PLH3D-2W-Series Operating Manual

Contact and Shipping:
Tomorrow's System Sp. Z o.o.

Okulickiego 7/9 hala G39
05-500 Piaseczno
Poland
tel.: +48 515 180 752

Company Information:
Tomorrow's System Sp. Z o.o.

Pułaskiego 125/35
15-337 Białystok
Poland
NIP: PL5423238556

General Laser Safety

Only person with specialized training and appropriate laser safety knowledge can use and maintain the laser head. The laser head operator must be aware of laser radiation hazard.
While laser head is operating protection Laser Glasses designed for 190 – 540 nm should be used. Make sure that all personnel in the same room worn protection glasses.
Eye exposure to the direct or diffusely reflected laser beam is a hazard. The laser head beam may cause permanent eye damage.
Skin exposure to the laser beam is a hazard. The laser beam may cause serious skin burns. Laser beam may easily burn cloth.
It is possible to get serious injury while using this product or being in the vicinity of an individual using it. Improper use of the laser head can result in injury or death.
Flammable substances exposure to the laser beam may pose fire hazard. The laser head operation in an explosive atmosphere may be dangerous. The working area must be well ventilated. During the operation laser beam may ignite gases or flammable liquids.
Before making any adjustments, changing accessories or performing maintenance, the laser should be powered off and disconnected from the power supply and CNC main board.
The laser head must be properly mounted to a rigid body such that it cannot be moved unintentionally. Unintentional move of the laser head is dangerous.
The unauthorized personnel must have no access to the system into which the laser head is integrated. The laser head must be stored out of the reach of children. Untrained persons are not allowed to operate, maintain and observe operation of the laser head.
Do not place high-reflectivity materials in front of operating lasers head. Remember, diffused reflection of the laser beam is uncontrolled and may pose hazard to eye.
Appropriate shielding should be used around the system into which the laser head is integrated. The system in which laser head is used must be equipped with key switch and safety interlock.

Responsibility of use or misuse belongs to the end user. Tomorrow's System and its affiliates accept no responsibility for use or misuse by the user. If you may not be able to use this product properly, we recommend that you do not begin use or cease use immediately.

Product Description

This is a medium-power engraving laser head with thermal protection function and high-speed laser diode driver. Laser head design ensures that the laser diode doesn't require any additional cooling. Fan design makes it work as a fully customized air nozzle protecting lens from dirt and cooling the laser head.

Laser diode driver ensures appropriate work of the laser head and protects laser diode from overheating. During normal work green indication LED is turned on. When ambient temperature is over 40^{o}C indication LED starts to glow and the laser head is shut down.

Turning lens objective allows user to change the working distance of the laser head. Note: beam spot size will change with working distance, smaller working distance – smaller beam spot size.

Air flow from the fan assures that the lens stays clean.

PLH3D-2W-Series laser head can be equipped with High-Resolution Mounted Triplet Lens or High-Efficiency Mounted Aspheric Lens. Selection of the right lens depends on your application.

The High-Resolution Mounted Triplet Lens has a relatively long effective focal length (EFL) of 8 mm, which allows it to focus laser light to a small spot. All 6 lens surfaces are coated with anti-reflection (AR) coating centered at 450 nm. It is usually preferred for engraving a thinner line, cutting a thicker material due to the reduced convergence and divergence, or when a longer distance between the laser head and the plane of the object to be engraved is necessary.

The High-Efficiency Mounted Aspheric lens is designed to obtain as much as possible power from the laser diode. Its short effective focal length (EFL) of 4 mm make a variety of working distances possible but makes the focus spot almost twice bigger compared to Triplet Lens. This lens should be used for engraving thick lines on wood or plastic where the low-quality engraving is acceptable.

The laser head allows to cut or engrave materials such as rubber, wood, paper, leather, plastic, cardstock and many other. Thanks to full analog modulation it is possible to engrave in shades of grey or change the output power during turns. The same effect can be achieved by using PWM signal which is fully compatible with PLH3D driver. High speed modulation (up to 100 kHz) allows to use high movement speed during engraving even complicated patterns.

Main key-features of the PLH3D-2W Engraving Laser Head:

- Easy connection to all 3D printers and CNC machines.
- Lightweight
- Integrated cooling and thermal protection
- Simple mounting to all 3D printers and CNC routers
- Integrated Laser Diode Driver

Product Specification

Specification	Value
Dimensions (L x W x H)	30 x 30 x 69 mm (1.2 x 1.2 x 2.7 in.)
Modulation Input	0 – 5V (Analog / PWM / TTL)
Recommended PWM Base Frequency	5 – 10 kHz
Max. Modulation Bandwidth	30 kHz
Input Voltage	12 – 24V
Max. Power Consumption	16W
Laser Diode Optical Power[1]	2.0 W
Laser Diode Wavelength	445nm (±10nm)
Working Distance	30 - 120 mm / 1.18 - 4.72”
Focused Beam Spot Size, WD = 60 mm (2.36”)	0.07 x 0.15 mm (0.004” x 0.012”)
Focused Beam Spot Size, WD = 30 mm (1.18”)	0.07 x 0.1 mm (0.004” x 0.008”)
Power Density	160 kW/cm^2
Noise Level	23 dBA
Max. Operating Amb. Temperature	40°C (104°F)
Weight	70g (2.5 oz.)

[1]Since the working distance and lens choice can both have a slight effect on the amount of power from the laser head, it is difficult to specify an exact power value of the laser head.

Connection of the laser head

Connecting engraving laser head is very simple and is using 4-pin connector. To each device 4-pin connector is included. Pins #2 and #3 should be connected to appropriate power supply unit, see requirements and recommendation section.

Pin #	Function
1	Modulation Input (0 - 5V Analog / PWM / TTL)
2	Power Supply (12 – 24VDC)
3	Ground
4	Modulation Input Ground

Working Distance

The PLH3D-2W Series laser head ships with the High-Resolution Triplet lens installed and preset to working distance of 60.0 mm (measured from the front-face surface of the laser head to engraving plane). This working distance has well-optimized focal spot size to output light power ratio which is suitable for many engraving and cutting applications. We recommend keeping the working distance of the laser set to the default of 60.0 mm as a starting point.

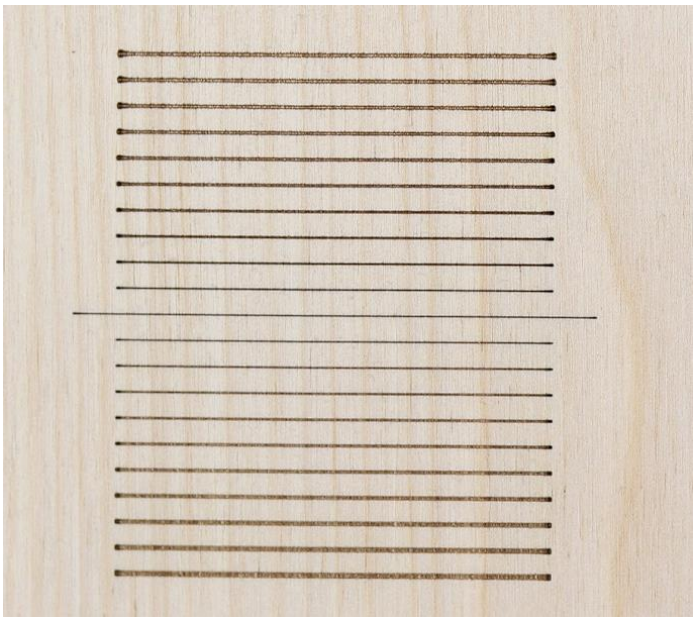
Mount the laser head on the CNC machine with front side (side on which lens is installed) pointing towards engraving material. Note: Make sure that the laser head is in stable position and does not move under influence of external forces. Engraving material should be at stable position as well, it should not move during engraving. Using your CNC machine, set laser head position at 60 mm measuring from the front side of the laser head to engraving material. Hint: Use a caliper or 60mm long piece of material to measure precisely the distance. After setting the position zero the Z-axis on the CNC machine and use the laser in XY plane without changing the Z value.

Setting the Working Distance

Some engraving applications may require small focus spot, i.e. high-resolution engraving, detailed engraving. PLH3D-2W-Series laser head has adjustable focal length and exchangeable lens. This future allows it to fulfill broad range of engraving applications. Shorter focal length of the laser head produces a smaller beam spot (higher power density).
You can adjust focus spot distance from the front of the laser head by rotating the lens clockwise or counterclockwise. Note: it is necessary to ensure that the mounted lens is sufficiently deep inside the laser head, so the lens does not move before powering on the unit.
Once you changed the position of the lens use your CNC machine to find where is the focus spot. Using the methods described above calibrate the laser head position.

Coarse adjustment:

a. Set current position as a zero position in your CNC software.
b. Engrave “zero position” line on the engraving material. Hint: make this line longer compares to the next engraved line, it’s going to be easier to find “zero line”.
c. Engrave (on the engraving material) 10 lines with step 1 mm in the positive direction of Z-axis
and 3 mm step in X-axis.
d. Go back to zero position.
e. Engrave (on the engraving material) 10 lines with step 1 mm in the negative direction of Z-axis. and 3 mm step in X-axis.
f. Inspect engraved lines, find the thinnest engraved line.
g. Count how many lines away is the thinnest line from “zero line”, and in which direction it is placed. Let’s consider case then the thinnest line is located 5 lines from zero line and in positive direction of X-axis. In such a case calibration parameter is +5mm.
h. In the CNC software, move “zero position” of the laser head by calibration parameter.



Fine adjustment:

To obtain the highest power density, which results in the better engraving performance, we recommend making fine adjustments to the distance of the laser head and the engraving material.
This adjustment should be done after performing coarse adjustment.
The process is similar to the coarse adjustment process expect steps in Z-axis, they are smaller to
make adjustment precise.

a. Set laser head at a zero position, which must be calibrated by know.
b. Engrave “zero position” line on the engraving material. Hint: make this line longer compares
to the next engraved line, it’s going to be easier to find “zero line”.
c. Engrave (on the engraving material) 10 lines with step 0.1mm in the positive direction of Z-axis and 3 mm step in X-axis. We recommend engraving lines with 50mm length, it is easier
for eye to compare thickness of a line on longer range.
d. Go back to “zero position”.
e. Engrave (on the engraving material) 10 lines with step 0.1 mm in the negative direction of Z-axis. and 3 mm step in X-axis.
f. Inspect engraved lines, find the thinnest engraved line.
g. Count how many lines away is the thinnest line from “zero line”, and in which direction it is
placed. Let’s consider case then the thinnest line is located 2 lines from zero line and in
negative direction of X-axis. In such a case calibration parameter is -0.2 mm.
h. In the CNC software, move “zero position” of the laser head by calibration parameter.

Recommendations and Requirements

Important: PLH3D-2W-Series engraving laser head should be powered from a high-quality power supply without anything else connected. Please note: connecting the laser head to the same power supply unit as a stepper motor or any other high-impedance equipment is not recommended. Doing so may cause damage to the laser diode.

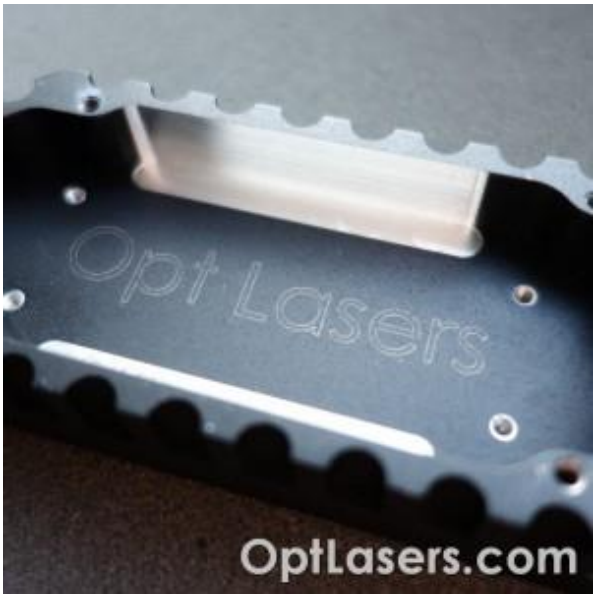
We recommend inspecting cleanest of the lens surface before starting engraving. It is easy to clean the front surface of the lens if it becomes dirty when engraving, which may be done with Isopropyl Alcohol (IPA) and an optical wipe. However, in some cases, it can be necessary to replace the lens. It is recommended to purchase an extra lens with PLH3D-Series laser heads if they will be used in an environment where dust, smoke or oil are generated.

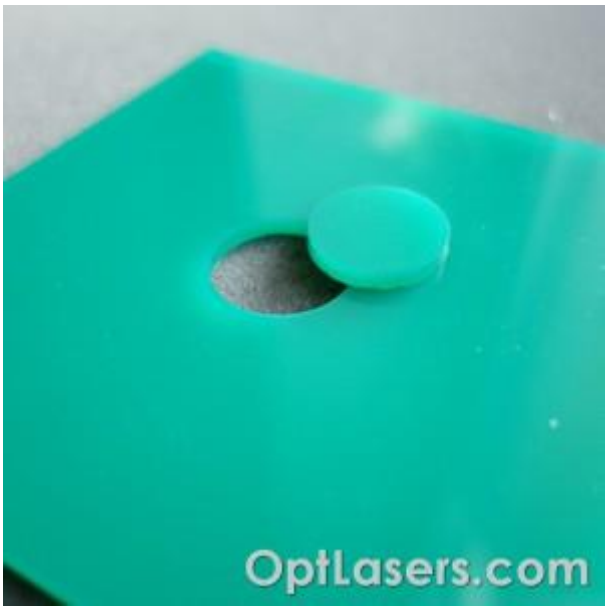
Regular maintenance of the laser head cleanest positively affects its lifetime, in some cases it may prevent from damaging the lens. Ventilation openings and fan must be kept clean and free of foreign matter. Remember to close the lens while cleaning laser head, for this we recommend using Kapton tape. We recommend using compressed air for cleaning ventilations channels or cotton swab (cotton buds) with Isopropyl Alcohol.

Application Note

Note, that this speeds and parameters are effects of tests and can be different for some materials, cooling systems as well setting of the focus distance.

1. Binder board; Thickness: 3mm; Feed rate: 5mm/s; Full Power; 8x0,5 passes
2. Balsa; Thickness: 5mm; Feed rate: 25mm/s; Full Power; 5 passes
3. 5-layer; cardboard Thickness: 5 mm; Feed rate: 10mm/s; Full Power; 4x1,25
4. Rubber; Thickness: 0,5mm; Feed rate: 15mm/s; Full Power; 3x0,25
5. Jeans; Thickness: 0,5mm; Feed rate: 8mm/s; Full Power; 1pass
6. T-shirt; Thickness: 0,5mm; Feed rate: 25mm/s Full Power 1 pass.
7. Glass fiber reinforced foil (dark); Thickness: 0,3mm; Feed rate: 3mm/s, 1 pass.




OptLasers.com


OptLasers.com


OptLasers.com


OptLasers.com