

Nivis

Universal station for testing night vision devices



Fig. 1. Photo of Nivis test station

1 Basic information

Night vision devices present on the market can be divided due to design differences into six basic types: 1) monoculars, 2) goggles (mono and bino type), 3) sights, 4) clip-ons, 5) binoculars, 6) periscopes.

Nivis is an universal, computerized, table type station for expanded testing/boresight of all these types of NVD. In detail, it enables testing NVDs having aperture of the optics up to 150mm (virtually all NVDs offered on the market). All important parameters of NVDs recommended by MIL standards can be measured. Tested NVDs can be fixed using universal adapters (fast easy connection) or mechanical railway (typically Picatinny rail) for precision positioning. The station is computerized and offers following features: output image on external monitor, automatic calculation of dark spots, software support for resolution/MRC measurement, high accuracy of FOV and distortion measurement, ability to measure MTF, computer read out of light source settings, and digital recording of measurement results.

2 How it works?

The universality of Nivis (case of most expanded version) has been achieved by a concept of an image projector built using a set of three exchangeable refractive collimators of different focal length, a single large movable calibrated light source, and a set of external targets all based on a horizontal platform (optical table). The active collimator is exchanged depending on field of view of tested NVD. In addition, a set of mechanical adapters and railways is used to enable positioning of tested NVDs.

The station projects images of some standard targets into direction of tested night vision. The user can control light intensity and type of target to be projected using two knobs. The tested NVD generates copies of the projected standard images. Images generated by tested NVD are evaluated by human observer, test software or with help of some other measuring tools (luminance probe) and important parameters of night vision devices are determined.

3 Versions

Nivis is a modular station that in most extended version can enable expanded testing and boresight of all types of night vision devices: 1) monoculars, 2) goggles (mono and bino type), 3) sights, 4) clip-ons, 5) binoculars, 6) periscopes. However, there are few potential customers who need ability to test all types of NVDs. In addition, test capabilities (number of parameters to be measured) vary from customer to customer. Therefore Nivis is offered in a form of many versions optimized for testing different types of NVDs and measurement of different parameters.

Six letter code is used to describe test capabilities of needed Nivis version:

A. Sights

1. no testing,
2. basic testing - measurement of resolution (center), focus (infinity checking)
3. typical testing - measurement of resolution (center, peripheral, high light level), screen quality (dark spots), FOV, focus (infinity checking), brightness gain, distortion
4. typical testing/boresight - as in level 3 but additionally angle between line of sight and axis of the mechanical platform (typically Picatinny rail)

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Nivis

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5. expanded testing/boresight - as in level 4 but additionally minimum resolvable contrast (MRC),
6. ultra expanded testing/boresight - as in 5 but additionally diopter power

B. Clip ons

1. no testing,
2. basic testing/boresight - measurement of resolution (center), focus (infinity checking), and deflection angle (angular image shift when clip on is inserted)
3. typical testing - measurement of resolution (center, peripheral, high light level), screen quality (dark spots), FOV, focus (infinity checking), brightness gain, distortion, and deflection angle
4. typical testing/boresight - as in 3 but additionally angle between line of sight and axis of the mechanical platform (typically Picatinny rail)
5. expanded testing/boresight - as in 4 but additionally minimum resolvable contrast (MRC),

C. Monoculars, cyclope goggles

1. no testing,
2. basic testing - measurement of resolution (center), focus (infinity checking),
3. typical testing - measurement of resolution (center, peripheral, high light level), screen quality (dark spots), FOV, focus (infinity checking), brightness gain, distortion
4. expanded testing - as in 3 but additionally minimum resolvable contrast (MRC),
5. ultra expanded testing/boresight - as in 4 but additionally diopter power

D. Binocular goggles

1. no testing,
2. basic testing - measurement of resolution (center), focus (infinity checking),
3. typical testing - measurement of resolution (center, peripheral, high light level), screen quality (dark spots), FOV, focus (infinity checking), brightness gain, distortion, collimation error, gain disparity
4. expanded testing - as in 3 but additionally minimum resolvable contrast (MRC)
5. ultra expanded testing/boresight - as in 4 but additionally diopter power

E. Binoculars

1. no testing,
2. basic testing - measurement of resolution (center), focus (infinity checking),
3. typical testing - measurement of resolution (center, peripheral, high light level), screen quality (dark spots), FOV, focus (infinity checking), brightness gain, distortion, collimation error, gain disparity
4. expanded testing - as in 3 but additionally minimum resolvable contrast (MRC)
5. ultra expanded testing/boresight - as in 4 but additionally diopter power

F. Periscopes

1. no testing,
2. basic testing – measurement of resolution (center), focus (infinity checking),
3. typical testing – measurement of resolution (center, peripheral, high light level), screen quality (dark spots), FOV, focus (infinity checking), brightness gain, distortion, collimation error, gain disparity (attention: all parameters can be measured for periscopes with FOV and diameter of objective lens below of FOV and aperture of CNV collimators – see specifications table)
4. expanded testing – as in 3 but additionally minimum resolvable contrast MRC
5. ultra expanded testing/boresight - as in 4 but additionally diopter power

Example: code Nivis – A1B3C4-D1E1F1 mean Nivis system that offers typical testing of clip ons, expanded testing of monoculars, cyclope goggles. Sights, binocular goggles and periscopes cannot be tested.

After customer specify requirements on test capabilities of Nivis using the code presented above Inframet delivers detail technical offer.

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4 Specifications of basic blocks

Maximal optical diameter of tested NVD	150mm
Light Source	Dual switchable light source: 1) 2850K color temperature halogen source, 2) LED 660 nm monochromatic LED source
Illuminance range of light source	from at least 0.1 mlx to 200 lx
Regulation resolution	0.01mlx (at low intensity range)
Regulation type	continuous (any value can be set within the regulation range)
Regulation mechanism	manual
Regulation stability	better than 2% of the set value
Collimator codes	CNV12100 collimator, CNV950 collimator, CNV421 collimator Option LA: CNV15120 collimator, CNV1260 collimator, CNV421 collimator
Apertures/focal length/FOV of the collimators	1) CNV12100 collimator: 120/1000mm/10°, 2) CNV950 collimator: 90/500mm/20°, 3) CNV421 collimator: 35/210mm/44°, 4) CNV15120 collimator: 150/1200mm/8°, 5) CNV1260 collimator: 120/600mm/16°
Resolution of the collimators	1) >100 lp/mrad, 2) >60 lp/mrad, 3) > 30 lp/mrad, 4) >120lp/mrad, 5) >70lp/mrad
Targets	Set of standard targets: 100% contrast USAF 1951 resolution target, three FOV targets, distortion target, set of five dark spot targets, three cross (collimation) targets, set of five variable contrast MRC targets
Range of luminance probe	0.01-1000 cd/m ²
DPM66 meter	for measurement of diopter power of optical oculars; +6D to -6D
IM 50 camera	for measurement of deflection angle (Clip ons) and angle between line of sight and axis of the mechanical platform (Sights and Clip ons)
Output readout	internal digital screen
Power	230 VAC 50/60 Hz
Operating temperature	5°C to 40°C
Average life time of light source	>10000 hours

*specifications are subject to change without prior notice

5 Comparison to other commercial test stations

There are other commercially available test stations that can be used for testing night vision. Here we will present advantages of the Nivis station in comparison to other commercially available test systems.

1. Much wider test capabilities, especially in case of expanded versions. More parameters can be measured.
2. All types of NVDs can be tested,
3. Nivis systems is offered in form of many versions and can be optimized for customer real applications,
4. Computerized test station
5. Nivis station is built using dual switch-able light source (polychromatic 2850K color temperature or monochromatic light source) in situation when typical stations are built using only a monochromatic light source. Due to use of polychromatic 2850K color temperature calibration of NV14 is valid for any type of night vision device. Calibration of typical stations is valid only for one type of NVD of specified spectral sensitivity.
6. Night vision sights of big apertures up to 150mm can be tested (virtually all NVDs offered on market).
7. Unique possibility of measurement of MRC characteristic. Detection, recognition, identification ranges of most targets of interest can be calculated when MRC characteristic is known.

Version 2.3

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