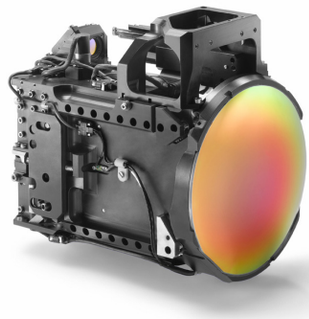
FoldIR™ CONTINUOUS ZOOM LENS FAMILY
DESIGNED FOR MWIR COOLED DETECTORS

FoldIR 16-180mm f/3.6
For cooled MWIR 10µm
VGA detectors

FoldIR 30-450mm f/3.4 NEW
For cooled MWIR 10µm
SXGA detectors



FoldIR 28-850mm f/5.5
For cooled MWIR 15µm
SXGA detectors

COMPACT DESIGN FOR VOLUME RESTRICTED APPLICATIONS, WITH NO COMPROMISE ON PERFORMANCE

Infrared imaging applications are evolving at a rapid pace and continue to drive challenging requirements for reduced Size, Weight, and Power (SWaP). In particular, gimbal size and weight are critical factors impacting UAS (unmanned aircraft systems) flight and mission time. With this in mind, MKS Ophir has developed an innovative folded optics design that significantly shrinks the length of the lens assembly, reducing the overall volume of the entire integrated system.

Optimize payload gimbal systems with folded optics design

The use of folded optics enables the creation of ultra-compact electro-optical systems, mainly gimbals, with unparalleled image quality. This technology paves the path to incorporating a large aperture lens with long effective focal length (EFL) and extended vision ranges (DRI's), while minimizing the total size of the payload gimbal.

Typical vs. folded optics designs

Typical zoom lens designs are characterized by a train arrangement of several lens elements, in which the front element has the largest diameter. In such a case, the largest lens diameter determines the diameter of the payload gimbal. However, in the case of a folded optics design, the height and width of the overall lens assembly (that impacts the gimbal size) are reduced.

Enhancing gimbal volume usage

Folded optics designs better utilize the available volume for both lens and detector modules. This reduction in size is accomplished by "double-folding" the lens optical axis back on itself by two, reflecting mirrors at 45° AOI, significantly reducing the overall length of IR lens.

Ophir FoldIR lenses: tailor made for payload gimbal systems

The new FoldIR product family of zoom lenses, developed by MKS Ophir, utilizes a double-folded design to generate small-size, lightweight, small aperture and long vision (DRI) ranges. These continuous zoom lenses enable near diffraction-limit performance in harsh environments, addressing challenges such as line-of sight (LOS) stabilization and athermalization. This makes them ideal for advanced UAS IR cameras, creating crisp, clear images in a wide range of conditions.

Image 1: IR thermal image taken with SupIR 28-850mm f/5.5 HD format continuous zoom lens from 3.6km distance, via IR cameras infrared imaging system.

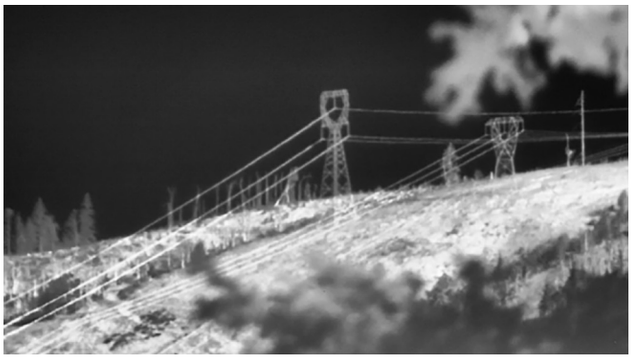


Image 2: IR thermal image taken with SupIR 16-180mm f/3.6 VGA format continuous zoom lens from 6.1km distance, via Ventus Micro by Sierra Olympia Technologies Inc.

Product family features

- Meets low-SWaP demand with long-range observation capabilities.
- Efficient folded optics design for maximum volume use.
- Designed for variable size thermal imaging aerial gimbals and various other volume constrained platforms.
- Focus is maintained through the entire zoom range, providing extremely fast zoom and focus response.

DETECTION, RECOGNITION, IDENTIFICATION RANGES (Km)

Cooled MWIR, 10µm detector

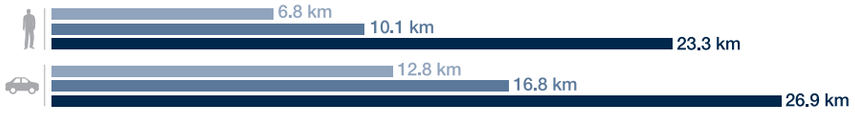
16-180mm f/3.6

30-450mm f/3.4

Cooled MWIR, 15µm detector

28-850mm f/5.5

50-1350mm f/5.5



Identification
Recognition
Detection

Vehicle size 2.3m x 2.3m

Human size 1.7m X 0.5m

Note: Calculation used are based on “Johnson Criteria” | Real world performance may vary depending on the weather conditions

* Assumptions: 23mK NETD (f/4 & f/5.5) | 35.5mK NETD (f/3.4) | 30Hz frame rate | 0.2km^{-1} atmospheric attenuation coefficient | 50% detection probability

FoldIR 16-180mm f/3.6 Motorized continuous zoom

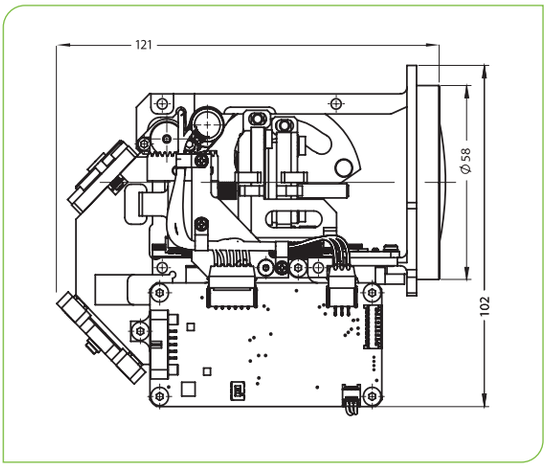
For cooled MWIR 10µm VGA detectors

680389

Cooled MWIR

NEW

TYPICAL ICD



WFOV (16mm)

HFOV	640x480
10µ	22.6°

NFOV (180mm)

HFOV	640x480
10µ	2.0°

Property	Value	
Optical	WFOV	NFOV
Focal Length	16mm	180mm
F#	3.6	
Average transmission (3.4-4.2µm)	≥80% (LRHC); >82% (HD)	
Cold stop to FPA Distance	12mm	
Cold Stop CA	Ø3.37mm	
Back Focal Length	23.08mm in air	
Distortion (in diagonal)	<2%	
Minimum Focusing Range	5m	50m
Nuc (by defocus)	Blur to 7mm diameter	
Mechanical		
Focus Mechanism	Motorized. Adjustable	
Focus Time (minimum range to ∞)	≤5.5 sec	
Zoom Time (NFOV to WFOV)	≤1 sec	
Max. Dimensions	Length 121mm; Width 70mm; height 102mm	
Weight	460gr	
Electrical		
Lens Control	Designated lens controller	
Drive Voltage	6-12VDC	
Current Consumption	< 0.5A average, 1.0A peak	
Communication Protocol	RS422	
Environmental		
Operation Temperature	-32°C to +75°C	
Storage Temperature	-54°C to +85°C	
Sealing	IP67 front lens only	

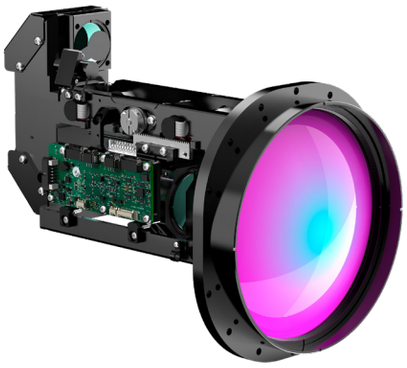
FoldIR 30-450mm f/3.4 Motorized continuous zoom

For cooled MWIR 10µm SXGA detectors

680465*

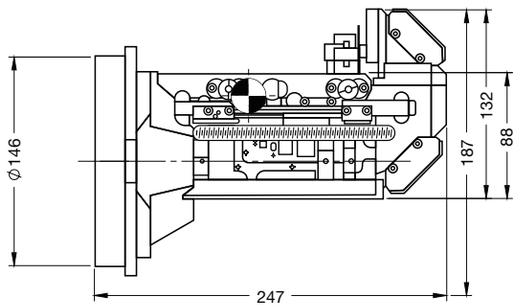
Cooled MWIR

COMING SOON



HD
FORMAT

TYPICAL ICD



WFOV (30mm)

HFOV	640x480	1280x1024
15µ	19.3°	
10µ	12.5°	26.9°

NFOV (450mm)

HFOV	640x480	1280x1024
15µ	1.3°	
10µ	0.8°	1.7°

Property	Value	
Optical	WFOV	NFOV
Focal Length	30mm	450mm
F#	3.4	
Average transmission (3.4-4.2µm)	80% (HC)	
Cold stop to FPA Distance	19.4mm	
Cold Stop CA	Ø5.7mm	
Back Focal Length	18.5mm in air	
Minimum Focusing Range	20m	50m
Nuc (by defocus)	Yes	
Mechanical		
Focus Mechanism	Motorized	
Focus Time (minimum range to ∞)	<1 sec.	
Zoom Time (NFOV to WFOV)	<5 sec.	
Max. Dimensions	Ø146mm x 247mm	
Weight	2kg	
Electrical		
Lens Control	Designated lens controller	
Supply Voltage	12V	
Current Consumption	< 0.5A average, 1.0A peak	
Communication Protocol	RS422, RS232	
Environmental		
Operation Temperature	-20ºC to +55ºC	
Storage Temperature	-40ºC to +70ºC	
Sealing	IP67 front element only	

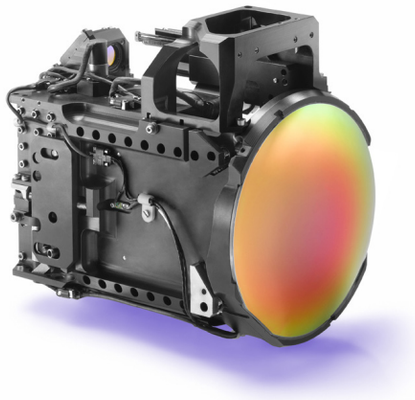
* Requires export license

FoldIR 28-850mm f/5.5 Motorized continuous zoom

For cooled MWIR 15µm SXGA detectors

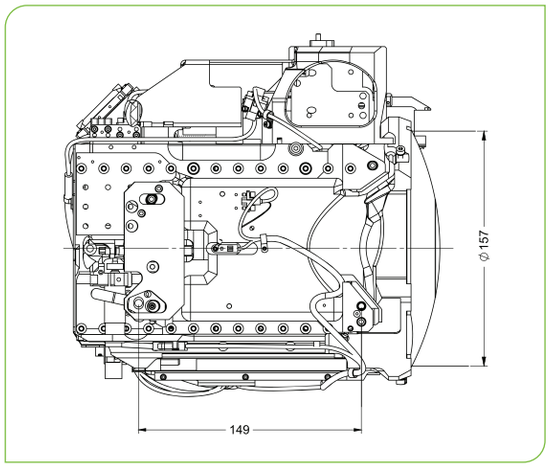
680072*

Cooled MWIR



HD
FORMAT

TYPICAL ICD



WFOV (28mm)

HFOV	320x240	480x384	640x512	1280x1024
30µ	19.8°	29.7°	39.8°	
20µ	13.2°	19.8°	26.4°	
15µ	9.9°	14.8°	19.8°	39.8°

NFOV (850mm)

HFOV	320x240	480x384	640x512	1280x1024
30µ	0.6°	1.0°	1.3°	
20µ	0.4°	0.6°	0.9°	
15µ	0.3°	0.5°	0.6°	1.3°

Property	Value	
Optical	WFOV	NFOV
Focal Length	28mm	850mm
F#	5.5	
Average transmission (3.4-5.0µm)	76% (HD)	
Cold stop to FPA Distance	28mm	
Cold Stop CA	Ø5.09mm	
Back Focal Length	≥37.6mm in air	
Distortion (in diagonal)	<5%	
Minimum Focusing Range	3m	50m
Nuc (by defocus)	Yes	
Mechanical		
Focus Mechanism	Motorized	
Focus Time (minimum range to ∞)	≤8 sec.	
Zoom Mechanism	Motorized	
Zoom Time (NFOV to WFOV)	≤8 sec.	
Max. Dimensions	Length 256mm; Width 176mm; Height 257.5mm	
Weight	4.6kg	
Electrical		
Lens Control	Designated lens controller	
Supply Voltage	28VDC	
Current Consumption	1.25A average, 2.5A peak	
Communication Protocol	RS422	
Environmental		
Operation Temperature	-20ºC to +65ºC	
Storage Temperature	-54ºC to +71ºC	
Sealing	Unsealed	

* Requires export license

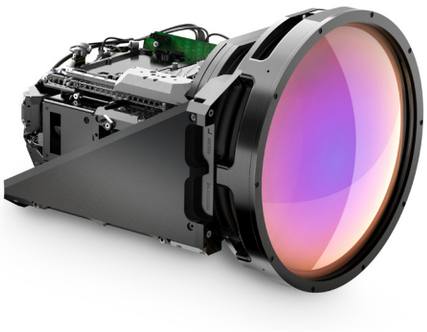
FoldIR 50-1350mm f/5.5 Motorized continuous zoom

For MWIR 15µm SXGA detectors

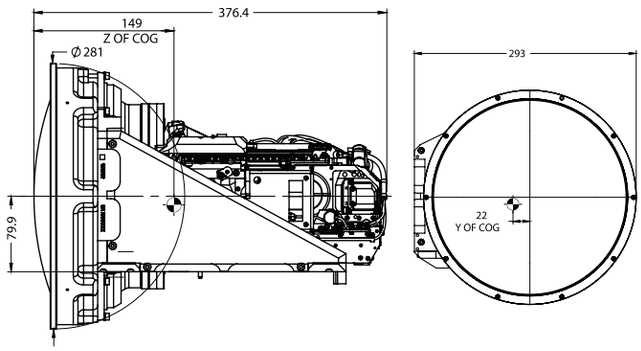
680356*

Cooled MWIR

HD FORMAT



TYPICAL ICD



WFOV (50mm)

HFOV	320x256	640x512	1280x1024
20µ	7.3°	14.4°	
15µ	5.4°	10.8°	20.5°

NFOV (1350mm)

HFOV	320x256	640x512	1280x1024
20µ	0.3°	0.5°	
15µ	0.2°	0.4°	0.8°

Property	Value	
Optical	WFOV	NFOV
Focal Length	50mm	1350mm
F#	5.5	
Average transmission (3.4-5.0µm)	70% (LRHC)	
Cold stop to FPA Distance	28mm	
Cold Stop CA	Ø5.09mm	
Back Focal Length	≥7.6mm in air	
Distortion (in diagonal)	<5%	<5%
Minimum Focusing Range	5m	200m
Nuc (by defocus)	Yes	
Mechanical		
Focus Mechanism	Motorized	
Focus Time (minimum range to ∞)	≤8 sec.	
Zoom Mechanism	Motorized	
Zoom Time (NFOV to WFOV)	≤8 sec.	
Max. Dimensions	Length 376.4mm; Ø281mm; Height 293mm	
Weight	~13.7kg	
Electrical		
Lens Control	Designated lens controller	
Supply Voltage	28VDC	
Current Consumption	1.25A average, 2.5A peak	
Communication Protocol	RS422	
Environmental		
Operation Temperature	-20ºC to +65ºC	
Storage Temperature	-54ºC to +71ºC	
Sealing	IP 67 front element only	

* Requires export license

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About Ophir Infrared Optics

With decades worth of knowledge and experience, Ophir Optronics Solutions LTD., Infrared Optics, an MKS Brand (NASDAQ: MKSI), is a world-leading designer and manufacturer of high-performance IR thermal imaging lenses and optical elements for SWIR, MWIR & LWIR imaging. Using advanced technologies, innovative engineering, and design configurations, Ophir provides a global solution for homeland security, surveillance, defense and commercial applications: IR components and complex lens assemblies with fixed or motorized focus and zoom lenses.

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