 3 Detach the hose clips and the electrical connection to the ACV board.
- 4 Remove the pump from its mechanical fixture as illustrated below.
- 5 When installing the new pump check the correct assembly of the eight insulating grommets (a) and (b), since the housing must not be subject to earth potential when in operation.

Fig. 41
Replacing pump



Warning:
High voltage!
Disconnect the Dornier Medilas H from the mains power supply during assembly.

When the unit is switched on, housing of the pump, the heat exchanger, the laser power supply and the EMC hood are under tension (half mains voltage).



(46) Pump K2011040

After replacement proceed as follows:

- 1 Filling up the coolant, see page 24
- 2 Check cooling system for tightness.

5.5 Replace ACV board

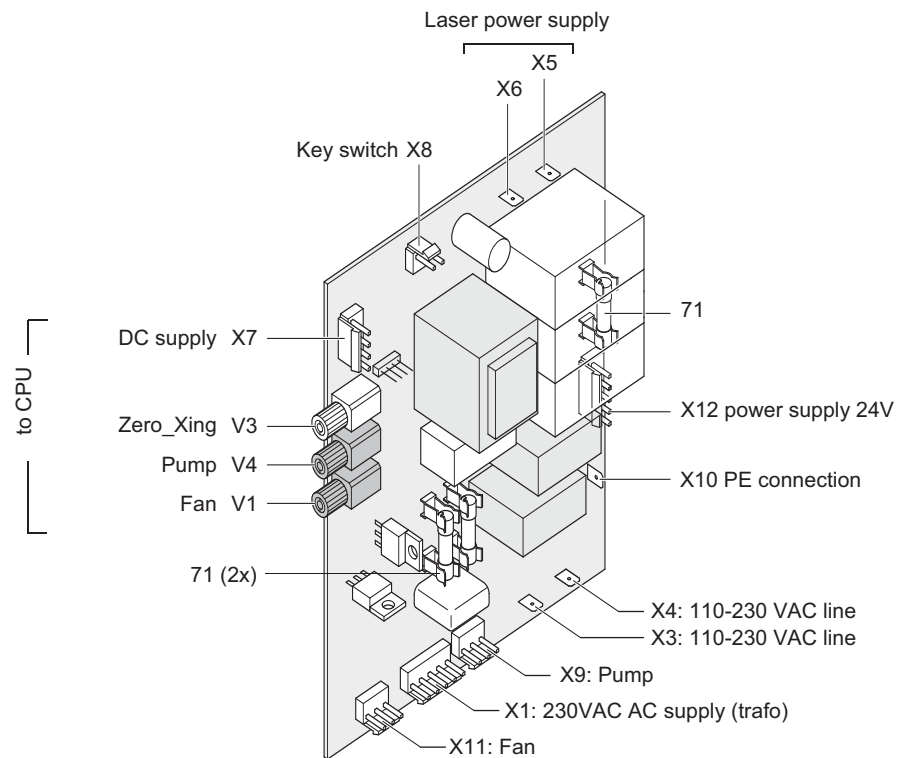
Preparation

- 1 Removing panel parts, see page 63-69.

Procedure

- 2 Mark all connections for reconnection.
- 3 Detach all connections and the four fastening nuts.

Fig. 42
Replace ACV board



- X7 Pin 1 <- nc.
- X7 Pin 2 <- CPU X2 (+5 V)
- X7 Pin 3 <- CPU X2 (GND)
- X7 Pin 4 <- nc.

(71) Fine-wire fuse T1,6A 250V . K2011093 (70) ACV board K2010790

After replacement proceed as follows:

- 1 Verify that all connectors are properly plugged in.
- 2 Setting of fan level, see page 53

5.6 CPU board

5.6.1 Replacing CPU board

Preparation

- 1 Removing panel parts, see page 63-69.

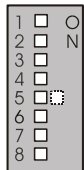
Procedure

- 2 Mark all connections for reconnection.
- 3 Detach all connections and the four fastening nuts.
- 4 Remove the PCB minimodul (s. page 78).

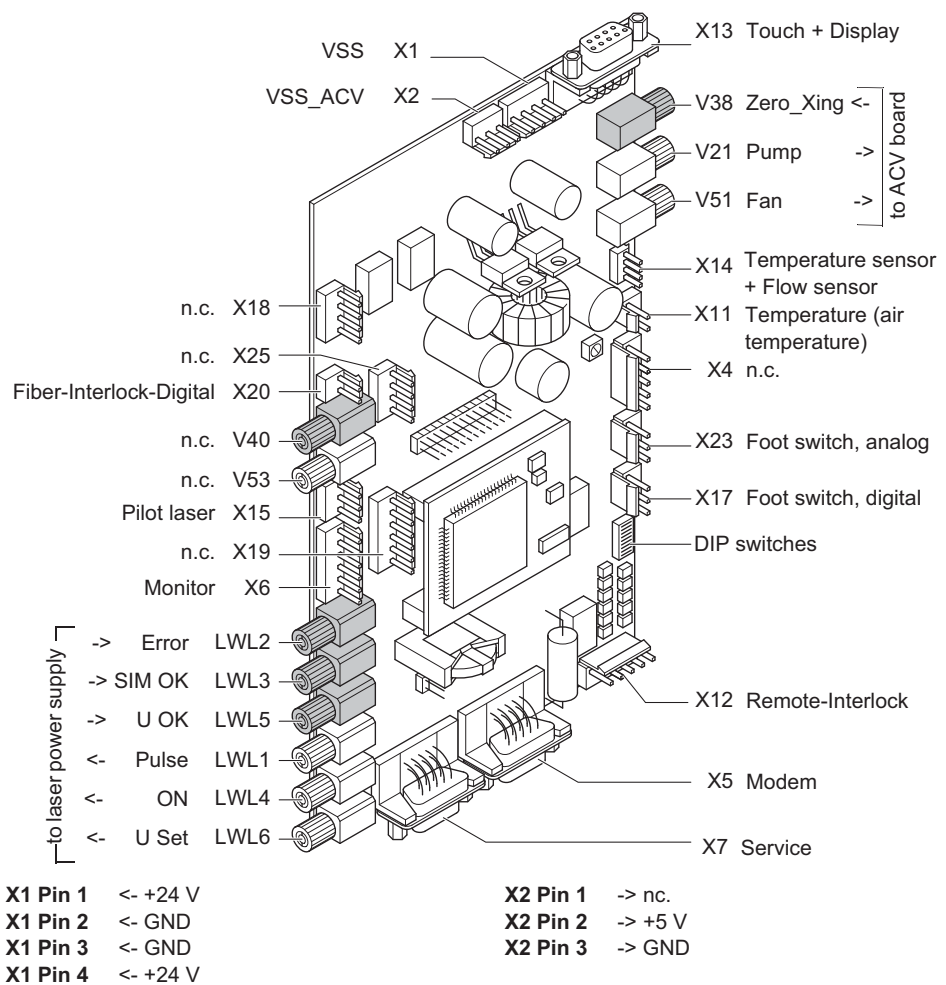
Fig. 43
Replacing CPU board



Note precautions for prevention of damage resulting from electrostatic charge.



DIP switch on CPU
Example: therapy operation mode 208/230 VAC (s. page 36, Fig. 8).



After replacement proceed as follows:

- 1 Fit the PCB minimodul (s. page 78).
- 2 Verify that all connectors are properly plugged in.
The connectors marked with n.c. in fig. 43 are not used.
- 3 Set date and time (see user manual)
- 4 Perform the calibrations in service mode (see 4.2) as described in 4.3 and 4.3.3.
- 5 Set DIP switches to therapy operation as shown in the figure above.

5.6.2 Replacing coin cell

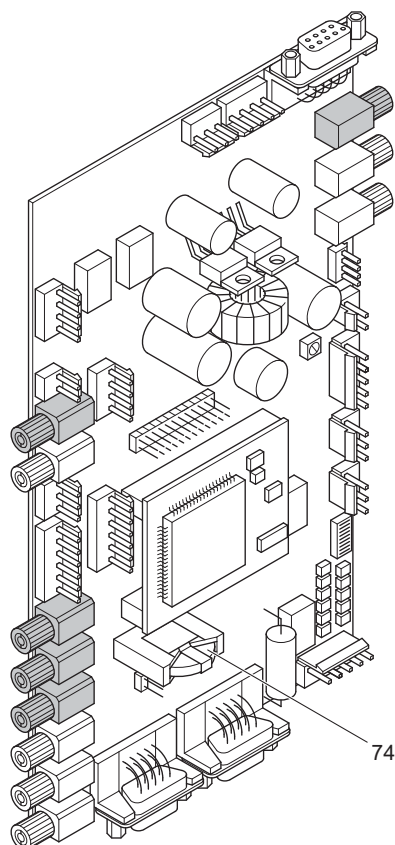
In fig. 44 the coin cell type CR2032 (72) is shown.

The coin cell type CR2032 must be replaced when the message "Battery empty" is displayed after switching on the device.

Preparation

- 1 Removing panel parts, see page 63-69.

Fig. 44
Replacing coin cell



(74) Coin cell type CR2032 K2010683

After replacement proceed as follows:

- 1 Set date and time (see user manual)

5.6.3 Replacing PCB minimodul

The PCB minimodul has to be replaced only when the software is upgraded. Customized user programs may be stored in the PCB minimodul. Before replacement, note these user programs. Inform the user that these user programs must be reloaded after replacement.

Preparation

- 1 Removing panel parts, see page 63-69.

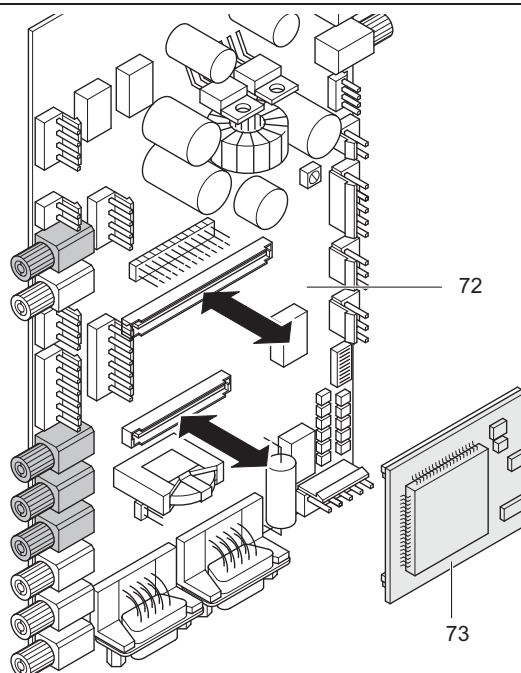
Procedure

- 2 Use a suitable blunt tool as a lever (screw driver or curved tweezers).
- 3 Position the lever carefully between the edge of the module and the CPU. Note that there are components on the back.
- 4 Lever the PCB minimodul lightly out on one side, and then completely out of the connector from the other side.
- 5 Make sure that the contacts are clean.
- 6 Gently push the PCB minimodul onto the pin connector.
- 7 Press PCB minimodul until you hear it click into place.

Fig. 45
Replacing PCB
minimodul



Note precautions for prevention of damage resulting from electrostatic charge.



(73) PCB minimodul K2011046

After replacement proceed as follows:

- 1 Set date and time (see user manual)
- 2 Re-store user programs.

5.7 Replacing laser power supply

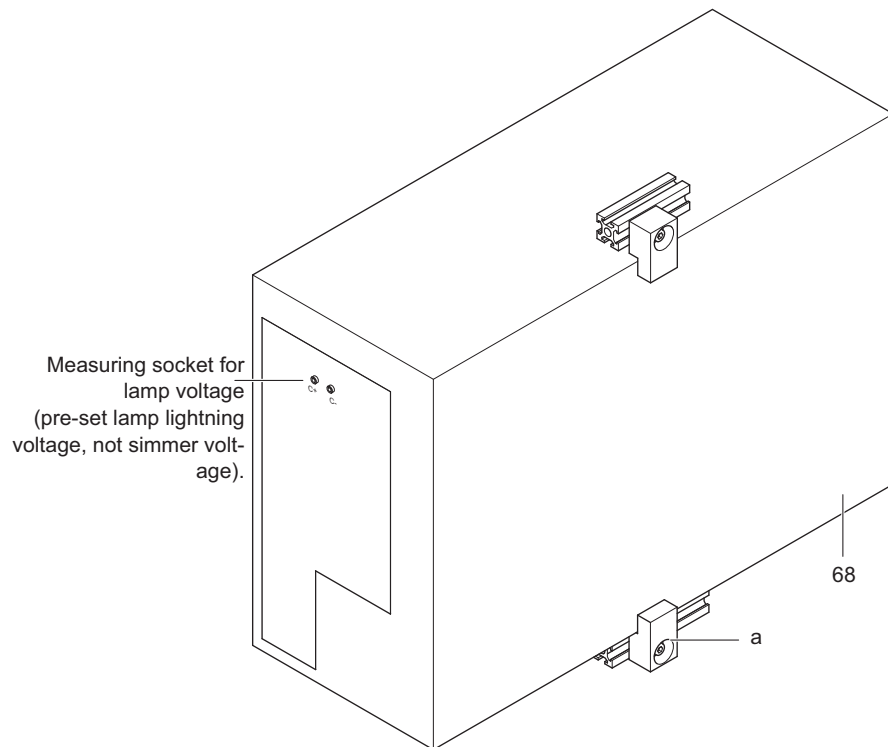
Preparation

- 1 Removing panel parts, see page 63-69.
- 2 Draining coolant, see page 27.

Procedure

- 3 Mark all connections for reconnection and/or note the connection diagram in section 4.1.1a.
- 4 Detach the laser power supply connections.
- 5 Detach the cable for the flash lamp as shown in section 5.9.6.2.
- 6 Detach the cable bushes on the laser head.
- 7 Detach the mounting bracket (a).
- 8 Carefully remove the laser power supply.

Fig. 46
Detail from fig. 39



(68) Laser power supply K2010830

After replacement proceed as follows:

- 1 Filling up the coolant, see page 24.
- 2 Check cooling system for tightness.
- 3 Calibration of energy values, see page 48.
- 4 Check energy values.

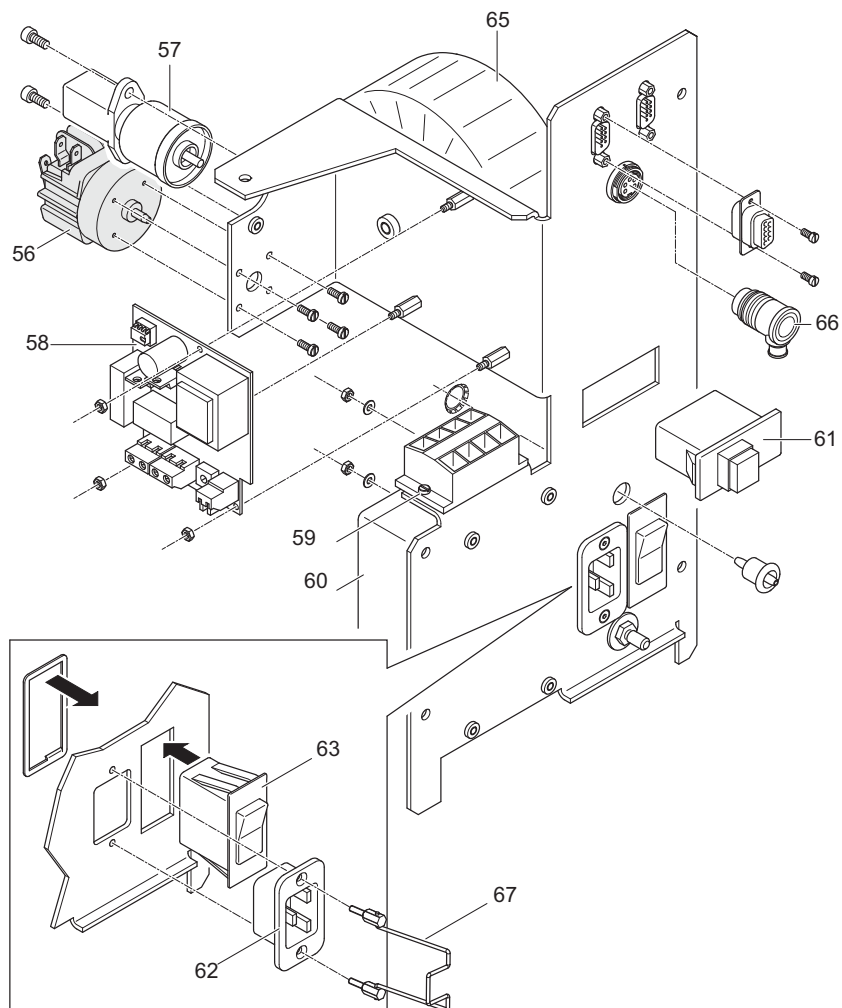
5.8 Electricity complete

The following figure shows the subassemblies which can be changed in the field. Cable connectors are not shown. See also the schematic diagram on page 38.

Preparation

- 1 Removing panel parts, see page 63-69.

Fig. 47
Electricity complete



(56) Air break switch	K1007148	(62) Appliance input.....	K2010510
(57) Pneumatic potentiometer	K2010777	(63) Over current protected switch 16A	K1009726
(58) Transformer relay	K2010892	(65) Toroidal core transformer RTO300	K2010891
(59) Terminal strip	K2010871	(66) Remote connector	K1009904
(60) Line filter	K2010568	(62) Appliance input.....	K2010510
(61) Over current protected switch 5A	K2010982	(67) Retaining clip	K2010990

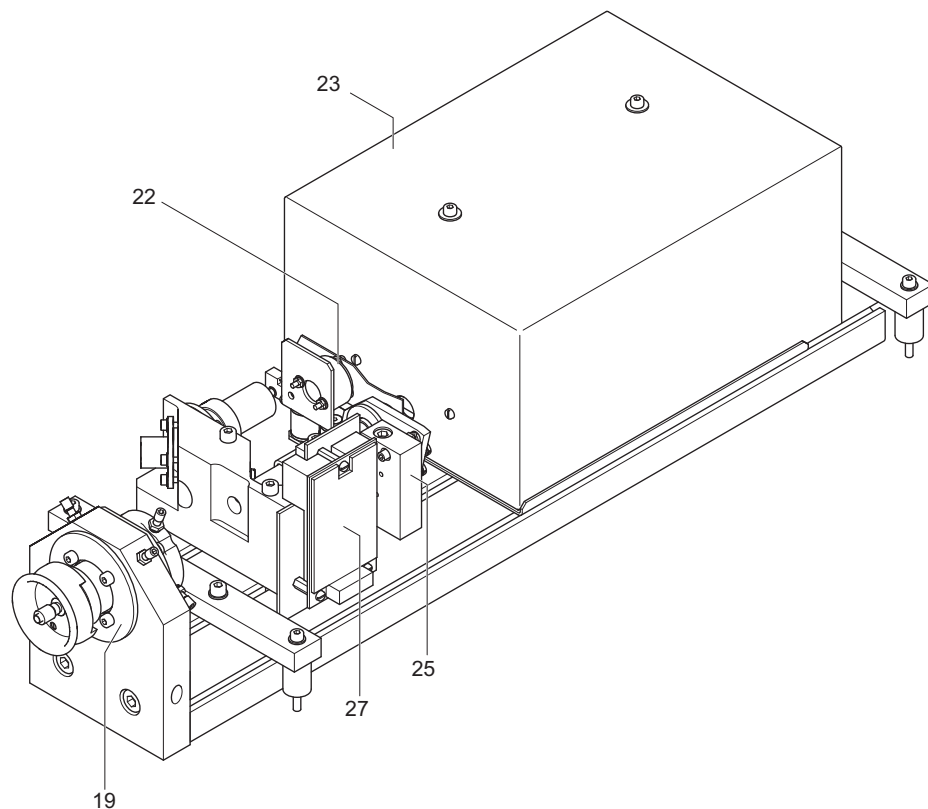
After replacement proceed as follows:

- 1 Check electrical connection of the replacement subassembly according to the figure on page 38.
- 2 Turn the potentiometer on the board "transformer relay" anti-clockwise as far as it will go.
- 3 Check overall appliance function.

5.9 Laser head

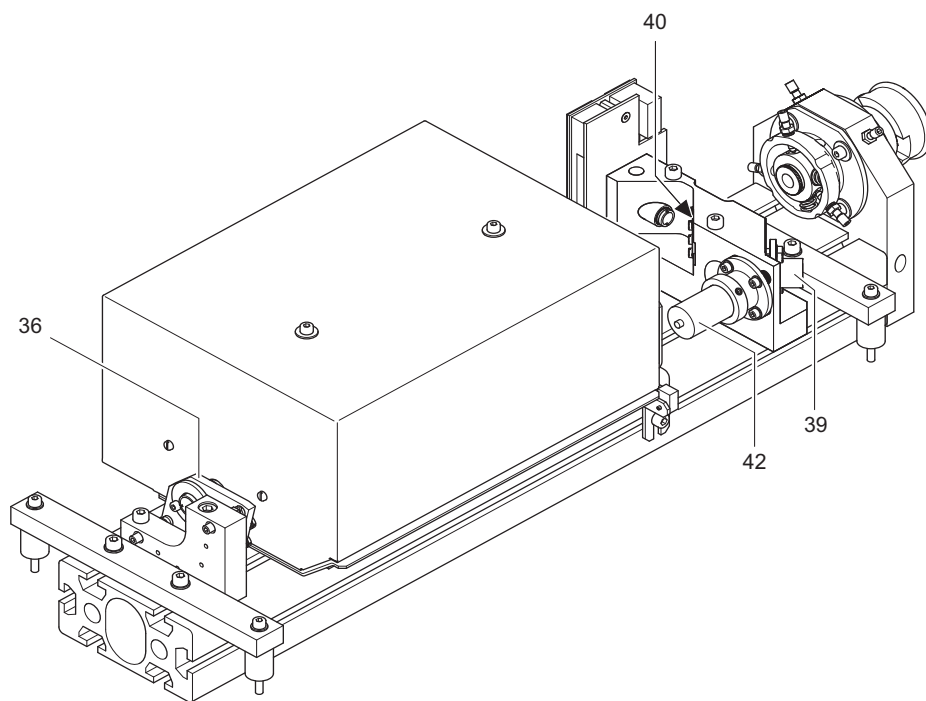
The following two figures illustrate replaceable subassemblies. The key gives the subassembly description and refers to detailed sections on the respective subassemblies which must be read. If the order number is given next to the subassembly description, there is no detailed description.

Fig. 48
Front view



- | | | | |
|--------------------------|------------|------------------------------|------------|
| (19) Fiber coupler | s. page 97 | (25) Mirror holder with | |
| (22) Shutter | s. page 83 | output coupler attached..... | s. page 85 |
| (23) Pump chamber | s. page 88 | (27) Monitor board | s. page 86 |

Fig. 49
Rear view



- | | | | |
|--------------------------------------------------------|------------|--------------------------|------------|
| (36) Mirror holder with reflector mirror attached..... | s. page 87 | (40) Beam splitter | K2010948 |
| (39) Pilot laser deflection mirror . | s. page 87 | (42) Pilot laser | s. page 87 |

5.9.1 Replacing shutter

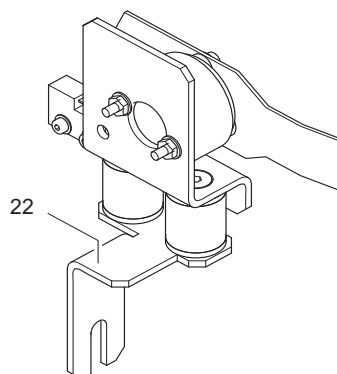
Preparation

- 1 Removing panel parts, see page 63-69.

Procedure

- 2 Detach the electrical connections and the fastening screw.
- 3 Replace the entire shutter.

Fig. 50
Shutter
Detail from fig. 48



(22) Shutter K2010902

After replacement proceed as follows:

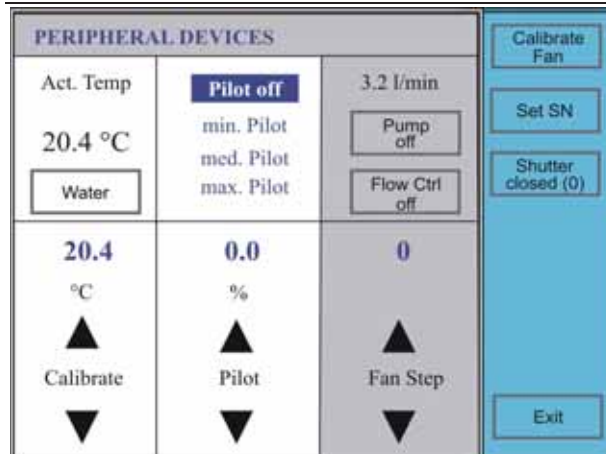
- 1 Check function. To do this, pulse the laser several times and observe the shutter through protective goggles.

5.9.2 Checking, adjusting Monitoring switch

Vorbereitung

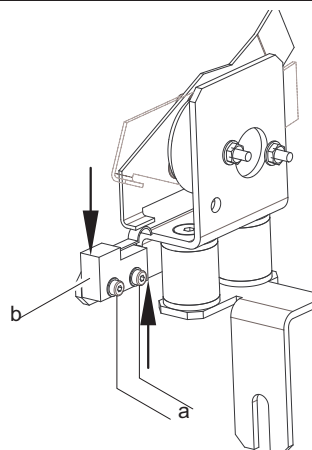
- 1 Switch unit to service mode (s. page 40).
- 2 Press key "Peripheral Devices".

Fig. 51
Anzeige: PERIPHERAL
DEVICES
Software version 1.10



- 3 Press key "Shutter closed (0)", to open the shutter (s. page 54).

Fig. 52
Shutter



(22) Shutter K2010902

After pressing the key "Shutter closed (0)", the inscription of the key must be changed - for "Shutter open (1) automatically" (inversely). If the key does not react, accomplish the following steps:

- 1 Loosen the two screws (a).
- 2 Turn the monitoring switch (b) against the clockwise direction till the inscription of the key change to "Shutter open (1)".
- 3 Fix the monitoring switch in this position with the two screws (a).

Accomplish after adjusting the following steps:

- 1 Check the function. For that press repeatedly the key "Shutter closed (0)" and/or "Shutter open (1)".

5.9.3 Replacing resonator mirror

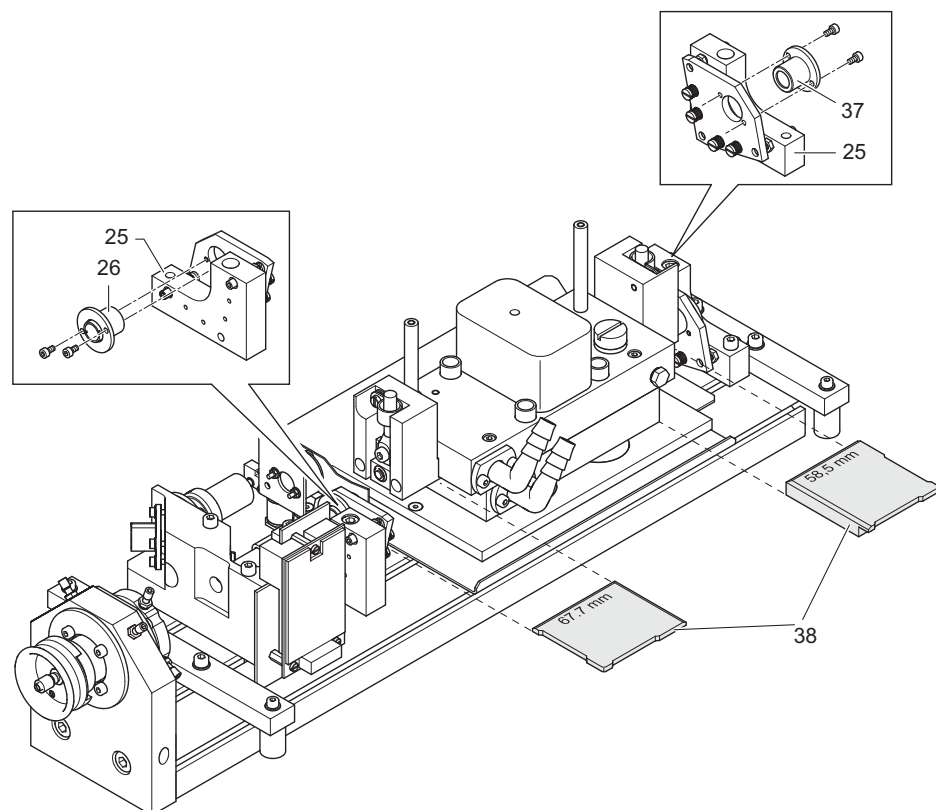
Preparation

- 1 Removing panel parts, see page 63-69.
- 2 Removing EMC hood, see page 88.

Procedure

- 3 If it is necessary to replace the output coupler or the reflector mirror along with the mirror holder, the front surface of the mirror holder should be adjusted towards the bottom edge of the cavity using a gauge as shown in fig. 53. This adjusts the spacing and parallelism. The gauge should be rotated as appropriate, depending on whether the output coupler or the reflector mirror is being adjusted.

Fig. 53
Replacing output coupler,
reflector mirror



(25) Mirror holder	K2010997	(37) Reflector mirror attached ...	K2011041
(26) Output coupler attached	K2011042	Reflector mirror	K2010922
Output coupler	K2010946	(38) Mirror adjustment gauge	K2011029

After replacement proceed as follows:

- 1 Adjusting resonator, see page 94.
- 2 Calibration of internal energy meter, see page 45.
- 3 Calibration of energy values, see page 48.

5.9.4 Replacing monitor board

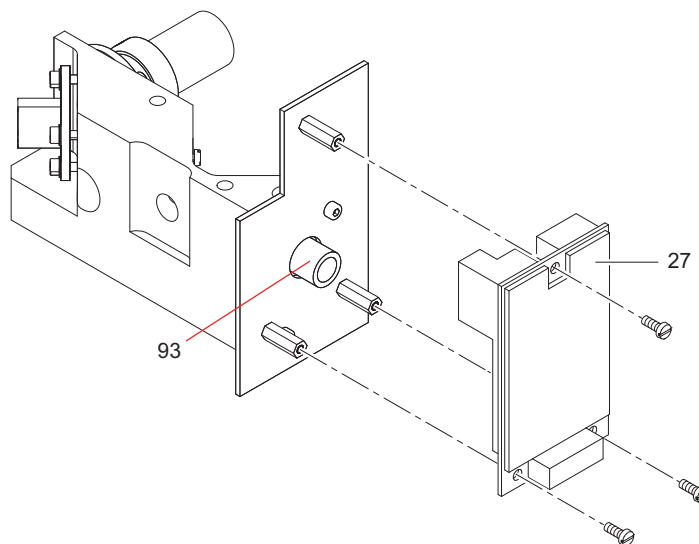
Preparation

- 1 Removing panel parts, see page 63-69.

Procedure

- 2 Detach the connection cable and remove the monitor board.
- 3 Fit the new monitor board.

Fig. 54
Monitor board
Detail from fig. 48



(93) Monitor tube K2010811 (27) Monitor board K2010609

After replacement proceed as follows:

- 1 Calibration of internal energy meter, see page 45.
- 2 Calibration of energy values, see page 48.

5.9.5 Replacing pilot laser

Preparation

- 1 Removing panel parts, see page 63-69.

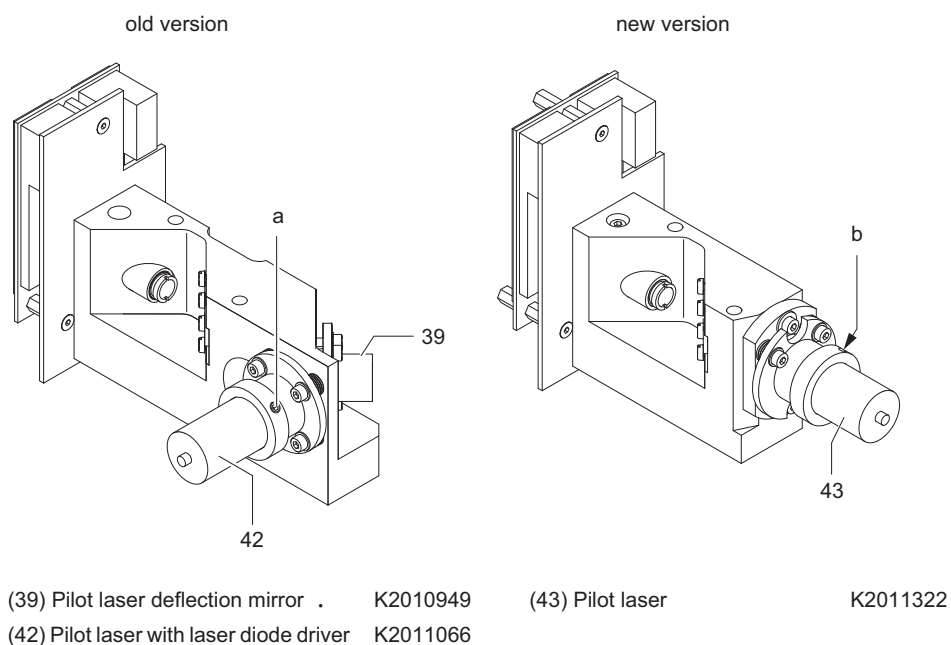
Procedure A (valid for the old version of the pilot laser only)

- 2 Unfasten clamping screw (a) und pull the pilot laser out of its holder.
- 3 Detach the connection cables of the laser diode driver.
- 4 Detach the pilot laser together with the laser diode driver.

Procedure B (valid for the new version of the pilot laser only)

- 2 Unfasten clamping screw (b) und pull the pilot laser out of its holder.
- 3 Detach the connection cables of the pilot laser.
- 4 Replace the entire pilot laser.

Fig. 55
Pilot laser
Detail from fig. 49



After replacement proceed as follows:

- 1 Adjusting pilot laser coaxially with regard to the therapy laser beam (units til serial number H20-079), see page 98.
- 2 Setting of pilot laser, see page 52.

5.9.6

Removing EMC
hood

Replacing cavity and/or its subassemblies

Preparation

- 1 Removing panel parts, see page 63-69.

WARNING High voltage

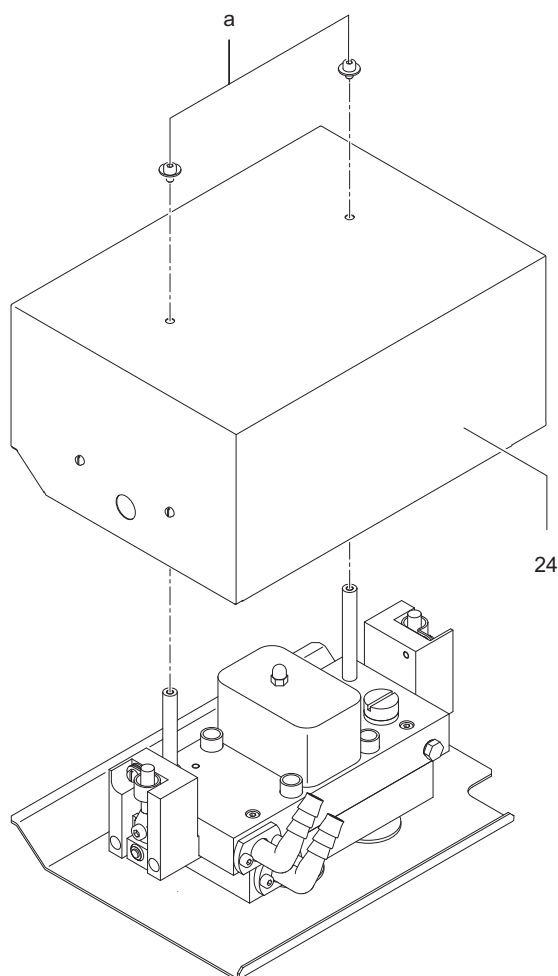
Ensure before touching the contacts of the flash lamp that the following conditions are fulfilled:

- The Dornier Medilas H must be separated from mains power supply.
 - There must not be a residual voltage at the cables of the flash lamp. Check with voltmeter, measuring range 1000VDC, at the measuring sockets (C+) and (C-) of the laser power supply. The measuring sockets are shown on page 79.
-
-

Procedure

- 2 Unfasten both screws (a) and carefully lift off the EMC hood.

Fig. 56
Cavity
Detail from fig. 48



(24) EMC hood - - - - -

5.9.6.1

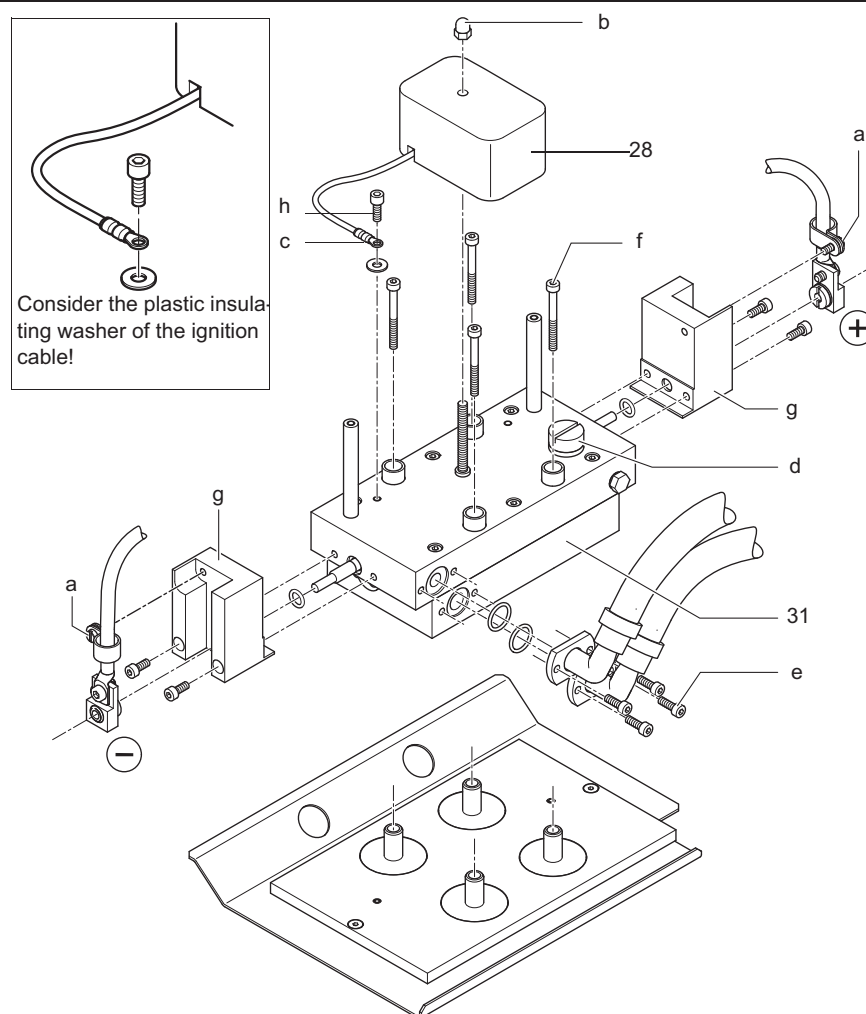
Replacing cavity**Preparation**

- 1 Remove panel parts, s. page 63-69.
- 2 Remove EMC hood, s. page 88.

Disassembling cavity

- 3 Remove the screws (a) from the two cable clips.
- 4 Remove the plastic nut (b).
- 5 Remove the plastic screw (h) and detach the ignition cable (c).
- 6 Lift the ignition unit (28) up and off and allow it to hang down the back. Never detach the connections to the contact blocks (+) and (-) as the mechanical forces could damage the flash lamp.
- 7 Open and after approx. 10 sec. close the vent screw (d).
- 8 Unfasten the four screws (e) and detach the two coolant hoses.
- 9 Remove four allen screws (f).
- 10 Turn the contact of the flash lamp (-) carefully left and right alternating around the axis of the lamp and pull simultaneously the contacts of the lamp in axial direction.

Fig. 57
Replacing cavity



(28) Ignition unit

K2010981

(31) Cavity.....

K2011008

- 11 Step 11 is not necessary for the devices with serial number > 12 .
For units with a serial number of ≤ 12 , lift the cavity carefully about 20 mm and hold firmly in this position with one hand.
- 12 Turn the contact of the flash lamp (+) carefully left and right alternating around the axis of the lamp and pull simultaneously the contacts of the lamp in axial direction.
- 13 Remove the cavity.

Installing cavity

- 1 Ensure the the flash lamp is built in with correct polarity. The red marked electrode has to be connected to the cable (+) (see Fig. 57). If necessary pull out the lamp axially and insert it the other way round. Do not touch the lamp or its contacts with bare fingers.
- 2 Replace the cavity. Take care to ensure that the openings for the coolant connections are facing forwards.
- 3 Push the lamp contact (-) together with the attached cable onto the flash lamp.
- 4 Step 5 is not necessary for the devices with serial number > 12 .
For units with a serial number of ≤ 12 , lift the cavity carefully about 20 mm and hold firmly in this position with one hand.
- 5 Push the lamp contact (+) together with the attached cable onto the flash lamp.
- 6 Replace the cavity.
- 7 Follow the disassembly steps in reverse order to complete reassembly.

After replacement proceed as follows:

- 1 Switch the unit on and check cooling circuit for tightness.
- 2 Adjust resonator, s. page 94.
- 3 Calibrate the internal energy meter, s. page 45.
- 4 Calibrate the energy values, s. page 48.

5.9.6.2

Replacing ignition unit

Replacing flash lamp

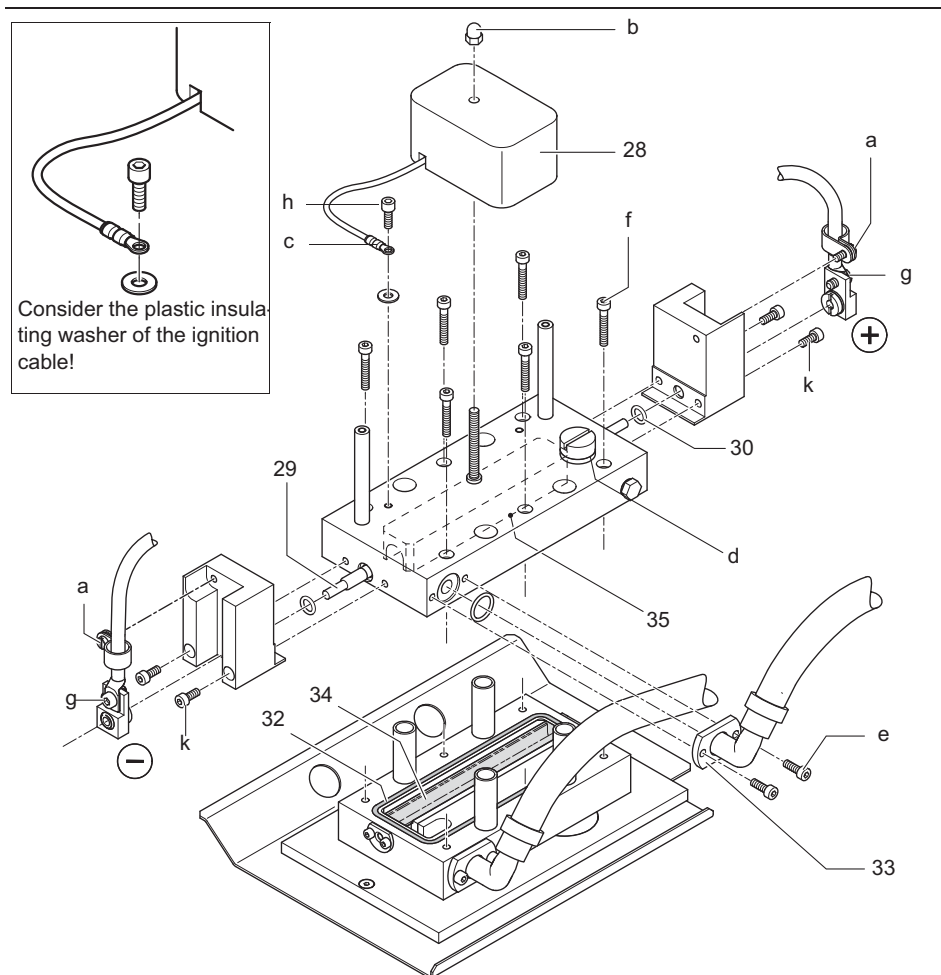
Preparation

- 1 Removing panel parts, see page 63-69.
- 2 Removing EMC hood, see page 88.

Disassembling ignition unit

- 3 Remove the screws (a) from the two cable clips.
- 4 Remove the plastic nut (b).
- 5 Remove the plastic screw (h) and detach the ignition cable (c).
- 6 Lift the ignition unit (28) up and off and allow it to hang down the back. At this point do not detach the connections (g) to the contact blocks (+) and (-) as the mechanical forces could damage the flash lamp.
- 7 Open and after approx. 10 sec. close the vent screw (d).
- 8 Unfasten the two screws (e) to detach the coolant hose.

Fig. 58
flash lamp, replace
ignition unit



(28) Ignition unit	K2010981	(33) Cavity flange	K2010794
(29) Flash lamp	K2010828	(34) Glass plate	K2010974
(30) Lamp o-ring	K2010853	(35) Lamp reflector	K2010716
(32) Cavity seal	K2010975		

- 9 Turn the lamp contact (-) carefully around the lamp axle back and forth and take off at the same time the lamp contact in axial direction.
- 10 Remove six allen screws (f).
- 11 Step 11 is not necessary for the devices with serial number > 12.
For units with a serial number of ≤ 12 , lift up the top section of the cavity carefully approx. 20 mm and hold it in this position with one hand.
- 12 Turn with the other hand the contact of the flash lamp (+) carefully left and right alternating around the axis of the lamp and pull simultaneously the contacts of the lamp in axial direction.
- 13 Step 13 is only necessary, if the ignition unit (s. page 93) or the laser power supply (s. page 79) are to be replaced.
Remove the contact screws (g).

Disassembling flash lamp

Note

The glass plate below the top section of the cavity may be inadvertently lifted out as well. Take care not to let the glass plate fall on the floor.

- 14 Carefully remove the top section of the cavity.
- 15 Unfasten four screws (k).
- 16 Pull out the flash lamp sideways.

Installing flash lamp

- 1 Place the flash lamp with the sealing rings into the top section of the cavity.
Note the polarity stated in fig. 58. The red marked electrode has to be connected to the cable (+).
- 2 Secure the flash lamp with the screws (k).
- 3 Examine the correct position of the sealing ring on the lower part of the cavity.
- 4 Examine the correct position of the sealing ring on the lower part of the cavity.
- 5 Replace the top section of the cavity.
- 6 Push the lamp contact (+) together with the attached cable onto the flash lamp.
- 7 Step 7 is not necessary for the devices with serial number > 12.
For units with a serial number of ≤ 12 , lift up the top section of the cavity carefully approx. 20 mm and hold it in this position with one hand.
- 8 Push the lamp contact (-) together with the attached cable onto the flash lamp.
- 9 Follow the disassembly steps in reverse order to complete reassembly.

After replacement proceed as follows:

- 1 Switch the unit on and check cooling circuit for tightness.
- 2 Calibrate the internal energy meter, s. page 45.
- 3 Calibrate the energy values, s. page 48.

5.9.6.3

Replacing ignition unit

The procedure for replacing the ignition unit is part of section Replacing flash lamp, see page 91.

Please take care that the ignition cable (Fig. 58) is galvanically indirect-connected to the cavity (plastic washer and screw).

5.10

Adjusting resonator**CAUTION**

Carry out adjustments in a protected laser area. All persons working in this area must wear protective goggles.

**WARNING**

Live parts are freely accessible when the appliance is open. Especially the lamp cables of the laser power supply and the EMC hood must not be touched while the system is in operation. The electrical energy stored in the appliance can have severe health effects culminating in fatality.

Adjustment aids

- Autocollimator
- Deflector mirror unit for autocollimator
- Energy meter
- Deflector mirror for energy meter, fitted
- Black photosensitive paper

Required tools

- Allen key, metric

Safety equipment

Laser safety goggles for 2.1 μm , min. safety class L4

5.10.1

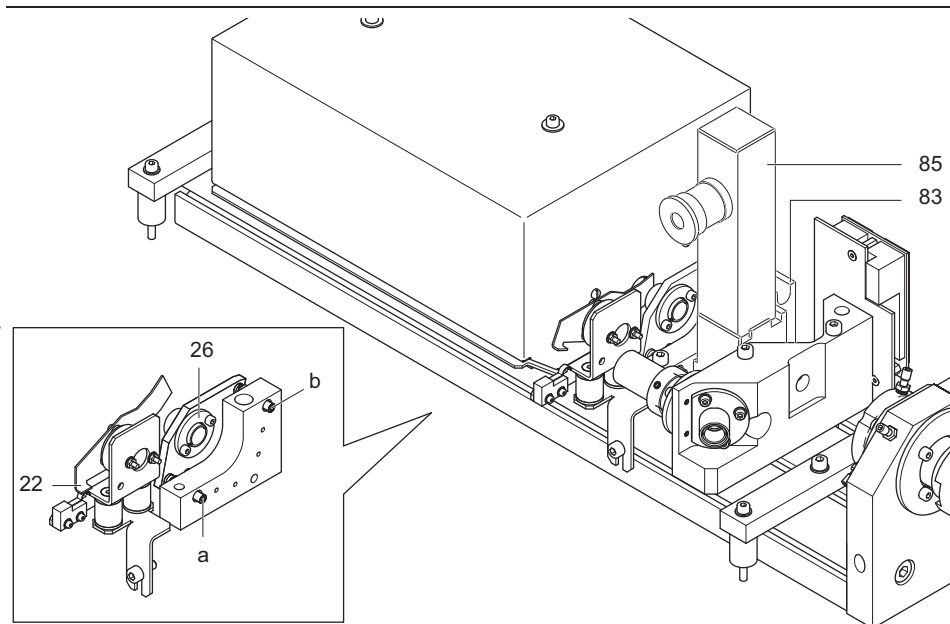
Adjusting output coupler with regard to laser rod

Adjustment is carried out using the autocollimator. The return reflexes of the output coupler and the laser rod are observed by the autocollimator and brought to convergence. This results in a sufficient adjustment of the output coupler with regard to the laser rod. The adjustment must not be changed subsequently.

Fig. 59
Adjusting output coupler
with regard to laser rod

**Caution:**

To prevent damage to eyes resulting from inadvertently triggering a laser beam, ensure that the Dornier Medilas H is disconnected from the power supply during the following adjustment.



- 1 Place the deflector mirror unit (83) and the autocollimator (85) onto the optical rail as shown above.
- 2 Switch on the autocollimator light.
- 3 The reflex of the output coupler (26) should now be visible through the autocollimator eyepiece. If necessary, move the deflecting mirror unit of the autocollimator until the reflex is visible.
- 4 Open the shutter (22) with light pressure onto the part of the flap situated above the microswitch.
- 5 The reflex from the top surface of the laser rod should now also be visible^{*)}.
- 6 Rotate the adjustment screws (a) and (b) of the output coupler until the reflexes of the laser rod and the output coupler converge.
- 7 Remove the autocollimator and deflector mirror unit from the optical rail.

^{*)} If the positions of the two reflexes converge exactly the reflex from the top surface of the laser rod should be barely visible. The "6" adjustment step is not required in this case.

5.10.2 Pre-setting reflector mirror

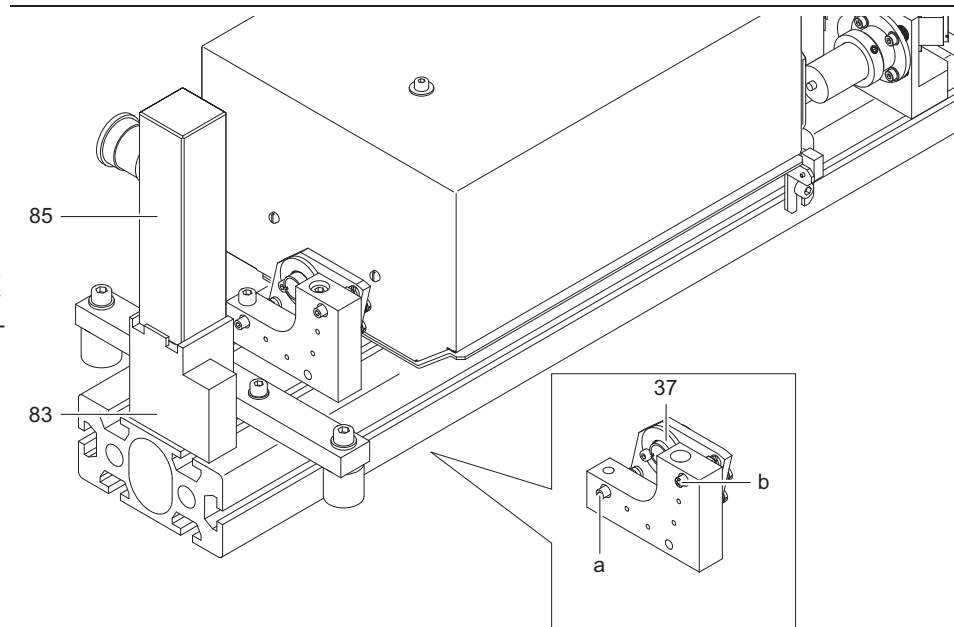
The reflector mirror is adjusted with regard to the laser rod in this pre-setting stage.

Fig. 60
Pre-setting reflector mirror



Caution:

To prevent damage to eyes resulting from inadvertently triggering a laser beam, ensure that the Dornier Medilas H is disconnected from the power supply during the following adjustment.



- 1 Place the deflector mirror unit (83) and the autocollimator (85) onto the optical rail as shown above.
- 2 Switch on the autocollimator light.
- 3 The reflex of the reflector mirror (37) and the reflex of the laser rod should now be visible through the autocollimator eyepiece^{*)}. If necessary, manipulate the deflecting mirror unit of the autocollimator until the reflexes are visible.
- 4 Adjust the reflector mirror using the setting screws (a) and (b) until the two reflex circles lie concentric with regard to one another^{†)}.
- 5 Remove the deflector mirror unit and the autocollimator from the optical rail.

^{*)} As the reflector mirror is convex, the reflexes appear as enlarged circular areas.

^{†)} The additional small point reflex which can be seen comes from the flat reverse side of the reflector mirror and can be ignored.

5.10.3

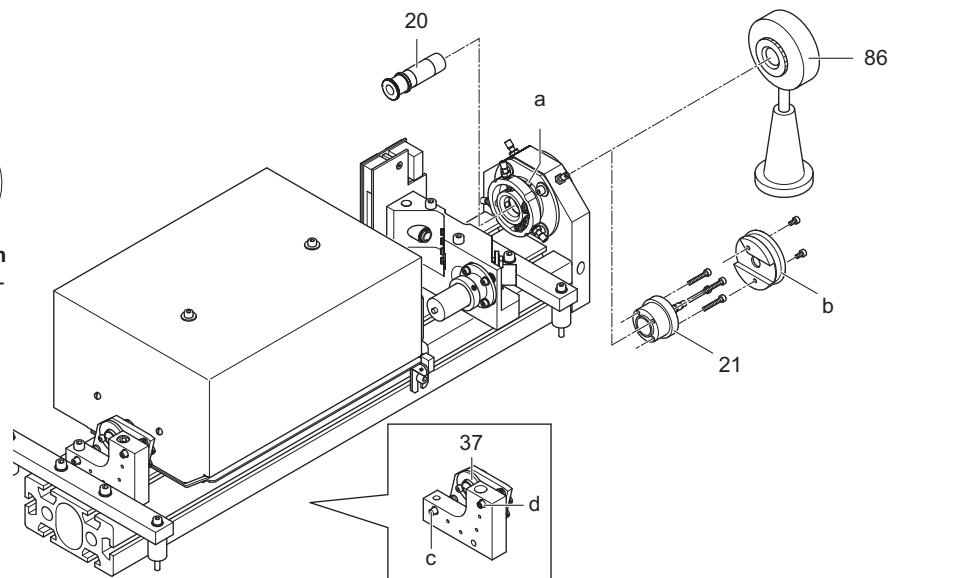
Fine adjustment of the reflector mirror

Once the above resonator set-up (output coupler - laser rod - reflector mirror) is complete it is time to optimise the power of the therapy beam. The laser power can increase in sudden jumps during optimisation. To prevent damage to the resonator therefore, the flash lamp voltage has to be lowered when output exceeds 120 mJ.

Fig. 61
Fine adjustment of the reflector mirror



Attention: laser emission
Observe the safety regulations and wear suitable safety goggles!



(20) Lens	K2011009	(37) Reflector mirror attached ...	K2011041
(21) SMA subassembly	K2011038	(86) Energy meter	-----

- 1 Unfasten the fastening screws (a) using a 2mm allen key and unscrew the lens.
- 2 Detach the plastic cap (b) and the SMA subassembly (21).
- 3 Position the energy meter (86) as shown above.
- 4 Bridge the fiber interlock.
- 5 Switch on Dornier Medilas H.
- 6 Switch the laser on in service mode and set the following values: 5Hz, 540V.
- 7 Press foot switch.
- 8 Observe the energy meter during the subsequent adjustment.
- 9 **If no laser emission can be measured:**
 - Release foot switch.
 - Repeat "Pre-setting reflector mirror" section.
 - Increase voltage by 10 Volts.
 - Repeat fine adjustment.
- 10 Optimise the reflector mirror (37) using setting screws (c) and (d). Reduce the flash lamp voltage during this process whenever the laser output exceeds 120 mJ.

5.10.4.a

Adjusting pilot laser coaxially with regard to the therapy laser beam (units til serial number H20-079)

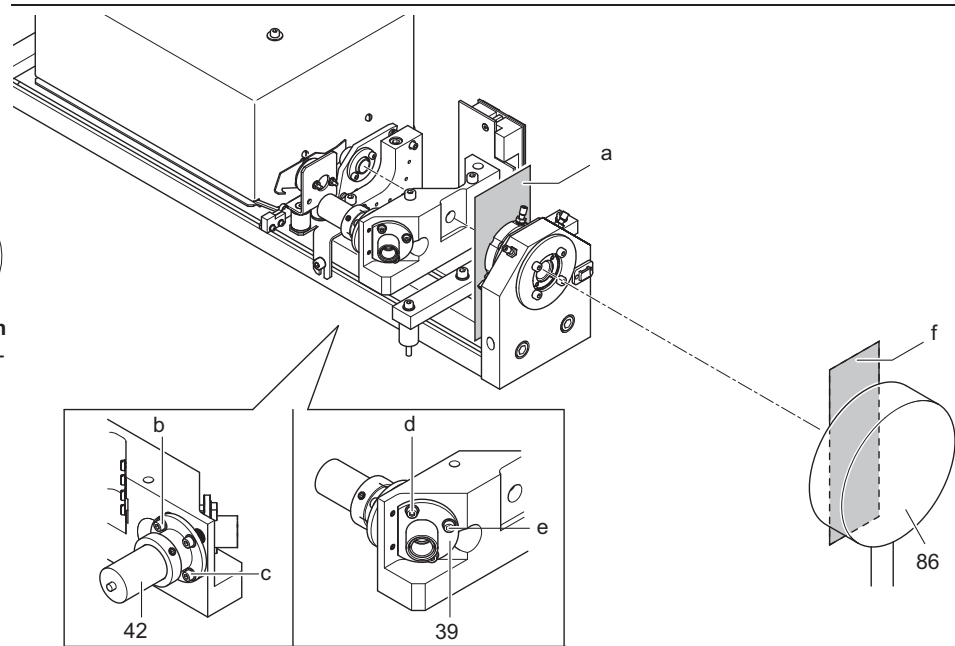
Valid for the pilot laser with power supply and deflector mirror (old version)

Fig. 62

Adjusting pilot laser coaxially with regard to the therapy laser beam (units til serial number H20-079)



Attention: laser emission
Observe the safety regulations and wear suitable safety goggles!



(42) Pilot laser (SN < 79)

K2011066

- 1 Position the energy meter (86) with a piece of photosensitive paper (f) in a distance of approx. 30 cm.
- 2 Aim a laser pulse (approx. 540 V) at the photo-paper.
- 3 Set the pilot laser deflecting mirror (39) with the setting screws (d) and (e) to the burn pattern.
- 4 Position a piece of photosensitive paper (a) as shown above*).
- 5 Aim a laser pulse (approx. 540 V) at the photo-paper.
- 6 Set the pilot laser (42) with the setting screws (b) and (c) to the burn pattern.
- 7 Repeat the adjustment until the pilot laser beam is aimed at the photosensitive paper (f) exactly at the burn pattern and at the photosensitive paper (a) at least tangentially at the burn pattern.

*) It is advantageous to the alternately to performed adjustment steps (3 and 6), to position the photosensitive paper (a) always in the same position into the optical path. For this it is recommended to fix the photosensitive paper (a) foldable with an adhesive tape.

5.10.4.b

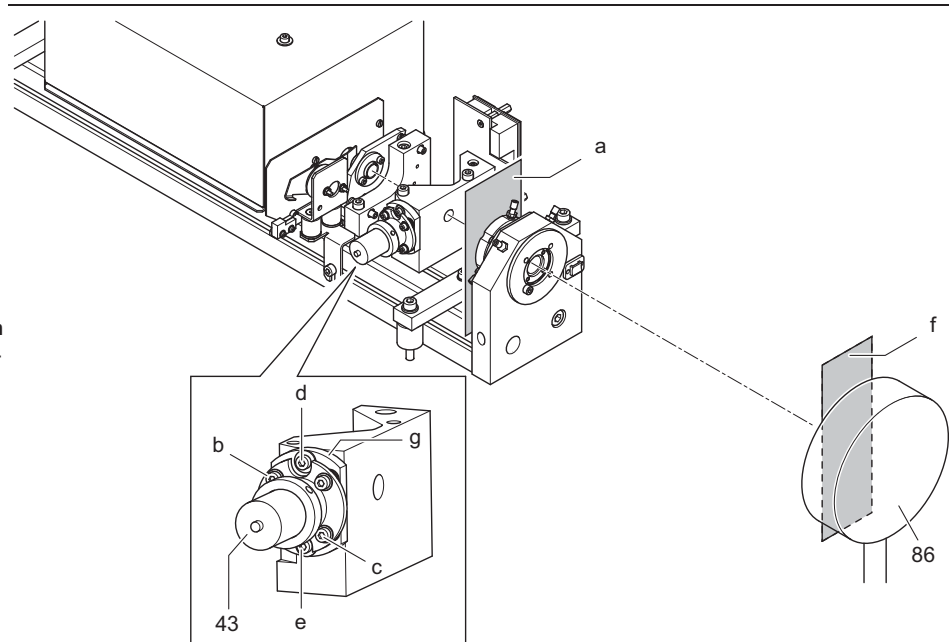
Adjusting pilot laser coaxially with regard to the therapy laser beam (units from serial number H20-080)

Valid for the pilot laser without power supply and deflector mirror (new version)

Fig. 63
Adjusting pilot laser coaxially with regard to the therapy laser beam (units from serial number H20-080)



Attention: laser emission
Observe the safety regulations and wear suitable safety goggles!



(43) Pilot laser (SN > 80)

K2011322

- 1 Loosen the fastening screws (e) and (d).
- 2 Move the adjustment plate (g) vertically and horizontally to a middle position.
- 3 Tighten the fastening screws (e) and (d) in this position.
- 4 Position the energy meter (86) with a piece of photosensitive paper (f) in a distance of approx. 30 cm.
- 5 Aim a laser pulse with approx. 200 mJ at the photo-paper (f).
- 6 Set the pilot laser (43) with the setting screws (b) and (c) to the burn pattern.
- 7 Position a piece of photosensitive paper (a) as shown above.
- 8 Aim a laser pulse (approx. 200 mJ) at the photo-paper.
- 9 Loosen the fastening screws (e) and (d).
- 10 Move the adjustment plate (g) vertically and horizontally to the burn pattern.
- 11 Tighten the fastening screws (e) and (d) in this position.
- 12 Repeat the adjustment from step 4 on until the pilot laser beam is aimed at the photosensitive paper (f) exactly at the burn pattern and at the photosensitive paper (a) at least tangentially at the burn pattern.

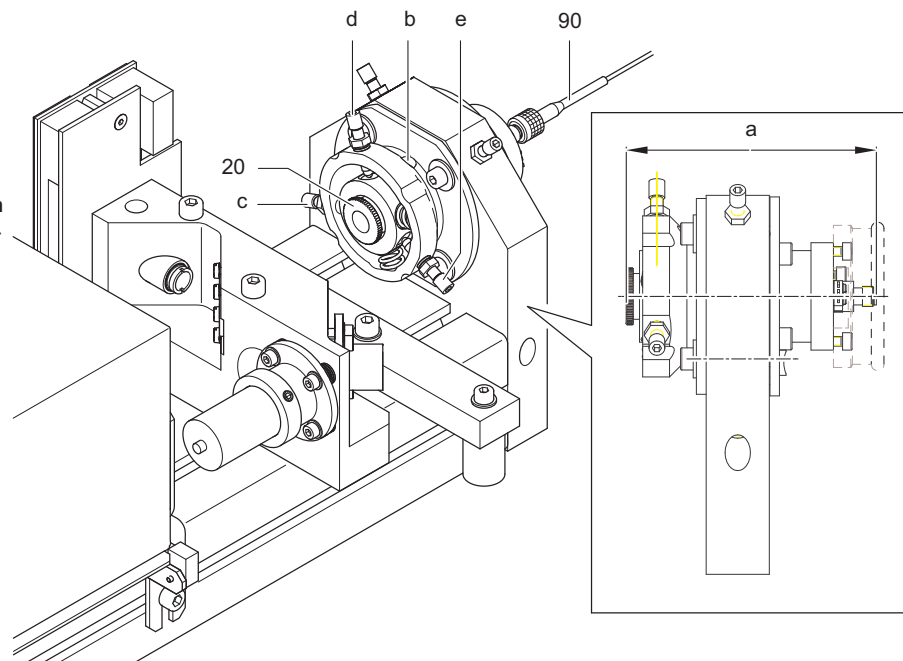
5.10.5 Adjust fiber coupler

In the next section the lens is installed and pre-set with the pilot laser beam. The lens is then adjusted to optimise the therapy laser beam entry to the optical fiber. Before installing the lens the energy values are measured and noted for verification.

Fig. 64
Adjust fiber coupler



Attention: laser emission
Observe the safety regulations and wear suitable safety goggles!



(90) Fiber for adjustment and testing K2011133

1 Measure the energy and temperature values at the following settings:

Settings		measured energy (without lens)	Displayed cooling water temperature
5Hz	520 V		
8Hz	570 V		
8Hz	600 V		
8Hz	650 V		

- 2 Insert the lens (20) into the fiber coupler.
- 3 Set the installation depth (a) with the aid of a caliper gauge (guideline value $79,6 \pm 0,05$ mm, unless stated otherwise on the lens).
- 4 Secure the lens holder with the retaining screw (b).
- 5 Connect the fiber for adjustment and testing (90) and position the distal end of the fiber in front of the energy meter approx. 30 mm away.
- 6 Loosen the counter screw (e).
- 7 Adjust the fine adjuster using screws (c) and (d) until the pilot laser beam is at maximum brightness.
- 8 Let the therapy laser pulse with 120 mJ (aprox. 530 V), 5 Hz.
- 9 Adjust the setting screws (c) and (d) until at the fiber ends the maximum of energy can be measured.

- 10 Change the voltage until the measured energy is approx. 120 mJ.
- 11 Turn the screw (c) in one direction until the energy falls just below 100 mJ. Remember this screw position.
- 12 Turn screw (c) in the other direction over the maximum energy value until the energy on the other side falls just below 100 mJ as well. Remember this screw position as well.
- 13 Turn the screw to mid-position between the positions of steps 11 and 12.
- 14 Repeat steps 11 to 12 with screw (d).
- 15 Carefully tighten the counter screw (e).
- 16 Check that the power at the fiber end is not affected when the counter screw is tightened. Repeat the previous steps if necessary.
- 17 Measure the energy and temperature values at the following settings and calculate the transmission rate:
- 18 Measure the energy and temperature values at the following settings: Recommended value: approx. 83% of the values measured in step 1 should be reached.

Settings		Distal measured energy	Displayed cooling water temperature	Transmission rate [%]
5Hz	520 V			
8Hz	570 V			
8Hz	600 V			
8Hz	650 V			

Note:

For every °C temperature increase in the cooling water, the laser power falls by approx. 20 mJ. Perform the measurements without the lens and distal at the same temperature.

- 19 Calibrate the internal energy meter (s. page 45).

The image shows a large grid of 20 columns and 30 rows. To the left of the grid, there are 10 horizontal lines, creating a margin for notes. The grid itself is composed of thin gray lines forming a uniform pattern of squares.

6 Maintenance

Replacing ion exchanger	105
Replacing water filter	106
CPU - Software Upload	107

Lined writing area consisting of 25 horizontal lines.

Large grid area consisting of 25 rows and 20 columns of squares.

6.1 Replacing ion exchanger

The ion exchanger must be replaced every 12 months.

Preparation

- 1 Remove panel parts, s. page 63-69.

Procedure

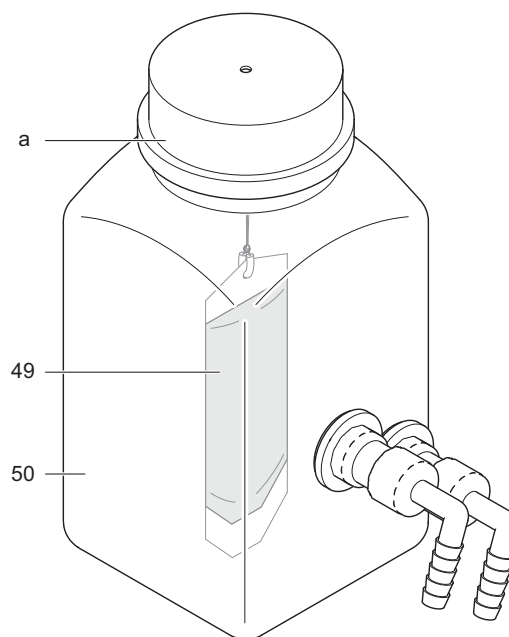
- 2 Open the screw top (a) and replace the ion exchanger.
- 3 Replace the coolant as described in sections 3.3.2 and 3.4.1.

Fig. 65
Replacing ion exchanger



Warning:
High voltage!
For assembly jobs disconnect Dornier Medilas H from mains power supply.

When the unit is switched on, housing of the pump, the heat exchanger, the laser power supply and the EMC hood are under tension (half mains voltage).



(49) Ion exchanger	K2010992	(50) Tank	K2010961
--------------------------	----------	-----------------	----------

6.2 Replacing water filter

The water filter must be replaced every 12 months.

Preparation

- 1 Removing panel parts, see page 63-69.
- 2 Drain the coolant as described in section 3.4.1.

Procedure

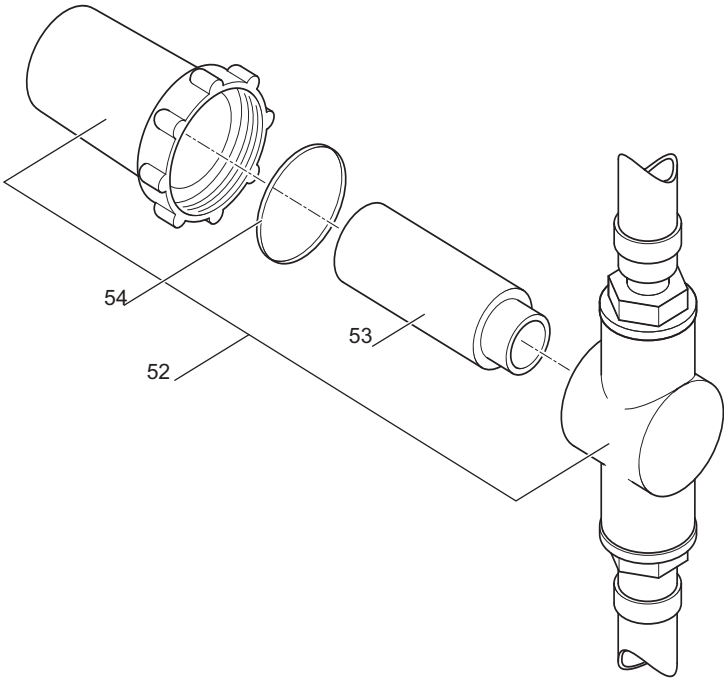
- 3 Replace the water filter as shown below.

Fig. 66
Replacing water filter



Warning:
High voltage!
For assembly jobs disconnect Dornier Medilas H from mains power supply.

When the unit is switched on, housing of the pump, the heat exchanger, the laser power supply and the EMC hood are under tension (half mains voltage).



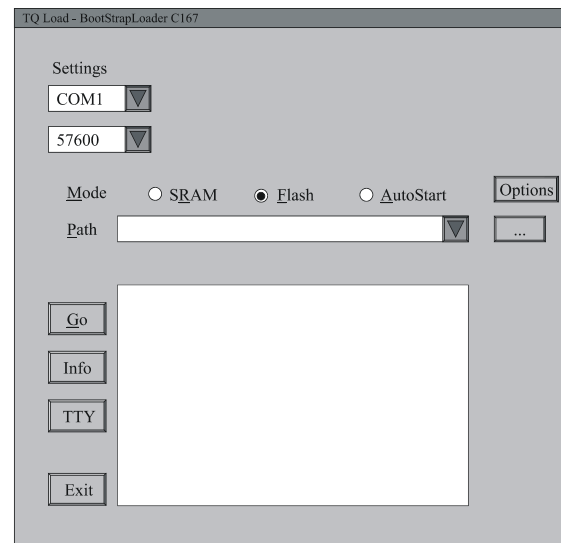
(52) Water filter	K2010967	(53) Cartridge	K2011019
		(54) Seal	K2012066

After replacement fill in the coolant as described in section 3.3.2.

6.3 CPU - Software Upload

- 1 Connect the Dornier Medilas H and the PC with the SW upload cable K2010807 as follows:
 - "X1" ("SERVICE" = COM 2) to "Service" interface at the rear panel
 - "X2" ("PC") to a free COM-Port on the PC
- 2 Insert upgrade CD into PC.
- 3 Start terminal program "TQLoad.exe" from CD.

Fig. 67
Terminal Program
"TQLoad"



- 4 Select the COM-Port used on the PC.
- 5 Set Baud rate to 57600.
- 6 Select upload file "PLH_1VXX.h86" on the CD.
Please note the instructions included with the software if necessary.
- 7 Set mode to "Flash".
- 8 Switch on Dornier Medilas H.
- 9 Start upload with button "Go".
- 10 Wait until download is completed.
"Application now running" is displayed in information field of TWLoad.
- 11 Wait until error "18.1" occurs on Dornier Medilas H.
- 12 Switch off Dornier Medilas H.
- 13 Switch on Dornier Medilas H.
The new software version is displayed on control panel during startup.

After upload proceed as follows:

- 1 Perform all calibrations (s. page 45).
- 2 Enter the serial number.
- 3 Set date and time (see user manual).



7 Troubleshooting

Errors with displayed error codes	111
<hr/>	
Errors without displayed error codes	114
Laser cannot be switched on with key switch	114
Display remains dark or	
key pressing is recognized wrong or not at all	114
System reports overtemperature repeatedly (error code "1" in Logbook)	114
Pilot laser is not visible very well or not at all at distal end of fiber	115
No laser pulse is emitted	115
Laser pulse aborts prematurely	115
Therapeutic effect is too low	116
<hr/>	
Status LED's of CPU	117

7.1 Errors with displayed error codes

For each error process the listed working steps in stated sequence.

Error code		Possible cause	Error detail, check	Measure, error clearing
1	2			
2	1	No flow in cooling system measurable	Flow sensor defective or not connected	Connect, replace, 5.4.1
			Pump defective or not connected	Replacing pump, 5.4.2
			Control fiber CPU-ACV (V31-V1) connected wrong or not at all	Connect correctly
			ACV board not connected (W11) or defective (check 230ACV on X9)	Replace, connect W11, Replace ACV board, 5.5
			Over current protected switch 5A has released	Press, 5.8
			Fuse on ACV board defective	Replace fuses, 5.5
			CPU defective	Replacing CPU board, 5.6.1
2		Coolant	Not sufficient	Refill coolant
		Filter	jammed	Replace filter insert 6.2
		Tubing	snapped off, radius is too small	Use new tubings
4	X	Shutter	Check mechanical and electrical function	Adjust, replace 5.9.1
			Cable W8 defective, not connected	Connect, replace, repair
			CPU defective	Replacing CPU board, 5.6.1
7	X	Laser power supply	Laser power supply defective, if LED "U-Ok" on laser power supply does not light in Stand-by	Replacing laser power supply, 5.7
			Control fiber "U-OK" defective resp. connected wrong or not at all (CPU V9)	Connect, replace
		CPU	CPU defective	Replacing CPU board, 5.6.1
8	X	Laser power insufficient	Adjustment of resonator: Check, adjust with autocollimator, adjust rear mirror	see 5.10
			Flash lamp is degraded: check pulse number and degradation in logbook (>1 Mio. pulses, <80% efficiency)	Replace, 5.9.6.2
			Resonator mirror: check for damages	Replace, 5.9.5
			Crystal: although adjusted to maximum, all cathode spots are not homogeneous and not round. Check for damages.	Replacing cavity, 5.9.6.1
		Energy monitor faulty	Measure energy without fiber coupler: external measured energy differs widely to internal measured energy	Calibration of internal energy meter, 4.3.1
			External measured energy >400mJ, screen does not change (service mode)	Replacing monitor board, 5.9.4
			Beam Splitter dirty	Clean
CPU	Defective	Replacing CPU board, 5.6.1		

Error code		Possible cause	Error detail, check	Measure, error clearing	
1	2				
10		mains frequency	not in range 45-65Hz	Establish a mains frequency of 45-65Hz	
11	X	Control panel	Control panel functions disassembled	Fit in display so that no pressure to the touch foil occurs	
			Replace control panel, error is cleared	Replacing control panel, 5.2.2.2	
		CPU	Replace CPU, error is cleared	Replacing CPU board, 5.6.1	
		Cable W3	Defective	Replace, repair	
12		Mains voltage not detectable	Cable W11 defective or not connected	Replace, connect	
			Control fiber CPU (V38) - ACV (V3) defective or not connected	Replace, connect	
			ACV board: defective, if V3 does not light	Replace ACV board, 5.5	
			CPU: defective, if V38 lights	Replacing CPU board, 5.6.1	
14	1,4	Laser power supply	Laser power supply defective or cable W2, W12 defective resp. not connected	Connect, Replacing laser power supply, 5.7	
	2	Laser does not simmer	Control fiber CPU V10-Laser-Netzteil "ON" defective, connected wrong or not at all	Connect control fiber, replace	
			Control fiber CPU V24-laser power supply "SIM-OK" defective, connected wrong or not at all	Connect control fiber, replace	
			CPU defective, if CPU V10 does not light or/and Laser power supply "SIM-OK" lights	Replacing CPU board, 5.6.1	
	3	Laser power supply does not obtain set charging voltage	Control fiber CPU V3-laser power supply "U-SET" defective, connected wrong or not at all	Connect control fiber, replace	
			Control fiber CPU V9-laser power supply "U-OK" defective, connected wrong or not at all	Connect control fiber, replace	
			CPU defective, if CPU V3 does not light or/and Laser power supply "U-OK" lights	Replacing CPU board, 5.6.1	
	5	Flash lamp does not ignite	Flash lamp defective	Replacing flash lamp, see page 91	
	15	1-4	Temperature sensor cooling water	Sensor (A11) defective, cable W13 not connected	Connect, replace, repair
		5-8	Temperature sensor appliance	Sensor (A18) defective, cable W16 not connected	Connect, replace, repair
1-8		CPU	Defective	Replacing CPU board, 5.6.1	
16	X	Foot switch	Remove foot switch and connect it again	Remove foot switch and connect it again	
			Disconnect air break switch (cable W1): no error message when switching on the laser	Replace air break switch, 5.8	
			Replace CPU	Replacing CPU board, 5.6.1	

Error code		Possible cause	Error detail, check	Measure, error clearing
1	2			
17	X	Fan	Cable W15 defective, not connected	Connect, replace
			Fan jammed, wrong wired or defective	Establish wiring
			Fiber CPU-ACV defective resp. not or wrong connected	Connect fiber correctly or replace it
			ACV board defective:voltage at X4 >50ACV	Replace ACV board, 5.5
			Fuse on ACV board defective	Replace fuses, 5.5
18	1,2	Control panel	Check cable W3	Replace
			Replace control panel	Replacing control panel, 5.2.2.2
	3,4	Display controller	Check compatibility of display and CPU software	Establish a compatible configuration of software
20-29	X	CPU	Replace CPU	Replacing CPU board, 5.6.1
30	1	Monitor calibration	Check if energy monitor calibrates	Perform calibration, 4.3.2
	2	Energy calibration	Check if all energies are calibrated	Perform calibration, 4.3.2
	3	Temperature calibration, calibration of pilot laser	Check if temperature sensors and pilot laser are calibrated	Perform calibration, 4.3
37-44	X	Software, (CPU)	no	Read error logbook and send it to service. If necessary Replacing CPU board, 5.6.1
45	X	Touchscreen	Touchscreen defective	Replacing control panel, see page 66

7.2 Errors without displayed error codes

For each error process the listed working steps in stated sequence.

7.2.1 Laser cannot be switched on with key switch

Possible cause	Check, error detail	Measure, error clearing
MUSHROOM SWITCH	Pressed	Pull out mushroom switch
	Defective	Replace, 5.2.3
Mains switch	Pressed	Switch on
	Defective	Replace, 5.2.3
Fuse	Defective	Replace, 5.2.3
Key switch	Defective	Replace, 5.2.3
Cables W21,W22,W17,W18,W12	Defective, not connected	Replace, repair
Laser power supply	Laser power supply A8 < 20V	Replacing laser power supply, 5.7
CPU defective	CPU X2 Pin 2-3 <5V	Replacing CPU board, 5.6.1

7.2.2 Display remains dark or key pressing is recognized wrong or not at all

Possible cause	Check, error detail	Measure, error clearing
Cable W3	Defective, not connected	Replace, repair
Control panel	Water between display and touch foil	Replacing control panel, 5.2.2.2 or let it dry slowly
	Defective	Replacing control panel, 5.2.2.2
CPU	Replace CPU	Replacing CPU board, 5.6.1

7.2.3 System reports overtemperature repeatedly (error code "1" in Logbook)

Possible cause	Check, error detail	Measure, error clearing
Restricted air change	Distance to wall <50cm	Change location
Dusty cooling system	Heat exchanger, housing openings	Clean
Cooling fan does not run	Connected wrong or not at all	Connect properly
	Jammed, defective	Replace cooling fan, 5.4.1
	CPU X6, X9 < 5V	Replacing CPU board, 5.6.1
Ambient temperature too high	≥30°C	Provide sufficient room cooling or change location
Temperature sensor cooling system	Calibration	Calibration of temperature sensors, 4.3.3.1
	Defective	Replace
Cable W13	Defective, not connected	Replace, repair
CPU defective	CPU X5 Pin 1-5: 0V	Replacing CPU board, 5.6.1

7.2.4 Pilot laser is not visible very well or not at all at distal end of fiber

Possible cause	Check, error detail	Measure, error clearing
Pilot laser on level 0	See setting of pilot laser	Set pilot to a higher level
Serial number < 79 only: Pilot driver (A10) is not switched on	Check position of switch A10 on pilot driver: On?	Switch it on
Cable W6	Defective, not connected	Connect, replace, repair
Pilot laser is calibrated wrong	Check calibration of pilot laser	Setting of pilot laser, s. page 52
Fiber not adjusted correctly or optic defective	Check optical path of pilot laser	Adjust pilot laser coaxially to the therapy laser beam; adjust fiber coupler; replace fiber
Pilotlaser or CPU defective	Check voltage on X15 CPU:	Perform: Replacing pilot laser, s. page 87; or Replacing CPU board, s. page 76
	Pin 1 (green) modulation: low intensity = 0V; high intensity= 5V	
	Pin 2 (white): GND	
	Pin 3 (braun) supply: + 12V	

7.2.5 No laser pulse is emitted

Possible cause	Check, error detail	Measure, error clearing
Foot switch defective	No pressure build-up on tube end	Replace foot switch
Air break switch defective	No or only one contact closes hearable, when foot switch is pressed slowly (or check with DVM).	Replace air break switch, 5.8, s. page 80
Tubing is leaking	Check tubing of air break switch, potentiometer and foot switch connection for tightness	Replace tubing, repair
CPU defective	LED V17 or V26 illuminates when foot switch is pressed	Replacing CPU board, s. page 76
Cable W4	Defective, not connected	Connect, replace, repair

7.2.6 Laser pulse aborts prematurely

Possible cause	Check, error detail	Measure, error clearing
Air break switch or pneumatic potentiometer defective	No or only one contact closes hearable, when foot switch is pressed slowly (or check with DVM). Try to connect foot switch to air break switch directly	Replace air break switch, pneumatic potentiometer, 5.8
Foot switch	No pressure build-up on tube end	Replace foot switch

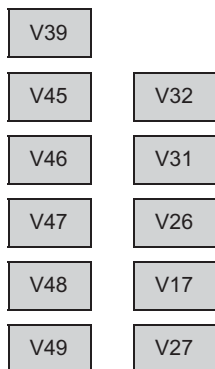
7.2.7

Therapeutic effect is too low

Possible cause	Check	Error clearing
Fiber, applicator	Proximal or distal end is impurified, broken or pilot laser is diffuse and not round	Replace applicator, fiber
Fiber coupler	Energy setting service mode: internal energy = approx. set energy value = higher than external measured energy value	Adjust fiber coupler Check input lens, replace
Adjustment of resonator	Energy setting service mode: internal energy <80% of set energy value	Adjusting resonator, 5.10
Flash lamp	Enter logbook, check: pulse number on lamp > 1 Mio pulses efficiency of lamp < 90%	Replacing flash lamp, 5.9.6.2
Resonator mirror	Disassemble resonator mirror and check for destruction and impurity	Clean, replace
Laser crystal	All previous checkings and measures unsuccessful, cathode spots inhomogeneous and not round	Replacing cavity, 5.9.6.1
Calibration	Voltage setting service mode: internal measured energy > external measured energy	Check monitor adjustment, calibrate, see "Calibration of internal energy meter" (4.3.1).

7.3 Status LED's of CPU

Fig. 68
Status LED's of CPU



LED	Description (LED lights up)
V39	AC voltage on ACV board O.K.
V45	Laser pulse is emitted
V46	Flash lamp is ignited
V47	Voltage of power supply is O.K.
V48	Flash lamp is simmering
V49	Temperature of laser power supply is too high
V32	Shutter is open
V31	Footswitch is pressed
V26	Footswitch is pressed
V17	REMOTE contact is closed
V27	5V voltage is supplied

8 Spare parts

Spare parts list	121
Order list	123

8.1 Spare parts list

Sort according to mat. no.

Mat. no.	designation	Recommended stockholding of spare parts			Fig. on page
		1-5 units	6-15 units	15-n units	
B3002710	Key switch				68
B3501734	Hose D13x3,5MM	1	1	n/20	39
B3501775	Hose D10x3MM	1	1	n/20	39
B3502445	Light guide/meter	1	1	n/10	
B3503587	Stand-by key	1	2	3	
B3505091	Hose clip SNP 10, Ø 14,5	5	15	15	39
B3505092	Hose clip SNP 12, Ø 15,4	5	15	15	39
K0724541	Round cord		1	2	
K1007148	Air break switch	1	2	3	80
K1009602	Mushroom switch				68
K1009726	Over current protected switch 16A				80
K1009862	Autocollimator				
K1009904	Remote connector	1	2	3	80
K2010510	Appliance input				80
K2010525	EMC shielding / meter		2	5	
K2010568	Line filter				80
K2010571	24V power supply		1	1	70
K2010609	Monitor board	1	2	3	86
K2010683	Coin cell type CR2032		1	2,	77
K2010716	Lamp reflector	1	2	n/10	91
K2010753	Cable set		1	1	
K2010754	Packaging, compl.		1	1	19
K2010759	Hood			1	64
K2010760	Front panel				68
K2010761	Right-hand panel			1	63
K2010762	Left-hand panel			1	63
K2010763	Front handle				68
K2010764	Rear panel			1	69
K2010777	Pneumatic potentiometer				80
K2010783	Temperature sensor (A18)	1	1	n/15	71
K2010790	ACV board		1	n/15	75
K2010794	Cavity flange	2	2	4	91
K2010807	SW upload cable				
K2010815	Rear handle				71
K2010828	Flash lamp	2	3	10	91
K2010830	Laser power supply		1	2	79
K2010848	Fiber holder socket				64
K2010853	Lamp o-ring	10	10	n/1,5	91
K2010871	Terminal strip				80
K2010891	Toroidal core transformer RTO300				80
K2010892	Transformer relay				80
K2010902	Shutter		1	2	83

Mat. no.	designation	Recommended stockholding of spare parts			Fig. on page
		1-5 units	6-15 units	15-n units	
K2010919	Set of labels		1	2	
K2010932	Steering roller				62
K2010937	Label Dornier Medilas H20	1			61
K2011075	Fan 142mm				72
K2010948	Beam splitter				82
K2010949	Pilot laser deflection mirror	1	1	3	87
K2010955	main cable				
K2010961	Tank				105
K2010967	Water filter	1	2	3	106
K2010974	Glass plate	1	2	n/5	91
K2010975	Cavity seal	1	1	n/20	91
K2010979	Equipment line Holmium Laser	1			61
K2010980	Manufactures name plate white	1			61
K2010981	Ignition unit				91
K2010982	Over current protected switch 5A				80
K2010992	Ion exchanger	5	5	n/15	105
K2011001	Main cable USA				
K2011008	Cavity			1	89
K2011009	Lens			1	97
K2011019	Cartridge	5	5	n/15	106
K2011033	Holder for hood with control panel				65
K2011036	Service manual, German				
K2011037	Service manual, English				
K2011038	SMA subassembly				97
K2011039	Flow meter + water temperature sensor	1	1	2	72
K2011040	Pump with cable			1	74
K2011041	Reflector mirror attached	1	2	3	85
K2011042	Output coupler attached	1	2	3	85
K2011044	Deflector mirror unit				
K2011046	PCB minimodul		1	2	78
K2011059	Hose clip SNP 18, Ø 21,4	5	15	15	39
K2011065	CPU without PCB minimodul	1	2	3	76
K2011066	Pilot laser (SN < 79) with power supply (SN < 80)	1	1	3	87
K2010939	Fan 130mm				73
K2011093	Fine-wire fuse T1,6A 250V				75
K2011133	fiber for adjustment and testing	2	2	n/20	97
K2011193	Hose clip SNP 14, Ø 18,1	5	15	15	39
K2011322	Pilot laser (SN > 80) (SN > 80)	1	1	n/15	87
K2011680	Control panel		1	1	66
K2011680	Control panel		1	1	66
K2011815	Operating manual, German/English			1	
K2012027	fiber holder				
K2012066	Seal	5	5	n/15	106
K2011346	Foot switch	1	2	3	

8.2 Order list

Sort according to designation

order	Mat. no.	designation	Recommended stockholding of spare parts			Fig. on page
			1-5 units	6-15 units	15-n units	
	K2010571	24V power supply		1	1	70
	K2010790	ACV board		1	n/15	75
	K1007148	Air break switch	1	2	3	80
	K2010510	Appliance input				80
	K1009862	Autocollimator				
	K2010948	Beam splitter				82
	K2010753	Cable set		1	1	
	K2011019	Cartridge	5	5	n/15	106
	K2011008	Cavity			1	89
	K2010794	Cavity flange	2	2	4	91
	K2010975	Cavity seal	1	1	n/20	91
	K2010683	Coin cell type CR2032		1	2,	77
	K2011680	Control panel		1	1	66
	K2011680	Control panel		1	1	66
	K2011065	CPU without PCB minimodul	1	2	3	76
	K2011044	Deflector mirror unit				
	K2010525	EMC shielding / meter		2	5	
	K2010979	Equipment line Holmium Laser	1			61
	K2011075	Fan 142mm				72
	K2010939	Fan 130mm				73
	K2011133	fiber for adjustment and testing	2	2	n/20	97
	K2010923	fiber holder				
	K2010848	Fiber holder socket				64
	K2010568	Line filter				80
	K2011093	Fine-wire fuse T1,6A 250V				75
	K2010828	Flash lamp	2	3	10	91
	K2011039	Flow meter + water temperature sensor with cable	1	1	2	72
	K2011346	Foot switch	1	2	3	
	K2010763	Front handle				68
	K2010760	Front panel				68
	K2010974	Glass plate	1	2	n/5	91
	K2011033	Holder for hood with control panel				65
	K2010759	Hood			1	64
	B3505091	Hose clip SNP 10, Ø 14,5	5	15	15	39
	B3505092	Hose clip SNP 12, Ø 15,4	5	15	15	39
	K2011193	Hose clip SNP 14, Ø 18,1	5	15	15	39
	K2011059	Hose clip SNP 18, Ø 21,4	5	15	15	39
	B3501775	Hose D10x3MM	1	1	n/20	39
	B3501734	Hose D13x3,5MM	1	1	n/20	39
	K2010981	Ignition unit				91
	K2010992	Ion exchanger	5	5	n/15	105
	B3002710	Key switch				68

order	Mat. no.	designation	Recommended stockholding of spare parts			Fig. on page
			1-5 units	6-15 units	15-n units	
	K2010937	Label Dornier Medilas H20	1			61
	K2010853	Lamp o-ring	10	10	n/1,5	91
	K2010716	Lamp reflector	1	2	n/10	91
	K2010830	Laser power supply		1	2	79
	K2010762	Left-hand panel			1	63
	K2011009	Lens			1	97
	B3502445	Light guide/meter	1	1	n/10	
	K2010955	main cable				
	K2011001	Main cable USA				
	K2010980	Manufactures name plate white	1			61
	K2010609	Monitor board	1	2	3	86
	K1009602	Mushroom switch				68
	K2011815	Operating manual, German/English			1	
	K2011042	Output coupler attached	1	2	3	85
	K1009726	Over current protected switch 16A				80
	K2010982	Over current protected switch 5A				80
	K2010754	Packaging, compl.		1	1	19
	K2011046	PCB minimodul		1	2	78
	K2011066	Pilot laser (SN < 79) with power supply	1	1	3	87
	K2011322	Pilot laser (SN > 80)	1	1	n/15	87
	K2010949	Pilot laser deflection mirror	1	1	3	87
	K2010777	Pneumatic potentiometer				80
	K2011040	Pump with cable			1	74
	K2010815	Rear handle				71
	K2010764	Rear panel			1	69
	K2011041	Reflector mirror attached	1	2	3	85
	K1009904	Remote connector	1	2	3	80
	K2010761	Right-hand panel			1	63
	K0724541	Round cord		1	2	
	K2012066	Seal	5	5	n/15	106
	K2011037	Service manual, English				
	K2011036	Service manual, German				
	K2010919	Set of labels		1	2	
	K2010902	Shutter		1	2	83
	K2011038	SMA subassembly				97
	B3503587	Stand-by key	1	2	3	
	K2010932	Steering roller				62
	K2010807	SW upload cable				
	K2010961	Tank				105
	K2010783	Temperature sensor (A18)	1	1	n/15	71
	K2010871	Terminal strip				80
	K2010891	Toroidal core transformer RTO300				80
	K2010892	Transformer relay				80
	K2010967	Water filter	1	2	3	106

address array

<p>sender's address</p> <p>_____</p> <p>name / company</p> <p>_____</p> <p>fax no.</p> <p>_____</p> <p>tel. no.</p> <p>receiver</p> <p>_____</p> <p>name / company</p> <p>_____</p> <p>fax no.</p>

A **Appendix**

Blank lined writing area consisting of 25 horizontal lines.

Blank grid writing area consisting of a 20x20 grid of squares.

Report

Dornier Medilas H

- Installation-
- Maintenance-
- Service-

set mains voltage: 115V 208V 230V

Customer: _____ SID: _____ Serial no.: _____

Comments (reason of checking, kind of repair etc.): _____

1. Visual inspection

housing grounding technical condition accessories
 adjustm. cooling system safety functions pilot (distal)

2. Maintenance activity

Filter exchange Cooling agent exchange Ion exchanger exchange
 miscellaneous

3. Functional Check in Service-Mode (3.1 – 3.4 carry out only during optical check)

Temperature of cooling water 24 – 30°C

3.1 Laser mode pictures without objective

Distance of photo paper: 40cm from the holder of the coupler

3.2 Checking of pulse threshold without objective

600V / 3Hz (rated val.: >500mJ) mJ

3.3 Checking of max. pulse energy without objective

Starting with 680V, increase the voltage in steps of 10V until the max. rated energy is reached.

Note set voltage:

680V-750V / 10Hz (rated val.: 2500mJ) V 680V-770V / 3Hz (rated val.: 3000mJ) V

680V-760V / 8Hz (rated val.: 3000mJ) V

3.4 Checking of input efficiency with 270µm test light guide

600V energy value from 2.2 is obtained to 80%:

3.5 Checking of energy with 400µm test light guide in calibrated condition

Setting: Energy, 1000mJ / 8Hz (rated val.: 880mJ - 1120mJ) mJ

4. Functional Check in User Mode (note the measured value in "mJ" or in "W")

setting	rated value	actual val.	setting	rated value	actual val.
400mJ/ 3Hz	320mJ – 480mJ	<input type="text"/> mJ	800mJ/12Hz	680mJ – 920mJ	<input type="text"/> mJ
	0,96W – 1,44W	<input type="text"/> W		8,16W – 11,04W	<input type="text"/> W
400mJ/10Hz	320mJ – 480mJ	<input type="text"/> mJ	1500mJ/ 5Hz	1350mJ – 1650mJ	<input type="text"/> mJ
	3,20W – 4,80W	<input type="text"/> W		6,75W – 8,25W	<input type="text"/> W
600mJ/ 8Hz	510mJ – 690mJ	<input type="text"/> mJ			
	4,08W – 5,52W	<input type="text"/> W			

5. Leakage current and protective grounding resistance measurement

5.1 Earth leakage current: IEC 60601-1 (VDE0751-1)

rated value actual val.
 NC ≤ 0,50mA mA
 SFC ≤ 1,00mA mA

UL 60601-1:

rated value actual val.
 NC ≤ 0,30mA mA
 SFC ≤ 1,00mA mA

5.2 Enclosure leakage current: IEC/UL 60601-1 (VDE0751-1)

rated value actual val.
 I_{max} ≤ 0,1mA mA

5.3 Patient leakage current: IEC/UL 60601-1 (VDE0751-1)

rated value actual val.
 DC: ≤ 0,01mA mA

rated value actual val.
 AC: ≤ 0,1mA mA

5.4 Grounding resistance: IEC/UL 60601-1 (VDE0751-1)

rated value actual val.
 ≤ 200mΩ mΩ

5.5 Measurement equipment:

Type	Serial Nr.	Cal. Date

Location: _____ Date: _____
 Name: _____ Sign.: _____

