TRAL

System for testing discrete optical detectors

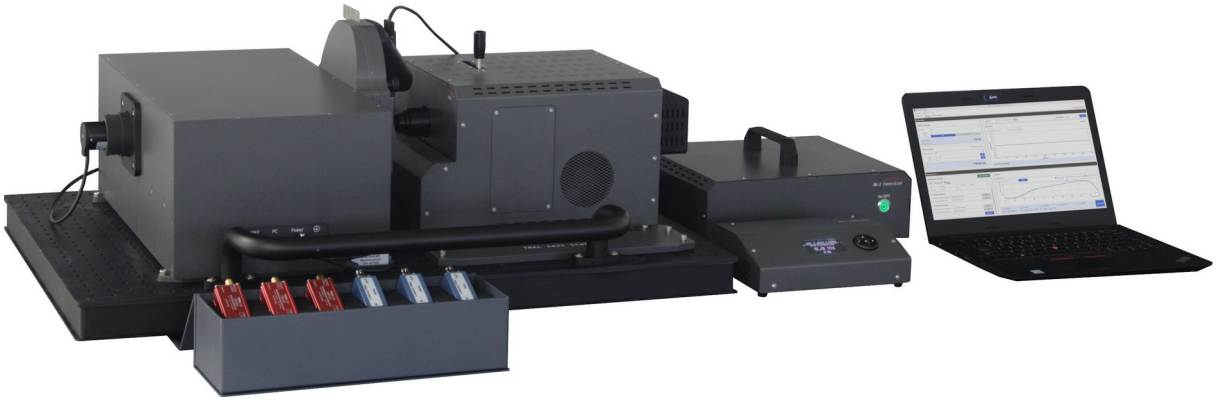


Fig. 1: TRAL test station

1. What is TRAL

TRAL test station is a quasi-universal test station designed to measure parameters of discrete (or small linear array) infrared detectors sensitive in a wide spectral range from 0.24 µm to 14 µm (UV/VIS/NIR/SWIR/MWIR/LWIR). All main types of infrared detectors can be tested:

A. Quantum / Photon Detectors
- photovoltaic detectors (PV)
- photoconductive detectors (PC)

B. Thermal Detectors
- pyroelectric detectors
- bolometers
- thermopiles

C. Operating Conditions
- cooled
- non-coooled detectors

The TRAL test system enables the measurement of critical detector parameters at variable wavelength, as detailed in the table below:

Table 1: TRAL test station measurements

Measurement	Detector type	Wavelength range
Dark current	All types	-
Responsivity	All types	UV/VIS/NIR/SWIR/MWIR/LWIR
NEP	All types	UV/VIS/NIR/SWIR/MWIR/LWIR
Normalized NEP	All types	UV/VIS/NIR/SWIR/MWIR/LWIR
Detectivity	All types	UV/VIS/NIR/SWIR/MWIR/LWIR
Quantum efficiency	Photovoltaic, Photoconductive	UV/VIS/NIR/SWIR/MWIR/LWIR

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2. How TRAL works?

TRAL station irradiates the tested detector using variable wavelength, variable intensity radiation. Analysis of electrical signal at output of tested IR detector enables determination of parameters of tested detector.

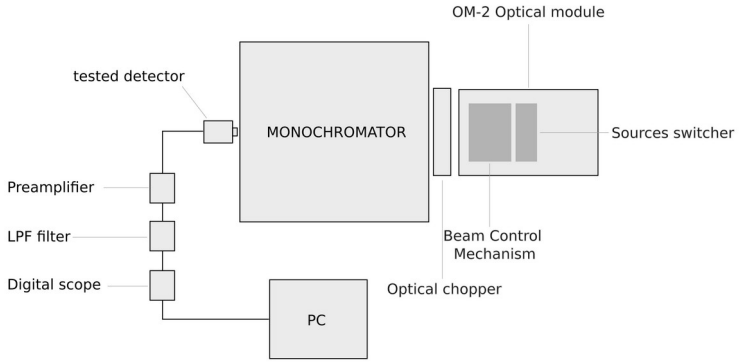


Fig. 2 TRAL test station block diagram

From a design perspective, the TRAL test system features a modular architecture built from a series of functional blocks:

1. OM-2 Optical Module with selectable source types (UV/VIS/IR – depents on choosed version), with fully controlled by software beam control module
2. Optical chopper for chopping incoming optical radiation
3. MON-Qx multi-grating monochromator
4. PRE-XX-Y – set of preamplifiers (different types depending on type of tested detectors)
5. LPF-X – set of low pass filters
6. DS1 Digital scope
7. Laptop
8. Test/Control software

3. TRAL features

TRAL is characterized by unique features:

1. Universal test station capable to test all main types of infrared detectors – all spectral bands: UV, VIS, NIR, SWIR, MWIR, LWIR.
2. Special multi-grating monochroamtor is used – no need to change monochroamator when changing spectral band.
3. Easily interchangeable light source via quick-switch lever – no optical realignment required.
4. PC controlled test station – all optical components are controlled by dedicated software, the user simply initiated the test, and the software handles the rest by controlling inidividual components.
5. User friendly software to support semi-automatic measurement of parameters of optical detectors.

4. Versions

TRAL test stations are modular test systems that can be delivered in form of different versions of different test capabilities and price. Two letter code shown in Table 2 is used to describe TRAL versions. The columns 1-3 present what letters are to be chosen to define precisely required version of TRAL test system.

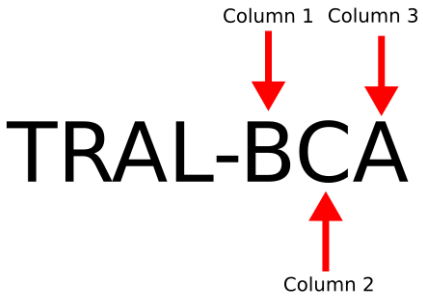
TRAL

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	1	2	3
Code	**Spectral range [µm]**	**Test capatibilites**	**Detector type**
A	2 – 6	Relative Responsivity [a.u.]	Photovoltaic
B	0.6 – 6	Absolute Responsivity [A/W / V/W]	Photovoltaic / Photoconductive
C	2 – 14	Everything included in configuration B and: • Detectivity D* • Normalized NEP • NEP • Dark current	Photovoltaic / Photoconductive / Thermal detectors (Pyroelectric, Bolometers, Thermopiles)
D	0.6 – 14	Everything included in configuration C and: • Quantum efficiency	
E	0.4 – 2.4		
F	0.24 – 2.4		
G	customized		

Example: TRAL-BCA test station means the TRAL test station of the following features:

1. Testing detectors sensitivity in spectral band 0.6 – 6µm
2. Ability to perform the following measurements:
   - Absolute Responsivity [A/W / V/W]
   - Detectivity D*
   - Normalized NEP
   - NEP
   - Dark current
3. Type of tested detectors: Photovoltaic



5. Why TRAL is special?

Testing discrete optical detectors at variable wavelenght selected by monochromators looks easy. The monochromators are spectral systems invented over 100 hundred years ago and offered by many manufacturers. It is easy to use monochromator as a system that transmit optical light at variable wavelngth used for relative measurements like measurement of transmission of optical windows. However, it is surprisingly difficult to built a system capable to measure accurately absolute values of radiometric parameters of optical detectors at variable wavelenght (especially at UV, MWIR and LWIR band). Accurate measurement of parameters of optical detectors is possible only after taking into account complex physical phenomenon that infleunce work of light sources, modulators, attenuators, monochromators, electronic amplifiers and mastering calculation of such parameters. Due to high requirements on know how there are only several manufacturers of systems for testing optical detectors. TRAL belong to a small elite group of test systems capable to do accurate testing of discrete optical detectors.

Version 3.2

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