

LBS-300HP-NIR

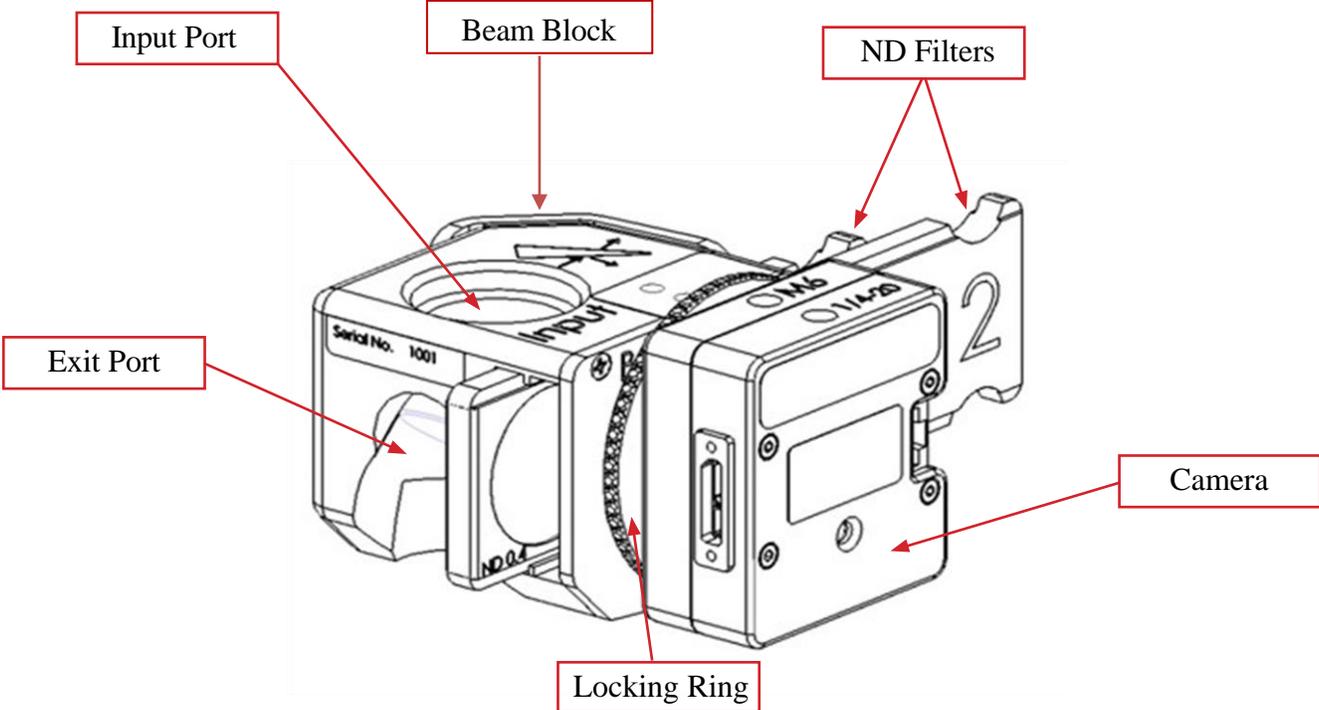
High Power Laser Beam Sampler for C-mount Cameras

P/N SP90540

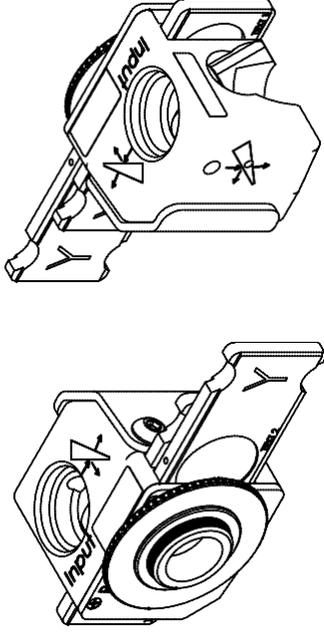
User Notes



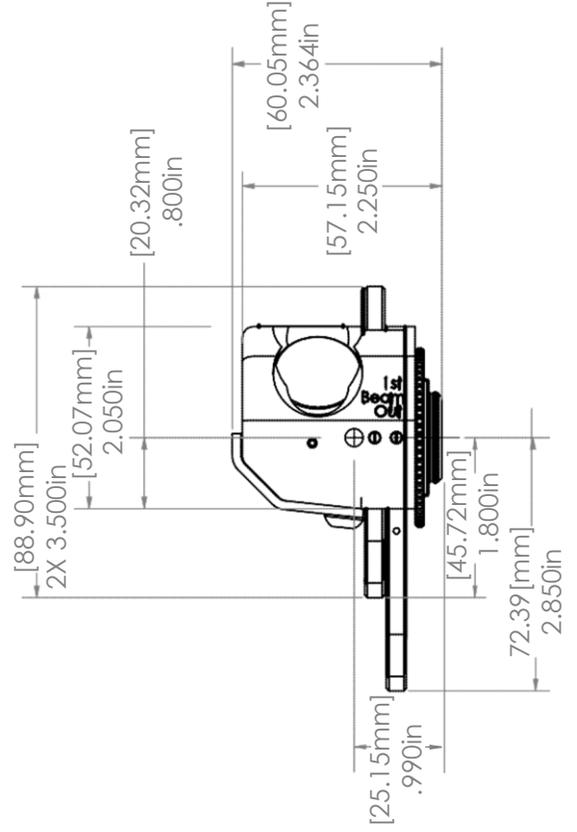
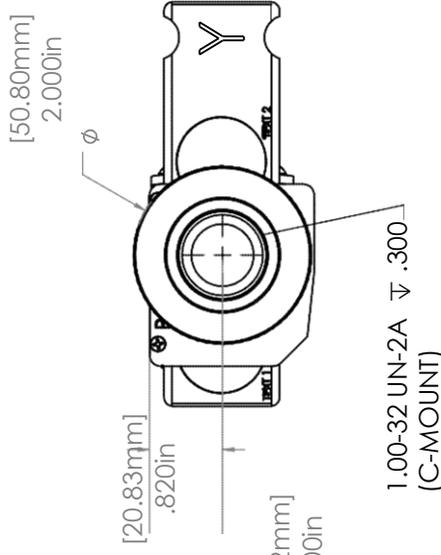
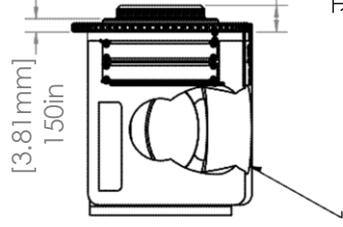
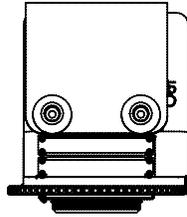
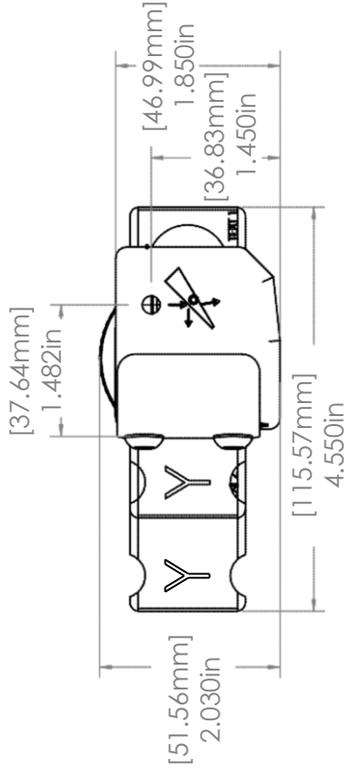
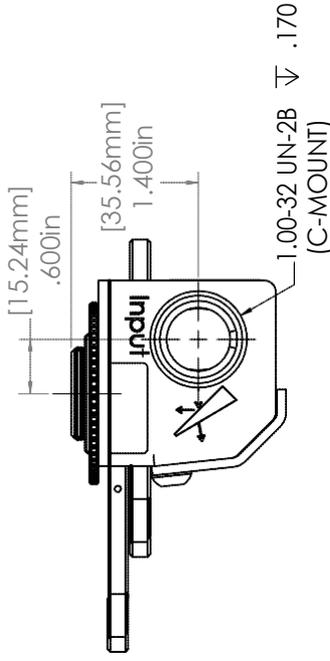
Components



Dimensions



Nominal Path Length = 2.820in [71.63mm]



Introduction

The LBS-300HP-NIR beam splitter for High Power lasers allows measuring NIR (~1064nm) focused or collimated laser beams profiles up to **5kW** or **15MW/cm²**.



A fraction of the incoming beam is reflected through the front surfaces of a pair of orthogonally oriented wedges. Less than 0.0001% ($1/10^6$) of the beam is reflected towards Ophir Beam Profiler Camera and less than 0.1 % towards optional Ophir power meter while remaining 99.9% of incident laser beam is transmitted. Thereby enabling beam shape, focal spot, beam waist, M^2 and overall power measurement of a up to 5kW or 15MW/cm² high power laser.

LBS-300HP-NIR with SP920s camera

¹ 100mW to 5000W

² The SP90540 passes less than 0.0001% to the camera.

³ 1×10^{-6} attenuation for the SP90540 without filter slides.

Each direction provides uniform attenuation of any beam shape Gaussian, flat-top, doughnut shape while preserves the polarization and overall profile of the incoming laser beam thus providing accurate sample of incident beam.

LBS-300HP housing has multiple mounting points for easy and versatile installation variants.

C-mount stackable design compatible with other C-mount accessories.

A set of 6 interchangeable ND filters is provided to make final intensity adjustments to the beam before it reaches the camera imager.

Warning when operating with high power lasers

Read the User Notes carefully to avoid damaging LBS-300HP-NIR.

Avoid any contact with Quartz wedges in order not to damage the surface. In case of wedge contamination, please read cleaning instructions and do not attempt to wipe the wedges.

In case the quartz wedge was damaged, please contact Ophir for further decision regarding cleaning or replacing the wedge.

When operating, always start lasing at low intensity and verify correct position of the focal spot, usually on Beam Profiler Sensor and only then increase the laser power.

LBS-300HP is designated to focus the laser on the camera CCD plane and not the wedge surface. It is not recommended to focus the laser on the wedges as the intensity of very small spots might damage the quartz wedge.

Installation and Setup

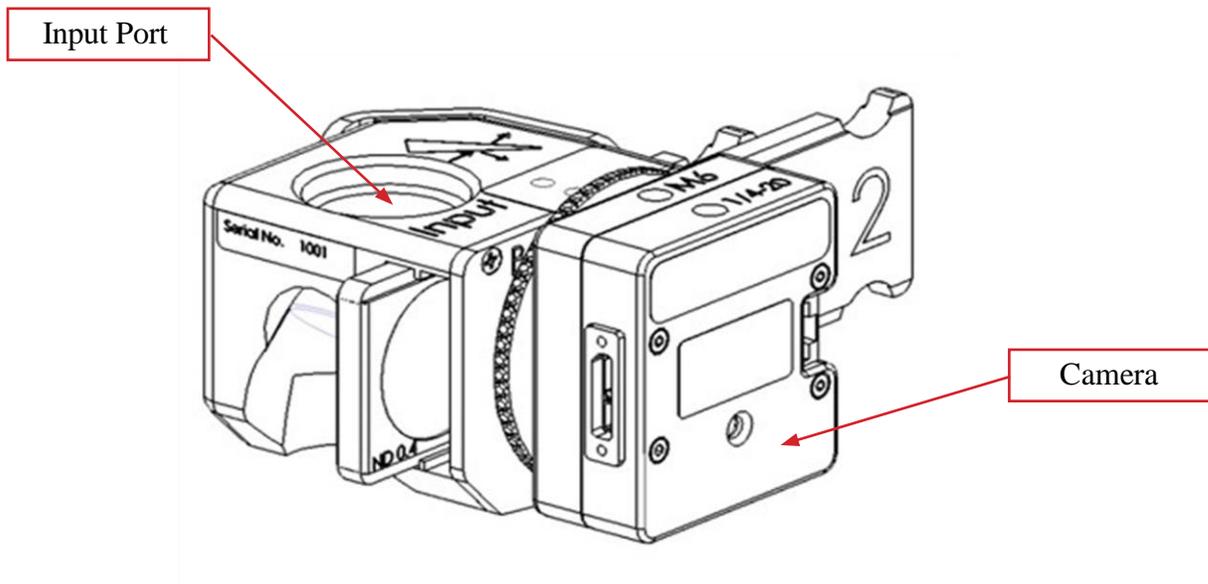


Figure 1

1. The LBS-300HP is attached to the camera as shown above in Figure 1. An adjustable locking ring is provided so that the beam splitter can be rotated in any orientation.
2. Beam reflection may change at different incidence angles or position offsets. Therefore, it's recommended to set the LBS-300HP so that the laser beam (or red alignment beam) enters the center of the input port at a 90° incidence.

A C-mount threaded alignment target can assist to ensure centricity and the angle of the input beam.

3. The beam will exit the LBS-300HP refracted approximately 6° as shown in Figure 2. Provision must be made to safely contain the transmitted beam. An optional beam dump or power meter is available to contain the beam if required.

A 1.035-40 thread is provided behind each wedge along the axis of the output beam that can be used to directly mount accessories with 1" lens tubes such as beam dumps or even power and energy sensors to the LBS-300HP.

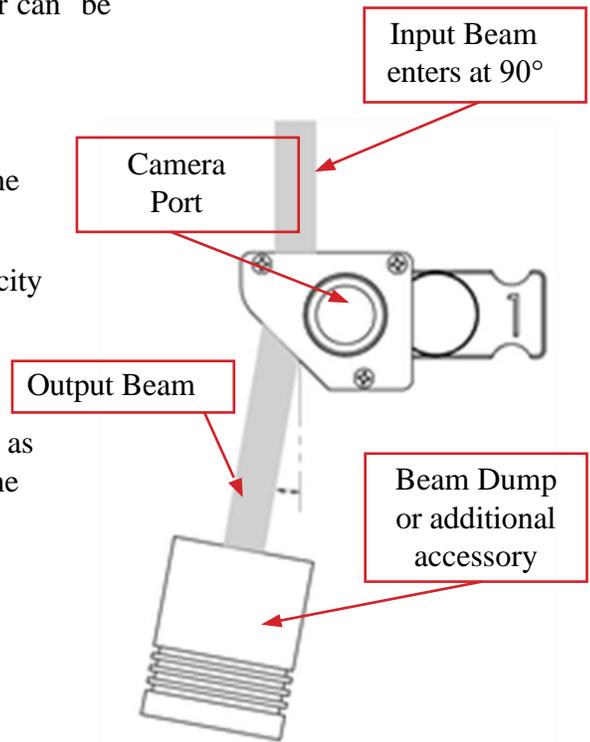
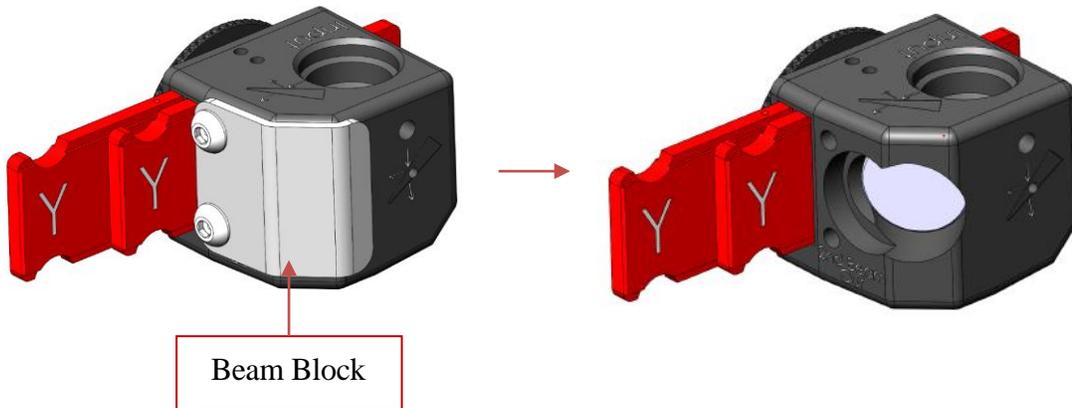


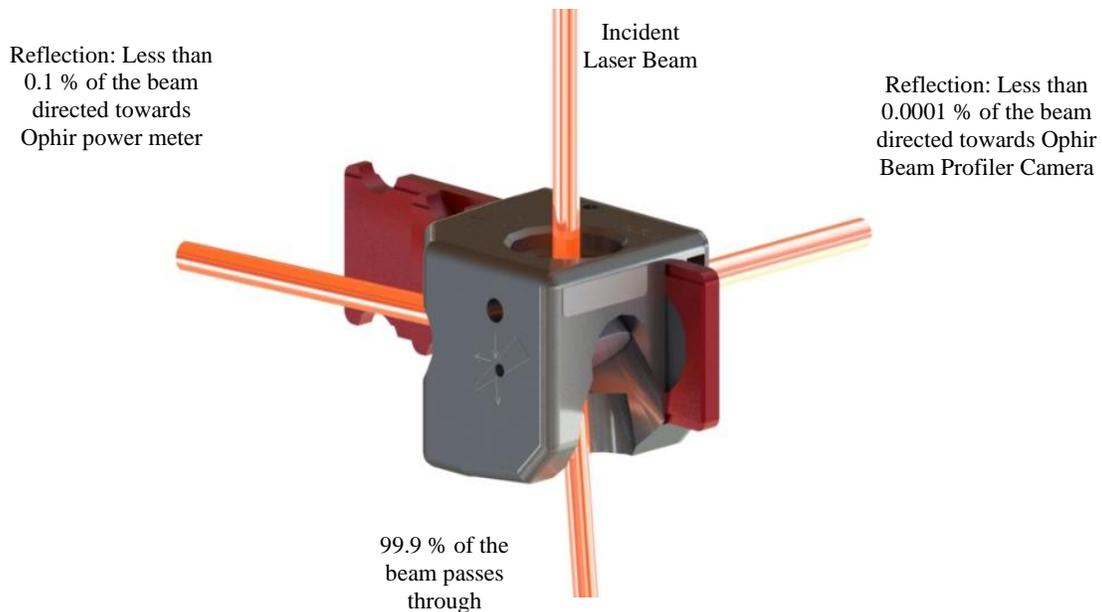
Figure 2

Warning: You must provide a beam stop for the laser beam that passes through the LBS-300HP. The beam stop must be able to withstand the continuous power/energy of the input beam.

4. Remove black beam blocker. The beam blocker is designated to keep the wedge surface protected during handling and shipping. It can be left attached for low power laser operations. However, in the case of high power laser irradiation, it must be removed.

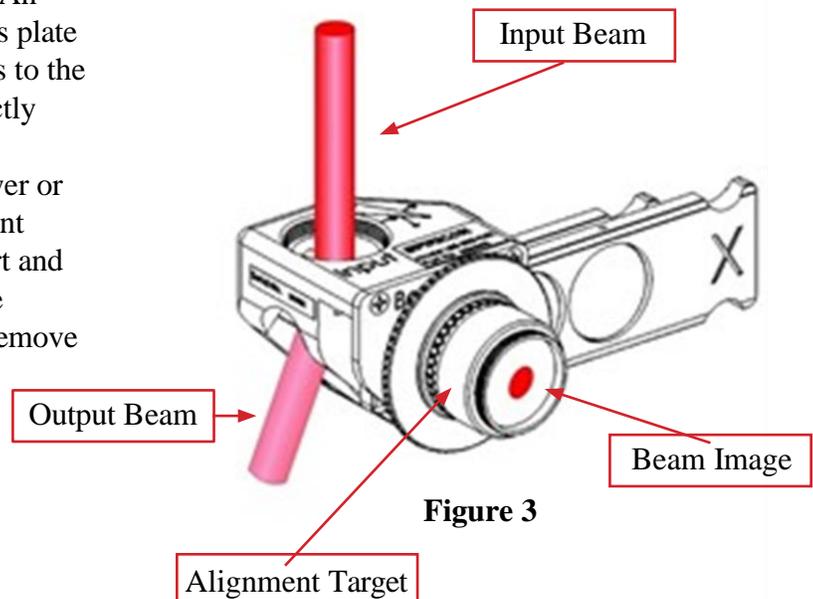


After removal, an additional output, having less than 0.1% of incident beam power will be reflected. That beam could be used for simultaneous measurement of laser power via Ophir Power Meter.



5. Adjust the position of the LBS-300HP so that the beam will exit the center of the camera port. An alignment fixture consisting of a ground glass plate is provided to assist in aligning visible beams to the camera imager. This plate allows you to directly view a visible alignment beam.

In the NIR, you will need to use an NIR viewer or a visible alignment beam. To use the alignment fixture. Screw the fixture onto the camera port and center the image of the beam in the plate. See Figure 3. When the LBS-300HP is aligned, remove the alignment fixture and attach the camera.



Operation

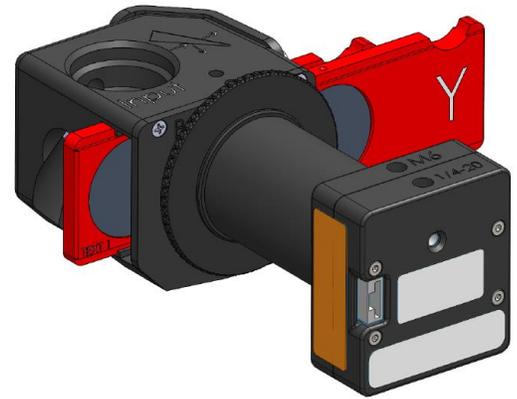
1. Start the beam profiler software and align the LBS-300HP with the laser operating at low intensity
2. Posit a focal spot of the laser on the beam profiler CCD plane. Avoid focusing a high-power laser on the quartz surface so as not to risk damaging it.
3. After verifying the laser is focused on the CCD plane, increase the laser intensity to the required level.
4. Start the beam profiler software and adjust the ND filter holders until the maximum beam intensity is approximately 80% of saturation. See Appendix A for ND filter details. If there are interference effects seen, slight angling of the camera-splitter setup to the beam path may eliminate this.
5. If no picture is seen, check again that the beam is aligned into the LBS-300HP. If the image is saturated when the maximum ND filters are in place, lower the camera signal below saturation by reducing the camera exposure setting. This can also be done by removing the camera, adding one or more of the C-mount ND filters provided with the camera, and remounting the camera.

6. During high power laser emission, due to extremely high beam attenuation, scattered NIR light could interfere with the beam measurement by increasing background.

In order to reduce scattering to minimal value, following actions are recommended:

- Distancing beam dump from the LBS-300HP assembly
- Using beam dump models designated to reduce 1064 nm scattering.
- Distancing Beam Profiler camera using C-mount extension tube of 50-100mm.

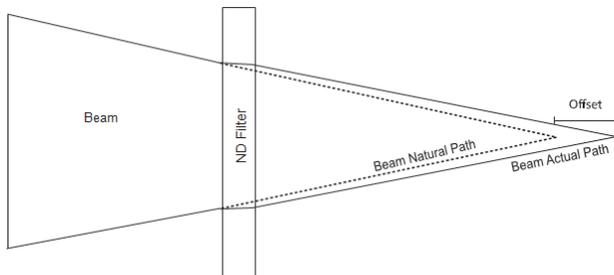
For distancing, we recommend using Ophir extension tubes equipped with C-mount adapters:



2" LT- Mount Extension Tube	SP90575
3" LT- Mount Extension Tube	SP90574
LT To External C-Mount Adapter	SP90576
LT To Internal C-Mount Adapter	SP90577

In case distancing the camera from LBS-300HP is impossible, the influence of scattering can be reduced by BeamGage "Smear Correction" function can be activated.

7. In case the analyzed beam is focused, and not collimated, nominal path distance is important for proper spot size on the camera CCD. Nominal path length from the LBS -300HP input plane to C-mount camera connector edge is 71.63mm (2.82in). Using ND filter slides could change this value, due to different refraction factors, causing some offset of the focal point.



Note: At power levels >5 Watts/cm² the ND filters may start to thermal lens and deform the observed beam profile.

Caution: The damage threshold for the ND filters is 50 Watts/cm². Make sure the power density in the beam as it hits the ND filters does not exceed this amount. If the beam is converging (focusing) rather than collimated, be sure to take this effect into consideration as well.

Additional usage notes

1. Thermal limitations

Due to high power laser irradiation thru UVFS wedges, the LBS-300HP assembly may increase temperature.

Thermal increase after 10 minutes of irradiation is demonstrated in Chart 1.

For example, at 4kW lasing the temperature is increased by 23.4 C°.

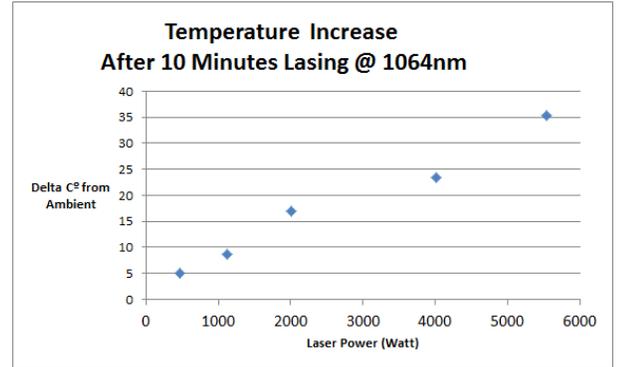


Chart 1: Increase from ambient temperature after 10 minutes of laser irradiation

In order to avoid LBS-300HP overheating, when using high power lasers, shorter periods of measurements are recommended. Heating tracking are demonstrated in Chart 2.

For example: After 15 minutes of 2kW lasing, the temperature is increased by 20.4 C°.

Active and passive cooling of the LBS-300HP assembly is also recommended when dealing with long period high power lasing.

Caution: It's not recommended to overheat the LBS-300HP assembly in order not to cause thermal lensing effect of ND filters.

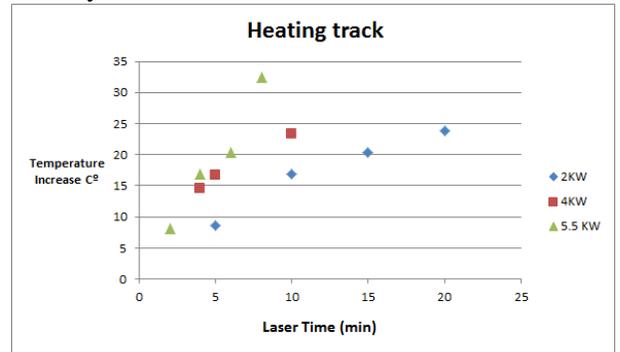


Chart 2: Increase from ambient temperature after lasing period for 2, 4 and 5.5KW.

2. Storage and handling

Any contact with UVFS wedges installed in LBS-300HP assembly can cause damage and reflection change resulting in beam profile distortion. Thereby, it is recommended to avoid even the slightest contact with the glass surface.

We recommend operating and storing the LBS-300HP in a dust-free environment.

In case of wedge contamination, please read cleaning instructions and do not attempt to wipe the wedges as this will damage the wedge surface.

In case the quartz wedge was damaged, please contact Ophir for further decision regarding cleaning or replacing the wedge.

3. Cleaning

Dust or debris on the wedge surface might cause reflection change and influence measured beam profile.

For detailed cleaning instructions, please contact the Ophir support team.

In case of debris or dust contamination, do not attempt to wipe the quartz surface. We recommend cleaning the wedge surface by rinsing it with a chemically pure solvent such as Ethanol, Methanol or IPA (Isopropyl Alcohol), followed by prolonged gentle nitrogen or pure compressed air purging.

Please ensure solvent and gas purity and lack of moisture in order not to contaminate the wedge surface.

Additional Usage recommendations could be found here:

<https://www.ophiropt.com/laser--measurement/knowledge-center/article/13656>

Ordering Information

Model	LBS-300HP-NIR
Part No.	SP90540
Wavelength ⁽¹⁾	1000-1100nm
Wedge Material	UVFS
Wedge Reflection	<0.1%
Surface Quality	$\lambda/6$
Clear Aperture	15mm
LBS-300HP-NIR Reflection	0.000025% - 0.0001% (1/10 ⁶)
Wedge ND value	≥ 3
Maximum Laser Power Exposure	5 kW for up to 10 minutes
Minimum Detectable Laser Power	100 mW
Maximum Power Density ⁽²⁾ , Energy Density	15MW/cm ² , 10J/cm ² at beam splitter
3 x Bulk Filters ND ⁽³⁾ values, nominal	0.4, 0.8, 1.0, 2.0, 3.0, 4.0 (Red Holders)

(1). Although the LBS-300HP-NIR is designated for 1000nm -1100nm, the real spectral range is significantly wider and covers 500nm-1500nm range. However, the spec above refers only to designated wavelength and can't be guaranteed for out of the range wavelength. Red alignment laser can also be used with LBS-300HP-NIR for alignment and targeting.

(2). 15 MW/cm² was maximal power density that was tested. Actual Maximum Power Density may be higher.

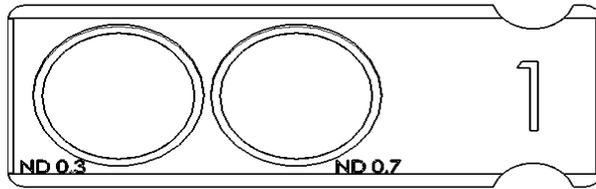
(3). ND bulk absorbing filters damage threshold is 5W/cm² for beam size 5mm, 10W/cm² for 2mm beam and >30W/cm² for 1mm beam.

Check our website for latest version spec: www.ophiropt.com/laser-measurement

Appendix A: ND Filters

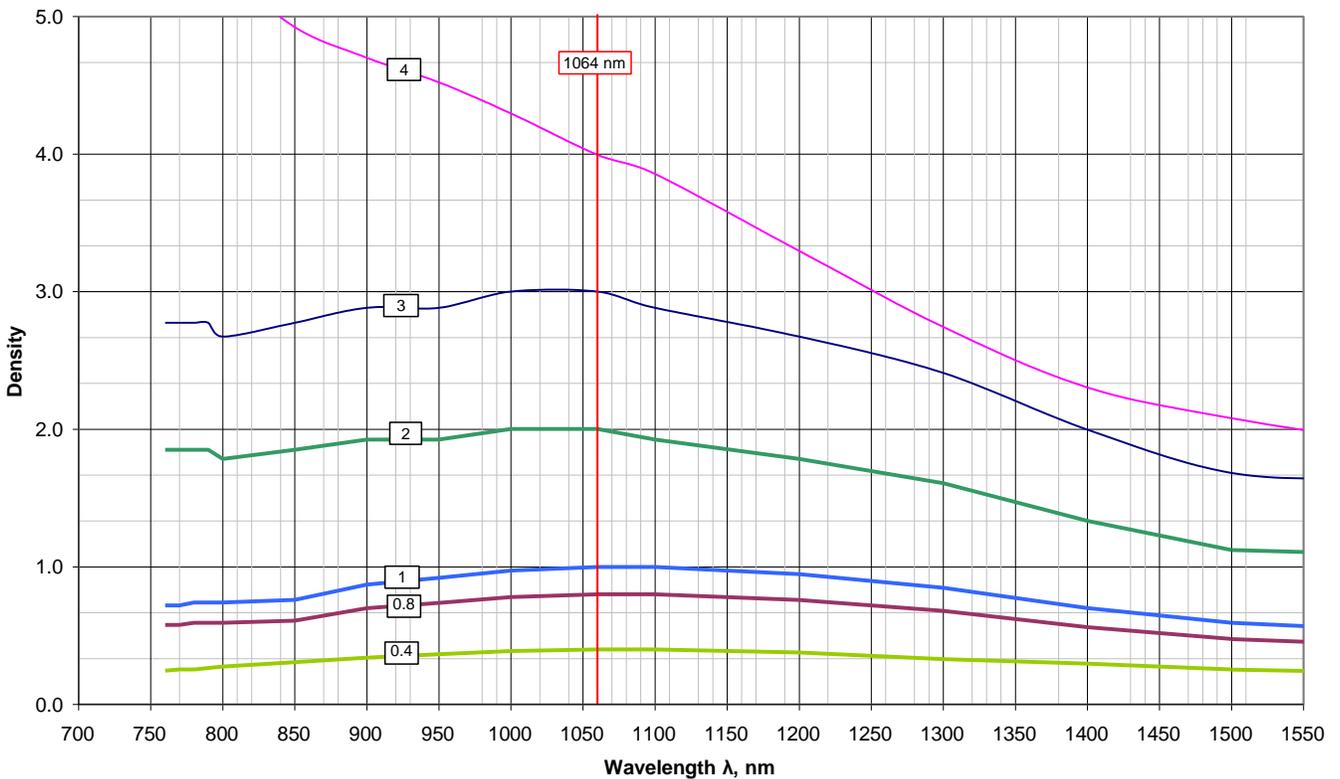
The ND filters provided with each LBS-300HP allow for final attenuation of the laser beam up to ND 6. Each filter in the holder provides for a different value of attenuation. To use, slide the desired holder into the slot in the LBS-300HP. A click is felt when the filter is properly aligned with the beam.

Holder Number	Filter A	Filter B
1	0.4	0.8
2	1	2
3	3	4



The attenuations at specified wavelengths are available in the charts below.

NIR filter set (Red Holders)
 Filter ND value vs. Wavelength
 NIR Range



About Ophir

Ophir is a brand within the MKS Instruments Light & Motion division. The Ophir product portfolio consists of laser and LED measurement products, including laser power and energy meters, laser beam profilers measuring femto-watt to hundred-kilowatt lasers, high-performance IR and visible optical elements, IR thermal imaging lenses and zoom lenses for defense and commercial applications. OEM and replacement high-quality optics and sub-assemblies for CO2 and high-power fiber laser material processing applications. Ophir products enhance our customers' capabilities and productivity in the semiconductor, industrial technologies, life and health sciences, research and defense markets. For more information, visit www.ophiropt.com/photronics

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Document No 8J06001 Rev 02 08 February 2021

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