

VIT

Station for testing VIS/NIR/SWIR imaging sensors

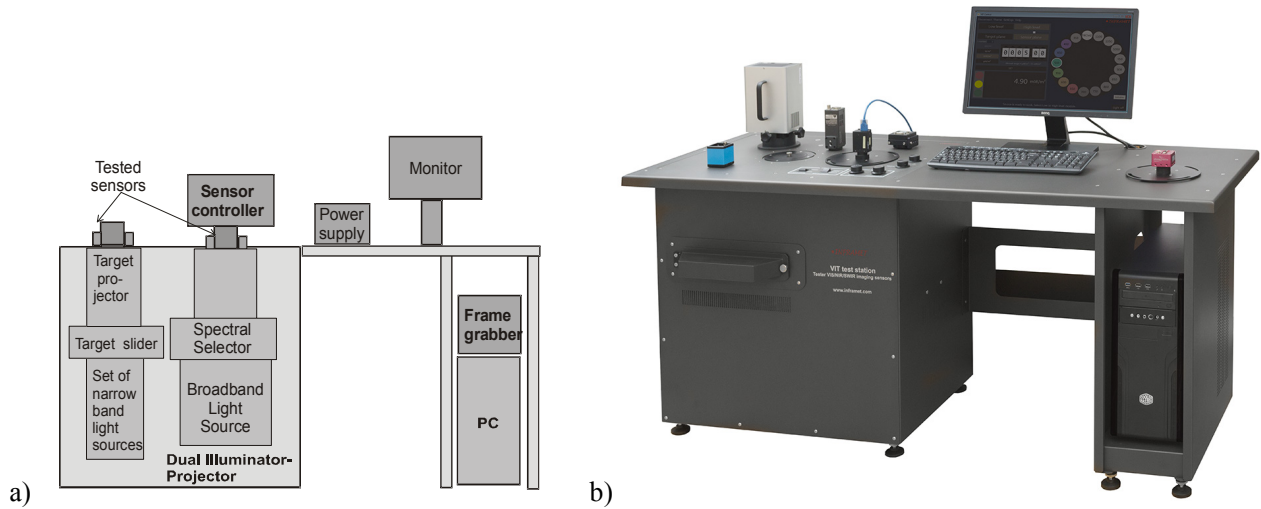


Fig. 1. VIT test station a) block diagram, b) photo

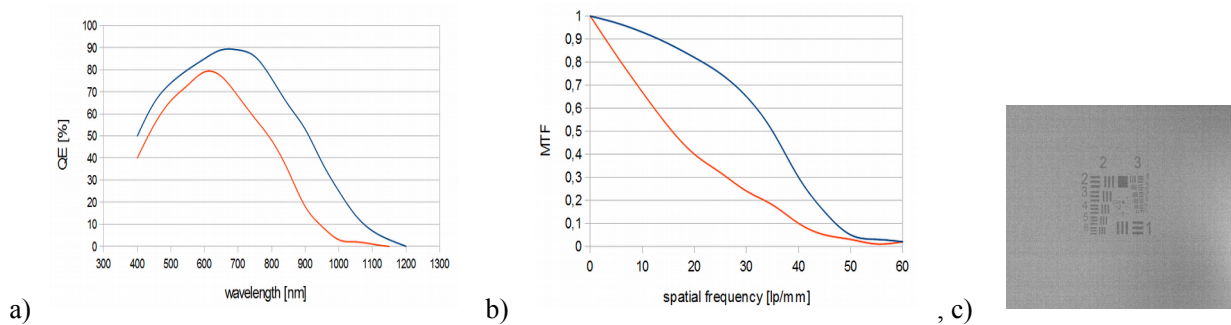


Fig. 2. Exemplary test results a) quantum efficiency versus wavelength, b) MTF graph of two sensors of different image quality, c) image of USAF 1951 target at moonless night conditions

BASIC INFORMATION:

Imaging electronic sensors sensitive in visible, near infrared, short wavelength infrared spectral bands that generate two dimensional electronic images have found mass applications in industry, defense, security, science, environmental protection, medicine etc.

Imaging sensors sensitive only in VIS/NIR range are almost exclusively silicon chips manufactured using a series of technologies: CCD, CMOS, ICCD, EMCCD, EBAPS, sCMOS in color or monochromatic versions. Color VIS/NIR sensors are sensitive to light only in visible range when monochromatic VIS/NIR sensors are sensitive up to about 1000nm.

InGaAs imaging sensors are sensitive mostly in SWIR range: non cooled in range from about 900nm to 1700nm; cooled sensors from about 1000nm to about 2200nm; and special broadband versions from about 600nm to about 1700nm.

Imaging sensors manufactured from black silicon of highly increased sensitivity in infrared band sensitive up to about 1300nm (or more) are a recent market novelty.

VIT is a station for expanded testing of silicon, black silicon and InGaAs imaging sensors. The station is built as system that offers five functions: a) calibrated light source or regulated light intensity and spectrum, b) high quality image projector, c) electronic controller of imaging sensors, d) frame grabber, e) software for image analysis. Combination of these functions enables measurement of all important parameters of silicon/black silicon/InGaAs imaging sensors.

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HOW IS BUILT:

VIT station is a modular system built from five main blocks: Dual Illuminator, sensor controller, set of frame grabbers, PC set, test software (SIP Control program, CON Control program, VITO test program). Dual Illuminator is the main block of VIT test station. DIP block is built as two quasi independent channels:

a) radiometric channel, b) imaging channel.

Radiometric channel is built as a calibrated broadband light source integrated with spectral selector that project to tested imaging sensor an uniform image of regulated light intensity and light spectrum. The spectral selector regulate spectrum of transmitting light using a set of narrow band optical filters. Regulation of light source enables simulation of both day and night conditions. Radiometric channel is used to measure radiometric parameters of tested imaging sensors.

Imaging channel is built as a spectral switchable LED light source integrated with set of targets and image macro-projector. This channel projects images of a set of standard targets (set of variable contrast USAF 1951 targets, edge target, FOV target, spot target) to surface of the tested sensor. User can regulate light intensity, spectral band, and type of target to be projected.

Tested imaging sensor integrated with CON controller is located at exit plane of radiometric or imaging channel. CON controller delivers necessary control/timing input signals to tested sensor. The sensor generates output digital signal that is delivered to frame grabber card. The latter module enables capturing by test software these electronic images. Finally the test software calculates parameters of tested sensor on basis of captured images.

TEST CAPABILITIES:

1. Radiometric parameters: relative spectral sensitivity, normalized detectivity D^{**} , Quantum Efficiency, sensitivity, dynamic range, linearity, Noise Equivalent Illuminance/Irradiance, Fixed Pattern Noise, Non Uniformity, Signal to Noise Ratio, dead pixels, 3D Noise,
2. Imaging parameters: Modulation Transfer Function, resolution, Minimal Resolvable Contrast, blooming, FOV.

SPECIFICATIONS

Modules	Dual Illuminator, CON sensor controller, frame grabber, PC set, test software (DIP Control program, CON control program, VITO test program)
Dual Illuminator-Projector	
<i>Radiometric channel</i>	
Light source type	Halogen bulb integrated with opto-mechanical attenuator
Spectral band	350nm to 1700 nm (option 2100 nm)
Color temperature	2856K±100K in spectral band 400-1300nm
Illumination range at sensor plane	1 μ lux to 10 000lx (10^{10} dynamic)
Regulation resolution	1 μ lux (at low intensity range)
Light regulation type	continuous (any value can be set within the regulation range)
Regulation stability	better than 2% of the set value
Number of switchable spectral bands	16 (user can select required wavelengths)
Band width	10 nm
Calibration of light source	in photometric units (cd/m^2) for broadband mode; in radiometric units (W/m^2) for narrow spectral bands mode. Ranges depends on selected wavelengths.
<i>Imaging channel</i>	
Light source type	Set of three monochromatic LEDs
Switchable wavelengths	590nm (VIS), 850nm (NIR), 1060nm (SWIR)
Illumination range at sensor plane	source calibrated in W/m^2 units but ranges roughly equivalent to 0.1lx to 1000lx for simulated 2856K color temperature source)
Targets	set of variable contrast USAF 1951 targets, edge target, FOV target, pinhole target
Spectral band of macro projector	400-1100nm
Resolution	at least 400 lp/mm at 590nm; 300 lp/mm at 850nm, and 200 lp/mm at 1060nm

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CON controller

Basic description

Version A: specialized controller (or controllers) developed by Inframet for specific silicon, black silicon or InGaAs sensors

Version B: universal reprogrammable controller that can be used to control a wide group of VIS-SWIR sensors

Set of frame grabbers

Number of frame grabbers

at least two frame grabbers

Types

Typical configuration: analog video and CameraLink

PC

Basic description

typical desktop PC

Test software

List of computer programs

DIP Control program, CON control program, VITO test program

Functions of DIP Control program

remote control of spectral selector (spectrum of illuminator), illuminance at exit of radiometric channel, light wavelength at image projector, illuminance at exit of imaging channel, type of target to be projected.

CON control program

CON controller delivers necessary control/timing input signals to tested imaging sensor

VITO test program

a) acquisition video image generated by tested imaging sensor,
b) measurement of parameters of tested sensor: relative spectral sensitivity, Quantum Efficiency, sensitivity, dynamic range, linearity, Noise Equivalent Illuminance/Irradiance, Fixed Pattern Noise, Non Uniformity, Signal to Noise Ratio, dead pixels, 3D Noise, Modulation Transfer Function, resolution, Minimal Resolvable Contrast, blooming, FOV.

Power

230/110 VAC 50/60 Hz

Operating temperature

10°C to 40°C

Dimensions

About 120x66x58 cm

Mass

About 89 kg

*specifications are subject to change without prior notice

VERSIONS:

VIT station can be delivered in two basic versions:

1. VIT-A
2. VIT-B.

VIT-A is a standard version of the station described in this data sheet. Customer is required to have his own controller of tested imaging sensors. The controller is expected to generate output electronic image in any of electronic standards: analog video, Camera Link, GigE, etc.

VIT-B is an expanded version that includes controller (or controllers) of tested sensor delivered by Inframet. In this case it is expected that customer is to deliver detail information or preferably sample sensors to enable Inframet to manufacture CON controller in proper version.

Version 2.1

CONTACT:

Tel: +48 604061817

Fax: +48 22 3987244

Email: info@inframet.com