PLH3D-XT8 45W Cutting and Engraving Laser Head

User Manual

Thank You for Your Purchase!

Thank you for choosing the Opt Lasers' PLH3D-XT8 (XT8 hereafter) laser head. Renowned for its unmatched versatility and power, the XT8 sets a new standard in the PLH3D Series for precision engraving and cutting across a broad spectrum of materials, including plastics, leather, wood, textiles, and metals like anodized aluminum, stainless steel, tool steel, and titanium.

Designed for seamless integration with CNC machines, the XT8 offers a flexible and energy-efficient alternative to CO2 lasers, boasting 4 times more energy efficiency. Its compact design and universal mountability make it ideal for a wide range of manufacturing processes.

The XT8 features a cutting-edge Copper Heatpipe Heatsink for rapid heat absorption and transfer, ensuring superior cooling, stability, and equipment longevity. Built-in overheating protection safeguards the semiconductor laser, automatically shutting off the laser head at 58°C (136°F) and resuming operation at 50°C (103°F) to maintain performance and durability.

With a professional high-speed laser driver integrated directly into the laser head, the XT8 supports high power modulation (up to 30 kHz) for fast, detailed engraving. Its exceptional focus depth and beam waist allow for consistent processing on both curved and flat surfaces, achieving high-performance in single-pass cutting without constant adjustments.

Capable of engraving and cutting a variety of materials, from different types of wood and textiles to metals and plastics, the XT8 excels in precision and efficiency. Its blue laser technology is especially effective for wood engraving and cutting, offering an energy-efficient solution for creating detailed 2D and 3D images.

As a versatile, powerful tool in the PLH3D Series, the XT8 laser engraver and cutter delivers exceptional performance for industrial, professional, and hobbyist applications, making it an invaluable asset for your creative and manufacturing projects.

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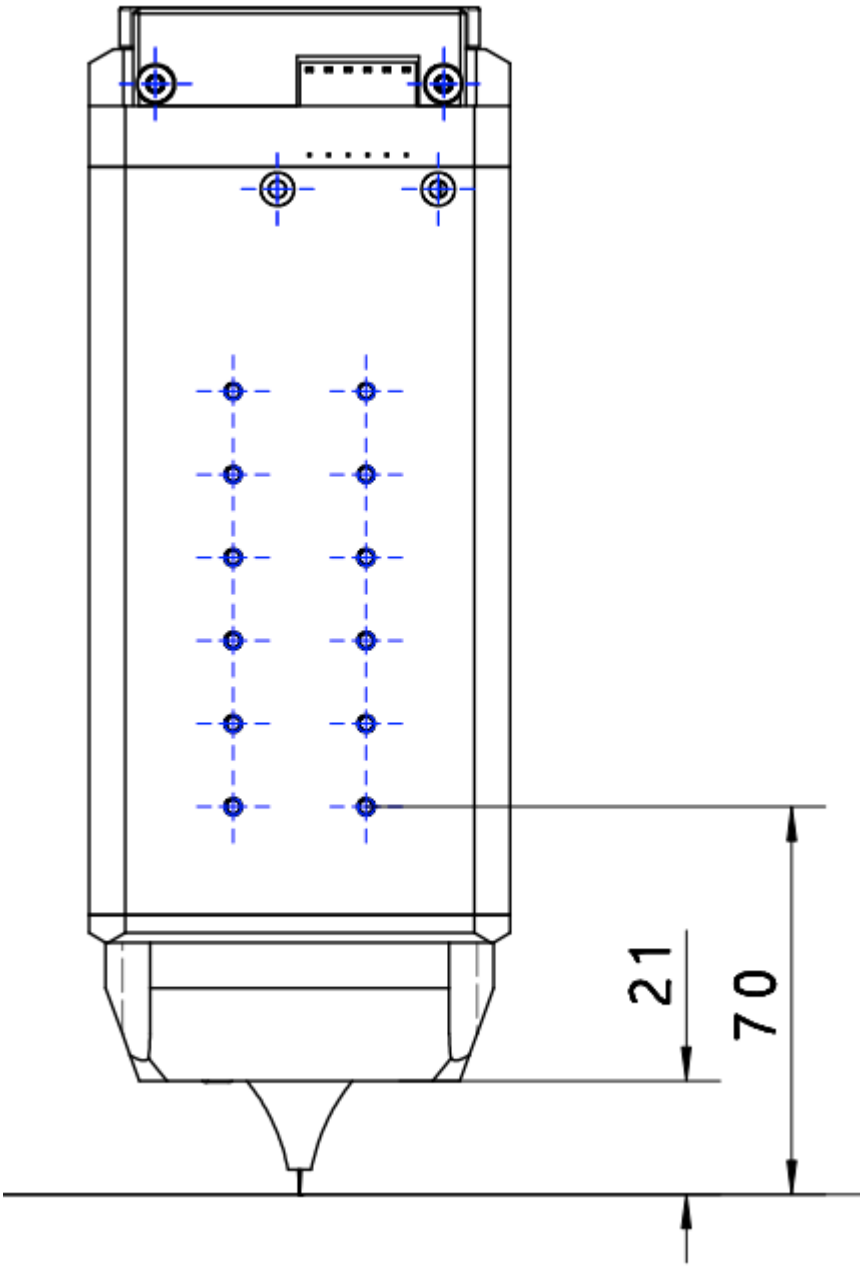
Technical Specifications

Performance Parameter	PLH3D-XT8
Maximum Optical Power	45 W
Typical Optical Power	38-43 W
Wavelength	450 ± 10 nm
Focused beam spot diameter	<180 µm
Working distance	21 mm
Dimensions of Laser Head (L x W x H)	76 x 89 x 194 mm (3 x 3,5 x 7,64 in.)
Weight of Laser Head, Typ.	1050 g (2.31 lb.) With LaserDock: 1230g (2.71 lb.)
Flow Rate of Fan	102,96 m3/h (53 CFM)
Fan Noise	68 dBA
Mounting Hole Pattern	3x 4 holes, 24 x 15 mm (0.94 x 0.59 in.)
Mounting Hole Type	M3 x 0.5 x 3 mm
Max. Ambient Temperature	40°C (104°F)
Modulation Input	PWM/TTL, 0 – 3 V 0 – 5 V 0 – 24 V
Recommended PWM Base Frequency	1 – 5 kHz

Max. Modulation Bandwidth	30 kHz
Modulation Input Impedance	>1 kΩ
Power Supply Unit Voltage	24 V
24 V PSU Min. Current	8.5 A
Maximum Power Consumption	170 W

Mounting Hole Pattern



Laser Safety

Important: Safety Regulations

The PLH3D-XT8 laser head is an accessory for your CNC machine. As the end user, it is your responsibility to prioritize and implement laser safety precautions associated with the operation and use of this laser equipment. For Safety Regulations when working with lasers, refer to **ANSI Z136.1 - Safe Use of Lasers** (US), **Safety of laser products - Part 1: Equipment classification and requirements** (International).

Basic Laser Safety Guidelines and Operational Protocols for Laser Head Operation

This section serves as an addition to Safety Regulations, providing basic laser safety guidelines. Please carefully follow these guidelines to protect yourself and others during its operation.

1. Only individuals with specialized training and proper laser safety knowledge should operate and maintain the laser head. The operator must be aware of the hazards associated with laser radiation.
2. While the laser head is in operation, use laser safety glasses designed for 190 – 540 nm (OD 7+). Ensure that all personnel in the same room wear protective glasses.
3. Eye exposure to the direct or diffusely reflected laser beam is a hazard. The laser head beam may cause permanent eye damage. Always protect your eyes during work with lasers.
4. Skin exposure to the laser beam is a hazard. The laser beam may cause serious skin burns or may easily burn cloth. Always protect your skin during work with lasers.
5. Serious injury is possible during use or when in the vicinity of someone using this product. Improper use of the laser head can lead to injury or death. Always follow the safety guidelines during work with lasers.
6. Exposure of flammable substances to the laser beam may create a fire hazard. Operating the laser head in an explosive atmosphere can be dangerous. Ensure the working area is well-ventilated, as the laser beam during operation may ignite gasses or flammable liquids.
7. Before making any adjustments, changing accessories, or performing maintenance, ensure that the laser is powered off and disconnected from both the power supply and the CNC main board.
8. The laser head must be securely mounted to a rigid body to prevent unintentional movement, as it can be dangerous.
9. Unauthorized personnel must not have access to the system integrated with the laser head. Store the laser head out of the reach of children. Only trained individuals are permitted to operate, maintain, and observe the laser head during its operation.
10. Avoid placing specularly reflective materials in front of the operating laser head. Keep in mind that a diffused reflection of the laser beam is uncontrolled and may pose a hazard to the eyes.
11. Use appropriate shielding around the integrated system for the laser head. Ensure the system incorporating the laser head is equipped with a key switch and safety interlock.

Engraving Highly-Reflective Materials & Metals

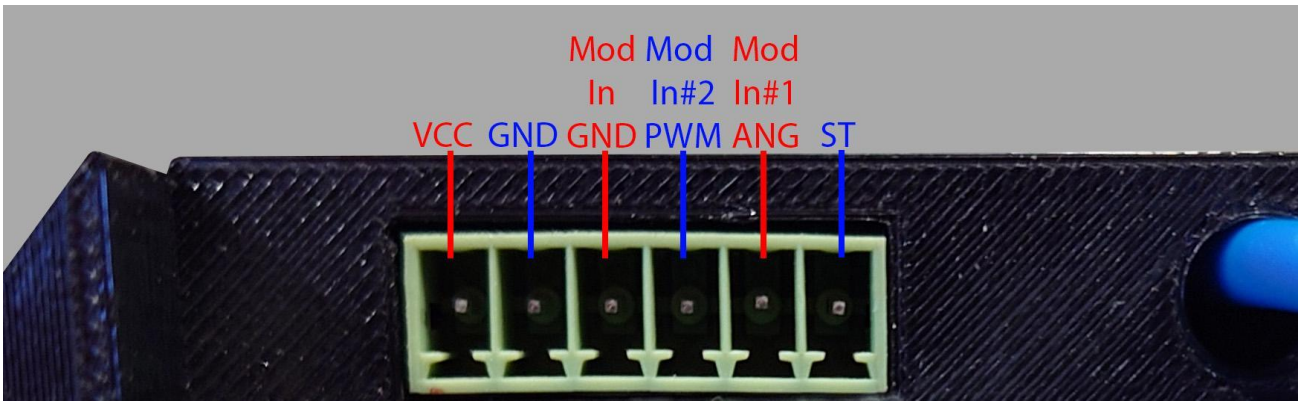
When laser engraving on highly reflective materials, such as mirrors or finely polished metals, it is essential to tilt the materials or adjust the laser head slightly, introducing a small angle (e.g., 7°). This precaution is crucial to prevent potential back-reflection to the laser diodes. If left unchecked, back-reflection can cause damage and compromise the longevity of your laser head. Therefore, tilting the material serves as a protective measure, ensuring the sustained performance of your equipment.

Additionally, it is advisable to introduce the tilt when working with metals in general.

It's important to note that when tilting the laser head, ensure that the beam direction is angled away from the user. For example, if engraving stainless steel, tilt the laser head so that the beam points away from the user, either left or right. This helps avoid direct exposure to the laser beam and minimizes the risk of accidental exposure. Always comply with laser safety regulations and wear appropriate protective gear, including safety glasses, when operating the laser engraving equipment.

Electrical Inputs

Refer to the image below for a visual guide to the electrical input pin. The subsequent description elaborates on its technical attributes and functionality.



Pin Descriptions

1. Vcc

This is the power supply (Vcc) for the laser head, requiring 24V with a minimum current of 8.5 A.

2. GND

This is the ground (GND) for the laser head's power supply (Vcc pin).

3. Mod Input GND

This is the common ground (GND) shared by Mod Input #1 ANG, Mod Input #2 PWM pins, and ST.

Note: GND and Mod Input GND are not isolated from each other.

4. Mod Input #2 PWM

Modulation Input #2 accepts PWM signals, where the voltage in the high state (interpreted as laser on) should be a minimum of 3 V. Examples of compatible control signal ranges are 0 - 3 V, 0 - 5 V, and 0 - 24 V.

For PWM control, we recommend using a base frequency of 5,000 - 10,000 Hz. Although frequencies like 1,000 Hz will work, higher frequencies generally produce better grayscale images. The signal fill percentage corresponds to the laser power output percentage.

Note: Do not connect signal cables simultaneously to Mod Input #1 ANG pin and Mod Input #2 PWM.

5. Mod Input #1 ANG - optional / available on request

Modulation Input #1 accepts analog or Pulse-Width Modulation (PWM) signals. The operating range of Modulation Input #1 is 0 to 5 V. If connected to a signal with a slightly higher voltage, e.g., 0 to 10 V, only the 0 to 5 V portion of the signal will affect the laser power. The voltage connected to this input should not exceed 10 V.

Note: Do not connect control signal cables simultaneously to Mod Input #1 ANG pin and Mod Input #2 PWM.

Note: Mod Input #1 ANG and Mod Input #2 PWM pins share a common ground, represented by pin #3 (Mod Input GND).

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Note: For the voltage to be interpreted as a high state (laser on), it should be a minimum of 3 V. Conversely, for it to be interpreted as a low state (laser off), it should not exceed 0.8 V. The state between 1-3 V is not defined.

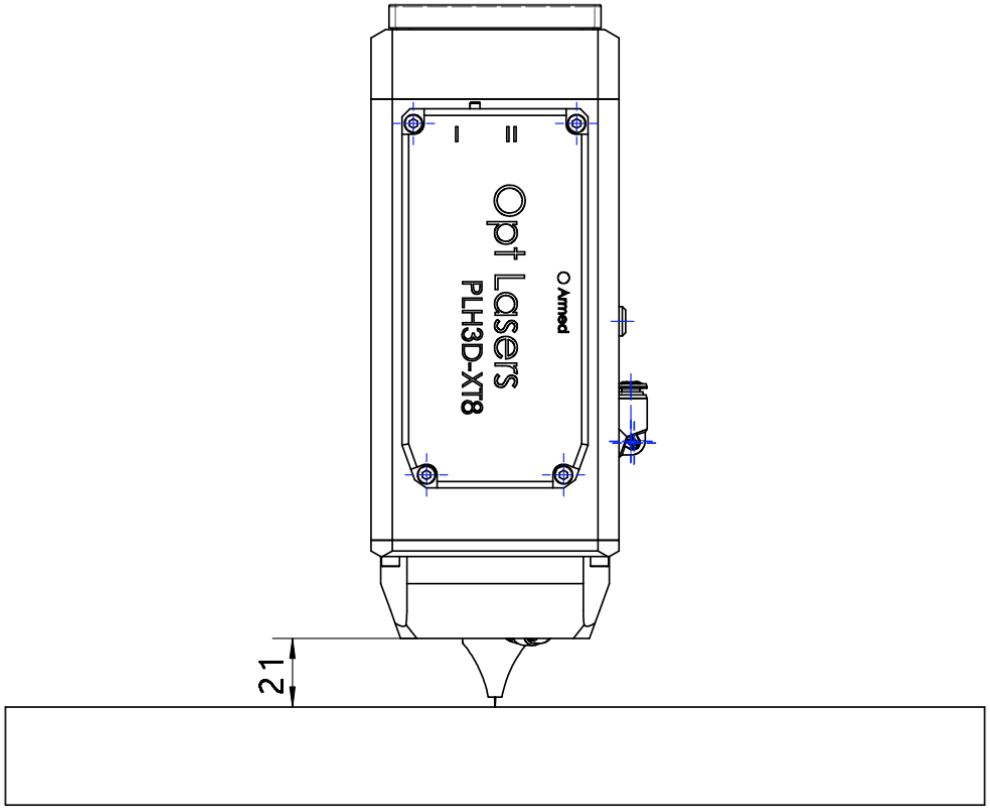
6. ST

Status line - pulled to VCC when the supply is present.

Working Distance

Engraving

The working distance (WD) of the XT8 laser head should be set to its nominal 21 mm (0.83 inch) between the bottom face of the laser head and the material processed, as shown below.



For units purchased with the Laser Upgrade Kits this can be conveniently done using the included Height Reference Tool (HRT). Place the HRT on the processed material and lower the laser head until it touches the upper surface of the HRT. Gradually reduce the laser height by 1mm initially, and then, when in close proximity to the HRT, further decrease it by 0.5mm to ensure careful adjustment and prevent any risk of crushing the HRT and material.

Cutting

For cutting thin materials (1-6 mm), the working distance should be set in such a way that the smallest beam spot is located around the middle of the material's thickness. Start by positioning the laser at the nominal working distance (see the instructions above for Engraving) and then lower the laser head by half of the material's thickness.

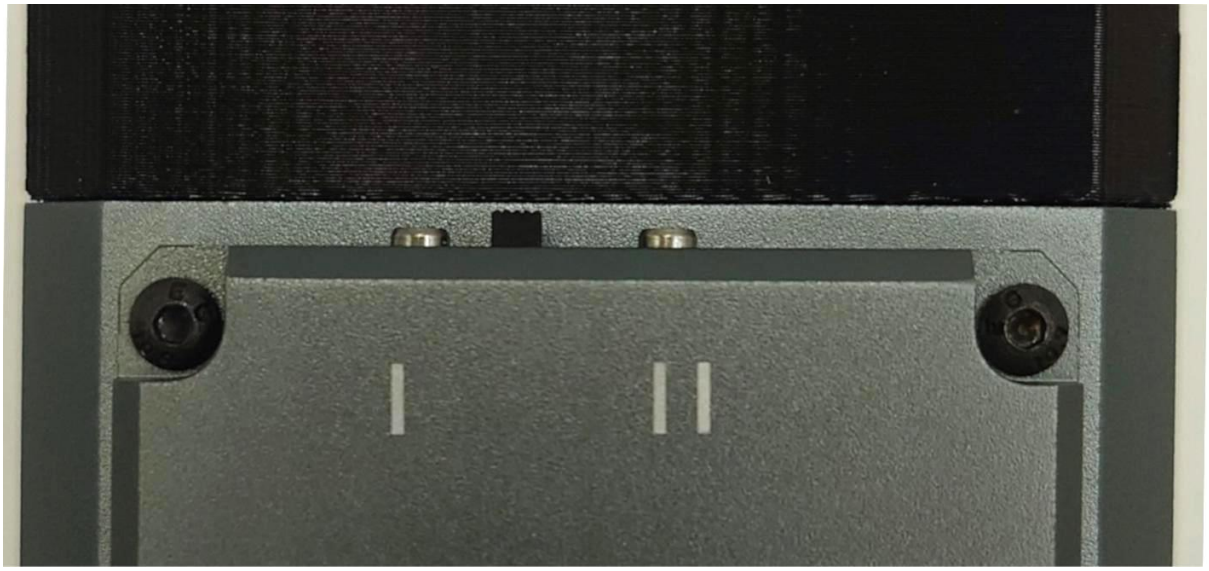
For thick materials (6+ mm), the material should be cut layer by layer, with the laser head gradually lowering closer to the cut material after each pass. This approach ensures that the laser beam consistently focuses on the point where the material needs cutting, enhancing the efficiency of the process. Exercise caution not to lower the laser head excessively, as this could lead to a collision between the nozzle and the material.

Note: For certain materials, such as birch plywood, MDF, PU foam or pinewood it is possible to cut thick pieces in one pass. In this case, place the laser head as close to the material as possible, without the nozzle touching its surface.

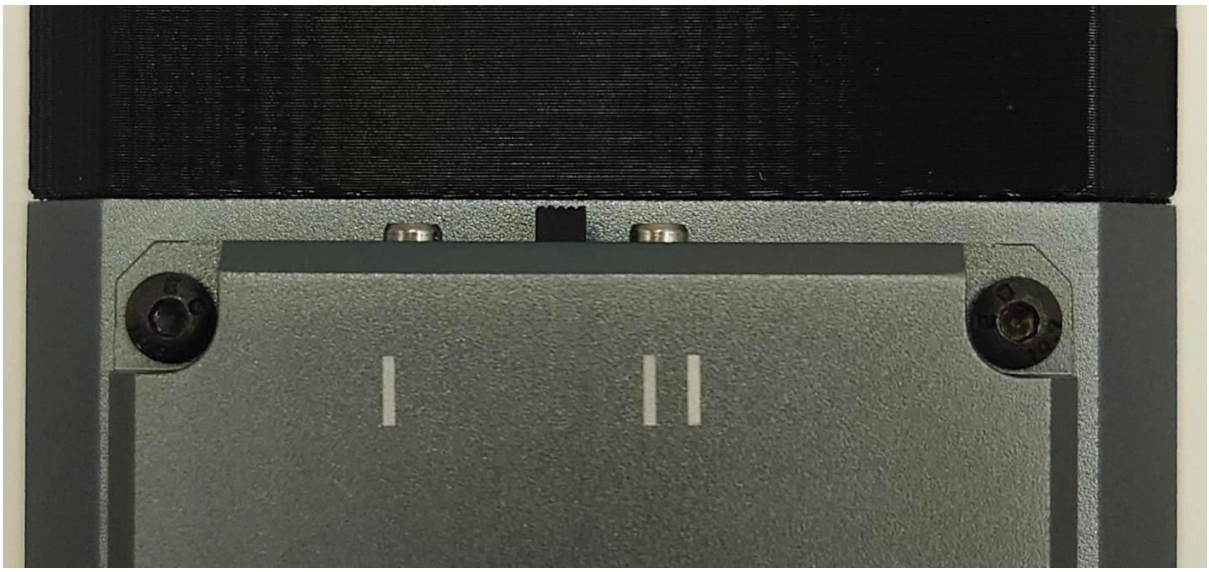
Two Power Modes

The PLH3D-XT8 laser head offers two power modes: “I” - 50% for grayscale engraving, and “II” - 100% for high-speed black and white engraving and efficient cutting.

The 50% mode, “I”, using about 0-20W, is perfect for detailed grayscale work, providing precision in shade rendering. For this mode, place the mode switch into the “I” position.



The 100% mode, “II”, excels in rapid cutting, even through thicker materials, and achieves clean cuts in a single pass without sacrificing quality. For this mode, place the mode switch into the “II” position.

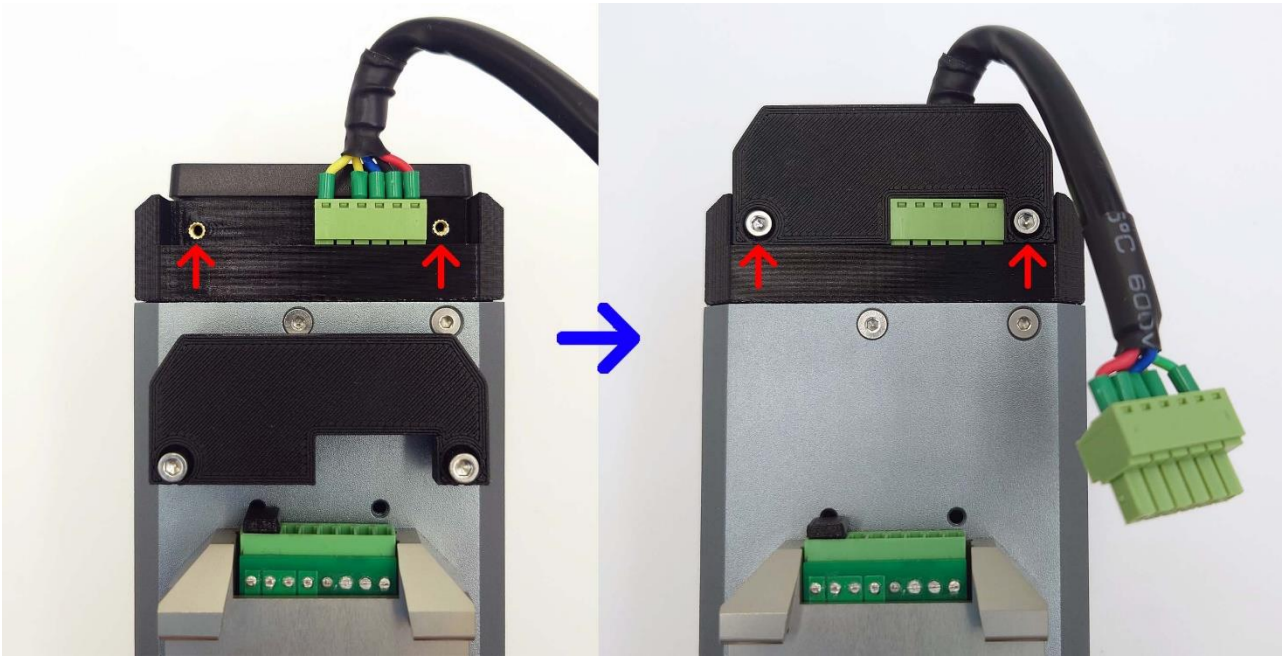


Cable Connection

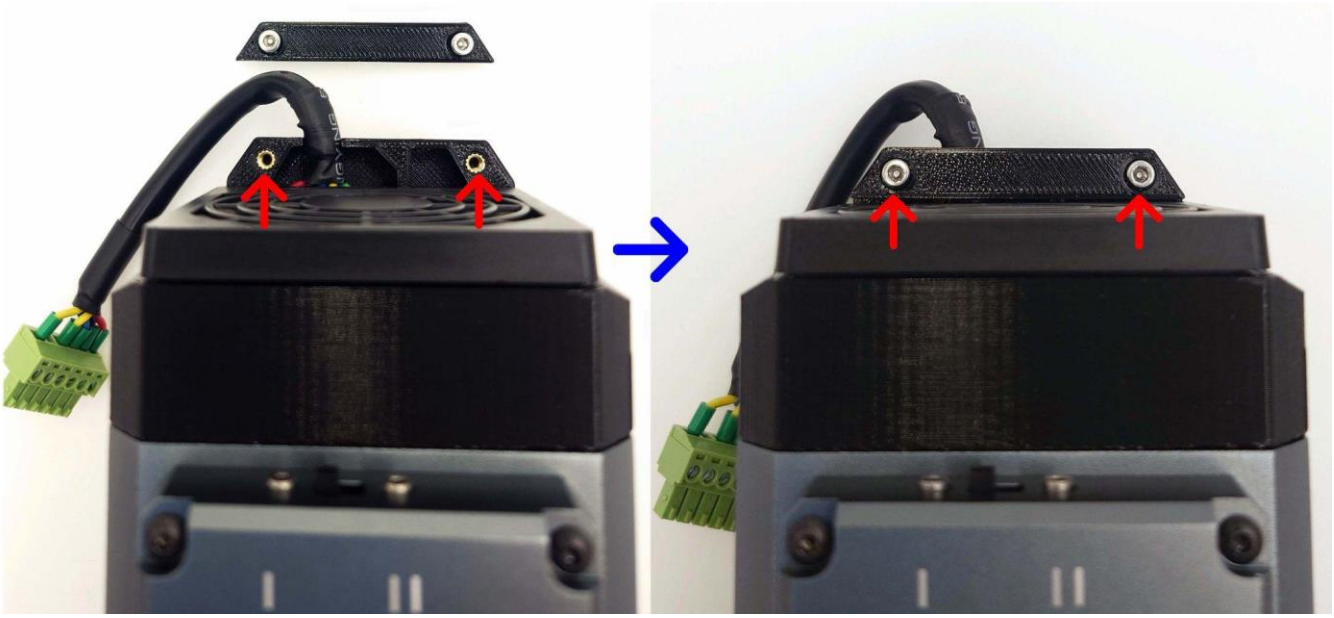
Note: In the pictures below, a short LaserDock to laser head cable can be seen. However, the same procedure applies to the Cable for PLH3D-XT8 Laser Head (7m / 22 ft).

Begin by connecting the cable's connector to the laser, ensuring that the correct end of the cable (labeled 'LASER HEAD') is connected. Note that when connected correctly, the ST cable (see Pin Descriptions above) should be positioned closer to the middle of the laser rather than near the side.

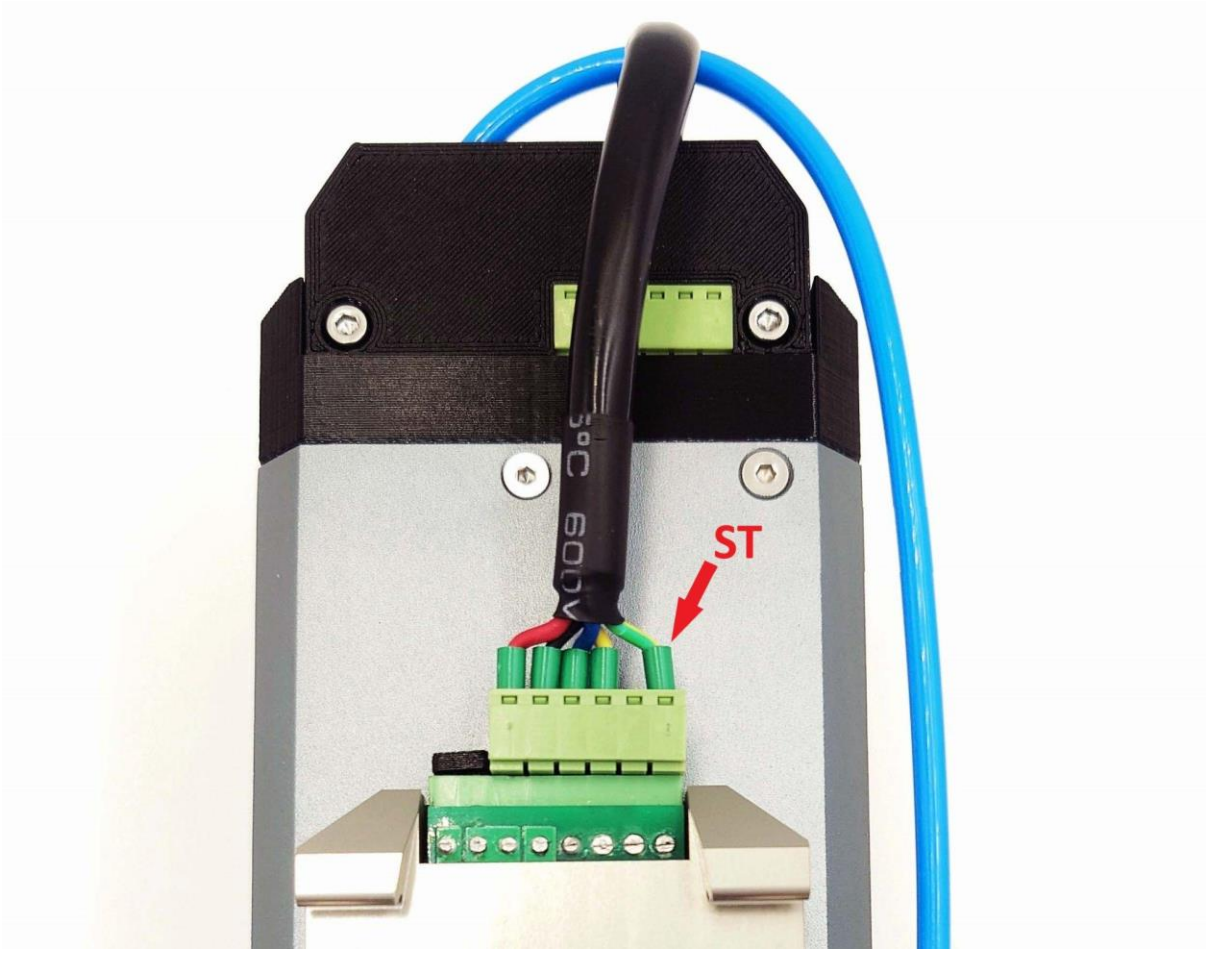
Secure the back part of the deflector in place by gently screwing in the two screws.



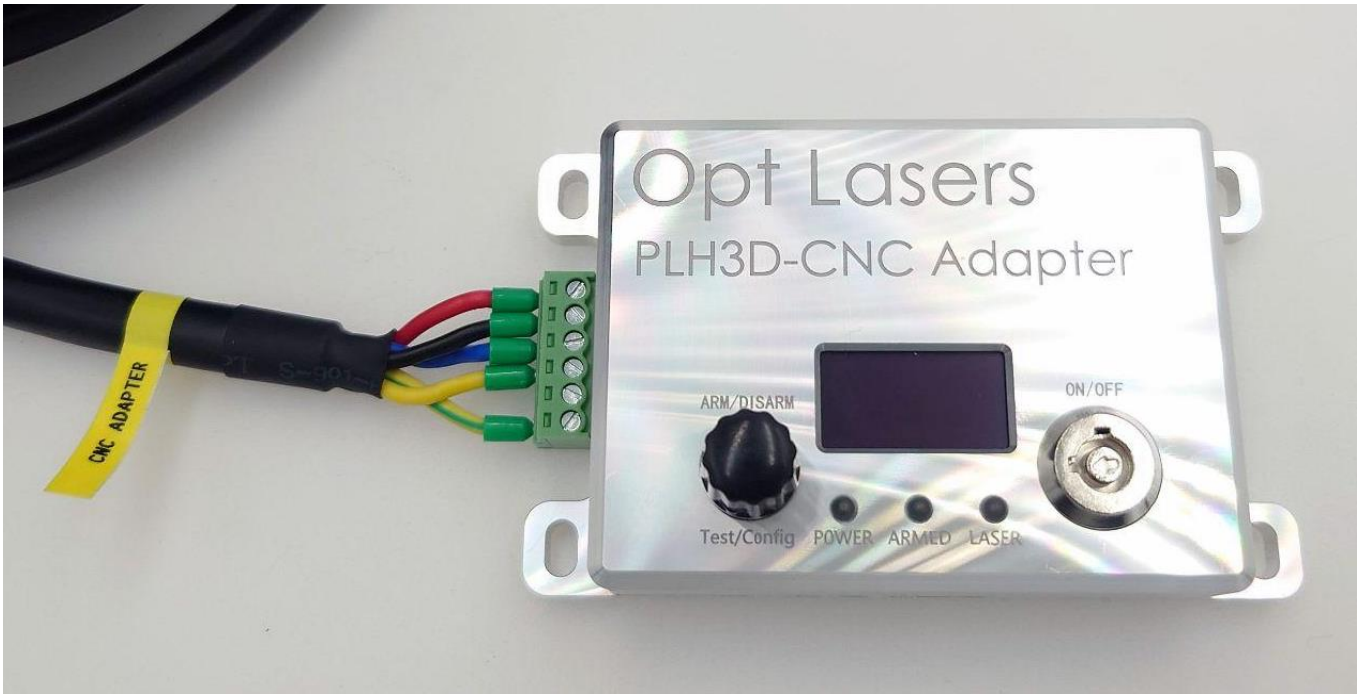
As you flip the laser around, repeat the process to attach the front part of the deflector.



If using the laser with the LaserDock Pro, plug the other end connector (labeled “LASERDOCK PRO”) into the laser part of the LaserDock Pro. Please observe the accurate position of the ST cable in the picture below.

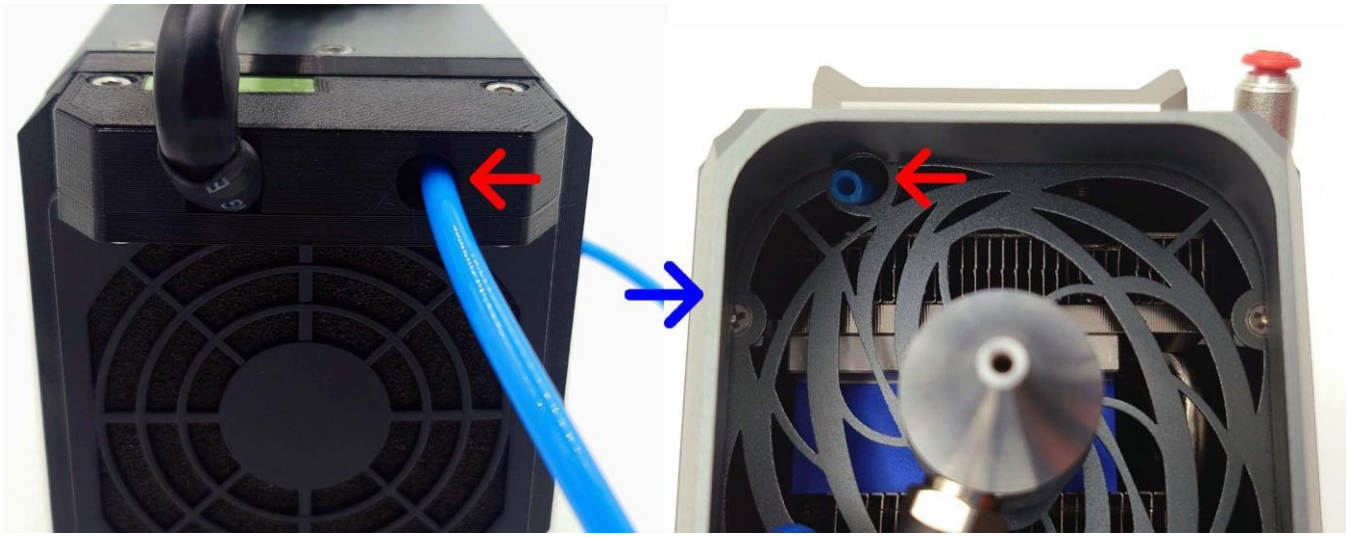


For direct connection to the PLH3D-CNC Adapter, plug the “LASER HEAD” connector to the laser, and the “CNC ADAPTER” connector to the Adapter.

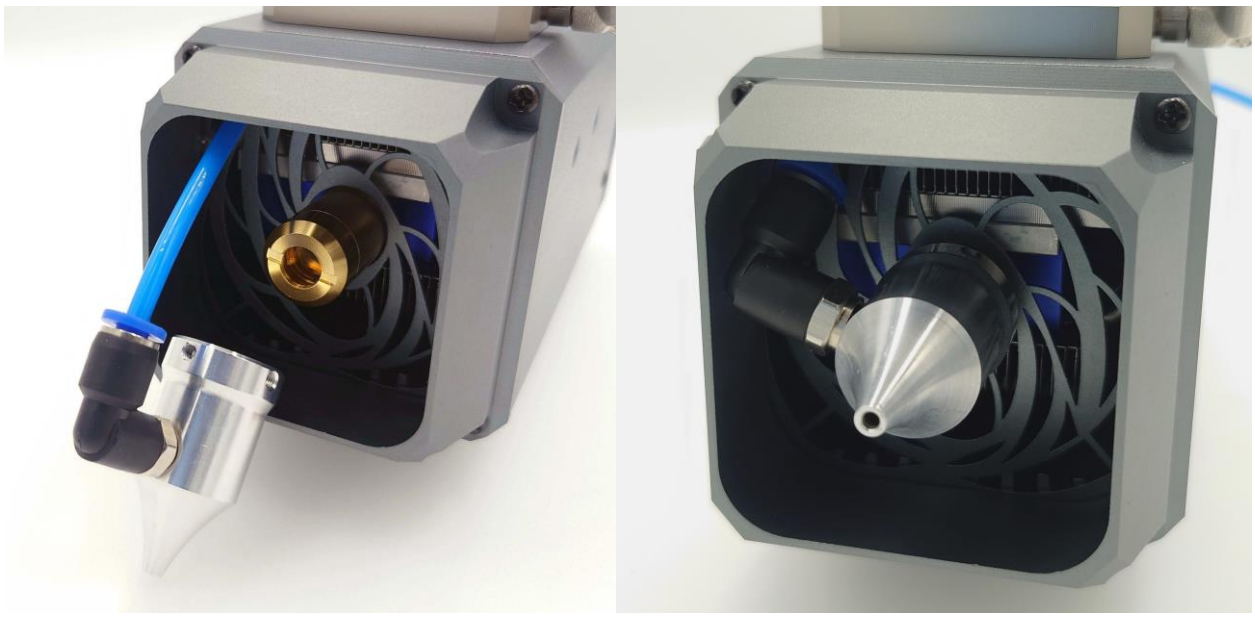


Air Assist Hose Attachment

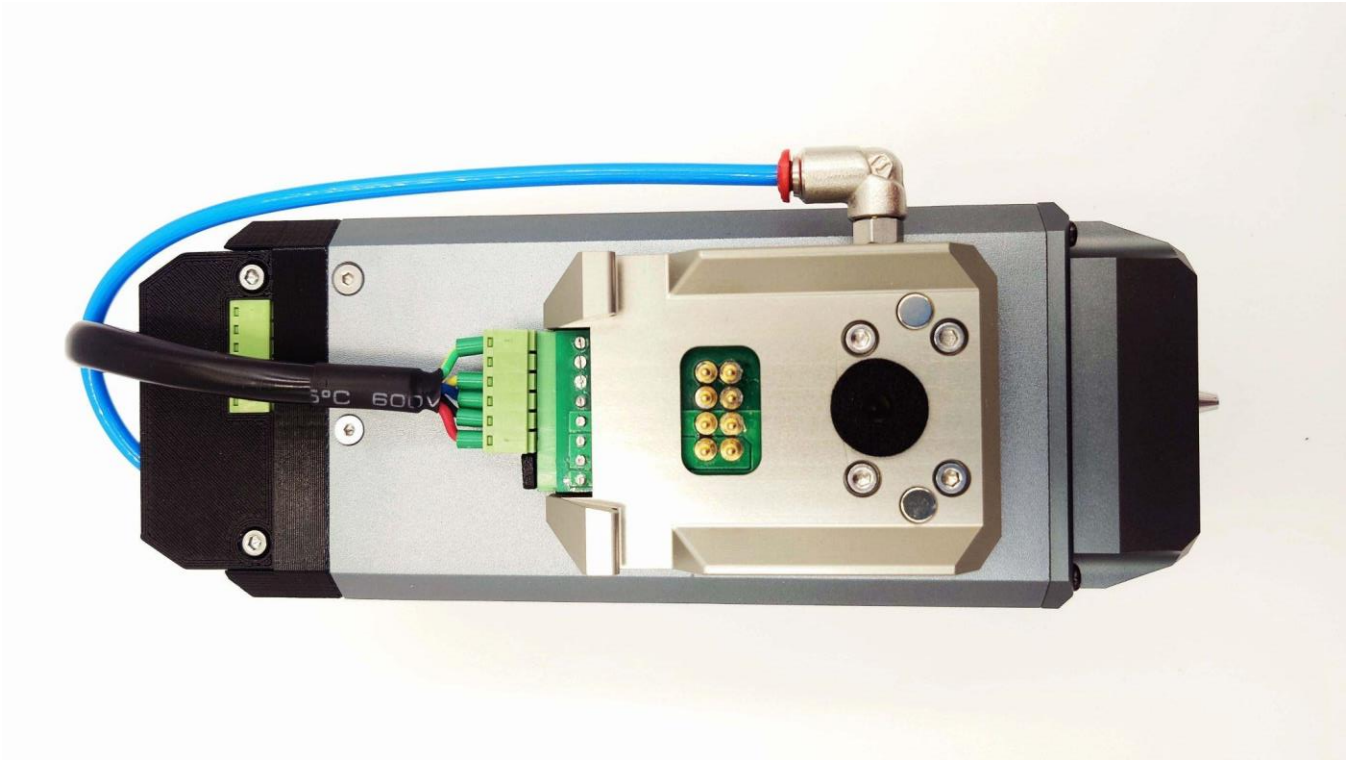
To securely attach the air assist hose to the laser head, start by threading it through the aperture in the deflector at the back of the laser. Guide it along the canal until it reaches the other end, ensuring it smoothly passes through the hole. You may need to delicately maneuver and aim it to ensure it aligns properly with the opposite hole.



Next, insert the front end into the connector on the high-pressure air assist nozzle and put the nozzle onto the lens tube. Make sure to loosen the locking screw in the nozzle before inserting it onto the lens tube to avoid scratching it. For the first usage of the laser, push the nozzle to the end of the lens tube.



If using a LaserDock Pro magnetic docking station with the laser, place the opposite end into the designated connector on the laser part of the LaserDock Pro for a seamless connection. Otherwise, connect the hose to the compressor.



High-Pressure Air Assist Nozzle Usage

The PLH3D-XT8 features an advanced built-in adjustable High-Pressure (HP) Air-Assist nozzle for optimal setup in both thin material engraving and efficient thick material cutting.

Always loosen the locking screw in the HP nozzle before removing, adjusting or inserting it onto the lens tube to avoid scratching. After adjusting the nozzle, securely fasten the locking screw, ensuring it is tightened gently.

Recommended Usage Depending on the Application

Case 1 - Laser Engraving and Laser Cutting Thin Materials

For laser engraving and laser cutting thin materials, we recommend to position the bottom tip of the HP nozzle approximately 1-3 mm above the material being processed.

Case 2 - Thick Line Engraving

The beam of the XT8, while not symmetrical, can still be employed for thick line engraving. In such instances, the laser is positioned higher than usual, for example, 15 mm above the Working Distance. During this process, it's recommended to have the HP Air Nozzle positioned close to the laser head.

Case 3 - Thick Materials Cutting

For laser cutting thick materials, it is advisable to have the High-Pressure Air Assist Nozzle positioned close to the laser head. Subsequently, the material should be cut layer by layer, with the laser head gradually lowering closer to the cut material after each pass. This approach ensures that the laser beam consistently focuses on the point where the material needs cutting, enhancing the efficiency of the process. Exercise caution not to lower the laser head excessively, as this could lead to a collision between the nozzle and the material.

Suitable Compressor

Any compressor is suitable for supplying air to your High-Pressure Air Assist Nozzle unit. However, determining the appropriate flow rate is crucial and may require experimentation for different types of materials. Small compressor units may not achieve the desired results. Optimal performance is observed with higher tank capacity and compressor efficiency, allowing for increased airflow through the air nozzle. Better compressor units also enhance work comfort by minimizing the frequency of tank refills.

We recommend a compressor with a real airflow of 10-12 l/min and a tank capacity of at least 50 liters. Nevertheless, experimentation with smaller compressors is possible, and many of our customers successfully use 5-liter tank capacity compressors, available on Amazon for approximately $70.

Importantly, ensure that your compressor is equipped with a filter and an oil separator to prevent the discharge of dirty air and/or oil droplets onto the laser head's lens. Failure to do so could result in protective window damage.

Additionally, in humid climates, it is advisable to use an air dryer as fittings in air lines act as venturis, potentially creating condensation. This condensation may lead to water droplets entering the nozzle, affecting the overall performance of the laser system.

Suitable Airflow

Based on our experience, a real airflow value between 10-15 l/min has proven to be the upper limit and is generally sufficient for most materials. We advise against exceeding 15-20 l/min, as this can lead to a decrease in laser cutting speed for all materials. To begin, we recommend a starting point of 10 l/min for the real airflow value. Subsequently, experimentation with slightly higher airflow rates is encouraged, as the optimum airflow value may vary depending on the material.

In general, **for laser cutting, the optimum real airflow value typically falls within the range of 5-15 l/min.**

For laser engraving, we recommend **airflow values ranging from 1-5 l/min.**

To facilitate monitoring, it is highly beneficial to equip your compressor with a flowmeter.

Laser Head Maintenance

Before starting any maintenance, make sure to power off the laser system to ensure safety. Disconnect the power supply to the laser head.

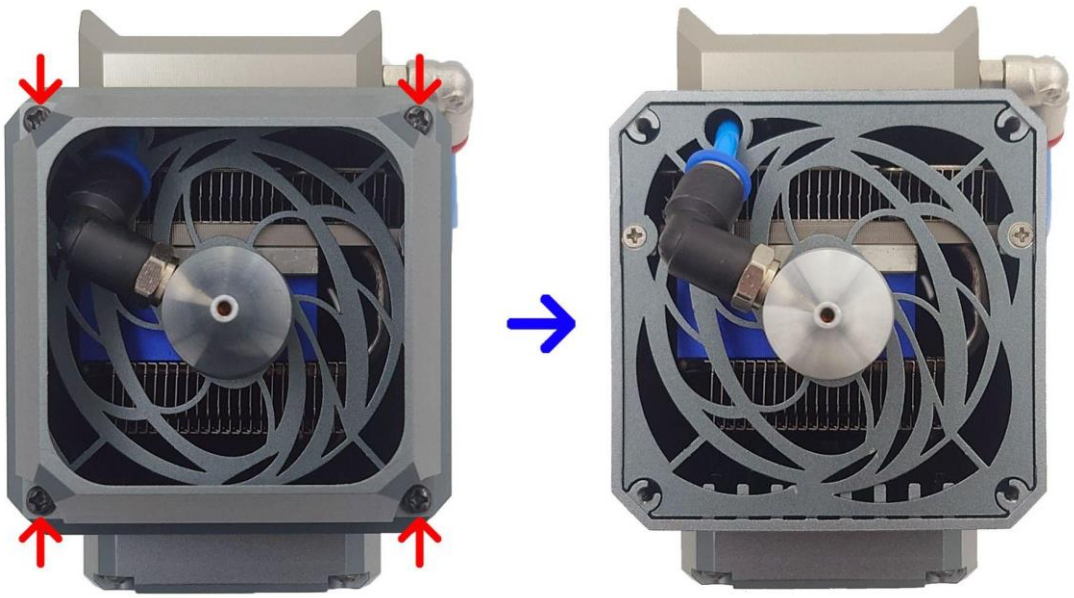
Laser Heatsink Maintenance

Heatsink maintenance is crucial for optimal performance and longevity of your laser equipment. It's recommended to blow compressed air through the heatsink regularly, especially after each use involving a significant amount of smoke or debris. The front part does not need to be unscrewed for this procedure. Use compressed air to blow from the front of the laser, effectively removing any accumulated debris or particles within the heatsink.

Note: Exercise caution when using compressed air to clean the fan, and avoid spinning it too rapidly. Overspinning the fan with compressed air may lead to damage to the bearings.

For more thorough maintenance, it's advisable to blow compressed air through the heatsink with the front part removed, approximately every 100 hours of operation. This ensures effective removal of accumulated debris, preventing overheating and promoting efficient heat dissipation. This routine contributes significantly to the overall reliability and extended lifespan of your laser system.

To remove the front part of the laser, remove the four screws located in the corners.



Laser Optics Maintenance

The front protective window of your laser head should be inspected before every use. If there is visible clouding or debris, it needs to be cleaned prior to using the laser. Additionally, it should ideally undergo cleaning every 100 working hours.

To maintain the protective window, gently unscrew the front cap part of the lens tube.

In the case of protective window damage, a replacement part can be purchased from the Opt Lasers shop: https://optlasers.com/accessories/plh3d-xt8-protective-window

The lens of your laser head should ideally undergo cleaning every 100 working hours.

Cleaning Procedure

For the cleaning process, it is recommended to utilize lab-grade 99.9% pure anhydrous isopropyl alcohol (anhydrous IPA). Here are five instances:

- IPA Plus (EU)
- MG Chemicals (824) IPA (USA), also available on Amazon
- Dustronics IPA (Canada)
- Hexeal IPA (UK)

- MG Chemicals (824) IPA (Australia)

An example cleaning routine is shown in this video: https://youtu.be/MLzFjfEJGa4
Cleaning should be carried out delicately, with just enough force to remove oil drops and dirt, but not too strong to prevent damage to the optical coating.

Note: Avoid using lens wipes advertised for cleaning reading glasses and microscopes on your laser equipment. These wipes often contain water (approximately 30%) and may include additives that can negatively interact with the lens coating. Using such wipes can result in smudges on the lens or even damage to the coating. Choose specialized cleaning materials suitable for laser equipment to ensure proper maintenance and longevity.

Note: Refrain from using products advertised as rubbing alcohol, as they typically contain approximately 70% isopropyl alcohol (IPA) and 30% water. The water content may leave marks on the lens after drying. Opt for anhydrous (water-free) isopropyl alcohol (IPA) for optimal lens cleaning without the risk of water-related residue.

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EU VAT No.: PL5423238556

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