More than 20 years of Dentaurum laser welding technology.

Instructions for use
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17. Annex
1. General information

Thank you for choosing the Dentaurum laser welding unit. In order for you to enjoy your laser welding unit in the future, please take time to observe all the information in these operating instructions. According to the EC guidelines, the Dentaurum laser welding unit is a piece of working equipment specifically designed for use in the dental laboratory.

Unit identification

**Product:** Laser welding unit (Nd: YAG laser wave length 1064 nm)

**Type:** desktop Compact – REF 090-578-50

**Company:** Dentaurum GmbH & Co. KG
Turnstraße 31
75228 Ispringen
Germany

The parts to be welded are manually arranged, positioned and laser welded in the welding chamber using the stereo microscope.
The required inert gas and the laser pulse are switched on or activated via a two-stage foot switch. During and after the processing, the welding vapor is automatically extracted.

⚠️ **Caution:** The unit must be installed and put into operation by authorized, qualified personnel or Dentaurum service technicians.
Before switching on the unit, you must have read and understood the user’s instructions!
Switch on the device only after having done this!
Before using the unit for the first time, the relevant authorities must be informed.
2. Safety information

2.1 Symbols and information
The following symbols indicating danger are used in these operating instructions:

⚠️ Warning: Notes on possible threat to life and health of personnel. Failure to heed this can cause serious damage to health and even dangerous injuries.

⚠️ Caution: Note on a possibly dangerous situation. Failure to heed this can cause minor injuries or damage to property.

2.2 Intended use
The desktop Compact is designed exclusively for welding metals. To use it for any other purpose or for anything beyond this is to use it improperly. Dentaurum is not liable for damages caused by this. Proper use also includes heeding all information of this manual and regular inspections and maintenance work.

⚠️ Caution: Processing non-metallic materials, especially plastics, constitutes improper use.

2.3 Warranty and liability
Our general terms and conditions of sale and delivery apply. Warranty and liability claims in the event of physical injury or damage to persons and property are invalid if they are caused by one or more of the following:

- Improper putting into operation, operating, mounting and maintenance of the laser
- Improper use of the laser
- Operating the laser with safety facilities that are defective or improperly installed or with inoperative safety and protective precautions
- Failure to heed the notes and information in this manual concerning the transport, storage, installation, operation and maintenance of this laser
- Lacking supervision of wearing parts
- Unauthorized structural modifications to the laser, especially the safety precautions
- Improperly performed repairs.
2.4 Employer's obligations

The employer will only allow personnel to work with this unit who

- are familiar with the basic regulations concerning safety at work and accident prevention and have been instructed in the use of this unit
- have read and understood the safety information and the warnings in this manual and have confirmed this by their signature (see the chapter “Confirmation of Instructions”)
- have been instructed in accordance with the valid regulations about accident prevention for laser radiation, in particular the accident prevention regulation for laser radiation (OStrV) and the regulations of the trade associations (BGV B2).
- Before using the unit for the first time, the relevant authorities for industrial safety (e.g. labor inspection) must be informed.

2.5 Personnel's obligation

Before starting to work all personnel who work with the unit must

- heed the basic regulations concerning safety at work
- read and understand the safety information and the warnings and confirm them by their signature.

2.6 Laser safety officers

Using a class 4 laser, a competent laser safety officer must be appointed in writing by the employer. The specialist should have training and experience in the field of laser radiation. The laser safety officer should fully understand the safety procedures and equipment used. He is responsible for the safe operation and safety measures of the unit.
2.7 Protection of the eyes against laser radiation
The unit is equipped to protect the eyes of the operator and other personnel around the unit.

Safety shutter
The safety shutter prevents generation of laser pulses or the unintended emission of laser radiation from the laser source and closes,
· when the feed flap is open
· if the laser parameters are changed
· if there is no control current at the safety shutter.

The laser pulse is only operational when
the feed flap is closed
· and no laser parameters are set
· and the charging of the energy reservoir has finished
· and the two-stage foot switch has been pressed down to stage 2.

Other devices for eye protection
· The unit is equipped with a large observation window made from a laser protection polymer for safe and direct observation of the welding process.
· The unit is equipped with an automatic glare protection in the optical path of the stereo microscope, which is activated during welding.
· The complete laser beam path is optically sealed.

The unit fulfils all stipulations for total eye protection!
This fulfils part of the stipulations of a class I laser.
The unit does not fulfil the second part of the stipulations for a class I laser, i.e. skin protection against laser radiation.
2.8 Protection of the skin against laser radiation

The unit has been developed for dental applications. Every workpiece is an individual part, the processes cannot be automated. The dental workpiece must be held with the hands as a large number of various materials with different measurements, appearances, surface compositions and fitting tolerances are connected together in various combinations or have to be processed at their surfaces. At the moment protective gloves against laser radiation technically cannot be realized and would hinder or even make impossible to work on the very small parts. The same problem exists for the use of holders, tweezers, etc. Therefore this laser has to be classified as work equipment for the dental laboratory that bears the threat of minor injuries.

Due to the design of the unit the area of danger is reduced to the hands and arms of the operator. In case of false operation the tissue of the skin can slightly be burnt by laser influence. In case of severe burns the operator should seek medical treatment.

⚠️ Caution: Invisible laser radiation!

You can avoid direct laser radiation to your hands:

- Do not position your hands directly under the reticule or in the laser beam!
- Look through the stereo microscope and position the workpiece so that the welding point appears sharp within the reticule!
- Take care that the hands do not appear – if possible – in the field of view of the stereo microscope!
- Keep your hands calm while releasing the laser pulse with the two-stage foot switch!
- Always look through the stereo microscope and control the position of your hands and the position of the workpiece!

⚠️ Caution: Scattered laser radiation

You can avoid scattered laser radiation to your hands:

Especially objects with shiny surfaces can scatter or deflect the laser radiation so that even in longer distances of the welding point there is a certain local danger of burning.

If possible do not wear any jewelry on arms or fingers while working with laser radiation or do not hold any shiny surfaces directly into the laser beam.
2.9 Further important safety issues, welding fume extraction

- The operating instructions must always be kept with the unit
- This unit is designed to weld dental metals and alloys using laser pulses, it must not be used for any other purposes
  - **Never** place flammable or explosive substances into the welding chamber!
- During the welding procedure, **health endangering vapors** may be produced!

Therefore, in order to maintain clean, breathable air, the trade association recommends the use of a suitable laser emission extractor during welding work with the laser.

The extraction unit, integrated in the desktop Compact is only permitted to extract laser emissions. It must not be used for any other purposes, e.g. the extraction of
- highly inflammable or explosive gases
- liquids of any kind
- organic substances (e.g. acrylics).

The vent slots for intake and exhaust air (see fig. 2 on page 12) must always be unrestricted. The welding fume extractor must only be used with the original spare filter and never without filter.

**Emergency off button**

The emergency off button is situated on the right of the touch screen (see fig. 2 on page 12). If a dangerous situation should occur, the desktop Compact laser can be switched off by pressing hard against this button. In order to re-start the unit, turn the switch in the direction of the arrow, it will automatically jump back into place.

**Electrical Safety**

⚠️ The desktop Compact laser is driven by AC voltage 1-phase 200 - 240 V/50 - 60 Hz, 10 A. In the laser there are voltages of up to 400 V.

The laser must be connected to a three-conductor mains cable with integrated protective earthing equipment. In order to avoid a short circuit, only de-ionised cooling water with a conduction value of < 2.5pS/cm can be used.

⚠️ **Caution:** Make sure the mains plug is removed before opening the machine.

2.10 Service activities

⚠️ **Caution:** When carrying out service and maintenance activities, never work alone!

All work on electrical parts, optical components and structure of the machine may only be carried out by authorized, qualified personnel or by the Dentaurum service technicians.

A second person, who should be at least familiar with the risks posed by laser radiation and high-voltage, should always be present during service and repair activities.

⚠️ **Warning:** Dangerous high-voltage!

In order to ignite the flash lamp, this laser runs with high-voltage capacitors. For this reason, after having turned off or disconnected the device, current-carrying components could still be live.
2.11 Laser warning signs

Invisible laser radiation
Avoid eye or skin exposure to direct or scattered radiation
Laser Class 4

Avoid irradiation
Emission of invisible laser radiation
2.12 Position of the laser warning signs

*Fig. 1: Position of the laser warning signs*
3. Basics of the laser and welding process

LASER = Light Amplification by Stimulated Emission of Radiation

It is a light amplification caused by stimulated emission of radiation. The light amplifier of the laser is a rod shaped crystal of neodymium-doped yttrium aluminum garnet (Nd: YAG) stimulated by a light pulse from an external rod shaped flash lamp. A suitable high-performance reflector guarantees a high efficiency and coupling-in rate of the lamp light into the laser crystal. In order to send out amplified and directive laser light, two mirrors are arranged outside the crystal so that the light coming from the crystal is reflected in itself and back to the crystal (resonator). One of the mirrors is semi-reflecting and releases a strongly directive laser radiation from the resonator. The wave length range of this radiation is strongly limited to 1064 nm. Due to the strong directional dependence and the narrow wave length range, the extreme concentration of the laser energy on the workpiece is possible (focusing via a suitable lens). This energy concentration exceeds the concentration of usual light sources many times.

The laser pulse facilitates welding by heating the workpiece in the focal area beyond the melting temperature and liquefying the materials that are to be connected. After a relatively short laser exposure time (0.5 ms to 20 ms), the melted materials solidify again and are tightly connected together.

Thanks to the high and short time concentration of the laser energy to a limited volume, heat is only produced where it is needed. This feature makes the laser an excellent tool for the dental laboratory.
4. Machine description

4.1 Overview

The desktop Compact laser welder is a very compact table-top unit for manual use. It supplies short, energy-rich invisible laser pulses at a wavelength of 1064 nm for welding metals. Fig. 2 shows a view of the device with all of the essential controls.

The workpieces are fed through the front feed flap into the integrated laser-safe working chamber (see fig. 3 on page 13). The workpiece is positioned manually under the stereo microscope through the two side openings and held to be welded. When both of your hands are inserted into the leather cuffs of the hand-access openings, the laser radiation cannot exit the device.

*Fig. 2: Front view of the desktop Compact laser*
Any inert gas that may be required as well as the laser pulse are turned on and triggered using a two-stage foot switch. During and after processing, the welding fume is automatically drawn off and filtered. All of the important functions and settings are shown on the touch screen. These parameter settings can be modified using the touch screen. They can also be modified in the working chamber (see fig. 4 on page 14). Important laser parameters can be directly adjusted using the joysticks in the chamber without having to remove your hands out of the working chamber.
4.2 The working chamber

The desktop Compact working chamber contains all controls necessary for easy manual laser welding. To provide a view of all of them, the working chamber in fig. 4 is shown from below.

At the top middle, the laser beam leaves through a focusing lens protected by protective glass.

The working chamber and the workpiece are illuminated from the right and left side of the laser exit by two powerful halogen lamps.

The swivelling nozzle for the inert gas can be swung forward and backward. When the nozzle is in its rear position, the flow of gas is interrupted. The height of the nozzle opening can be adjusted 5 mm by turning the nozzle. When the swivelling nozzle is in its front position, it marks the focus point of the laser. The flexible nozzle on the left side is used to guide the inert gas precisely to the welding spot.

There is also a rigid nozzle on the right that can be used to cool the workpiece and the working chamber with compressed air.

**Fig. 4: View from below into the working chamber**

The intake openings for the welding fumes filter are in the top of the chamber behind the laser exit.

The controls (2 joysticks and 2 toggle switches) are easily accessible at the bottom rear of the chamber, and they can be monitored through the observation window.
4.3 Design of the desktop Compact

All functions for operating the desktop Compact are integrated in the compact housing. Fig. 5 shows a block diagram of the construction.

The heart of the unit is a solid-state laser. It is pumped with a flash lamp operated by a power supply with a high electrical efficiency. The laser flash is guided along a carefully adjusted beam path through the stereo microscope to the workpiece.

Fig. 5: Schematic layout of the desktop Compact

A newly developed control unit precisely manages the laser pulses and monitors all of the functions necessary for safe welding.

The filtered and purified cooling water is pumped in a closed circuit through the pumping chamber of the laser and thereby cools the flash lamp and laser rod. The arising heat is removed to the surrounding air by a heat exchanger and fan.

The inert gas (such as argon) necessary to protect the weld seam is supplied from the outside by a connection at the rear of the unit (see fig. 6 on page 16). The inert gas can be directly guided to the welding point via a swivelling and flexible nozzle in the working chamber. The flow of gas is controlled by the two-stage foot switch.

The welding fumes arising during welding are drawn out of the welding chamber and thoroughly filtered (see fig. 4 on page 14).
4.4 External connections

All of the external connections are at the rear of the unit (see fig. 6). The rating plate shows the serial number of the unit as well as the properties of the laser source.

*Fig. 6: Connections on the back of the desktop Compact*

The gas connections have a connector for tubes with a diameter of 6 mm.

**Inert gas:**
Recommended inert gas: Argon 4.6 (99.996 % purity) according to DIN EN ISO 14175:2008-06.

**Cooling air nozzle:**
The maximum permissible compressed air pressure is 6 bar.

**Power connection:**
The power is supplied through the provided standard power cable. The unit is operated with 200 - 240 V, 50 - 60 Hz, 10 A, single-phase

**Two-stage foot switch:**
The provided two-stage foot switch is connected to the 15-pin sub D socket (female). When the two-stage foot switch is not or insufficiently connected, the status indication “Laser OK” will light up red on the touch screen.
4.5 Installation and starting operation

Initial inspection
Check the packaging and the device for any visible damage. If the packaging is damaged, please report it immediately to the shipping agent. Document the damage for later claims.
The desktop Compact weighs 50 kg. It takes two people to move or transport the device.
Check the shipment for completeness.
Only undamaged units may be used.

Setup
The surface under the unit must be flat. Compensate for small unevenness with non-slip material.
The device should be placed in a dust-free location protected from direct sunlight.
Base: 560 mm wide x approx. 700 mm deep.

Cooling water
De-ionized cooling water must be poured into the reservoir for the cooling circuit before initial startup.
See the chapter “Changing cooling water and particle filter” on page 36.
To prevent damage from leaking or freezing cooling water, drain the cooling water container each time you move the unit.

Electrical connections
Before connecting to the mains, make sure that the line voltage is appropriate for the desktop Compact. The unit is operated with 200 - 240 V, 50 - 60 Hz, 10 A, single-phase.
Connect the two-stage foot switch to the 15-pin socket next to the power connection. When the two-stage foot switch is not or insufficiently connected, the status indication “Laser OK” will light up red on the touch screen.
4.6 Operating the desktop Compact

The desktop Compact was designed to be very easy to use. You will quickly achieve successful welding results when you observe the following points. The subsequent chapters offer detailed descriptions of each step.

Quick start for experienced users

BEFORE YOU TURN THE UNIT ON you must read and understand the instructions for use, especially the safety instructions! ONLY THEN MAY YOU TURN ON THE UNIT!

1. Turn the key operated switch to start the laser (emergency off button must be released). Once “Laser OK” lights up green on the touch screen (see fig. 2 on page 12), the laser is ready to use.

2. Position workpiece under laser head.

3. If you need inert gas, connect the gas bottle to the inert gas supply connection and adjust the appropriate gas flow with the pressure regulator. Open the gas supply. Recommended flow: 6…8 l/min.

4. Insert the workpiece into the working chamber, and close the feed flap.

5. Adjust the stereo microscope to your personal preference.

6. Set the desired parameters for the welding process using the touch screen or the joystick in the working chamber.

7. Open the safety shutter by pressing the “Shutter open” key on the touch screen (see chapter 7.2 on page 26). The key must light up green.

8. Through the stereo microscope, visualize the site to be welded on the workpiece. The stereo microscope cannot be moved. You need to move the workpiece into the line of vision and adjust the sharpness by changing the distance.

9. Direct the appropriate inert gas nozzle toward the welding site.

10. Press the two-stage foot switch to the first switching point, and the inert gas will flow. When you press the two-stage foot switch all the way down, the laser will emit pulses at the set value, and you can start welding.

Turning on the unit

Open the gas bottle.

Turn the key-operated switch to the front.

(If you have changed the flash lamp or cooling water, wait for approximately 1 minute until all the air bubbles leave the cooling water circuit.)
Inert gas
The connection for the inert gas supply is on the back of the unit (see fig. 6 on page 16).
The flow of gas to the workpiece is turned on as long as the two-stage foot switch is pressed to the first stage.
The inert gas can be directed to the welding point through both a swivelling and flexible nozzle in the working chamber (see fig. 4 on page 14). The swivelling nozzle for the inert gas can be swung forward and backward. When it is in the rear position, the gas flow is stopped. The height of the nozzle opening can be adjusted 5 mm by turning the nozzle.
The flexible nozzle can be shut off with a turncock.

Please attend to these hints for the gas supply:
· Gas bottle 200 l or smaller (at least 10 l)
· The gas bottle can be placed in a lying position if it is secured from rolling away and the argon fitting is protected
· Standing bottles must be secured in accordance with regulations
· The pressure regulation for argon can be adjusted within a range of 6 - 8 l/min
· The gas hose diameter is 6 mm (outer ø)
· Do not forget: After you have finished working, close the valve on the gas bottle.

The two-stage foot switch
The two-stage foot switch is connected to the rear of the device (see fig. 6 on page 16). It switches in two stages.
In the first switching stage, the inert gas is released.
In the second switching stage, the laser pulses are released.
This allows the inert gas to displace the air around the welding point before welding starts to ensure an oxide-free weld seam.
5. The stereo microscope

The stereo microscope is used to place the required area on the piece of work in the direct path of the laser. Protective filters are integrated in the stereo microscope which protect the eyes against the laser radiation and intensive radiation which is always generated during welding processes. If the stereo microscope is adjusted to suit the user correctly, then it is possible to position even the finest welding joints accurately.

To this, at first the **eye distance** is regulated.

**Adjusting the reticule in the stereo microscope**

- **Setting the eye distance**
  The eye distance is set correctly, when you see one round image with both eyes. If this is not the case, look through the eyepiece and adjust the ocular tubes by pushing them together or pulling them apart with both hands.

- **Setting the exit pupil**
  The distance between the eye and the eyepiece is about 22 mm. You have found the correct distance once you see the complete image area without any shadows. Slowly move your eyes towards the eyepieces.

- **Set the eye shells of the stereo microscope**
  If you do not wear glasses and wish to have close contact with the eyepieces: Hold the dioptre ring and fold the rubber eye shells upwards. If you wear glasses fold the eye shells back down (see fig. 7).

- **Adjust oculars to individual visual acuity**
  Set the dioptre on both eyepieces to “0”. Place a flat test piece (e.g. a piece of metal) under the laser lens, using a titanium holder, until it can be seen sharply with the right eye. Turn the left dioptre in the left ocular until the test piece can be seen sharply. Do not move the test piece (see fig. 8 on page 21).

- **Adjust the reticule according to the division scale**
  For horizontal adjustment, set the right ocular to “0” so that the reticule and the division scale are horizontal (see fig. 8 on page 21).

- Every operator should only need to adjust his setting once. He should note down his own personal values (number of lines in +/− in the left ocular). The operator simply needs to re-set these values before he works with the laser again. With this method it is possible to enable all laser operators to use the laser under the same focal settings and identical laser conditions.

Fig. 7: Ocular adjustment at the stereo microscope
Fig. 8: Adjust the reticule according to the division scale
6. Setting the pulse parameters

For welding to be successful, the appropriate laser pulses must be used. The proper laser pulses depend on the joint partners and their thicknesses. The best values can only be found when fine adjustments are made on the work piece. Please ask your sales partners to get recommendations and empirical values. Here only a very general guideline can be offered. The following pulse parameters can be set:

- The pulse peak output by the voltage
- The pulse length
- The pulse rate
- The size of the laser spot on the work piece, and
- The time characteristic of the laser pulse.

This sequence corresponds to the sequence on the touch screen from top to bottom (see fig. 12 on page 25).

The most important parameters may also be changed using the joysticks in the working chamber. With the left toggle switch on the control panel you can select parameter sets.

The figure below explains the relation between pulse parameters and actual form of the laser pulse:

![Fig. 9 : Pulse Parameters](image)

The user sets the parameters on the control panel:

1. The laser power is varied with the parameter “voltage” in Volts.
2. The pulse length is set directly in ms.
3. The pulse rate is set directly in pulses/second (Hz).

The energy of the laser pulse is given roughly by the product of Power x Pulse length.

Additionally, there are the parameters:

4. Size of the laser spot. It is set in 1/10 mm and
5. Shape of the laser pulse. Usually it is nearly rectangular, but it may be varied.
   - The shapes are described on page 24.
Special note

1. You cannot set both, high voltage and long pulses at the same time. In some cases the actual limit for the parameters voltage and pulse length can be lower than its maximum value.

2. In some cases, the pulse rate will be decreased automatically when the voltage or the pulse length are increased, i.e. the value on the touch screen will decrease automatically.

Voltage from 150 to 400 V

The voltage influences the peak pulse output. The voltage should be increased to accommodate the weld seam depth, the heat conductivity, and reflectivity of the material.

In addition to the arrow keys on the touch screen, the voltage can also be controlled by pushing the left joystick in the working chamber up (V+) to increase it, and down (V-) to decrease it.

When the target voltage has been reduced, the flash lamp is activated when the safety shutter is closed in order to lower the voltage at the charging capacitor to the target value. “Wait for discharge” is displayed on the touch screen. You can only continue working when the target voltage has been reached.

Voltage from 0.5 to 20 ms

The energy of the pulse depends on the pulse length. Given an equivalent peak output, the longer the pulse lasts, the more energy is fed into the welding point and more material gets melted. The welding point tends to become wider as opposed to deeper.

In addition to the arrow keys on the touch screen, the pulses can also be lengthened by pushing the left joystick in the working chamber to the right (ms+), and the pulse length can be lowered by pushing the joystick to the left (ms-).

Pulse rate from an individual pulse (0 Hz) to 25 Hz

The pulse rate is limited by the performance of the laser device. When the pulses are energy-rich, the performance limit of 50 W will be exceeded after just a few pulses are emitted. Only when the pulses are short and weak, the pulse rate can be accelerated. The frequency that is chosen depends on the operator’s experience.

In addition to the arrow keys on the touch screen, the pulse rate can also be adjusted by using the right joystick in the working chamber; it can be raised by pushing the joystick up (Hz+) and lowered by pushing the joystick down (Hz-).

Beam diameter from 0.2 to 2 mm

By means of an installed optical system, the diameter of the beam can be adapted to create weld seams of different widths. It should be noted that the laser output is distributed over a larger area when the spots are larger. To achieve comparable welding results, a correspondingly higher voltage must be used.

In addition to the arrow keys on the touch screen, the beam diameter can also be increased by pushing the right joystick in the working chamber to the right (Ø +), and the spot size can be decreased by pushing the joystick to the left (Ø -).
**Pulse shape**

Four different pulse shapes can be selected that are identified by symbols:

- $\square$ indicates an uninfluenced pulse (Shape 0)
- $\sqcap$ indicates a pulse that grows weaker in steps (Shape 1)
- $\sqsubset$ indicates a pulse that is weaker at the end (Shape 2)
- $\sqcup$ indicates a pulse that is weaker at the beginning (Shape 3)

*Fig. 10: Controls in the working chamber*
7. Operating the touch screen/working chamber
After turning on the desktop Compact, the main menu is displayed on the touch screen.

![Touch screen display](image)

**Fig. 11: The touch screen**

The following paragraphs describe the laser parameters that can be set with the touch screen.

7.1 Setting pulse parameters on touch screen

You can modify the pulse parameters voltage (V), pulse length (ms), pulse rate (Hz) and beam diameter (mm).

Press the “Left”/“Right” arrow keys / next to the desired pulse parameter to raise or lower the current value. The new value is displayed between the arrow keys of the respective pulse parameter. The corresponding pulse energy (J) and pulse power (W) is displayed below the pulse shape.

![Pulse parameter settings](image)

**Fig. 12: Modifying pulse parameters with ◀ or ▶**
7.2 Opening / closing safety shutter on touch screen

Press “Shutter open” key to open the safety shutter. If all conditions for emitting a laser pulse are fulfilled (see chapter 2.7 on page 6), the safety shutter will open and the “Shutter open” key will light up green. You can start emitting laser pulses.

Press “Shutter close” key to close safety shutter. The safety shutter closes and the “Shutter close” key lights up red. You cannot emit laser pulses.

7.3 Saving / loading parameter sets on touch screen or in working chamber

Saving and loading parameter sets on touch screen

You can save and load pulse parameters that you use frequently as parameter set in the desktop Compact database.

“Mxx:” indicates the storage space number of the active parameter set (M01 – M39).

“M00:” indicates that the active pulse parameters are not saved as set in the database. When turning on the desktop Compact, the screen always displays “M00:.” Next to it appears a description text of the parameter set that you can modify.

If you modify the pulse parameters of a loaded parameter set, the “M” of the storage space number turns blue.

Saving parameter sets on touch screen

“Mxx:” indicates the storage space number of the active parameter set (M01 – M39).

“M00:” indicates that the active pulse parameters are not saved as set in the database. When turning on the desktop Compact, the screen always displays “M00:.” Next to it appears a description text of the parameter set that you can modify.

If you modify the pulse parameters of a loaded parameter set, the “M” of the storage space number turns blue.

Saving parameter sets on touch screen

Fig. 13: Keys to save pulse parameters

“Mxx:” indicates the storage space number of the active parameter set (M01 – M39).

“M00:” indicates that the active pulse parameters are not saved as set in the database. When turning on the desktop Compact, the screen always displays “M00:.” Next to it appears a description text of the parameter set that you can modify.

If you modify the pulse parameters of a loaded parameter set, the “M” of the storage space number turns blue.

Saving parameter sets on touch screen

Fig. 14: Touch screen – saving parameter sets
1. Press the “Save parameter set” key . The arrow key turns orange for a moment and the two keys to the right and left change their functions. Use these keys to select the number of storage space. In addition, two keys in the menu bar change their function (see fig. 14 on page 26).

2. Press the “Minus”/“Plus” keys until the desired storage space number is displayed (M01 – M39).

3. Press the “Return” key to save the active pulse parameter values as parameter set with the selected storage space number.
   Or: Press the “Escape” key to return to standard mode without saving.

If you do not press one of the two keys within 3 seconds, the display returns automatically to the standard main menu.

**Loading parameter sets on touch screen**

![Touch screen – loading parameter sets](image)

**Fig. 15: Touch screen – loading parameter sets**

1. Press the “Save parameter set” key . The arrow key turns orange for a moment and the two keys to the right and left change their functions. Use these keys to select the number of storage space. In addition, two keys in the menu bar change their function (see fig. 15 on page 26):

2. Press the “Minus”/“Plus” keys until the desired storage space number is displayed (M01 – M39). The pulse parameter values of the selected parameter set are displayed.

3. Press the “Return” key to load the selected parameter set.
   Or: Press the “Escape” key to return to standard mode without loading.

If you do not press one of the two keys within 3 seconds, the display returns automatically to the standard main menu.

**Loading parameter sets in the working chamber**

Parameters can also be selected directly in the working chamber. As soon as the toggle switch “data select” is pressed, the modus for selecting the parameters is automatically activated. In this modus it is possible to select parameter sets in sequence and the currently selected set can be seen in the display.
Whilst in this modus, the position of the joystick has the following functions:
Hz- “DataOut” is used to confirm the choice of parameter set and Hz+ (ESC) is used to exit the modus.

Modifying description text of active parameter set on touch screen
1. Press the “Text” key.
2. Use the displayed keypad to enter the description text for your parameter set:
   Text box (max. 23 characters)
   Shift between:
   aaa: Lower case
   AAA: Upper case
   123: Numbers
   Spaces
3. Press the “Return” key to save the modified description text.
   Or: Press the “Escape” key to return to standard mode without saving the modifications.

If you do not press one of the two keys within 3 seconds, the display returns automatically to the standard main menu.

7.4 Resetting error message on touch screen

In case of a status or error message (= Interlock), a corresponding symbol is displayed in the icon bar. In case of an error message, in addition, the “Reset Interlock” key will light up yellow.

In case of an error message, you will have to reset the message after solving the error. Press the “Reset Interlock” key. The yellow light will turn off. Find more information on status and error messages in chapter 11 starting on page 38.
7.5 Displaying and modifying basic settings on touch screen

Open options menu with \(\textcolor{blue}{\rightarrow}\) to display and modify basic settings of the desktop Compact.

**Fig. 17: Touch screen – basic settings**

Arrow keys:
- Up/Down: navigating to the desired menu item
- Left/Right: selecting decimal place in menu items with numerical values

Plus/Minus keys:
- changing decimal place in menu items with numerical values
- selecting an option in menu items with options

Return key:
Updating system value in menu items with system value query. Afterwards, OK is displayed on the right.

Escape key:
Leaving the option menu

Example 1: Modifying fan off time

Use “Up”/“Down” arrow keys \(\textcolor{blue}{\uparrow} / \textcolor{blue}{\downarrow}\) to navigate to the “Fan Off Time [s]” entry. Use the “Left”/“Right” arrow keys \(\textcolor{blue}{\leftarrow} / \textcolor{blue}{\rightarrow}\) to navigate to the decimal place that you want to modify and change the value with the “Minus”/“Plus” keys \(\textcolor{blue}{-} / \textcolor{blue}{+}\).

Example 2: Displaying a system value – cooling water flow rate

To update the active flow rate of the cooling water, use the “Up”/“Down” arrow keys \(\textcolor{blue}{\uparrow} / \textcolor{blue}{\downarrow}\) to navigate to the “Get FlowRate l/min” entry, then press the “Return” key \(\textcolor{blue}{\rightarrow}\). The active value is displayed, e.g. “4.3 OK”. The “OK” entry indicates that the system value has been queried successfully. Follow the same steps to display the active number of emitted laser pulses “Get Pulse Cntr”.

---

**Note:**
- The keyboard keys \(\textcolor{blue}{\rightarrow}\) and \(\textcolor{blue}{\leftarrow}\) are used to navigate through the options menu.
- The keys \(\textcolor{blue}{\uparrow}\) and \(\textcolor{blue}{\downarrow}\) are for navigating to the previous or next option.
- The keys \(\textcolor{blue}{-}\) and \(\textcolor{blue}{+}\) are for modifying numerical values.
- The “Return” key is used to update system values.
8. **Welding**

To weld, you need to open the safety shutter by pressing the “Shutter open” key (bottom menu bar). The “Shutter open” key must light up green and the red light of the “Shutter close” key turn off.

Through the stereo microscope, observe the site to be welded on the workpiece. The microscope cannot be moved. You need to move the workpiece into the line of vision and adjust the sharpness by changing the distance. The welding point should be precisely in the reticule. If this is not the case, the reflecting mirror needs to be adjusted (see chapter 10.7 on page 37).

Direct the appropriate inert gas nozzle toward the welding site (see fig. 4 on page 14).

Press the two-stage foot switch to the first switching level, and the inert gas will flow.

As long as you press the two-stage foot switch all the way down, the laser will emit pulses at the set value, and you can start welding. The motor for drawing off the welding fumes starts running. For your protection, the stereo microscope becomes briefly dark during the laser pulse.

Move the workpiece under the laser beam to create a weld seam. Adapt the speed to the pulse rate so that the welding spots overlap sufficiently on the workpiece (approximately 80%).

After welding is finished, the exhaust will still operate briefly. Close the safety shutter by pressing the “Shutter close” key. The “Shutter close” key must light up red and the green light of the “Shutter open” key turn off.

9. **Turning off the system**

Even when there are brief interruptions, close the safety shutter by pressing the “Shutter close” key.

After you are finished welding, let the cooling water pump run for approximately 5 minutes to provide additional cooling.

Turn the key-operated switch to the left.

Close the gas bottle.
10. Maintenance advice

⚠ Caution: Never work alone on any service or maintenance activities!
Various work on electrical parts, optical components and structure of the machine may only be carried out by authorized, qualified personnel or by the Dentaurum service technicians.
Hotline: +49 7231/803-211

⚠ Caution: Only skilled persons are allowed to perform maintenance work on the switched off laser!

If maintenance or service work is required to be carried out on the laser whilst it is switched on, which requires the laser safety mechanisms to be put out of action, then the stipulations according to laser class 4 applies:
All persons present in the same room must wear protective eyewear suitable for laser wave lengths. It is advisable to restrict the laser area with protective walls or curtains so that only persons within the laser area are required to wear protective goggles.

⚠ Caution: All maintenance work which is carried out on the laser must comply with the accident prevention regulations, in particular
• BGV B2 Laser radiation
• BGV A2 Safety regulations on voltage-carrying parts

⚠ Caution: Unplug the device before opening it!
10.1 Check lists 1, 2 and 3

Check list 1
Regular maintenance guarantees a long service-life of your desktop Compact – it is advisable to observe the following points!

The following laser modules are required to be checked every day before starting to work:
· Is the observation window scratched or soiled?
· Is the inert gas nozzle positioned correctly?
· Do you have an unrestricted view through the stereo microscope or is the lens soiled?
· Do the indicator lamps for the safety shutter switch from red to green without flickering?
· Does the two-stage foot switch work correctly?
· Always maintain a clean extraction sieve in the extraction unit!

Check list 2
The following checks are required to be performed once a month:
· Are the hand opening cuffs damaged or are they no longer tight fitting?
· Are the holding cuffs fixed tightly?
· Is there enough de-ionised water in the supply container?
· Do the safety switches react after opening the side flaps?
· Does the key operating switch work properly and is it mounted correctly?
· Does the emergency off button function correctly?

Check list 3
Yearly examination:
The particle filter must be changed together with the de-ionized water once a year (see chapter 10.6 on page 36). Failure to change the filter leads to a reduction in the cooling function and contamination of all parts which come into contact with the water. This could cause the laser crystal, the flash lamp or the lamp reflector to become irreparably damaged. The service life of the lamp could also be reduced.

A maintenance contract will take care of a large part of the above duties and serves towards the conservation value of your laser!
10.2 Test of laser adjustment and beam path
Check the laser adjustment once a week or when the welding results are unsatisfactory under normal laser settings. Make sure the protective glass is clean during adjustment.
Place laser photo paper on the floor of the working chamber.
Set the beam diameter to 2.0 mm, the voltage to 300 V and the pulse duration to 1 ms. Trigger a laser pulse.
Look at the image on the photographic paper:
Ideally, it should be round and only have a small, rough black edge and the black photographic layer should be evenly removed. If the edge is ragged or small, black dots are visible, change the protective glass for the lens.
If the spot is oval or not cohesive and asymmetrical, either objects are in the way of the laser beam, or the laser needs to be readjusted (contact service).

10.3 Changing the protective glass
If the protective glass (see fig. 19) is too dirty or defective, the glass must be replaced with a new glass:
Turn off the unit using the key-operated switch.
Open the feed flap.
With one hand grasp the bottom of the laser lens, and rotate the knurled retention ring to the left.
Unscrew the retention ring and remove it together with the protective glass.
Remove the old protective glass and insert the new glass in the retention ring. Screw the retention ring with the new protective glass to the bottom of the laser output.
10.4 Check and change the filter for welding fumes

To ensure that the welding fumes are completely drawn off, the filter has to be checked regularly and changed if necessary. The filter consists of a pre-filter fleece for larger particles and a particulate filter of class EU 13/K2. The filter is located at the upper rear of the working chamber.

![Diagram of filter components]

**Fig. 20: Filter for welding fume extraction**

⚠️ **Caution:** The particles in the filter can be **hazardous to health.** Wear gloves. Pack the filter right away in a plastic bag. **Dispose of the filter in accordance with local regulations.**

To change the filter, remove the two fastening screws (see fig. 4 on page 14), then the filter holder swings down and the filter can be removed through the flap.

![Diagram of filter holder and screws]

**Fig. 21: Welding fume extraction in the working chamber**

When installing new filters, the pre-filter fleece is placed on the bottom of the filter holder. The black seal for the particulate filter must be at the top and should be lubricated lightly for an easier installation. Screw filter holder back on.
10.5 Opening the desktop Compact

⚠️ Before opening the unit, pull the power plug!

Many of the parts of the desktop Compact that need to be serviced are under the housing cover. To open it, you first need to remove the top part of the stereo microscope:

The set screw on the right under the stereo microscope is removed, and the stereo microscope is lifted to the right out of the dovetail guide.

**Note:** Do not touch any optical surfaces. Protect the stereo microscope from dirt!

---

**Fig. 22: Microscope flange (from above)**

The microscope flange is attached with three screws (see fig. 22). Unscrew the screws, and pull out the flange upward.

The cover is fastened with four screws near the door flap (see fig. 23). When these are unscrewed, you can open the cover flap to the rear. To avoid damage to the cover, take care that it can rest e.g. on a table.

---

**Fig. 23: Laser with open cover**
10.6 Changing cooling water and water filter

Open the cover of the desktop Compact (see chapter 10.5 on page 35).
The cooling water container is on the left to the rear. It holds 4.5 l de-ionized water. To open it, unscrew three screws in the lid, and carefully lift the lid upward with a broad blade screwdriver. To close it, press the lid into the opening, and then screw it tight. Make sure that the seal is clean and undamaged. If it is hard to press in the lid, wet its seal or use a bit of grease.

Draining the cooling water
The cooling water needs to be suctioned out of the container. A small pump is useful, otherwise carefully suck out the cooling water with a hose and then let it drain over the edge into a lower container.

Exchanging the particle filter
The particle filter is a white, 100 mm long cylinder with a diameter of 70 mm that floats freely in the cooling water.

· Unscrew the particle filter to the feed hose
· Remove the old filter
· Insert a new filter
· Screw on the feed hose, and make sure there are no kinks
· Add clean water, and let the filter fill up with water. Only use de-ionized water!

Add cooling water
You need approximately 4.5 l de-ionized water with a conductance < 2.5 µS/cm. When you are adding water, make sure that no particles get in it.

Plug in the power plug, and turn the key-operated switch on.
Wait approximately 5 minutes until the air escapes from the cooling system, and add distilled or de-ionized water if necessary until the level monitor is completely under water.

Turn off the device, and pull the power plug.
Close the cooling water container, and affix the device cover. Mount the stereo microscope again.
10.7 Adjustment of laser welding point according to the reticule in the stereo microscope

Using the bending mirror the laser beam can be easily brought into line with the reticule in the ocular of the stereo microscope.

Adjustment

- Put an adjustable focusing device (REF 090-525-00) or a small elevated platform under the laser lens and place a pad of paper or a piece of flat metal on top. Bring the object into sharp focus under the stereo microscope.
- Set 200 V, 1 ms, beam diameter to 0.8 mm and trigger a single laser pulse. An arc spot will appear on the object.
- By using the adjusting screws the bending mirror can be corrected (see fig. 25) so that the arc spot is drawn into the reticule of the stereo microscope.
- If the upper screw is turned to the right (left) the welding spot will move to the left (right).
- If the upper screw is turned to the left (right) the welding spot will move to the right (left).
- When the laser spot is central, set the parameter to 300 V, 5 ms, beam diameter of 2.0 mm, and release a laser shot. Now the laser spot should still be central in the reticule of the stereo microscope.

If there are large discrepancies, check the laser adjustment. The laser beam axis could also be misaligned (service).

Fig. 24: Adjustment of the laser welding point and reticule

With an angled allen key (3 mm) the adjustments can be carried out at closed hood.

Fig. 25: Adjustment screws for the bending mirror
## 11. Possible faults, causes and elimination

<table>
<thead>
<tr>
<th>Fault/Symbol</th>
<th>Further symptoms</th>
<th>Possible cause</th>
<th>Elimination</th>
<th>Who?</th>
</tr>
</thead>
</table>
| **Box open** | “Shutter close” key lights up  
“Shutter open” key flashes | Feed flap is open. | Close feed flap. | Customer |
| **Safety Loop Error** | “Shutter close” key lights up  
“Shutter open” key flashes  
“Reset Interlock” key lights up  
“Laser OK” key lights up red  
Warning symbol ! lights up | The safety circuit cannot be closed because one of the two monitors in the feed flap reports an error. | Check the two feed flap sensors. | Customer |
| **Safety Loop Ilck** | “Shutter close” key lights up  
“Shutter open” key flashes (about 5 seconds)  
“Reset Interlock” key lights up  
“Laser OK” key lights up red  
Warning symbol ! lights up | The safety circuit cannot be closed because one of the two monitors in the feed flap reports an error for more than 3 seconds. | Press the “Reset Interlock” key. Check the two feed flap monitors. If this does not help, contact Service. | Customer |
| **Wait for Discharge** | “Shutter close” key lights up  
“Shutter open” key flashes | The user has reduced the voltage value. | Wait. The laser system discharges the excessive voltage by activating the flash lamp with closed safety shutter until the value reached the lower value that has been specified. When this has been done, the displayed message will clear automatically. | Customer |
| **Footswitch ERROR** | “Laser OK” key lights up red  
Warning symbol ! lights up | Laser pulse input (two-stage foot switch) not connected, wrong or defective. | Check the cable; try a different two-stage foot switch. If this does not help, contact Service. | Customer, Service |
<p>| <strong>Footswitch PRESSED</strong> | Warning symbol ! lights up | Laser pulse input active (two-stage foot switch). | To trigger another laser pulse, release the two-stage foot switch. | Customer |
| <strong>Simmer Off Ilck</strong> | | Spare interlock active. Jumper on LS1 control board is missing. | Contact Service. | Service |
| <strong>Overload</strong> | | Laser is overloaded at current pulse parameter configuration. | Reduce pulse frequency. Check power voltage. If this does not help, contact Service. | Customer, Service |
| <strong>Waiting... try to connect</strong> | | Communication error between touch screen and control board. | Contact Service. | Service |
| <strong>Wait for Ignition</strong> | “Shutter open” key lights up red | Flash lamp is being ignited. | No action required. Message disappears after ignition. | |</p>
<table>
<thead>
<tr>
<th>Fault/Symbol</th>
<th>Further symptoms</th>
<th>Possible cause</th>
<th>Elimination</th>
<th>Who?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ignition fail</strong></td>
<td>“Shutter close” key lights up</td>
<td>Flash lamp failed to ignite automatically. Flash lamp, laser power supply or starter is defective.</td>
<td>Replace flash lamp.</td>
<td>Service</td>
</tr>
<tr>
<td></td>
<td>“Reset Interlock” key lights up yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Laser OK” key lights up red</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Safety Shutter Ilck</strong></td>
<td>“Laser OK” key lights up red</td>
<td>The electrical connection to the safety shutter is interrupted. The safety shutter is jammed. The safety shutter monitor is defective. No 24 V power supply.</td>
<td>Press the “Reset Interlock” key. Check the cable. If this does not help, contact Service.</td>
<td>Customer, Service</td>
</tr>
<tr>
<td></td>
<td>“Reset Interlock” key lights up yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Shutter close” key flashes red. Warning symbol ! lights up</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>“Laser OK” key flashes red</strong></td>
<td></td>
<td>Laser power supply is defective.</td>
<td>Check the input voltage.</td>
<td>Service</td>
</tr>
<tr>
<td></td>
<td>Thermal overload due to frequent switching on and off.</td>
<td></td>
<td>Use the key switch to turn the laser system off. Wait about ten minutes. Switch the laser system back on.</td>
<td>Customer</td>
</tr>
<tr>
<td><strong>“Laser OK” key lights up red</strong></td>
<td></td>
<td>Thermal overload due to frequent switching on and off.</td>
<td>Use the key switch to turn the laser system off. Wait about ten minutes. Switch the laser system back on.</td>
<td>Customer</td>
</tr>
<tr>
<td></td>
<td>“Reset Interlock” key lights up yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Shutter close” key lights up red</td>
<td>Charger has forced a switch-off because the charge voltage is too high. Flash lamp is defective. Two-stage foot switch not connected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HEX Temperature Ilck</strong></td>
<td>“Laser OK” key lights up red</td>
<td>Coolant temperature is above 50 °C / 122 °F.</td>
<td>Press the “Reset Interlock” key. Check that the vent slots are clean. Run the fans and pump for about ten minutes without using the laser. If this does not help, contact Service.</td>
<td>Customer, Service</td>
</tr>
<tr>
<td></td>
<td>“Reset Interlock” key lights up yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Shutter close” key lights up red</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HEX Level Ilck</strong></td>
<td>“Laser OK” key lights up red</td>
<td>Coolant level too low.</td>
<td>Press the “Reset Interlock” key. Add de-ionized water to above level monitor (see page 36).</td>
<td>Customer, Service</td>
</tr>
<tr>
<td></td>
<td>“Reset Interlock” key lights up yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Shutter close” key lights up red</td>
<td>The level monitor in the coolant tank has jammed.</td>
<td>Release the jammed level monitor. If this does not help, contact Service.</td>
<td>Customer, Service</td>
</tr>
<tr>
<td>Fault/Symbol</td>
<td>Further symptoms</td>
<td>Possible cause</td>
<td>Elimination</td>
<td>Who?</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------</td>
<td>----------------</td>
<td>-------------</td>
<td>------</td>
</tr>
<tr>
<td>HEX FlowRate lick</td>
<td>Flow monitor is defective.</td>
<td>Press the &quot;Reset Interlock&quot; key. Release the jammed flow monitor. If this does not help, contact Service.</td>
<td>Customer, Service</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water pump is defective.</td>
<td>Contact Service.</td>
<td>Service</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Particle filter is blocked.</td>
<td>Press the &quot;Reset Interlock&quot; key. Replace particle filter (see page 36). If this does not help, check the flow rate (see page 29) and contact Service.</td>
<td>Trained customer, Service</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kink in the coolant hose.</td>
<td>Press the &quot;Reset Interlock&quot; key. Check the hose for kinks. If this does not help, check the flow rate (see page 29) and contact Service.</td>
<td>Customer, Service</td>
<td></td>
</tr>
<tr>
<td>Usual pulse parameters</td>
<td>Laser pulse energy seems too low for the usual parameters.</td>
<td>Protective glass is dirty.</td>
<td>Clean or replace the protective glass (see page 33).</td>
<td>Customer</td>
</tr>
<tr>
<td></td>
<td>Flash lamp has deteriorated.</td>
<td>Replace the flash lamp.</td>
<td>Trained customer, Service</td>
<td></td>
</tr>
<tr>
<td>Usual pulse parameters</td>
<td>Laser cannot be focused in the usual way. Welding spot is too large.</td>
<td>Oculars of the stereo microscope attachment are not properly adjusted.</td>
<td>Focus the cross hair in the right-hand ocular (see page 20).</td>
<td>Customer</td>
</tr>
<tr>
<td></td>
<td>Work piece is in the wrong position.</td>
<td>Position the work piece at the correct height so that it is in focus (see page 20).</td>
<td>Customer</td>
<td></td>
</tr>
<tr>
<td>Usual pulse parameters</td>
<td>The welding spot and the cross-hair do not coincide.</td>
<td>The bending mirror for the laser beam is out of adjustment.</td>
<td>Adjust the bending mirror (see page 37).</td>
<td>Customer</td>
</tr>
<tr>
<td>Usual pulse parameters</td>
<td>Welding spot is not round, it appears angular or frayed (see page 33).</td>
<td>Laser is out of adjustment.</td>
<td>Check the laser adjustment.</td>
<td>Service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Leak in laser mount, water in beam path.</td>
<td>Switch off the laser system immediately. Contact Service.</td>
<td>Service</td>
</tr>
<tr>
<td>Usual pulse parameters</td>
<td>Welding spot is not regularly distributed.</td>
<td>Protective glass is cracked.</td>
<td>Replace protective glass (see page 33).</td>
<td>Customer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Protective glass is dirty, welding spattering on the surface.</td>
<td>Replace protective glass (see page 33).</td>
<td>Customer</td>
</tr>
<tr>
<td>None</td>
<td>Touch screen cannot be operated.</td>
<td>Turn off unit. With the joystick pressed (Data out), turn on unit until the touch calibration mode appears on the touch screen. Carry out calibration.</td>
<td>Customer</td>
<td></td>
</tr>
<tr>
<td>Fault/Symbol</td>
<td>Further symptoms</td>
<td>Possible cause</td>
<td>Elimination</td>
<td>Who?</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------</td>
<td>----------------</td>
<td>-------------</td>
<td>------</td>
</tr>
<tr>
<td>None</td>
<td>Laser system does not move, Pump not working, Fan fails to start, Lighting not working.</td>
<td>Mains plug not plugged in. No power to power socket. Defective RCD in power socket. Emergency off button has been pressed. Fuse blown, once. Fuse blown, repeatedly.</td>
<td>Plug in mains plug. Check power socket. Plug the RCD back in. Turn the emergency button to release it (see page 18). Reset fuse (see page 16). Contact Service.</td>
<td>Customer Customer Customer Customer Customer</td>
</tr>
<tr>
<td>None</td>
<td>Touch screen is dark. Laser fails to pulse.</td>
<td>24 V power supply is defective. Two-stage foot switch not pressed far enough. Two-stage foot switch not connected. Malfunction of laser system.</td>
<td>Replace 24 V power supply. If this does not help, contact Service. Press two-stage foot-switch all the way down. Contact two-stage foot-switch. Contact Service.</td>
<td>Trained customer, Service Customer Customer Service</td>
</tr>
</tbody>
</table>
12. Spare part list

Spare parts ........................................................................................................................................... REF
Particle filter in water tank .................................................................................................................. 908-231-50
Filter insert in the welding fume extraction ......................................................................................... 908-235-60
Pre-filter fleece for welding fume extraction ......................................................................................... 908-236-60
Flash lamp ........................................................................................................................................... 908-232-55
Protective glass for the lens .................................................................................................................. 908-234-00
Halogen lamp with cold light reflector ................................................................................................. 908-316-50
Cuff for the hand flap ............................................................................................................................. 907-490-20

Service – Accessories

Laser protective goggles
1 sheet A4 format – detection paper for laser radiation ...................................................................... 907-877-00
Adjustable focusing device .................................................................................................................... 090-525-00

13. Environment and disposal

Return the desktop Compact laser to your dealer or manufacturer for disposal. Please note that the desktop Compact laser should be used for commercial or industrial purposes only. Disposal via public disposal services is not permitted.
14. Technical Data

**Laser:**
- Laser crystal: Nd: YAG
- Wavelength: 1064 nm
- Max. average power: 60 W
- Pulse energy: 50 J
- Pulse peak power: 7.5 kW
- Pulse duration: 0.5 - 20 ms
- Pulse rate: single pulse … 25 Hz
- Pulse shape: 4 pre-formed pulse shapes
- Laser cooling: integrated water-air-heat exchanger
- No external cool water connection necessary
- Cooling water level: 4.5 l de-ionised water (conductance < 2.5 µS/cm)

**Electrical connection:**
- 1-phase: 200 V - 240 V / 50 - 60 Hz / 10 A
- Max. power consumption: 2.2 kW

**External measurements:**
- Width x height x depth: 510 x 430 x 645 mm (without stereo microscope)
- Height with stereo microscope: 485 mm
- Weight: Approx. 50 kg

**Welding chamber:**
- Flap, height x width: 140 x 185 mm
- Max. height: 180 mm
- Max. depth: 240 mm
- Max. width: 480 mm
- Max. height of work piece: 60 mm
- Welding spot diameter: 0.2 - 2.0 mm
- Stereo microscope: 16x magnification
- Field of view: ø 16 mm
- Focus: 120 mm
- Inert gas inlet: 2-part, 1 fixed and 1 flexible, individually lockable
- Extraction: Integrated, with suspended particle filter Kl. EU 13/K2
- Cool air nozzle: integrated
- Programme memory: space for 39 parameter data
- Illumination: 2 x 20 W halogen lamps, non-dimmable

**Environmental requirements:**
- Environmental temperature: 10 °C - 30 °C / 50 °F - 86 °F
- Transport and storage temperature: 5 °C - 45 °C / 41 °F - 113 °F
- Max. rel. humidity: 70 %
- Max. mounting height: 3000 m
EC-Declaration of Conformity
according Machinery Directive 2006/42/EC, Annex IIA

DENTAURUM GmbH & Co. KG
Turnstr. 31
75228 Ispringen

hereby declares that the design and construction of the laboratory equipment described below, including the version marketed by us, comply with the basic regulations governing safety and health as stated in the EC Guidelines. This declaration will become invalid if the laboratory equipment is modified or altered in any way without our prior consent.

Description of unit: desktop Compact Laser
REF: 090-578-50
Type of unit: Dental laser unit
Start with No.: 011560114-01.16

EC guidelines
Machinery directive (2006/42/EC)
Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (2011/65/EU)

Applied unified standards
DIN EN ISO 11553-1:2008 Safety of machinery - Laser processing machines - Part 1
DIN EN ISO 11553-1:2007 Safety of machinery - Laser processing machines - Part 2
DIN EN 60204-1:2007 Safety of machinery - Electrical equipment of machines
DIN EN 207:2012 Filters and eye-protectors

Applied national standards
and technical specifications
OStrV
DGUV – V11 (BGV B2)
DGUV – V3 (BGV A3)

Date and manufacturers signature: 28.01.2016
Signatory: - i.V. Dipl.-Ing. (FH) Klaus Merkle -
Production Manager Mechanic
16. Confirmation of Instruction

The following list of persons confirm hereby with their signature that they have read the operating instructions and have been instructed about the regulations of use and the safety precautions:

Dentaurum laser welding unit desktop Compact, unit no: ________________________________

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