



## MFPM 20H-D MOPA Pulsed Fiber Laser

# USER GUIDE

# Copyright Notation

Copyright © Maxphotonics Co., Ltd (hereinafter referred to as Maxphotonics). All rights reserved. You may not copy, adapt, transmit or publish this publication, in any form, in any media or by any means, without the prior written permission of Maxphotonics, except as allowed under applicable copyright laws. Permitted copies shall bear the same copyright and proprietary notices that were contained on the original version.

All information contained in this document is subject to change and revision without notice. Maxphotonics believes that the information provided is accurate and reliable; however Maxphotonics makes no warranty, representation, expression or implication that this document can be used as reference in other occasions. Furthermore, Maxphotonics does not assume responsibility for any infringement of patents or other rights of third parties due to use of the information contained in this document. Maxphotonics shall not be liable for indirect or direct damages of relevant equipment as a result of usage of this document.

Maxphotonics grants no rights for patent or other intellectual property mentioned herein.

Maxphotonics and the Maxphotonics Logo are registered trademarks of Maxphotonics Co., Ltd., and the Logo does not break any regulations of Trademark law.



## **Maxphotonics Co.,Ltd.**

Address: Maxphotonics Industrial Park, 3rd Furong Road,  
Furong Industrial Area, Shajing, Baoan, Shenzhen, China.518125

E-Mail: [info@maxphotonics.com](mailto:info@maxphotonics.com)

<http://en.maxphotonics.com>

Subject to change without notice. © Maxphotonics Co., Ltd.

## Preface

Thank you for using the MFPM 20H-D Series MOPA Pulsed Fiber Laser. We compile this document for you in order that the laser is used and maintained properly. Due to the limited level of the writers, coupled with time constraints, there may be some careless mistakes in this document, and your understanding will be much appreciated. Thank you again for using Maxphotonics' products.

Please take time to read and understand this User's Guide and familiarize yourself with the operating and maintenance instructions before you use the product. We strongly recommend that the operator read the Section titled "Safety Information" prior to operating the product.

This User's Guide should stay with the product to provide you and all future users and owners of the product with important operating, safety and other information.

We identify the parts to which you need to pay special attention in the document with underscore. Please notice those information to avoid the unnecessary damages.

## Company Profile

As a large laser manufacturer founded in 2004, Maxphotonics Co., Ltd. specializes in research and development, production and sales of lasers and ancillary products. Maxphotonics owns a number of independent intellectual property rights and patents as well as high-power pulsed fiber laser, high-power fiber laser and high-power fiber amplifier etc.

So far, with intellectual property rights and patents, Maxphotonics owns industrial pulsed fiber laser series, fiber laser for scientific researches, tunable fiber laser, fiber amplifier, ASE light source, etc. Those products are widely applied to fields of laser marking, DTS system and scientific research.

Maxphotonics offers laser, relevant solution and ancillary facility to domestic and foreign customers. We adhere to the enterprise mission statement of "Maxphotonics leads the industry", take customer satisfaction as the start point, completely implement ISO9001 quality management system, introduce ERP information management system and provide all-round pre-sales and after-sales service for customers.

Relying on excellent ability of product design and development, we carry out all-round exchanges and cooperation with international famous laser companies and various research institutions of China, continuously increase the investment of science research, constantly update diversification of production types, lead the trend of the industry and create maximum value for customers, so as to strive perseveringly for the world-class laser manufactures and forge ahead.

|  |           |
|--|-----------|
| <b>Chapter 1 Characteristic Description .....</b>    | <b>5</b>  |
| <b>Chapter 2 General Safety Information .....</b>    | <b>6</b>  |
| 1–Safety Conventions .....                           | 6         |
| 2–Laser Protection .....                             | 7         |
| 3– General Safety Instructions.....                  | 8         |
| 4–Additional Safety Information .....                | 12        |
| <b>Chapter 3 Product Description .....</b>           | <b>13</b> |
| 1–Property Introductions .....                       | 13        |
| 2–Laser Model Designation Codes .....                | 14        |
| 3–Certification .....                                | 14        |
| <b>Chapter 4 Specification .....</b>                 | <b>15</b> |
| 1–Optical Characteristic Parameters.....             | 15        |
| 2–General Characteristic Parameters .....            | 16        |
| 3–Structural Layout .....                            | 17        |
| <b>Chapter 5 Operation Guide .....</b>               | <b>18</b> |
| 1–Electrical Power Connection .....                  | 18        |
| 2–Control Connector Pin Assignment, DB–25 plug ..... | 20        |

|   |           |
|---|-----------|
| 3-Laser Operation using Digital Interface ..... | 26        |
| 4-Cut-off Power Frequency .....                 | 29        |
| 5-Pulse Adjustment .....                        | 31        |
| <b>Chapter 6 Common Fault Treatment .....</b>   | <b>32</b> |
| 1-Laser Emission Failure .....                  | 32        |
| 2-Power Drops .....                             | 32        |
| <b>Chapter 7 Service and Maintenance .....</b>  | <b>34</b> |
| 1-Maintenance Notes .....                       | 34        |
| 2-Service Statement .....                       | 35        |
| <b>Chapter 8 Warranty Statements.....</b>       | <b>36</b> |
| 1-General Clause.....                           | 36        |
| 2-Warranty Limitations .....                    | 36        |

# Chapter 1

## Characteristic Description

The MFPM 20H-D (MOPA Pulsed Fiber Lasers) Series products are characterized by high reliability and high performance with the central emission wavelength of 1060nm. They are high-effecient, air-cooled and maintenance-free, which make them ideal tools for industrial laser marking, engraving etc..

Maxphotonics' MFPM 20H-D (MOPA Pulsed Fiber Lasers) Series are Class 4 laser products and are designed and tested with safety. By following this User Guide and applying sound laser safety practices, it will be a safe and reliable device.

Laser light exhibits unique characteristics that may pose safety hazards. Therefore, the laser light can't be treated as normal light sources, and all operators and people near the laser must be aware of these special hazards.

In order to ensure the safe operation and optimal performance of the product, please follow all warnings and safety instructions in this guide during process of operation, maintenance and service.




For ensuring the safety of operators, operators are urged not to open the equipment privately at all times. There are no user serviceable parts, equipment or assemblies associated with this product. Lasers of unauthorized disassembly shall not be subject to warranty

## Chapter 2

# General Safety Information

### 1–Safety Conventions

All safety warning symbols during operating process of the laser include:

| SYMBOLS   | DESCRIPTION  |
|---|--|
|    | <p><b>WARNING :</b><br/>Refer to a potential Electrical Hazard to human body; It requires certain procedures; otherwise, it may result in bodily harm to you and/or others. In order to ensure the personal safety of operators, do not violate the requirement of the WARNING sign.</p> |
|   | <p><b>CAUTION :</b><br/>Refers to a potential hazard on product. It requires certain procedure that, if not correctly followed, may result in damage to the product or components. In order to ensure normal use of equipment, do not violate the requirement of the CAUTION sign.</p>   |
|  | <p><b>WARNING :</b><br/>Refers to a potential Laser Hazard.<br/>The symbol represents laser radiation. The symbol is pasted on laser output end.</p>   |
| NO SYMBOL   | <p><b>IMPORTANT :</b><br/>Refers to any information regarding the operation of the product. Please do not overlook this information.</p>   |



**NOTE :**

◎ This device is classified as a high power Class IV laser instrument which emits light with the wavelength of 1060nm and the optical output power is up to 20W. This level of light may cause damage to the eye and skin. Despite the radiation being invisible, the beam may cause irreversible damage to the retina. Laser safety eyewear is not provided with this instrument, but must be worn at all times while the laser is operational. Use appropriate laser safety eyewear when operating this device. The manufacturer of the laser system is responsible for the safety compliance according to the applicable standards and regulations.

## **2-Laser Protection**

### **1.Laser Protection Requirements**

You must wear the safety protective glasses while operating the laser, and rationally select the safety protective glasses according to the lasing wavelength of the laser. If the device is a tunable laser or Raman product, it emits light over a range of wavelengths and the end user should confirm the laser safety eyewear used protects against light emitted by the device over its entire range of wavelength.

### **2.Laser Protective Equipment Suppliers**

Maxphotonics recommends material or equipments provided by following laser protective equipment suppliers for you, including LaserVision USA, Kentek Corporation, Rochwell Laser Industries, etc. All the supplier information is provided by Maxphotonics only for the convenience to use, so Maxphotonics assumes no responsibility for any problem caused by using the products of abovementioned suppliers.

## 3-General Safety Instructions

In order to ensure the safe operation and optimal performance of the product, please follow these warnings and cautions in addition to the other information contained elsewhere in this document.

### 1.Specular Reflection

There are often numerous secondary laser beams produced at various angles in the output port of the laser. These divergent beams are produced when the primary beam of laser reflects off a smooth surface, and they are called specular reflections. Although these secondary beams may be less powerful than the total power emitted from the primary beam, the intensity may be great enough to cause damage to the eyes and skin as well as surface of materials.

WARNING:

⦿ You must exercise caution to avoid/minimize specular reflections as these laser radiations are invisible!

### 2.Safety Instructions of Accessories

WARNING:

⦿ This device has an output optical head connected to the laser with a fiber cable. Please be careful dealing with the output head.

### 3.Optical Operating Instructions

We strongly recommend that you read the following procedures before operating the laser:

- ( 1 ) Never look directly into the laser output port when the power is turned on.
- ( 2 ) Avoid positioning the laser and all optical output components at eye level.
- ( 3 ) Ensure that all personal protective equipment is suitable for the output power and wavelength range of the laser.

( 4 ) Do not install or detach cutting heads or collimators when laser is active.

( 5 ) It is forbidden to turn on the laser during the mounting of fiber or cutting head. Carry out commissioning, calibration and focusing at low output power and then increase the output power gradually when the calibrating and focusing work is done.

( 6 ) Marking on highly reflective materials is feasible, but you must make the laser out of focus, or else you may damage the laser.

( 7 ) For collimated outputs, maintaining a clean output lens is essential. Always close (re-cap) the collimator after use. Do not touch the output lens and do not clean it with any solvents. Cleaning with the special solvent and cleaning buds is allowed as described later on in this manual.

**WARNING :**

⊙ Make sure that the individual protective equipment meets the output power and wavelength range of the laser.

⊙ Never look directly into the optical fiber or the collimator, and use appropriate laser safety eyewear when operating this device.

⊙ Optical damage may result from failure to comply with the above instructions. Such damage is not covered by the warranty.

**WARNING :**

⊙ Use of controls or adjustments or performance of procedures other than those set forth in this User's Guide and related documents may result in hazardous radiation exposure.

## **4. Electrical Operating Instructions**

MFPM 20H-D Laser module supply voltage: 24VDC.

| Cable Colour | Supply |
|--------------|--------|
| BROWN        | +24VDC |
| BLUE         | GND    |
| YELLOW-GREEN | SHELL  |

**WARNING :**

- ⦿ Make sure the shell of this equipment is properly grounded. Any interruption of the ground loop may result in personal injury.
- ⦿ Make sure that the input DC voltage of the laser is the voltage of the normal DC mains, and wires are connected accurately. Any incorrect wiring method may cause damage to people or instrument.
- ⦿ Before supplying the power to the device, make sure that the correct voltage of the DC power source is used. Failure to use the correct voltage could cause damage to the device.
- ⦿ No operator serviceable parts inside. Refer all servicing to qualified Maxphotonics personnel.
- ⦿ To prevent short circuit, do not remove shell, detach the laser without permission and damage the relevant signs. Any product with unauthorized dismounting shall not be subject to warranty.

## 5.Environment Conditions and Precautions

We strongly recommend that you read the following procedures before operating the laser :

- ( 1 ) Do not expose the laser to a high moisture/high temperature environment. Install the laser in the cabinet with the function of temperature-humidity control and dust-free
- ( 2 ) Laser Module has at least three fans at the rear panel for active cooling. Make sure that there is at least 5cm between fan protector and external objects, and with sufficient airflow to cool the device.

( 3 ) Before switching on the device make sure that environmental temperature and humidity are within a specified range.

WARNING :

© Optical damage may result from failure to comply with the above instructions. Such damage is not covered by the warranty.

## 6.Routine Maintenance

( 1 ) Avoid the impact on the shipper rod of worktable when the laser is working.

( 2 ) The laser and optical lens are fragile, please handle with care.

( 3 ) Stop running once device failure, and provide professional treatment.



( 4 ) Please follow a set sequence of on-off.

( 5 ) The limitation on surface of marking machine is within the working area.

( 6 ) Keep the device clean and indoor.

## 7.Safety Labels and Labeling Locations

The following shows the pictures of tags and their positions on the product :

| Pictures of label   | Label name     | Label location |
|---|----------------|----------------|
|  | Light Emission | Top Cover      |
|  | CAUTION        | Top Cover      |

## 4-Additional Safety Information

**For additional information regarding Laser Safety, please refer to the list below :**

Laser Institute of America(LIA)

13501 Ingenuity Drive, Suite 128

Orlando,Florida 32826

Phone:407 380 1553,Fax: 407 380 5588

Toll Free:1 800 34 LASER

American National Standards Institute

ANSI Z136.1, American National Standard for the Safe Use of Lasers

(Available through LIA)

International Electro-technical Commission

IEC 60825-1,Edition 1.2

Center for Devices and Radiological Health

21 CFR 1040.10 – Performance Standards for Light-Emitting Products

US Department of Labor – OSHA

Publication 8-1.7 – Guidelines for Laser Safety and Hazard Assessment.

Laser Safety Equipment

Laurin Publishing

Laser safety equipment and Buyer's Guides

## Chapter 3

### Product Description

#### 1-Property Introductions

The MFPM (MOPFA Pulsed Fiber Lasers) Series products adopt Q-Switched main oscillator, MFPM structure with a compact and rugged package. It's easy to operate and maintenance-free, and can be directly integrated into the laser equipment. The emission wavelength is around 1060nm and the peak power is up to 10KW. The operating parameters of the fiber laser are entered through 25pin control interface. After matching customer's special controller, it can be used as handheld laser.

#### Features:

- ( 1 ) Short optical pulses, high peak power, a wide range of PRR.
- ( 2 ) Superior reliability, long service life
- ( 3 ) No shadow or virtual open circuit phenomenon when processing on special materials
- ( 4 ) Universal DB 25 Pin Interface

#### Application:

- ( 1 ) Industrial applications
- ( 2 ) Scientific research

2-Laser Model Designation Codes

| Model      | Model Coding Rules  |
|------------|---|
| MFPM-20H-D | Maxphotonics 20W High Performance MOPA Pulsed Fiber Laser |

3-Certification

Maxphotonics guarantee that this equipment has been thoroughly tested and inspected and meets published specifications prior to shipping. Upon receiving your equipment, check whether the packaging and accessories have been damaged in transit. If damage is apparent, please contact Maxphotonics immediately..



## Chapter 4

### Specification

#### 1-Optical Characteristic Parameters

| Characteristics                    | Test conditions           | Min. | Nom. | Max. | Unit |
|------------------------------------|---------------------------|------|------|------|------|
| Mode                               | Pulse                     |      |      |      |      |
| Polarization                       | Random                    |      |      |      |      |
| Beam Quality $M^2$                 | $P_{out}=P_{nom}$         |      | 1.2  | 1.45 |      |
| Center Wavelength                  | $P_{out}=P_{nom}$         | 1060 | 1064 | 1070 | nm   |
| Spectrum Width(3dB)                | $P_{out}=P_{nom}$         |      | 8    | 15   | nm   |
| Average Optical Power( $P_{nom}$ ) |                           | 19.5 | 20   | 20.5 | W    |
| Power Range                        |                           | 10   |      | 100  | %    |
| Max. Pulse Energy                  | 350ns/30KHz               |      |      | 0.66 | mJ   |
| Pulse Width Range                  |                           | 2    |      | 350  | ns   |
| Optical Pulse Width(FWHM)          | 350ns/30KHz               |      |      | 85   | ns   |
| Pulse Repetition Frequency (PRF.)  | For Pulse Width 2-40ns    | 1    |      | 2000 | KHz  |
|                                    | For Pulse Width 50-80ns   | 1    |      | 1000 | KHz  |
|                                    | For Pulse Width 100-200ns | 1    |      | 400  | KHz  |
|                                    | For Pulse Width 250-350ns | 1    |      | 200  | KHz  |
| PRF. Range Under Full Power        |                           | 30   |      | 2000 | KHz  |
| Output Power Stability             | $P_{out}=P_{nom}$         |      |      | 5    | %    |
| Beam Diameter                      | 1/e <sup>2</sup>          | 6    | 7    | 9    | mm   |
| Beam Ellipticity                   |                           | 90   |      |      | %    |
| Delivery Cable Length              |                           | 1.9  | 2.5  | 3    | M    |

|                     |                       |  |  |     |    |
|---------------------|-----------------------|--|--|-----|----|
| Laser startup Time  | Pout=Pnom,<br>10%~90% |  |  | 300 | us |
| Laser Shutdown Time | Pout=Pnom,<br>90%~10% |  |  | 200 | us |

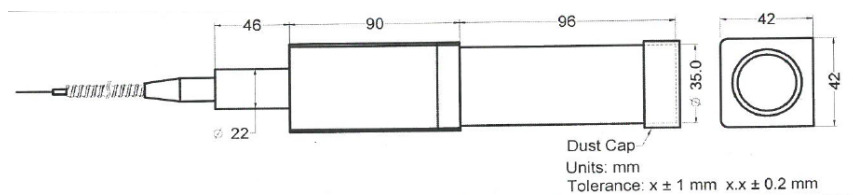
◎ Note: Beam Diameter and Delivery Cable Length can be customized against User's specific demand.

2-General Characteristic Parameters

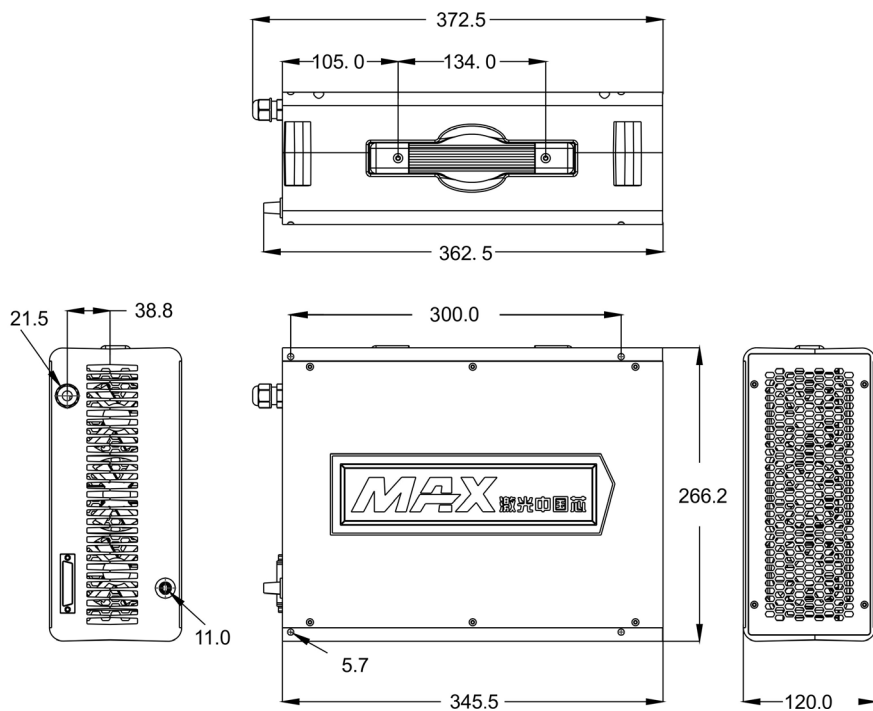
| No. | Characteristics                | Test conditions     | Min. | Nom. | Max. | Unit |
|-----|--------------------------------|---------------------|------|------|------|------|
| 1   | Operating Environment Tem.     |                     | 0    |      | 40   | ℃    |
| 2   | Storage Tem.                   |                     | -10  |      | 60   | ℃    |
| 3   | Cooling Method                 | Air-cooling         |      |      |      |      |
| 4   | Warm Up Time                   | Operate             |      |      | 1    | min  |
|     |                                | Stable              |      |      | 10   |      |
| 5   | Operating Environment humidity |                     | 10   |      | 95   | %    |
| 6   | Dimensions                     | 264*120*348         |      |      |      | mm   |
| 7   | Weight                         |                     |      | 11   |      | kg   |
| 8   | Power Supply                   |                     | 23   | 24   | 25   | VDC  |
| 9   | Power Consumption              | Pout=Pnom,<br>T=20℃ |      | 90   | 120  | W    |

### 3 -Structural Layout

Standard isolated output head dimensions: ( Unit: mm )



Laser module dimensions: ( Unit: mm )



# Chapter 5

## Operation Guide

Packing List :

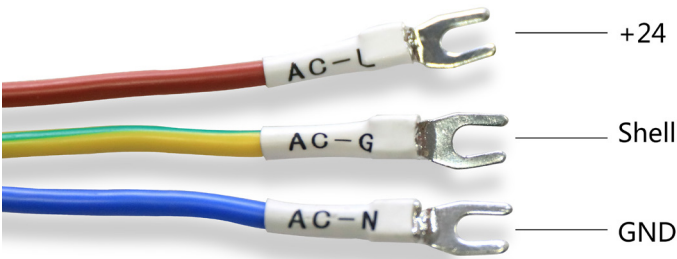
| Contents                          | Quantity |
|-----------------------------------|----------|
| User Guide+ Qualified Test Result | 1        |
| Power Wire (Optional)             | 1        |

CAUTION :

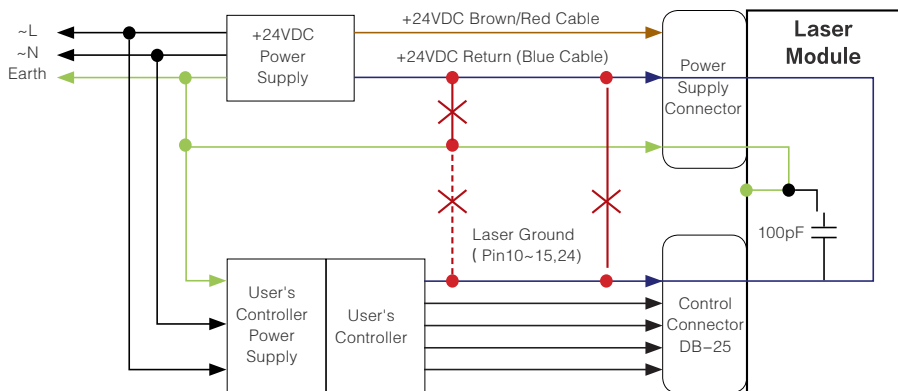
◎ If any damage of the external package and internal parts has been found upon receipt of product, please contact Maxphotonics Co., Ltd. or designated agent immediately.

### 1-Electrical Power Connection

Power wire



## Recommend Electric Circuit Diagram



## Note:

◎ Main power supply (24VDC) should be capable to permanently supply operating current (refer to the maximum current consumption in the laser specification) and supply peak current 50% higher for short periods up to 250us. Typical models of the laser consume less than 8A current, consequently peak current consumption for such models is less than 12A.

◎ Power supply should hold the voltage, measured on the laser cable leads, within a specified range (refer to the laser model specification) both for the steady and for the peak current consumptions. Supply voltage undershoots and overshoots out of the specified range may lead to an unstable laser operation. Power supply transient load regulation should be carefully investigated to choose a suitable power supply model.

◎ Wires in the cable connecting main power supply and the laser supply cable should have appropriate length and cross section to ensure negligible voltage drop (especially for the peak current consumption).

◎ The main 24VDC supply should have floating outputs. Its return wire should be connected only to the laser 24VDC return terminal (BLUE CABLE). Wrong connections, which may create current loops should be avoided.

- Laser GND (DB-25 pin 10-15,24) and laser 24VDC return (BLUE CABLE) are connected inside the laser module. No connections are allowed between these terminals outside of the laser module.
- Inside the module the common ground is connected to the laser housing via 470 Ohm resistor and parallel 47nF capacitor. This network is utilized to balance the differential pressure between GND and the laser shell.
- User controller electronics ground may be connected to the earth by design (dashed red line on the diagram). If there is no such connection, it should not be intentionally made.

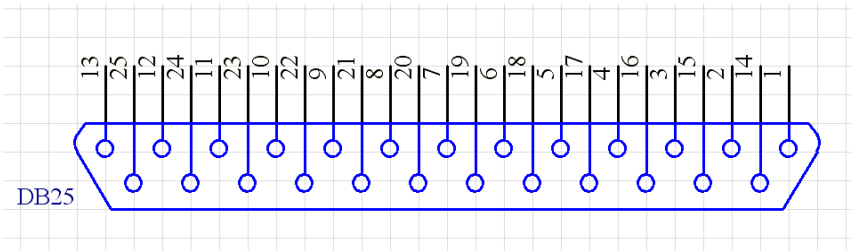
## 2–Control Connector Pin Assignment, DB–25 Plug

### 1.Pin Function

All control pins are TTL compatible, unless otherwise noted in the pin description. For the interface designs level ranges of the TTL standard should be taken into consideration.

| Pin#          | Description  |
|---------------|--|
| 1–8 ( D0–D7 ) | 1.Power setting (16–bit bus. 0–FFh in hexadecimal or 0–255 in decimal formats).<br>2.Least significant bit (lsb) (D0) corresponds to Pin number 1, Most significant bit (msb) (D7) corresponds to pin 8. |
|               | – 00h(0): Minimum output power   |
|               | – FFh(255): Maximum output power   |
|               | – Disconnected corresponds to 00h.<br>2. PWM (pulse–width modulation)Communication interface Control Bus is DB25.22,Refer to –5.5 Pulse duration Set<br>D1: Data Bus<br>D2: Timing Bus<br>Other reserves |

|                |   |
|----------------|---|
| 9              | Latch(Latches power setting into the laser by the rising edge)  |
| 14,15          | Ground  |
| 24, 25         | Floating  |
| 11, 12, 16, 21 | Laser alarms (see alarm codes in the table below).  |
| 17             | +5 ± 0.25VDC power supply input for pin   |
| 16, 21         | Laser alarms status (see alarm codes in the table below).   |
| 18             | Master Oscillator(MO) signal  |
|                | HIGH: MO on   |
|                | LOW or disconnected: MO off   |
| 19             | Booster signal (ON/OFF input)   |
|                | HIGH: Booster on  |
|                | LOW or disconnected: Booster off  |
| 20             | Pulse Repetition Rate (Synchronization) input   |
| 22             | Guide Laser (red diode) ON/OFF input  |
|                | HIGH: Red diode ON  |
|                | LOW or disconnected: Red diode OFF  |
|                | 2.PWM (pulse-width modulation)Communication interface, Control Bus, data timing bus refer to -5.5 Pulse duration Set. |
|                | High: OFF   |
| 23             | Emergency Stop Input  |
|                | High: OK (Normal operation)   |
|                | LOW or disconnected: STOP   |



### 2.Digital Control Interface (DB–25) Function Description

( 1 ) The laser is controlled via signals applied to the DB–25 connector. Please refer to the connector interface description table above for 5.2.1 pin designation and operating levels.

( 2 ) Pins 1 to 8 are the 8 bit bus for the output power setting. Pin 1 is the least significant bit and pin 8 is the most significant bit. Codes in the range 0...255 (0...FFh) should be applied to these pins, which correspond to the power setting of 0...100% of the specified nominal value, such as:

|         | Setting 1 | Setting 2 | Setting 3 | Setting 4 |
|---------|-----------|-----------|-----------|-----------|
| Pin 1   | 0         | 0         | 0         | 0         |
| Pin 2   | 0         | 0         | 0         | 0         |
| Pin 3   | 0         | 0         | 0         | 0         |
| Pin 4   | 0         | 0         | 0         | 0         |
| Pin 5   | 0         | 0         | 0         | 1         |
| Pin 6   | 0         | 0         | 1         | 1         |
| Pin 7   | 0         | 1         | 1         | 1         |
| Pin 8   | 1         | 1         | 1         | 1         |
| Current | 50%       | 75%       | 87.5%     | 93.75%    |



(3) Pin 9 is the “Latch” control line to store power settings (pin1–8) into the laser. The data is stored to the laser by the rising edge of the signal on the pin 9. Data on the pins 1–8 should be stable for 1us before and 1us after the rising edge on pin 9. Stability of the data on the Pin 1–9 out of the above mentioned time frames is not required. Maxphotonics recommends supplying single positive pulse with duration longer than 2us to latch the data into the laser. Time interval between adjacent latching pulses should be longer than 100us (latching frequency less than 10kHz).

(4) Pins 11, 12, 16 and 21 are the alarm and status outputs. Pin 11 and 12 is reserved for future alarm codes expansion. These pins indicate the following device states:

| Pin12 | Pin11 | Pin16 | Pin21 | Alarm description  |
|-------|-------|-------|-------|--|
| X     | X     | L     | L     | Temperature alarm Laser temperature is beyond the operating temperature range. |
| X     | X     | H     | L     | PD Alarm   |
| X     | X     | L     | H     | Normal Operation   |
| X     | X     | H     | H     | PD Alarm   |

#### CAUTION:

☉ In the case of any alarm the laser will be automatically switched OFF and sets internal Alarm flag. To continue operation after alarm event the internal Alarm flag should be reset. To reset Alarm flag pin 18 and 19 should be set to LOW. Alarm outputs (pins 11, 12, 16 and 21) will be recovered to the normal state simultaneously with the reset of Alarm flag signal (except Back Reflection alarm).

☉ Back reflection alarm: Alarm flag may be dropped when at least one second passes after the alarm activation. If reset was done earlier, the flag will be dropped when 1 second passes after alarm activation.

☉ Laser is not ready for emission state: Laser is not ready to emit power. That may be a result of Emergency Stop and Guide Laser activation without following reset or external power supply voltage out of specified range.

( 5 ) Pin 18 is the Emission Enable (EE) signal. The Emission Enable input should be switched ON at least 5ms earlier than the Emission signal is switched ON. After switching ON Emission Enable input, the laser starts to consume more electrical power and emits residual optical power to the output even when EM pin 19 is LOW (Emission). The optical power value depends on the laser model and the operating model. High contrast option ensures low residual optical power.

CAUTION :

⦿ The EE switches ON simultaneously with the rising edge on the pin 18. If the HIGH level was applied to the pin 18 before supplying electrical power to PCB, the laser does not recognize that EE has ON state. In order to enable emission the pin 18 (EE) should be dropped and set to HIGH level again after completing of warm-up phase. If the pin 19 (EM) was also in the HIGH state before supplying power to PCB it should be also dropped to the LOW state at the same time.

( 6 ) Pin 19 is the Emission Modulation (EM) control input. Use pin 10 (modulation return) as the return wire for this signal. Apply HIGH to switch ON the Emission and LOW to switch it OFF. The laser starts to emit optical power within specified delay after setting the pin 19 to the HIGH level and stops emitting with specified delay after being set to the LOW level. Refer to the laser optical specification for the laser average power rise and fall times. Modulation with a period shorter than sum of the rise and fall times (the laser response time) may lead to the inadequate laser power behavior and optical over/undershoot.

CAUTION:

⦿ The EE input should be switched ON at least 5ms earlier than the Emission signal is switched ON. In case of switching ON EM while the EE is OFF, the laser does not start to emit. In case of switching ON the EM and later the EE, the laser starts to emit in less than 5ms after switching ON the EE.

⦿ Emission Modulation(EM) should be switches ON simultaneously with

rising edge on the pin19. If the HIGH level was applied to the pin 19 before supplying voltage to the PCB, the laser does not recognize that as the Emission switching ON signal. The pin 19 should be dropped and set to HIGH level again. If the pin 18 was also in the HIGH state before supplying voltage to the PCB it should be also dropped at the same time.

( 7 ) Pin 20 is the Synchronizing Frequency Input. Pulse train with a repetition rate (PRR) within a specified operating range should be applied to the pin 22 (refer to the optical specification for PRR limits). The laser emits pulses simultaneously with the rising edge of the signal. The square wave input signal with duty cycle from 0.1 to 0.9 is allowed. Variation of the duty cycle does not affect to the laser characteristics.

CAUTION :

◎ In case of the PRR supplied being out of the specified range (or no PRR signal supplied) the laser safety circuit substitutes missing pulses or limits the PRR.

( 8 ) Pin 22 is the guide laser (red diode/ pointer) control line. Apply HIGH to switch the guide laser ON and LOW to switch the guide laser OFF. If the guide laser option is not installed, pin 22 can either be connected to ground (pin14) or left floating.

CAUTION :

◎ The laser emission is not allowed simultaneously with the guide laser operation. MO and Booster are blocked internally during the guide laser operation. If the Emission Modulation (pin 19) or Emission Enable (pin18) is set to HIGH level during guide laser operation, the laser will not emit power, and will not start to emit it even after switching OFF the guide laser. It is necessary to drop both Emission Modulation (pin 19) and Emission.

◎ Enable (pin 18) prior to restarting the laser emission. Until the restarting is done the state “Laser is not ready for emission” will be active on appropriate alarm/status pins.

( 9 ) Pin 23 is the “Emergency stop” input. It should be set to HIGH for normal operation. In case of dropping this pin to LOW state (even for a short period) the laser automatically switches OFF (similar state when both EE and EM are OFF) independently of other control signals. It is necessary to drop both Pin 18 and Pin 19 prior to restarting the laser. Until the restarting is done state “Laser is not ready for emission” will be active on appropriate alarm/status pins. Pin 23 should be set to HIGH at least 2us before applying ON signals to EE and EM pins.

### 3-Laser Operation Using Digital Interface

#### 1 .Operation Steps

( 1 ) Remove the protection cap from the laser output optical head.

( 2 ) Connect the laser module to the control system via DB-25 connector. Use pins according to the description above. Refer to 5.2.2 Digital Control Interface (DB-25) Description.

( 3 ) Recommended initial state of control pins:

Pins 18,19,22    LOW

Pin 23            HIGH

Pin 20            With repetition rate within the specified range

( 4 ) Connect power supply sources to the laser as described above.

( 5 ) In 10 seconds after supplying +24V voltages (warm-up time) the laser is ready for operation.

CAUTION :

⦿ It is allowed to supply +24V or +5V Housekeeping voltage before initialization of the control signals.

( 6 ) Set desired power via pin 1-8. Apply the latch pulse to the pin 9 to store the power settings into the laser.

( 7 ) Switch the EE ON applying HIGH to the pin 18.

( 8 ) Wait 5ms.

( 9 ) Laser can be fast modulated via Pin 19 and the laser state of ON or OFF can be set with a HIGH or LOW input signal respectively. Switching ON/OFF of the laser has a finite rise/fall time (refer to the specification for the particular model). The time of the modulation should not be less than the sum of rise and fall times, otherwise laser optical response may not be as expected.

( 10 ) If the EM OFF time between subsequent ON/OFF batches (jobs) is more than 500ms, it is recommended to switch OFF the Emission Enable pin. This will reduce power consumption, avoid unnecessary aging of the laser and eliminate the residual MO power at the laser output.

( 11 ) After finishing the laser operation, switch OFF the EM and EE (set LOW to pin 19 and pin 18).

( 12 ) Remove all power supplies.

## 2 .Operation Features

( 1 ) PRR can be changed during laser operation with the adjustment of the signal frequency at the pin 20. The laser has its own internal frequency generator to ensure correct optical PRR for driving MO. The internal generator is a “slave” circuit and is controlled by the “master” pulses applied to the pin 20. Control circuit attempts to synchronize the frequency and phase of “slave” pulses with “master” pulses by an appropriate frequency tuning of internal generator. When synchronization pulses of a stable frequency within a specified range are applied to the pin 20, the laser synchronizes the frequency and phase of the optical pulses with the “master” pulses at the pin 20.

( 2 ) If the “master” PRR (pin 20) is higher than the maximum allowed PRR, the laser will operate at the maximum specified PRR. If the “master” PRR (pin 20) is lower than the minimum allowed PRR, the laser will

operate at the minimum specified PRR.

( 3 ) The power setting can be changed during the laser operation by applying updated values to pin 1–8 and latching them into the laser via pin 9. The laser will respond to the changes on the subsequent specified rise time.

( 4 ) If pins 18 and 19 are in LOW state, there is no laser radiation at the operating wavelength.

( 5 ) If the EE is ON, and the EM is OFF, there is a residual radiation at the laser output. The value depends on the laser model and the operating mode.

( 6 ) If the EE is ON and the EM is ON with the zero power set (all pins 1–8 were LOW during the latching of the power into the laser) there is a residual radiation at the laser output. The value depends on the laser model and the operating mode.

( 7 ) The red diode can be switched ON during laser operation (if the option is installed) via pin 22. The guide laser should be turned ON when the EE and EM pins are OFF. If either EE or EM is ON, the emission is automatically stopped. To restart the laser operation it is necessary to drop pins 18, 19 to LOW. Switching ON of EE and EM is available only when the pin 22 is LOW.

( 8 ) The optional red guide laser may be driven by either 24VDC or 5VDC.

( 9 ) Make sure that pin 22 is connected to the ground or left floating if the guide laser is not in use. Connection to the HIGH level disables laser emission.

( 10 ) The laser automatically switches OFF emission, if the module temperature is beyond the specified range. The alarm signal combination appears on the alarm pins 11, 12, 16 and 21. The laser will not resume the emission unless the alarm signals are restarted. With regard to devices with remote-controlled amplifiers, the alarm signal has something to do

with the temperature of the controlling head.

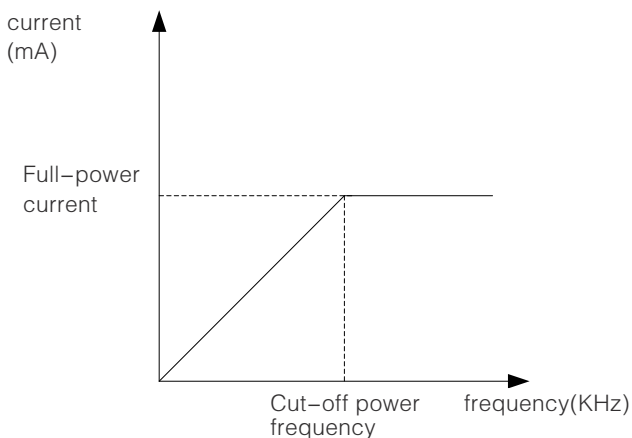
( 11 ) The laser has an internal back reflection sensor. It switches the emission OFF if there is enough reflected light which is potentially dangerous for the laser. The internal Alarm flags is set and the appropriate alarm signal combination appears on the alarm pins 11, 12, 16 and 21. The laser does not resume the emission and holds the alarm pins unchanged until the Alarm flag is reset. It is possible that the EE and EM are switched ON again in one second after the alarm was emerged.

( 12 ) If the temperature of the laser module exceed a specified value, +45 °C for example, the laser will be automatically switched OFF and the alarm signal will appear on pins 16 and 21. Even if the temperature drops back under +45 °C , the laser will not resume the emission and the alarm pins remain unchanged until the main power supply (24VDC) is turned off.

## 4-Cut-off Power Frequency

Recommend high speed galvanometer.

MFPT Series Cut-off Power Frequency



| Set Pulse Width ( ns ) | MFPT-20H-D |
|------------------------|------------|
| 2                      | 1000       |
| 4                      | 630        |
| 8                      | 500        |
| 10                     | 350        |
| 15                     | 200        |
| 20                     | 160        |
| 30                     | 120        |
| 40                     | 100        |
| 50                     | 85         |
| 60                     | 75         |
| 80                     | 68         |
| 100                    | 58         |
| 125                    | 54         |
| 135                    | 50         |
| 150                    | 48         |
| 160                    | 47         |
| 180                    | 46         |
| 200                    | 45         |
| 220                    | 42         |
| 250                    | 40         |
| 300                    | 35         |
| 350                    | 30         |

( 1 ) Set the pulse width, pulse repetition rate, and power according to different materials and marking purpose.

( 2 ) Cut-off power frequency : If the pulse frequency is lower than the cut-off power frequency the exact maximum output power will be also lower than that at the cut-off power frequency. But if the frequency is higher than the cut-off power frequency, the maximum output power is the same with that at the cut-off power frequency. For example, the maximum output power is 20W if the laser is set with 200ns/45KHz/100%, while the maximum output power is drop to 10W if the laser is set with 200ns/23KHz/100%, and the maximum output power is also 20W if the laser is set with 200ns/46KHz/100%.



## 5-Pulse Adjustment

### (1) Hardware parts configuration

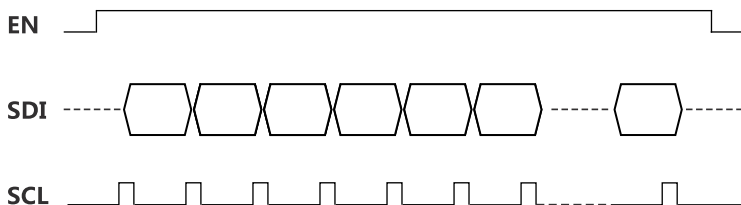
Pins standard-DB25, 25 pins. Pin 1 to Pin 25.

DB25-PIN2 – SDI

DB25-PIN3 – SCL

DB25-PIN22– EN

Hardware logic as below:



Sample the input data at the rising edge of SCL when EN is HIGH valid.

### (2) Protocol

High nibble first, pulse duration setting range is within 4BYTE, 32bit.

[HEAD] → [PULSEWIDTH]

2BYTE                      2BYTE

HEAD = 0x A501

PULSEWIDTH

Bytes sequence is as follows, 32bit is from high to low

10ns=0x A501000A, 32bit

## Chapter 6

# Common Fault Treatment

### 1-Laser Emission Failure

- ( 1 ) Make sure the connection of power supply is correct.(+24VDC and GND connect correctly? Earth the ground wire?)
- ( 2 ) Make sure the E-STOP switching is released, Emergency Stop Input is high when the laser is in normal operation.
- ( 3 ) Make sure the power supply is in normal condition, and check its output without and with load( connected with the laser).
- ( 4 ) Software set correctly.
- ( 5 ) Interface DB25 connect correctly under specified guide.
- ( 6 ) Normal Signals of Pins 18 and 19.
- ( 7 ) Normal signal and supply power of control card(please refer to 5.2 DB25 control interface pin function)

### 2-Power Drops

- ( 1 ) Check whether the power supply output steady, and the current is at its rated value.
- ( 2 ) For collimated outputs, maintaining a clean output lens is essential, Cleaning with lens tissue is allowable as required. Do not scratch the film layer.

( 3 ) Inspect whether other optical lens are clean, such as red light combiner, galvanometer, field lens.

( 4 ) Inspect whether optical output is covered or not and make sure the isolator output terminal and galvanometer are at grade when installing.

( 5 ) Power loss out of laser operation lasting 20,000 hours is normal phenomenon.

( 6 ) There may be breakage while marking result from signal interference or ground connection incorrectly. The leads of weak and strong current cannot be linked together or at the same side. Use the signal wire with shielded function.

( 7 ) Make sure the pulse duration, frequency are set within the specified range.

## Chapter 7

# Service and Maintenance

### 1-Maintenance Notes

#### CAUTION :

- ⦿ No operator serviceable parts inside. Refer all servicing to qualified Maxphotonics personnel.
- ⦿ For ensuring that the repairs or replacement within the warranty scope can be carried out, and perfectly maintaining your interests, please submit application to the Maxphotonics or the local representative after finding the faults. Upon receiving our authorization, you need to pack the product in a suitable package and return it.
- ⦿ You should keep the proof when finding any damage after receiving the product, so as to claim the rights to shippers.

#### IMPORTANT :

- ⦿ Do not send any product to Maxphotonics without RMA.
- ⦿ If the product is beyond the warranty period or the warranty scope, customers shall be responsible for the repairing cost.

#### CHANGE :

- ⦿ We have the rights to change any design or structure of our product, and the information is subject to change without notice.

## 2-Service Statement

More problems regarding the safety, set-up, operation or maintenance can be solved by carefully reading this "User Guide". Please call the Customer Service Department for other questions.

If your problems cannot be solved over the telephone with our technical support group, you may need to return the product to Maxphotonics for further troubleshooting.

## Chapter 8

# Warranty Statements

### 1-General Clause

Maxphotonics carries out warranty for any defect of the product caused by its material and production technology within the warranty period agreed in contract, and ensures that its product meet the relevant quality and specification requirements specified in the document under normal use condition.

Maxphotonics rationally determines to repair or replace the products with faults caused by its material or production technology within the warranty period, and repairs or replacement of all the products within the warranty scope are carried out according to the rest of the warranty period of primary products.

### 2-Warranty Limitations

Under the following circumstances, the products, parts (including the fiber connectors) or equipment are not within the warranty scope:

- ( 1 ) Tampered, opened, detached or reconstructed by personnel outside Maxphotonics;
- ( 2 ) Damaged from misuse, neglect or accident;
- ( 3 ) Used beyond the specification and technical requirements of the product;
- ( 4 ) Indirectly damaged from users' software or interfaces;

( 5 ) Improper installation or maintenance, or operating under conditions not included in this manual.

( 6 ) The fittings and the fiber connectors are not included in the warranty scope.

Customers are obligated to understand the information above and operate according to the User Guide and specification, or the faults arising therefrom are not included in the warranty scope.

IMPORTANT :

◎ Within the warranty scope, purchasers must feed back within 31 days after finding the product defect.

◎ Maxphotonics does not grant any Third Party rights to repair or replace the parts, the equipment or other Maxphotonics products.