Low Light Level Imaging

Image Intensifiers are used to amplify low light level images in a wide wavelength range to observable levels. PHOTONIS offers a broad range of detectors mostly based on microchannel plate technology. Image Intensifiers of 18, 25, and 40mm optical diagonal are available.

This selection guide will help you choose the matching options for the best product, optimized to your industrial and scientific application.

As a leader in Image Intensifiers for Industrial and Scientific applications Photonis has also developed innovative products such as the Intensified CCD and CMOS (ICCD, ICMOS) and the Hybrid Photo Diode (HPD).

Co-Development programs have been created to give you access to our latest know-how and shorten your time to market for new products.

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Applications

Image Intensifiers are electron-optical devices in which the image of a scene, focused onto a photocathode, is intensified electronically and displayed on a luminescent screen.

Industrial

Non-destructive testing / quality control

X-rays are often used for non-destructive testing of a wide range of materials. Examples are food (unwanted metal or glass particles) as well as integrated circuits or printed circuit boards (damaged traces).

The performance of testing systems can be enhanced when using Image Intensifiers. X-ray doses can be greatly decreased when the light, generated in the scintillator, is amplified by an Image Intensifier. A “fast shutter” (gating) option makes it possible to examine moving objects. Another example is real time testing of single crystal turbine blades by scanning them with X-rays and then analysing the diffraction pattern. Existing systems can be upgraded to a real time detector, in which the (wet) film is a replaced by an X-ray ICCD camera.

Power lines can be tested in full daylight for high voltage leaks by means of an SB (solar-blind) ICCD camera (high voltage leaks emit UV light).

High-speed photography

When visualising high-speed phenomena, it is necessary to use high-speed cameras. Image Intensifiers with a short decay time provide the speed and sensitivity required for high-speed imaging.

Robotics / vision

During the automatic inspection of goods an Image Intensifier can recognise a scene without using artificial light. The fast shutter option can instantly “freeze” fast moving objects.

Analytical

Fluorescence

Fluorescence detection requires the presence of a fast optical shutter to block the effect of the excitation light and to set the exposure time window. The ease with which MCP-based Image Intensifiers can be gated make them ideal candidates for this application. The excellent shutter ratio of 10^9 to 10^{10} guarantees a well-maintained resolution and contrast down to the nanosecond range. General applications are Luminescence measurement and Fluorescence Imaging. In fluorescence Lifetime Imaging the technique of Image Intensifier modulation is used. Either the front gap voltage or MCP-voltage is sinusoidally modulated. Lifetimes of fluorophores in tissues can be measured and reveal information about their structure.

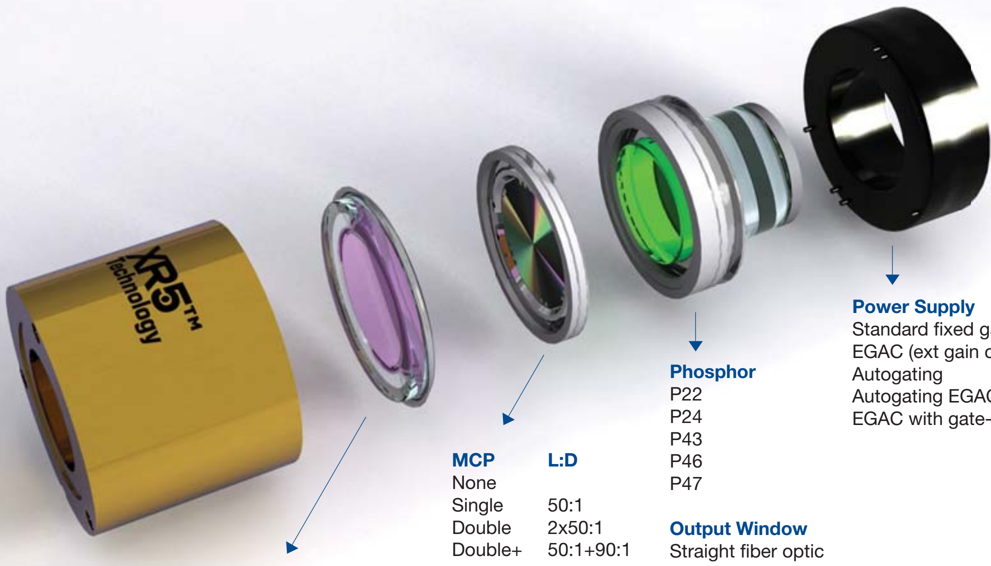
Spectroscopy

When coupled to a high-resolution linear or square CCD, proximity focused MCP-based Image Intensifiers are ideally suited for measuring the weak absorption or emission spectra of samples. This is because of the total absence of distortion. The spectral elements composing the spectrum can be perfectly matched onto CCD-pixels. A wide spectral band can be covered. As for fluorescence detection, the fast gating feature is essential.

Medical diagnostics

Image Intensifiers are especially successful in tissue inspection systems based on fluorescence, such as Fluorescence Endoscopy, and DNA- and drug-sample analysis.

Image intensifiers can be easily customised to your needs by choosing within the main design options below. Please contact for any question in order to optimize them for your application.



Features & benefits

1. Choosing photocathode and window material

The spectral sensitivity characteristic (Fig. 1) is the curve showing how cathode radiant sensitivity varies with wavelength. The spectral response is determined at the longer wavelength (photo emission threshold) by the photocathode type and thickness and at the shorter wavelengths by the input window transmission (Fig. 2).

2. Choosing the right type of MCP (Minimum light level ->MCP (number, gain)

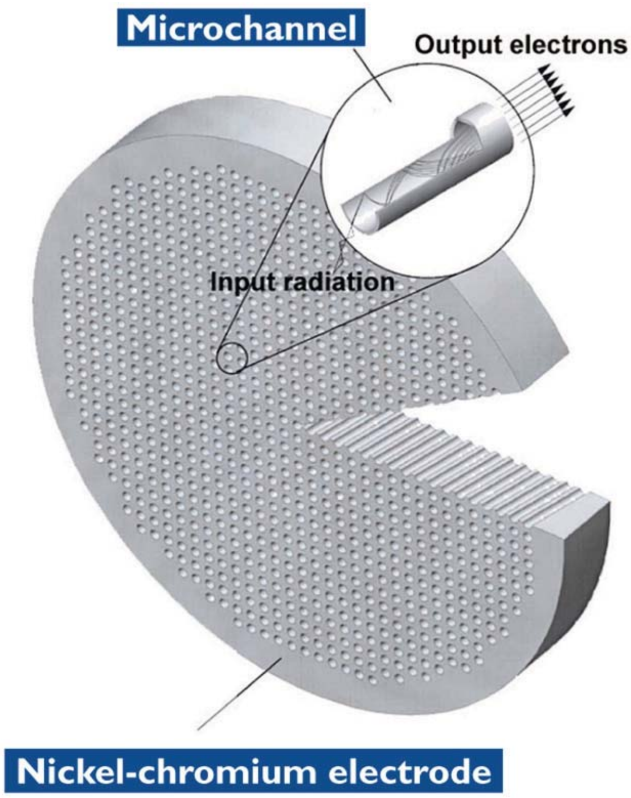
An MCP amplifies the number of electrons generated in the photocathodebefore they are accelerated and finally hit the phosphor screen. The result in proximity focused image intensifiers is an amplification of a few thousand times.

(based on S25 photocathode and P22 Phosphor)	Gain values
0 MCP (PFD, Proximity Focused Diodes)	30 - 100
1MCP	3 000 - 15 000
2MCP	200 000 - 500 000
2 MCP+ (2MCP, one with increased thickness)	> 1 000 000

3. Speed (phospor + gating sublayer)

MCPs can be supplied with different types of phosphor screens.

P22 = standard = 100% efficiency of 45ph/e^-/kV
P43 = 20 ph/e^-/kV
P24 = 8 ph/e^-/kV
P46 = 6 ph/e^-/kV
P47 = 4 ph/e^-/kV



4. Chain options (on the output window)

- Coupling coatings such as NESA/ITO conductive coating for CCD coupling
- No MCP (=PFD for intensification and wavelength shifter)
- Coupled CCD & CMOS
- Gating
- Power Supply (autogating day/night)

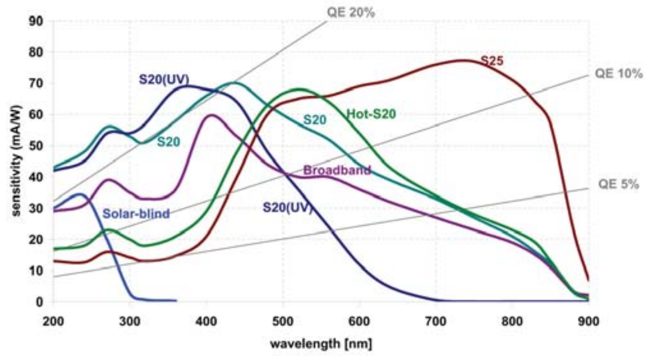


Fig. 1: Photocathode Spectral Sensitivity curves (deposited on glass) Photocathodes deposited on Fibre optic window are ~20% less sensitive and cut at 400nm

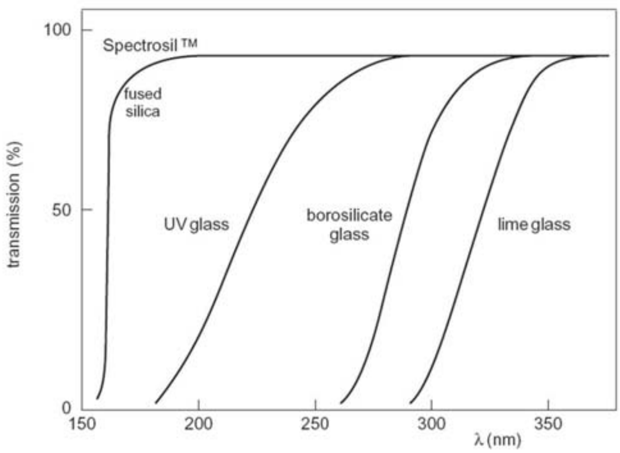
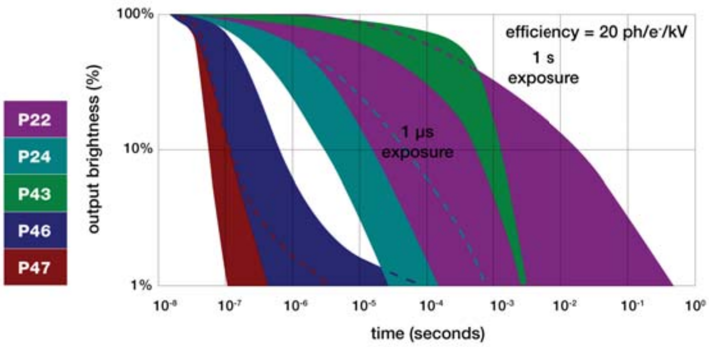


Fig 2: Transmission (%) as a function of wavelength for various glasses used in input windows (thickness 3 mm)



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