

MCP IMAGE INTENSIFIERS



FEATURES

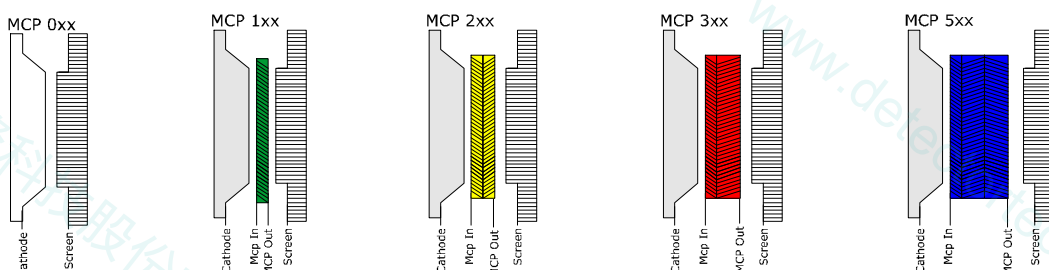
- Custom design
- Proximity focused - No distortion Unaffected by magnetic fields
- 12, 25, 40, 75 and 150 mm
- High gain options
- Compact size
- X-ray, VUV, solar blind, visible and IR
- Fast gating

APPLICATIONS INCLUDE

- Spectroscopy
- Low light level imaging
- Astronomy
- Photon counting
- Multi-channel spectrophotometry
- High speed imaging
- Biofluorescence
- Bioluminescence

INTRODUCTION

Photek manufactures a range of 12, 25, 40, 75 and 150 mm active diameter image intensifiers. The metal ceramic body is rugged and the proximity focus design gives a distortion free image in a very short overall length. A range of photocathodes and input window materials enables a wide choice of spectral responses to suit many applications. The fibre optic output ensures a defined output focal plane and allows efficient coupling to CCDs and linear image sensors. A variety of MCP configurations satisfies all gain requirements.



Spectral Response and Phosphor Screen

Photek are able to offer a wide range of Photocathodes including Solar Blind, Bialkali, LNS20 and S20. Phosphors include P11, P20, P24, P31, P43 P46 and P47.

Please refer to the separate Photocathode and Phosphor screen data sheets for further details.

Input Windows

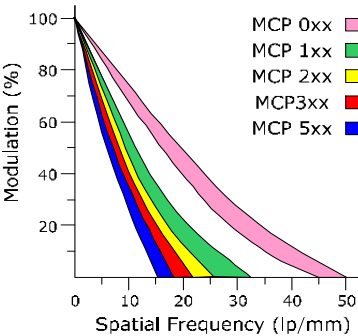
All Photek intensifiers are available with a choice of input window materials. These include Glass, Fibre Optic, Fused Silica and MgF₂.

Resolution

The resolution of an image intensifier is reduced as the number of MCPs is increased. The modulation transfer function (MTF) measures the relative output contrast as a function of spatial frequency when a suitable bar pattern is imaged by the tube under test.

Diode image converters without an MCP have almost no gain, but can achieve high MTF and a limiting resolution of 50 lp/mm. They are useful as optical shutters and wavelength converters.

75 and 150 mm tubes are usually built using MCPs with a pore size of 25 microns, which limits



resolution to about 15 lp/mm. Our 12 mm tubes are built using 6 micron pore MCPs, which enables limiting resolution of 50 lp/mm, but 25 and 40 mm tubes are usually built with 10 micron pore MCPs giving resolution of 25-36 lp/mm.

The superior pulse height distribution is used to discriminate between photon events and electronic noise, and the resolution performance can

be recovered by suitable event-processing software. Photon counting systems can in fact achieve resolution only limited by the size of the microchannel plate pores (usually 10 microns).

Uniformity & Blemishes

The standard overall uniformity of Photek intensifiers is:

Tube Size	Black Spots		Uniformity % Standard De- viation/Mean
	75-100 μ	101-150 μ	
MCP125	<3	<2	7%
MCP225	3	2	10%
MCP140	4	2	10%
MCP240	6	2	12%
MCP175	10	5	15%

The non-uniformity is mainly caused by gain variation in the MCP and so often removed by digitisation in photon counting applications, blemishes usually occur in the fibre optic and tubes with glass input and output are very clean.

Photographic Applications

In photographic applications it is common to set the tube up in contact with a film and switch all voltages, except the photocathode, to normal running conditions. It is important that no light is produced by the tube until the photocathode is switched on to make the photographic exposure. Our film grade tubes are tested for exposures of up to 10 min in contact with ASA 3000 film.

Space Qualified and Other Special Image Intensifiers

Photek is involved with several space projects, and has experience in both the mechanical and quality assurance aspects of these programmes. We have developed special ruggedised structures, housings and space encapsulation techniques for these projects.

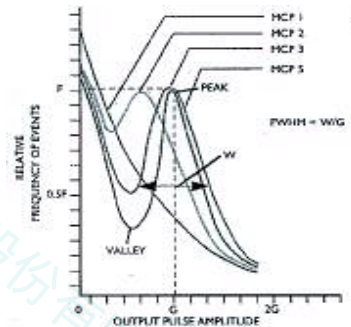
Gain

The MCP voltage is used to control the gain, and each tube is supplied with test data showing gain as a function of MCP voltage. Photek routinely manufactures a range of image intensifiers with one, two or three MCPs (both single and double thickness), and with a variety of configurations. Photek also manufactures proximity photodiodes using the same construction but without any MCPs.

Pulse Height Distribution

Single MCP intensifiers have an exponential pulse height distribution.

For photon counting image intensifiers, pulse height distribution is measured during processing to optimise channel plate out-gassing.



Gating/Electronic Shuttering

Many customers use these tubes as fast electronic shutters. Applying a voltage pulse to the photocathode turns a proximity focus intensifier into an optical block. The on/off gain/attenuation ratio is typically greater than 10¹⁰. Tubes can be supplied with a small gating control unit which will accept a 5 Volt TTL pulse to turn the tube on/off in less than a microsecond, and rather more sophisticated units can achieve control down to a few ns.

For fast gating response it is usually necessary to increase the photocathode conductivity by using a transparent conducting undercoat or by reducing cathode size. Photek make tubes of both types, the most common of the latter type being the slot photocathode for multi channel analyser applications. 25 mm intensifiers can be switched on/off in approximately 3 ns FWHM using these techniques, while 40 mm tubes have achieved 12 ns FWHM. Tubes can also be modulated at high frequency; over 100 MHz has been achieved with a special 25 mm intensifier.

Ultra-Fast Gating

Ultra-fast gating is possible using a conductive mesh undercoat. The inherent iris time can be reduced to 50 ps by this technique, but there are no commercially available pulse generators made to achieve this. Electrical connection to the tube is also a problem. Our MCP 40-25 and MCP 12 are available with stripline connectors to enable ultra-fast gating from suitable power supplies.

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