IPAS

Station for testing power supplies of II tubes

1 Introduction

Commercially available, ready to use, potted image intensifier tubes are built by combining two modules: bare image intensifier tube and a miniaturized electronic circuit called HV power supply. The latter module controls voltages at different electrodes of bare tube: photocathode, input of MCP, output of MCP, screen) that vary depending on input light conditions. The main aim of this miniaturized HV power supply module is to control tube gain and photocathode gating in order to achieve desired output screen luminance at minimal stabilization time. The second aim to deliver protection of the photocathode against strong light flashes. Poor quality power supplies can generate unwanted effects like flickering, long stabilization time, poor protection against strong light flashes even when cooperating with perfect bare tubes.

It should be also noted that bare tubes generate best image only when the tube is powered at optimal set of voltages between different electrodes (photocathode, MCP input, MCP output, screen). This optimal set of voltages varies from tube to tube. Therefore powering bare tubes using set of voltages optimal for such tube is important, too.

In such a situation proper testing of the miniaturized power supplies at real work condition when connected to a powered bare tube is critical in both manufacturing new potted tubes and in repairing old potted tubes.

Typical voltage meters/oscilloscopes connected to outputs of such HV power supplies change these output voltages due to too low input resistance of such voltage meters. Further on, the input resistance of these typical meters depends on value of measured voltage. Therefore errors of measurement of voltages at outputs of these power supplies using typical voltage meters are typically very big (much over 100%). To summarize, measurement of high voltages generated by miniaturized HV power supplies is a technical challenge especially in case of power supplies used for gated tubes due to fast temporal changes.

2 What is IPAS?

IPAS is a test station that enables testing miniaturized HV power supplies used to built modern potted image intensifier tubes. The station can be used for testing these power supplies in two modes:

1. power supply connected to a set of reference resistors that simulates real bare image intensifier tube,
2. power supply connected to a real bare image intensifier tube illuminated.

3 How IPAS works?

IPAS is a four purpose system:

1. Meter of high voltages of at outputs of tested power supply for bare image intensifier tubes,
2. Low voltage power supply/current meter for tested miniaturized HV power supply,

3. Regulated illuminator of photocathode of image intensifier tube,
4. Meter of intensity of light at screen of the image intensifier tube.

4 How IPAS is built?

IPAS station is built from the six main modules:

1. MONI high voltage computerized multichannel monitor,
2. P2.7MET computerized power supply/current meter,
3. ILUM computerized illuminator,
4. set of light probes (LP1 luminance probe, TP4 temporal probe)
5. control/test software (Light Control program, MONI Control computer program),
6. support accessories (set of adapters for potted tubes, adapter for bare tubes).

MONI is the most important block. It is a four channel (option eight channel) high voltage digitizer capable to enable fast measurement of voltages at outputs of tested power supply with negligible influence on the tested electrical circuit system. P2.7MET is a low voltage power supply and current meters of tested II power supply. ILUM is a block that delivers regulated illumination of photcathode of the II tube connected to tested II power supply. Set of light probes are two light probes that are used to measure light intensity at screen of the II tube. The MET control/test software are computer programs used to: 1)measure voltages at HV outputs of tested II power supply, 2)measure current consumption of tested II power supply, 3) control photocathode illuminance, 4)measure output luminance at screen of the II tube. Support accessories are accessories used to power IPAS station, support mounting potted/bare tubes, and cables to connect II tube.

5 Test capabilities

IPAS test station can be used in three main configurations (X, Y, Z) of different test capabilities:

IPAS-X is expected to be used only for measurement of electrical properties of tested HV power supply: measurement of input current and output voltages. The measurements can be done when tested power supply is connected to a set of reference resistors that simulates real bare image intensifier tube or is connected to real image intensifier tube. In the latter case the customer is expected to illuminate tested tube. IPAS-X station is delivered in simplified form of a set of three blocks: MONI high voltage multichannel monitor and P2.7MET power supply/current meter, MONI Control computer program.

IPAS-Y is expected to be used for recording of reactions of both HV power supply and bare image intensifier tube to light stimulus (static or dynamic) applied to phtocathode of the bare tube. Practically it means simultaneous measurement of: 1)intensity of light stimulus at the photocathode, 2)high voltages at outputs of the tested HV power supply, 3)current consumed by the tested HV power supply, 4)output light stimulus at screen of the bare tube.

Photocathode of the tube can be illuminated at regulated light intensity using light source of rough calibration. Temporal profiles that simulate flare burst at night conditions can be generated to evaluate performance of tested power supply at variable illumination conditions.

IPAS-Y station is delivered in form of a set of blocks: MONI high voltage multichannel monitor, P2.7MET power supply/current meter, ILUM-Y illuminator, TP4 temporal probe, control/test software (Light Control program, MONI Control computer program), and support accessories (set of adapters for potted tubes, set of adapters for bare tubes).

IPAS-Z offers the same capabilities as IPAS-Y. However, due to use of high accuracy illuminator and additional calibrated luminance probe it enables also measurement of photometric parameters of tested bare tube connected to power supply: luminance gain and maximum output brightness.

From design point of view IPAS-Z differs from IPAS-Y due to these changes: LS-MONI-Z light source is delivered instead of LS-MONI-Y light source, and additional LP1 probe is delivered.

6 Specifications

MONI monitor	
Number of HV measurement channels	4
Channel 1 high voltage range	±300V (option up to ±1000V)
Channel 2 high voltage range	±3000V
Channel 3 high voltage range	±3000V
Channel 4 high voltage range	±8000V
Minimal pulse interval	0.001ms (option 0.0005ms)
Max gating frequency	100 kHz
Voltage measurement accuracy	≤ 2%
PC interface	USB
P2.7MET	

LV Power supply voltage	2,65 – 2,75V
Current meter range	Up to 120mA
Measurement uncertainty	<1mA (option: 0.02mA)
ILUM illuminator	
Light Source	ILUM-Y: monochromatic LED light source ILUM-Z: dual: 1)polychromatic 2850K color temperature halogen source 2)monochromatic LED light source
Illumination level	Regulated from at least 0.1 mlx to at least 200 lx ILUM-X – low accuracy calibration (up to 25%) ILUM-Z – high accuracy calibration (about 1%)
Regulation type	Digital from PC
LP1 luminance probe	
Measurement range	0.02 cd/m² – 500 cd/m²
Measurement speed	up to 1 per second
TP4 luminance probe	
Measurement range	0.1 cd/m² – 500 cd/m²
Measurement speed	Up to 10 per second

7 Versions

IPAS is offered in three versions: IPA-X, IPAS-Y and IPAS-Z. Test capabilities as presented in Section 5.

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