

NV test stations

Testers of night vision devices



Fig. 1. NV test stations: a)NVT, b)NV14, c)NVS, d)NV20, e)NICOM

BASIC INFORMATION:

Night vision devices are one of crucial surveillance technologies for defense/security sector. NVDs have also found mass applications outside the defense sector. Testing NVDs is needed for both manufacturers, maintenance workshops and final users for a set of different and important reasons. Hi-tech test equipment can help significantly in manufacturing, maintenance, training, purchase optimization, and optimal use of night vision devices. Testing night vision devices and crucial modules (image intensifier tubes and optics) is regulated by a series of MIL standards. These standards propose measurement over 50 parameters of night vision devices, image intensifier tubes, and optical modules. Inframet has developed a series of high-tech stations to enable professional testing night vision devices.

The set of five test stations (NVT, NV14, NVS, N20, and NICOM) enable testing virtually all night vision devices present on the market. The first three test stations (NVT, NVS, and NV14) are optimized for acceptance/ maintenance tests.

The fourth station (NV20) is optimized to carry out simplified tests of night vision goggles before important missions.

The fifth station (NICOM) is an advanced computerized station optimized for R&D, manufacturing quality control, and acceptance tests.

Each test station can be delivered in several different versions of different design and different test capabilities. Therefore NV series test stations can be considered as an optimal solution for manufacturers, scientific institutes and users of night vision devices.

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How NV test stations work

All NV test stations work as image projectors that project images of some standard targets into direction of tested night vision device. The latter device distorts projected image that is later evaluated by human observer or with help of more objective measuring tools (luminance meter, optical bridge, TV camera connected to PC).

MIL standards generally recommend simple methods of measurements of parameters of night vision devices where only simple tools like human observer, luminance meter, or illuminance meter are used to carry out tests. More advanced computerized methods are not mentioned. NV series test stations are generally developed to carry out testing according MIL guidelines. However, the most advanced versions of NV series (NICOM) is fully computerized to enable more objective evaluation of night vision devices.

Light source

MIL standards recommend to use a calibrated tungsten filament lamp of 2856K color temperature as a radiation source. It is technically difficult to develop a reliable, 2856K color temperature tungsten filament light source that enables regulation of light intensity in wide range. Therefore typical test stations for testing night vision devices offered on market are built using a single LED light source that can be electronically regulated. Most of NV series stations (NVT, NVS, NV14, NICOM) are built using two light sources: a) halogen bulb of 2856K color temperature source and b) LED light source. Design that use halogen 2856K color temperature light source give NV test stations two important advantages.

First, calibration of NV test station working in halogen mode is valid for all night vision devices of different spectral sensitivity curves. Calibration of typical test stations built using only LED light source is valid only for one type of night vision devices (typically night vision device built using Gen 3 tubes and having optics of Class A airborne comparability). Therefore NV test stations enable accurate measurement of photometric parameters (example: brightness gain) of all night vision devices in situation when typical test stations enable accurate measurement of parameters for only one type of night vision devices (information about this limitation is presented using small letters in manuals of typical test stations).

Second, NV series can be potentially checked and re-calibrated by advanced photometric laboratory because the stations use classical photometric light source. Typical test stations built using an LED source of non-standard light spectrum cannot be checked and re-calibrated by photometric laboratories.

Test capabilities

NV series test stations are delivered in versions of slightly different design and different test capabilities. The lists of parameters that can be measured presented below refer to most advanced versions:

NVT, NVS, NV14:

- Main tests: focus, resolution, screen quality (dark spots), brightness gain, field of view, Minimal Resolvable Contrast, collimation error, gain disparity
- Maintenance level checks: Operational defects (shading, edge glow, flashing/flickering/intermittent operation, emission points); Cosmetic defects (Dark Spots, Bright Spots, Fixed-Pattern Noise, Chicken Wire, Image Disparity, Output Brightness Variation, Image Distortion)

NICOM: the same as NVT, NVS, NV14 and also MTF, SNR, ability to capture and record images in digital form

NV20: focus, resolution check at several illumination levels, operational defects checks, cosmetic defects checks

How to choose

NVS test station is potentially almost an universal test station that can be used for testing night vision devices of magnification from 1 to 10 (practically all types of NVDs). This universality was achieved by use of three exchangeable collimators and using concept of a modular, horizontal configuration test station placed on a table. However, manual exchange of collimators and test targets, time consuming process to align position of tested night vision device (NVD) on an optical stage are significant drawbacks of this station when testing different types of night vision devices, especially for tests of goggles/monoculars.

NVS station is strictly needed when testing night vision sights/binoculars with big optics (magnification higher than 4) is needed. In general NVS can be treated as a station optimized for testing night vision sights/binoculars.

However, if night vision goggles/monoculars are majority of tested NVDs then two other test stations are recommended: NVT, NV14.

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NVT test station is a test station optimized for high speed, user friendly testing of short range night vision devices (FOV about 40 deg, magnification equal to 1). The NVT station is built using a vertical configuration test concept. The tested NVD is simply put on a holder in test station and the tested device is immediately aligned. Next, this test station have a built in collimator of small aperture and no collimator exchange is needed. However, aperture of optics of tested NVDs should be generally smaller than collimator aperture. This feature limits generally testing capabilities of NVT station to testing night vision devices of apertures below 30mm (NVDs of magnifications equal to 1).

NV14 test station can be treated as a NVT station with bigger internal collimator (55 mm for NV14 and 30mm for NVT station) modified to achieve ability to test not only night vision goggles/monoculars but also testing night vision sights/binoculars. The station enables testing night vision sights/binoculars of apertures up to about 70 mm and magnification up to 3-4. When aperture of tested NVD is bigger then 55mm then a special algorithm to correct difference on measurement result of brightness gain is used.

If sights/binoculars of bigger aperture than 70mm or magnification higher than 4 are be tested then NVS test station is strictly needed. Next, NVT station is recommended when only night vision goggles/monoculars are to be tested due to more convenient mechanized target exchange used in NVT station instead of manual target exchange in NV14 station.

NV20 test station is a station optimized for testing night vision goggles before important missions. The station projects image of a resolution target in two separate channels that enable fast focusing and testing of binocular night vision goggles (typically aviator NVGs). The station enable to carry out focusing, resolution check at several illumination levels, operational defects checks, cosmetic defects checks.

System comparison:

	NVT	NVS	NV14	NV20	NICOM
Maximal aperture of tested NVD	30mm	120 mm (option 150 mm)	70 mm	30	70mm
Configuration	vertical	horizontal	vertical	horizontal	vertical
Design concept	compact, stand alone test station	modular test station with exchangeable collimators	compact, stand alone station	compact, stand test portable station	stand alone, test laboratory station
Test range	standard range	MIL standard MIL range	standard range	MIL basic, mission readiness tests	expanded test range, digital data/image recording

Recommendations:

1. Optimal solution for standard MIL tests range of all types of NVDs including long range night vision sights/binoculars (aperture from 70mm to 150mm, magnification over 4) → **set of two test stations: NVT and simplified version of NVS**
2. Cost effective solution for standard MIL tests range of all types of NVDs including long range night vision sights/binoculars: **expanded version of NVS**
3. Optimal solution for standard MIL tests range of night vision goggles/monoculars → **NVT**
4. Optimal solution for standard MIL tests range of all night vision goggles/monoculars and medium range night vision sights/binoculars (aperture below about 70mm, magnification lower or equal to 4) → **NV14**
5. Optimal solution for expanded computerized tests of all night vision goggles/monoculars and medium range night vision sights/binoculars → **NICOM**
6. Optimal solution for field tests of night vision goggles/monoculars → **NV20**

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Advantages of NV test stations:

- NV series stations enable testing all types of night vision devices of magnification from 1 to 10 (typical test stations enable testing NVDs of magnification 1),
- NV series test station offer much bigger test capabilities (more parameters can be measured) than typical test stations,
- NV series stations are designed using optical collimators of negligible distortion (collimators used in typical test stations generate significant, noticeable distortion of projected image),
- NICOM station is a first commercially available computerized test station on world market. The station is capable to carry out ultra expanded testing and to record test results in digital form.
- NVT, NVT, NV14, NICOM test stations (due to use of dual light source: halogen/LED source) enable accurate measurement of photometric parameters of all night vision devices of different spectral sensitivity curves in situation when typical test stations (based on only LED source) enable accurate measurement of these parameters only for a single type NVDs (typically devices built using Gen 3 II tube and optics of Class A airborne comparability),
- NVT, NVT, NV14, NICOM test stations can be re-calibrated by advanced photometric laboratories because due to use of classical photometric light source (halogen bulb of 2856K color temperature).

More information:

1. Read data sheets of NVT, NVS, NV14, NV20, and NICOM test station.
2. Visit educational section of Inframet website.

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