ITIP

Universal station for testing image intensifier tubes

Fig. 1. ITIP test station

BASIC INFORMATION:

ITIP is a modular quasi universal station for expanded testing of image intensifier tubes. This station enables measurement of a long series imaging parameters, photometric parameters, electrical and temporal parameters of image intensifier tubes recommended in US MIL military standards. The station is generally designed for testing potted tubes (encapsulated II tubes powered from low voltage supply) but can be optionally delivered in versions capable to test bare tubes (modules before encapsulation powered from high voltage power supplies). Therefore ITIP stations can be used by manufacturers, test laboratories, repairing workshops at different stages of life of II tubes. The test procedures used by the ITIP station are based on recommendations of the US MIL series military standards.

From design point of view ITIP station is built from three main blocks: image projector, set of measuring tools, and computer system. The projector projects images of some standard targets to tube photocathode plane of precisely controlled light flux. The measuring tools enables capturing images of output images from tested II tubes and measurement of output light intensity at the tube screen. The computer system carries out processing of data from image projector block and the measuring tools and finally calculates parameters of tested II tubes.

TEST CAPABILITIES:

1. Image quality parameter: Resolution (center, peripheral, high level), Modulation Transfer Function (MTF), Signal To Noise Ratio (S/N), Halo, Useful cathode diameter, Dark and bright spots, Output Brightness Uniformity, Alignment, Distortion, Multi-Multi Pattern Noise, Multi-Boundary Pattern Noise, Image Inversion, Magnification.
2. Photometric parameters: luminance gain, saturation level (maximal output brightness), EBI (optionally also photocathode luminous sensitivity and radiometric sensitivity).
3. Electrical parameters: current consumption, power consumption
4. Temporal parameters: rise time, decay time and phosphor decay time.

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FEATURES:

- Computerized test station. Semi-automatic easy measurement of the above mentioned parameters.
- Testing II, III and IV generation tubes
- High resolution and stability of illuminance regulation
- Both 18mm, 25mm and 16mm tubes can be tested.
- ITIP station can be offered in different versions offering different measurement capabilities

SPECIFICATIONS

Main modules	1) Base blocks, 2) Set of measuring tools 3)System for data processing Ad1) BM-IP base module, OS-1 stage, set of 3 adapters, set of cables for potted tubes, Ad 2) VMI video microscope, DCI digital camera, MI microscope, LP1 luminance probe, LP2 luminance probe, CP current probe Ad 3)PC, frame grabber, TAS-IP program, ITS Display program, MC Viewer program
1. BM I base module	The module projects on photocathode of II tube image of seven patterns at regulated illumination level.
1.1 Light source	
Light Source	Dual: 1)polychromatic 2850K color temperature halogen source 2)monochromatic 595nm LED light source
Spectral band of halogen light source	400-1000nm
Illuminance range	1 10^{-7} lx to 20 lx (option 200lx)
Regulation resolution	0.05 µlux (at low intensity range)
Light regulation type	continuous
Regulation stability	better than 2% of the set value
Illuminance uncertainty	better than 5% of the set value
1.2 Projector of test patterns	
Type of macro projector	Custom designed refractive objective
Resolution of target projector	≥400 [1p/mm]
Target change mechanism	manual
Number of test patterns	7
Target	single multi-pattern target having the following patterns: USAF1951 pattern, edge/slit pattern, pinhole pattern, tube diameter pattern, gross/shear distortion pattern, uniform pattern
Maximal acceptable diameter of photocathode of tested II tube	25 mm
Spatial frequencies of resolution targets	16, 17.95, 20.16, 22.62, 25.39, 28.5, 32, 36.0, 40.3, 45.3, 47.9, 50.8, 53.8, 57, 60.4, 64,0, 67,8, 71,8, 76,1, 80,6 lp/mm
Tube holders	optimized for the following tubes: MX-10160, MX-10130, MX-11620, MX-9444 (other types are also possible – photocathode diameters up to 25mm)
LV power source	DC 2.7 V
Type of tube holders	exchangeable holders for 18 mm and 25 mm tubes
2. Set of measuring tools	Tools: VMI video microscope, DCI digital camera, MI microscope, LP1 luminance probe, ultra sensitive LP2 luminance probe, CP current probe
2.1. VM-I video microscope	For analysis of small parts of screen of II tubes. It enables measurement of the following parameters: resolution, MTF, SNR, halo, distortion, image non alignment
VM-I video microscope type	high resolution, high sensitivity CCD camera integrated with custom macro objective, custom image processing electronics
Image resolution	768 x 576
Field of view	1,97 x 1,49 mm
Max magnification	200x

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2.2 DC-I digital camera	For analysis of images from entire area of screen of II tubes. It enables measurement blemishes, photocathode diameter, distortion, non uniformity
Type of DC-I camera	High resolution digital camera with custom designed objectives
Image resolution	2554x1944 [5 MPx]
Depth of focus	Over 3.9 mm (optimized for testing tubes with curved screens)
Field of view	Dual FOV (optimized for 18mm and 25 mm II tubes)
FOV at 18 mm mode	>24,9 x 19 mm
FOV at 25 mm mode	>34,2 x 26 mm
PC communication	Yes. USB 2.0
2.3. Monocular microscope	To be used for resolution measurement, image quality evaluation, and photocathode diameter measurement
M-I microscope type	custom designed high-res mono microscope
M-I microscope magnification	50x
Measurement resolution range	Up to 161 lp/mm
2.4 LP1 luminance probe	
Spectral range	similar to human eye
Measurement range	0.05 cd/m^2 – 5000 cd/m^2
Resolution	<0.01 cd/m^2
Measurement uncertainty	<5%
2.5 LP2 luminance probe	
Type	intensified silicon photodiode
Measurement range (linear range)	10 µcd/m^2 – 10 mcd/m^2
Resolution	10 µcd/m^2
2.6 CP current probe	
Current measurement range	10 pA - 100µA
Current resolution	5 pA
Other parameters	
Power	AC230/110 V 50/60 Hz (DC12V option)
Operating temperature	5°C to 40°C
Storage temperature	-5°C to 60°C
Humidity	Up to 98% (non condensing)
Mass	<85 kg (including PC set)
Dimensions	Overall dimensions: 1300x600x730mm

*specifications are subject to change without prior notice

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VERSIONS OF ITIP TEST STATION

ITIP test station can be delivered in different versions optimized for different customers. Both measurement capability and price depends significantly on version number.

Version	List of measured parameters	Blocks of test station
ITIP /A Basic imaging tests	Resolution, SNR	BM-IP/A base module, MI microscope, VMI video microscope, OS1 stage, set of 3 holders for potted tubes, PC, frame grabber, TAS-IP/A computer program, ITS Display computer program, LP1 luminance probe
ITIP /B Expanded imaging tests	Resolution (center, peripheral, high level), MTF, SNR, blemishes (dark and bright spots), photocathode cathode diameter, gross distortion, output brightness non uniformity, power consumption, current consumption	BM-IP/B base module, MI microscope, VMI video microscope, DCI camera, OS1 stage, set of 3 holders for potted tubes, PC, frame grabber, TAS-IP/B computer program, ITS Display computer program, MC Viewer program
ITIP /C Basic imaging/ photometric tests	Resolution (center, peripheral, high level), MTF, SNR, Halo, power consumption, luminance gain, maximal output brightness,	BM-IP/C base module, MI microscope, VMI video microscope, OS1 stage, set of 3 holders for potted tubes, PC, frame grabber, TAS-IP/C computer program, ITS Display computer program, MC Viewer program, LP1 luminance probe
ITIP /D Expanded imaging/ photometric tests	Resolution (center, peripheral, high level), MTF, Blemishes (dark spots/fixed pattern noise), SNR, Output Brightness Uniformity, Halo, Useful cathode diameter, Image Alignment, Shear Distortion, Gross Distortion, Image inversion, Magnification, power consumption, luminance gain, maximal output brightness, EBI	BM-IP/D base module, MI microscope, VMI video microscope, DCI camera, OS1 stage, set of 3 holders for potted tubes, PC, frame grabber, TAS-IP/D computer program, ITS Display computer program, MC Viewer program, LP1 luminance probe, LP2 luminance probe
ITIP/E Ultra expanded imaging/ photometric tests	As in D but additionally luminous sensitivity and radiometric sensitivity (recommended for tube manufacturers or repairing workshops	BM-IP/D base module converted to BM-IP/E version, additional CP current probe, HVP high voltage power supply, set of three bare tube holders

Attention:

1. Additional versions can be delivered optimized for customer requirements.
2. Old test stations listed before 2018 year as ITS-I, ITS-P and ITS-IP can be delivered on special demand.
3. Typical test stations are optimized for testing potted image intensifier tubes. Customer should inform Inframet if bare tubes are to be tested and additional high voltage power supply is needed.

Comparison of ITIP and other test stations

ITIP test station represents a new generation of test stations for testing image quality of II tubes. It was developed by Inframet in 2017 year as the first commercially available single test station that enabled measurement of all image quality, photometric, electrical and temporal parameters of II tubes recommended by MIL standards. A few commercially available test stations were needed to do the same task. Several test stations offered by competitors are needed to do the same task.

ITIP design is based on experience that Inframet got working as trusted supplier of test equipment for top work manufacturers of image intensifiers and night vision devices since 2004 year. It should be noted that a significant portion of these manufacturers use Inframet test stations (different versions of ITS stations offered before manufacturing of ITIP in 2017 year).

Version 6.2

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