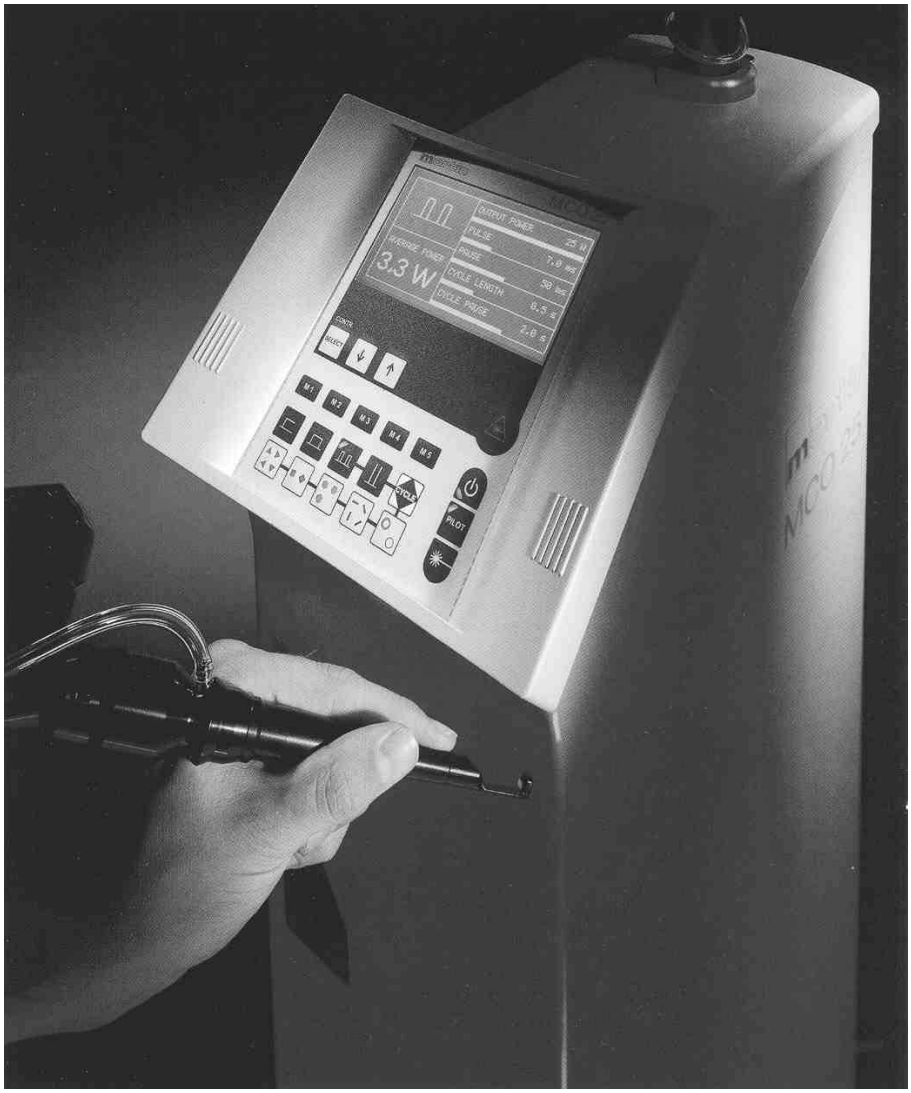
Operating Instructions

and Technical Description



CO_2 Laser System MCO 50

1 Product Liability and Warranty

Martin Medizin-Technik will accept no responsibility for the safety, reliability and proper functioning of the equipment unless:

- all readjustments, modifications or repairs that become necessary are carried out by persons authorized to perform such work,
- all electrical installations of the respective room are in conformity with the requirements provided by pertinent IEC regulations,
- the unit is used in accordance with the Operating Instructions supplied with the product.

Any modification or repair work performed on the unit by persons who have not been specially authorized by the manufacturer to perform such work shall void the warranty given.

The user is strictly required to observe all operating instructions provided herein. Accordingly, the manufacturer will assume no liability – whether within or after the period of warranty – for any damage done to optical components as a result of improper handling of the articulated arm or the handpiece.

Our Standard Terms and Conditions effective at the time shall apply.

Note!
The warranty excludes damage done to the unit or its accessories in consequence of improper handling. So please carefully read and understand these Operating Instructions prior to operating the unit!

2 Safety Instructions

The following regulations and recommendations have been taken from:

DIN EN 60825-1 Safety of laser products – Part 1: Equipment classification, requirements and user's guide (IEC 60825-1:1993); German version EN 60825-1:1994 + A11:1996

DIN EN 60601-1-1 Medical electrical equipment – Part 1: General requirements for safety (IEC 60601-1:1988 + A1:1991 + A2:1995); German version EN 60601-1:1990 + A1:1993 + A2:1995

DIN EN 60601-2-22 Medical electrical equipment – Part 2: Particular requirements for the safety of diagnostic and therapeutic laser equipment (IEC 60601-2-22:1995); German version EN 60601-2-22:1996

In addition to the above, pertinent national provisions and regulations – which may provide otherwise – must be observed as well!

2.1 General Provisions

Installing and commissioning the unit may be carried out only by qualified persons who have been specially trained and authorized by Martin Medizin-Technik to perform such work.

Note!
All persons involved in the operation of this unit must be fully familiar with these Operating Instructions. Note that improper handling (i.e. any action not in compliance with the instructions given herein) may lead to personal injuries and/or damage the equipment.
Improper handling as well as modifications or repairs performed by non-authorized persons shall void the warranty.

Please use the unit only after the following steps have been performed:

- Handing over of the unit in perfect working order plus user training/instruction (to be provided by Martin Medizin-Technik or an authorized agent);
- acceptance by the purchasing department;
- formal appointment of a Laser Safety representative by the owner of the unit (see relevant national regulations concerning the prevention of accidents);
- appointment of a person who is responsible for the unit; familiarizing that person as well as other staff/operators with the unit;
- setting up an equipment log;
- registration of the unit with the respective employers' liability insurance association and the official body responsible for labor safety matters (if applicable);
- carrying out all safety measures;

- making sure that all operational procedures as well as measures to be taken in case of trouble/failure are fully understood.

When using the unit in medical practice, all pertinent regulations for the prevention of accidents must be strictly observed. Such medical use includes all diagnostic, surgical or therapeutic applications where laser radiation plays a role (in the broadest sense).

The owner of the unit and the Safety representatives (e.g. the Laser Safety representative) are responsible for the proper carrying out of all required safety measures in such a manner that the system can be used safely and nobody – neither the patient nor the doctor providing treatment nor the assisting staff – will be endangered during laser operation.

Moreover, the following supplementary provisions need to be observed:

- The Martin **MCO 50** may be operated only by qualified and duly authorized personnel. These persons must be fully familiar with the laser system and must have a complete understanding of all safety measures required. The names of these authorized persons must be recorded in the equipment log.
- Operating staff training should be repeated on an annual basis (refresher courses); all participants in such training should confirm their participation in writing.
- Whenever the unit is out of operation, it must be protected against unauthorized use (e.g. by locking the unit and keeping the key in a safe place).
- The unit must be operated and maintained in accordance with these Operating Instructions; this also applies to the regular safety checks required.

The Martin **MCO 50** is a	Class IIb unit (acc. to MDD),
classifies as a	Class IV laser unit (acc. to. DIN EN 60825-1)
and carries the	CE-mark in acc. with the Directive 93/42/EEC.

We recommend the owner/user of the unit to maintain the following documents and keep them accessible at any time:

- equipment log or ID card
- Operating Instructions

If an accident occurs or persons are injured when using this system, such incidents must be reported to the appropriate body immediately.

2.2 Laser Safety

This unit is a Class IV laser unit, which means that both the laser beam as such and the diffuse laser light reflected from surfaces may be dangerous.

The unit emits radiation in the non-visible spectral range of 10600 nm. Such radiation may cause irreversible damage to the eyes, skin and other organs!

The laser area is defined as the area in which the maximum permissible exposure (MPE) values that are normally binding may be exceeded. This requires taking account also of any accidental deflection of the laser beam. All doors providing access to the laser area must be marked with warning lamps.

Therefore, the following safety measures must be strictly observed:

- Any person present in the laser area while the laser unit is being used must have a full understanding of all the dangers posed by laser radiation and must wear protective goggles. The patient's eyes must also be adequately protected.
- It is the responsibility of the owner/user of the unit to provide suitable protective equipment.
- The organ most endangered by laser radiation is the human eye. Therefore, all persons present in the laser area must wear antilaser goggles (rated 10600 nm L4 or higher) whenever the unit is switched from “standby ⏻” mode to “ready ✷” mode.
- Never make direct eye contact with the red pilot laser light! Please note that the protective goggles just mentioned do not protect against the red pilot laser radiation.
- When performing open surgery, the entire operating room is considered the laser area.
- Never keep potentially explosive substances in the laser area. Easily inflammable materials may catch fire!
- If laser radiation is applied to organs, body cavities or tubular structures which may contain easily inflammable gases or vapors, protective measures must be taken against potential fire and explosion hazards (see Section 2.3).
- Objects that are capable of reflecting the CO_2 radiation must either be covered or removed altogether from the laser area. Windows and reflecting walls also need to be covered by using suitable materials. Moreover, adequate protective measures must be taken if harmful gases, dust, smoke or secondary radiation could be generated, or potentially explosive gas mixtures could be formed, as a result of the impact of laser radiation on certain substances or materials.
- All instruments that need to be brought into the optical path in the course of the treatment must be of such a shape and finish that dangerous reflections are largely excluded.
- The laser area should always be kept as small as possible and should be screened off, making sure that this area cannot be accessed by unauthorized persons. The number of people present in the laser area should always be kept at a minimum.
- At least once a year, all persons working in the laser area must be informed on pertinent safety requirements and measures to be taken, and must be instructed in using the device. Such training must be recorded, including a list of all participants.

2.3 Explosion and Fire Hazards

Class IV laser systems (DIN EN 60825-1) represent a potential ignition source. When laser radiation is absorbed, the laser energy is transformed into heat. As a consequence, the reactivity of the irradiated material increases. So when working with the Martin **MCO 50**, the user is required to observe the following measures in order to prevent laser-induced fires and explosions:

- Never use materials that have a high ignition potential – such as inflammable liquids of all danger classes – either during or prior to the laser treatment.
- Highly inflammable or fire-stimulating gases – such as oxygen and nitrous oxide – may be used for endolaryngeal operations only in connection with special safety measures in order to prevent laser-induced tube ignition (for example, wrap the intubation tube with a self-adhesive aluminum foil or use a flexible metallic tube).
- Always be very careful when using easily flammable materials – such as pads, compresses, etc. – in the operating area. In other words,
  - never direct the laser beam towards inflammable objects;
  - always use the pilot beam for aiming purposes;
  - always moisten potentially inflammable materials;
  - switch off the laser beam when it is no longer used;
  - safeguard the laser unit against accidental/improper use by switching it from "ready" to "standby" mode; switch off or lock all applicator systems connected to the laser unit whenever those systems are not being used.
- In the event of an accidental laser beam activation, it must be guaranteed that neither the patient nor any staff present in the operating room could be endangered and that there is no risk of easily flammable materials getting ignited.

Attention!

Never operate the unit in the vicinity of easily inflammable narcotics or high-volatile mixtures such as alcohol or petroleum spirit.
In the case of endoscopic applications, never use oxygen for intestinal irrigation purposes.

2.4 Protecting the Patient

The patient must be protected against injuries caused by improper use of the laser system. In particular, this means

- protecting the patient's eyes with suitable antilaser goggles (see Section 2.2) or by using a light- and radiation-proof cover;
- protecting those organs and tissues of the surgical field which may not be exposed to laser radiation, using diffuse-reflection or radiation-absorbing materials such as moist towels or compresses;
- prevention of laser-induced fires (see Section 2.3), particularly in endolaryngeal operations;
- effective removal of developing toxic smoke, particularly in the laryngeal region;
- prevention of ignition of flammable intestinal gases in rectoscopic operations;
- prevention of ignition by direct laser radiation when using artificial respiration techniques such as jet ventilation, particularly in connection with flammable, oxidant gases.

2.5 Treatment Room Requirements

- All rooms in which the Martin **MCO 50** is used must be marked at the entryways/doors with a laser radiation warning sign (see “laser star“ symbol provided in the accessories kit).
- A warning lamp (see Sections 2.6, 4.4, and 5.3) must be installed at all doors leading to the laser area. Whenever the warning lamp is on, the laser area may only be entered by authorized persons wearing antilaser goggles.
- As far as possible, all doors leading to the laser area must be kept closed while the laser system is being used.
- All surfaces that reflect the CO_2 laser light well must either be removed from the laser area or covered adequately.

2.6 Safety Requirements Relating to the Laser Unit and its Accessories

- All instruments used should have matt surfaces from which the CO_2 laser light is reflected diffusely.
- All optical equipment employed in the operating field must have been specially designed for use with laser systems. Such equipment may only be used in connection with suitable auxiliary filters that meet the requirements applying to antilaser goggles. As regards pilot laser radiation, please refer to Section 2.7.
- Never switch on the laser system unless all parts of the housing have been properly fixed in place. Note that laser radiation may be emitted in an uncontrolled manner if the laser unit is open! Moreover, there is the further risk of coming in contact with dangerously high electric voltages or currents.
- In case the laser unit is found to be in any way defective, these findings must be duly entered in the equipment log and must be reported to the Laser Safety representative. In such a case, either Martin Medizin-Technik or a serviceman authorized by Martin Medizin-Technik to carry out such work must be contacted immediately. Never use the system as long as it is defective!

2.7 Safety Instructions Relating to Pilot Laser

The radiation emitted by the red pilot laser (diode laser, wavelength 635 ± 10 nm) is not very dangerous. For example, this type of radiation will neither damage the skin nor ignite materials present in the operating room. However, it can be dangerous for the human eye! If intensive pilot laser light accidentally hits the eye several times during a working day, eye damage cannot be ruled out.

The pilot light brightness can be adjusted by the operator. The maximum intensity is around 2 mW, which corresponds to laser class 3B.

Note!
Upon switching on the unit, visible pilot laser radiation will be emitted at the front end of the applicator system (focusing handpiece or scanner head) if the pilot laser function has not been switched off by pressing the yellow-backlight pilot laser button. So when this button is on, never look in the direction of the exit opening (aperture) of the applicator system to avoid eye damage!
While the D 10600 nm L4 antilaser goggles provide adequate protection against CO_2 laser radiation, they are ineffective with regard to pilot laser radiation!

In contrast, the scattered radiation produced by the pilot laser light (e.g. the light reflected by the target tissue) is completely harmless even at maximum output power (2 mW).

To sum it up: No special eye protection (such as protective goggles) is required in connection with the pilot laser light, provided that the instructions outlined above are duly observed.

2.8 Laser Safety Representative

The pertinent accident prevention regulations (relating to laser radiation) require the user/owner of the system to appoint a Laser Safety representative who has the following responsibilities:

- Carrying out all safety measures required;
- providing instruction to all people involved, inasmuch as safety measures and the proper use/operation of the unit is concerned;
- marking the laser area;
- checking the alarm devices for proper functioning;
- providing antilaser goggles;
- ensuring proper application of the unit in the course of the therapy;
- keeping the key to the laser system in a safe place;
- storing the unit away in a safe place when not in use;
- ensuring proper connection of the laser system following relocation;
- maintaining the equipment log (or ID card) properly.

2.9 Surgeon Providing Treatment

The therapeutic application of the unit requires that the user is sufficiently experienced in working with a CO_2 laser system. The physician in charge (therapist) is responsible for the safe and proper use of the medical laser. He/she is required to verify that all safety measures have been duly observed; moreover, he/she must be familiar with laser-specific operating techniques. To ensure proper use of the laser system in clinical practice, the surgeon needs both theoretical and practical training, which can be obtained by attending suitable further-education/training courses (basic course in laser medicine, plus further special laser-application training courses or practical work as a student surgeon).

2.10 Electrical Safety

The unit is a Class 1 system (as per IEC 601-1), which means that it must be connected to a duly grounded supply system in accordance with the specifications contained herein.

- Only the power cable supplied may be used.
- Both the power cable and the connector must be in perfect working order. Never use them if they are in any way defective.

2.11 Grounding the Unit

The unit is grounded via the ground conductor integrated in the power cable. This is an important prerequisite for the safe operation of the unit. So if the power cable is connected in accordance with pertinent electrotechnical regulations, proper grounding is automatically ensured.
The yellow-and-green potential equalization cable must be connected to the equipotential bonding conductor provided in cardiac intervention rooms (see standard relating to rooms used for medical purposes).

2.12 Danger from High Voltage

Dangerous high voltages are present in the laser system!

The user is <u>not</u> entitled to dismantle the unit. Any repair or maintenance work that becomes necessary must be carried out by Martin Medizin-Technik or by a serviceman who has been specially authorized by Martin Medizin-Technik to perform such work.

2.13 Fuses

Defective fuses may be replaced only by an authorized serviceman.

2.14 Safety Devices

In designing this laser system, we strictly adhered to the principle of providing utmost user safety in combination with user-friendliness. This shows in the fact that the system is extremely easy to operate. Moreover, the technical safety devices incorporated in the system virtually preclude maloperation.

When the system is switched on, it is automatically set to “standby“ mode; which means that the laser beam cannot be activated at this stage.

Likewise, the laser beam cannot be activated unless the articulated arm has been connected (error message: “Interlock Error“).

At the end of the articulated arm – at the tip of the focusing handpiece – the visible pilot laser radiation is emitted with a maximum output power of 2 mW, which is equivalent to a Class 3A laser system. The brightness can be decreased in line with the Class 3A safety regulations.

As soon as the system is ready to emit the laser beam, the “ready“ button will come on. However, the shutter – as the final device of a series of safety measures – is kept shut until the footswitch is operated to release the beam. Moreover, a distinctly audible acoustic signal (activation signal) is sounded as long as laser radiation is being emitted.

As concerns irradiation time, the footswitch has absolute priority over the pulse times set. Which means that the irradiation process is definitely stopped as soon as the footswitch is released, even though the preselected pulse time may not have elapsed yet.

In order to ensure that the irradiation parameters selected cannot be accidentally changed during the laser treatment, all operator-panel buttons are rendered inoperable for the entire period during which the footswitch is held down.

With the help of a microprocessor, the laser output power is automatically kept at a constant level (in accordance with the value selected, and within system-specific tolerance limits). In case the system is unable to maintain the selected power level any longer, this is indicated at once – even during the treatment – by an appropriate error message (“Power Error“ or “Current Error“) that will be displayed on the LCD (see Sections 5.1 and 10).

In the “ready“ mode, Class IV infrared laser radiation is emitted upon operating the footswitch. Therefore, all persons present in the laser area (i.e. the closed room, or screened-off part of a room, where laser application is permitted) are required to wear protective goggles when the warning lamps are on (for details, see Section 2.2).

The option of using an external door contact as part of the safety system is described in Sections 4.5 and 5.3 (Figure 5.3).

With the emergency stop device, the system can be disconnected at once in a case of emergency.

2.15 Laser Flue Gas

Note!	**Laser smoke may contain viable particles.**

To protect the user as well as the patient, a powerful laser smoke exhaust system must be used. Via the power supply line, the laser can be controlled so that the suction system is automatically started when the laser is activated. If the laser goes into standby mode, the exhaust system continues to operate for some time (as defined by the user) before it is also switched to standby mode.

2.16 Rating Plate and Warning & Information Labels

Figures 2.1 to 2.3 show the various labels with which the unit is marked (nameplate, warning and information labels). The place of attachment of each label is also indicated.

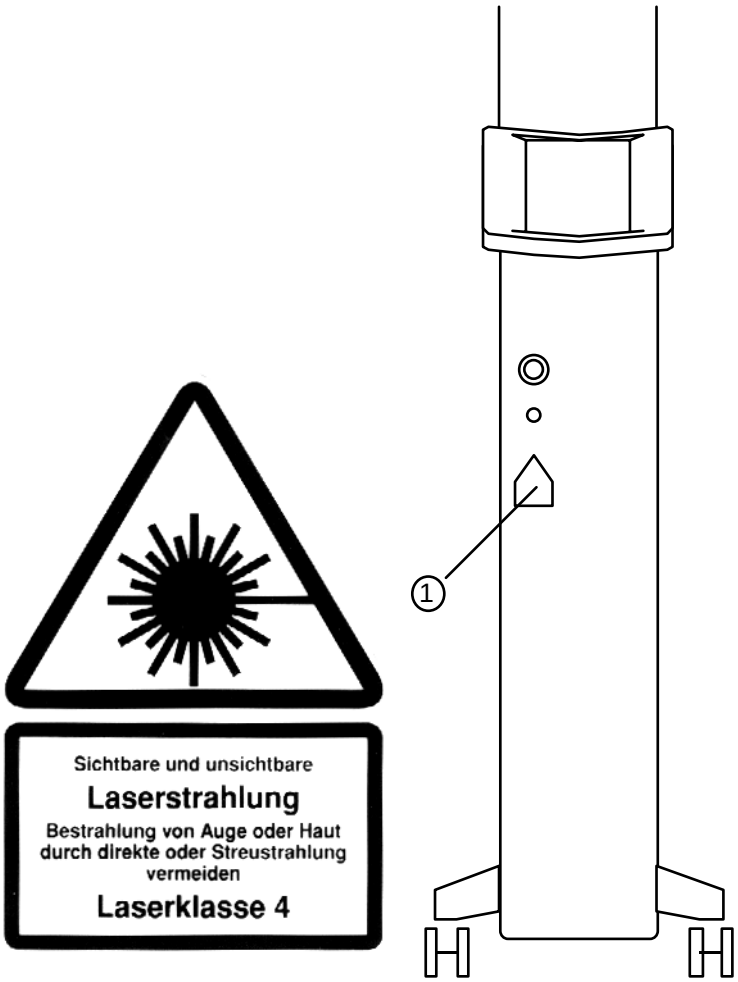
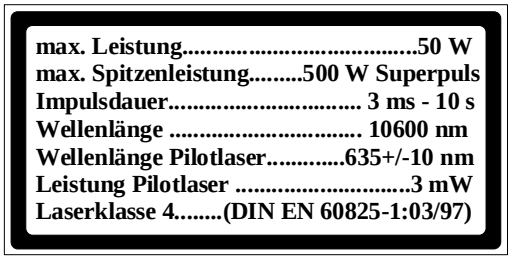


Fig. 2.1 1 "Laserstrahlung" (Laser Radiation) and "Laserklasse" (Laser Class) warning labels according to DIN EN 60825; label position indicated



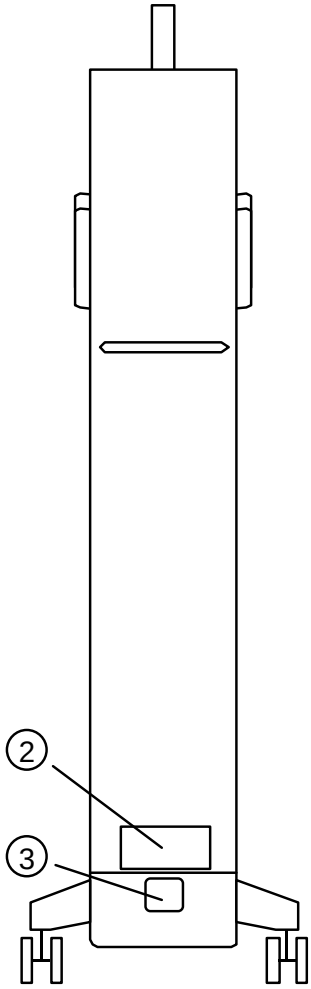
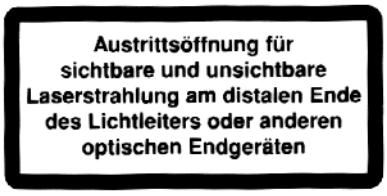


Fig. 2.2 Label positions
2 Identification label *3 Rating plate (nameplate)*



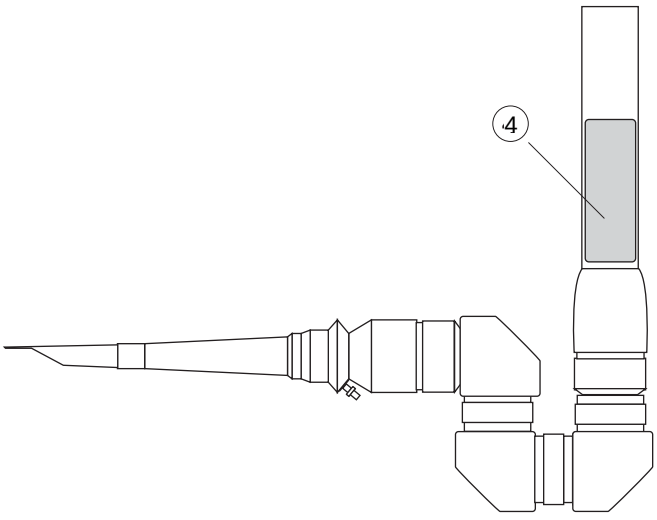


Fig. 2.3 Warning label
4 Position of label at end of articulated arm

3 Description of the Unit

3.1 Some General Remarks on the Laser Principle

LASER is an acronym meaning "Light Amplification by Stimulated Emission of Radiation". The laser (light source) consists of an active medium and an excitation source. This excitation source transforms ("pumps") the active medium from its normal state into a stimulated energy state (high energy level). The medium then begins to return to its normal state (transition to lower energy levels), and in this process photons are emitted. The radiation thus emitted is amplified optically with the help of an optical resonator consisting of a highly reflecting mirror and a partially transmitting one. Via the partially transmitting mirror, part of the laser light is coupled out and is then used for medical purposes.
The main characteristics of the laser light include:

1) High degree of beam parallelism – very little beam divergence.

2) Monochromaticity – light of a very narrow wavelength range, equivalent to a single color in the spectrum of electromagnetic radiation.

3) Coherence – all photons emitted are in phase (in terms of both space and time).

The active medium (lasing material) can either be a gas, a liquid dye or a solid. Most gas lasers consist of atoms or small molecules or a mixture of both. In the case of the solid-state laser, the active medium consists of atoms or ions doped (bound) in a solid-state host crystal. In the case of the dye laser, the active medium consists of molecules of a relatively high molecular weight, dissolved in a liquid.
For the pumping energy that is needed, either a direct current, high-frequency energy or – as in the case of the solid-state laser – a light source is used. Under specific pumping energy conditions, the so-called "population inversion" phenomenon can be observed in all of the above materials. This means that it is possible to induce laser light emission at a specific wavelength characteristic of the active medium used. The high light intensity gain is achieved by way of optical back-coupling, which means that the radiation emitted is reflected with the help of (laser) mirrors (the optical laser resonator).

3.2 The CO_2 Laser

The continuous-wave (CW) CO_2 laser is a gas laser which emits high-intensity radiation at a wavelength of 10.6 micrometers (10,600 nm). The medium used is a CO_2-N_2-He gas mixture contained in a sealed tube. As the tube has a relatively long lifetime, gas refilling is required only after several thousand operating hours. The direct-current discharge excites the gas molecules. The excited CO_2, in turn, emits photons. The coherent light generated in the optical resonator exits the resonator through the semitransparent output mirror and is transmitted through the optical arm. The laser light intensity can be controlled via the electric power pumped into the gas discharge.

3.3 Range of Application

The therapeutic effect produced by the continuous-wave CO_2 laser light is based on the conversion of radiation energy into heat, a process that triggers both reversible and irreversible tissue reactions (hyperthermia, coagulation, vaporization). Since radiation of the CO_2 wavelength is easily absorbed in water or human tissue, it is characterized by a very strong surface tissue effect, a low penetration depth and very good vaporization properties. The specific therapeutic effect of this type of radiation mainly depends on the following three factors:

- power density (irradiation intensity)
- irradiation time (treatment/exposure time)
- tissue characteristics

The irradiation intensity achieved on the surface is a function of:

- the effective distal laser output power (tissue side)
- the diameter of the beam hitting the tissue

The tissue characteristics that are of primary importance with respect to medical laser therapy include:

- tissue absorptivity
- heat conductivity and thermal capacity (among other factors, water content and perfusion rate)

The application possibilities of the Martin **MCO 50** are numerous. Apart from a low penetration depth and high-precision cutting, the advantages of laser surgery also include low patient strain and cost reduction (due to faster wound healing), since this type of operation can usually be performed on an outpatient basis (at least, hospitalization times are much shorter).

The main application areas of the Martin **MCO 50** include:

- ENT
- dermatology
- gynecology
- plastic surgery
- tumor surgery
- proctology
- neurosurgery
- bronchology
- dental

To ensure proper use of the Martin **MCO 50** laser system in clinical practice, theoretical background knowledge and sufficient practical experience/training are indispensable prerequisites. We recommend attending a further-education course in “laser medicine“ in order to acquire the specific technical knowledge required. It should also be noted that the proper and safe use of the unit is ensured only if the user duly observes all requisite measures and application instructions contained in the Operating Instructions. Before putting the unit into service, therefore, all potential operators are required to sufficiently familiarize themselves with the system using the Operating Instructions supplied.

3.4 General Description of the System

The Martin **MCO 50** is a microprocessor-controlled, continuous-wave CO_2 laser system that provides a maximum laser output power of 50 W at the handpiece. The system is integrated in a single housing, including the laser tube, the high voltage supply source, the closed-circuit water cooling system, the pilot or aiming laser, the safety shutter and the operator interface (control panel).

The articulated mirror arm supplied separately must be mounted at the top of the system, which ensures that the surgeon has sufficient room for movement when performing the treatment. The usability of the system is greatly enhanced by a whole range of accessories for different fields of application, which must be attached to the handpiece or connected separately. The operator panel offers a user-friendly interface, so the system can be handled with great ease.

3.5 System Design Options

The Martin **MCO 50** is available in two versions that differ in terms of scanning functions available. Thanks to the system's modular design, the performance characteristics of both versions are fully identical. The modular concept allows the scanner option to be added later (retrofitting option).

The Martin **MCO 50** systems consist of the following components:

	Standard version	Scanner version
Laser main frame	✔	✔
Two keys	✔	✔
Power cable	✔	✔
Articulated mirror arm	✔	✔
Footswitch	✔	✔
Focusing handpiece, 127 mm	✔	✔
Air irrigation tube	✔	✔
Scanner		✔
Scanner connecting cable		✔
Two laser warning signs	✔	✔
Operating Instructions	✔	✔

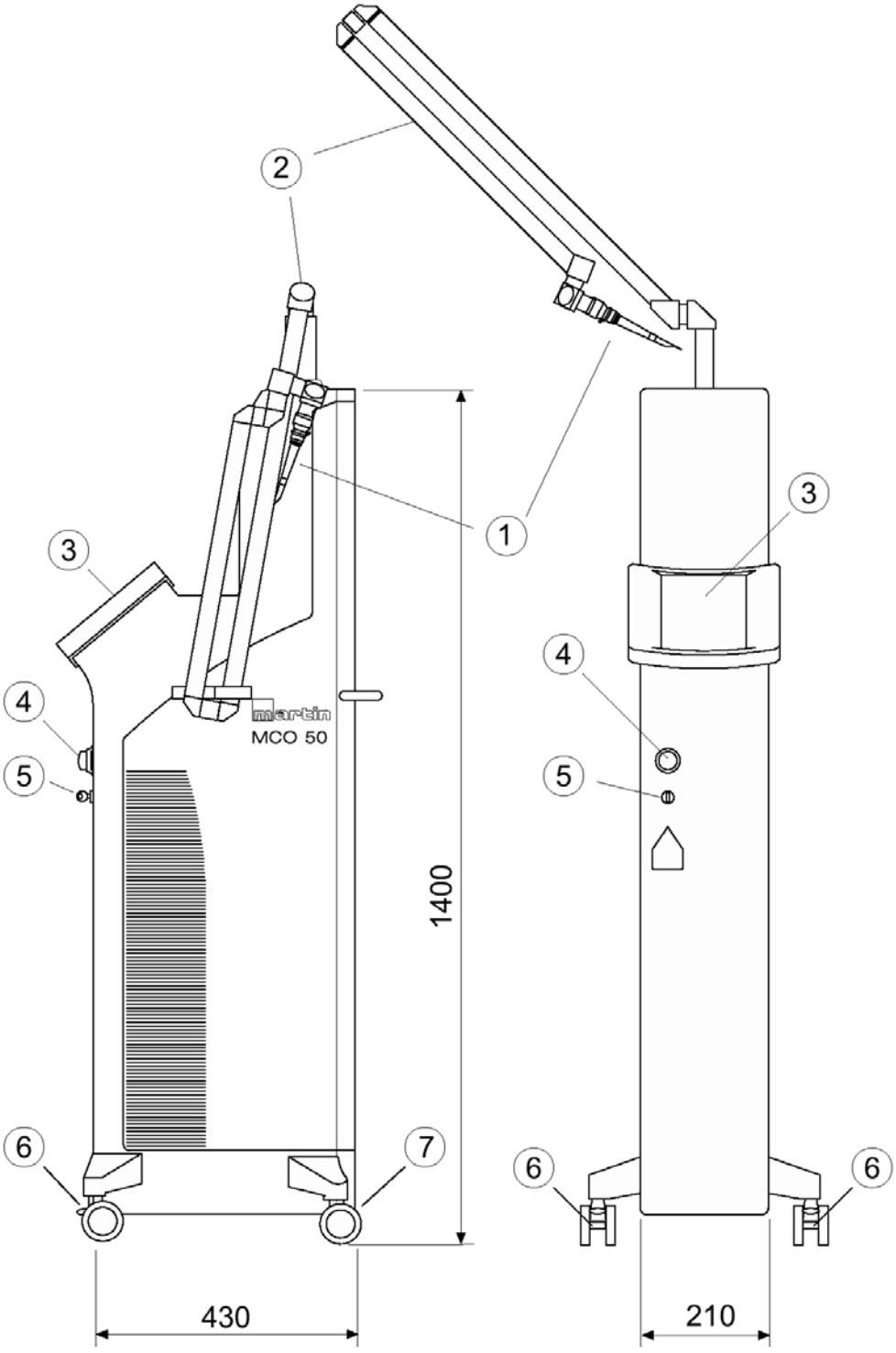


Fig. 3.1 *Martin **MCO 50** standard version*

1	*Focusing handpiece, f = 127 mm*		
2	*Articulated arm*	*3*	*Display and controls*
4	*Emergency stop button*	*5*	*Keylock switch*
6	*Front castor with locking device*	*7*	*Rear castor*

4 Installation

4.1 Preparatory Work

Before the system is shipped, the user is informed on preparatory measures that need to be taken prior to installation.
When setting up and installing the Martin **MCO 50**, a minimum clearance of 30 cm should be maintained around the unit's outer surfaces. This safety distance is required for cooling purposes (as warm air flows from the cooling slots when the system is being used).

4.2 Laser Location

The dimensions of the unit are shown in Figure 3.1. The laser system has a weight of 65 kg and can be easily moved on its wheels (castors).

> **Note!**
> **The unit may only be used when its temperature is roughly the same as that of the ambient air! This requirement is of particular importance when the system is relocated. In case of temperature differentials (especially during the winter months), it is best to transfer the unit to the respective treatment room one day in advance so that there is time enough for the unit to adapt to the room temperature.**

4.3 Electrical Connection

The unit must be connected to a separately fused socket conforming to the voltage and power supply requirements indicated on the rating plate located on the rear wall of the unit. The power cable supplied is a three-core one (i.e. including a PE conductor). Only this cable may be used for the laser system!

> **Note!**
> **The cable supplied must be connected to a grounded socket protected by a 6-A fuse. Never use extension cables or distributors whose rating is below 10 A.**

To ensure reliability in service, we recommend protecting the grounded mains socket with a 10-A fuse. Always use a device-specific "miniature fuse"! A general circuit-breaker is not suitable for this purpose (because of starting current surges).
For potential equalization purposes, the special potential equalization cable must be used. This cable needs to be connected to the PE pin located on the rear side of the unit.

4.4 External Warning Lamps

External alarm lamps must be installed over all entryways/doors providing access to the laser area. These lamps must be switched on when the laser is being used.

4.5 Door Interlock

An external door contact (normally closed) may also be included in the safety system. When using this contact, the laser irradiation is automatically interrupted and an error message ("Interlock Error") is displayed as soon as this contact is opened. Operation can only be resumed after the door has been closed and the error has been cleared by pressing the "standby ⏻" button. However, we do not recommend connecting and using such a door contact device. The reason is that this solution might involve patient hazards, as the laser beam would of course also be interrupted during the treatment if the entry door is opened unexpectedly. Therefore, the system is shipped with these contacts bridged (jumpered) by the manufacturer.

4.6 Unpacking the Unit & User's Inspection

All Martin **MCO 50** units are routinely subjected to thorough quality inspection and testing prior to shipment. Accordingly, the system should be in proper working order when it arrives on the user's premises. Note, however, that the unit may only be unpacked, installed and checked by a person specially authorized by Martin Medizin-Technik to do such work. Any external defects found – either on the packing or the unit itself – must be reported to Martin Medizin-Technik immediately. In case of external shipping damage, the user is required to leave the unit in packaged condition in order to be able to provide evidence of the damage and substantiate potential warranty claims.

4.7 Safety Checks

Prior to handing over the system to the user, the unit must be checked by an authorized serviceman (Technical Service) on the basis of the Safety Check (Installation Report) sheet provided by Martin Medizin-Technik. Subsequently, all system-specific documents must be passed on to the user, who is required to keep these documents in a safe place. Along with the Operating Instructions, these documents should be available to the serviceman at any time.

4.8 Basic Setting

The unit allows a customized standard setting in pulsed mode and scanner mode. In principle, the user can carry out this customization himself. However, we recommend having this done by a service technician at the time of initial installation and startup.

4.8.1 Time Mode

When this basic setting is used, pulse parameter selection is done by entering *time* parameters. For this, the ”standby ⏻” button must be pressed simultaneously when switching on the unit by means of the keylock switch, and must be held down until the following menu items are shown on the display unit:

* TIME SETUP

FREQ SETUP

Use the ↑ and ↓ arrow buttons to move the star-type cursor to the desired position (here: “TIME Mode“), then press the “SELECT SELECT” button for confirmation. The usual initial screen (as it appears whenever the system is started with the keylock switch) will now be displayed, which means that the laser is ready for operation in the Time mode. For further operating instructions, see Section 5.

4.8.2 Frequency Mode

When this basic setting is used, pulse parameter selection is done by entering the *pulse duration* and the *pulse repetition rate* (frequency) parameters. For this, the ”standby ⏻” button must be pressed simultaneously when switching on the unit with the keylock switch, and must be held down until the following menu items are shown on the display unit:

* TIME SETUP

FREQ SETUP

Use the ↑ and ↓ arrow buttons to move the star-type cursor to the desired position (here: “FREQ Mode“), then press the “SELECT SELECT” button for confirmation. The usual initial screen (as it appears when the system is started by means of the keylock switch) will now be displayed, which means that the laser is ready for operation in the Frequency mode. For further operating instructions, see Section 5.

4.9 Handing Over the Unit to the User

After the system has been installed and checked for proper and safe functioning as required by the Martin Medizin-Technik Installation Report, the unit and its accompanying documentation are handed over to the user/owner. The latter is required to formally appoint a Laser Safety representative in accordance with pertinent legal provisions and regulations. Moreover, a person in charge of the unit should be appointed, and this person should be thoroughly familiarized with the unit as part of the hand-over procedure.

4.10 Service Partner

For details concerning a competent service partner in your region, please contact
Gebrüder Martin Medizin-Technik
Ludwigstaler Straße 132
D-78501 Tuttlingen, Germany
Phone.: ++49-7461-706-0
Fax: ++49-7461-706-193

5 Controls, Indicators & Display, and Connections

5.1 Operator Panel (Time Mode)

The operator panel consists of a high-resolution LCD (liquid-crystal display) and a keyboard. These components are integrated into a sealed (membrane-covered) control panel. In “Time Mode”, the display shows the following parameters:

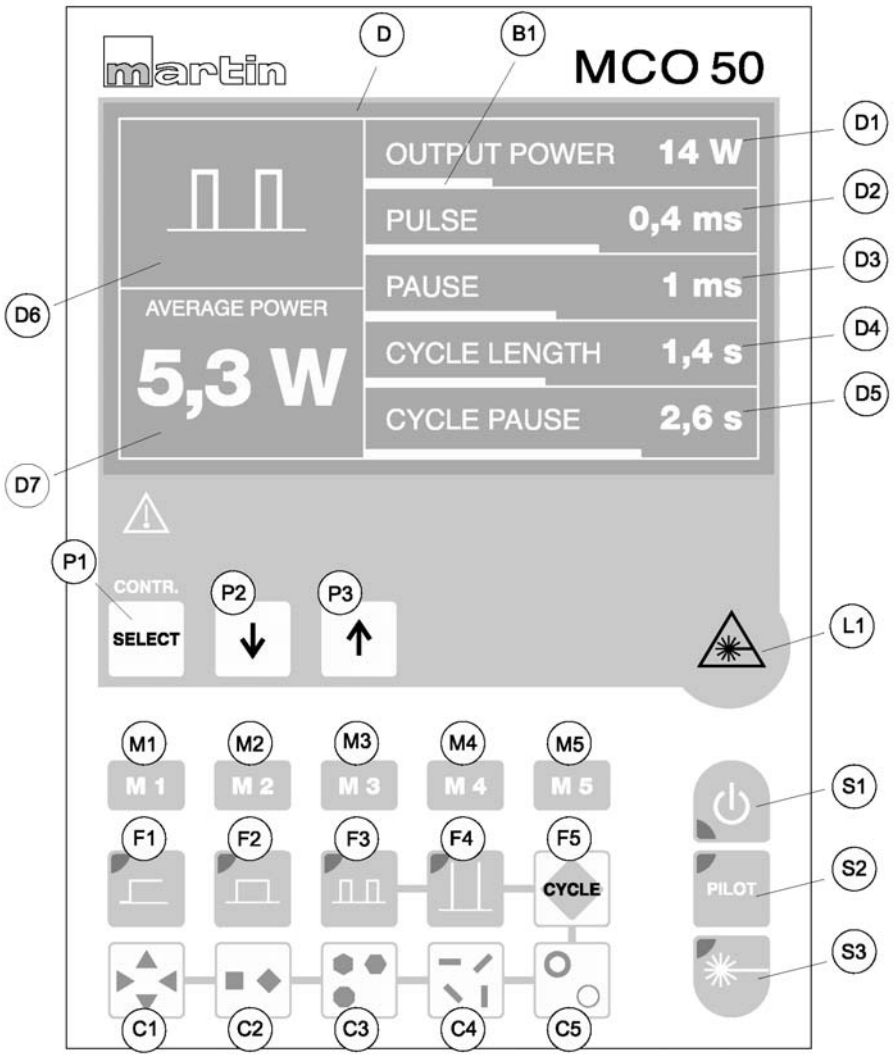


Fig. 5.1 Operator panel view in Time Mode (CW and pulsed operation)

D Display and display elements

P Buttons for parameter selection/presetting

M Memory keys

F Function keys

C Scan keys

L Laser activation indicator

5.2 Operator Panel (Frequency Mode)

In “Frequency Mode”, the display shows the following parameters:

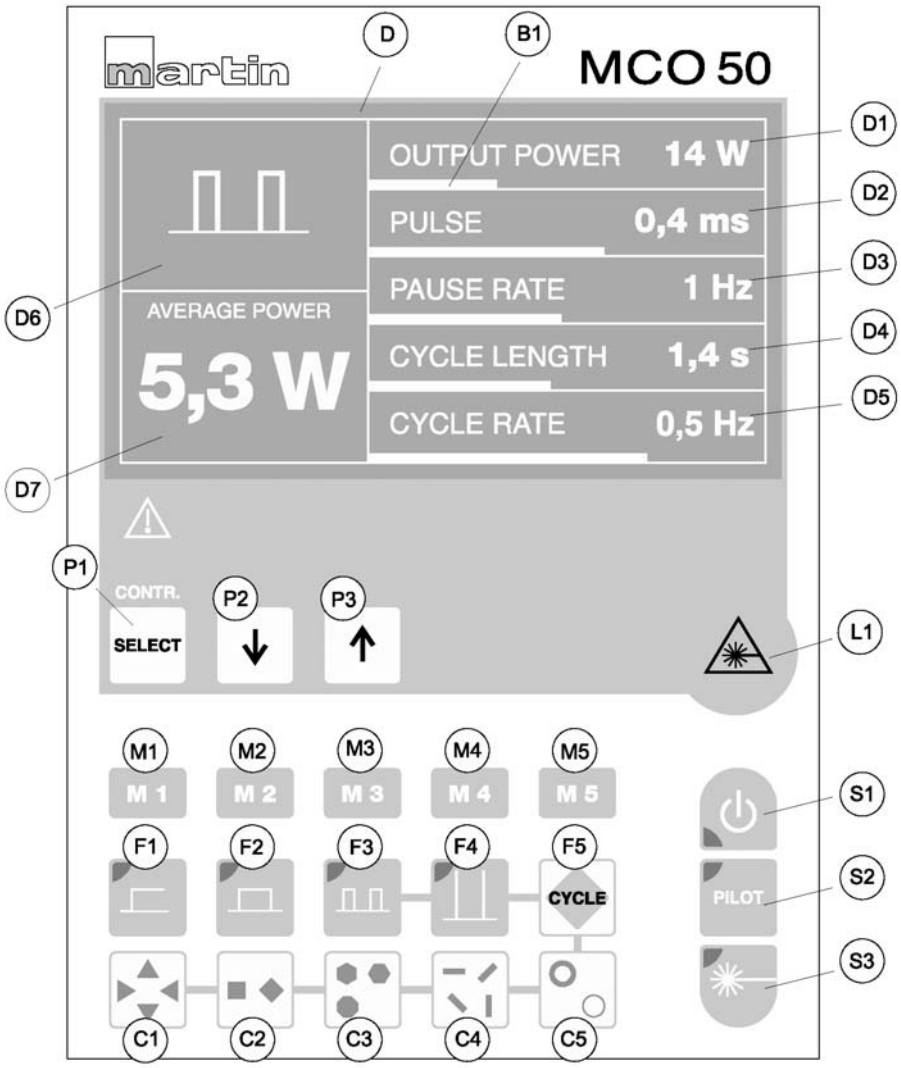


Fig. 5.2 Operator panel view in Frequency Mode (CW and pulsed operation)

D Display and display elements

P Buttons for parameter selection/presetting

S Buttons for operating mode selection

M Memory keys

F Function keys

C Scan keys

L Laser activation indicator

5.3 Explanation of Function Keys

No.	Designation	Function	Explanation
L1	Laser activation indicator	Indicator will light up as soon as radiation is emitted	Functional signal and laser warning light, yellow
S1	Standby	Pressing this button switches unit to safe operating condition; unit inoperable; no power output (irradiation) possible	Standard mode after switching on the unit; green
S2	Pilot	Pressing this button switches pilot laser beam on/off; pressing it together with one of the M1...M5 keys allows brightness adjustment	5 different levels plus OFF; yellow
S3	Ready	Activation (emission of laser radiation) now possible by operating the footswitch	Yellow button backlight on; flashes alternatingly with S1 if a power check is carried out
P1	Select	Pressing this button allows cyclical selection (downward) of items displayed on LCD	Selected item is shown in reverse display
P2	Reduce	Pressing this button (or keeping it pressed) allows continuous incremental decrease of the parameter selected	Short touch means single-step reduction (1 increment); keeping button pressed means continuous, repetitive reduction
P3	Increase	Pressing this button (or keeping it pressed) allows continuous incremental increase of the parameter selected	Short touch: one-increment change; keeping button pressed: continuous, repetitive increase
M1 M2 M3 M4 M5	Memory 1 Memory 2 Memory 3 Memory 4 Memory 5	These functions allow retrieval of the parameters stored in the system's memory. If the respective button is pressed for more than 5 seconds, the currently used settings are stored. An acoustic signal is sounded for confirmation in this case.	Call up (short touch) Store (keep pressed)

Table 5.1a Control keys available on operator panel

No.	Designation	Function	Explanation
F1	Continuous-wave operation	Selects continuous-wave (CW) mode	Operating mode, yellow
F2	Single pulse	Selects single-pulse mode; the laser emits a single laser light pulse	Operating mode, yellow. Laser stops once the pulse is emitted or the footswitch is released
F3	Pulse train	Selects multi-pulse mode; the laser emits laser light pulses on a repetitive basis	Operating mode, yellow. Laser stops upon releasing the footswitch
F4	Super pulse	Selects super-pulse mode; the laser emits very short but high-power pulses on a repetitive basis	Operating mode, yellow. Laser stops upon releasing the footswitch
F5	Cycle	In "Cycle" mode, the laser generates pulse packages on a repetitive basis when using F3 or F4; if used in connection with C, scanning patterns are automatically repeated	Operating mode, yellow. Laser stops upon releasing the footswitch
C1	Triangular scanning pattern	Selects the scanning function; pressing this button repeatedly rotates the triangle by 90 degrees counterclockwise	Without F5, the pattern is scanned only once; with F5, the scan is repeated periodically. Operating mode, yellow
C2	Square scanning pattern	Selects the scanning function; pressing this button repeatedly rotates the square by 45 degrees	Without F5, the pattern is scanned only once; with F5, the scan is repeated periodically. Operating mode, yellow
C3	Hexagonal/octa-gonal scanning pattern	Selects the scanning function; pressing this button repeatedly rotates the hexagon by 45 degrees and selects the octagon	Without F5, the pattern is scanned only once; with F5, the scan is repeated periodically. Operating mode, yellow
C4	Rectangular scanning pattern	Selects the scanning function; pressing this button repeatedly rotates the rectangle by 45 degrees counterclockwise	Without F5, the pattern is scanned only once; with F5, the scan is repeated periodically. Operating mode, yellow
C5	Circular scanning pattern	Selects the scanning function; pressing this button repeatedly selects a thin or thick ring	Without F5, the pattern is scanned only once; with F5, the scan is repeated periodically. Operating mode, yellow

Table 5.1b Control buttons available on operator panel

No.	Designation	Function	Explanation
D1 (F)	Output power	Laser output power in watts; indicates peak power in pulsed or multi-pulse (pulse-train) mode	2 W to 50 W, cont. (F1), 10 W to 50 W, pulsed (F2, F3)
D1 (C)	Pattern size (“Figure Size”)	Side length or diameter of the scanning pattern (in mm)	2 mm to 8 mm (C1, C2, C3) 4 mm to 8 mm (C4) 4 mm to 8 mm (C5 thin) 6 mm to 8 mm (C5 thick)
D2	Pulse duration ("Pulse")	Duration of one pulse in ms or s; range from	3 ms to 10 s (F2, F3)
D3 TM	Pause duration ("Pause")	Length of time between two pulses (= interpulse period), indicated in s	3 ms to 10 s (F3) 2 ms to 0.1 s (F4)
D3 FM	Pulse rate	Pulse frequency/rate; number of pulses per second (in Hz)	0.1 Hz to 200 Hz (F3) 0.1 Hz to 0.3 kHz (F4)
D4	Cycle length	Duration of a pulse package/train; TM: Cycle includes pulse package (D4) plus pause (D5)	0.1 s to 10 s (F3, F4)
D5 TM	Cycle pause	Period of time (interval) between two cycles, indicated in s	0.1 s to 10 s (F3, F4, C)
D5 FM	Cycle rate	Cycle frequency/rate; number of cycles per second (in Hz)	0.1 Hz to 5 Hz (F3, F4)) 0.1 Hz to 2 Hz (C)
D6	Symbol display	Indicates the selected laser operating mode (, ⊓, ⊓⊓, ⊥⊥ x10, plus scanning pattern and rotational position)	Symbol of activated function key and selected scanning function
D7 (F)	Average power	Average output power value, calculated from the following parameters: pulse duration, pause duration and peak power	0.1 W to 50 W; value calculated by the system, so no direct setting possible
D7 (C)	Energy density	Laser energy per unit area; kept constant when the scanning pattern changes (in type or size)	5 J/cm^2 to 12 mJ/cm^2
B1	Luminous bar	Range indicator; length of bar proportional to numerical value	Lowest value = 0 bar length; highest value = bar extends across the entire field

Table 5.1c Display fields (TM = Time Mode, FM = Frequency Mode)
(F) = Selected function F1…F4, (C) = Selected scanning function C1…C5

5.4 External Electrical Connections

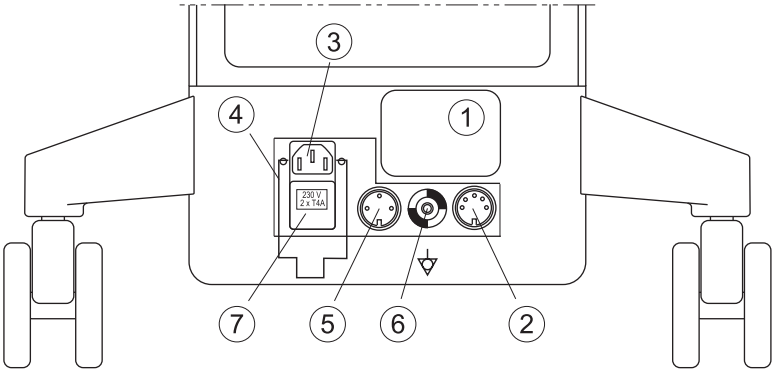


Fig. 5.3 System connections

①	*Rating plate*	②	*Footswitch connector socket*
③	*Mains connector socket*	④	*Cord retaining clamp*
⑤	*OR door interlock connector*	⑥	*Equipotential bonding pin*
⑦	*Mains fuses*		

① **Rating plate:** The rating plate contains important information (electrical connection parameters, serial number, etc.) of which the service technician must be aware when the unit needs servicing. Provide this information when calling the Technical Service.

② **Footswitch connection:** The footswitch supplied must be connected to this 5-pole, screwlock connector.

③ **Mains connection:** 230 V, 50/60 Hz, max. 4 A. For connecting the laser system, only the power supply cable supplied (or a genuine Martin replacement cable) may be used. For reliability reasons, the grounded power-supply socket must be protected with a 6-A fuse.

④ **Cord retaining clamp:** Use this clamp for protection against loosening or accidental disconnection of the plug connector. Only usable with the original power cable. (Lift clamp, insert the plug, then press the clamp onto the plug.)

⑤ **Operating-room door interlock:** Whenever the door contact is opened, the laser irradiation process will be stopped at once and the system will lapse into standby mode. To reactivate the laser beam, the interlock contact must first be closed again and the system must be switched to “ready” state. The interlock contact is a floating contact (i.e. potential-free). The load to be connected is 24 V/0.1 A DC. For this, a 3-pole circular connector must be used. If you prefer not to use this door-interlock shutdown function, use the jumpered (shorting) plug supplied.

Warning: Never insert the shorting plug into the footswitch socket!

⑥ **Equipotential bonding pin:** This connector is to be used only if on-site conditions require such equipment grounding.

⑦ **Fuses in mains filter:** Through this hinged cover, two miniature fuses are accessible whose characteristics are indicated on the holder.

6 Operating the Unit

6.1 Preparatory Measures

When setting up and installing the Martin **MCO 50**, a minimum clearance of 30 cm should be maintained between the unit's external surfaces and the wall or other objects. This distance is required for cooling purposes (as warm air flows from the cooling slots when the system is being used).

Electrical connection:

- Connect the power cable to a grounded socket outlet.
- Protect the laser area against access by unauthorized persons. Provide all doors leading to the laser area with laser warning signs and alarm lamps.
- Cover all surfaces from which the CO_2 laser beam could be reflected, using suitable materials.
- Remove all easily inflammable liquids and gases from the laser area.
- Provide protective goggles for all persons present in the laser area (incl. patient).
- Connect OR door interlock (optional).

Note!
Never operate the system with the beam-path protective caps in place.

6.2 Footswitch

Position the footswitch so that it is easily accessible to the operator, then connect it to the laser system (insert plug on rear side of the unit; see Fig. 5.3) and secure the plug with the threaded ring.

6.3 Articulated Mirror Arm

Please note!

The jointed mirror arm is a precision component. Therefore, be sure to keep it free from any mechanical load when moving or transporting it. Readjustments may only be carried out by the Technical Service.

6.3.1 Unpacking the Articulated Mirror Arm

The articulated mirror arm is delivered separately and must therefore be installed on the unit as part of the installation procedure. First, unpack the arm. For transportation purposes, the lower part of the arm has been relieved from the spring load by means of a setscrew (see screw with white dots). In mounted condition, this spring ensures that the arm can be moved easily and conveniently and will automatically return to its upright “non-use” position. As shown in Figure 6.1, the arm can be rotated by approx. 190° following unpacking, but it is to be noted that the final section of this rotary movement must be performed against spring resistance (so some force is required). At approx. 190°, the setscrew 2 can be turned from position º to position ºº (see Fig. 6.2). The spring is now loaded and the arm will remain in the position shown in Fig. 6.2.

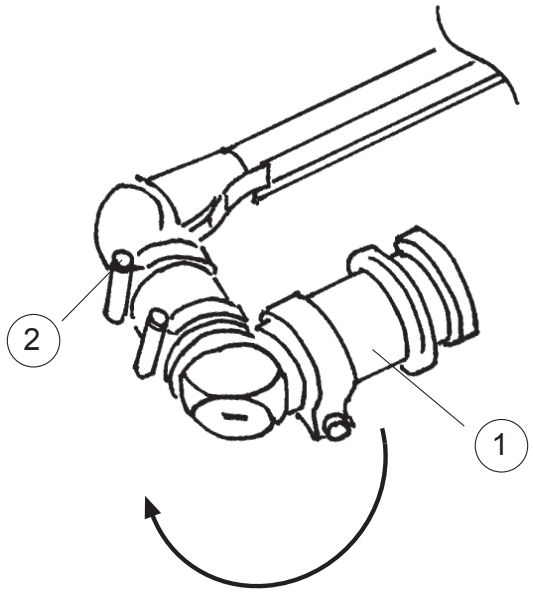


Fig. 6.1 *Transport position of the articulated mirror arm, spring unloaded*

1 *Lower part of the arm (to be fitted to the laser unit)*

2 *Adjusting screw (with white dots) for unlocking the arm (set to position º during transportation)*

6.3.2 Mounting the Articulated Mirror Arm

The articulated arm can now be mounted by screwing the connecting thread 1 (Fig. 6.1) into the upper opening provided on the laser unit. Before doing this, remove the respective covers on the unit and the arm (8, Fig. 6.2).

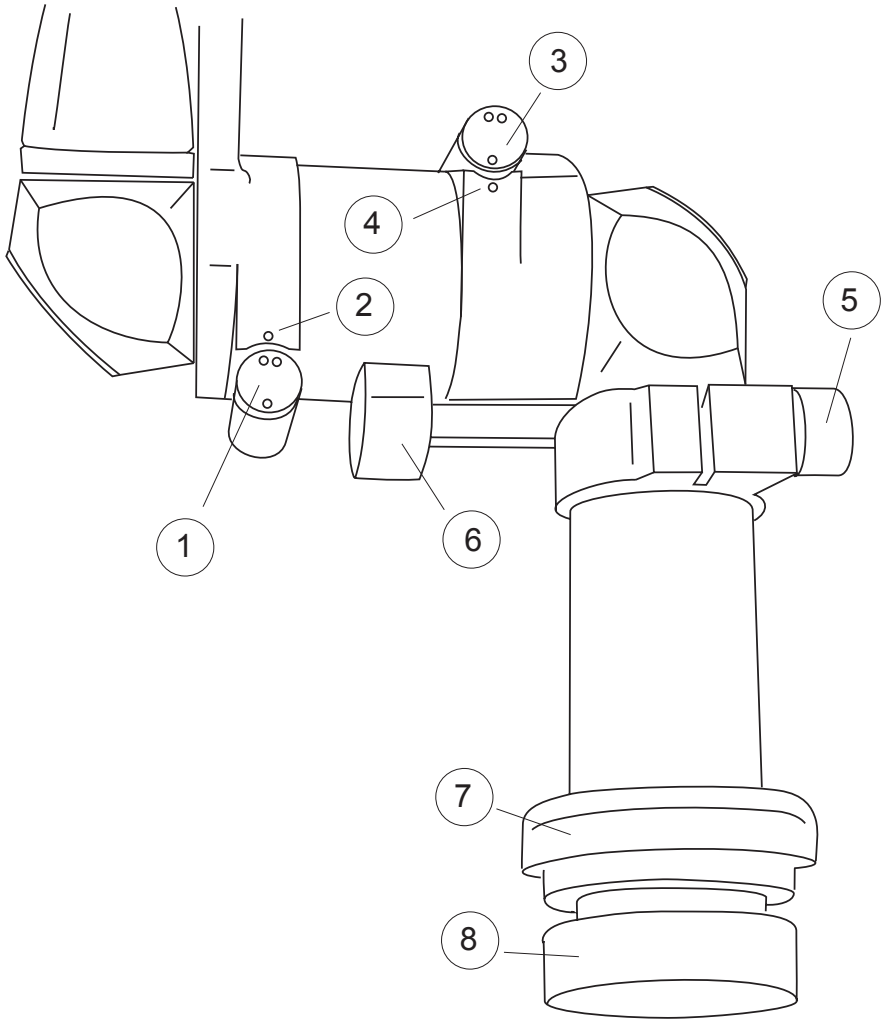


Fig. 6.2 *Functional components of articulated mirror arm*

1, 2 *Lock/unlock facility: º unlocked, ºº with stop = working position (with white dots)*

3, 4 *Choice of spring load: º normal, ºº high = scanner mode (with red dots)*

5 *Setscrew for arm rotation stop*

6 *Elastic arm holder* *7* *Cover ring*

8 *Protective cap for connecting thread*

After loosening the clamping screw 5 (Fig. 6.2), insert the arm vertically into the thread, then tighten by carefully rotating the arm clockwise. Be sure not to jam the thread. Approximately 15 rotations of the lower arm part 2 (Fig. 6.1) are required to achieve the proper mechanical and optical position. Subsequently, connect the flexible plastic air tube to the air outlet located on the unit behind the mirror arm, then push the cover ring fully downwards.

6.4 Application Handpiece

Remove the screwed-on plastic protective cover at the distal end of the mirror arm, then attach the selected application handpiece.

> **Warning:**
> **Never activate the laser without using a handpiece! The laser beam exits the mirror arm so strongly focused that it is "sharp" even at a distance of several meters. This creates a considerable hazard potential.**

Upon connecting the handpiece, the transparent air tube must be connected to the tube connector of the handpiece.

6.5 Switching on the Unit

- The red emergency stop switch (see 4, Fig. 3.1) must be in „pulled-out" (deactivated) position. If this switch has been pressed, unlock it by rotating the red part of the device either clockwise or counterclockwise until it jumps out.
- Insert the key into the keylock switch located on the front panel (see 5, Fig. 3.1).
- Rotate the key clockwise. (It is no longer possible to withdraw the key in this position.) The system is started now. The display unit lights up.
- The LCD shows a starting screen with the information "MARTIN MCO 50" and the green "standby ⏻" button light comes on. An automatic self-test is performed, in the course of which the various functions of the system are checked.

> **Note!**
> **All persons present in the room must wear antilaser goggles. Avoid direct eye exposure to the red pilot laser beam!**

6.6 Functional Checks

The tests described below must be carried out by the Technical Service as part of the system checkout that is required after installing the unit. They may be repeated from time to time by experienced users who wish to verify that the laser system and its optical components are still in good working condition. Moreover, these tests and their results represent a reference source of information for the laser service technician.

6.6.1 Checking the Optical System (Visual Inspection)

The optical system must always be checked for potential defects prior to starting the therapy.

- Press the "pilot PILOT" and M4 (M4) buttons together for 2 s. This increases the brightness of the pilot laser beam.
- Aim the pilot beam at a light-colored (white) surface and focus it. The beam must exit the handpiece centrically, irrespective of the position of the handpiece and the arm. There should be no scattered red light.

- Aim the pilot beam at a light-colored (white) surface from a distance of approx. 2 m. The pilot beam must produce a clearly outlined, round, red spot on the surface. If this is not the case, call the Technical Service.

6.6.2 Testing the Optical System

To perform the optical system test, proceed as follows:

- Switch on the laser unit (see section 6.4).
- Set the system to single pulse, 5 W and a 0.5-second pulse duration.
- You may also use other parameters for testing, given sufficient experience in the use of different test objects.
- Verify that all persons present are wearing protective goggles.
- Set the system to "ready ⏻".
- Place an appropriate test object (sheet of paper) into the beam focus.
- Operate the footswitch.
- Hold the footswitch down for at least one second while keeping the test object firmly in place!
- Check whether the pilot beam and the focus are coaxial. In case of significant divergence, withdraw the system from service and call the Technical Service to have the optical system realigned.

6.6.3 Testing the Irrigation Air Output

For safety purposes, switch the system to "single pulse ⊓" mode, 10 W, pulse duration 8 ms. When pressing the "ready ✳" button, a gentle air flow can be felt at the end of the handpiece.

Warning!	**Do not operate the footswitch!**

6.7 Setting the Laser System Parameters

The user can select the operating mode (continuous-wave, single pulse, pulse train, super pulse and scanner) as well as the corresponding parameters such as laser output power, pulse duration, scanning pattern size, etc. The selected parameters are always indicated on the LCD. In addition, the average laser output is automatically calculated and indicated as well. The above parameters can of course be changed by the user at any time and in any sequence after the unit has been switched on, except during laser application. To prevent an accidental change of the treatment/irradiation parameters while the laser beam is being used on the patient, the system automatically blocks (i.e. renders inoperable) all buttons as soon as the footswitch is operated.

6.7.1 Continuous Operation (⎍)

In this mode, the laser works with a continuous-wave beam which emits energy continuously at a constant output power as long as the footswitch is held down. This mode of operation – also called "CW" mode – is possible only with CO_2 lasers based on direct-current excitation, such as the **MCO 50**.

Information displayed: F1, ⎍

6.7.1.1 Programmable parameters in continuous-wave (CW) mode

- Output Power
  With the selector button (P1), select the “OUTPUT POWER” field, then change the power value using the [↑] and [↓] arrow buttons (increase or decrease as required). Both buttons provide an autorepeat function: keeping the respective button pressed continuously increases or decreases the power value increment by increment.
  The selected value is indicated on the LCD.

  Adjustment range: from 2 to 50 W in 1-W increments

6.7.2 Single-Pulse Mode (⊓)

This mode allows the application of single pulses whose intensity and duration can be defined by the user. When pressing the footswitch and holding it down, the laser emission process will be interrupted as soon as the selected pulse time has elapsed (in other words, only one pulse is emitted). If the footswitch is released before the selected pulse time has elapsed, the laser beam is cut off immediately.

Information displayed: F2, ⊓

For safety reasons, the footswitch function has been given absolute priority. So as soon as the footswitch is released, the laser beam will be cut off, irrespective of the pulse time set.

6.7.2.1 Programmable parameters in single-pulse mode

- Output Power
  Setting procedure same as described above for CW mode.

  Adjustment range: from 10 to 50 W in 1-W increments

- Pulse Duration

  Select the pulse length (“PULSE”) field with the “SELECT” button (P1), then adjust the value using the [↑] and [↓] arrow buttons. Both buttons provide an autorepeat function: keeping the respective button pressed continuously increases or decreases the value increment by increment.

Adjustment range:	from	10	to	100 ms	in 10-ms increments
	from	0.1	to	1 s	in 0.1-s increments
	from	1	to	10 s	in 1-s increments

6.7.3 Pulse-Train Mode (⊓⊓)

Upon operating the footswitch, the laser emits a sequence of laser pulses until the footswitch is released again. At the same time, the average laser power (“AVERAGE POWER“) is indicated on the display. This value is calculated from the output power, the pulse duration and the time interval (pause) or the pulse rate.

Information displayed: F3, ⊓⊓

6.7.3.1 Programmable parameters in pulse-train mode

- Output Power
  Power setting procedure same as described above for single-pulse or CW mode
  Adjustment range: from 10 to 50 W in 1-W increments

- Pulse Duration (“PULSE”)
  Adjustment range: from 10 ms to 10 s (same as for single-pulse mode)

- Pulse Pause
  Select the pulse pause (“PAUSE”) field with the “SELECT” button (P1), then adjust the value using the [↑] and [↓] buttons. Both buttons provide an autorepeat function: keeping the respective button pressed continuously increases or decreases the value increment by increment.

Adjustment ranges:	from	10	to	100 ms	in 10-ms increments
	from	0.1	to	1 s	in 0.1-s increments
	from	1	to	10 s	in 1-s increments

- Pulse Rate
  (In the frequency mode, either the pulse frequency or the pulse rate can be set.)

Adjustment ranges:	from	0.1	to	1 Hz	in 0.1-Hz increments
	from	1	to	10 Hz	in 1-Hz increments
	from	10	to	50 Hz	in 10-Hz increments

6.7.4 Super-Pulse Mode (⊥⊥)

In super-pulse mode, the laser generates very short laser light pulses whose intensity is amplified by the physical processes occurring in the laser tube. This allows a more or less “athermal” laser application, due to the high peak power outputs and the simultaneously low pulse energy. While the footswitch is held down, the laser emits a sequence of short light pulses separated from each other by the time interval selected. Releasing the footswitch stops the irradiation process. Via the display, only the time interval (pause) or the pulse frequency can be set. The pulse width and the peak power, in contrast, are fixed values. In addition, the average power is displayed.

Information displayed: F4, ⊥⊥

6.7.4.1 Programmable parameters in super-pulse mode

- Pulse Pause
  Select the pulse-pause (“PAUSE”) field using the selector button (P1), then increase or decrease the pulse-pause value as desired, using the [↑] and [↓] arrow buttons. Both buttons provide an autorepeat function: keeping the respective button pressed continuously increases or decreases the value increment by increment.

Adjustment ranges:	from	3	to	10 ms	in 1-ms increments
	from	10 ms	to	0.1 s	in 10-ms increments

- Pulse Rate
  (In the frequency mode, either the pulse frequency or the pulse rate can be set.)

Adjustment ranges:	from 10	to	100 Hz	in 10-Hz increments
	from 100	to	300 Hz	in 100-Hz increments

Note: In the frequency mode, the pulse duration and the pulse rate values influence each other. Therefore, a long pulse duration will limit the maximum pulse rate. A high pulse rate, in turn, has a limiting effect on the maximum pulse length.

6.7.5 Cycle Mode (CYCLE)

The “CYCLE” button (F5) can be selected together with the pulse-train, super-pulse and C1…C5 scanner buttons. This enables further, special laser applications. When using this mode, the previously selected function (F3 or F4) can be applied over a selectable period of time (“CYCLE LENGTH”) followed by a variable pause (“CYCLE PAUSE”) during which no laser power is emitted. Subsequently, the cycle is repeated as long as the footswitch is held down. In frequency mode, it is also possible to set the cycle repetition rate instead of the duration of the cycle pause.

Information displayed: Die “CYCLE” button lights up. In addition, the "CYCLE LENGTH" and "CYCLE PAUSE" (or "CYCLE RATE") values are indicated on the display.

6.7.5.1 Programmable parameters in cycle mode

- Cycle Length
  Use the selector button (P1) to select the “CYCLE LENGTH” field, then increase or decrease the value as desired, using the ↑ or ↓ arrow button.

Adjustment ranges:	from	0.1	to	1 s	in 0.1-s increments
	from	1	to	10 s	in 1-s increments

Note: The cycle duration is automatically adjusted so that the cycle includes only whole pulses.

- Cycle Pause
  Use the selector button (P1) to select the “CYCLE PAUSE” field, then increase or decrease the value as desired, using the ↑ or ↓ arrow button.

Adjustment ranges:	from	0.1	to	1 s	in increments of 0.1 s
	from	1	to	10 s	in increments of 1 s

- Cycle Rate
  In frequency mode, either the cycle frequency or the cycle rate can be set.

Adjustment ranges:	from	0.1	to	1 Hz	in increments of 0.1 Hz
	from	1	to	10 Hz	in increments of 1 Hz

6.7.6 Permanent Scanning (CYCLE)

The scanner repeats the selected scanning pattern continuously (no pause) as long as the footswitch is held down.

Information displayed: Die “CYCLE” button lights up. In addition, the "CYCLE LENGTH" and "CYCLE PAUSE" (or "CYCLE RATE") values are indicated on the display.

- Cycle Pause: The pause rime is set to “0“.

Please note: The ablation rate is significantly higher in this mode!

6.8 Scanner Mode

6.8.1 Installing the Scanner

In order to be able to use the **MCO 50** in scanner mode, the optionally available equipment is required. In particular, the usual application handpiece must be replaced by the scanner handpiece (Fig. 6.3). To do this, screw the articulated mirror arm into the connector 1 (Fig. 6.3). Moreover, the scanner cable supplied must be connected to jack 2 (Fig. 6.3) and to the laser unit (upper side, behind articulated arm). This cable serves control signal transmission purposes).

Note: Do not switch on the laser unit unless the electrical connection between the scanner and the laser has been established. Also, never disconnect the scanner cable unless the laser system has been switched off.

To keep the working area between the handpiece and the application site free from smoke or fumes, connect the gas tube to the connector 3 (Fig. 6.3).

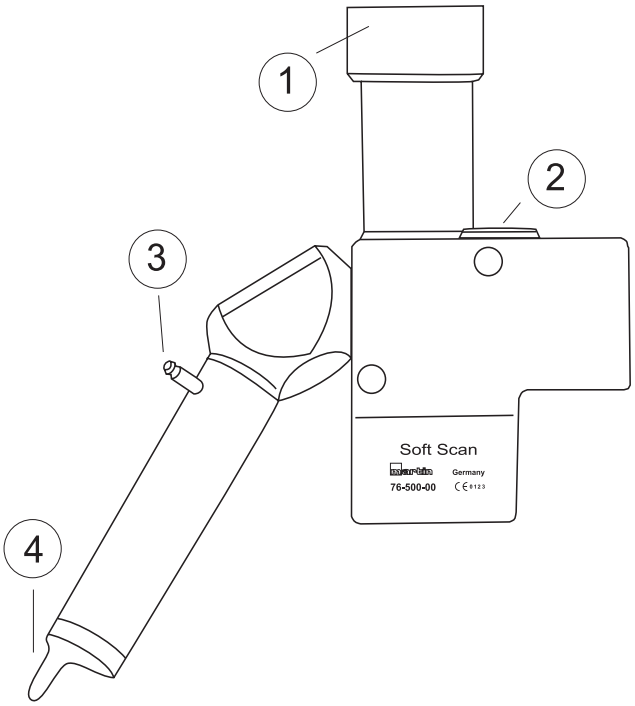


*Fig. 6.3 Scanner for **MCO 50***

① *Connecting thread for articulated mirror arm*

② *Socket for connecting cable to laser unit*

③ *Irrigation air connector* ④ *Beam exit with distance piece*

To account for the higher weight of the scanner (compared with standard application components), the higher preload value must be selected on the mirror arm. To do this, relieve the mirror arm, rotate the setting knob 1 (see Fig. 6.2) to position º, then swivel the arm a little backward until the setscrew 3 (see Fig. 6.2) can be turned to position ºº. Now pull the arm forward again against the spring resistance and arrest the arm by setting the screw 1 (see Fig. 6.2) to position °°. The mirror arm has now the correct spring load required for scanner operation.

6.8.2 Display (Time Mode)

Upon pressing one of the C1…C5 buttons or selecting one of the scanning patterns stored in the system's program memories, the following screen will be displayed:

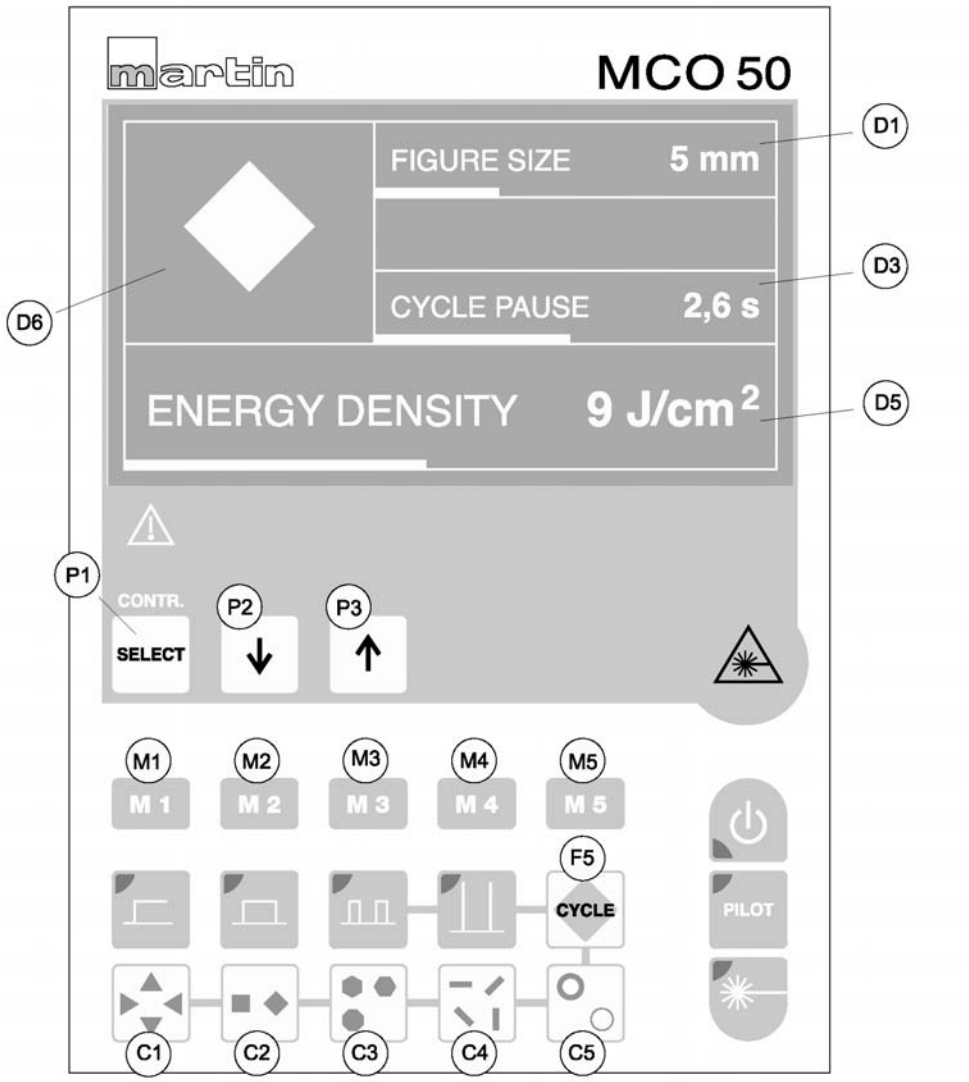


Fig. 6.4 Display available during scanner operation in Time Mode)

D1 Adjustable "pattern size" parameter

D3 Pause interval between two scans (only when F5 has been activated)

D5 Energy density, adjustable

D6 Scanning pattern (in selected rotational position)

P1 Parameter selection (selector button)

P2, P3 Setting buttons

C1…C5 Scanning-pattern selector buttons

M1…M5 Memory

F5 Cycle button

6.8.3 Display (Frequency Mode)

The D3 parameter displayed varies depending on the basic setting selected (time mode or frequency mode).

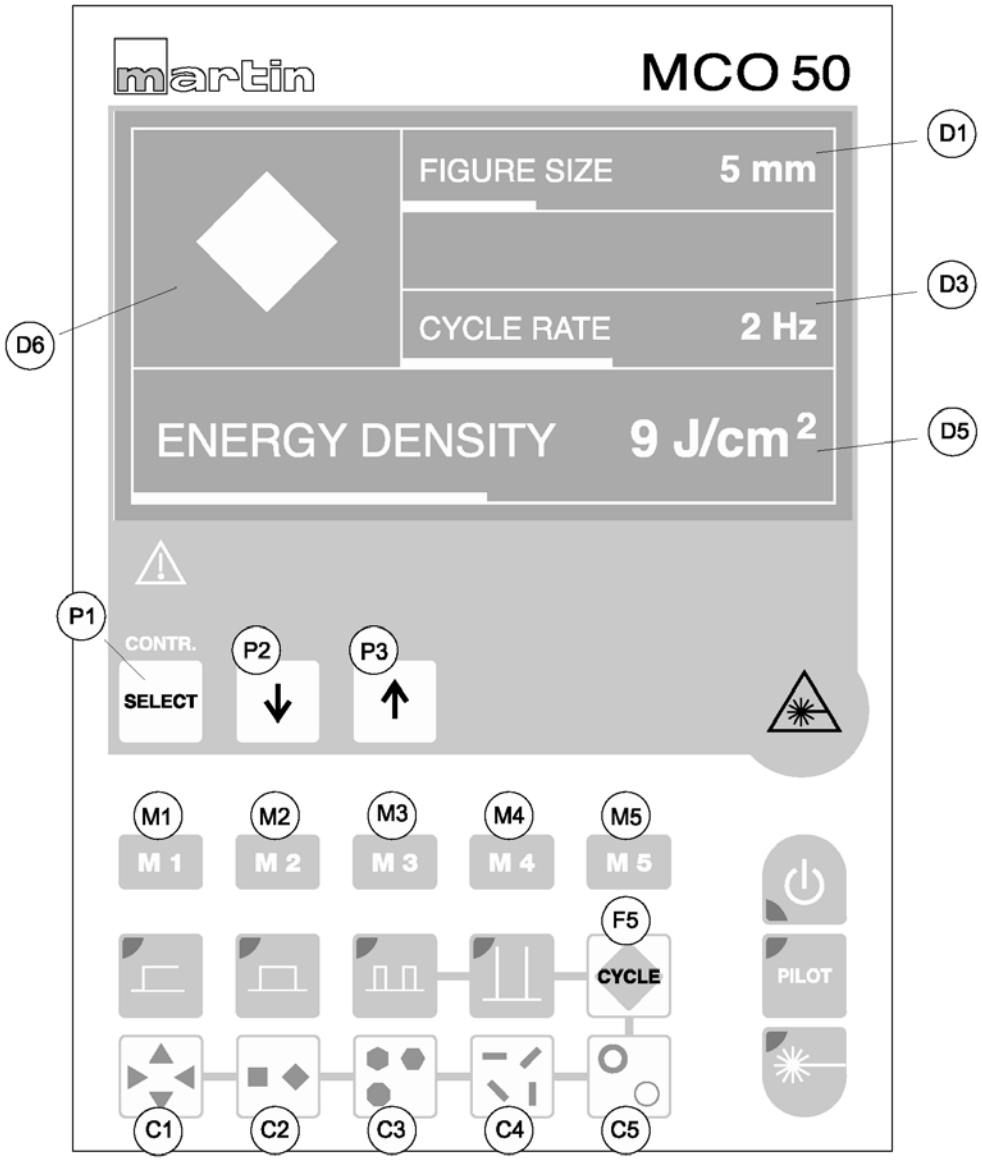


Fig. 6.5 *Display available during scanner operation in Frequency Mode*

Display elements and corresponding description same as in Fig. 6.4, except for D3, "cycle rate" (scanning pattern repetition rate, only with F5)

6.8.4 Scanner Modes (, , , ,)

With a scanner connected, the laser output power can be uniformly distributed across a defined area. The shape of this area can be selected with the C buttons (Fig. 6.3). The chosen pattern can be positioned/rotated as desired by pushing the respective button repeatedly. The size of the scan area can be set on the display.

Information displayed: The appropriate button (C1…C5) lights up and the corresponding symbol appears on the LCD screen. At the same time, the red pilot laser marks the selected pattern constantly in the focal plane of the scanner handpiece.

6.8.4.1 Programmable parameters in scanner mode

- Scanning Pattern Size
  Activate the “pattern” (or “FIGURE SIZE”) field with the selector button (P1), then increase or decrease the size value as desired, using the ↑ or ↓ arrow button.

  Adjustment ranges: from 2 to 8 mm in 1-mm increments for triangle , quadrangle , octagon and hexagon
  from 4 to 8 mm in 1-mm increments for quadrangle
  from 4 to 8 mm in 1-mm increments for 1-mm ring
  from 6 to 8 mm in 1-mm increments for 2-mm ring

- Energy Density
  Select the “ENERGY DENSITY” field with the selector button (P1), then increase or decrease the energy value as desired, using the ↑ or ↓ arrow button.

  Adjustment range: from 5 to 24 J/cm^2 in increments of 1 J/cm^2. ”J” (Joule) is the unit of measurement for energy.

> **Note: Changing the size of the scanning pattern has <u>no influence</u> on the selected energy density! In other words, only the size of the surface scanned is changed while the impact of the laser beam on the tissue (unit area) remains exactly the same.**

6.9 Memory functions

6.9.1 Storing and Recalling Parameters

The memory buttons allow the user to store frequently used laser parameters – or the ones currently shown on the display unit – so that they can be easily retrieved later. There are five memory locations available for storing five different settings, designated M1 (M1) to M5 (M5). The settings stored in this way are retained also when the laser unit is switched off.

- Storing a setup

If you want to store the currently used settings for later reuse, press the appropriate memory button (M1 to M5) for approximately 5 seconds. As soon as the setup has been stored, a short confirmation signal is sounded. In addition to the parameters shown on the display unit, the pilot laser brightness and the turn-on condition of the pilot laser are also stored.

- Calling up a setup

To call up a stored setup, just push the respective memory button (M1...M5). This switches the laser to the previously stored parameters.

6.9.2 Selecting Pilot Beam Brightness Levels

This function allows the user to choose between 5 factory-preset pilot beam brightness levels. To select a setting, first press the "pilot [PILOT]" button and keep it pressed, then shortly touch the appropriate M1…M5 button ([M1]…[M5]) and release the two buttons. If you release the pilot button too quickly, the pilot beam will be switched off. In this case, just press the "pilot [PILOT]" button again. This switching the pilot beam on/off does not affect the chosen brightness level.

Note: When focusing the laser with the S3 button, the pilot beam is switched on automatically. However, for certain skin/tissue surface applications it might be desirable to switch off the pilot light in order to obtain a better view of the site. Activating/deactivating the pilot laser is done with the S2 button.

6.10 Adjusting the LCD Contrast

The LCD contrast can be adjusted to the environmental conditions. To do this, press the "SELECT [SELECT]" button and keep it pressed, then use the appropriate arrow button ([↑] or [↓]) to increase or decrease the contrast as required. The change in contrast will set in after one second and will be continued until you release the button. The contrast can be adjusted from very dark to very bright.

Note: If the symbols on the display unit are unclear or non-recognizable after switching on the laser, adjust the contrast as necessary!

6.11 Performing the Laser Treatment

- Select the appropriate pilot laser brightness level by simultaneously pressing the "pilot" button and one of the M1…M5 buttons. In "standby [⏻]" mode, the pilot laser can also be switched off by pressing the "pilot" button (see Section 6.9.2)
- Aim the handpiece at the operating field.

Note!
Press the "ready [✳]" button only after the handpiece has been directed towards the operating field and all safety measures required for the prevention of laser-induced fires and explosions – as described in Section 2.3 – have been duly carried out.

Note!
All persons present in the room are required to wear protective goggles!

- Press the "ready" button to make the laser system ready for use. This button is now illuminated by a yellow backlight.

Note!
Prior to operating the footswitch, once again check the values set/indicated on the operator panel for correctness.

- To start the laser treatment, operate the footswitch. This activates the laser radiation. At the same time, the L1 "laser activation ( )" control light comes on and an acoustic warning signal is sounded as long as the irradiation process is going on.
- If the footswitch is released before the preset pulse time has elapsed, the laser light emission will be stopped at once. When operating the footswitch anew, the original pulse time will apply again.

Note!
During the therapy, take care that no blood, tissue particles or smoke will penetrate into the handpiece. Such particles could damage the optics of the handpiece in consequence of increased absorption. If particles are detected on the optical system, clean it in accordance with the cleaning instructions provided (after disconnecting the handpiece). Be sure to switch the laser to "standby" mode first.

Note!
During the laser application, the surgeon/therapist should carefully monitor the tip of the handpiece as well as the effects the laser beam generates on the tissue.

Note!
If the laser treatment is interrupted for an extended period of time, always press the "standby" button for safety reasons. As long as the green backlight of this button is on, an accidental activation of the laser beam (via the footswitch) cannot occur.

6.12 Switching off the Unit

- Press the “standby ⏻” button.
- Rotate the keylock switch (5, Fig. 3.1) counterclockwise by 90 degrees, then withdraw the key and store it in a safe place.
- Disconnect the footswitch and hang it on the hooks provided on the side of the unit. The footswitch cable can be coiled around the hanging footswitch.
- Clean all accessories, then store them away.
- Clean or disinfect the outer surfaces of the unit in accordance with in-house hygiene requirements, using a suitable towel. Take care, however, that no liquid will penetrate into the system in places where the unit has openings. Never use sprays!
- Set the mirror arm to initial (non-use) position. This can be done in two ways. 1) The arm can be arrested in upright position, thus keeping it ready for operation (upper parking position). 2) It may also be unlocked and folded down if the laser system is to be transported over greater distances (lower parking position).

Upper parking position:

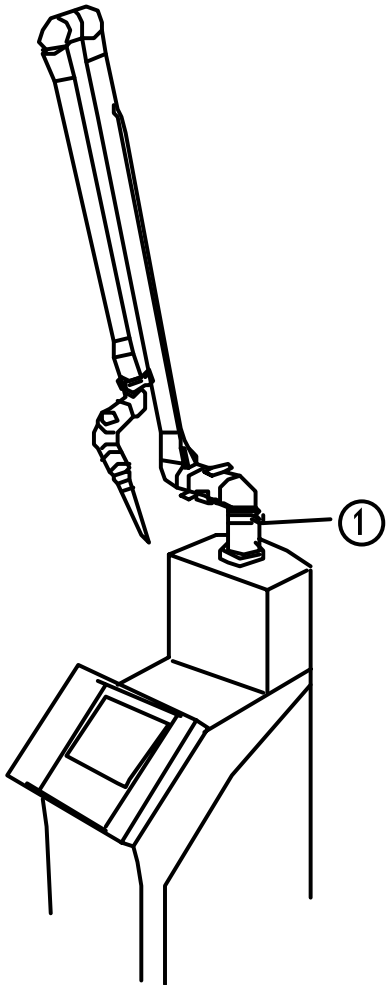


Fig. 6.6 Laser with arm arrested in upper parking position

① Locking screw for arm holder

Latch arm into the blue clip so that its two long legs are kept in parallel. Turn arm so that it slightly bends forward on the left. Tighten the clamping screw 1 (Fig. 6.6) of the arm holder. This prevents arm rotation.

Lower parking position

The lower parking position provides more arm protection and should thus be used whenever the system is moved through corridors or across greater distances.

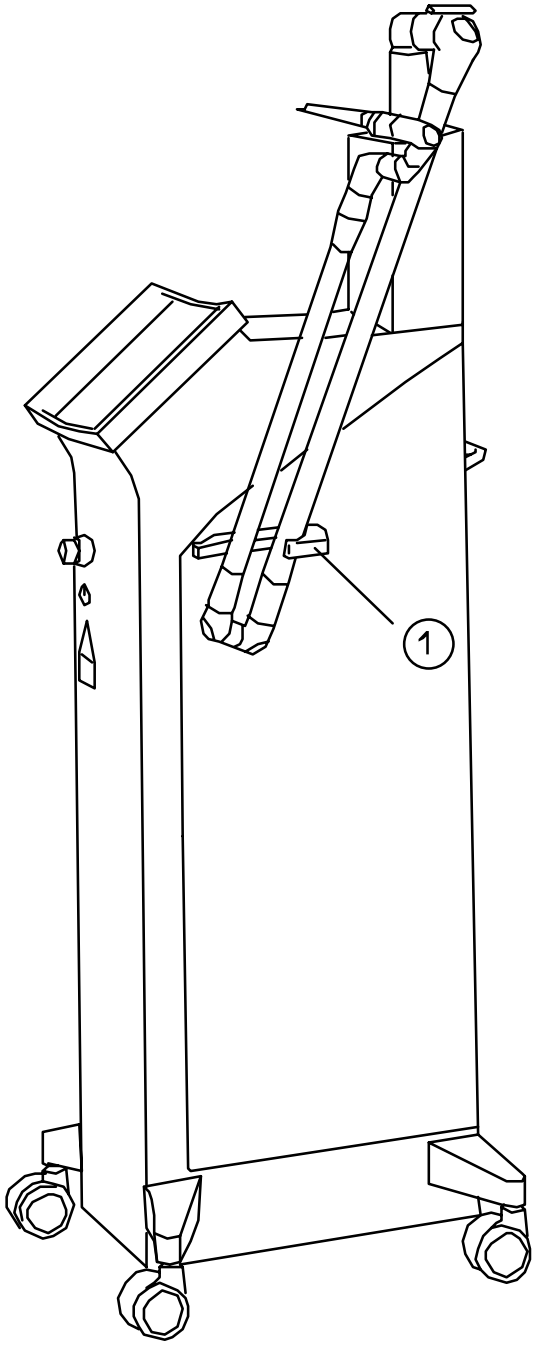


Fig. 6.7 Laser with mirror arm folded down (lower parking position)

1 Elastic arm holder

To fold the arm back into the lower parking position, first turn arm as described for the upper parking position but leave the clamping screw 1 (Fig. 6.8) untightened.

Pull the arm a little forward at position 2 (Fig. 6.8). This allows rotating the adjusting screw 3 (Fig. 6.8) to position º so that the arm can be folded back by slowly releasing the spring load at position 2 (Fig. 6.8).

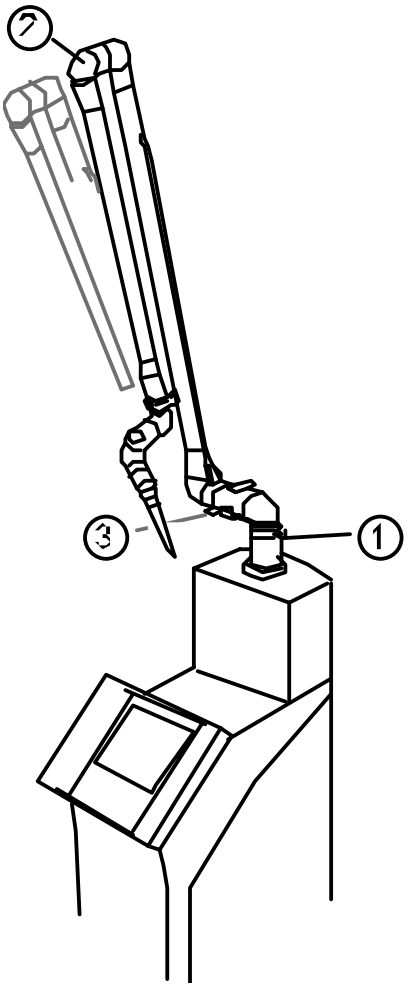


Fig. 6.8 Unlocking the articulated mirror arm

1 Locking screw for upper arm holder

2 Pull the arm to release the lock

3 Adjusting screw for locking the arm in position (º unlocked, ºº locked)

From position 2 (Fig. 6.8), move the arm forward in a sweeping leftward movement and insert it into the lateral holder 1 (Fig. 6.7).

In this position, the laser can be safely transported and stored away.

6.13 Emergency Shutdown

As the name suggests, the emergency shutdown function – the red pushbutton with a yellow edge – may be used only in a case of emergency.

Procedure:

- Press the red emergency stop button located below the operator panel.
  The laser beam will be cut off at once and the system will be shut down completely.
- Set the keylock switch (located on supply unit) to the “0” position.
- Before restarting the system, verify that the red emergency stop button is in the “pulled-out” (deactivated) position. To deactivate this function, turn the button left or right until it snaps out.
- Never use the emergency stop button for normal switch-off!

6.14 Error Messages

To secure the desired treatment results, the system is under permanent monitoring. If failure or malfunction is detected in any one of its components, the system is automatically switched to “standby“ and an error message is displayed. In this state, the system can no longer be operated.

The error message remains displayed until the “standby ⏻” button is pressed. This triggers a self-test in which the entire system is checked for faults. Provided no faults are detected, normal operation can be resumed. Otherwise error messages are displayed.

Section 9 contains a list of potential error messages.

6.15 Relocating the Unit

The system can be easily transported to another location. For safety reasons, however, it is advisable to remove all accessories prior to relocation. Note that the unit must be moved with care. Avoid jerks, vibrations, shocks and the like, particularly with regard to the optical components!

If outdoor transportation is required, please note that the unit is frost-protected up to a temperature of -10 °C.

If the system is to be transported in a vehicle, dismount the articulated arm and transport it separately.

In a vehicle, the laser unit must be transported lying, with the front side down. Be sure to remove the key first and store it in a safe place. We recommend placing the unit on soft pads for protection. Put one pad beneath the display and a second pad beneath the bottom part of the unit (right above the castor supports). Be sure to safeguard the unit against falling over after placing it onto these pads.

6.16 Transportation and Storage

When transporting the unit or storing it away with the water tank filled (maximum storage period: 10 weeks), an ambient temperature of between –10 °C and +50 °C is permissible. The relative humidity of air must be between 10% and 75% (no condensing humidity allowed!). Moreover, an atmospheric pressure of between 700 and 1060 mbar is required.

7 Accessories

Accessories and disposable products may only be used if they are CE-marked and conform to the following list. This accessories list is subject to expansion and modification. The current list can be obtained from the manufacturer.

Ordering data

- **MARTIN CO_2 laser MCO 25** 77-025-00

including basic unit (25 W), articulated mirror arm, standard focusing handpiece (127 mm), power cable, and footswitch

- **MARTIN CO_2 laser MCO 25** 77-025-10

with integrated scanner (plus standard accessories; same as 77-025-00)

- **MARTIN CO_2 laser MCO 50** 77-050-00

including basic unit (50 W), articulated mirror arm, standard focusing handpiece (127 mm), power cable, and footswitch

- **MARTIN CO_2 laser MCO 50** 77-050-10

with integrated scanner (plus standard accessories; same as 77-050-00)

- **General accessories**

Focusing handpiece, focal distance of 50 mm	76-100-05
Tip, detachable, for 50-mm focusing handpiece	76-100-06
Focusing handpiece, focal distance of 127 mm	76-100-10
Tip, detachable, for 127-mm focusing handpiece	76-100-11
Focusing handpiece, focal distance of 200 mm	76-100-15
Tip, detachable, for 200-mm focusing handpiece	76-100-16
Backstop for 127-mm focusing handpiece	76-100-20
Backstop for 200-mm focusing handpiece	76-100-25
Angle unit for 127-mm focusing handpiece, 90°	76-200-05
Angle unit for 120-mm focusing handpiece, 120°	76-200-10
Adapter for angle unit for 200-mm focusing handpiece	76-200-15
CO_2 antilaser goggles *	76-100-50
CO_2 antilaser goggles for persons wearing spectacles **	76-100-51
CO_2 and Nd:YAG antilaser goggles ***	79-100-50
CO_2 and Nd:YAG antilaser goggles for persons wearing spectacles ****	79-100-51

- **Micromanipulator**

"Mini Point" micromanipulator (gynecology, proctology)	76-400-00
Adapter, Zeiss system, for Mini Point	76-400-10
Adapter, Kaps system, for Mini Point	76-400-11
Adapter, Möller-Wedel system, for Mini Point	76-400-12
Adapter, Leica system, for Mini Point	76-400-13
Adapter, Zeiss OPMI FC 1, for Mini Point	76-400-14
Adapter, Möller-Wedel VM 500, for Mini Point	76-400-15
"Micro Point" micromanipulator (ENT, neurosurgery) *****	76-401-00

- **Scanner**

Retrofit kit for "Soft Scan" scanner for MCO 25	76-500-00
Retrofit kit for Soft Scan scanner for MCO 50	76-500-10
Scanner installation kit	76-500-20
Scanner head	76-500-30
Scanner connecting cable	76-500-40

- **Special accessories**

Special optics set for nasal operations	76-600-00
consisting of:	
Optical system	76-600-01
0° attachment for optics	76-600-02
90° attachment for optics	76-600-03
120° attachment for optics	76-600-04
Brush for attachments	76-600-05

*Table 7.1: Accessories for **MCO 50** laser*

* D 9000 – 10600 L5 RH DIN CE acc. to 89/686/EEC (PSA)

** D 9000 – 11000 L4 RH DIN CE acc. to 89/686/EEC (PSA)

*** D 1060 L6 RH DIN CE acc. to 89/686/EEC (PSA) / DI 10600 nm L4 RH DIN CE

**** D 1060 L7 RH DIN CE acc. to 89/686/EEC (PSA) / DI 10600 nm L3 RH DIN CE

***** ZEISS adapter inclusive; further adapters available on request

7.1 Nominal Ocular Hazard Distance (NOHD)

For the accessories to be used on this laser, the following safe clearances or hazard distances (NOHD = Nominal Ocular Hazard Distance) must be observed. Below these minimum distances, the limit values for laser radiation exposure and radiation intensity would be exceeded.

Accessory	**NOHD**	**Specifications**	**Item number**
Focusing handpiece, 50 mm	4 m	Focal distance = 50 mm	76-100-05
Focusing handpiece, 127 mm	7 m	Standard focusing handpiece	76-100-10
Focusing handpiece, 200 mm	10 m	Focal distance = 200 mm	76-100-15
Special optics set for nasal operations	20 m	Cannula straight and angled	76-600-00
Scanner head	7 m	Handpiece for area irradiation	76-500-30

Table 7.2: Safety distances (NOHD) for **MCO 50** accessories

8 Maintenance

In your correspondence with Martin Medizin-Technik, please always specify the model you are working with and the complete serial number of the laser system whenever maintenance or repair issues are involved. All these details are indicated on the rating plate of your unit. Information on the software version is available when the system is switched on (see initial screen; information provided below the Martin logo). Whenever the unit exhibits obvious defects – particularly with regard to the power plug or the connecting cable – the user is required to have the system repaired as quickly as possible. Besides, the system should be checked and serviced at regular intervals in order to ensure the long-term reliability of the unit.

8.1 Routine Maintenance Work

Visual Inspection & Maintenance	Frequency / Interval	To Be Carried out by:
Checking, disinfecting and sterilization of the accessories	prior to each operation	hospital staff
Checking the aiming beam for coaxial exit from the handpiece	daily	hospital staff
Checking CO_2 beam and aiming beam coincidence	daily	hospital staff
Checking the laser alarm lamp for proper functioning	daily	hospital staff
Checking the electrical connections and cables for potential defects	monthly	hospital staff
Replacing fan filters	annually	Technical Service
Checking the cooling water level; refill if required	annually	Technical Service
Replacing auxiliary air filter	every 2 years	Technical Service
Replacing cooling water	every 2 years	Technical Service
Cleaning and disinfecting the unit's external surfaces	as required by in-house regulations	hospital staff
Checking output power levels	annually	Technical Service
Safety checks	annually	Technical Service, testing agency

Table 8.1 Recommended routine maintenance & inspection schedule

8.1.1 Cleaning and Disinfecting

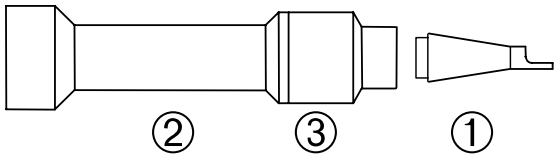
All external surfaces of the unit, including the front panel, may be cleaned with common non-alcoholic cleaning agents.

> **Warning!**
> **Be sure that no liquid will enter the system in places where the unit has openings (cooling slots; arm and scanner connectors).**
> **For this reason, never use a spray for cleaning purposes! Whenever possible, keep the unit closed (for example, cover it with a large towel.**

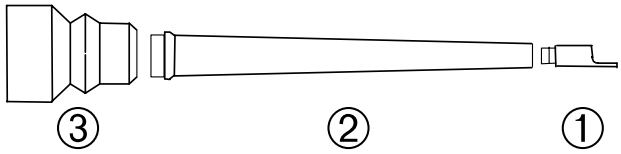
The outer surfaces of the unit and its non-sterilizable accessories may be disinfected using disinfectants commonly used in operating rooms.
Before using the system again after such cleaning, verify that no disinfectant residues are left on the unit.

8.1.2 Cleaning the Focusing Handpiece

76-100-05



76-100-10



76-100-15

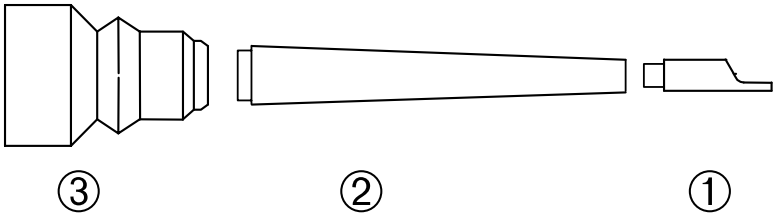


Fig. 8.1 Disassembled focusing handpieces
1 Tip 2 Tube 3 Optics

Cleaning	Component 1 – tip	Comp. 2 – tube	Comp. 3 – optics
Disinfecting solution	✓	✓	
Steam sterilization, 135 °C	✓	✓	
Gas sterilization	✓	✓	✓
Plasma sterilization	✓	✓	✓

Detach the focusing handpiece from the mirror arm, then disassemble the handpiece. The components 1 and 2 (Fig. 8.1) can be cleaned by immersion in a disinfecting solution and subsequent sterilization (options: steam sterilization at 135 °C; ethylene oxide gas sterilization; formaldehyde gas sterilization; plasma sterilization). Please note that the optical system of the focusing handpiece (3, Fig. 8.1) may neither be immersion-treated nor steam-sterilized (however, gas sterilization is permissible). As a general rule, this component needs cleaning only when its surface has become visibly dirty. For cleaning the lens, lint-free wiping paper (e.g. lens cleaning paper) in conjunction with acetone or pure alcohol must be used. Proceed as follows: Take hold of the lens holder; remove any dust or dirt from the lens surface using a blower, then put some cleaning solution onto the surface. Fold the wiping paper several times, then use the resulting “lip” or edge to remove the cleaning solution by wiping over the surface just once.

Note: Wipe only in one direction – not in a circle. If done correctly, this cleans the optical surface without leaving any drying marks or streaks. Subsequently, clean the other side of the lens in the same manner.

If the lens is very dirty, allow the solvent some time to take effect before wiping it off. In cases where too much dirt has accumulated on the glass or the lens is defective, the optics must be replaced.

Note that defective optics should not be discharged through the normal household garbage collection! For proper disposal of such components, call either Martin Medizin-Technik’s Technical Service or an authorized serviceman.

8.1.3 Cleaning the Focusing-Handpiece Backstops

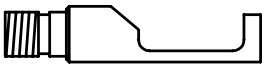
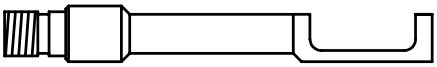
76-100-20  *76-100-25* 

Fig. 8.2 Backstops for 127-mm and 200-mm focusing handpieces

The backstops can be cleaned in a disinfecting solution and subsequently sterilized. Permitted sterilization processes include steam sterilization (at 135 °C), ethylene oxide gas sterilization, formaldehyde gas sterilization and plasma sterilization.

8.1.4 Cleaning the Angle-Unit Adapters for 200-mm Focusing Handpiece

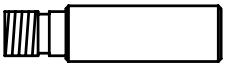
76-100-15 

Fig. 8.3 Adapter for angle unit for 200-mm focusing handpiece

The angle-unit adapter may be cleaned in a disinfecting solution and subsequently sterilized. Permitted sterilization processes include steam sterilization (at 135 °C), ethylene oxide gas sterilization, formaldehyde gas sterilization and plasma sterilization.

8.1.5 Cleaning the 90° and 120° Angle Units for 127-mm Focusing Handpiece

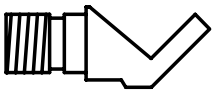
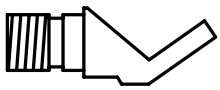
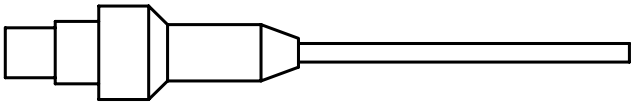
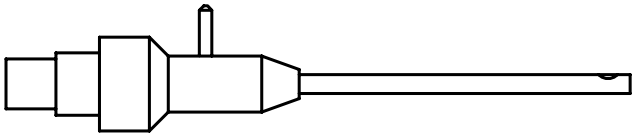
76-200-05  *76-200-10* 

Fig. 8.4 90° and 120° angle units for 127-mm focusing handpiece

The 90-degree and 120-degree angle units for the 127-mm focusing handpiece may be cleaned in a disinfecting solution and subsequently sterilized. Permitted sterilization processes include steam sterilization (at 135 °C), ethylene oxide gas sterilization, formaldehyde gas sterilization and plasma sterilization.

8.1.6 Cleaning the 0°, 90° and 120° ENT Set Attachments

76-600-02 

76-600-03 

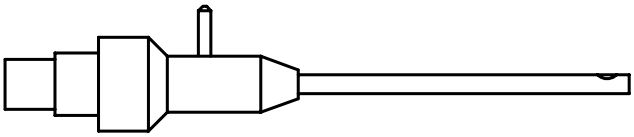
76-600-04 

Fig. 8.5 0°, 90° and 120° attachments for the ENT set

The 0-degree, 90-degree and 120-degree attachments may be cleaned in a disinfecting solution and subsequently sterilized. Permitted sterilization processes include steam sterilization (at 135 °C), ethylene oxide gas sterilization, formaldehyde gas sterilization and plasma sterilization.

The deflecting reflectors (deviating mirrors) must always be clean!

8.1.7 Cleaning the ENT Set Optics

76-600-01

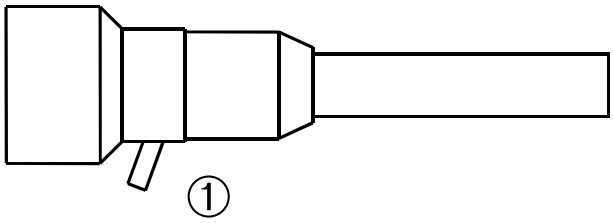


Fig. 8.6 *ENT set optics*

1 Optics

The optics of the ENT set (1, Fig. 8.6) may neither be immersion-treated nor steam-sterilized. Cleaning is required only if the surface is visibly dirty. Gas sterilization is permitted for this component. To clean the lens, use lint-free wiping paper (e.g. special lens cleaning paper) in connection with acetone or pure alcohol. Proceed as follows: Take hold of the lens holder; remove any dust or dirt from the lens surface using a blower, then put some cleaning solution onto the surface. Fold the wiping paper several times, then use the resulting “lip” or edge to remove the cleaning solution by wiping over the surface just once.

8.1.8 Cleaning the “Soft Scan“ Scanner

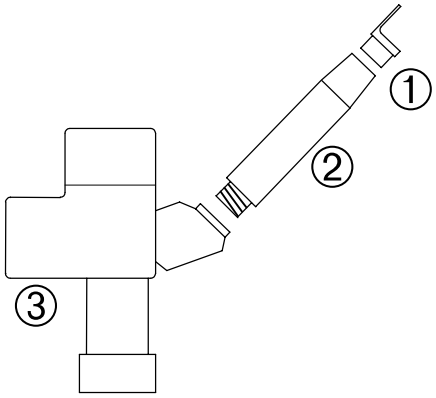


Fig. 8.7 *Soft Scan scanner, exploded view*

1 Tip 2 Handpiece 3 Scanner head

Disassemble the scanner. The components 1 and 2 (see Fig. 8.7) may be cleaned in a disinfecting solution and subsequently sterilized. Permitted sterilization processes include steam sterilization (at 135 °C), ethylene oxide gas sterilization, formaldehyde gas sterilization and plasma sterilization. However, never immerse or steam-sterilize the scanner optics (3, Fig. 8.7)! This component needs cleaning only if dirt has visibly accumulated on the surface. Gas sterilization is permitted for the optics.

To clean the lens, use lint-free wiping paper (e.g. special lens cleaning paper) in conjunction with acetone or pure alcohol. Proceed as follows: Take hold of the lens holder; remove any dust or dirt from the lens surface using a blower, then put some cleaning solution onto the surface. Fold the wiping paper several times, then use the resulting “lip” or edge to remove the cleaning solution by wiping over the surface just once.

8.1.9 Cleaning the “Mini Point” Micromanipulator

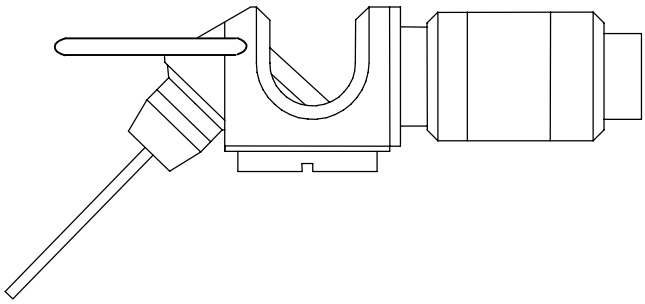


Fig. 8.8 “Mini Point“ micromanipulator

Wipe the micromanipulator clean with a clean, lint-free piece of cloth. A moistened cloth (saturated with a disinfectant) should only be used if really required (e.g. for removing stubborn dirt).

The micromanipulator may be gas-sterilized using ethylene oxide gas at a maximum temperature of 52 °C. However, the manufacturer of the product recommends using gamma-ray sterilization.

To clean the beam splitter, use lint-free wiping paper (e.g. special lens cleaning paper) in conjunction with pure methanol. Proceed as follows: Take hold of the lens holder; remove any dust or dirt from the lens surface using a blower, then put some cleaning solution onto the lens surface. Fold the wiping paper several times, then use the resulting “lip” or edge to remove the cleaning solution by wiping over the surface just once.

For further information on treating, servicing and cleaning the Reliant Technologies CO_2 laser micromanipulator, see the Operator Manual supplied with the product.

8.2 Maintenance Work to Be Performed by Martin Medizin-Technik's Technical Service

Whenever the unit has been repaired or modified by Martin Medizin-Technik's Technical Service, the following must be entered in the equipment log:

- nature and scope of the repair work done (with precise information, e.g. in the case of rating-related modifications)
- date of performance
- signature of the person carrying out the work

8.3 Safety Checks

Once a year a comprehensive safety check should be carried out in order to verify that the unit duly conforms to safety regulations. The results of such checks must be recorded in the equipment log.

Frequency and scope of the safety check

Frequency:	annually
Type of equipment:	CO_2 laser unit
Class of equipment:	IIb
Serial number of laser system:	**.....**
Operating hours:	**.....**
User/owner:	**.....**
Location:	**.....**

1 Visual inspection

[ ] 1.1 Lettering (laser class, max. power, wavelength, etc.)
[ ] 1.2 Information/warning signs: properly attached; complete?
[ ] 1.3 Operating Instructions / equipment log available?
[ ] 1.4 Equipment complete?
[ ] 1.5 Outer surfaces OK
[ ] 1.6 Connecting cable / strain relief OK

2 Functional check

[ ] 2.1 Checking the sealed keypad (foil) for potential defects
[ ] 2.2 Beam guiding system / coupling in/out / pilot laser
[ ] 2.3 Keylock switch
[ ] 2.4 Optical accessories

3 Checking the required monitoring/safety and signaling devices for proper functioning

[ ] 3.1 Shutter prevents laser radiation emission at output during internal power level check (safety shutter)
[ ] 3.2 Antilaser goggles
[ ] 3.3 Warning signals during laser activation (acoustic/optical)
[ ] 3.4 Power meter (internal-external comparison)
[ ] 3.5 Interlocking device (check for proper functioning)
[ ] 3.6 Emergency stop switch (check for proper functioning)

4 Electrical safety (DIN EN 60601-1)

[ ] 4.1 Protective conductor resistance: < 0.3 Ω

[ ] 4.2 Ground leakage current: < 0.5 mA

5 Measuring safety-related output parameters

[ ] 5.1 Checking output power at 2, 5, 10, 15, 20, 25, 30, 40 and 50 W, using an external power meter with a measuring accuracy greater than ± 10%. Permissible tolerance: ± 20%.

Note!
If safety-related defects are found during this safety check, be sure to repair the unit before it is used again.

Measures taken:

[ ] Technical Service contacted on: **.....**

[ ] Unit withdrawn from service on: **.....**

[ ] Results entered in equipment log on: **.....**

Person performing checks/tests: **.....**

Date: **.....**

Signature: **.....**

9 Troubleshooting

9.1 Error Indication

The unit incorporates an automatic self-testing routine which permanently monitors the system, thus ensuring the safety of the patient as well as the staff and the unit itself. As soon as an unusual/non-conforming operating condition is detected, this is indicated to the user by error messages appearing on the LCD. At the same time, the system automatically lapses into “standby“ mode. The error messages remain displayed until you press the “standby“ button for confirmation. This causes the system to check the entire system for potential faults. If no malfunction is found, normal operation can be resumed.

9.2 Error messages and Measures to be Taken

9.2.1 Interlock Error

There are two possible causes for this:

1. The external interlock function senses a circuit interruption. Check the door switch (if used) or install the shorting cap on the external interlock connector.
2. The articulated arm is not connected or incorrectly installed. Check mounting condition.

9.2.2 Power Error

Whenever the “ready” button is pressed or a parameter is changed, the system automatically performs an output power check. If the power value measured exceeds the permissible tolerance range (± 20%), an error message is displayed. If several error messages are displayed, wait for approx. 10 seconds, then press the ”ready” button once again to have the power check repeated. If this does not help, change some parameters and work with this new setup. If the error message reoccurs or is displayed permanently, call the Technical Service.

9.2.3 Current Error

During laser activation (i.e. laser light emission), the system monitors the current supplied to the laser tube. The input power must be proportional to the output power. If a predetermined limit value is exceeded, the laser is stopped automatically. To resume operation, restart the laser. If the fault occurs permanently, call the Technical Service.

9.2.4 Shutter Error

The shutter position is constantly monitored for safety reasons. Even minimal deviations lead to error messages, with the consequence that the system is switched to standby mode and the laser beam is cut off. This error message also appears if the closed position is not reached within the set time limit when the shutter position is switched from “open” to “closed” (by releasing the footswitch). If the fault cannot be cleared or occurs permanently, call the Technical Service.

9.2.5 Water Flow Error

The cooling water flow is constantly monitored by the system. In case of trouble or irregularities, an error message is displayed. Call the Technical Service.

9.2.6 Temperature Error

The cooling water temperature is constantly monitored by the system. If the temperature exceeds the set limit, an error message is displayed. In this case, the unit should be switched off to allow it to cool down. As soon as the temperature has returned to normal, the system can be used again after the “standby ⏻” button has been pressed for confirmation.

9.2.7 Power Supply Error

The system monitors the internal power supply conditions. If this error message is displayed, the system has been automatically disconnected for safety reasons. Call the Technical Service.

9.2.8 Laser Power Supply Error

The high-voltage power supply to the laser is constantly monitored by the system. If this error message is displayed, the power supply is interrupted. Call the Technical Service.

9.2.9 Scanner Disconnected Error

If a scanner is connected, the system monitors the power supplied to the scanner. If this error message is displayed, the power supply is interrupted and the scanner therefore not operable. Call the Technical Service.

9.2.10 No Scanner Error

This error occurs when the scanner cable is not (or incompletely) connected and you try to switch the laser to scanner mode with one of the memory buttons (M1...M5). If you want to use the scanner, switch off the unit and connect the scanner, then restart the laser. The error message should now no longer be present. If it still occurs, call the Technical Service.

9.2.11 RS485 Error

The communication taking place on the electronic system level is monitored by the controller of the internal micro-computer. This error message signals a fault in the computer’s electronic system. Call the Technical Service.

9.2.12 Footswitch Error

Check the footswitch for proper functioning (pedal must move up when releasing the footswitch).

9.2.13 Time Error

Internal fault. Call the Technical Service.

9.2.14 Power Meter Error

Internal fault. Call the Technical Service.

9.2.15 Off Error

Internal fault. Call the Technical Service.

9.2.16 RAM Error

Internal fault. Call the Technical Service.

9.2.17 EE-Read Error

Internal fault. Call the Technical Service.

9.2.18 EE-Write Error

Internal fault. Call the Technical Service.

9.2.19 AD Conversion Error

Internal fault. Call the Technical Service.

9.2.20 Power Meter Error

Internal fault. Call the Technical Service.

9.3 Error Symptoms Without LCD Messages

The following table contains faults (and their potential causes) for which no error messages are available.

If the recommended measures are no help, contact Martin Medizin-Technik's Technical Service.

Symptom	Potential Cause	Remedies
No reaction after keylock switch has been turned on	1) No power supply	Check cable for proper connection
	2) Emergency stop button pressed	Pull out (release) emergency pushbutton
No laser energy emitted when operating the footswitch	1) Foot switch not connected	Connect foot switch
	2) System in "standby" mode	Switch system to "ready" by pressing corresponding button
Pilot laser light not visible	1) Pilot laser brightness level too low	Select higher brightness level
	2) Optical system not properly adjusted	Call Technical Service
Pilot laser beam and CO_2 beam not coaxial	1) Optical system maladjusted	Call Technical Service
No airflow at the tip of the handpiece when laser is in "ready" state	1) Tube ends not connected	Check tube
	2) Air tube kinked or untight	Check tube
	3) Compressor malfunction	Call Technical Service
LCD information not recognizable	1) Wrong contrast setting	Adjust contrast
	2) Power supply or backlight malfunction	Call Technical Service

Table 9.3: Malfunction and errors not indicated by the system

Warning!

High voltage – never open the casing!

Removing the cover could lead to an uncontrolled release of laser radiation. Therefore, improper handling of the unit may endanger the persons present!

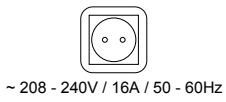
Non-observance of these Operating Instructions voids the warranty given by the manufacturer!

10 Summary Operating Instructions

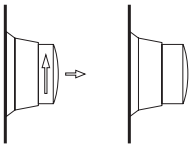
10.1 Preparatory Measures/Checks

Read Operating Instructions

Connect laser system to the mains

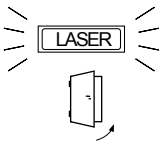


Pull/deactivate “emergency stop” pushbutton



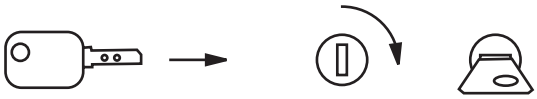
Put on antilaser goggles

Close doors and activate alarm system/lamp



10.2 Switching on the Unit

Insert key and rotate clockwise by 90°



Laser performs self-test; sets standard parameters

Laser in standby  mode

10.3 Selecting Parameters

Select the desired operating mode,

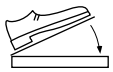
set/adjust parameters

and store or call up specific settings

10.4 Performing the Therapy

Press the ”ready” button (S3),

then operate the footswitch

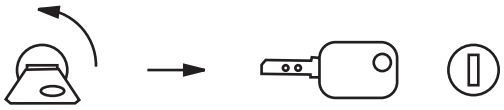


and apply the laser radiation

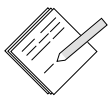
10.5 Switching off the Unit

Turn keylock switch counterclockwise by 90°,

then withdraw key and store it in a safe place



Keep record/equipment log



11 Technical Specifications

Type of laser:	Continuous-wave (CW) CO_2 laser
Laser wavelength:	λ = 10600 nm (infrared)
Laser output power	2 - 50 W ± 20% *
Laser class:	IV
Class of equipment:	IIb acc. to MDD (Medical Device Directive)
Class of protection:	I
Type of protection:	IP X1

Operating modes:

1)	Continuous (CW)	2-50 W *
2)	Pulsed operation:	
	▪ single pulse	8 ms - 10 s; output power 10 - 50 W
	▪ pulse train	Frequencies selectable between 0.1 and 200 Hz; minimum pulse duration: 8 ms; average output power: < 0.1 – 50 W
	▪ super pulse	Factor 10; 0.3 ms; 0.1 - 300 Hz
3)	Cyclical (pulse train, repeated)	Cycle duration: - permanent - 10 ms to 10s

Mode structure	TEM_{00}
Laser beam divergence	2.5 ± 0.5 mrad (without application handpiece)
Laser tube	sealed off, DC-excited
Minimum tube life	2,000 h (maximum 24 months)
Peak output power	up to 10 times higher (super pulse factor)
Pilot laser	635 nm, laser class 3B diode laser
Pilot laser power	2 mW, adjustable in 5 steps
Laser light transmission	Articulated spring arm with 7 joints/mirrors, arm length 1,300 mm, handpiece exchangeable
Scope of delivery	Articulated spring arm with 7 mirrors, footswitch and standard applicator

Standard applicator	Focusing handpiece, f = 127 mm
Alternative applicator	Scanner, different handpieces
Focus size	0.1 mm at a focal distance of 50 mm 0.2 mm at the standard focal distance of 127 mm 0.32 mm at a focal distance of 200 mm
Cooling	closed water circuit
Heat exchange	by air
Ambient temperature	10 - 45 °C
Rel. humidity of air	10% – 95%
Operator panel	Bluemode LCD (liquid crystal display) with illuminated symbol buttons; sealed (membrane-covered) operator panel with integrated scanner functions
Program memory	5 freely assignable storage positions for customized settings; can also be used for scanner
Power requirements	230 V AC
Nominal frequency	50 / 60 Hz
Power input/consumption	max. 1100 W
Dimensions (H x W x D)	1430 x 290 x 430 mm (articulated arm folded down) 2200 x 290 x 430 mm (articulated arm upright/in working position)
Weight	65 kg
Safety check:	annually
CE 0297	conform with 93/42/EEC

* in the lower range (up to 11 W) pulsed

12 Test Certificates

CE 0297 This symbol indicates that the unit meets the essential requirements set by the EC Directive 93/42/EEC relating to medical devices. The symbol is located on the rear side of the unit.

martin
Medizin-Technik

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