

HIGH LIGHTS

23

by SILL

HIGHLIGHTS 23 *by SILL*

HIGH POWER F-THETA

F-theta lenses are extensively utilized in laser materials processing and find applications in various scanning systems. However, high-power f-theta scanning systems present certain challenges. Scaling the laser power necessitates careful consideration of thermally induced phenomena and ghost reflections, which further complicates the optimization of optical configurations and the correction of major sources of errors, even during the pre-design phase. Moreover, achieving high positioning accuracy requires addressing all potential causes of distortion within the processing field.

Our high-power f-theta lenses offer an **ideal solution for demanding laser material processing applications**. Equipped with state-of-the-art optics, they are perfectly suited for laser welding and laser cutting tasks. Whether you require precise welds for industrial applications or accurate material cutting, our lenses deliver impressive beam quality and ensure high focus stability, meeting your exacting standards for precision and efficiency.

Additionally, **our high-power f-theta lenses are widely employed in the automotive industry**. They enable precise marking, welding, and cutting in the production of automotive components. Furthermore, **our lenses play a crucial**



role in battery technology. In the production of battery packs for the automotive industry, precise machining of components is vital. You can rely on the proven performance and quality of our lenses to meet the rigorous requirements of battery technology.

PART NUMBER	FOCAL LENGTH [mm]	SCAN AREA [mm x mm]	FOCUS SIZE (1/e ²)	MAX. BEAM-Ø [mm]	MAX. TELECENTRICITY ERROR [°]	WORKING DISTANCE [mm]	SP/USP*
S4LFT5430-328	430	250 x 250	30	30	11.6	540	yes
S4LFT0910-328	910	500 x 500	65.8	30	16.2	1048.8	yes

MOTORIZED BEAM EXPANDERS

Introducing our Motorized Beam Expander – the ultimate solution for automation, flexible laser processing, and versatile focal sizes in your machining system. With our cutting-edge technology, we provide a state-of-the-art solution that caters to your expanding needs. Our **Motorized Beam Expanders are specifically designed to precisely and efficiently increase or decrease the beam diameter**.

By maintaining a constant product of beam diameter and divergence, our expanders ensure optimal beam quality throughout the entire laser processing procedure. Whether you require fixed expansion or variable magnification with our zoom expanders, we have the perfect solution for you.

Our beam expanders are built using **fused silica** as the primary material for all optical elements, ensuring exceptional stability and reliability even under high average power or intense laser conditions. The standard product includes a

low absorption coating, specially designed to handle the high-power density at the entrance lens element. To accommodate various requirements, we offer a **wide range of beam expanders** with different functionalities. From fixed magnification options suitable for large beam diameters to compact expanders with fixed magnification, we have the perfect solution for every application. Additionally, our **motorized divergence adjustment feature allows for seamless adaptability and fine-tuning** without the need to open your setup for adjustment.

For those seeking ultimate versatility, our motorized variable magnification beam expanders are the ideal choice. With the ability to adjust both magnification and divergence, you have complete control over the focal size and precision of your laser processing. Experience the power of automation and flexibility with our Motorized Beam Expanders.

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

*usable for SP=Short Pulse, USP=Ultra Short Pulse

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DUV OPTICS

Lasers in the deep ultraviolet (DUV) range have become essential in electronics manufacturing, allowing for the creation of structures that are at the limit of human visual perception. With precise processing capabilities, glass materials or foil-based materials can be accurately handled. Furthermore, due to the telecentricity of the optics, the heat-affected zone is minimized. Our DUV optics provide an ideal solution for these demanding applications.

In many cases, achieving small focal points and large scan fields poses conflicting requirements. However, **we have pushed the boundaries of scanning solutions and successfully offer small structures with high throughput simultaneously.** With wavelengths of 257 nm or 266 nm, our optics empower electronics manufacturers to achieve precise focal points measuring less than 5 μm on a scan field of up to 20x20 mm².

Moreover, our DUV optics are highly flexible for custom designs, ensuring maximum adaptability to specific requirements.



PART NUMBER	FOCAL LENGTH [mm]	SCAN AREA [mm x mm]	FOCUS SIZE (1/e ²) [µm]	MAX. BEAM-Ø [mm]	MAX. TELECENTRICITY ERROR [°]	WORKING DISTANCE [mm]	SP/USP*
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

LARGE TELECENTRIC F-THETA LENSES



Introducing our state-of-the-art Large Telecentric Lenses, designed to revolutionize display processing with unmatched precision, superior performance, and exceptional control. Our lenses **focus on high accuracy and a vertical angle of incidence on the processing field**, redefining the possibilities of optical technology. Specifically engineered for large format applications, this telecentric lens series ensures optimal image quality and clarity, delivering unparalleled resolution and detail in your display processing tasks.

One key advantage of our Large Telecentric Lenses is their **minimal heat influence on your workpiece**. By maintaining a low heat affected zone, our lenses ensure that your display processing remains unaffected by thermal effects. This guarantees superior results and long-lasting performance.

In addition to their advanced functionalities, **our lenses can be customized** with mounts that perfectly align with your setup. We understand that each project has unique demands, and our team is dedicated to providing tailored solutions to meet your specific needs. By investing in precision, accuracy, and innovation with our Large Telecentric Lenses, you can discover the potential to elevate your display processing capabilities to unprecedented heights. Trust in our unwavering commitment to delivering optical excellence tailored to your unique requirements.

*usable for SP=Short Pulse, USP=Ultra Short Pulse

TRAPPED ION LENSES

Unleash the power of quantum computing with the latest breakthrough in technology: the Trapped-Ion Lens. Quantum computers, renowned for their unparalleled computing capabilities and lightning-fast speeds, are ushering in a new era of scientific advancements. **At the core of these quantum experiments lies the remarkable trapped-ion technology, offering prolonged superposition states and unprecedented control.**

Through the integration of a Paul trap and our innovative trapped-ion lens, we have revolutionized the detection and manipulation of trapped ions. By harnessing the power of laser cooling and observing the reflected fluorescence wavelength, our lens enables precise control and extends the ions' superposition state.

The Trapped-Ion Lens is uniquely designed to accommodate multiple wavelengths, ensuring optimal stimulation and imaging of the ions on a sensor. Sill Optics can provide lenses for both observation and observation combined with laser focusing for these experiments. We understand the importance of sharp focus, which is why our lens boasts a high numerical aperture (NA) and guarantees diffraction-limited imaging at the center of the trap.

While the Paul trap secures the ions within a vacuum chamber, our lens is strategically positioned outside the

chamber, allowing the beam path to pass through one or more vacuum windows. Although these windows may impose limitations on the NA and the minimum distance between the lens and the focal plane, our Trapped-Ion Lens overcomes these challenges with ease.

We acknowledge that every laboratory setup is unique, with varying ion types, wavelengths, beam parameters, and vacuum chamber dimensions. That is **why we offer both catalog optics and custom redesigns** based on our catalog optics. Our expertise in lens design, coupled with in-house manufacturing capabilities, ensures cost-efficient solutions, eliminating the need for designing from scratch and saving you valuable time and resources. At Sill Optics, we are committed to providing you with the perfect solution for your specific requirements.

Take the first step towards unlocking the potential of quantum computing. Contact our dedicated project management team today to learn more about our Trapped-Ion Lens. Provide us with a detailed description of your laboratory setup and relevant technical data, including vacuum window specifications, required wavelengths, distance to the focal plane, desired NA, installation space limitations, and working distance requirements.



OUTLOOK FOR 2024

We at Sill Optics are setting new standards in laser optics. Our highly precise f-theta lenses are the perfect choice for demanding applications in laser material processing. Our beam expanders enable flexible adjustments and optimal beam quality for a wide range of applications. Additionally, we are working intensively on increasing the damage threshold (LIDT) of our anti-reflection coatings. Specifically in the UV range, lasers have advanced so significantly that the enormous pulse energy of certain ultra-short

pulse lasers can exceed the maximum allowable energy density in some beam expanders. Our goal is to further push the LIDT higher, ensuring that Sill Optics products can be used without damage in the future. Preliminary experiments are currently underway, and we plan to present optimized products at Photonics West. With our focus on customized developments and the highest quality, we will continue to be your innovative partner beyond 2023.

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IMAGING OPTICS

Sill Optics is responding to the increased demand for C-mount lenses for large sensors with a **new series of telecentric lenses**.

The series includes three lenses with 0.6x, 0.7x, and 0.8x magnification, optimally designed for a 22mm sensor. With high resolution, these lenses **fit perfectly on the current Sony Pregius S series sensors** with a 2.74µm pixel size.

The lenses can be used both monochromatically and with white light. They can also be used in the NIR (near-infrared) range by slightly adjusting the working distance. This lens series fills the gap in our portfolio, which now includes high-resolution telecentric lenses with magnifications ranging from 0.13x to 3.0x for 1.25-inch sensors.



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
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

IMAGING OPTICS



Sill Optics has developed a telecentric lens with a **2x magnification, large aperture, and integrated liquid lens** for focus adjustment. The increasing demand for magnifying telecentric lenses, particularly with large apertures that accommodate a 2.74µm 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 6mm.

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

PART NUMBER	MAGNIFICATION	RECOMMENDED SENSOR DIAGONAL [mm]	WORKING DISTANCE [mm] (TR=TUNING RANGE)	WAVELENGTH BAND MONO (RED, GREEN, BLUE) WHITE (COLOR/BAYER) NIR (800-900 nm)	RECOMMENDED PIXEL SIZE [µm]	THREAD
S5VPJ6415	1.500	19.2	80.2 TR≈6	R,G,B,W	2.74	C
S5VPJ6420	2.000	19.2	68.2 TR≈6	R,G,B,W	2.74	C
S5VPJ6425	2.500	19.2	61.4 TR≈6	R,G,B,W	3.10	C



[www.silloptics.de/
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