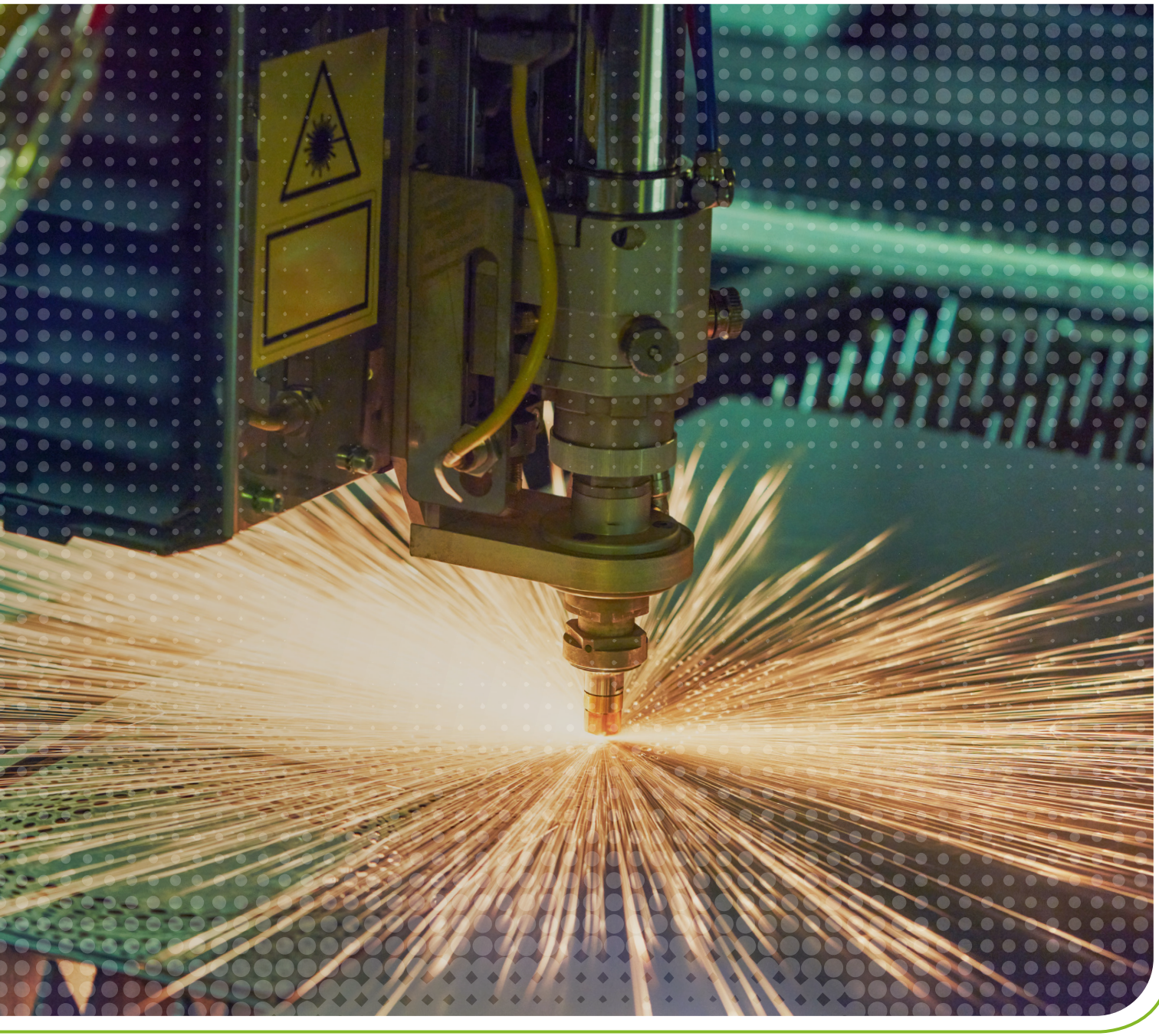
HIGH PERFORMANCE OPTICS FOR HIGH POWER LASERS

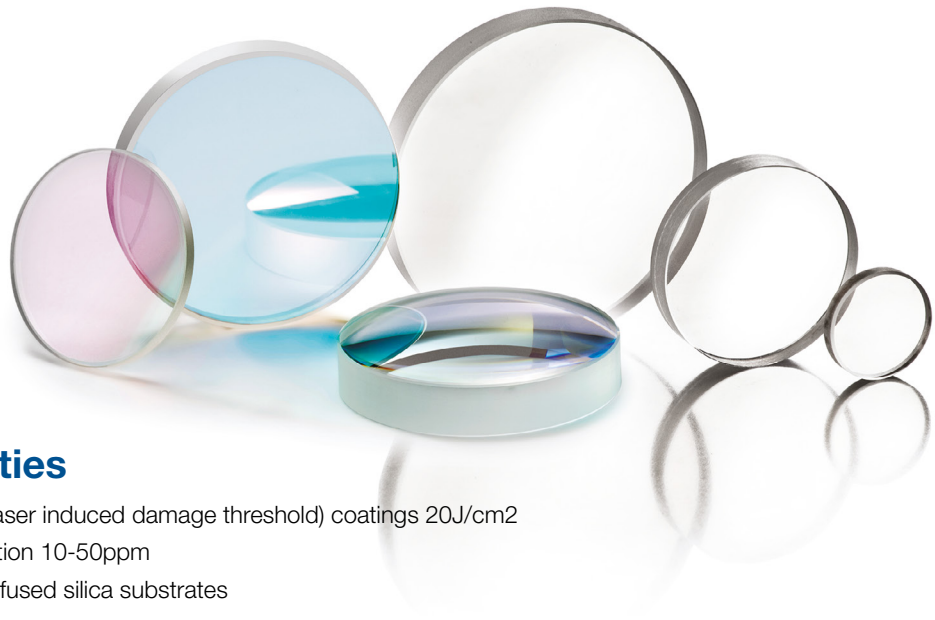


WIDE RANGE OF OPTICS FOR 1 MICRON HIGH POWER FIBER LASERS

With decades of knowledge and experience in the optical industry, using cutting-edge measurement equipment, Ophir offers a wide array of first-class optics for high power fiber lasers in the 1 micron wavelength range, including:

- Protective windows
- Spheric & aspheric lenses
- Optical collimation and focusing assemblies (doublets and singlets)
- Motorized zoom lens for laser cutting head

High power lasers are a growing industry with numerous applications. As technology advances, and lasers become more sophisticated, the optics used in such systems must provide increasingly superior levels of performance.
Here's where Ophir steps in. With the 1 micron high power laser optics range, Ophir guarantees maximum focus stability and minimum aberrations, by using advanced manufacturing technologies, for high optical performance.



Capabilities

- High LIDT (laser induced damage threshold) coatings 20J/cm2
- Low absorption 10-50ppm
- High quality fused silica substrates

Typical coating features	
AOI	0º-15º
%R	@1030-1090 < 0.1%-0.2%
%T	@650-670>60%-95% (2 sides)
%T @1030nm	T>99.6%
%T @1064nm	T>99.9%
%T @1070-1080nm	T>99.6%
S/D	10-5

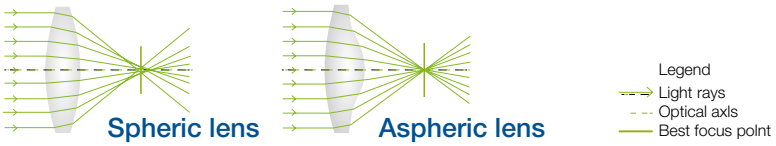
Mechanical properties	
Elastic (Young's) modulus	73GPa
Poisson's ratio	0.16
Density	2.20g/cm^3
Knoop hardness (100g load)	522kg/mm^2

Thermal properties	
Specific heat	0.770 J/(gK)
Thermal conductivity	1.38W/(mK)
Thermal diffusivity	0.0075 cm^2/s
Thermal expansion	9.6×10^{-6} K^{-1}
Thermal coefficient	Δn/ΔT 9.6×10^{-6} K^{-1}

ASPHERIC LENSES

Aspheric surfaces on collimating and focusing lenses provide improved performance over conventional, spheric surfaces, in high-power industrial fiber laser and direct diode laser systems. The aspheric shape of the optics reduces spheric aberration, resulting in a smaller spot size, a uniform spot shape and greater depth of focus.

Ophir Fiberlens™ aspheric lenses are available in custom configurations for all high-power industrial fiber laser and direct diode laser systems.



Specification	Value / Range	Tolerance
Diameter (range)	12.0 – 300.0 mm	+ 0 / - 0.10 mm
Effective focal length (EFL)	20.0 – 500.0 mm	<0.1%
Lens types	Aspherical - plano Aspherical - spherical Aspherical - aspherical	
Clear aperture	> 90% of diameter	
Asphere power	< 2.0 fringe at 632.8 nm Radius of curvature	
Asphere irregularity	< 0.5 fringe at 632.8 nm (P-V)	
Scratch - you	20-10 or better	
Surface roughness	<2 nm RMS	
Substrate material	High-purity, UV-grade fused silica	
Focal length	≤0.1%	
ETV	≤10µm	

Lenses for high power fiber lasers

Ophir P/N	Diameter (inch/mm)	F.L. (inch/mm)	E.T. (mm)
Focusing Doublet			
633859-117	1.18/ 30.0	4.92/ 125.00	Assembly #680339-001
633860-117	1.18/ 30.0	4.92/ 125.00	
633910-117	1.46/ 37.0	5.91/ 150.00	Assembly #680337-001
633911-117	1.46/ 37.0	5.91/ 150.00	
633771-117	1.18/ 30.0	5.91/ 150.00	
633772-117	1.18/ 30.0	5.91/ 150.00	
Collimating Doublet			
633861-117	1.18/ 30.0	3.94/ 100.00	Assembly #680340-001
633862-117	1.18/ 30.0	3.94/ 100.00	
634132-117	1.46/ 37.0	3.94/ 100.00	Assembly #680355-001
634133-117	1.46/ 37.0	3.94/ 100.00	
Single Lens			
632284-117	1.50/ 38.1	7.50/ 190.50	7.00
631669-117	1.50/ 38.1	5.00/ 127.00	7.00
632291-117	1.50/ 38.1	7.09/ 180.00	3.00
632292-117	1.50/ 38.1	8.66/ 220.0	3.30
632294-117	2.00/ 50.8	5.91/ 150.00	11.60
633112-117	2.00/ 50.8	7.50/ 190.00	11.45
632331-117	1.18/ 30.0	7.87/ 200.00	2.45
632754-117	1.00/ 25.4	8.00/ ~200.00	6.00
633842-117	1.00/ 25.4	4.43/ 112.5	2.40
633214-117	1.00/ 25.4	3.94/ 100.00	2.00
631521-117	1.38/ 35.0	5.91/ 150.00	9.00
633841-117	1.00/ 25.4	8.86/ 229.00	3.20
633415-117	1.50/ 38.1	8.27/ 210.00	6.38
633120-117	1.97/ 50.0	8.66/ 220.00	2.80
633230-117	1.57/ 40.0	5.91/ 150.00	5.00

Protective windows for high power fiber lasers

Ophir P/N	Diameter (inch/mm)	E.T. (mm)
633267-117	0.85/ 21.5	2.00
632252-117	0.88/ 22.4	4.00
632445-117	1/ 25.4	3.00
633723-117	1/ 25.4	5.00
633481-117	1/ 25.4	4.00
632830-117	1.18/ 30.0	5.00
632240-117	1.18/ 30.0	1.50
632755-117	1.26/ 32.0	6.35
632595-117*	1.31/ 33.3	1.50
632251-117	1.34/ 34.0	5.00
632851-117	1.42/ 36.0	5.00
633411-117	1.46/ 37.0	7.00
632958-117	1.5/ 38.1	5.00
633347-117	1.5/ 38.1	1.50
632933-117	1.65/ 42.0	9.00
632498-117	1.97/ 50.0	2.00
634376-117	1.97/ 50.0	8.00
632346-117	2/ 50.8	6.35
632713-117	2.17/ 55.0	1.50
633824-117	1.38/ 35.0	1.50

*Octagonal window

Optics for CO_2 lasers

Clear Magic™
Ultra Low Absorption

- Focusing lens made of high quality ZnSe substrate
- **Radioactive-free coating***
- ≤0.13% absorption (guaranteed)
- Designed specifically for high power laser systems
- Superior focus stability
- Transparent for red laser pointer
- Longer life expectancy at strained working conditions

Black Magic™
Low Absorption

- Focusing lens made of high quality ZnSe substrate
- **Radioactive-free coating***
- ≤0.15% absorption (guaranteed)
- Highest durability available
- Humidity resistant
- Superior cost/benefit ratio
- High resistance to back spatter
- Ideal for cutting aluminum and stainless steel

Duralens™

- Focusing lens made of high quality ZnSe substrate
- High durability
- **Radioactive-free coating***
- 0.2% absorption
- OEM approved
- Available mounted or non-mounted
- Available for all common laser machines

Mirrors

- Copper and Silicon
- Total reflectors
- Phase retarders
- Maximum Metal Reflector (MMR)
- Absorbing Thin-Film Reflectors (ATFR)
- Output couplers
- Rear mirrors
- OEM approved

*Thorium, 90 Th free

EZ your laser application maintenance. Prolong its lifespan.

EZ Mount™

- Reusable lens mounts compatible with Amada laser applications
- Unbeatable cost savings
- Minimized downtime
- No tools required
- No Indium wire

EZ Clean™

- Wipes for routine cleaning of optical laser lenses
- Quick and easy to use
- Superior cleaning results
- Disposable, single-use packets
- Resistant to shop contamination
- “No touch” holders available

EZ Test™

- Portable lens stress analyzers
- Immediate problem identification
- Non-contact holders
- Replaceable polarizing filters
- No additional hardware required

WIDE OPTIONS FOR VIA DRILLING OPTICS

HIGH PRECISION CO_2 OPTICS & COATINGS FOR 9.4µm PCB VIA DRILLING EQUIPMENT

Optics type

- ZnSe lenses
- Silicon Mirrors
- Cu Mirrors
- ZnSe Prisms
- Knife edge Mirrors
- Beam Splitters
- Thin Film Polarizers

Coating Type

- Anti Reflection (AR)
- Diamond Like Carbon (DLC)
- Phase Shift (PS)
- Metal Mirror Reflector (MMR)
- Thin Film Polarizer (TFP)
- Absorbing Thin film Reflector (AFTR)

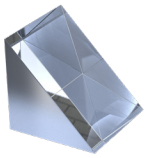
Key Benefits

- Low absorptance
- Low reflectance (AR)
- High reflectance (Mirrors)
- High durability (DLC)
- Strict surface quality

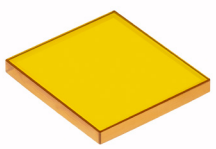
ZnSe Lenses

Copper Mirrors

Silicon Mirrors



Prism



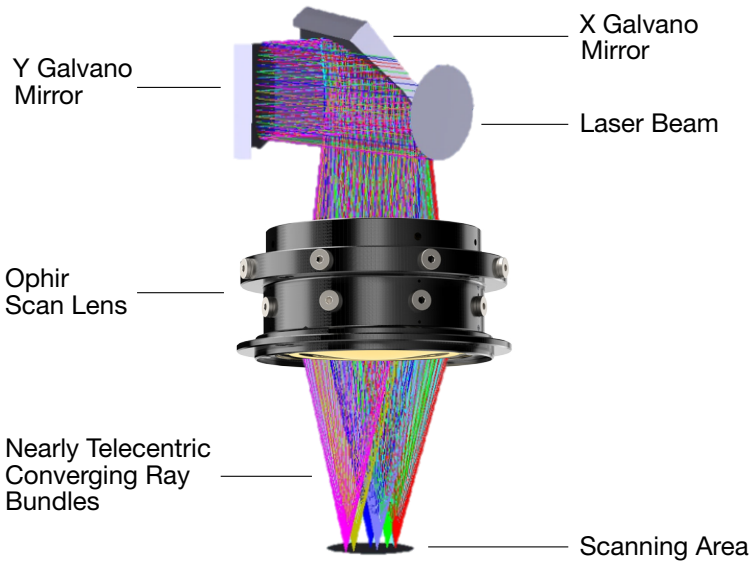
TFP

OPTICAL ASSEMBLY SOLUTIONS – OPHIR SCAN LENSES FOR CO_2 LASER PROCESSING

Ophir laser Scan Lenses are customized for advanced, high-resolution laser micromachining applications.

Specifically, Ophir CO_2 scan lenses deliver the performance for PCB via hole drilling applications, including:

- Small spot sizes with tight tolerances
- Excellent beam roundness
- High telecentricity
- Wide scanning areas
- Unique AR coatings for high incidence angels
- Diffraction limited performance



Popular CO2 lenses* for high power lasers

Ophir P/N	Optics Typs	Diameter (inch)	Focal Lenght (inch)	E.T. (mm)	Max. BAR	Mounting Distance	OEM
60260	Meniscus	1.5”	5.0”	6.00mm	21.70	120.84	Bystronic
60602	Meniscus	1.5”	7.5”	6.00mm	21.70	183.19	Bystronic
61171	Meniscus	1.5”	7.5”	7.87mm	37.30	185.31	Shanghai Unity
61960	Meniscus	1.5”	10.0”	7.40mm	32.67	245.45	Trumpf
61961	Meniscus	1.5”	9.0”	7.40mm	33.02	219.31	Trumpf
61982	Meniscus	1.5”	5.0”	7.40mm	32.10	120.80	Trumpf
61983	Meniscus	1.5”	7.5”	7.40mm	32.10	185.45	Trumpf
61962	Meniscus	1.5”	3.75”	7.40mm	33.02	89.13	Trumpf
62649-117	Plano-convex	1.5”	7.5”	7.60mm	34.83	185.57	Amada
62670	Plano-convex	1.5”	5.0”	7.60mm	34.83	123.66	Amada
631916-117	Plano-convex	1.5”	7.5”	7.80mm	37.00	185.88	Amada / Han's Laser
631917-117	Plano-convex	1.5”	5.0”	7.80mm	37.00	123.70	Amada / Han's Laser
631079-117	Meniscus	1.5”	5.0”	9.00mm	48.80	119.03	Bystronic
60616	Meniscus	1.5”	7.5”	9.00mm	48.80	184.04	Bystronic
633126-117	Meniscus	50mm	170mm	8.9mm	33.00	168.20	Trumpf Cut Lens with RFID
631088-117	Meniscus	50mm	250mm	8.9mm	33.00	244.86	Trumpf Cut Lens with RFID
633125-117	Meniscus	50mm	170mm	8.9mm	33.00	168.20	Trumpf Cut Lens with RFID
62439	Meniscus	50mm	250mm	8.9mm	33.00	244.86	Trumpf Cut Lens with RFID
631091-117	Meniscus	40mm	130mm	7.5mm	33.00	244.86	Trumpf Cut Lens with RFID
631090-117	Meniscus	40mm	250mm	7.5mm	33.00	124.54	Trumpf Cut Lens with RFID
630790-217	Meniscus	40mm	130mm	7.5mm	33.00	244.86	Trumpf Cut Lens with RFID
630789-217	Meniscus	40mm	250mm	7.5mm	33.00	124.54	Trumpf Cut Lens with RFID
62728	Plano-convex	2.0”	5.0”	7.90mm	21.00	122.74	Mazak / Mitsubishi
62729	Plano-convex	2.0”	7.5”	7.90mm	21.00	185.45	Mazak / Mitsubishi
61405	Plano-convex	2.0”	7.5”	9.65mm	31.20	185.67	Mazak / Amada / JFY
61019	Plano-convex	2.0”	5.0”	9.65mm	31.20	122.31	Mazak / Amada / JFY
60698-117	Meniscus	2.0”	7.5”	9.65mm	31.20	182.58	LVD

* Standard coating

About Ophir Infrared Optics

With vast knowledge and extensive experience accumulated over four decades, Ophir Laser Optics Group, an MKS (NASDAQ:MKSI) company, offers a full range of high quality OEM and replacement optics for high power CO2 and 1µm laser applications, in the 10.6µm, 9.3µm and 1µm wavelength ranges. Used by leading laser manufacturers around the world, our products meet the highest industry standards and have been widely tested with outstanding results. All manufacturing is carried out in-house using automated CNC, patented diamond turning technologies, and advanced, cutting-edge coating processes and measuring equipment. With a global distribution and support network, our commitment to our customers is unparalleled.

International Headquarters
Ophir Optronics Solutions Ltd.

Science based industrial park
Har hotzvim P.O.B 45021
Jerusalem, 9145001 Israel
Tel. 972-2-5484444

JAPAN
Ophir Japan Ltd.

Mr. Kenji Suzuki
6F Kudan First Place
4-1-28 Kudan Kita, Chiyoda-ku,
Tokyo 102-0073 Japan
Tel. +81-3-3556-2791
Fax. +81-3-3556-2790
oj.optics@mksinst.com
www.ophiropt.com/laser-optics/jp

USA
MKS Instruments Inc.

Mr. Jonathan Pulsifer
3050 North 300 West
North Logan, UT 84341 USA
Toll Free No. 1-866-755-5499
Tel. +(435) -753 3729
Fax. +(435) -753 5231
sales.ophir.usa@mksinst.com

GERMANY
Ophir Spiricon Europe GmbH

Guerickeweg 7
D-64291 Darmstadt
Germany
Main: +49-6151-708-0
ose-sales@mksinst.com

CHINA
MKS Instruments Inc.

Mr. Nick Gong / 宫广彪
New G312 Road-Gao Lang Road,
Block G, Huaren Industry Park
Cell: +86-158-6242-9426
nick.gong@mksinst.com
https://www.ophiropt.com/zh/laser-optics