

ORI test systems

Testers of IR optical systems



Fig. 1. Photo of ORI test system (version ORI 33-21 – no PC)

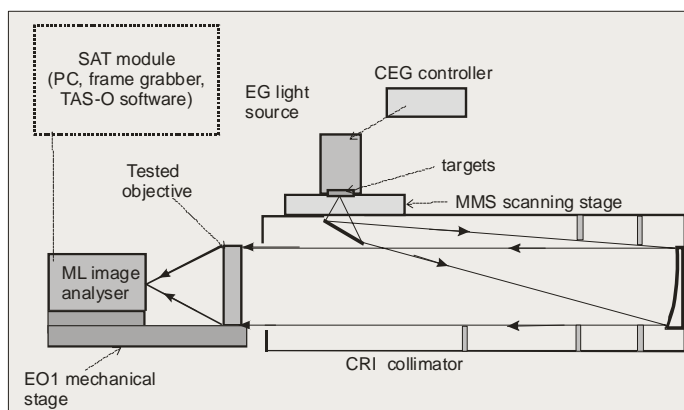


Fig. 2. Block diagram of the ORI series test system

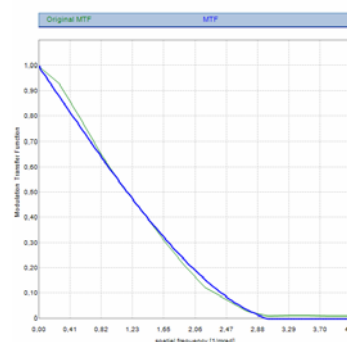


Fig. 3. MTF curve of an exemplary diffraction limited LWIR objective

BASIC INFORMATION:

The ORI test systems are specialized test systems optimized for task of extensive testing of optical systems. These test system enable measurement of MTF (on axis, off axis), focal length and relative transmittance of optical systems. Both converging objectives and afocal systems can be tested.

The test system basically works as an optical projector of images of standard targets. The tested optics distorts the projected images. Quality of the output images are evaluated with help of the image analyser and specialized software.

The ORI test system consists of CRI collimator, MMS scanning stage, set of targets, EG light source, CEG controller, EO1 mechanical stage, ML image analyser, PC, frame grabber, TAS-O software.

The ORI test system is an unique design that enables to test all types of optical systems in the optical spectral range from UV to LWIR (UV optics, visible/near infrared optics, infrared optics). Such universality is achieved by designing several versions of some modules (image analyser, set of targets, light source) optimized for different spectral range of tested optics. By exchange of these modules ORI system can be easily converted from version for testing visible objectives to a version optimized for testing infrared objectives or ultraviolet objectives.

High quality of collimators and image analysers used as modules in ORI test system enables accurate testing of even diffraction limited optical systems in all optical spectral ranges. A series audit objectives used as optional modules of ORI test system enables convenient during recalibration of this test system.

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FEATURES:

- Unique design that enables recording images of pixels size about ten times smaller than pixels of typical IR FPA/CCD sensors (about $3\mu\text{m}$ in MWIR/LWIR range and about $0.6\mu\text{m}$ for VIS/NIR range),
- Semi-automatic measurement of most important parameters of optical systems: MTF, focal length, relative transmittance
- Modular flexible design that can be used for testing totally different optical systems: from small objectives used commercial thermal imagers (aperture below 30mm) to ultra big objectives (apertures up to 300 mm) used in special ultra long distance surveillance thermal imagers
- Unique design that enables testing optics from UV optics to LWIR optics.
- Both converging optical objectives and afocal optical systems can be tested.
- Objectives of ultra high resolution up to 500 lp/mrad can be tested (max resolution of tested objective depends on version of ORI test system)

VERSIONS

ORI systems can be delivered in many different versions. The version is described using four digit code (abcd) presented in the table below.

Tab. 1. Definition of codes used to describe versions of ORI test system

	a	b	c	d
Code number	Max aperture/ max focal length	Test capabilities	Type of tested optical system	Spectral range of tested optical system
1	30mm/150mm	MTF (on axis), resolution (for VIS optics)	Converging objectives	VIS/NIR
2	70/300	MTF (on-axis, off-axis), focal length, resolution (for VIS optics)	Afocal systems	MWIR/ LWIR
3	110/500	MTF (on-axis, off-axis), focal length, depth of focus, resolution (for VIS optics), transmittance, vignetting	Both Converging objectives and Afocal systems	MWIR/LWIR/ VIS/NIR
4	150/600			VIS/NIR/UV
5	200/1000			MWIR/LWIR/SWIR
6	300/1400			MWIR/LWIR/SWIR/VIS/ NIR/UV

Example: ORI 33-12 means the following ORI test system: a) maximal aperture of tested optical objective equals 110mm, maximal focal length equals 500mm, b) test system capable to measure MTF, focal length and transmittance of tested objectives, c) the test system capable to test only Converging optical objectives; d) MWIR / LWIR objectives can be tested.

STRUCTURE

System structure depends on version chosen. Here we will list modules of two exemplary versions of ORI test system.
ORI 43-12 test system: CRI 160/1800 off axis collimator, MMS scanning stage, EG-IR light source, CEG controller, set of IR targets, LW image analyzer, EO1 mechanical stage, LIR audit objective, PC, frame grabber, TAS-O software
ORI 33-11 test system: CRI 120/1500 off axis collimator, MMS scanning stage, EG-V light source, CEG controller, set of visible targets, VN image analyzer, EO1 mechanical stage, VIR audit objective, PC, frame grabber, TAS-O software

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PERFORMANCE

Test performance of ORI test station (effective focal length measurement range, MTF measurement range) depends significantly on version of this test system.

Parameter	Value
ELF measurement range	As stated in Tab. 1 column <i>a</i>
ELF measurement uncertainty	1.5%
ELF repeatability	0.75%
MTF frequency range	Tab. 1 column <i>a</i> (version definition) 1: 0-5 lp/mrad; 2 : 0-10 lp/mrad; 3 :0-18 lp/mrad; 4: 0-40 lp/mrad for MWIR/LWIR optical systems Tab. 1 column <i>a</i> 1: 0-50 lp/mrad; 2 : 0-100 lp/mrad; 3 :0-180 lp/mrad; 4: 0-400 lp/mrad for VIS/NIR optical systems
MTF measurement uncertainty	4%
MTF measurement repeatability	2%
Relative transmission measurement range	10-100%
Transmission measurement uncertainty	4%
Transmission measurement repeatability	2%
Ability to record magnified images of standard targets	Yes. Magnification up to 12x depending on parameters of tested optics.
Pixel size of recorded magnified images	about 3 μ m in MWIR/LWIR range and about 0.6 μ m for VIS/NIR range

SUMMARY

The ORI test system represent a new generation of systems for testing optical systems due to several features.

- Extremely wide spectral range of tested optical systems. It is a first commercially available test system that enables testing all types of optics: LWIR/MWIR/SWIR/NIR/VIS/UV.
- Semi-automatic measurement of parameters of optical systems. This feature enables high speed tests of optical systems.
- Modular design. The system can easily modified from version for testing MWIR/LWIR objectives to version for testing VIS/NIR objectives
- Ability to test very wide range of optical systems (aperture up to 300mm -option 500mm) and resolution of tested objective up to 600 lp/mrad
- Cost-effective solution for testing modern optical systems.

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