Sill OPTICS

LASER OPTICS
IMAGING OPTICS

2025

LASER OPTICS

IMAGING OPTICS

OUR HIGHLIGHTS 2025

Sill Optics sells customized lenses for CO_2 lasers. Scan lenses, beam expanders, focusing lenses and other customized optics for lasers with wavelengths above 9 µm can be calculated, designed, constructed, assembled and distributed thanks to our new materials (zinc selenide, zinc sulfide and germanium).

ZINC SELENIDE

Zinc selenide is particularly suitable for the design of high-performance lenses. This is mainly due to its high transmission (approx. 70 %) in the range of 550 nm to 20 µm and its low absorption. This means that little power remains in the lenses, which could otherwise lead to damage. The low hardness and therefore low mechanical strength as well as the toxicity of the dust during processing (due to the selenium content) are disadvantages of the material. However, due to its excellent optical properties, it is usually gladly accepted.

The 1-3x zoom beam expander S6EXZ9313-684 made of zinc selenide was developed for the use of high-power CO_2 lasers. For the first time, you can order a lens for lasers in the LWIR (long wave infrared) range from our catalog. Many other lenses can be requested as customized designs at any time.

GERMANIUM

Due to its high refractive power, germanium is particularly suitable for the color correction of lenses. Highly refractive materials are also advantageous for lenses that are only designed for one wavelength and therefore usually consist of one glass, as this saves single lens elements. The very high Knoop hardness of approx. 800 kg/mm² makes germanium insensitive to mechanical stress. Germanium is particularly suitable for low-power applications in the LWIR (long wave infrared) range. The medium transmission of 50 % between 1.8 µm and 18 µm and the high absorption make it less suitable in combination with high-power lasers. In addition, there is a strongly temperature-dependent refractive index, which leads to an enormous thermal focus shift.

The material is opaque in the visible range and therefore poses challenges during testing.

Nevertheless, it is often used for color-corrected applications in the low-power range due to its high refractive power and good machinability (non-toxic and hard).

CUSTOMIZED LASER OPTICS
BENEFIT FROM OUR EXPERTISE

OUR HIGHLIGHTS 2025

ZINC SULPHIDE

Zinc sulphide is a cost-effective alternative to zinc selenide. It is non-toxic during processing and slightly harder than zinc selenide, which makes it easier to manufacture lenses from this material. The high transmission of 70 % (clear grade) in the range of 500 nm to 12 µm makes the material interesting for medium power applications.

Zinc sulphide is less suitable for high-performance applications due to its higher absorption. In addition, the compound is not resistant to water, which causes problems for certain applications.

However, the temperature-stable refractive index and the low coefficient of thermal expansion ensure a low thermal color shift and suitability for use at high or strongly fluctuating temperatures. In addition, zinc sulphide as an alternative to zinc selenide allows a wider choice of glasses for the long-wave infrared range. This simplifies the color correction of lenses for this area of application.

NEW ZINC SELENIDE BEAM EXPANDERS FOR HIGH POWER LASERS

With the two zoom beam expanders S6EXZ9313-684 and S6EXZ9313-681, Sill Optics is launching lenses for CO_2 lasers with wavelengths of 9.3 µm and 10.6 µm as a standard product for the first time.

Both beam expanders are manually adjustable in an **expansion range from 1x to 3x**. All magnification levels in between can be set manually. As with all Sill Optics beam expanders, the divergence can also be set manually.

Both zoom beam expanders contain lenses made exclusively from **high-performance zinc selenide**. The material is characterized by very high transmission and low absorption for this spectrum. State-of-the-art coatings and a special optical design with particularly few individual lenses allow very high overall transmission through the lens. S6EXZ9313-684 and S6EXZ9313-681 are both suitable for usage with high-power lasers due to their material and optical design. A free entry aperture of 28.5 mm (mechanical limitation) can be widened to a maximum of 45 mm.

The difference between the two beam expanders lies in the correction for the wavelengths of 9.3 µm (S6EXZ9313-584) and 10.6 µm (S6EXZ9313-581). These are the two most common wavelengths for standard CO_2 lasers.

If you require a beam expander with other specifications (magnification, aperture, etc.) for your setup in the LWIR range (long wave infrared), you are welcome to contact us with your request at any time.

Since Sill Optics offers lenses made of materials for this range (zinc selenide, zinc sulphide, germanium), our engineers have experience in the design of such optics. In addition to beam expanders, this also applies to scan lenses, focusing optics and many other lenses. We design, manufacture and sell customer-specific prototypes and small series that are specially adapted to your requirements and wishes.

OUR HIGHLIGHTS 2025

MOTORIZED BEAM EXPANDER FOR HIGH-POWER LASERS

The success of the Sill Optics beam expanders made of high-quality fused silica and coatings over the past decades invited Sill Optics to start a new project, which resulted in the newly developed motorized beam expander S6EZM0940-574.

This new motorized beam expander S6EZM0940-574 features the identical optical design as the manually adjustable S6EXZ0940-574. By using the highest quality coatings and fused silica, Sill Optics also ensures that this new beam expander achieves a particularly high resistance, when used by modern high-power lasers. The beam diameter does not fall below the minimum value on all inside lens surfaces of the lens. As a result, the energy input even on the usually critical second lens is so low, even when using high-power lasers, that damage to the material and the coating is avoided.

While zoom beam expanders score with an adjustable range of the magnification factor, beam expanders with a fixed magnification are often interesting because of their suitability for extremely short-pulsed high-power lasers. The new high-power motorized beam expander S6EZM0940-574 combines both advantages as its manually adjustable counterpart.

In contrast to the S6EXZ0940-574, the inside lenses of the S6EZM0940-574 are moved motorized. This allows both the magnification factor in the range of 0.9x – 4x and the divergence to be set with high precision and fully automatically. Since no components are touched during the magnification and divergence setting and the lenses are positioned with an accuracy of up to 30 µm, a pointing error of ≤0.2 mrad can be realized.

Our wide range of products in the field of beam expanders is large and includes many different models. The spectrum ranges from compact or natural anodized beam expanders with fixed magnification to manual, partially motorized or fully motorized zoom beam expanders. If you need a specific magnification or have other special requirements that cannot be realized by our portfolio lenses, we are happy to adapt existing products to your needs or develop a customer-specific new design. Please feel free to contact us and experience the performance of our high-quality beam expanders.

CUSTOMIZED LASER OPTICS
BENEFIT FROM OUR EXPERTISE

OUR HIGHLIGHTS 2025

NEW LENSES FOR HIGH POWER LASERS

Sill Optics is expanding its laser range with a telecentric lens that combines two advantages: telecentricity and an extremely large scanning field.

Common LC display formats are usually very cheap. However, in some industries, such as aviation or modern trains, other formats are required. As a new development with special aspect ratios would be enormously expensive, especially for small and medium quantities, standard formats are preferred for cutting. In fact, this approach is possible without any loss of function, as LC displays consist of several individual components connected in series. If these are completed in advance, special formats can be produced cost-effectively by that.

Laser cutting is the method of choice for cutting the displays. It is particularly important that the cut is made perpendicular to the surface of the display. A minimal cutting depth results in minimal heat input so that neighbouring assemblies are not affected. In addition, a vertical cut is required to fit the extremely narrow space between the individual assemblies.

Telecentric f-theta lenses **enable a vertical beam incidence and therefore a vertical section in the entire working plane due to their low telecentric error**. This is most important for the field corners, where the input beam is deflected to the maximum by the upstream galvanometer scanner. Telecentric lenses are also characterized by a particularly homogeneous spot shape and size in the entire scan field area, especially when it comes to a diffraction-limited optical design.

Nevertheless, the advantages of telecentricity also come at a price, especially for applications which need a large scan field size. The scan field is mechanically limited by the diameter of the last lens. Therefore, the rear lenses of telecentric lenses must be significantly larger than those of non-telecentric versions to cover extended scan fields. The larger the scan field of the f-theta lens, the higher the maximum section length.

S4LFT3340-075 fulfils both criteria at a laser wavelength of 343 nm - 355 nm and has a low **telecentric error of less than 1° and a large scan field of 205 mm x 205 mm**. Due to its properties, the lens is particularly suitable for extremely fine cutting tasks such as cutting LC displays. Telecentric f-theta lenses are also available for other fields and wavelengths. Sill Optics also specializes in customized solutions for complicated applications with high quality requirements. This means that customized lens designs can be developed and manufactured. Existing designs can modified and adapted according to your wishes. Please contact us to find out more about the possibilities of our telecentric high-performance optics.

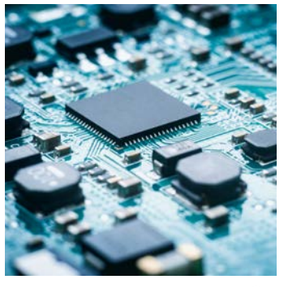
CUSTOMIZED LASER OPTICS

BENEFIT FROM OUR EXPERTISE

Sill Optics has been a trusted partner for customized laser optic solutions for years. Our specialties lie in many different areas of application and a wide variety of designs. Sill Optics also has many years of experience with various projects for customized optical designs and individual mechanical layouts.

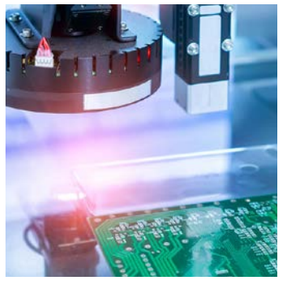
The close coordination between various internal departments, our large range of manufacturing capabilities and our high quality series production are the reasons why we are able to build your prototype in the shortest time possible.

In recent years, we have successfully completed more then 60% of laser optic orders as development projects based on individual inquiries and participation in public research projects. Most of these developments took part in the field of high-power solutions in solar systems, consumer electronics, eMobility or additive manufacturing applications for mechanical engineering processing.



SEMICONDUCTOR & DISPLAY MANUFACTURING

AUTOMOTIVE INDUSTRY, E.G. BATTERY PRODUCTION BODY WELDING ETC.



CONSUMER ELECTRONICS

SOLARCELL PRODUCTION

ADDITIVE MANUFACTURING

YOUR BENEFITS FROM A SILL OPTICS DEVELOPMENT

- development of specification sheet close to design and production possibilities
- direct contact to optical designer and project manager
- short distances between design, development and production
- prototypes at short notice
- high quality of series production
- quality assurance according to individual needs

CUSTOMIZED LASER OPTICS

BENEFIT FROM OUR EXPERTISE

YOUR BENEFITS FROM SILL OPTICS DEVELOPMENT

WHY SILL OPTICS?

- Development of specification sheets closely aligned with design and production capabilities
- Direct contact with optical designers and project managers
- Short distances between design, development and production
- Quick turnaround for prototypes
- High quality in series production
- Customized quality assurance based on individual needs

WHICH SPECIFICATIONS?

- Scan lens: laser data (wavelength, pulse duration, pulse energy, M^2), scanner data (beam diameter, mirror distances, scanner type), Lens data (telecentricity, scan field size, spot diameter, focal length)
- Beam expander: wavelength, magnification (region), motorization, entrance beam diameter
- Focussing system: wavelength, focal length, spot diameter
- Trapped Ion lens: wavelengths, NA, vacuum window data (thickness, material, position), scan field

WHEN STARTING A PROJECT?

A typical starting point for a customized design, considering the overall benefit in terms of the price-performance ratio, is around 50-100 lenses per year. Sill Optics' production capacity is well-suited for up to 500 pieces per year.

However, the ideal number of lenses will vary depending on the size, number of elements, and complexity of the system. For highly complex designs with large elements, special glass types, high alignment demands and end test requirements, even as few as 5 pieces can be beneficial. Other designs may start with quantities of 20 or 50 pieces.

WORKFLOW THROUGH OUR CUSTOM DESIGN PROCESS

PROJECT DESCRIPTION AND SPECIFICATION → OPTICAL PREDESIGN AND FEASIBILITY ANALYSIS → QUOTE FOR DEVELOPMENT, TOOLING, PROTOTYPES AND SERIES CONDITIONS

PROTOTYPE AND TOOLING ORDER → PROTOTYPE PRODUCTION → PROTOTYPE FINAL TEST AND SHIPMENT

F-THETA LENSES

BENEFIT FROM OUR EXPERIENCE

Sill Optics has been manufacturing high-quality laser optics for almost 40 years. These lenses are specifically designed for laser material processing applications for industrial mechanical engineering.

They are specially designed for applications in CE, automotive, semiconductor, additive or solar cell manufacturing. In addition to medical and biotech applications (confocal microscopy, ophthalmology) and science and research. The design and the quality of the optical components play a key role in the lens performance.

GLASS OPTICS

PART NUMBER	FOCAL LENGTH [mm]	SCAN AREA [mm x mm]	FOCUS SIZE (1/e²) [µm]	MAX. BEAM-Ø [mm]	MAX. TELE-CENTRICITY ERROR [°]	WORKING DISTANCE [mm]	SP/USP*	ACHROMATIC
1064 nm								
S4LFT0080-126	80	39 x 39	6.5	25	3.8	79.4	no	no
S4LFT0163-126	163	107 x 107	26.4	12	15	181.2	no	no
S4LFT0253-126	254	160 x 160	35.2	14	16.7	284.9	no	no
S4LFT1254-126	254	160 x 160	41.4	12	14.9	306.5	no	no
S4LFT3254-126	254	115 x 115	16.6	30	8.5	297.0	no	no
S4LFT0350-126	350	212 x 212	56.3	12	16	412.2	no	no
S4LFT0420-126	420	242 x 242	27.7	30	14.8	480.9	no	no
S4LFT0508-126	508	325 x 325	55.6	20	16.3	651.4	no	no
S4LFT0635-126	635	370 x 370	51.3	25	16.3	732.8	no	no
532+1064 nm								
S4LFT1163-081	163	102 x 102	13.3 / 20.0	12	12.7	159.0	no	yes
S4LFT8254-081	254	180 x 180	16.6 / 33.0	15	19.7	211.6	no	yes
515-589 nm								
S4LFT7012-292	100	35 x 35	9.4	10	1.3	101.4	yes	yes
532 nm								
S4LFT5100-121	100	69 x 69	9.8	10	2.4	126.7	no	no
S4LFT0300-121	300	200 x 200	19.4	14	15.8	324.1	no	no

Besides our portfolio and customized optics, we also offer a variety of F-Theta lenses and Beam Expanders from our former portfolio with outstanding specifications upon request. This also includes lenses for different lens markets, applications and specifications.

- **MORE WAVELENGTHS**
- **MORE FOCAL LENGTHS**
- **MORE MAGNIFICATIONS**

*usable for SP=Short Pulse, USP=Ultra Short Pulse
In case of deviations from the portfolio and delivery times, please contact our Customer Care Team.

F-THETA LENSES

BENEFIT FROM OUR EXPERIENCE

FUSED SILICA OPTICS

	PART NUMBER	FOCAL LENGTH [mm]	SCAN AREA [mm x mm]	FOCUS SIZE (1/e²) [µm]	MAX. BEAM-Ø [mm]	MAX. TELECEN-TRICITY ERROR [°]	WORKING DISTANCE [mm]	SP/USP*
	1030-1080 nm							
	S4LFT4147-328	48	7 x 7	6.3	15	2.1	61.1	yes
	S4LFT4065-328	65	15 x 15	9.4	15	2	83.1	yes
	S4LFT0710-328	100	60 x 60	39.1	5	11.5	120.7	yes
	S4LFT4010-328	100	35 x 35	19.5	10	1.3	129.8	yes
	S4LFT4127-328	125	50 x 50	13.6	15	1.5	157.6	yes
	S4LFT0763-328	163	100 x 100	45.6	7	14.6	194.1	yes
	S4LFT3162-328	163	90 x 90	21.2	15	5.6	201.5	yes
	S4LFT3167-328	163	100 x 100	32.6	10	11.6	200.7	yes
	S4LFT0725-328	254	140 x 140	61.5	8	16.2	282.8	yes
	S4LFT3250-328	254	160 x 160	33.2	15	10.7	321.3	yes
	S4LFT1330-328	330	215 x 215	33.3	20	23.5	203.4	yes
	S4LFT1420-328	420	280 x 280	58.5	14	17.3	499.2	yes
	S4LFT5430-328	430	250 x 250	30.0	30	11.6	538	yes
	S4LFT1655-328	650	410 x 410	63.3	20	22.5	581.6	yes
	S4LFT0910-328	910	500 x 500	65.8	30	16.2	1048.8	yes
	515-532 nm							
	S4LFT4148-292	48	6 x 6	3.2	15	1.8	60	yes
	S4LFT4066-292	65	15 x 15	4.8	15	1.5	85.8	yes
	S4LFT4010-292	100	35 x 35	9.8	10	1.5	130.2	yes
	S4LFT4126-292	125	53 x 53	12	10	1.6	167	yes
	S4LFT3161-292	163	90 x 90	15.4	10	4.8	219	yes
	S4LFT4262-292	163	65 x 65	12.7	12	1.7	195.4	yes
	S4LFT1330-292	330	212 x 212	24.3	14	20.3	279	yes
HIGHLIGHT	S4LFT5650-292	650	410 x 410	31.8	20	22.7	569.9	yes
	420-480 nm							
	S4LFT4125-373	125	45 x 45	6.1	20	1.6	160.2	yes
	S4LFT3170-373	168	75 x 75	7.6	20	3.2	228.3	yes
	S4LFT3250-373	241	115 x 115	10	20	7.4	304.8	yes
	S4LFT1330-373	330	180 x 180	10.7	20	11.1	268.2	yes
	343-355 nm							
	S4LFT4149-075	48	6 x 6	2.1	15	2.1	69.3	yes
	S4LFT4067-075	65	15 x 15	3.1	15	1.8	81.7	yes
	S4LFT4010-075	100	35 x 35	6.5	10	1.2	132	yes
	S4LFT4125-075	125	53 x 53	8	10	1.1	156.9	yes
	S4LFT3170-075	163	90 x 90	11.4	10	4.3	221.7	yes
	S4LFT4262-075	163	65 x 65	10.5	10	2	193.7	yes
	S4LFT1330-075	330	210 x 210	15.4	14	21	260.5	yes
HIGHLIGHT	S4LFT3340-075	340	205 x 205	17.0	14	0.85	479.5	yes
	257-266 nm							
	S4LFT4068-199	65	20 x 20	2.5	15	1.3	85.6	yes
	S4LFT3170-199	154	85 x 85	7.7	10	3.8	208.1	yes
	S4LFT4263-199	163	70 x 70	9.2	10	2.6	218.4	yes

BEAM EXPANDERS
BENEFIT FROM OUR EXPERIENCE

Sill Optics has been manufacturing high-quality laser optics for almost 40 years. These lenses are specifically designed for laser material processing applications of industrial mechanical engineering.

They are specially designed for applications in CE, automotive, semiconductor, additive or solar cell manufacturing. In addition to medical and biotech applications (confocal microscopy, ophthalmology) and science and research. The design and the quality of the optical components play a key role in the lens performance.

Many of our Beam Expanders can also be used in reverse direction. Using a Beam Expander reverse may the result in increased divergence and possibly other disadvantages as the Beam Expanders are usually designed to magnify beams. Therefore, please feel free to contact our technical support if you have any questions.

ZOOM BEAM EXPANDERS

	PART NUMBER	MAGNIFICATION	CLEAR INPUT APERTURE [mm]	CLEAR OUTPUT APERTURE [mm]	LENGTH [mm]	THREAD
	9300-10600 nm					
HIGHLIGHT	S6EXZ9313-684	1-3x	28.5	45.0	150.0	M55x1
HIGHLIGHT	S6EXZ9313-681	1-3x	28.5	45.0	150.0	M55x1
	1030-1080 nm					
	S6EXZ5310-328	1-3x	10.5	20.0	85.2	C-Mount
	S6EXZ5311-328	1-3x	10.5	20.0	85.2	M30x1
	S6EXZ5076-328	1-8x	10.3	31.0	162.0	C-Mount
	515-532 nm					
	S6EXZ5310-292	1-3x	10.5	20.0	85.2	C-Mount
	S6EXZ5311-292	1-3x	10.5	20.0	85.2	M30x1
	S6EXZ5076-292	1-8x	10.3	31.0	162.0	C-Mount
	355 nm					
	S6EXZ5310-075	1-3x	10.5	20.0	85.2	C-Mount
	S6EXZ5311-075	1-3x	10.5	20.0	85.2	M30x1
	S6EXZ5075-075	1-8x	10.3	31.0	162.0	C-Mount
	343-355 nm					
	S6EXZ0940-574	0.9-4x	16.0	28.0	191.0	M30x1
	S6EXZ5310-574	1-3x	10.5	20.0	85.2	C-Mount
	S6EXZ5311-574	1-3x	10.5	20.0	85.2	M30x1
	S6EXZ5075-574	1-8x	10.3	31.0	162.0	C-Mount
	257-266 nm					
	S6EXZ5075-199	1-8x	10.3	31.0	162.0	C-Mount

MOTORIZED BEAM EXPANDER

	PART NUMBER	MAGNIFICATION	CLEAR INPUT APERTURE [mm]	CLEAR OUTPUT APERTURE [mm]	LENGTH [mm]	THREAD
	343-355 nm					
HIGHLIGHT	S6EZM0940-574	0.9-4x	12.0	28.0	200.0	M30x1

In case of deviations from the portfolio and delivery times, please contact our Customer Care Team.

BEAM EXPANDERS
BENEFIT FROM OUR EXPERIENCE

FIX MAGNIFICATION BEAM EXPANDERS

PART NUMBER	MAGNIFICATION	CLEAR INPUT APERTURE [mm]	CLEAR OUTPUT APERTURE [mm]	LENGTH [mm]	THREAD
1030-1080 nm					
S6EXK0005-328	0.5	12.0	12.0	44.7	M30x1
S6EXK0008-328	0.8	12.0	12.0	44.7	M30x1
S6EXK0010-328	1.0	12.0	14.0	44.7	M30x1
S6EXK0012-328	1.2	12.0	26.0	44.7	M30x1
S6EXK0015-328	1.5	12.0	26.0	44.7	M30x1
S6EXK0020-328	2.0	12.0	26.0	44.7	M30x1
S6EXK0025-328	2.5	11.0	26.0	44.7	M30x1
S6EXK0030-328	3.0	8.0	26.0	44.7	M30x1
S6EXK0035-328	3.5	8.0	20.0	44.7	M30x1
S6EXK0040-328	4.0	8.0	20.0	44.7	M30x1
515-532 nm					
S6EXK0005-292	0.5	12.0	12.0	44.7	M30x1
S6EXK0008-292	0.8	12.0	12.0	44.7	M30x1
S6EXK0010-292	1.0	12.0	14.0	44.7	M30x1
S6EXK0012-292	1.2	12.0	26.0	44.7	M30x1
S6EXK0015-292	1.5	12.0	26.0	44.7	M30x1
S6EXK0020-292	2.0	12.0	26.0	44.7	M30x1
S6EXK0025-292	2.5	11.0	26.0	44.7	M30x1
S6EXK0030-292	3.0	8.0	26.0	44.7	M30x1
S6EXK0035-292	3.5	8.0	20.0	44.7	M30x1
S6EXK0040-292	4.0	8.0	20.0	44.7	M30x1
355 nm					
S6EXK0008-075	0.8	12.0	12.0	44.7	M30x1
S6EXK0012-075	1.2	12.0	26.0	44.7	M30x1
S6EXK0015-075	1.5	12.0	26.0	44.7	M30x1
S6EXK0020-075	2.0	12.0	26.0	44.7	M30x1
S6EXK0025-075	2.5	11.0	26.0	44.7	M30x1
S6EXK0030-075	3.0	8.0	26.0	44.7	M30x1
S6EXK0035-075	3.5	8.0	20.0	44.7	M30x1
S6EXK0040-075	4.0	8.0	20.0	44.7	M30x1
343-355 nm					
S6EXK0008-574	0.8	12.0	12.0	44.7	M30x1
S6EXK0010-574	1.0	12.0	14.0	44.7	M30x1
S6EXK0012-574	1.2	12.0	26.0	44.7	M30x1
S6EXK0015-574	1.5	12.0	26.0	44.7	M30x1
S6EXK0020-574	2.0	12.0	26.0	44.7	M30x1
S6EXK0025-574	2.5	11.0	26.0	44.7	M30x1
S6EXK0030-574	3.0	8.0	26.0	44.7	M30x1
S6EXK0035-574	3.5	8.0	20.0	44.7	M30x1
S6EXK0040-574	4.0	8.0	20.0	44.7	M30x1

BEAM EXPANDERS

BENEFIT FROM OUR EXPERIENCE

FIX MAGNIFICATION BEAM EXPANDERS

PART NUMBER	MAGNIFICATION	CLEAR INPUT APERTURE [mm]	CLEAR OUTPUT APERTURE [mm]	LENGTH [mm]	THREAD
1030-1080 nm					
S6EXP0005-328	0.5	14.0	31.0	85.0	M30x1
S6EXP0008-328	0.8	14.0	20.0	85.0	M30x1
S6EXP0012-328	1.2	14.0	28.0	85.0	M30x1
S6EXP0015-328	1.5	8.0	31.0	85.0	M30x1
S6EXP0020-328	2.0	8.0	31.0	85.0	M30x1
S6EXP0025-328	2.5	8.0	31.0	85.0	M30x1
S6EXP0030-328	3.0	8.0	31.0	85.0	M30x1
S6EXP0040-328	4.0	8.0	31.0	85.0	M30x1
S6EXP0050-328	5.0	8.0	31.0	85.0	M30x1
515-532 nm					
S6EXP0005-292	0.5	14.0	31.0	85.0	M30x1
S6EXP0008-292	0.8	14.0	20.0	85.0	M30x1
S6EXP0015-292	1.5	8.0	31.0	85.0	M30x1
S6EXP0020-292	2.0	8.0	31.0	85.0	M30x1
S6EXP0025-292	2.5	8.0	31.0	85.0	M30x1
S6EXP0030-292	3.0	8.0	31.0	85.0	M30x1
S6EXP0040-292	4.0	8.0	31.0	85.0	M30x1
S6EXP0050-292	5.0	8.0	31.0	85.0	M30x1
355 nm					
S6EXP0015-075	1.5	8.0	31.0	85.0	M30x1
S6EXP0020-075	2.0	8.0	31.0	85.0	M30x1
S6EXP0025-075	2.5	8.0	31.0	85.0	M30x1
S6EXP0030-075	3.0	8.0	31.0	85.0	M30x1
S6EXP0040-075	4.0	8.0	31.0	85.0	M30x1
S6EXP0050-075	5.0	8.0	31.0	85.0	M30x1
343-355 nm					
S6EXP0015-574	1.5	8.0	31.0	85.0	M30x1
S6EXP0020-574	2.0	8.0	31.0	85.0	M30x1
S6EXP0025-574	2.5	8.0	31.0	85.0	M30x1
S6EXP0030-574	3.0	8.0	31.0	85.0	M30x1
S6EXP0040-574	4.0	8.0	31.0	85.0	M30x1
S6EXP0050-574	5.0	8.0	31.0	85.0	M30x1
257-266 nm					
S6EXP0015-199	1.5	8.0	31.0	85.0	M30x1
S6EXP0020-199	2.0	8.0	31.0	85.0	M30x1
S6EXP0030-199	3.0	8.0	31.0	85.0	M30x1
S6EXP0040-199	4.0	8.0	31.0	85.0	M30x1
S6EXP0050-199	5.0	8.0	31.0	85.0	M30x1

ASPHERES

BENEFIT FROM OUR CAPABILITIES

ASPHERES

The use of aspheric lenses in optical systems is increasing. Aspheric lenses enable an enhancement of resolution especially for optical systems with a high numerical aperture. The aspheric deviation of the high end series is smaller than 0.05 µm RMSi.

Aspheres offer the great advantage to accomplish monochromatic imaging tasks with one optical element where multiple lens elements would otherwise be needed. Main advantages of aspheres are less spherical aberrations, less weight, increased transmission and no internal ghosts.

PART NUMBER	FOCAL LENGTH [mm]	LENS-Ø [mm]	CENTER THICKNESS [mm]	WORKING DISTANCE [mm]
1064 nm				
S1ADX0220-328	20	25.0	13.2	13.3
S1ADX0230-328	30	30.0	16.0	20.9
S1ADX0240-328	40	30.0	15.0	31.3
S1ADX0250-328	50	30.0	13.7	42.1
S1ADX0260-328	60	30.0	11.3	53.5
S1ADX0370-328	72	38.1	11.0	63.6
S1ADX0380-328	80	38.1	12.0	73.1
S1ADX0310-328	100	38.1	11.0	93.7
S1ADX0312-328	120	38.1	10.3	114.0
S1ADX0316-328	150	30.0	9.6	144.4
S1ADX0320-328	200	38.1	8.9	194.8
S1ADX0325-328	250	38.1	8.9	245.2
S1ADX0330-328	300	30.0	9.0	294.7
S1ADX0540-328	400	52.0	8.0	395.2

Besides our portfolio and customized optics, we also offer a variety of F-Theta lenses and Beam Expanders from our former portfolio with outstanding specifications upon request. This also includes lenses for different lens markets, applications and specifications.

- **MORE WAVELENGTHS**
- **MORE FOCAL LENGTHS**
- **MORE MAGNIFICATIONS**

In case of deviations from the portfolio and delivery times, please contact our Customer Care Team.

FOCUSING ELEMENTS
BENEFIT FROM OUR CAPABILITIES

LENS SYSTEMS
Multi-element lens systems minimize the imaging errors of single lenses and provide precision focusing for non-scanning applications.

MULTI-ELEMENT LENS SYSTEMS

PART NUMBER	FOCAL LENGTH [mm]	FOCUS SIZE 1/e² [µm]	HOUSING-Ø [mm]	LENGTH [mm]	WORKING DISTANCE [mm]
532 nm					
S6ASS2020-292	25	2.4	25.0	13.5	19.3
S6ASS2060-292	62	3.0	40.0	32.0	47.9
S6ASS5300-292	100	5.4	41.0	16.0	86.7
S6ASS6151-292	150	7.2	56.0	20.0	135.0
S6ASS6200-292	200	6.6	54.0	15.0	188.5
355 nm					
S6ASS2020-075	25	1.6	25.0	17.0	17.9
S6ASS2060-075	60	2.8	40.0	30.0	46.5
S6ASS5120-075	114	5.6	48.0	20.0	104.4
266 nm					
S6ASS2020-199	24	1.4	25.0	17.0	17.1
S6ASS2060-199	57	2.2	40.0	30.0	43.9
S6ASS5120-199	109	4.6	48.0	20.0	99.1

Besides our portfolio and customized optics, we also offer a variety of F-Theta lenses and Beam Expanders from our former portfolio with outstanding specifications upon request. This also includes lenses for different lens markets, applications and specifications.

- **MORE WAVELENGTHS**
- **MORE FOCAL LENGTHS**
- **MORE MAGNIFICATIONS**

In case of deviations from the portfolio and delivery times, please contact our Customer Care Team.

TRAPPED ION LENSES
BENEFIT FROM OUR CAPABILITIES

TRAPPED ION LENSES
Trapped (cold) ions are a research topic with increasing interest over the last few years because of their possibility to store Qubits (quantum bits) and the related use for quantum computers. To make the qubits usable under certain conditions, we must observe and study their behaviour in detailed experiments first.

Sill Optics has designed lenses both, for just observation and observation combined with laser focusing for these experiments. Those lenses are exceptional for their high NA and adjustment to specific wavelengths (UV to IR). As the vacuum cryostats differ in dimension (e.g. the window thickness) every lens has to be designed specifically for the existing conditions.

PART NUMBER	WAVE-LENGTH 1 [nm]	WAVE-LENGTH 2 [nm]	MATERIAL	FOCUS LENGTH [mm]	NA	MAX. FOV [mm]	MAGNIFI-CATION @ WAVE-LENGTH 1	MAGNIFI-CATION @ WAVE-LENGTH 2	THICK-NESS WINDOW	MATERIAL WINDOW	WORKING DISTANCE [mm]
S6ASS2243-126	1064	-	optical glass	40.5	0.4	0.71	infinity	-	6.0	fused silica	50.7
S6ASS2242-081	590	1064	optical glass	40.0	0.4	0.71	infinity	infinity	6.0	fused silica	50.7
S6ASS2224	494	671	optical glass	22.0	0.5	0.08	infinity	infinity	-	-	11.6
S6ASS2255	422	-	fused silica	45.0	0.4	0.27	10.0	-	19.1	fused silica	63.4
S6ASS2256	422	-	fused silica	44.9	0.4	0.27	10.0	-	19.1	N-BK7	63.8
S6ASS2258	397	422	optical glass	44.8	0.4	0.28	10.0	10.0	19.1	N-BK7	62.3
S6ASS2258-006	397	422	optical glass	45.5	0.4	0.29	10.0	10.0	6.3	fused silica	60.5
S6ASS2241	395	729	optical glass	66.9	0.3	0.2	20.0	20.0	6.0	fused silica	55.7
S6ASS2241-045	395	729	optical glass	66.9	0.3	0.19	20.0	20.0	6.0	fused silica	55.7
S6ASS2341	370	-	optical glass	82.1	0.2	0.2	6.0	-	6.0	fused silica	55.7
S6ASS2245	369	-	fused silica	40.0	0.4	0.35	infinity	-	8.0	fused silica	39.3
S6ASS2246	369	-	fused silica	41.2	0.4	0.36	infinity	-	4.3	fused silica	38.7
S6ASS2247	369	493	fused silica	50.1	0.2	0.95	8.0	78.0	2.0	sapphire	49.4
S6ASS2247-389	313	397	fused silica	49.0	0.2	0.95	8.2	79.0	2.0	sapphire	48.2
S6ASS2248	313	397	fused silica	49.0	0.3	0.27	15.0	145.0	3.0	fused silica	46.5

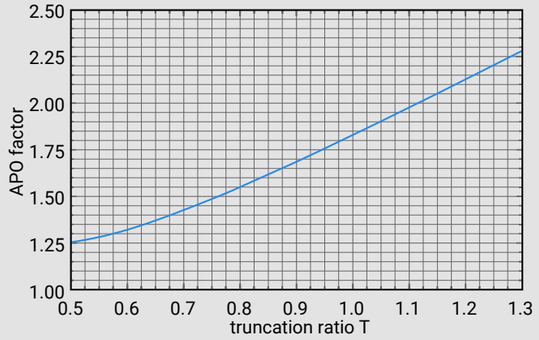
In case of deviations from the portfolio and delivery times, please contact our Customer Care Team.

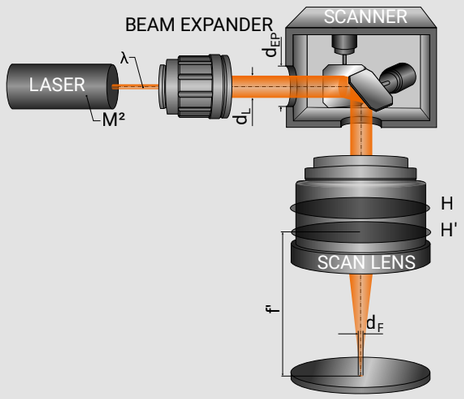
1. FOCUSSING LENSES

1.1 CALCULATION OF THE MINIMUM FOCAL DIAMETER

$$d_F = \frac{\lambda \cdot f' \cdot APO \cdot M^2}{d_L}$$

$$T = \frac{d_L}{d_{EP}}$$





d_F: focal spot diameter
d_{EP}: entrance pupil of the scanner
d_L: entrance beam diameter (1/e²)
f': focal length
λ: wavelength
APO: apodisation factor
M²: diffraction value of the laser
T: truncation ratio

1.2 CALCULATION OF THE RAYLEIGH LENGTH

zR: rayleigh length

$$z_R = \pi \cdot \left(\frac{d_F}{2}\right)^2 \cdot \frac{(APO/1.27)^2}{\lambda \cdot M^2}$$

1.3 CALCULATION OF THE FOCAL DIAMETER FOR FIBER IMAGING

$$d_F = M \cdot d_{fc} \approx \frac{f_2}{f_1} \cdot d_{fc}$$

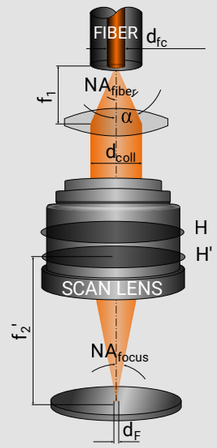
$$M = \frac{NA_{fiber}}{NA_{focus}}$$

$$NA_{focus} = \sin\left[\tan^{-1}\left(\frac{d_{coll}/2}{f_2}\right)\right]$$

$$d_{coll} = 2 \cdot f_1 \cdot \tan(\alpha)$$

$$\alpha = \sin^{-1}(NA_{fiber})$$

$$\alpha = \tan^{-1}\left(\frac{d_{coll}}{2 \cdot f_1}\right)$$



d_{fc}: fiber core diameter
NA_{fiber}: numerical aperture of the fiber
α: half beam cone angle
M: magnification by NA calculation
d_F: focal spot diameter
f_1: focal length of the collimating lens
f_2: focal length of the focussing lens

2. LASER INDUCED DAMAGE THRESHOLD (LIDT)

2.1 ENERGY- AND POWER DENSITY

$$F\left[J/cm^2\right] = \frac{E[J]}{1/4 \cdot (d_F[cm])^2 \cdot \pi}$$

$$I\left[W/cm^2\right] = \frac{P_{peak}[W]}{1/4 \cdot (d_F[cm])^2 \cdot \pi}$$

F: energy density / fluence
E: pulse energy
F: focal spot diameter
I: power density / irradiance
P_{peak}: peak power of the laser

2.2 ESTIMATE OF THE LIDT

$$\frac{E[J]}{1/4 \cdot (d_F[cm])^2 \cdot \pi} << LIDT \approx$$

$$\approx \frac{\lambda}{\lambda_{spec}} \cdot \sqrt{\frac{\tau}{\tau_{spec}}} \cdot LIDT_{spec}$$

E: pulse energy
d_F: focal spot diameter
λ: used wavelength
λ_{spec}: specified wavelength
τ: pulse duration of the used laser
τ_{spec}: specified pulse duration
LIDT: real LIDT
$LIDT_{spec}$: specified LIDT

$$\frac{P_{peak}[W]}{1/4 \cdot (d_F[cm])^2 \cdot \pi} << LIDT \approx$$

$$\approx \frac{\lambda}{\lambda_{spec}} \cdot \sqrt{\frac{\tau}{\tau_{spec}}} \cdot LIDT_{spec}$$

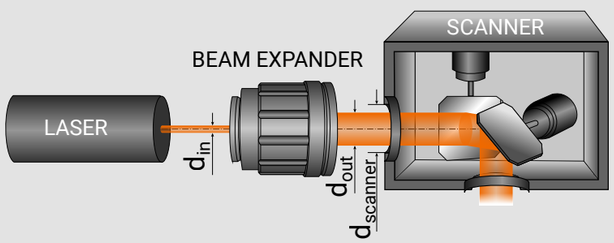
3. BEAM EXPANDERS

3.1 CALCULATION OF THE MAGNIFICATION

$$\beta' = \frac{d_{out}}{d_{in}}$$

$$\beta'_{max} = \frac{d_{scanner}}{d_{in}}$$

β‘: magnification
β'_{max}: maximum magnification
d_{in}: entrance beam diameter
d_{out}: outgoing beam diameter
$d_{scanner}$: aperture of the scanner

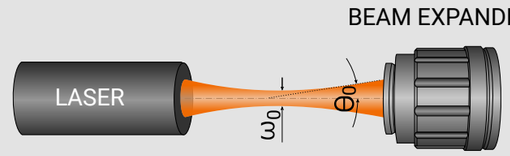


The outgoing beam diameter d_{out} is limited by the beam expander or by the aperture of the scanner.

3.2 DIVERGENCE ANGLE

$$\Theta_0 = \frac{\lambda}{\pi \cdot \omega_0/2} \rightarrow \Theta_0 \cdot \omega_0 = const$$

Θ_0: divergence angle
λ: wavelength
ω_0: beam diameter at the waist



The higher the beam diameter the lower is the divergence!

Laser specifications
(pulse duration, wavelength, 1/e² beam diameter, pulse energy, M²)

Scanner data
(free aperture, mirror positions, distance to scan lens)

Scan lens requirements
(telecentricity, scan field, focal length, spot diameter, entrance beam diamater)

Beam expander requirements
(magnification (region), wavelength, motorized, entrance beam diameter)

Trapped Ion lens data
NA, vacuum window data (thickness, material, position), wavelengths, magnification, scan field)

IMAGING OPTICS

HIGH PERFORMANCE TELECENTRIC LENSES

- **LOW F# AND HIGH RESOLUTION**
- **LOW DISTORTION <1%**
- **LOW TELECENTRIC ERROR <0.2°**
- **CUSTOM MODIFICATIONS**

NEW FOCUS TUNABLE LENS WITH 2X MAGNIFICATION

Sill Optics has developed a telecentric lens with a 2 x magnification, large aperture, and integrated liquid lens for focus adjustment.

The increasing demand for magnifying telecentric lenses, particularly with large apertures that accommodate a 2.74 µm pixel size and a 1.1-inch sensor diagonal while maintaining stable imaging performance across various wavelengths, has posed significant challenges. However, through collaboration between Sill Optics and Optotune, these requirements have been met.

The lens, named EL16-40, achieves a resolution of 90 lp/mm across the entire field of view, exhibiting the best wavefront specification in vertical alignment. This outstanding performance enables the lens to deliver exceptional results as a 2x magnification telecentric lens for sensors with 12-20 megapixels, along with an additional automated focus adjustment capability of at least 6 mm.

This groundbreaking product opens up new possibilities for the fields of semiconductor inspection and precision metrology, enabling them to achieve sinificant milestones.

OUR HIGHLIGHTS 2025

SILL OPTICS LAUNCHES FIRST RGB-NIR LENS FOR 8K LINE SCAN CAMERA

The S5LPJ4465 lens enables imaging with four color channels (RGB-NIR) for 8k resolution (pixel size up to 5 µm).

The ongoing development of camera technologies also requires modern lens designs. Different camera manufactures offer new line scan cameras that are sensitive to four color channels. While the chips of conventional cameras only detected light in the visible range, this new camera not only **has a red, blue and green channel, but also a color channel in the near infrared range**.

Conventional entocentric and telecentric lens designs are often unable to compensate the axial color shift. This results in at least one of the channels at the edge of the spectrum being blurred. Especially blue and NIR channel are affected.

In this context, Sill Optics has developed an innovative lens with a **focal length of 65 mm** for 8k resolution with a **pixel size of 5 µm (with a line length of 40 mm)**. This new development marks the beginning of a small series of lenses that meet customer requirements for color correction for all four wavelengths.

Until beginning of 2025, f'28 mm and f'40 mm will be available, too. In addition to the new series of color corrected lenses, Sill Optics also offers custom lens designs that are perfectly tailored to the individual requirements of a specific application. Furthermore, lenses from the series can be easily adapted to customized setup requirements by making small modifications, such as adjusting the camera mount.

NEW LENS SERIES FOR APS-C FORMAT SENSORS

In addition to the S5LPJ2607-M42, Sill Optics offers four other lenses for use with cameras with APS-C format sensors.

High End Resolution in telecentric imaging is our main motivation in development of our product portfolio. After introducing lenses with C-Mount and imaging diagonal up to 22.0 mm in the last years, we now go a step ahead and offer five different lenses for **APS format sensors with Pixel size down to 2.74 µm**.

The lenses cover a **sensor diagonal up to 32.6 mm** and can be used with line and area sensors. **Magnification range covers 0.2 x to 1.0 x**. Additionally to standard imaging in visible range with small bandwidth, most of the lenses are color corrected for bayer pattern sensors and have a high transmission as well in near infrared (800- 900 nm). We offer two standard threads: M42x1 with BFD 12 mm and F-Mount. Other threads are available upon request.

CUSTOMIZED IMAGING LENSES

BENEFIT FROM OUR EXPERTISE

Sill Optics has been a trusted partner for customized imaging lens solutions for many years. We specialize in various areas of application and offer a wide range of design types. With our extensive experience, we have successfully completed numerous projects involving customized optical designs and unique mechanical layouts.

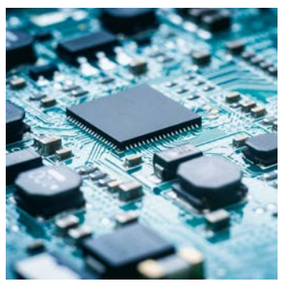
The key to our success lies in the close cooperation between our different internal departments, our vast manufacturing capabilities, and our commitment to high-quality production. These factors enable us to build your prototype in the shortest possible time.

In recent years, we have focused on developing nearly 80% of our imaging lens orders as individual development projects. We actively participate in public research projects and respond to specific inquiries from our customers. Our expertise has been particularly applied in high-precision measurement applications for mechanical engineering, as well as in biomedical applications and material processing.

We take pride in our ability to deliver tailored solutions to meet your specific requirements. By choosing Sill Optics, you benefit from our experience, expertise, and dedication to providing top-notch imaging lens solutions.

MACHINE VISION

BIOMEDICAL IMAGING



SEMICONDUCTOR INSPECTION

OPTICAL METROLOGY

CUSTOMIZED IMAGING LENSES

BENEFIT FROM OUR EXPERTISE

YOUR BENEFITS FROM SILL OPTICS DEVELOPMENT

WHY SILL OPTICS?

- Development of specification sheets closely aligned with design and production capabilities
- Direct contact with optical designers and project managers
- Short distances between design, development, and production
- Quick turnaround for prototypes
- High quality in series production
- Customized quality assurance based on individual needs

WHICH SPECIFICATIONS?

- Aperture
- Field size (FOV, sensor size)
- Waveband (UV, VIS, IR, bandwidth)
- Space constraints (total track, working distance, maximum length, maximum diameter, mounting)
- Camera specifications (sensor dimensions, pixel size, resolution, camera thread, back flange distance, maximum chief ray angle, color)
- Performance requirements (Strehl ratio, MTF, edge spread function, distortion, color correction)

WHEN STARTING A PROJECT?

A typical starting point for a customized design, considering the overall benefit in terms of the price-performance ratio, is around 50-100 lenses per year. Sill Optics' production capacity is well-suited for up to 500 pieces per year.

However, the ideal number of lenses will vary depending on the size, number of elements, and complexity of the system. For highly complex designs with large elements, special glass types, high alignment demands and end test requirements, even as few as 5 pieces can be beneficial. Other designs may start with quantities of 20 or 50 pieces.

WORKFLOW THROUGH OUR CUSTOM DESIGN PROCESS

PROJECT DESCRIPTION AND SPECIFICATION → OPTICAL PREDESIGN AND FEASIBILITY ANALYSIS → QUOTE FOR DEVELOPMENT, TOOLING, PROTOTYPES AND SERIES CONDITIONS

PROTOTYPE AND TOOLING ORDER → PROTOTYPE PRODUCTION → PROTOTYPE FINAL TEST AND SHIPMENT

TELECENTRIC IMAGING LENSES

For nearly 40 years, Sill Optics has been manufacturing **high-end telecentric imaging lenses**. These lenses are specifically designed for measurement applications in industrial machine vision, aiming to eliminate magnification changes and measurement deviations caused by depth of field or defocus.

With the increasing data rates and sensor sizes, there is a clear trend towards larger sensor diagonals and smaller pixel sizes. As a result, our lens portfolio focuses on lenses optimized for small pixel sizes, supporting sensors up to APS format (with sensor diagonal of 32.6 mm).

- Telecentric FOV up to Ø150 mm
- Lens design for R,G,B illumination and monochrome sensor
- Variable iris for improved DOF (depth of focus)
- Available with integrated coaxial illumination upon request

Benefit from our extensive experience and expertise in telecentric imaging lenses. Contact Sill Optics today to discuss your specific requirements and discover the right lens solution for your measurement applications.

PART NUMBER	MAGNIFICATION	RECOMMENDED SENSOR DIAGONAL [mm]	WORKING DISTANCE [mm]	WAVELENGTH BAND MONO (RED, GREEN, BLUE) WHITE (COLOR/BAYER) NIR (800-900 nm)	RECOMMENDED PIXEL SIZE [µm]	THREAD	PART NUMBER FOR VERSION WITH INTEGR. COAXIAL ILLUMINATION
LENSES FOR 1/3“ AND 1/2” SENSORS							
S5LPJ1823	0.044	6.0	300.0	R,G,B,NIR	2.20	C	S5LPL1823-LED
S5LPJ1514	0.054	6.0	284.0	R,G,B	2.20	C	S5LPL1514-LED
S5LPJ1824	0.056	8.0	300.0	R,G,B	2.20	C	S5LPL1824-LED
S5LPJ1522	0.068	8.0	284.0	R,G,B	2.20	C	S5LPL1522-LED
S5LPJ6014	0.079	6.0	180.0	R,G,B	2.00	C	S5LPL6014-LED
S5LPJ1523	0.082	8.0	284.0	R,G,B	3.45	C	S5LPL1523-LED
S5LPJ6022	0.100	8.0	180.0	R,G,B	2.20	C	S5LPL6022-LED
S5LPJ1224	0.110	6.0	190.0	R,G,B,W,NIR	2.20	C	S5LPL1224-LED
S5LPJ1201	0.132	6.0	190.0	R,G,B,W	2.20	C	S5LPL1201-LED
S5LPJ1223	0.158	8.0	190.0	R,G,B,NIR	2.00	C	S5LPL1223-LED
LENSES FOR 1/1.8“ AND 2/3” SENSORS							
S5LPJ1832	0.065	8.9	300.0	R,G,B,NIR	2.00	C	S5LPL1832-LED
S5LPJ1533	0.098	11.0	284.0	R,G,B	2.00	C	S5LPL1533-LED
S5LPJ6024	0.121	8.9	180.0	R,G,B	2.20	C	S5LPL6024-LED
S5LPJ6033	0.145	11.0	180.0	R,G,B	2.50	C	S5LPL6033-LED
S5LPJ5015	0.160	8.9	88.0	R,G,B	2.80	C	S5LPL5015-LED
S5LPJ1299	0.200	11.0	92.0	R,G,B,NIR	2.80	C	S5LPL1299-LED
S5LPJ2298	0.244	11.0	92.0	R,G,B,W	4.60	C	S5LPL2298-LED
S5LPJ1252	0.265	11.0	190.0	R,G,B,W	2.50	C	S5LPL1252-LED
S5LPJ2893	0.292	11.0	92.0	R,G,B,W,NIR	2.50	C	S5LPL2893-LED
LENSES FOR 1“ AND 1.1” SENSORS							
S5LPJ1852	0.112	16.0	300.0	R,G,B	2.20	C	S5LPL1852-LED
S5LPJ1860	0.134	17.6	300.0	R,G,B	3.45	C	S5LPL1860-LED
S5LPJ1551	0.165	16.0	284.0	R,G,B	3.45	C	S5LPL1551-LED
S5LPJ1565	0.195	16.0	284.0	R,G,B	4.20	C	S5LPL1565-LED
S5LPJ6050	0.246	16.0	180.0	R,G,B	3.45	C	S5LPL6050-LED
S5LPJ6060	0.292	16.0	180.0	R,G,B	3.45	C	S5LPL6060-LED
S5LPJ1260	0.313	16.0	190.0	R,G,B	4.60	C	S5LPL1260-LED
S5LPJ2499	0.492	17.6	92.0	R,G,B,W,NIR	3.45	C	S5LPL2499-LED
S5LPJ2898	0.581	17.6	92.0	R,G,B,W,NIR	4.60	C	S5LPL2898-LED

PORTFOLIO IMAGING LENSES
BENEFIT FROM OUR EXPERIENCE

TELECENTRIC IMAGING LENSES FOR SMALLER FOV

- Low cost alternatives for pixel size 3.45 µm
- Lens design for R,G,B illumination and monochrome sensor

PART NUMBER	MAGNIFICATION	RECOMMENDED SENSOR DIAGONAL [mm]	WORKING DISTANCE [mm]	WAVELENGTH BAND MONO (RED, GREEN, BLUE) WHITE (COLOR/BAYER) NIR (800-900 nm)	RECOMMENDED PIXEL SIZE [µm]	THREAD
LENSES FOR 1/3“ AND 1/2” SENSORS						
S5LPJ4425	1.000	8.0	107.5	R,G,B	3.45	C
LENSES FOR 1“ AND 1.1” SENSORS						
S5LPJ4061-216	0.600	16.0	121.0	R,G,B,W	3.45	C
S5LPJ3208	0.770	16.0	119.5	R,G,B,W	3.45	C

TELECENTRIC IMAGING LENSES WITH COLOR CORRECTION AND NIR USABILITY

- Telecentric FOV up to Ø120 mm
- Lens designs for white illumination with Bayer pattern color sensor
- Lens designs for NIR illumination with monochrome sensor
- Variable iris for improved DOF (depth of focus)

PART NUMBER	MAGNIFICATION	RECOMMENDED SENSOR DIAGONAL [mm]	WORKING DISTANCE [mm]	WAVELENGTH BAND MONO (RED, GREEN, BLUE) WHITE (COLOR/BAYER) NIR (800-900 nm)	RECOMMENDED PIXEL SIZE [µm]	THREAD
LENSES FOR 1/3“ AND 1/2” SENSORS						
S5LPJ6122	0.100	8.0	180.0	R,G,B,W,NIR	2.00	C
S5LPJ1722	0.068	8.0	284.0	R,G,B,W,NIR	2.00	C
LENSES FOR 1/1.8“ AND 2/3” SENSORS						
S5LPJ1733	0.098	11.0	284.0	R,G,B,W,NIR	2.00	C
S5LPJ6133	0.145	11.0	180.0	R,G,B,W,NIR	2.50	C
LENSES FOR 1“ AND 1.1” SENSORS						
S5LPJ6150	0.246	17.6	180.0	R,G,B,W,NIR	3.45	C
S5LPJ1750	0.165	17.6	284.0	R,G,B,W,NIR	3.45	C

TELECENTRIC IMAGING LENSES FOR SENSOR SIZE UP TO APS FORMAT

- High performance telecentric lenses for pixel size <3.45 µm
- Large sensor diagonal for high resolution C-Mount cameras up to 25 MPx
- Large sensor diagonal for high resolution APS format cameras up to 60 MPx
- Excellent color correction for Bayer pattern color sensors with white illumination
- Excellent performance in NIR with small working distance adjustment

	PART NUMBER	MAGNIFICATION	RECOMMENDED SENSOR DIAGONAL [mm]	WORKING DISTANCE [mm]	WAVELENGTH BAND MONO (RED, GREEN, BLUE) WHITE (COLOR/ BAYER) NIR (800-900 nm)	RECOMMENDED PIXEL SIZE [µm]	THREAD
	LENSES FOR 1.2“ AND 1.5” SENSORS						
	S5LPJ1862	0.130	19.2	300.0	R,G,B,W,NIR	2.74	C
	S5LPJ1762	0.200	19.2	284.0	R,G,B,W,NIR	2.74	C
	S5LPJ1762-M42	0.200	24.0	284.0	R,G,B,W,NIR	2.74	M42x1
	S5LPJ6162	0.300	19.2	180.0	R,G,B,W,NIR	2.74	C
	S5LPJ6162-M42	0.300	24.0	180.0	R,G,B,W,NIR	2.74	M42x1
NEW	S5LPJ6405	0.500	19.2	176.0	R,G,B,W,NIR	2.74	C
	S5LPJ6406	0.600	22.0	155.0	R,G,B,W,NIR	2.74	C
	S5LPJ6407	0.700	22.0	140.0	R,G,B,W,NIR	2.74	C
	S5LPJ6408	0.800	22.0	131.0	R,G,B,W,NIR	2.74	C
NEW	S5LPJ6409	0.900	19.2	127.0	R,G,B,W,NIR	2.74	C
	S5LPJ7201	1.000	21.4	81.0	R,G,B,W,NIR	2.74	C
	S5LPJ6415	1.500	21.4	80.2	R,G,B,W	2.40	C
	S5LPJ6420	2.000	21.4	68.1	R,G,B,W	2.74	C
	S5LPJ6425	2.500	19.2	61.4	R,G,B,W	3.10	C
	S5LPJ6430	3.000	19.2	57.0	R,G,B,W	3.45	C
	LENSES FOR APS FORMAT SENSORS						
HIGHLIGHT	S5LPJ1894-FMO	0.200	28.2	300.0	R,G,B,W,NIR	2.74	F
HIGHLIGHT	S5LPJ1894-M42	0.200	28.2	300.0	R,G,B,W,NIR	2.74	M42x1
HIGHLIGHT	S5LPJ1794-FMO	0.310	32.6	284.0	R,G,B,W,NIR	2.74	F
HIGHLIGHT	S5LPJ1794-M42	0.310	32.6	284.0	R,G,B,W,NIR	2.74	M42x1
HIGHLIGHT	S5LPJ6194-FMO	0.450	32.6	180.0	R,G,B,W,NIR	2.74	F
HIGHLIGHT	S5LPJ6194-M42	0.450	32.6	180.0	R,G,B,W,NIR	2.74	M42x1
HIGHLIGHT	S5LPJ2607-FMO	0.710	35.0	140.0	R,G,B,W,NIR	2.74	F
HIGHLIGHT	S5LPJ2607-M42	0.710	35.0	140.0	R,G,B,W,NIR	2.74	M42x1
HIGHLIGHT	S5LPJ7201-FMO	1.000	32.6	81.0	R,G,B,W,NIR	2.74	F
HIGHLIGHT	S5LPJ7201-M42	1.000	32.6	81.0	R,G,B,W,NIR	2.74	M42x1

PORTFOLIO IMAGING LENSES
BENEFIT FROM OUR EXPERIENCE

TELECENTRIC LENSES WITH INTEGRATED TUNABLE LIQUID LENS

- High performance stability within specified tuning range.
- Constant telecentricity, small linear magnification change within tuning
- Good color correction and performance stability for 1.2” magnifying lenses in vertical orientation (gravity influence on liquid reduces performance in horizontal orientation)
- Good performance stability in both vertical and horizontal orientation for 1” demagnifying lenses.

PART NUMBER	MAGNIFICATION	RECOMMENDED SENSOR DIAGONAL [mm]	WORKING DISTANCE [mm]	TUNING RANGE [mm]	WAVELENGTH BAND MONO (RED, GREEN, BLUE) WHITE (COLOR/BAYER) NIR (800-900 nm)	RECOMMENDED PIXEL SIZE [µm]	THREAD	PART NUMBER FOR VERSION WITH INTEGR. COAXIAL ILLUMINATION
S5VPJ1565	0.193	16.0	284.0	+/-70.0	R,G,B	2.74	C	-
S5VPJ6060	0.289	16.0	180.0	+/-32.5	R,G,B	2.74	C	S5VPL6060-LED
S5VPJ1260	0.311	16.0	190.0	+/-27.5	R,G,B	3.10	C	-
S5VPJ2898	0.578	16.0	92.0	+/-8.5	R,G,B	3.10	C	S5VPL2898-LED
S5VPJ6415	1.500	19.2	80.2	+/-5	R,G,B,W	2.74	C	-
S5VPJ6420	2.000	19.2	68.2	+/-5	R,G,B,W	2.74	C	-
S5VPJ6425	2.500	19.2	61.4	+/-5	R,G,B,W	3.10	C	-

SPECIAL IMAGING LENSES

BENEFIT FROM OUR CAPABILITIES

Besides our portfolio telecentric lenses, we also offer a variety of **telecentric and entocentric designs upon request.**
These special lenses are not manufactured regularly. We kindly ask you to send us your inquiry to check availability, lead time and price according your required quantity.

To enable a short lead-time for your test setup, we are going to build up a demo lens stock.

PART NUMBER	MAGNIFICATION	RECOMMENDED SENSOR DIAGONAL [mm]	WORKING DISTANCE [mm]	WAVELENGTH BAND MONO (RED, GREEN, BLUE) WHITE (COLOR/BAYER) NIR (800-900nm) SWIR (900-1700nm)	RECOMMENDED PIXEL SIZE [µm]	THREAD
TELECENTRIC LENSES FOR APS FORMAT SENSORS						
S5LPJ0492-M42	2.00	35.0	96.5	R,G,B,W	4.60	M42x1
TELECENTRIC LENSES FOR FULL FORMAT AND LARGER SENSORS						
S5LPJ3025-M58	0.25	43.3	310.0	R,G,B,W	3.45	M58x0.75
S5LPJ3005-M72	0.33	60.0	310.0	R,G,B	3.45	M72x0.75
S5LPJ1556-M58	0.46	43.3	332.3	R,G,B,W,NIR	3.30	M58x0.75
S5LPJ7207-M72	0.66	43.3	180.0	R,G,B	5.50	M72x0.75
S5LPJ7209-M72	0.80	43.3	180.0	R,G,B	4.00	M72x0.75
S5LPJ7255-M72	1.00	56.0	120.0	R,G,B	4.60	M72x0.75
S5LPJ7211-M90	1.00	70.0	180.0	R,G,B	5.00	M90x1
S5LPJ7212-M90	1.25	70.0	141.0	R,G,B	4.20	M90x1
S5LPJ7215-M90	1.51	70.0	111.0	R,G,B	6.00	M90x1
HIGH-MAGNIFICATION TELECENTRIC LENSES						
S5LPJ2533	3.00	16.0	100.4	R	3.45	C
S5LPJ2555	5.00	16.0	100.5	R	4.50	C
TELECENTRIC SWIR LENSES						
S5LPJ6835	0.33	16.0	147.0	SWIR	10.00	C
S5LPJ6837	0.50	24.0	147.0	SWIR	10.00	M42x1

PART NUMBER	FOCAL LENGTH [mm]	RECOMMENDED SENSOR DIAGONAL [mm]	MINIMUM F#	WORKING DISTANCE RANGE [mm]	WAVELENGTH BAND MONO (RED, GREEN, BLUE) WHITE (CO-LOR/BAYER) NIR (800-900nm) SWIR (900-1700nm)	RECOMMENDED PIXEL SIZE [µm]	THREAD
ENTOCENTRIC LENSES FOR MULTILINE CAMERAS RGB-NIR							
HIGHLIGHT S5LPJ4429	28.0	40.96	4.0	450 - 1200	R,G,B,W,NIR	5.00	M58, optional M42
HIGHLIGHT S5LPJ4440	40.0	40.96	4.0	350 - 1200	R,G,B,W,NIR	5.00	M58, optional M42
HIGHLIGHT S5LPJ4465	65.0	40.96	4.0	500 - 1500	R,G,B,W,NIR	5.00	M58, optional M42
ENTOCENTRIC SWIR LENSES							
S5LPJ6805-216	50.0	16.0	1.8	400 - inf	SWIR	10.00	C
S5LPJ6807-M42	75.0	25.6	2.0	500 - inf	SWIR	10.00	M42x1
ENTOCENTRIC TELE LENSES FOR LASER PROCESS IMAGING							
S5LPJ0305	150.3	8.0	8.0	infinity	R	5.60	C
S5LPJ0303	305.3	11.0	16.0	infinity	R	5.00	C
ENTOCENTRIC TELE LENSES FOR LASER PROCESS IMAGING WITH INTEGRATED LIQUID LENS							
S5VPJ0305	150.0	11.0	8.0	infinity	R	5.60	C
S5VPJ0303	304.3	11.0	11.0	infinity	R	5.00	C

PORTFOLIO LED CONDENSERS

BENEFIT FROM OUR EXPERIENCE

Within our telecentric imaging lens portfolio, we have also developed LED condensers that complement our offerings. These condensers serve as collimated backlights for high-precision measurements in machine vision applications. Our main expertise lies in optical subassemblies that ensure the emitted light exhibits high homogeneity and parallelism.

In addition to the condensers available in our portfolio, we can provide other sizes (up to an illumination diameter of Ø150) and offer modifications or custom developments upon request. We are committed to meet your specific requirements and providing tailored solutions for your imaging needs.

PART NUMBER	CLEAR APERTURE/ ILLUMINATION DIAMETER [mm]	FOCAL LENGTH [mm]	LED	WAVELENGTH [nm]	MAX. CURRENT [mA]	CONNECTOR
IR CONDENSER						
S6IRI4530	30.0	30.0	SFH4770S	850	1000	M8 / 4-pin
S6IRI4540	55.0	76.0	SFH4770S	850	1000	M8 / 4-pin
S6IRI4550	73.0	100.0	SFH4770S	850	1000	M8 / 4-pin
RED CONDENSER						
S6IRI4531	30.0	30.0	GR QSSPA1.13	623	1000	M8 / 4-pin
S6IRI4541	55.0	76.0	GR QSSPA1.13	623	1000	M8 / 4-pin
S6IRI4551	73.0	100.0	GR QSSPA1.13	623	1000	M8 / 4-pin
BLUE CONDENSER						
S6IRI4532	30.0	30.0	GB QSSPA1.13	470	1000	M8 / 4-pin
S6IRI4542	55.0	76.0	GB QSSPA1.13	470	1000	M8 / 4-pin
S6IRI4552	73.0	100.0	GB QSSPA1.13	470	1000	M8 / 4-pin
GREEN CONDENSER						
S6IRI4533	30.0	30.0	GT QSSPA1.13	528	1000	M8 / 4-pin
S6IRI4543	55.0	76.0	GT QSSPA1.13	528	1000	M8 / 4-pin
S6IRI4553	73.0	100.0	GT QSSPA1.13	528	1000	M8 / 4-pin

ACCESSORY FOR TELECENTRIC IMAGING LENSES AND LED CONDENSERS

PART NUMBER	DESCRIPTION
LENS MOUNT SET	
S5SET0020	Clamping Ø60/Ø75 for many telecentric lenses
S5SET0022	Clamping Ø47 for all LED condensers
BEAMS SPLITTER CUBES FOR INTEGRATED COAXIAL ILLUMINATION	
S0SET9125-000	Polarized beam splitter (standard condition)
S0SET9125-017	Non-polarized beam splitter
RETARDATION PLATES FOR INTEGRATED COAXIAL ILLUMINATION	
S5SET1150	half wave plate for 630nm, slide-in unit
S5SET8325-040	half wave plate for 630nm, add-on unit
USB DRIVER FOR FOCUS TUNABLE OPTOTUNE LENSES	
S5ZUB1640	Optotune USB Driver EL-E-4i
S5ZUB1641	Hirose 6-pin connection cable for USB Driver EL-E-4i

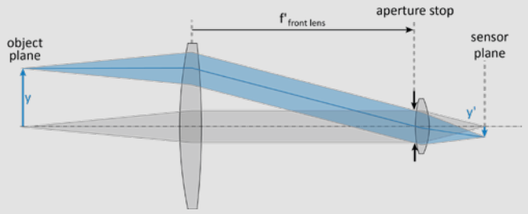
Other accessory upon request.
In case of demands on modifications, please contact our Customer Care Team.

LENS DESIGNS – TELECENTRIC LENSES

OBJECT-SIDED TELECENTRIC LENS

Object-sided telecentric lenses offer the highest measurement precision because the chief rays in the object space are parallel, and there is no magnification change with variations in working distance within the depth of field.

In addition to our portfolio of telecentric lenses, Sill Optics has successfully developed numerous customized telecentric designs for series production.



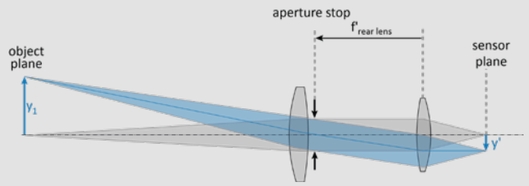


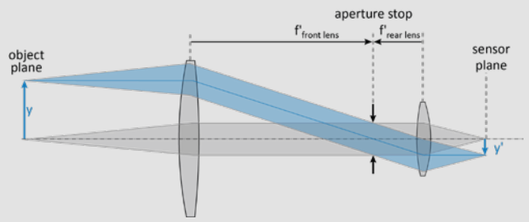
IMAGE-SIDED TELECENTRIC LENS

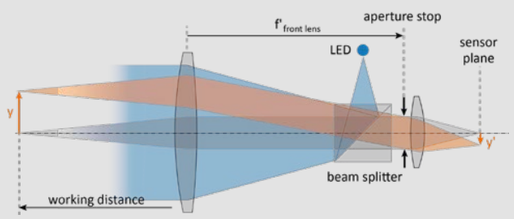
Image-sided telecentric lenses are essential for various specialized imaging purposes or specific camera types. These lenses are specifically designed for applications where intermediate images are required for follow-up systems (e.g., spectrometers) or for prism-based three-chip sensors.

In many applications with CMOS sensors, a small angle of incidence at the sensor side is adequate for optimal performance.

BI-TELECENTRIC LENS

Bi-telecentric lenses integrate both object-sided and image-sided telecentric beam paths into a single lens. These lenses offer significant advantages for high-spec imaging applications and provide minimal distortion.





TELECENTRIC LENS WITH INTEGRATED COAXIAL ILLUMINATION

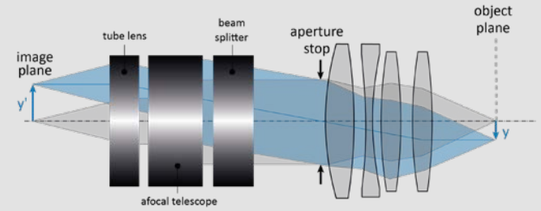
Telecentric lenses with integrated coaxial illumination offer a unique combination of telecentric imaging and coaxial collimated front illumination. This design incorporates a beam splitter to introduce the illumination path, while the front part of the telecentric lens collimates the light.

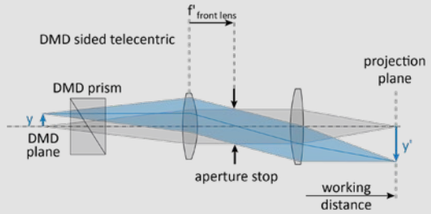
TECHNICAL GUIDE
BENEFIT FROM OUR EXPERTISE

LENS DESIGNS – TELECENTRIC LENSES

MICROSCOPE LENSES

Sill Optics is no typical microscope lens manufacturer for standards with small field of view (FOV) and high NA.
Nevertheless, we have the manufacturing expertise to realize microscope lenses for applications with larger working distance (≥ 5 mm) and NA ≤ 0.5 that require larger FOV or special waveband correction.
We are your trusted partner in finding customized solutions to meet your individual requirements.





DMD LENSES

DMD lenses are specifically designed for the projection of a digital micromirror device. These lenses feature a telecentric design on the DMD side. When working with DMDs, it is essential to consider the prism material and internal distances to prevent axial color shift.

At Sill Optics, we are your trusted partner, especially when it comes to lenses for DMD manufacturing and precision measurement pattern projection. Our experti-
se in this area ensures that we can provide you with the optimal lens solutions tailored to your specific needs.

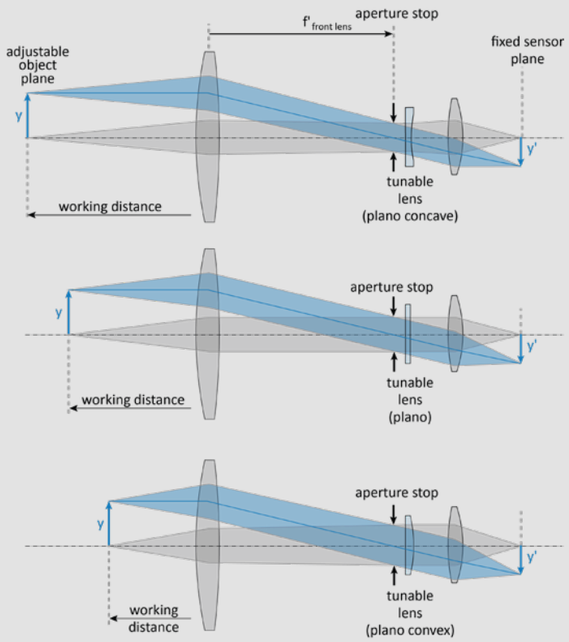
TELECENTRIC LENSES WITH INTEGRATED TUNABLE LIQUID LENS

Telecentric lenses with integrated tunable liquid lenses provide the capability for fast focus changes without the need for moving elements. While we offer a range of telecentric lenses in our portfolio, our true strength lies in designing custom lenses with integrated liquid lenses.

In our projects, we typically incorporate liquid lenses from Optotune, as we have had positive experiences with their reliable products.

However, it is worth noting that we can also develop entocentric designs with integrated liquid lenses if needed.

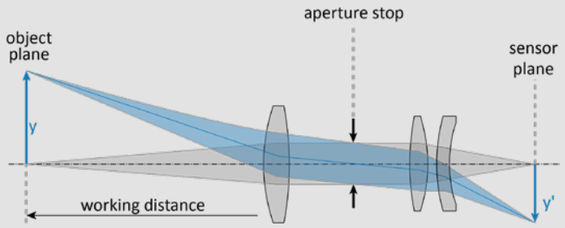
Count on Sill Optics to deliver the precise lens solution with integrated tunable liquid lenses that meets your specific requirements.

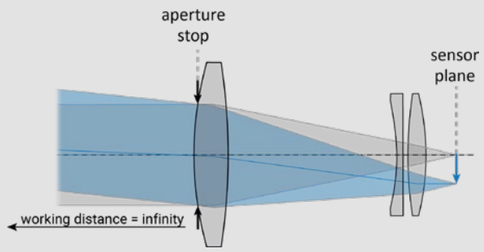


LENS DESIGNS - ENTOCENTRIC LENSES

LARGE FIELD ENTOCENTRIC LENS

Sill Optics defines "large field" as referring to lenses designed for use with sensors of a large diagonal size. When dealing with line scan cameras or large format area sensors with a length or diagonal size exceeding 43.3mm (full format), the complexity of entocentric lens design increases. These scenarios create a demand for custom development, particularly when high aperture, high resolution, and/or large bandwidth are required.





TELEPHOTO LENS

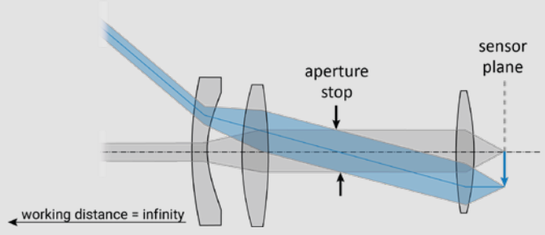
Telephoto lenses are characterized by their long focal length, which is typically greater than their physical length. These lenses are designed to capture images of distant objects with a specific magnification factor.

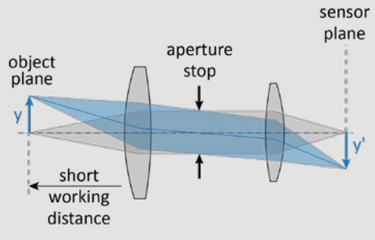
In telephoto lenses, the aperture stop is typically positioned at the front surface of the lens. When a larger aperture is desired, a correspondingly large front lens element is necessary to accommodate it.

WIDE-ANGLE LENS

Wide-angle lenses are commonly used for observation applications or imaging tasks that require capturing a large field of view at significant distances.

These lenses can be designed in two main configurations: fisheye lenses, which feature concave lens elements at the front, as shown; or pinhole lenses, where the aperture is positioned outside the lens assembly.





MACRO LENS

Macro lenses are entocentric lenses designed for capturing close-up shots with magnifications ranging from approximately 0.5x to 1.5x. These lenses feature a small optical transfer length and typically have a large aperture.

Due to the short transfer length, macro lenses require a short focal length and must be carefully designed to fit within the available space without compromising performance.

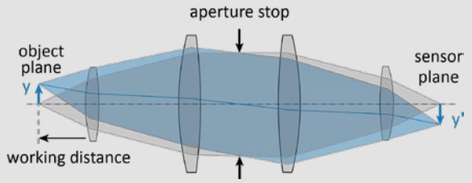
TECHNICAL GUIDE
BENEFIT FROM OUR EXPERTISE

LENS DESIGNS - ENTOCENTRIC LENSES

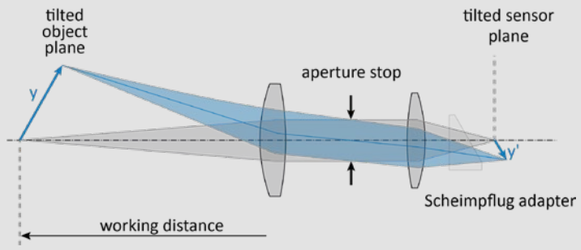
RELAY LENS

Relay lenses are integral components of optical systems used to transfer an intermediate image plane to the pupil plane (Fourier plane) and/or back to a final image plane. They play a crucial role in various applications, such as refractive spectrometers.

Relay systems can be designed in a symmetric configuration, where the magnification is 1:1, or in an asymmetric configuration with a magnification ratio of 1:X. The choice of configuration depends on the specific requirements of the optical system.



Furthermore, relay lenses can also be utilized for pupil relays in specialized scanning setups. These setups allow for precise scanning and control of the beam path.



SCHEIMPFLUG LENS FOR TILTED OBJECT PLANE

Scheimpflug lenses are designed to image a tilted object plane onto a tilted image plane while minimizing critical blur. This allows for capturing accurate measurements even when dealing with non-planar objects. The distortion can also be optimized for specific measurement purposes.

To accommodate standard imaging cameras, a tilting adapter can be used to meet the imaging performance requirements. This adapter ensures that the Scheimpflug imaging setup is compatible with the camera system being used.

NOTES
FOR YOUR INDIVIDUAL PROJECT

Field size (FOV, sensor size)

Camera specifications
(sensor dimensions, pixel size, resolution, camera thread, back flange distance, maximum chief ray angle, color)

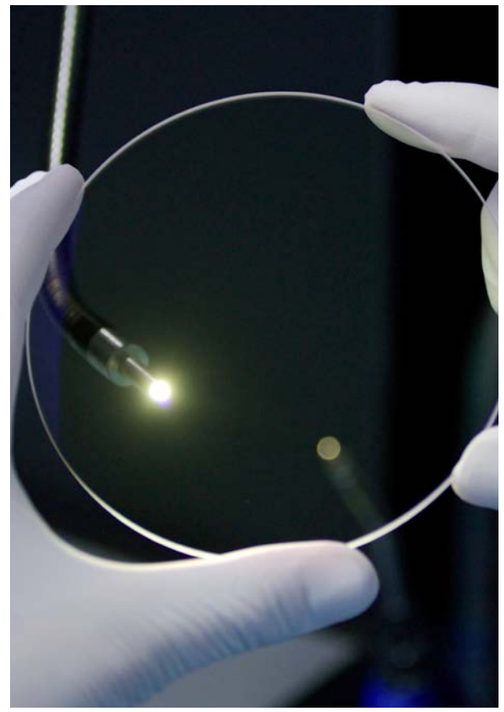
Aperture

Waveband
(UV, VIS, IR, bandwidth)

Space constraints
(total track, working distance, maximum length, maximum diameter, mounting)

Performance requirements
(Strehl ratio, MTF, edge spread function, distortion, color correction)

NOTES
FOR YOUR INDIVIDUAL PROJECT



Jürgen Stollhof
Director Sales
& Marketing

Bernhard Westerhoff
Global Key Account
Manager

Stefan Best
Senior Sales Engineer

Markus Klahr
Manager Internal Sales

Karen Bloss
Customer Care

Sophia Tillack
Customer Care

Lenka Hightower
Customer Care

Sabine Epner
Customer Care

Sabrina Rienesl
Customer Care

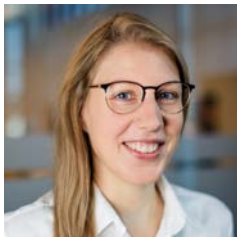
Sara Hildebrandt
Customer Care

Raphaela Streit
Project Management

Manuel Zenz
Project Management

Julian Perlitz
Project Management

Andreas Platz
Project Management



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