MPBC Fiber Laser

2RU-VFL-Series Class 4

User's Manual

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1.0. INTRODUCTION

1.1. Safety Information

1.1.1. Class 4 Source of Optical Radiation

Lasers in the 2RU-VFL-Series with output power of more than 500 mW are Class 4 sources of optical radiation. These lasers have CW emission at a single, factory preset wavelength within the range of 400 to 700 nm.

All units have been designed in compliance with applicable safety standards. Safety information and operating instructions are detailed in this manual. Failure to follow instructions may impair the protection provided by the equipment design and result in hazardous radiation exposure.

This product was primarily designed for use in research applications such as fluorescence spectroscopy or flow cytometry and should be operated in a laboratory environment.

1.1.2. Compliance

All models in the 2RU-VFL-series are compliant with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007. This laser may be imported into the United States under FDA Accession Number 1031140-000.

All units also comply with following safety standards:

- IEC/EN-60825-1 & -2 , Safety Standards
- CSA C22.2 No 61010-1/UL61010-1 (for USA & Canada) Safety Standards
- IEC/EN 61010-1 (for Europe & International) Safety Standards
- MET Certification for Electrical Safety

1.1.3. Technical Specifications:

Optical specifications

1) Wavelength: 400 to 700 nm,
2) Beam size at aperture: <1.2 mm
3) Beam divergence (full angle): <5 mrad
4) Maximum CW Output Power Class 4: more than 500 mW

Electrical requirements

1) Input Voltage: 100-240 VAC
2) Input Frequency: 50/60 Hz
3) Input Current: 2.0 A @ 100 VAC , 1.0 A @ 240 VAC
4) Input Protection Fuse: F2.5 A, 250 V, Fast Blow

5) Inlet connector: C14 acc. to IEC/EN 60320-1, for use with C13 mating socket.

Environmental conditions

1) Temperature: 15 °C to 30 °C
2) Humidity: RH 93%,
3) Others: indoor, altitude 2000 m, pollution degree 2.

Embedded Laser

These units contain high power pump laser diodes at 915 nm, 25 W CW, with NA<0.12. The output radiation from these laser diodes is fiber coupled into a protected fiber preventing any collateral radiation. The 2RU enclosure has been sealed with warranty void stickers. The user is not permitted access into the enclosure.

1.1.4. Optical Interface

The output beam is emitted from a 5-mm aperture on the laser head (Second Harmonic Generator module) which is connected to the fiber laser with a steel armored fiber optic cable. This armored cable is permanently attached to the unit and users should not attempt to disconnect or apply undue stress to the cable.

1.1.5. Eye Protection

It is mandatory that users wear protective eye goggles which provide better than OD5 attenuation at the emission wavelength of the laser. These goggles should permit the transmission of a portion of a white light spectrum such that the LASER STATUS LED on the front panel is clearly visible.

IMPORTANT

WARNING: Both direct and scattered radiations are deceptively dangerous. Appropriate laser safety goggles are an absolute necessity.

1.1.6. Skin Exposure

Avoid skin exposure to both direct and scattered laser radiation. Serious skin damage can result even from exposure to diffusely scattered laser radiation.

1.2. Labels

1.2.1. Identification Label

The identification label, showing the manufacturer's name and address, laser model number, serial number and manufacturing date, is attached to the back panel of the laser.

MPB Communications inc. **147 Hymus Blvd.** **Pointe-Claire, QC** **Canada H9R 1E9**	**Model**
	S/N
	Mfg Date

A generic VFL-P Series Visible Fiber Laser label is affixed to the front panel of the laser.

1.2.2. Warning Label and Explanatory Label

The Explanatory label combined as above with the Warning label is affixed on the front panel of the fiber laser.

1.2.3. Aperture Label

The following Warning / Explanatory label is affixed to the Second Harmonic Generator, close to the laser aperture.

1.2.4. Electrical Hazard

A warning symbol is displayed next to the mains input requirements on the front panel below the power entry module. See electrical requirements in section 1.1.3.

The following symbol is also displayed next to the input ratings on the front panel to indicate the requirements for alternating current.

1.3. Radiation Emission Indicators

There are 2 LED indicators on the front panel:

- **Green/Orange LED**: First, when the laser is powered up and goes through a warm-up process, it emits orange light. The LED turns green when the unit is ready for operation. Blinking orange indicates the detection of a fault.
- **White LED**: When the “laser enable” command has been submitted, the white LED starts blinking indicating the laser is about to start emitting light. There is a 3 second delay between the time the “laser enable” command has been issued and the time laser emission appears at the laser output. At that moment, the LED switches to continuous illumination.

1.4. Key switch

The role of the key switch is to prevent unauthorised use of the laser. The laser cannot be started unless the key is in ON position.
In case of emergency, the key switch can be used to shut the laser down quickly.

In case the interlock loop is opened, the laser will be shut down immediately. To restart the laser after the interlock loop is restored, the key switch must be turned counter clockwise and turned back to the ON (Horizontal) position before the laser emission can be software enabled.

If the laser was powered up when the key switch was in the ON position, the laser cannot be enabled. In that case the key switch must be reset - first turned OFF and then turned back to the ON position.

1.5. Remote Interlock Connector

The Remote Interlock is a safety feature which results in the laser being shut down immediately when a safety interlock loop is opened. To restart the laser after the interlock loop is restored, the

key switch must be turned counter clockwise and turned back to the ON position before the laser emission can be software enabled. The interlock is rated at 5 V, 2.5 mA. The short-circuit resistance should be less than 200 Ohm to guaranty a valid state

1.6. Time Delay

For safety considerations, a time delay of 3 seconds has been imposed between the time when a "laser enable" command is submitted and the time when the laser emission begins. The white LED starts blinking, indicating that the laser is about to start emitting light. After the mandatory 3 seconds, the laser emission begins and the LED switches to continuous illumination.

1.7. Manual Reset

If the laser is shut down by either activation of the interlock or by a line power failure, the key switch will have to be turned counter clockwise and then turned ON again in order to enable laser emission.

1.8. Beam Block

The main output of the laser is equipped with a mechanical beam block. To prevent laser radiation from exiting the aperture, keep the beam block in front of the output aperture. Conversely, when emission from the aperture is desired, rotate the beam block clockwise to the end of its travel so that the beam block completely clears the opening of the aperture. Do not leave the laser ON with the beam block closed for extended periods of time.

1.9. Input Line Voltage

This unit requires alternating current input between 100 and 240 VAC, 50/60 Hz, with current capability of 2.0 A at 100 VAC and 1.0 A at 240 VAC.

1.10. ON/OFF switch

The power entry module is equipped with a rocker switch marked with symbols "O" and "I". To turn the unit ON, depress the switch in the "I" position. Depress "O" to turn OFF.

1.11. Input Protection Fuse

The main fuse is located in the fuse drawer of the power entry module on the front panel. To replace, remove the fuse drawer and use a Fast Blow 2.5 A, 250 V fuse.

1.12. Earth Connection

The power cord supplied with this equipment provides the protective earth connection for this product. Use only IEC-60320 compliant cords for replacement. No other earth connection is provided on the unit.

2.0. UNPACKING AND INSTALLATION

2.1 Initial Inspection

MPBC VFL-series lasers have been carefully packaged at the factory to minimize the possibility of damage during shipping. However, if there is visible damage to the unit upon receipt, inform the shipping company and MPBC immediately.

Although not recommended, there should be no adverse effects if the unit is transported upside down or sideways, but there may be damage if the unit is exposed to temperatures out of – 40 °C to 60 °C range.

If the equipment is used in a manner not specified in this manual,
the protection provided by the equipment may be impaired.

Along with the laser unit, please check that the following accessories are included in the shipment:

- SHG Cable with 10-pin connectors
- RS-232 cable (MPB P/N W-01517-1)
- Test Report Datasheet
- CD with user's manual and GUI (MPB P/N CD-04425)
- AC power cord
    - Continental Europe CEE 7/7 to IEC 60320-C13 (MPB P/N 3190)
    - North America/Japan NEMA 5-15P to IEC 60320-C13 (MPB P/N 2056LF)
    - UK/Ireland BS 1363 to IEC 60320-C13 (MPB P/N 4851LF)

- L-brackets (MPB P/N F-03982-2)
- USB Cable (MPB P/N 4724LF)

2.2 Electrical Requirements

The 2RU-VFL-series lasers are equipped with a universal power supply and can be operated with two-phase 100 V or 240 V AC voltage input. The AC power inlet located on the right side of the front panel has a built-in fuse and ON/Off switch. Please refer to the technical specifications for details.

2.3 Mounting of Unit for Operation

This unit can be mounted in a 19" rack using the two L-brackets supplied or can be placed on any reasonably firm table or bench.
Be sure not to obstruct the back, left and right sides of the laser enclosure used for ventilation.
Do not position equipment so that it is difficult to turn OFF the AC source in case or emergency.
The SHG unit must be mounted on a heat sink to facilitate heat dissipation.

2.4 Operating Conditions

The VFL-series lasers should be operated within a temperature range from 15 °C to 30 °C, RH 93%, indoor, altitude ≤ 2000 m, pollution degree 2.

3.0. DESCRIPTION / OPERATION

A VFL-P-series laser is a source of a linearly-polarized visible light. It consists of a narrow-band fiber laser and a Second Harmonic Generator (SHG). The fiber laser emission is guided to the SHG laser head by a polarization-maintaining optical fiber protected with a stainless steel conduit. This fiber conduit is permanently attached and cannot be disassembled. The laser unit also provides temperature stabilization for the SHG crystal and an active power stabilization of the laser output power through the SHG control cable connected between the Fiber Laser and the SHG.

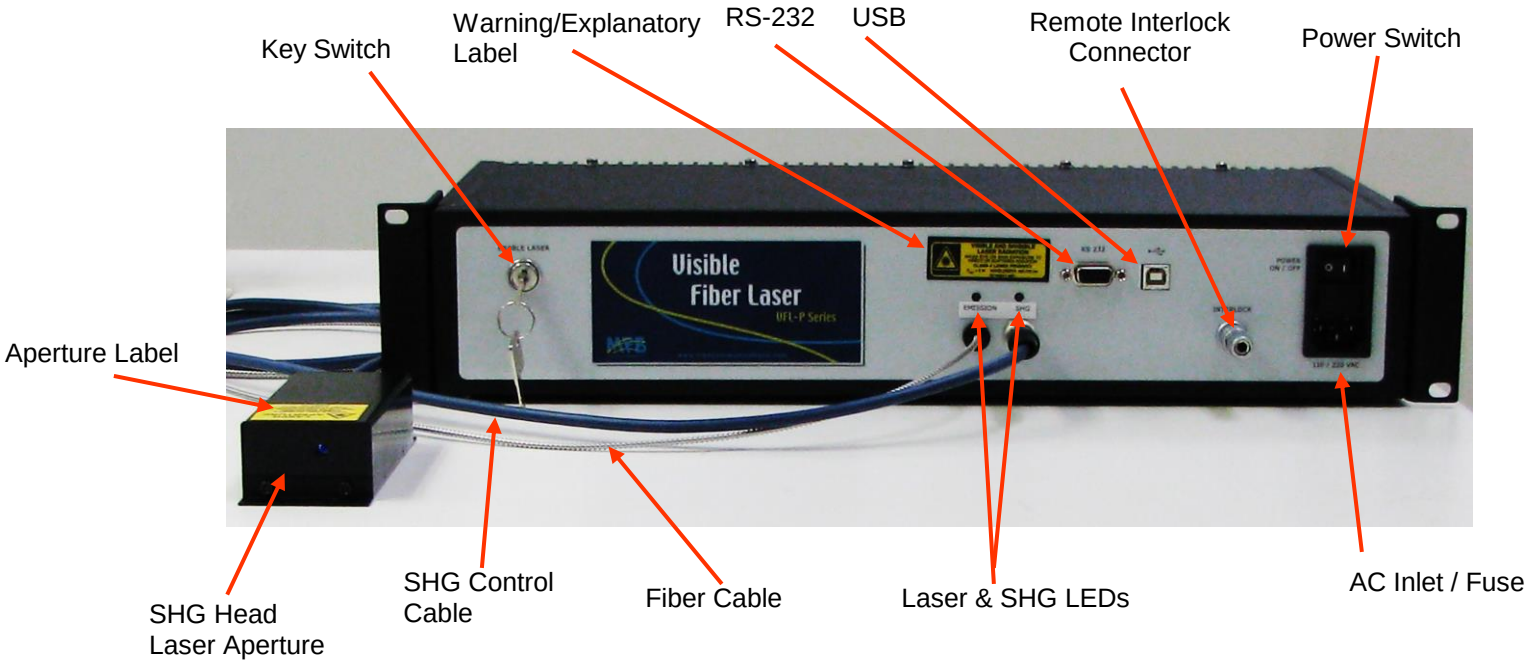


Fig. 1

3.1 Front Panel Connectors and Indicators

- AC power inlet, fuse and power switch are located on the right side of the front panel.
- RS-232 (for connector pin out, refer to Table 1 in Section 4.1).
- USB.
- Interlock (pins 1 and 3 have be wired to an interlock safety loop). To operate the laser, the safety loop must be closed.
- 10-pin SHG connector for temperature control and power monitoring of the SHG unit.
- Green/Orange LED is located above the 10-pin connector. Orange indicates temperature stabilization is in progress. Steady green indicates temperature is within the operational range. Blinking orange indicates a fault condition which prevents the laser from being started.
- White LED, located above the optical fiber cable, is illuminated when the laser is enabled.
- Key switch.

3.2 Available Models

All models in the VFL-series emit linearly-polarized light in the spectral band of 400 - 700 nm. Available output power ranges from 200 mW to 2 W. Laser modules with other wavelengths/powers are available upon customer request. Please visit our web site to view a list of standard models.

VFL-series lasers in a 2RU rack mountable enclosure may be ordered as 2RU-VFL-P-XXXX-YYY, where XXXX is the output power in mW and YYY is the emitted wavelength in nm.
For example, 2RU-VFL-P-1500-592 denotes a linearly-polarized 592-nm fiber laser with an output power of 1500 mW in a 2RU enclosure.

3.3 Power-up the Unit

- Connect the fiber laser to the SHG laser head using the SHG control cable.
- Connect the unit with an RS-232 cable (or optional USB) to a serial (USB) port of a computer.
- Wire the interlock LEMO connector to an interlock safety loop. VFL-series lasers come with a receptacle LEMO connector with a shorting wire already in place.
- Connect AC power cord to the laser unit.
- REMOVE the tape that seals the aperture of the output window on the SHG. Point the SHG output to a power meter, a beam dumper or connect it to your set-up to avoid having the laser beam propagating freely in the air.

IMPORTANT

NEVER look directly into the beam output aperture even when the laser is in a standby mode.

- Insert the key switch and leave it in the OFF (vertical) position.
- Turn the AC power switch ON. The LED labeled SHG is orange at power up, indicating the temperature stabilization is in process. Usually, it takes approximately 1 minute for the temperature stabilizer to reach the set point. Once the LED has turned green, the laser is ready for operation. **If the key switch was in the ON position when the laser was powered, it must be then reset (turned OFF and then turned back ON), otherwise the laser cannot be enabled.**

3.4 Activate and Control the Unit Using Graphical User Interface

The VFL laser module can communicate with a computer either using the RS-232 or the USB port. If the USB cable is installed, the unit will communicate through the USB port. For the RS-232 communication to be effective, the USB cable must be unplugged.

The GUI is a simple software program for controlling and monitoring the VFL module. With it, the user can:

- Turn the laser ON/OFF,
- Set and monitor pump LD current,
- Set and monitor laser output power,
- Monitor SHG temperature,
- Adjust SHG temperature.

To work with the GUI-VFL use the following procedure:

- Install GUI-VFL and mpbcusbcdc64.inf files on your computer. For more details, see Section 4.0.
- Install the communication cable (Serial or USB) between the laser and the computer.
- Run the GUI-VFL software (shown in Fig. 2).
- Select a COM port number by clicking on the Serial Port icon in the top left corner. Once a proper COM port is selected, the laser model and serial number will appear in the bottom right corner of the interface panel.
- Turn the laser enable key switch, located on the left side of the front panel, clockwise to the ON position. The Key State indicates if the Key is actually **ON** or **OFF**. If the Key state is **LOCK**, it indicates the Key must be reset to the **OFF** position then switched back to the **ON** position before the laser could be enabled.

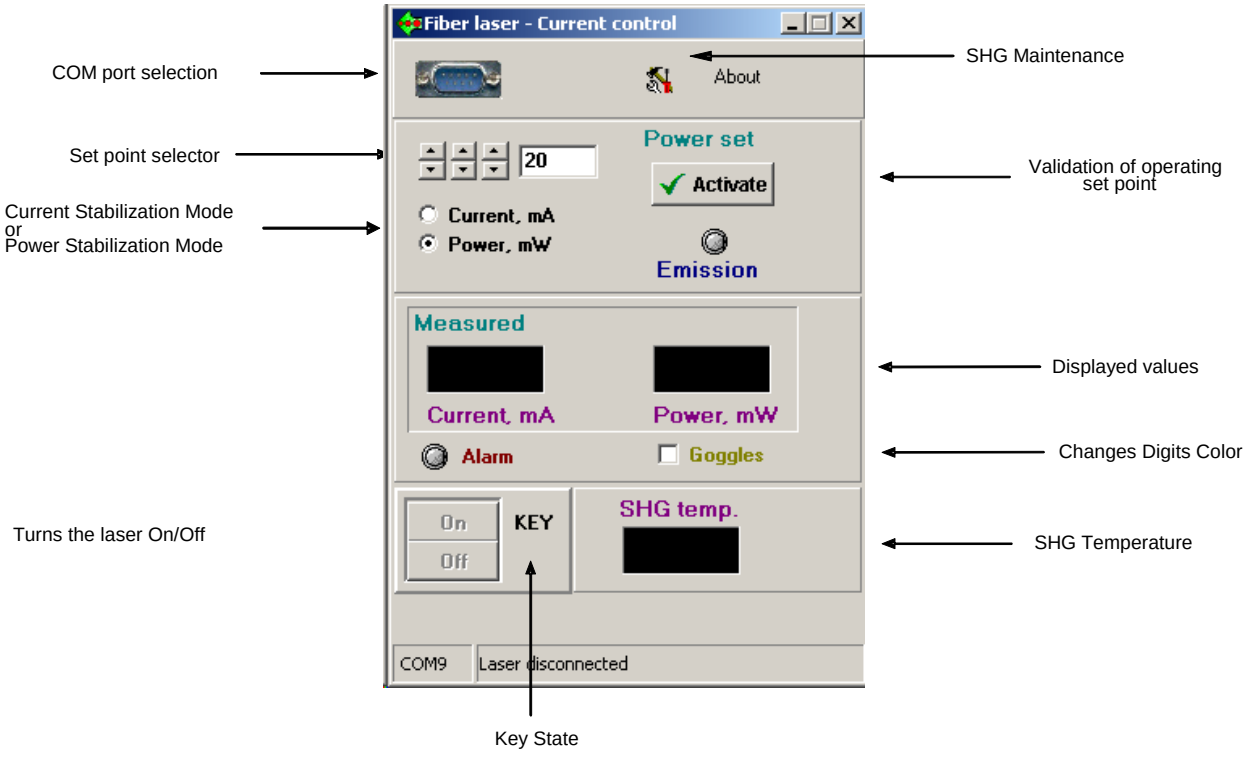


Fig. 2 GUI-VFL graphical user interface

- The unit can work in **Current Stabilization Mode** or **Power Stabilization Mode** by selecting either "**Current, mA**" or "**Power, mW**", located under the set point selection arrows. In **Current Stabilization Mode**, the pump current can be adjusted with the arrows or directly in the value display window. Once a new set value has been entered, the **Activate** button must be "clicked" to implement the change. The emission indicator on the GUI panel will turn green when the laser is activated.

- ***To turn the unit ON, it is necessary to click the ON button.***

- Once the Activate button has been pressed, the laser will start emitting light after ~ 3 seconds delay. During that time the Laser emission status LED, located on the front panel, will be blinking.

- To turn the unit OFF, click the OFF button.

- In the **Power Stabilization Mode**, the unit works with a constant output power, which is implemented with an active power stabilization feedback loop. **We recommend turning the unit on initially at a relatively low output power, for example at 50 mW, then gradually increase the output power to the operating level.**

- Always wear eye safety goggles before turning the laser ON. If the goggles do not transmit the displayed values, click on the "Goggles" feature to change the color of the digits.

3.5 Manual SHG Tuning in Current Mode

- The SHG temperature has been pre-set to nominal value (each laser has a particular SHG set point value, which can be found in the test report). If necessary, the temperature can be readjusted by clicking on the **SHG Maintenance** icon in the **Current Stabilization Mode**. Once clicking on the **tools icon**, a small window will open for validation [see figure 3]. Refer to Maintenance in section 5 for recommended tuning intervals.

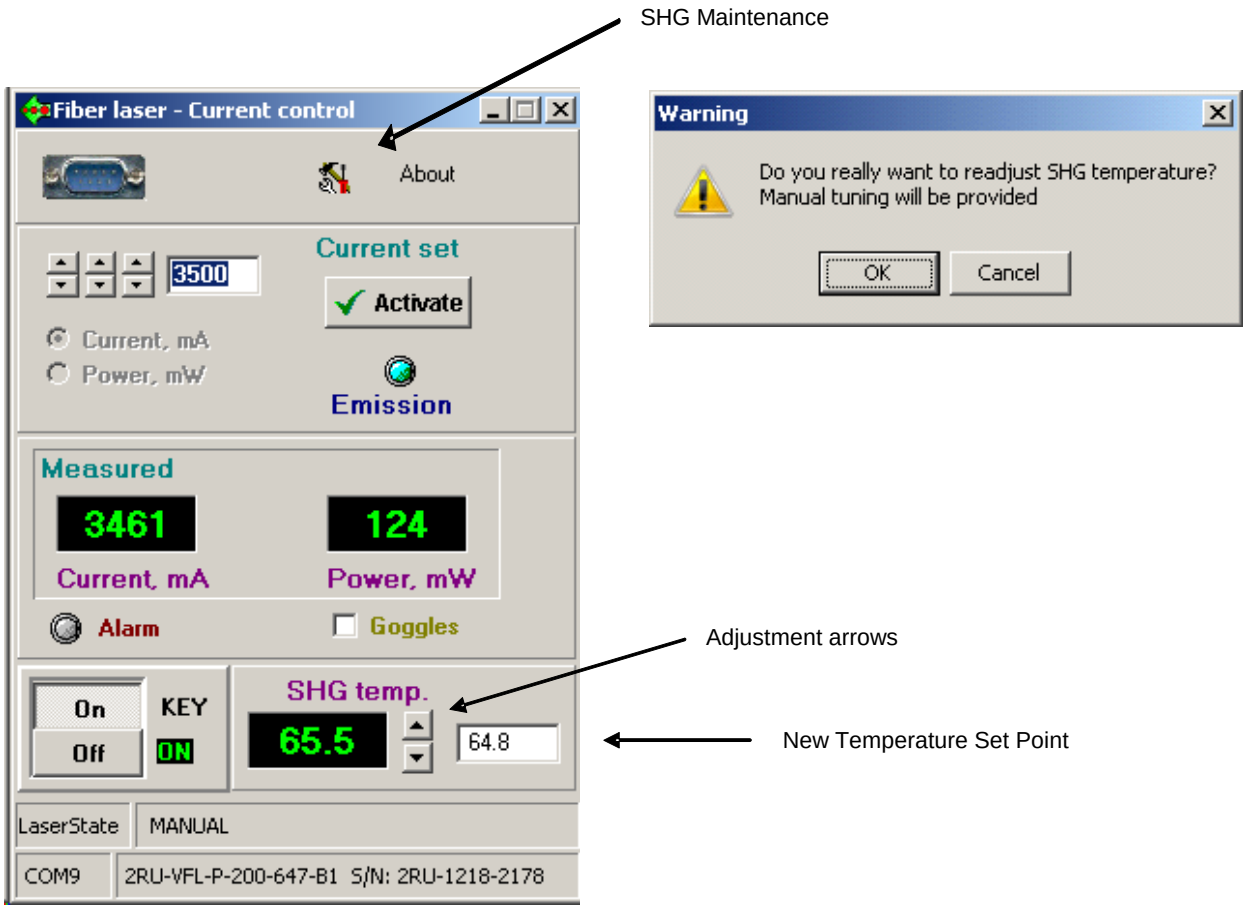


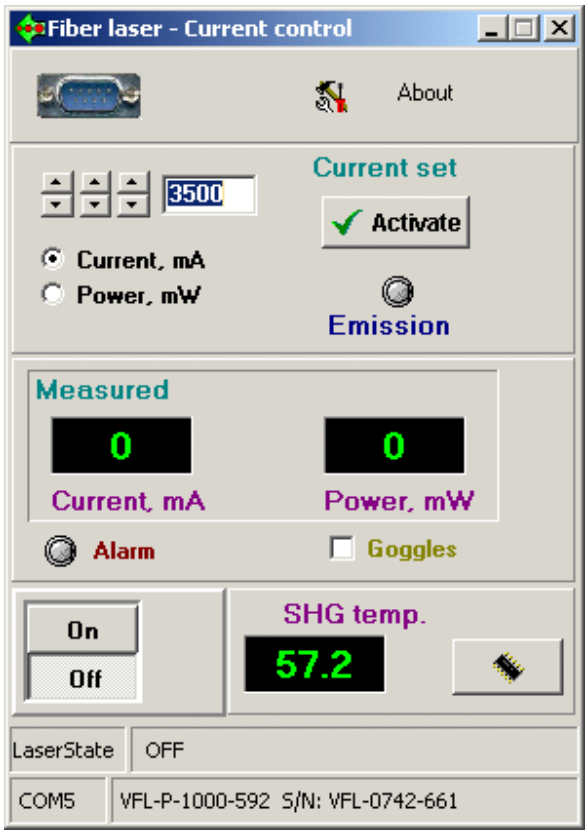
Fig. 3 SHG Maintenance in Current Mode

- By clicking on **OK** in the pop-up window, a temperature set window will appear on the SHG panel together with the pair of up/down **arrow adjustment buttons**. The set value can be adjusted up or down in 0.1 °C increments by clicking on the up/down **adjustment arrow buttons.**

- Monitor the laser output power during SHG temperature adjustment process. Generally, the optimal SHG temperature (set to maximize the laser output power at a constant pump LD current) can be found within ± 0.5 °C. Please note, the values of the optimal temperature may be slightly different at different pump LD currents. Practically, one can optimize the SHG temperature at a certain current, for example at 4 A, then keep the temperature setting for the whole current range.

- For newer versions of the laser firmware, SHG temperature set point is automatically stored in unit's non-volatile memory when it is changed.

- For older firmware, it is not done automatically. Once a new optimum value has been found, to store a new value in the non-volatile memory, turn the laser OFF. Then click on the **IC** icon button appeared to the right of the SHG temperature display (Fig.4). The laser will be automatically restarted and the new value will be permanently stored in the memory until the next maintenance. If the IC icon button does not show up, it means the value was automatically stored previously.



IC icon to store a new value of SHG temperature in non -volatile memory

(Optional icon only displayed for older firmware revision without automatic storage)

Fig. 4 Storing Temperature in non-volatile memory

3.6 Automatic SHG Tuning in Power Mode

- For newer versions of the laser firmware, it is also possible to perform an automatic SHG tuning in the **Power Stabilization mode**. Once clicking on the **tools icon**, a small window will open for validation [see figure 5].

- By clicking on **OK** in the pop-up window, the Automatic SHG tuning will be initiated. If the laser is not running at the actual power set point for 30 minutes, another pop-up window warns you that the laser is not warmed-up yet. The automatic SHG tuning always provides a better result when the laser is warmed-up.

- By clicking on **OK**, the automatic tuning will proceed. A pop-up window indicates the tuning is in progress with a possibility to **ABORT** the process. The tuning process can last up to fifteen minutes. During this time, the SHG temperature will be varied and the laser current will be adjusted to maintain constant the power.

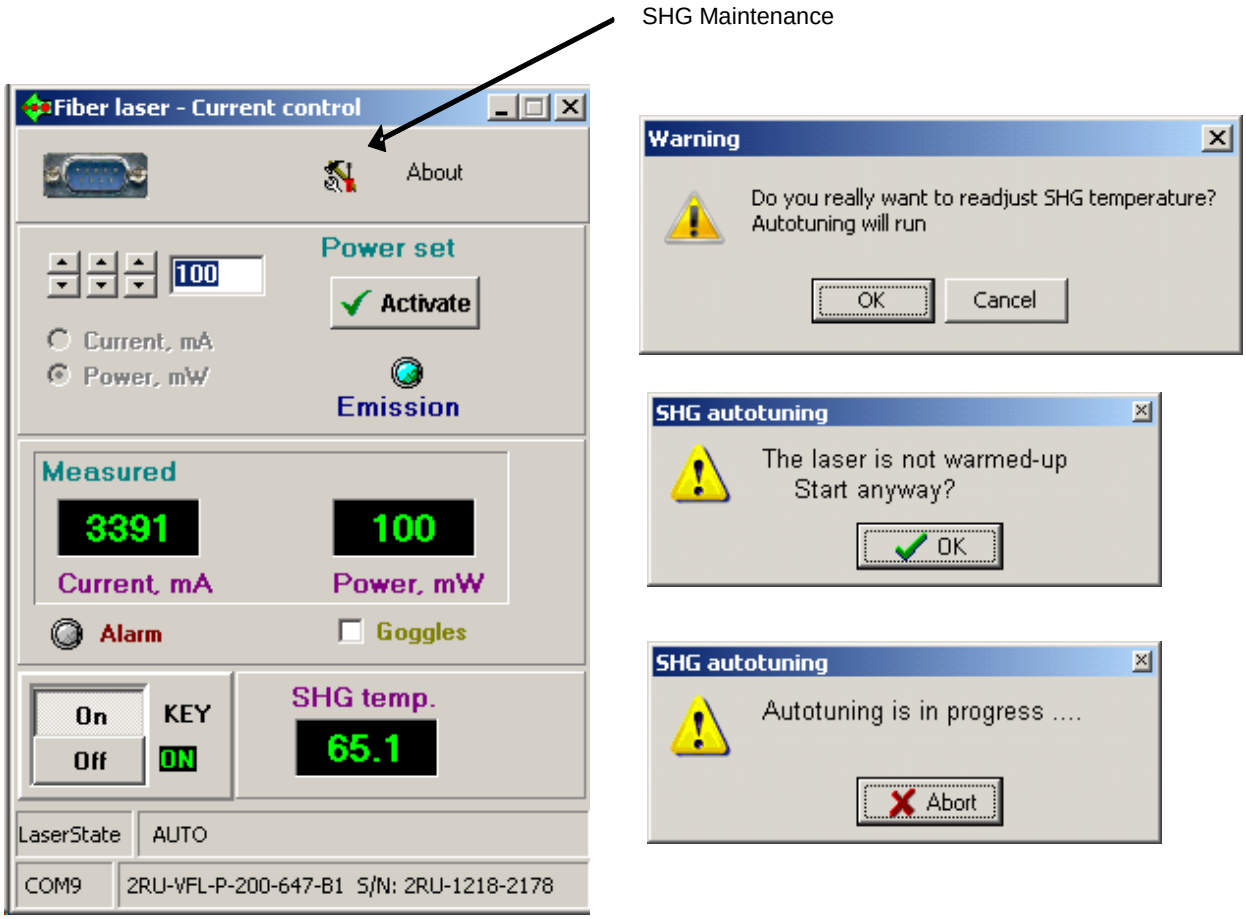


Fig. 5 Initiating SHG Maintenance in Power Mode

- At the end of process (Fig 6), a pop-up window indicates the tuning is completed successfully. The new optimum SHG monitored temperature is displayed and the minimized current as well

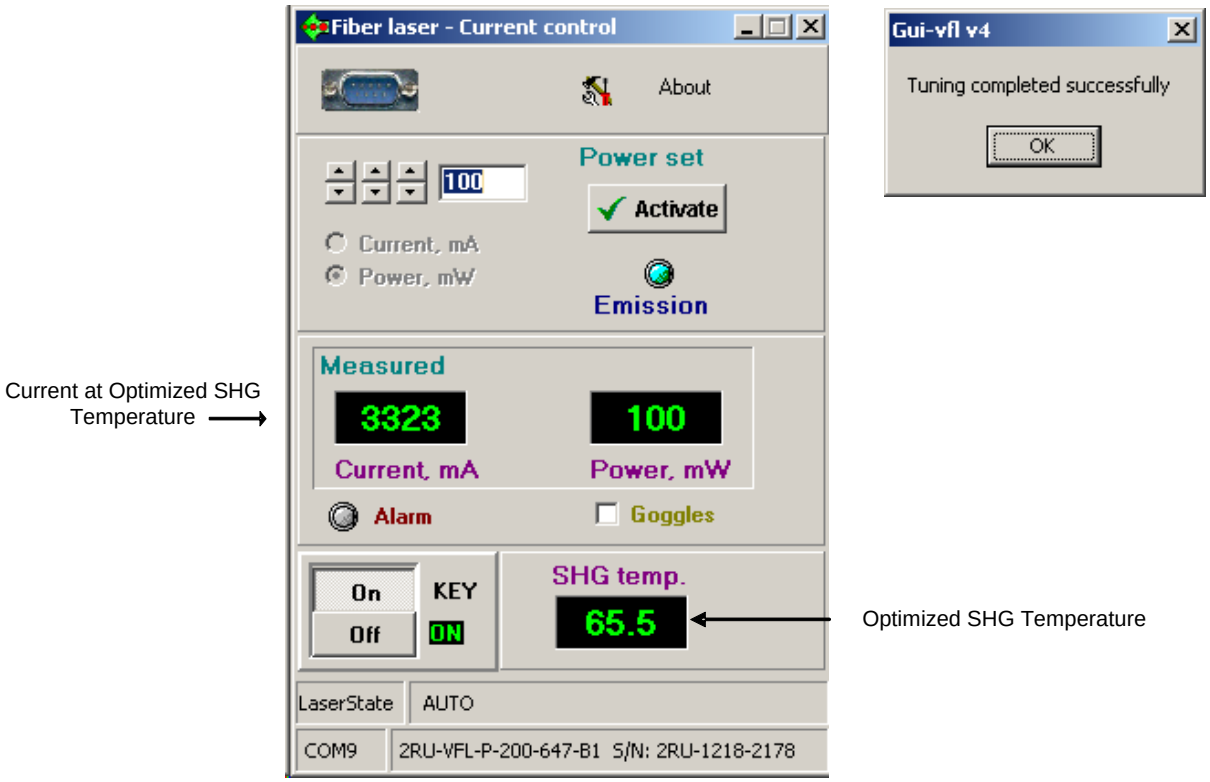


Fig. 6 Completion of SHG Maintenance in Power Mode

4.0. COMMUNICATION WITH PC

The VFL module can communicate with a computer either via RS-232 or USB port.

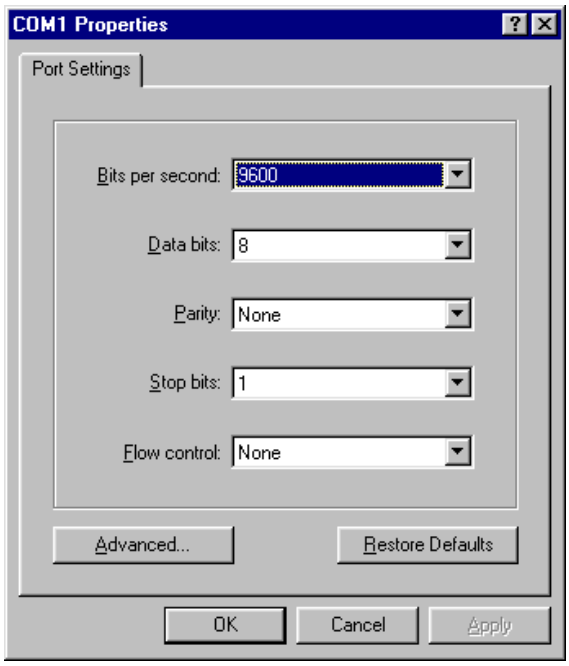
4.1 RS-232 COM Port Settings

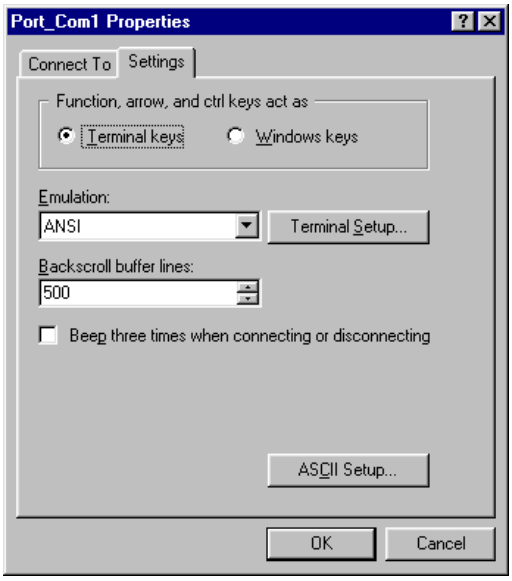
The RS-232 has the following pin out:

Signal	I/O	Pin #	Description
TX	O	2	Serial communication Laser RS232 Transmit Line.
RX	I	3	Serial communication Laser RS232 Receive Line.
COM	-	5	Common return for RX and TX
NC	-	1,4,6,7,8,9	No Connect

Table 1 RS232 pin-out

To communicate with the unit through RS-232 port, a standard serial extension cable (supplied with the unit) should be used to connect the unit to a COM port of a computer. Use the Windows Hyper Terminal program to establish communication. Settings for COMx port are as follows:


COM1 Properties
Port Settings
Bits per second: 9600
Data bits: 8
Parity: None
Stop bits: 1
Flow control: None
Advanced...
Restore Defaults
OK
Cancel
Apply


Port_Com1 Properties
Connect To
Settings
Function, arrow, and ctrl keys act as
Terminal keys
Windows keys
Emulation:
ANSI
Terminal Setup...
Backscroll buffer lines:
500
Beep three times when connecting or disconnecting
ASCII Setup...
OK
Cancel

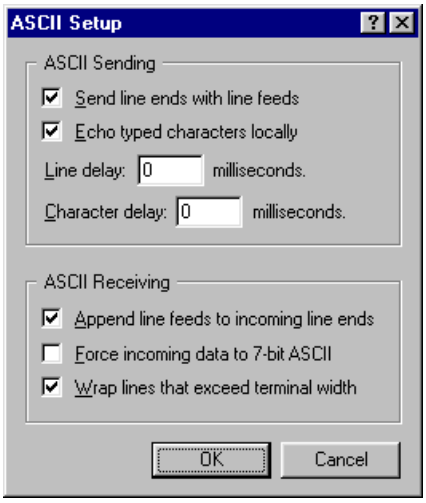


Fig. 7 RS-232 Communication Settings

4.2 USB Port Settings

To communicate with the unit through the USB port, a standard USB cable should be used to connect the computer USB port (USB Type A connector) to the unit (USB Type B connector). If the USB cable is installed, the unit will communicate through the USB port and the RS-232 port will be automatically disabled.

The unit supports the standard USB Communication Device Class (CDC), used to simulate RS-232 port using the USB hardware. Once the USB device is properly configured, a virtual COM port will be available through the USB device. So the PC application will be the same one as for the RS-232 option. The USB CDC driver is included in Windows 2000, XP and Vista.

Once the unit is powered on and the USB cable is connected properly, a new device detection wizard will appear in Windows, the first time the USB device is detected.

Fig. 8

Point the wizard to the folder where the info file ***mpbcusbcdc64bit.inf*** is located.

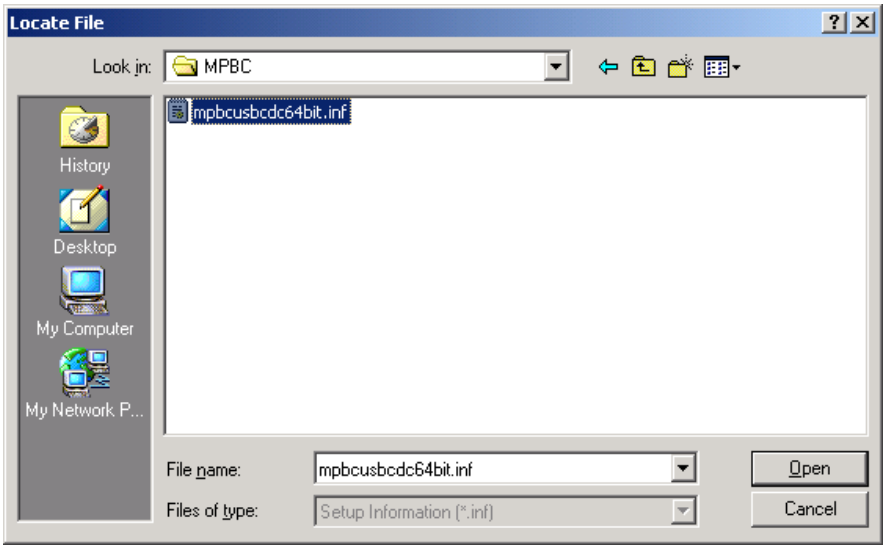


Fig. 9

For older Windows 32-bit systems, you may also use ***mpbcusbcdc.inf***.

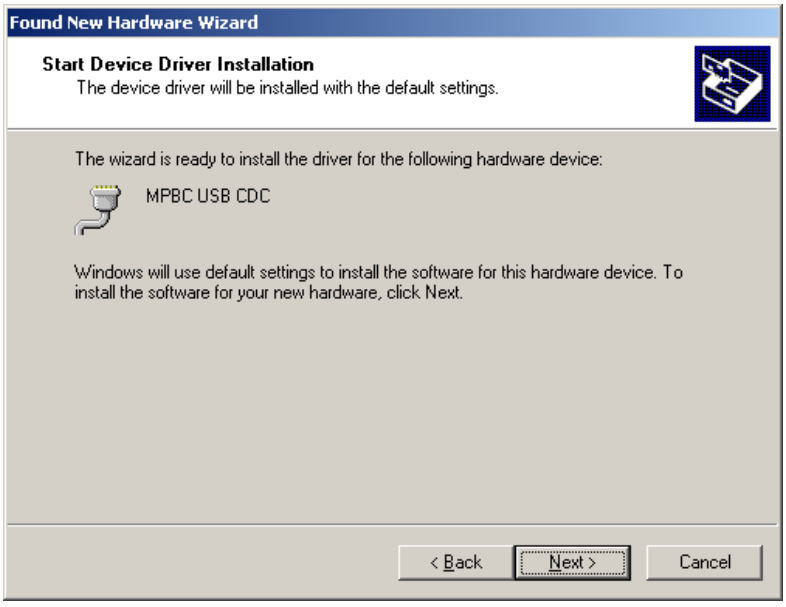


Fig. 10

Then check in the Device Manager utility, that the unit is enumerated as a **MPB USB CDC** COM Port.

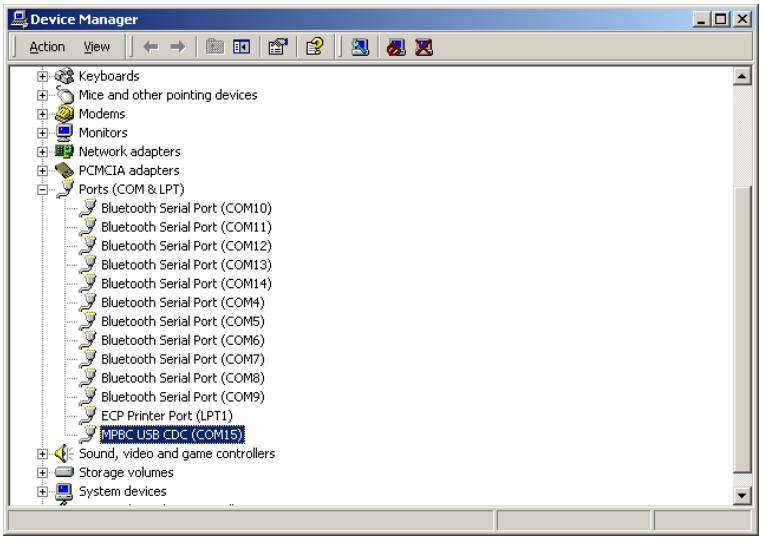


Fig. 11

Then you can select this COM port in the GUI application to communicate with the unit.

4.3 List of Commands

All commands shall be completed with <CR> symbol. Some commands require decimal (integer or floating point) parameter. If a command is received and executed successfully, then a requested value will be returned (if any) and a new command line is promoted to enter with “D >”. If the unit is not able to interpret the command properly, or parameter sent is out of range, or other conditions were not met and command can’t be executed, an error message is returned. Then the command prompt will be changed to “F >”.

MNEMONIC	NAME	ACTION	CONDITIONS	NOTES
Enable / Disable Commands				
setLDenable 1	Enable the laser	1 - turn the laser On	TEC temperature is within range.	None
setLDenable 0	Disable the laser	0 - turn the laser Off	None	The Laser is turned off. The white LASER LED is OFF.
getLDenable	Get laser software enable flag value	Return laser software enable flag value [0:Disable, 1:Enable]	None	None
Powerenable 0/1	Disable/enable power stabilization mode	0 – disable automatic power control (APC) mode, enable automatic current control (ACC) mode 1 – enable APC mode	None	None

Getpowerenable	Return mode of operation	Return the mode of operation: 0 – ACC mode 1 – APC mode	None	None
Measurements and Control				
getLDcur 1	Get LD current	Return laser diode current setpoint in mA	None	None
setLDcur 1	Set LD current	Set laser diode current setpoint in mA	None	None
LDcurrent 1	LD current	Return monitored pump LD current in mA	None	None
LDtemp 1	LD temperature	Return monitored LD temperature in °C	None	None
Setpower 0 XXX	Set output power	Set laser output power setpoint in mW	None	None
Getpower 0	Get set power	Return laser output power setpoint in mW	None	None
Power 0	Power	Return monitored laser output power in mW	None	None
SHGtemp	Get SHG sensor monitored temperature	Return SHG sensor monitored temperature in °C	None	None
SaveALL	Save All Settings	Save All actual settings in the non-volatile memory to be reloaded automatically after laser power-up	None	None
GETALR	Get alarms	1: SHG Temperature, flag [0, 1] 2: TEC Temperature, flag [0, 1] 3: Pump Bias, flag [0,1] 4: Loss of Output, flag [0, 1] 5:Case Temperature, flag[0,1]	None	None
GETFLT	Get faults	1: SHG temperature, flag [0, 1] 2: Tec temperature, flag [0, 1] 3: Laser diode current, flag [0, 1] 4: Watchdog timeout, flag [0, 1] 5: Case temperature, flag [0, 1]	None	None
GETMODEL	Get laser model number	1: Model, string	None	None
GETSN	Get laser serial number	1: Serial #, string	None	None
GETTIMEOP	Get Time of Operation of laser head	1: # of Hours, integer [0..11930046] 2: # of seconds, integer [0..3599] 3: # of msec, integer [0.999]	None	None

Table 2 List of Commands

5.0. MAINTENANCE

5.1 Protecting the output window

The laser output is provided through a window on the aperture, which also serves to prevent dust from entering the second harmonic generator.

Do not use the laser in a dusty environment to prevent dust from accumulating on the output window. When the laser is not in use, protect the output window with a piece of tape, as is done when the laser is shipped, to prevent accumulation of dust.

DO NOT attempt to clean the output window. Contact MPB Communications' customer service.

5.2 SHG Maintenance

The Second Harmonic Generation crystal is mounted on a TEC and temperature stabilized to offer optimum conversion efficiency and helps reduce the operation current of the pumping laser diodes. After initial annealing, the crystal temperature has been factory set to optimum prior to shipment. The optimum temperature can vary slightly as the laser accumulates hours of operation especially during the first thousand hours of the laser. MPBC recommends a retuning of the SHG after 200 hours, 500 hours, 1000 hours and every 1000 hours of laser operation thereafter.

A manual tuning in current mode can be done through the GUI as described in section 3.5 of this manual. An automatic tuning in power mode can be done through the GUI as described in section 3.6. For more details about automatic tuning, see the DOC-04384 VFL Firmware and Serial Interface provided on the user's CD.

5.3 Calibration / Repairs

No calibration and/or repairs should be done on the VFL-series lasers others than the one described in this manual. If the performance of the laser is not optimal, contact MPB Communications' customer service. The covers of this unit have been sealed prior to shipment. Users are not permitted access inside the laser enclosure.

5.4 Cleaning

The external surfaces (housing and front panel) can be cleaned when needed.

To clean the instrument:

1. Make sure the instrument is turned OFF and the power cord is disconnected.
2. Clean the housing and the front panel with a soft dry cloth.

Caution
Do not clean the instrument with a water jet, spray can, or spray bottle. Liquid could seep in and damage the instrument, or the connector contacts could stay wet and produce a short circuit when plugging cables.

DO NOT clean the optical output window.

6.0. WARRANTY

6.1 General Information

MPB Communications Inc. (MPBC) warrants this equipment against defects in material and workmanship for a period of one year from the date of original shipment. MPBC also warrants that this equipment will meet applicable specifications under normal use.

During the warranty period, MPBC will, at its discretion, repair, replace, or issue credit for any defective product. This warranty also covers recalibration for one year if the equipment is repaired or if the original calibration is erroneous.

IMPORTANT

The warranty can become null and void if:

- ***the equipment has been tampered with, repaired, or worked upon by unauthorized individuals or non-MPBC personnel,***
- ***the warranty stickers have been removed,***
- ***the equipment serial number has been altered, erased or removed,***
- ***the equipment has been misused, neglected, or damaged by accident.***

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED, IMPLIED OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MPBC BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES.

6.2 Liability

MPBC shall not be liable for damages resulting from the use of the purchased product, nor shall be responsible for any failure in the performance of other items to which the purchased product is connected or the operation of any system of which the purchased product may be a part.

6.3 Exclusions

MPBC reserves the right to make changes in the design or construction of any of its products at any time without incurring any obligation to make changes whatsoever on units purchased. Accessories, including but not limited to power cords and interlock connectors used with MPBC's products are not covered by this warranty.

6.4 Certification

MPBC certifies that this equipment met its published specifications at the time of shipment from the factory.

6.5 Service and Repairs

To obtain service or repair for any equipment, follow the procedure below.

1. Call MPBC Sales and Marketing Group. Support personnel will determine if the equipment requires service, repair, or calibration.

2. If the equipment must be returned to MPBC, support personnel will issue a Return Merchandise Authorization (RMA), an address for return and shipping instructions.

3. Pack the equipment in its original shipping material. Be sure to include a statement or report fully detailing the defect and the conditions under which it was observed.

IMPORTANT

4. Return the equipment, prepaid, to the address given by the support personnel. Be sure to write the RMA on the shipping slip. MPBC will refuse and return any package, which does not bear an RMA.

   Note: *A test setup fee will apply to any returned unit, which after test, is found to meet the applicable specifications.*

5. After repair, the equipment will be returned with a repair report. If the equipment is not under warranty, the customer will be invoiced for the cost appearing on this report. The customer will pay return-shipping costs for equipment under warranty. However, shipping insurance is at the customer's expense.

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