MIM

Economy station for testing multi-sensor systems

a)

b)

Fig. 1. Photos of two MIM test systems: a)MIM110, b)MIM300

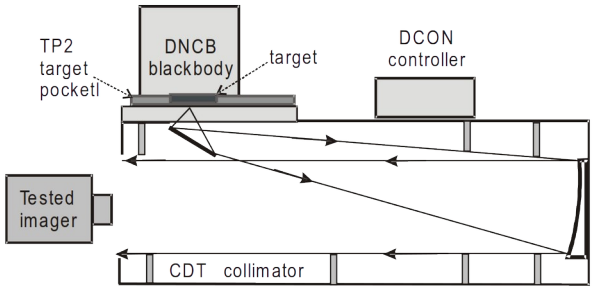

Fig. 2. Block diagram of MIM test system

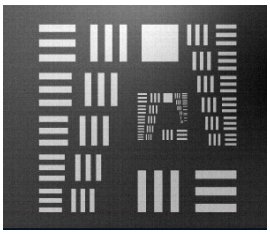

Fig. 3. Image of IR USAF1951 target

BASIC INFORMATION:

Inframet offers MS series computerized test systems based on high performance calibrated DCB dual-color blackbodies (work at the same time as typical blackbody and as a typical light source for testing multi sensor imaging systems), motorized MRW-8 rotary wheel,different tools for testing laser systems and advanced software. These test systems offer accurate measurement of a long series of parameters of such imaging systems (see http://www.inframet.com/multi-sensor_systems.htm). However, MS systems are expensive. Therefore Inframet offers also , lower cost non computerized MIM systems based on a simpler DNCB non calibrated dual-color blackbodies, manual target slider and more limited tools for boresight laser systems. Test capabilities of MIM are significantly limited comparing to MS systems but boresight capabilities are similar. Therefore MIM is a perfect tool for manufacturers of multi sensor imaging systems or maintenance workshops that need simple, low cost tool to check focusing, resolution, sensitivity and boresight errors of tested multi-sensor system.

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DESIGN

MIM is a modular system built is from following main blocks: CDT off axis reflective collimator, DNCB color blackbody. DCON controller, TP2 target pocket, set of resolution targets, and LSC set of laser sensing cards. MIM works as an image projector that projects images of a target located at collimator focal plane and irradiated by the DNCB dualcolor blackbody and show position of laser spot created by LRF to tested thermal imager and VIS-NIR camera. Targets and laser sensing cards are manually exchanged using TP2 target pocket but optionally motorized MRW8 wheel can be used. Thermal contrast of projected images can be regulated using DCON controller by changing temperature of DNCB blackbody. Both positive and negative thermal contrast can be achieved. Light intensity in VIS-NIR band can be regulated too. It should be noted that DNSB is a non calibrated dual-color blackbody. User can regulate of temperature and light intensity of the emitter but it is relative regulation when user does knows current fraction of regulation stimulus but not absolute value of temperature/luminance.

Comparison of MIM versus MS systems

A table that show main features of MS system and MIM system is presented below.

System feature/parameter	MS	MIM
Targeted application	Expanded testing and boresight of mult sensor imaging/laser systems	Basic testing and boresight of mult sensor imaging/laser systems
Price level	High/medium	Medium/low
General description	Computerized image projector integrated with image acquisition/analysis block	Manual image projector
Modularity	Yes	Yes
Typ of collimator	Off axis reflective collimator	Off axis reflective collimator
Radiation source	Computerized calibrated color blackbody	Manual non-calibrated color blackbody
Target set	expanded	basic
Laser analysis and sensing tools	Expanded imaging and analysis	Basic sensing cards
Type of boresight tests	Software supported measurement of boresight errors	Visualization of effect of boresight errors

TEST CONCEPT

MIM can be considered as a system that combines two subsystems

1. variable target, multi spectral projector that project reference images of reference target (used for testing and boresight imaging systems)
2. laser sensitive system that can generate images of laser spots and measure parameters of laser pulses or laser beam (used to test transmitters of LRFs and laser pointers/illuminators) .

TEST CAPABILITIES

MIM enables following tests:

1. infinity focusing of both thermal imagers and VIS-NIR camera
2. measurement of resolution and relative sensitivity of thermal imagers
3. measurement of resolution and relative sensitivity of VIS-NIR cameras,
4. checking boresight error between thermal imager and VIS-NIR camera,
5. checking boresight error between thermal imager and LRF,

6. checking boresight error between VIS-NIR camera and LRF,
7. checking boresight of thermal imager when changing FOV (zoom or step FOV)
8. checking boresight of VIS-NIR when changing FOV (zoom or step FOV).

Range of tested sensors and test capabilities can be optionally expanded.

VERSIONS

MIM test systems are modular test systems that can be delivered in form of different versions of slightly different configurations. The basic division of MIM series system is based on output aperture of the collimator: Collimators of HR class and of aperture up to 300mm are typically offered. A series of versios are offered: MIM110, MIM 150, MIM 200, MIM 250, MIM 300, MIM350, MIM400. MIM110 means collimator aperture equals 110mm.

TECHNICAL SPECIFICATIONS

Technical specifications of of MIM test station are presented below.

Collimator code (depends on version)	CDT11100HR; CDT15150HR; CDT20200HR; CDT25250HR, CDT30200HR, CDT35200HR, CDT40240HR
Collimator type	reflective, off-axis
Aperture	Depends on model from 110mm to 300mm
Focal length	Depends on model from 1000mm to 300mm
Spectral range	0.4-15 um
Spatial resolution	not less than 100 lp/mrad
Mirror manufacturing accuracy	L/6 at 630 nm P-V for HR class collimators
Coating	Protected aluminum
Field of view	Depends on model from 1.3˚ to 2.7˚ details at http://www.inframet.com/Data%20sheets/CDT.pdf
Operating temperature	10ºC to 35ºC
Dimensions	Depends on model from about 610x140x210 to 2610x350x400
Mass	Depends on model from about 7 kg to 90 kg
Color blackbody	
Type	Non calibrated, relative regulation
Emitter dimensions	At least 35x35 mm
Emissivity of emitter	>=0.95
Differential temperature range	At least -10ºC to +10ºC from ambient
Spectral range of emitted light	Visible – basic version (can be expanded to VIS-NIR or VIS-SWIR in optional versions)
Luminance range	At least up to 500 cd/m^2
Type of regulation of temperature and luminance	Manual. Two regulation knobs: temperature and luminance.
Dimensions	From 100x110x130 mm
Mass	3.5 kg
Targets	
Number and types of targets	Three targets: metal USAF1951 IR target, glass USAF1951 target, cross target
Metal USAF 1951 target	Substrate -metal sheet with holes Spatial frequency of 3-bar patterns of in range 1,00 – 14,30 lp/mm
Glass USAF1951 target	Substrate -glass plate with opaque patterns Spatial frequency of 3-bar patterns of in range 1,00 – 57 lp/mm

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Alignment target	Cross target with center pinhole and four bars Hole diameter: 0.8 mm, bar widht 0.54mm and length 17mm
LSC set of laser sensing cards	
LSC set of laser sensing cards	TEG – high sensitivity converter of SWIR laser pulsed light into thermal radiation, TEP – medium sensitivity converter of SWIR laser pulsed light into thermal radiation, MON – low sensitivity absorber of SWIR laser pulsed light that permanently change color when irradiated, MOG – medium sensitivity absorber of SWIR laser pulsed light that permanently change color when irradiated, MOS – medium sensitivity converter of SWIR laser pulsed light into visible light, FOS – high sensitivity converter of SWIR laser pulsed light into visible light)
Set of optical attenuators SOA	
Set of optical attenuators SOA	three OA attenuators and AH1 holder integrated with collimator and AH2 External mount) - to protect collimator mirrors against ultra high power LRFs/designators
Other parameters	
Power supply	220/110 VAC 50/60Hz
Operating temperature	+5°C ÷ +35°C
Mass	Depends on model from about 17 kg to 100 kg

OPTIONS

Following options are possible:

1. MRW8 motorized rotary wheel controlled from external controller to replace manual TP2 target pocket. This option enables more convenient exchange of targets.
2. Expaded spectral band of DNCB color blackbody in light source mode from 450nm to 850nm. Recommended when testing multi sensor systems having monochromatic VIS-NIR cameras.
3. Ultra expaded spectral band of DNCB color blackbody in light source mode from 450nm to 1100nm. Recommended when testing multi sensor systems having monochromatic VIS-NIR cameras and SWIR imagers.
4. Set of variable contrast USAF1951 targets to enable measurement of MRC of VIS-NIR cameras and SWIR imagers
5. AT optical table optimized for MIM station and tested system.

Coding: Number of interesting option should be added to the station code. MIM300-124 means that MIM station of collimator aperture 300mm with options 1,3 and 4 is to be delivered.

Version 2.5

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