Model: Miran

Superpulse

CO_2 LASER SURGICAL SYSTEM

Service Manual

CAUTION
Use of controls, adjustments or performance of procedures other than those specified in this user manual may result in hazardous radiation exposure.

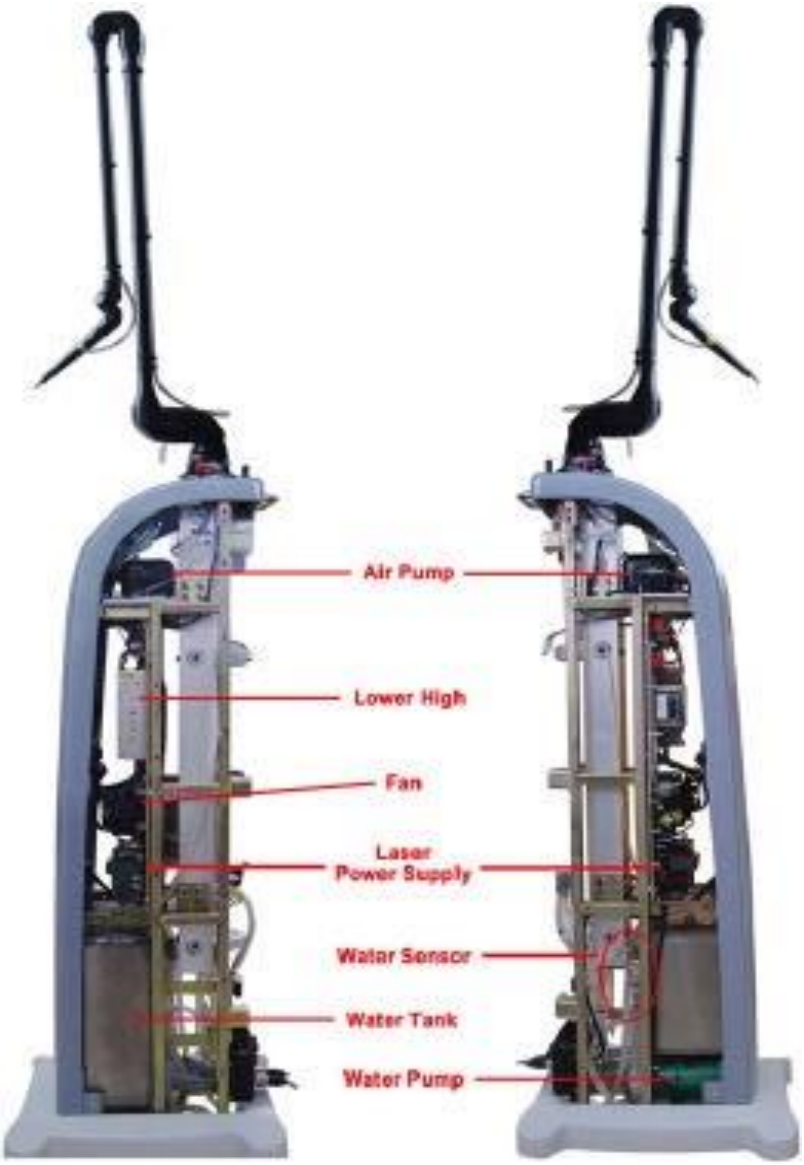
SPECIFICATIONS SUBJECT TO CHANGE
WTHOUT NOTICE
Version 1.0
General information:
The following chapters of this user manual contain the maintenance, troubleshooting and repairing of principal parts of the Miran 25 CO_2 Surgical Laser System. The person servicing the Miran 25 must be thoroughly familiar with the contents of this manual.

Service
This manual has been prepared to aid authorized technical personnel to understand and service the Miran CO2 Laser system.

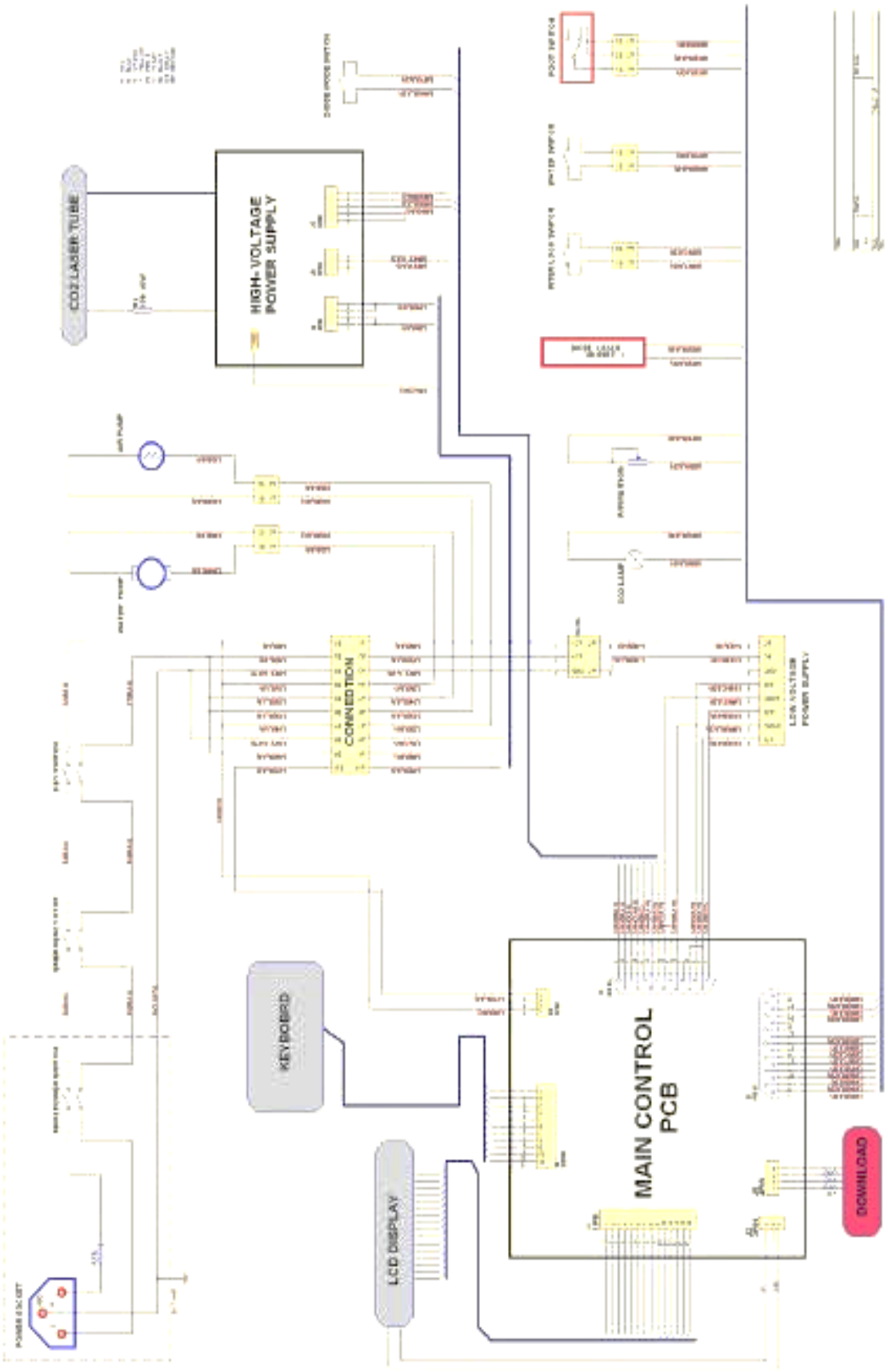
Special tools required: CO_2 Power meter
Diode laser aligning tool
Delivery system aligning tool

Components Position:

1. Control system: LCD control PCB and Main board
2. Power supply: HV laser power supply and low power supply
3. Cooling system: water pump, water tank, water sensor, fan
4. Laser source: Diode laser and CO_2 laser
5. Optic and delivery system



Wiring diagram



Chapter 1: Control system

The main board administrates all the controls and commands of the system. The chips and the connections designed for interfacing with the other electronics, and with the rest of the system.

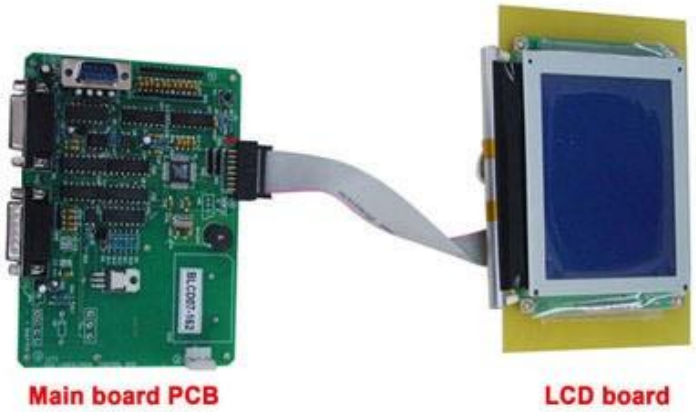


Fig. 1.1

1.1_ Connections description:

Conn. J1 – power supply
Low power supply P 9 - 5V
P11, 12 – GND
P 1 – 12V
P 2 - -12V

High power supply
P6, P14, P8, P7, P15

Conn. J2 – Mechanics
P1 - Footswitch
P2 – Footswitch
P9 – Footswitch

P3 – Water sensor
P10 – Water sensor

P4 – Interlock
P11 – Interlock
P7 – Diode laser – P14 – Diode laser
+

P6- Diode lamp – P13 – Diode lamp
+

P8 – Resistor for aiming beam density adjustment
P15 – Resistor for aiming beam density adjustment

Conn. J5

P1 – Pump
P3 – High power supply

Conn. J6 LCD

Conn. J7 Key board Conn. J8 Software

downloads

1.2. Controller Replacement

Main board replacement

A) Unplug connector J6 on the main board
B) Unscrew the main board from the unit.
C) Calibration procedures are required after the main board replacement.

LCD board replacement

A) Unplug connector J 202 on the LCD Board.
B) Unscrew the LCD board from the unit.
C) Calibration procedures are not required after LCD board replacement.

1.3. Calibration procedures

A) Remove the handpieces from the articulated arm.
B) Ensure the CO_2 laser beam enters the power meter.
C) Switch on the system.
D) Set the laser operation mode in CW mode and tissue exposure mode in Continuous.
E) Press "READY" key
F) Press "CALIBRATE" Key for seconds and the system display as follows.
G) Press "SELECT" Key, the cursor will move to the right side of Power value that is about to calibrate.
H) Press "MODE" key, and move the cursor to the "DATA list", press UP and DOWN key to calibrate the data unit. The power value that is displayed on the power meter equals to the calibrating power.
I) Press "SELECT" Key and move to the next power value calibration needs. The procedures are as above.
J) After all the power value calibration steps, press the "SAVE" key to store all the data.

LASER OPERATION MODE: CW

POWER	DATA
0.5W	10
1W	15
2W	20
3W	25
4W	30
5W	35
6W	40
7W	45
8W	50

CALIBRATION

Note:

Moving the cursor up or down by pressing the SELECT key.

Moving the cursor left or right by pressing the MODE key.

Chapter 2: Power supply

The Miran 25 CO_2 Surgical Laser system can be operated either at 220V A.C. or 110V A.C. Changing operating voltage cannot be performed.

Power supply of Miran 25 CO_2 Surgical Laser includes: A) Low voltage power supply
B) H.V. laser power supply

2.1 Low power supply

Caution:
High voltage inside.
Do not remove the cover of the low power supply!

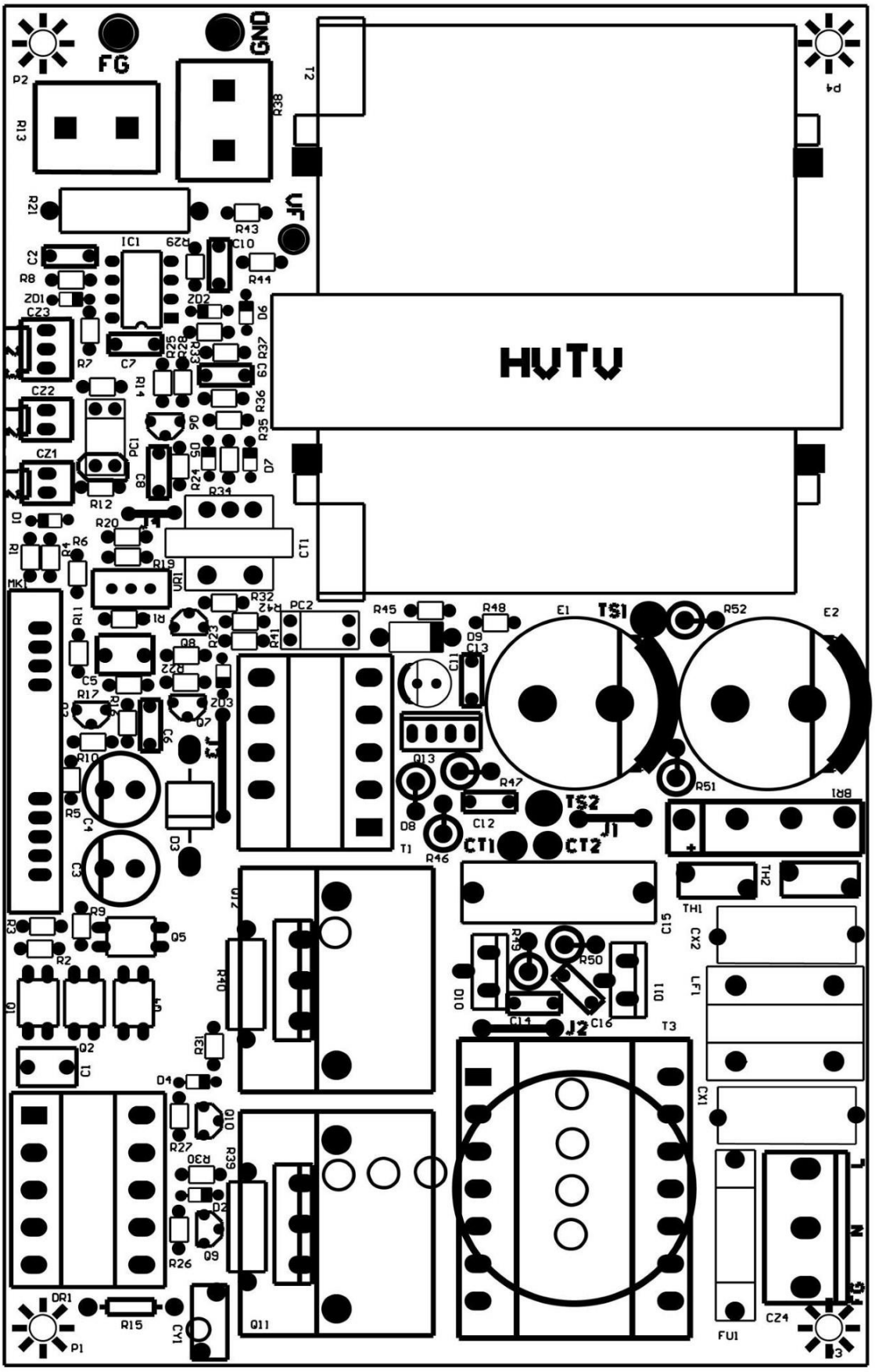
AC Input: 220V _ 20% (Fig. 2.1)
110V _ 20% (Fig. 2.2)

Fig. 2.1

Fig. 2.2

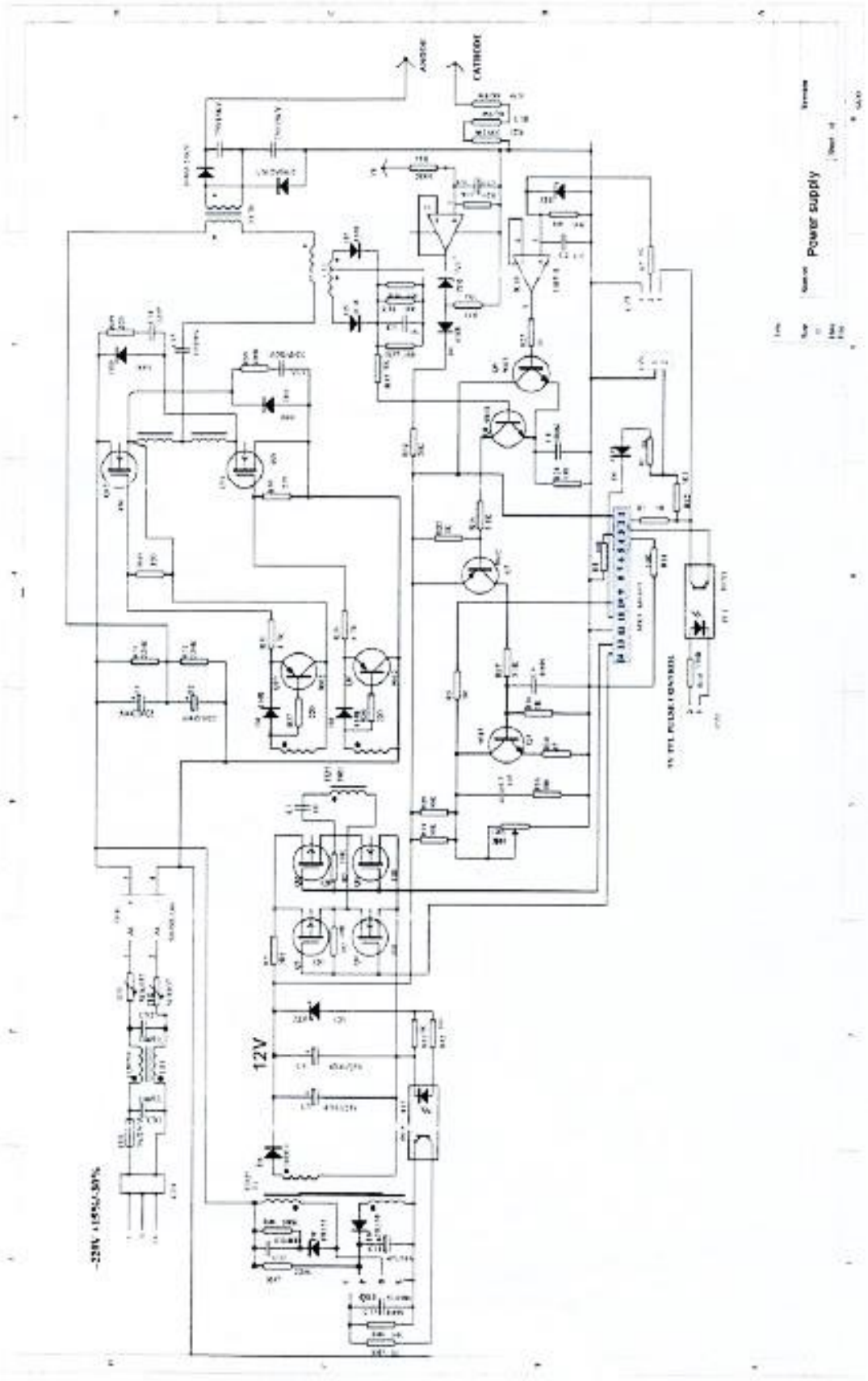
DC Output:
V1: 5V 3.0A
V2: 12V 1.0 A
V3: -12V 0.5A

2.2 H.V. Laser power supply



Lay out of the power supply

2.2.1. Testing point (+12V) of the power supply is indicated in the following diagram



2.2.2. Power supply replacement (Fig. 2. 3):

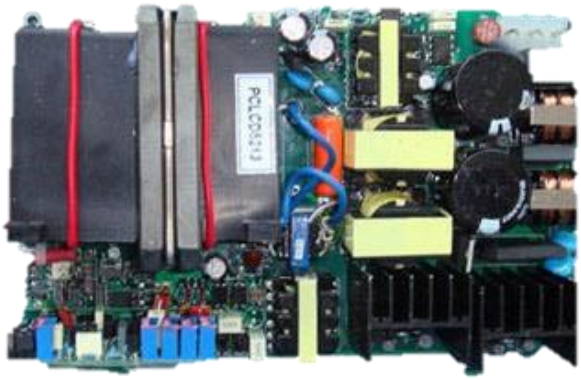


Fig. 2. 3

Power supply replacement Procedure: A) Switch off the system.

B) Cut the connections of laser tube. Yellow wire connects the cathode of the laser tube. Red wire connects the anode of the laser tube.

> **Warning:**
> **The anodes of CO_2 laser tube contain high voltage.**
> **Electric shock hazard.**
> **Never touch the anodes unless discharged.**

C) Unscrew the power supply board from the unit.

D) Calibration procedure is required after H.V. laser power supply replacement. Refer to Chapter 1.3 for calibration procedures.

Chapter 3: Laser source

3.1 Diode laser resource

In view of the invisible beam of the 10.6um CO_2 laser, a visible red diode laser is emitted coaxially with the CO_2 laser to assist the operator to locate the laser beam conveniently.

Diode laser wavelength 650 nm max
3mW CW adjustable

3.1.1. Diode laser Replacement Procedure:

A) Remove the plastic cover of the unit, and unscrew the base of the articulated arm, including diode laser (Fig. 3.1)
B) Disconnect the diode laser from the unit, and take the diode laser out.
C) Place a new diode laser which is already aligned.

fig. 3.1

3.1.2 The diode laser alignment procedures are as follow:

A) Supply 3V to the diode laser needs alignment. Put the diode laser into the tube with a cover with a hole in the center as fig. 3.2, the aiming beam lit.
B) Trim the adjusting screws (position A) to center the red beam (Fig.3.3).
C) Install the aligning tube on the tube; proceed as in B) but using the Position B screws of fig 3.3.

Fig. 3.2

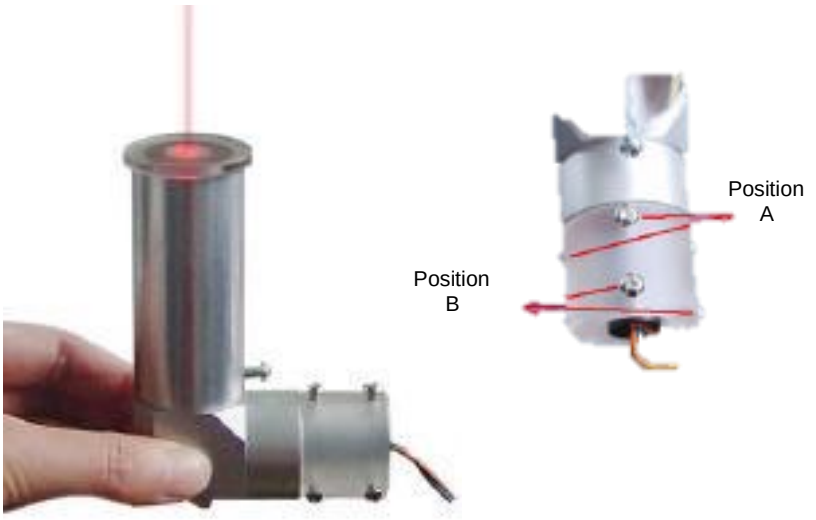


Fig. 3.3

D) Repeat points B) and C) until no more adjustments are needed (Fig.3.4).

Fig. 3.4.

3.2 CO_2 Laser source

The technician must wear the protection goggles for invisible radiation at 10.6 microns in Class 4. In the operative conditions, the anode of the CO_2 tube contains a 20,000 volts voltage. Such voltage might be LETHAL.

The technician must never touch the anode of the CO_2 tube with bare hands or with metallic tools.
Risk of Death!

3.2.1. CO_2 tube replacement

A) Remove the back panel and let out all the water in the system.
B) Desolder the wires and disconnect from the power supply. The yellow wire connects the cathode of the laser tube. Red wire connects the anode of the laser tube.

Warning:
The anodes of CO_2 laser tube are under high voltage.
Electric shock hazard.
Never touch the anodes unless discharged.

C) Disconnect the two tubes of the cooling circuit; Pay special attention at the one at anode side.

D) Unscrew the fixing screw of the laser tube and take the tube out.
E) Replace the new laser tube following the opposite sequence.
F) Calibration procedure is required after CO_2 tube replacement.

3.2.2. Aligning the CO_2 Laser beam

Wear the protection goggles for CO_2 laser beam.

The CO_2 radiation can cause irreversible damages to the skin with direct or diffuse radiation.

Do not use metallic tools within the CO_2 laser beam nor let your hands stay in the CO_2 beam path. A) Remove the articulated arm.
B) Put a small piece of thermal paper close to the base (Fig. 3.5)

Fig. 3.5

C) Active the footswitch mutual position of CO_2 laser and diode laser beam. Trim the adjusting screws (position A) closer to the output in order to make the two beams concentric (Fig.3.6).

D) Install the aligning tube on the base of the articulate arm (Fig. 3.7), and put the thermal paper on it and proceed as in C) but using the (Position B) screws of fig. 3.6.

E) Repeat points C) and D) until no more adjustments are required.

Fig.3.6

Fig.3.7

Chapter 4: Cooling system

Cooling system includes water pump, water tank, and air system.
The position of the above components:

Water pump: is supplied by 110V or 220V A.C. net power supply. Check the label of the unit to ensure the correct voltage input.

Water tank: The water in the water tank needs to be replaced every six months. **Water sensor:** gives audio warning if the system lack of water **Air:** mainly gives out the heat from the H.V. laser power supply.

Water pump replacement

C) Remove the back and side panel, and give out all the water in the water tank.
D) Disconnect the wires of pump. The yellow wire ground; the brown wire connects C24-L of power supply; the blue wire connects C24-N. E) Disconnect the water tube from water sensor and water tank.
F) Unscrew the fixing screws and take the water pump out.
G) Replace a new pump following the opposite sequence.

Fig. 4.1

Chapter 5: Delivery System

The Miran 25 laser system is wrapped with the delivery arm demounted for ensuring a safety delivery.
The beam delivery system is a lightweight, spring-balanced 7-joint articulated arm.
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.
The surgical arm is pre-aligned. No need for mirror alignment.
When the laser is improper transported, the laser spot may not remain in the center.
Do the Following:

A) Tighten the screw shown in the fig. 5.1.
B) Check all the 7 joints of the arm, and make sure all joints are tightened.
C) Check if the spot remains centered with every position of the arm.
D) If this cannot be achieved check again chapter 3.1.2. diode laser alignment.

fig. 5.1.

Cleaning the optic lens

Clean the optics with optic grade cleaning wetted with pure acetone or ethanol only**.**

Chapter 6: Troubleshooting

Symptom	Condition	Verify that
No switch on	Key switch turned on	A) There is a correct connection of the plug in the system's inlet, and in the main plug. The red main switch is turned on. B) Emergency switch turned upwards. The inlet plug's fuses are O.K. The right voltage is present in the main plug.
The display does not light up	Key switch on, emergency switch on, pump rotated	A) Perfect connection of J1 B) The presence of 5V between P9 and P11 of J1 C) Replacement of display board
Water pump does not rotate	Key switch on, emergency switch On, keyboard lit	A) The correct voltage (220V A.C.) in B) Deflation from the pump. C) Mechanical problem in the pump itself
No aiming beam	Key switch on, emergency switch on, keyboard lit on	A) Perfect connection of J2 B) The presence of 3V between P7 and P14 of J2 C) Replacement of new Diode laser
No laser emits	Key switch on, emergency switch on, keyboard lit on	A) Perfect connection of J2 B) Perfect connection between J1-P6, P14 of control board and CZ1 of power supply; between J1-P7, P15 and CZ3 of power supply
No laser emits	Above condition met	A) Laser beam Alignment to avoid emitting to the wall of articulate arm (refer to chapter 5)
No laser emits	Above condition met	A) Activity of shutter in the front of laser tube aperture once the footswitch stepped. B) No crack on the laser tube C) Presence of laser light in laser tube once footswitch stepped. D) Replacement of laser tube
No laser emits	Above condition met	A) The presence of normal data according to all the power value in Calibration mode B) Calibration and raise the data (refer to chapter 1.3.)
No laser emission	Above condition met	A) The presence of 12V on the testing point of power supply (see chapter 2.2.2)