



Model: MIRAN 30W-S
Ultrapulse
CO₂ Surgical Laser System
Operating Instructions Manual

PLEASE READ THIS OPERATION INSTRUCTION
MANUAL CAREFULLY BEFORE USE AND KEEP
IT FOR REFERENCES

Mediclase

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**Operating Safety Precautions and
Compliance with International Standards**

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CHAPTER 1

Operating Safety Precaution and Compliance with International Standards

1.1. General

The Ultrapulse CO Surgical laser System Model: Miran 30W-S is specially designed to minimize accidental exposure to hazardous radiation

CAUTIONS

1. Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Therefore, personnel operating this system must be thoroughly familiar with all its safety requirements and operating procedures.

2. Improper use or adjustment of this system may invalidate the MedicLase service warranty agreement. Please contact your MedicLase representative before attempting to use this system in any manner other than as specified in this manual.

1.2. Burn Hazard

The areas of concern for safe CO₂ laser operation are discussed in this chapter.

1.3. Reflection and Direct Eye Exposure Hazard

CO₂ laser radiation is invisible to the human eye and can cause third-degree burns, even when unfocused.

The system output beam contains visible and invisible laser radiation that is hazardous to the eye.

Never stare into the CO₂ laser beam or allow it to be reflected from any reflective surface—even rough metal can reflect the CO₂ laser beam. As a precaution against accident exposure to the output beam or to its reflections, all personnel must use safety eyewear.

1.4. Safety Eyewear

Never stare directly into the aiming beam. Also ensure that the aiming beam is not directed at anyone's eyes. Although this beam is low powered, direct exposure can be hazardous to eyes.

ALL Personnel in the vicinity of the laser unit must use safety eyewear, and must ascertain that eyewear provide adequate protection from the 10.6 micron wavelength radiation. This is generally provided by most quality safety glass spectacles with side guards for protection from lateral exposure.

1.5. Patient Safety

Safety eyewear is not required when viewing through a microscope, colposcope or endoscope, as the glass lenses of these instruments provide sufficient protection.

For enhanced patient safety, perform the following safety procedures:

1. Surround the surgical area with wet towels.
2. Make sure that safety eyewear is available to the patient, if conscious.
3. For facial surgery, completely cover the patients eyes with moistened eye pads.

1.6. Explosion and Fire Hazard

Do not operate the unit in the presence of flammable aesthetics or volatile substances such as alcohol, gasoline or solvents. Flammable drapes, surgical gowns, gauze and other ignitable materials must be kept out of the beam path.

The use of non-flammable materials and instruments is advised. Flame retardant surgical drapes, gowns, etc., are recommended. A readily accessible fire extinguisher in the vicinity of the unit is also recommended.

1.7. High Voltage Hazard

The MEDICLASE 30W-S laser unit generates high voltages within the main cabinet. To avoid injury, do not operate the unit before ensuring that all its panels are properly closed. Do not attempt to remove or disassemble any panels. Only MedicLase authorized technical personnel may service the unit.

1.8. Using the Proper Power Receptacle and Plug

Use only the power receptacle and plug specified for your unit.

Use only a power receptacle and plug that are in good condition.

Use only a hospital grade plug and a correctly matched power receptacle.

1.9. Grounding the Unit

To remove the power cord from the receptacle, hold it by the plug.

Never pull on the power cord to remove the plug from the receptacle.

The unit is grounded through the grounding conductor in the power cord. Good grounding is essential for safe operation. To ensure grounding reliability, always plug the power cord into a properly wired hospital grade power receptacle.

1.10. Fuse Replacement

The user may replace only the two line fused that are located near the power cord connection.

Open the fuse holder with a screwdriver and remove the original fuse. Before replacement, check and ensure the new fuse is identical in type and specifications to the original one (type 616, 250V, 3.15A) to avoid damage arising from unfit fuses.

WARNING

Before removing a fuse, turn off the key-switch, remove the power cord from the ac outlet, and wait two minutes to allow high voltage discharge.

1.11. Safety Guidelines

The following information is provided for the correct utilization of CO₂ surgical laser system. The information includes not only the accident protection regulations the products comply with, but also the effective precautions regarding proper use of the products.

The safety regulations that ML series CO₂ Surgical laser system comply with the following 3 categories:

1. Electric safety regulation
2. Laser radiation safety regulation
3. Electromagnetic radiation safety regulation

These safety regulations comply with the following standards set by IEC:

IEC60601-1 1998+A1:1991+A2:1995

Medical Electric Equipment Part1: General Requirements for safety

IEC 60601-1-2:2000

Medical Electric Equipment General Requirement for Safety

Collateral Standard: Electromagnetic Compatibility Requirement and Test

IEC 60602-2-22:1995

Medical Electric Equipment Part2, Specific Safety Requirement on Diagnosing and Treatment Laser Equipment

IEC 60825-1:2001

Radiation Safety for Laser Products, Equipment Classification Requirement and Users Guidance.

IEC 14971:2000/Amd.1:2003(E)

Risk Analysis

The MEDICLASE 30W-S laser unit is also designed to comply with U.S. Federal Performance Standards 21 CFR 1040.10 and CFR 1040.11 for Class IV laser products.

In compliance with these standards, the MEDICLASE 3CW-S laser unit incorporates an emission indicator, a CO₂ laser beam shutter, a power display, a remote interlock system, a master key switch and proper labelling.

Although ML series CO₂ laser surgical systems are designed according to accident prevention regulations, only a proper and careful use can guarantee safety. For effective precautions, please refer to chapter in operators manual.

1.12. Warning, Identification and Certification Labels



①



②



③



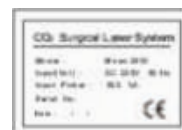
④



⑤



⑥



⑦

1.13. Label Explanation

NO.	Symbol	Definition
label 1		Notice! Please see accompanying documents
label 2		Type B applied part
label 3		Protectively earth
label 4		Dangerous voltage
label 5		Warning and explanatory label
label 6		Caution
label 7		Warning label-hazard symbol
label 8		Manufacture & Product Information
label 9		Laser aperture
label 10		Fuse
label 11	REMOTE CONTROL	Remote control plug
label 12	FOOT SWITCH	Footswitch plug
label 13		Interlock connector
label 14		Emergency stop
label 15		Keyswitch

CHAPTER 2

Unpacking and Installation

2.1. Unpacking and Inspection

The MEDICLASE 30W-S CO₂ Surgical Laser System has passed full quality assurance testing before shipment. Thus, the unit should be operational upon delivery.

The unit should be unpacked, installed and tested by an authorized MedicLase representative, or must be thoroughly familiar with all its safety requirements and operating procedures.

After unpacking, please check to ensure that the unit is not seriously damaged, circuit lines are well connected and accessories are available.

Note

Any damage to the container or to the unit found prior to opening the container or during unpacking, installation or testing of the unit should be immediately reported to MedicLase distributor.

2.2. Equipment List

The CO₂ laser system includes the following:

1. MEDICLASE 30W-S laser unit
2. Articulated arm
3. Footswitch
4. Power cable
5. Master keys
6. Spare fuses
7. Remote control inter-lock connector
8. Nozzle screw cap

2.3. Pouring coolant

Normal Status:



- ① Water pump / laser tube water outlet nozzle
- ③ Water outflow nozzle

- ② Water filling nozzle
- ④ Water tank outlet nozzle

Procedures of filling water:



1. This hose should be at least 1 meter long and should fit tightly on to upper right water connection.
2. Raise free end as high as possible, insert a funnel and pour distilled water in slowly.
3. Stop filling when water spurts from connection #3 pinhole.
4. Remove hose when finished and leave connector open as is.



Nozzle screw cap
Do not remove this cap

Never turn on power when the tank is empty.

2.4. Line Power Considerations

The unit is delivered factory-set for the proper ac line voltage rating of the country to which it is shipped. The ac line voltage and maximal working current ratings appear on the identification label affixed to the rear panel.

The unit is equipped with a power cord-one end for connection at the rear panel of the unit, the other end with a 3-pin plug for connection to a grounded, hospital grade, single-phase AC receptacle, suited to the labelled power rating.

2.5. Remote Interlock System Connection

The MEDICLASE 30W-S laser unit has a remote interlock connection point (REMOTE S.W.) at the rear of the unit , to which a normal open external switch can be connected to create a remote interlock system. This external switch can be mounted (e.g., on an operating theatre entrance door) in such a manner that if the external switch contacts open, the laser beam extinguishes, the unit is placed in STANDBY state, and the **INTERLOCK ALARM** message appears on the message display. In order to resume operation the external switch contacts must be closed.

2.6. Footswitch Connection

To connect the foot-switch to unit, position it on the floor and plug its cable into the FOOTSWITCH connection point on the rear of the unit.

2.7. Checking Power Voltage

Ensure that the power voltage complies with the requirement of the unit.

2.8. Power Cable Connection

Plug the two terminals of the power cable into the power input socket and the power socket. (Make sure the ground socket is in working order).

2.9. Installation and Alignment

Insert the key into the hole of the lock on the panel and rotate clockwise to 90degree, then the power supply is turned on, and the water pump and cooling fan are started up.

2.10. Articulated arm Installation

CO₂ laser beam delivery arm consists of an alignment tube articulated arm, focusing tip, focus-setting tube, divergent physiotherapy head and a connector base. The connector base is fixed on the output terminal of the laser unit.

Usually the only thing required to do is to install the articulated arm on the connector base and lock it tightly.

CHAPTER 3

System Description

3.1. General Laser Theory

LASER is an acronym for **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation. The laser is a device consisting of an active medium enclosed in an optical cavity, and a pumping source. The pumping source pumps the active medium from its ground energy state to its excited energy states. If population inversion between two excited states takes place (where the higher energy state is more populated), stimulated emission of radiation (photons) can occur. This radiation is bounced back and forth in the optical cavity, and is amplified. This amplified electromagnetic radiation is emitted as a laser beam.

The properties of the beam are:

- 1. High degree of collimation** - unidirectional beam with a very small divergence.
- 2. Monochromaticity** - the radiation is within an extremely narrow wavelength range on the spectrum.
- 3. Coherence** - all photons are in phase, both in space and time.

The active medium of a laser can be either gas, liquid or solid. Most gas lasers consist of atoms, small molecules, or mixtures of both. Solid state lasers consist of atoms or ions doped in some solid matrix. Liquid lasers consist of higher molecular weight molecules dissolved in liquids.

Under specific pumping conditions, all these materials can undergo the unnatural phenomenon of population inversion, which results in stimulated emission of radiation at wavelength characteristic of the active medium.

The beam's transversal power distribution or mode structure determines its quality. For medical applications, the best choice is the TEM₀₀ mode, wherein the beam has Gaussian (bell-like) transversal power distribution, ensuring a minimal spot size, and thus, maximal power density on tissue.

3.2. CO₂ Laser Theory

The MEDICLASE 30W-S laser unit incorporates a sealed-off unit's articulated arm. CO₂ laser tube. The active medium used is a proprietary gas mixture. The gas mixture is enclosed within a glass laser tube equipped with electrodes. The laser tube is positioned between the two mirrors of the optical cavity. The rear mirror is totally reflective, whereas the front mirror is partially reflective and transmits the CO₂ laser beam into the unit's articulated arm.

3.3. General System Description

The DC Power supply (pumping source) provides voltage to the electrodes which produce an electrical discharge along the tube. The discharged electrons collide with the CO₂ molecules in

the gas mixture and excite them to vibrationally excited level (an asymmetric stretching mode). The stimulated emission takes place between this level and a lower vibrationally excited level (a symmetric stretching mode), resulting in laser emission in the far- infrared range at a wavelength of 10.6 microns.

3.4. Main Cabinet

3.4.1. General

The MEDICLASE 30W-S laser unit is an advanced microprocessor - controlled, user friendly CO₂ laser system based on a sealed-off CO₂ laser tube providing up to 30watts on tissue. The system incorporates the CO₂ laser tube within the main cabinet, an articulated arm beam delivery system and attachable laser accessories. The unit is activated for laser emission by a footswitch.

The main cabinet includes the following:

1. CO₂ laser tube
2. Optical bench assembly
3. Power supply
4. Laser cooling system
5. Control panel

3.4.2. CO₂ Laser Tube

Please refer to 3.2.CO₂ laser theory.

3.4.3. Optical Bench Assembly

The optical bench assembly is positioned vertically in the main cabinet.

The aiming beam is diode laser beam (3mW 650nm)

The beam combiner combines the CO₂ laser beam and the diode aiming beam coaxially, and guides them into the articulated arm beam delivery system.

3.4.4. Power Supply

The MEDICLASE 30W-S laser unit is equipped with a switching-mode power supply which converts the input line voltage to the high voltage required for laser operation.

The inherent advantages of the switching-mode power supply over the conventional power supply are its small physical dimensions, high energy conversion efficiency and increased safety from high voltage hazards, wherein the high voltage components are activated only during laser emission.

3.4.5. Laser Cooling System

The laser tube cooling system is circulated water.

The coolant is circulated by the pump.

3.4.6. Control Panel

The microprocessor-based soft-touch control panel is used to control all operating functions. It includes a built-in status display, which provides direct on-line monitoring of all functions for safe system operation.

Messages on the LCD display guide the user through each phase of operation, making the MEDICLASE 30W-S system exceptionally simply and safe to operate.

3.5. Articulated Arm Beam Delivery System

The beam delivery system is a lightweight, spring-balanced 7-joint articulated arm. It includes two arm and a 3-kunckle end joint to which the laser surgical accessories are attached. MEDICLASE 30W-S laser unit articulated arm beam delivery system provides excellent manoeuvrability, adequate working distance and full wrist motion. The working radius at full articulated arm extension is 110cm from the main bearing.



- 1. Main Cabinet
- 2. LCD Screen
- 3. Polt beam Intensity Adjustor
- 4. Emergency Stop Switch

- 5. Articulated Arm
- 6. Master Key
- 7. Footswitch Connect Plug
- 8. Remote Control
- 9. Power Input Plug

3.6. System Modes of Operation

The MEDICLASE 30W-S laser unit modes of operation are based on two distinct types of settings: the laser operation mode and the tissue exposure mode settings. The laser operation modes control the power pattern and the peak power outputs, while the tissue exposure modes control the duration pattern of the laser beam delivered to tissue.

The system offers three laser operation modes and three tissue exposure modes as follows:

<i>Laser Operation Modes:</i>	<i>Tissue Exposure Modes:</i>
1. CW (Continuous Wave)	1. Continuous
2. Pulse	2. Single Pulse
3. Ultrapulse	3. Repeat Pulse

3.6.1. Laser Operation Modes

The laser operation modes are CONTINUOUS WAVE (CW), PULSE and ULTRAPULSE.

Each laser operation mode is available in the three tissue exposure modes, thus yielding the following nine system modes of operation, for a wide range of clinical applications:

1. CW- Continuous
2. CW- Single Pulse
3. CW- Repeat Pulse
4. Pulse- Continuous
5. Pulse- Single Pulse
6. Pulse- Repeat Pulse
7. Ultrapulse- Continuous
8. Ultrapulse- Single Pulse
9. Ultrapulse- Repeat Pulse

In the CW laser operation mode is activated by default - i.e., when neither the ULTRAPULSE nor PULSE laser operation modes are selected. In this mode, a Continuous Wave laser beam is emitted in the power range of 0.5-30W.

In the Pulse laser operation mode, the laser emits high-frequency pulse in a constant preset pulse frequency. The average power requested and delivered to tissue is controlled by the microprocessor by varying the ON time (the duty cycle).

In the ULTRAPULSE laser operation mode, the laser beam is emitted in a train of very narrow high-peak-power pulse. The peak power is 500 W. The Ultrapulse frequency and the ON time are adjusted by the microprocessor to obtain the desired average power by maintaining either the ON time or the frequency constant, and varying the other.

Tissue incision capability is generally enhanced with higher peak power of the laser beam. Thermal damage to surrounding tissue is usually reduced with shorter laser activation durations, whereby the adjacent healthy tissue has more time to cool between pulses.

The ULTRAPULSE and PULSE laser operation modes enable these tissue effects to be achieved through their constant high peak power level and variation of the duty cycle for control of average power.

3.6.2. Tissue Exposure Modes

The tissue exposure modes control the duration pattern of the laser beam delivered to tissue. The three tissue exposure modes are CONTINUOUS, SINGLE PULSE and REPEAT PULSE.

In the CONTINUOUS tissue exposure mode, the laser beam is emitted for as long as the footswitch is pressed.

In the SINGLE PULSE tissue exposure mode, the laser beam is emitted as a single pulse (for the CW laser operation mode) or as a single burst (for the ULTRAPULSE and PULSE laser operation modes), for a preset duration (ON time), or until the footswitch is released. The ON time range is 10-1000ms for all laser operation modes.

In the REPEAT PULSE tissue exposure mode, the laser beam is delivered intermittently as a series of bursts for a preset duration, determined by the ON time and OFF time values, for as long as the footswitch is pressed. The selected ON time (emission duration) determines the duration of each burst, while the selected OFF time determines the interval between bursts. The ON time ranges are the same as in the SINGLEPULSE mode, the OFF time range is 10-1000ms for all laser operation modes.

3.7. Technical Specifications

Laser type	Sealed-off CO ₂ laser tube
Wavelength	10.6 micron
Mode structure	TEM ₀₀
Power to tissue	0.5 -30 W
Ultra pulse peak power	500W
Ultra pulse frequency	1 - 250 Hz automatic with power setting
Ultra pulse duration (on-time)	100 - 500 μ s
Laser operation modes	CW, Pulse, Ultra pulse
Tissue exposure modes	Continuous, Single Pulse, Repeat Pulse
Aiming beam	3mW (650nm diode) adjustable

Articulated arm	7-joint spring-balanced articulated arm
Working radius	130cm
Cooling type	Closed loop liquid
Power input requirements	110VAC/60Hz or 220VAC/50Hz +/- 10%
Dimension (Wide)	34cm
(Depth)	46cm
(Height)	96cm
Weight	35Kg

CHAPTER 4

Operating Instructions

4.1. General

This Chapter contains detailed operating instructions for the laser unit. For easy reference, a checklist-type summary of procedures for the entire operation is also included.

4.2. Operating the Unit

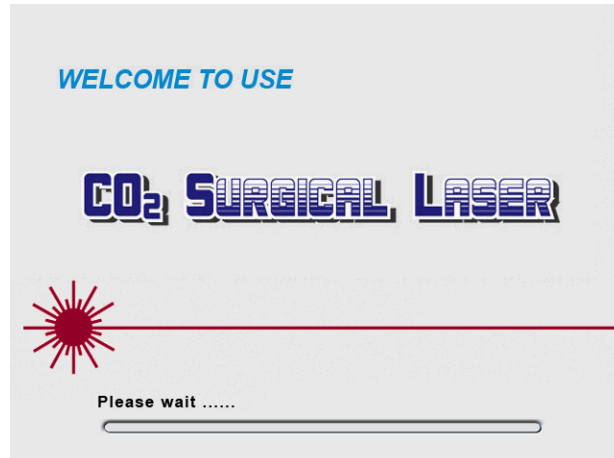
4.2.1. Control keys for Operation

Turn on the key switch.

Initialization interface will appear on the display after wait for 4 seconds.

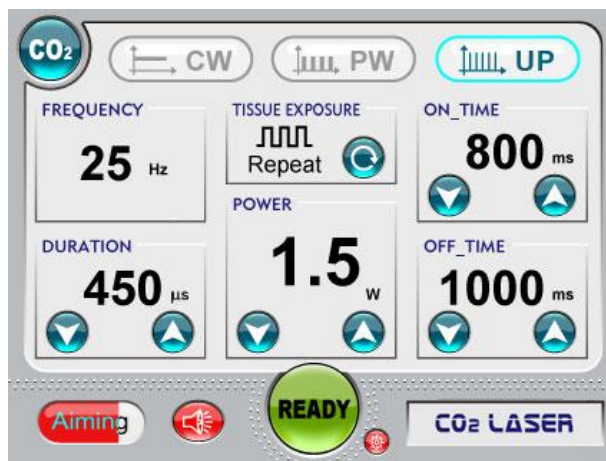
The unit start self-test (including coolant flux, temperature, and the status of footswitch, remote interlock connector, etc.)

When the self-test is satisfactorily completed, the unit enters into the Standby State; or the unit enters into an error interface.



4.2.2. Laser Operation Mode Selection

When the unit is placed to **STANDBY** state, the mode can be selected (Laser Operation Mode and Tissue Exposure Mode).



The three keys on the top indicate three kinds of laser Exposure modes which are CW (Continuous Wave)/ PW (Pulse) / UP (Ultra Pulse).The Laser operation mode is selected whenever the message **CW** (Continuous Wave), **PULSE** or **ULTRAPULSE** is highlighted.

4.2.3. Tissue Exposure Mode Selection

The tissue exposure mode is to be selected whenever the message **CONTINUOUS**, **SINGLE** or **REPEAT** will appear on the display. The user may subsequently change tissue exposure modes as required by simply pressing the **TISSUE EXPOSURE** button.

4.2.4. CO2 Laser Parameters Setting

A. POWER SETTING:

The power displayed is the average power delivered on tissue. The user should set the desired power level when the POWER is activated.

When the Laser Operation Mode is set as **CW**, and the Tissue Exposure Mode is set as **CONTINUOUS**, **SINGLE**, **REPEAT**, the power setting range is 0.5-30W.

(“DURATION” and “FREQUENCY” are not adjustable)

When the Laser Operation Mode is set as **PULSE**, and the Tissue Exposure Mode is set as **CONTINUOUS**, **SINGLE**, **REPEAT**, the average power setting rang is 0.5-20 W.

(“DURATION” and “FREQUENCY” are not adjustable)

When the Laser Operation Mode is set as **ULTRAPULSE**, and the Tissue Exposure Mode is set as **CONTINUOUS**, **SINGLE**, **REPEAT**, the average power setting rang is 0.5-10 W.

(“DURATION” is adjustable from 100 to 500ms, and the “FREQUENCY” varies automatically)

Increment / Decrement:

<i>Power Range (W)</i>	<i>Power Setting Increment (W)</i>
0.5-5W	0.5W
Above 5W	1W

<i>Duration (μs)</i>	<i>Power Setting Increment (μs)</i>
100-500	100

B. TIME SELECTION:

In **SINGLE PULSE** tissue exposure modes, the user can set the desired ON times (from 10-1000ms) through press the cursor UP / DOWN

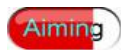
In **REPEAT PULSE** tissue exposure modes, the user can set the desired ON (from 10-1000ms) and OFF times (from 10-1000ms) through press the cursor UP / DOWN.

Increment / Decrement:

<i>ON time (ms)</i>	<i>Power Setting Increment (ms)</i>
10-100	10
100-200	20
200-500	50
500-1000	100

<i>OFF time (ms)</i>	<i>Power Setting Increment (ms)</i>
50-100	10
100-200	20
200-500	50
500-1500	100

4.2.5. The others functions**A. Aiming Beam**



There're five levels available, including off.

B. Warning sound

Sound on Status  ; Sound off Status 

C. Laser emission indicator

The laser emission indicator turns on once pressing the foot switch  .

4.3. System failure warning

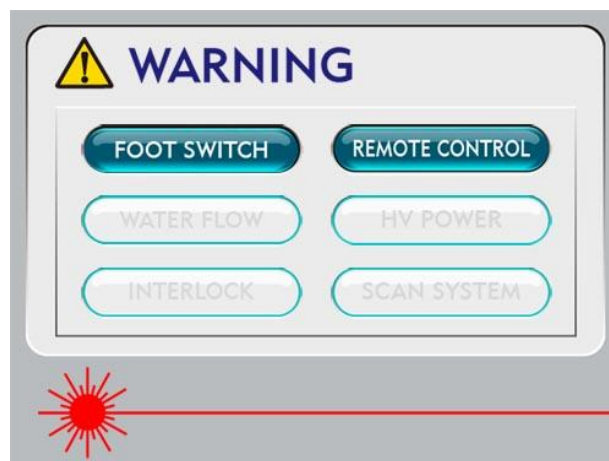


NOTE

The blue highlight indicates the certain failure in the system.

The system will return back to the previous operation interface after elimination of the malfunction.

If the warning note displays and the malfunction is not eliminated with 20 seconds, the system will start self-protection function, and the system needs to be restarted.



CHAPTER 5

Maintenance

5.1. Introduction

This chapter contains the laser unit routine inspection and maintenance instructions. Only those procedures designated herein may be carried out by clinic/hospital staff. All other procedures must be performed only by Laser technical personnel.



Any unauthorized service or modification of this unit can cause serious injury and may invalidate the ML025-CB Service Warranty Agreement.

All the maintenances and services of product must be performed by the qualified service people authorized.

5.2. Service Information

The laser unit generates high voltages within the main cabinet. Therefore, the interior of the unit should be checked by Laser technical personnel only.

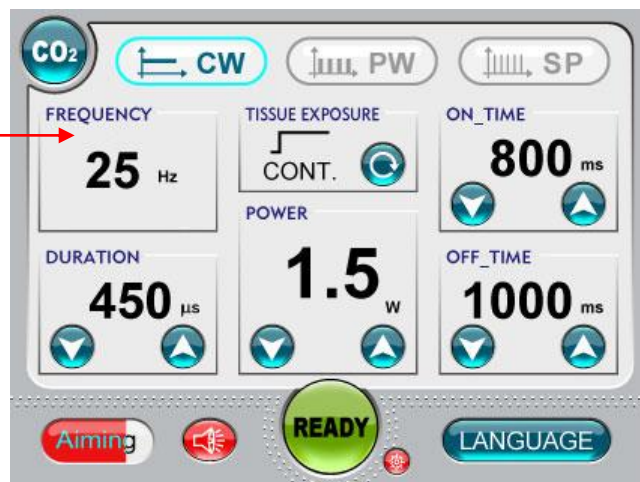
All correspondence with your laser representative, regarding the unit, should include the model and serial numbers appearing on the identification label.

5.3. Calibration :

The calibration of the unit power output should be checked every six months with standard CO₂ laser power meter.

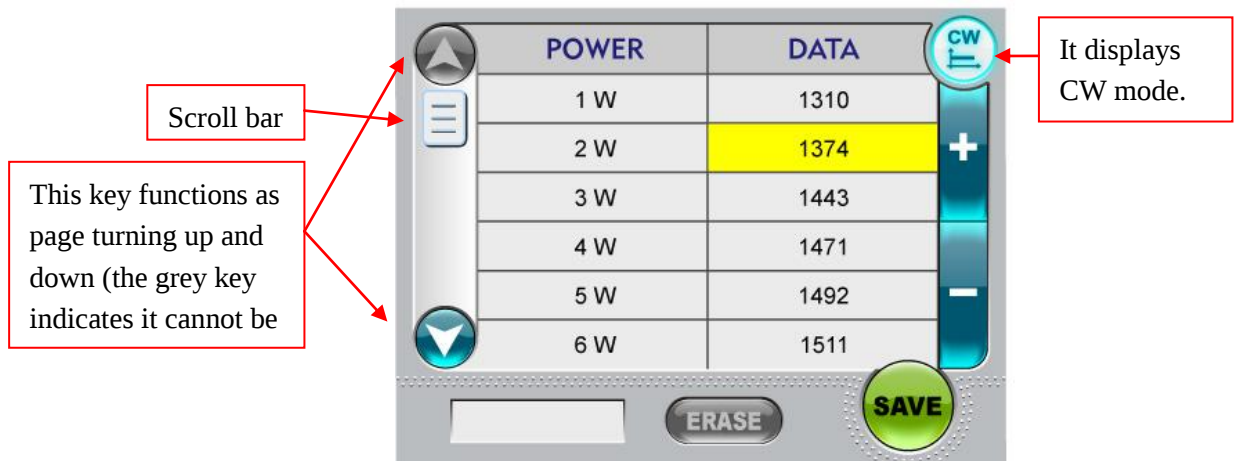
The calibration must be performed and make ensure the CO₂ laser power delivered to the tissue is within 20% of the displayed power value.

In the CO₂ Operation Interface, select CW mode, and make sure the aiming beam is on. Then keep pressing the FREQUENCY box for 5 seconds to enter into CALIBRATION



5.3.1. Calibration method

Insert the handpiece (disconnect the focus lens) into the power meter to measure the output power. The yellow highlight indicates the chosen data, which can be adjusted by pressing '+' or '-' to achieve the correct power



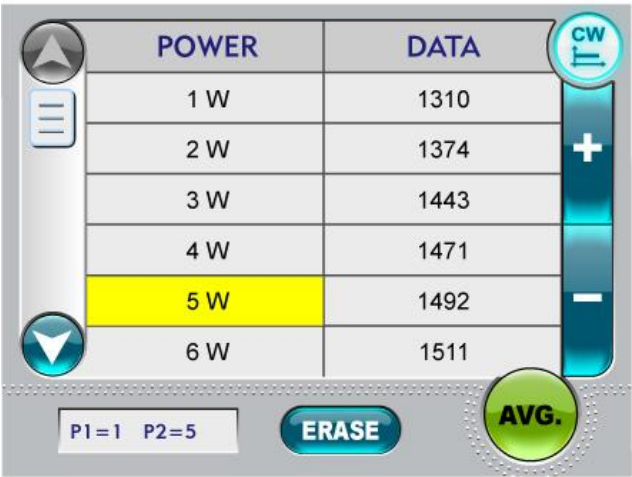
5.3.2 .Averaging

For a faster calibration procedure, the system incorporates a function of average data calculation.

To press one of the POWER data to set as the first value (P1), calibrated the data of P1 according to the power meter. ERASE turns highlight when the P1 is set (ERASE function is activated).



To select the second value (P2) as above operation.
SAVE button switches to AVG. button once P2 is selected.



POWER	DATA
1 W	1310
2 W	1374
3 W	1443
4 W	1471
5 W	1492
6 W	1511

P1 = 1 P2 = 5

ERASE

AVG.

Pressing AVG. to get all the average data calculated between P1 and P2, and the right down button switches back to SAVE button. Pressing SAVE to store the calibrated data and quit the calibration interface.

5.3.3. Eraser

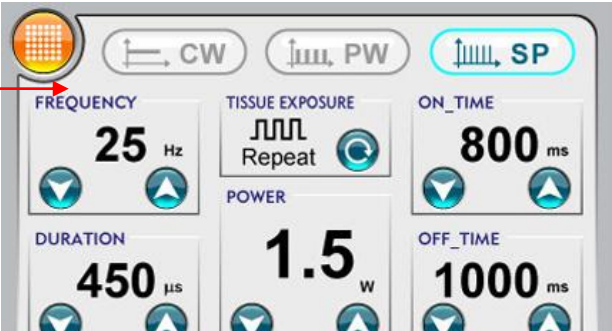
The operator is able to erase P1 and P2 in backward order.. Once both P1 and P2 are erased, And the right down button switches back to SAVE button at the same time.

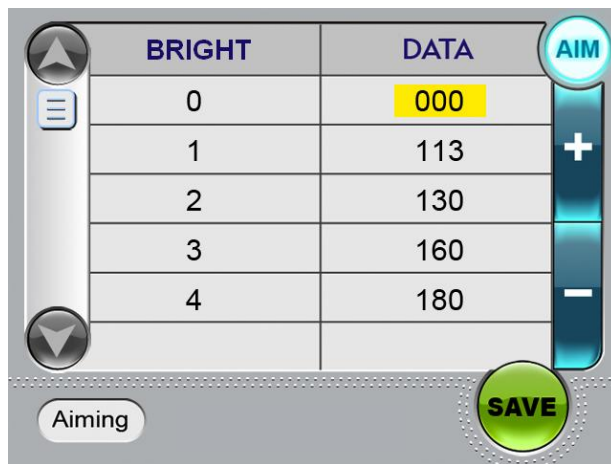
5.4. Aiming Beam Adjustment

The procedures of aiming beam adjustment as follow:

1. Turn off the aiming beam.
2. Keep pressing the frame of FREQUENCY for 5 seconds and system enter into aiming beam adjustment display, as follow:

In the CO2 Operation Interface, make sure the aiming beam is off, and keep pressing the frame of FREQUENCY for 5 seconds to enter into Aiming Beam Adjustment





In the aiming beam adjustment interface, the yellow highlight indicates the chosen data, which can be adjusted by pressing '+' or '-' to achieve the correct power.

CHAPTER 6

Troubleshooting

6.1. Troubleshooting Guide

Please refer to professional personnel for maintenance.

SYMPTOMS	POSSIBLE CAUSE	ACTIONS
After the main power is on, the panel does not light, the water pump does not work either. (When the water pump works, there are slight Vibration and sound.)	The power plug has not been properly plugged. The emergency stop switch is pressed down.	Check the two plugs at the two ends of the power cable. Replug properly. Turn the red mushroom-shaped key of the emergency key in the indicated directions to have the emergency key connected.
No laser beam emits out though the unit seems running normally.	The setting of the control panel is STANDBY status. When the unit is used for the first time, after water is filled the cover is not closed tightly. The interlock keys are not pressed down. The joint of the articulated arm is loosened.	Set the unit to READY status by pressing READY key. Close the cover and press the interlock keys. Screw the joint tightly.
No laser emits. The unit alarms	The unit has been working for too long and the coolant is too hot.	Stop running the unit. Wait till the temperature of the cooling water goes down below 25 degree, then restart the instrument.
The unit makes big noise when running.	The unit is not well-balance.	Place the unit on a stable and flat surface.
Red pilot beam does not converge or does not emit from the end of the tube. CO ₂ laser is off the centre.	The articulated arm is either damaged inside or not working normally. No laser emits or output power Drops significantly.	Refer to professional personnel for service.