

TVT

Systems for testing surveillance TV cameras

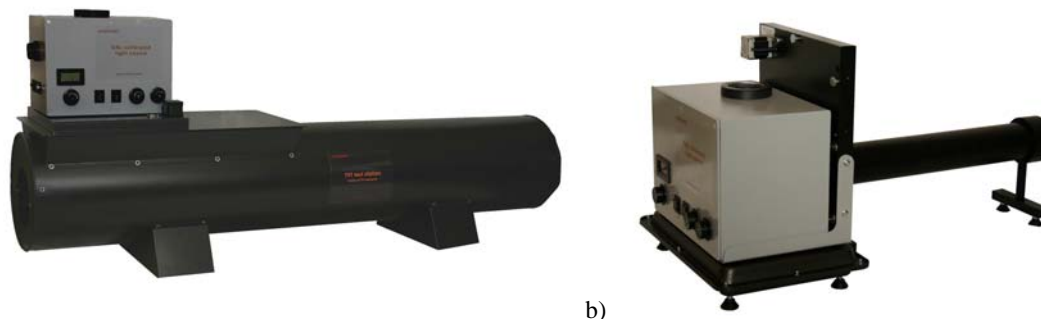


Fig. 1. TVT test system a) configuration with CDT 1500 collimator, b) configuration with CVT-L collimator set

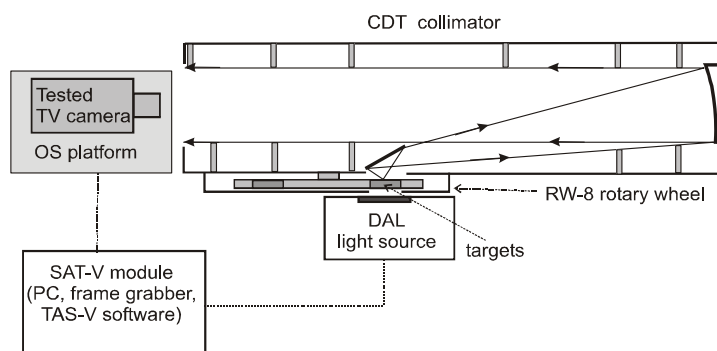


Fig.2. Block diagram of the TVT test system

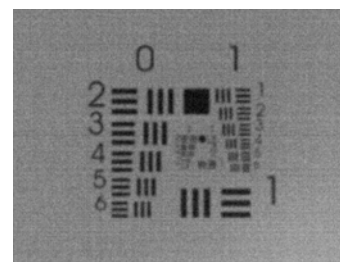


Fig.3. USAF 1951 target image (projected by the TVT and generated by the tested ICCD camera during MRC measurement)

BASIC INFORMATION:

The TVT measuring set is a variable intensity image projector that projects images of some standard targets to the tested TV camera (CCD/CMOS/ICCD/EBAPS cameras). The tested TV camera generates distorted copies of the projected images. Quality of the images generated by the camera is evaluated and its important characteristics are measured.

The TVT test systems are built from the following blocks: DAL calibrated multispectral light source, CDT reflective collimator, set of exchangeable refractive collimators, MRW-8 rotary wheel, set of targets, OM -50 macro projector, FOC platform, PC, frame grabber (2x), TAS-V software.

The TVT test systems are recommended for testing professional TV cameras used for medium/long distance surveillance applications. The TVT test systems enable testing TV cameras working at any illumination conditions (day level/night level).

Testing surveillance TV cameras with TVT test system can generate a series of parameters that give vital information about potential camera surveillance capabilities for camera users. In case of TV camera designers tests using TVT system can deliver valuable information about methods to improve camera design.

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FEATURES:

- Universal modular test system that enable extended tests of all commercially available surveillance TV cameras
- Measurement capabilities: Resolution, Minimal Resolvable Contrast, MTF, Distortion, FOV, Sensitivity, SNR, Noise Equivalent Input, Fixed Pattern Noise, Non Uniformity, 1/f noise, 3D Noise, Number of bad pixels and bad pixel localisation, Resposivity function (Responsivity, Linearity, Dynamic, Light Range), Color fidelity. *Typical test systems offer typically measurement of one or two parameters.*
- Ability to simulate both day conditions and night conditions due to extremely wide range of illumination regulation. *There is on the market no test system that could simulate illumination condition in so wide range.*
- Unique light source (dual polychromatic/monochromatic mode, extremely wide rage of illumination, continuous regulation). *Typical light sources has much lower dynamic (cannot simulate fully real work conditions), offer step regulation, only single mode: polychromatic or monochromatic, quite often real light output is not measured but estimated.*
- A set of exchangeable refractive/reflective collimators (enable regulation of angular size of the simulated scenery depending FOV of the tested imager). *Typical test systems are equipped with only one collimator and there is no possibility to optimise collimator field of view depending on TV camera field of view.*
- Advanced software for image capturing and analysis that enable measurement of all important parameters of all types of surveillance TV cameras. *Typical test systems cannot be used for testing modern TV cameras generating video image using modern digital formats like Camera Link or LVDS. Additionally typical test systems do not offer integrated software for capture and image analysis.*
- TVT systems offer for testing a set of at least five USAF 1951 targets of different contrast. *Typical test stations offer usually only one USAF 1951 target of fixed 100% contrast.*
- A set of different versions of TVT station of different test capabilities and different price is offered. It is possible to optimize TVT depending on local requirements.

Specifications

Parameter	Value
Work modes	1)polychromatic halogen bulb 2850 K color temperature source 2)polychromatic warm white LED 3)monochromatic LED 590 nm light source
Illuminance range	0.02 cd/m ² - 7000 cd/m ² - version D (day level) 0.01 mcd/m ² - 1 cd/m ² – version N (night level) 0.01 mcd/m ² - 1000 cd/m ² - version DN (day/night level)
Regulation resolution	0.01 cd/m ² (at low intensity range) – D version 0.01 mcd/m ² (at low intensity range) – N or DN versions
Regulation type	continuous (any value can be set within the regulation range)
Regulation mechanism	manual (option: motorized)
Regulation stability	better than 1% of the set value
Active aperture diameter	40 mm
Type of light level indication	digital display
Targets	Set of five variable contrast USF 1951 targets, edge target, distortion target, gray scale target
Collimators	Set of three refractive collimators (max aperture 80mm) and a single reflective collimators (typical aperture 150mm; 200m; optional 300 mm)
PC Control	RS 232/USB 2.0 (all functions of DAL light source and MRW-8 rotary wheel)
Accepted electronic image formats	PAL, NTSC, Fire Wire and optional: Camera Link, LVDS, GigE

*specifications are subject to change without prior notice

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SYSTEM VERSIONS:

TVT test systems are basically modular test systems. The TVT series systems can be delivered in form of different versions of different configurations and of different test capabilities.

The version is determined on basis of eight different criterions:

1. Simulated light conditions,
2. System configuration,
3. Test capabilities,
4. Maximal optical aperture of tested TV camera,
5. Acceptable electronic image formats of tested TV camera,
6. Boresighting capabilities
7. Simulated distance
8. Optional software for evaluation support of test results

Therefore combinations of eight digits (TVT abcd-efgh) is used to compose precise codes that describe different available versions of TVT test system. Definitions of the codes are shown in Tab. 1. As we see in this table by changing digits from 1 to 4 we increase test capabilities of TVT test system but also increase the cost is increased.

TVT 1123-1111 test station means the TVT test station optimized for testing day level TV cameras; cameras of narrow FOV; typical measurement range; max aperture of tested TV camera not more than 200 mm; PAL or NTSC), FireWire, USB 2.0 formats are accepted; no boresighting capabilities; non-regulated simulated distance, no optional software.

0.02 cd/m² - 7000 cd/m² - version D (day level)

0.01 mcd/m² - 1 cd/m² - version N (night level)

0.01 mcd/m² - 1000 cd/m² - version DN (day/night level)

Tab. 1. Definitions of the codes used to describe versions of TVT test system (format TVT abcd-efgh)

	a	b	C	d	e	f	g	h
C	od	e						
	Simulated light conditions	Optimal system configuration	Test capabilities	Max aperture of TV camera	Image formats of TV camera	Boresighting	Simulated distance	Optional software
1	Day/Bright night	TV cameras of wide/medium FOV	Basic: resolution	80 mm	Analog video (PAL or NTSC), FireWire, USB 2.0	Only reference optical point ²	Only infinity	No
2	Night	TV cameras of narrow FOV	Typical: resolution, distortion, FOV, sensitivity, SNR, NEL, FPN, non uniformity, 1/f, responsivity function	150mm	Additionally CameraLink or GigE, or LVDS ¹	Boresighting to reference optical axis ³	Regulated from 200m to infinity	Movis ⁵ computer program
3	Day/Night Range	TV cameras of narrow/wide FOV	As for level 2 but additionally MRC measurement	200 mm		Boresighting to reference mechanical axis ⁴		
4		a)TV cameras of narrow/wide	Ultra expanded: as in level 3 but additionally 3D Noise model, PVF,	300 mm				

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		FOV b)TV camera modules	NPSD					
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Detail interpretation of the codes is presented below:

a) Simulated light conditions

Different versions of DAL light source are used to simulate different light condition.

b) Optimal system configuration:

1. TV cameras of wide/medium FOV

The TVT station is optimized for testing TV cameras of field of view over 10°. The test station is equipped with a set of small refractive collimators (no reflective collimators).

2. TV cameras of narrow FOV

The TVT station is optimized for testing TV cameras of narrow FOV below about 10°. The test station is equipped only with one reflective off axis collimator (CDT 1500/CDT 2000/CDT 3000).

3. The TVT station is optimized for testing TV cameras of any FOV. The test station is equipped only one reflective off axis collimator (CDT 1500/CDT 2000/CDT 3000) and a set of three refractive collimators.

4. The TVT station is optimized for testing TV cameras of any field of view and for testing TV camera modules (TV camera without optics). In the latter case it is possible to check performance in case of quasi-perfect optics. The station is additionally equipped with a macro-projector to enable imaging tests of TV modules.

c) Test capabilities

List of test capabilities is presented in Tab.1. The difference between level 3 and level 2 is that in case of level 3 optional set of variable contrast USAF 1951 targets is added. In case of level 4 expanded version of TAS-V software and a pinhole target are added.

d) Max aperture of tested TV camera

At level 1 – only set of refractive collimators of apertures below 80mm; at level 2- CDT 1500 reflective collimator of aperture 150mm; at level 3- CDT 2000 collimator of aperture 200mm; at level 4 – CDT 3000 collimator of aperture 300mm

e) Image formats of TV camera

Level 1- test station is equipped with a frame grabber capable to accept electronic signals in the following formats: PAL or NTSC), FireWire, USB 2.0.

Level 2- for this version two frame grabbers are delivered: typical analog/digital capable to accept Analog video (PAL or NTSC), FireWire, USB 2.0 and additional digital frame grabber capable to accepts one of the following formats: CameraLink or GigE, or LVDS

f) Boresighting

Level 1- the alignment target creates a reference point in the image generated by TV camera but no other means for boresighting to a reference optical axis or mechanical axis are provided

Level 2- – additional software that enable easy boresighting of optical axis of the tested TV camera with an optical axis of a thermal imager

Level 3- additional software and additional hardware modules that enable easy and accurate boresighting of optical axis of the tested TV camera with a reference mechanical axis

g) Simulated distance

Level 1- the targets are located at focus plane of the reflective collimator. The position is not regulated. The collimator simulate targets at so called optical infinity.

Level 2 – position of the wheel with targets can be regulated. Additional platform to move the rotary wheel. PC control. The collimator simulate targets at regulated distance.

h) Optional software

Level 1- no optional software

Level 2- additional MOVIS software that enables easy calculation of detection, recognition and identification ranges of several targets with tested TV camera

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