

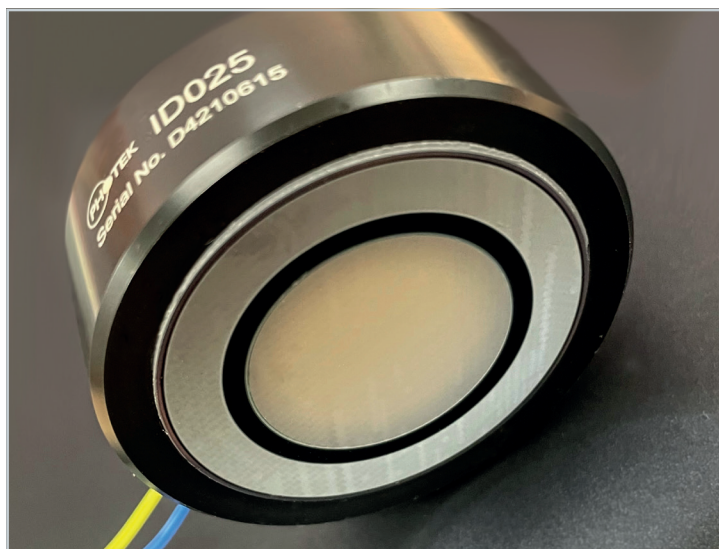


**DATASHEET**  
DETECTORS  
Image Diode

**PHOTEK**  
ENVISAGE THE FUTURE

# Image Diode

Proximity focussed diode



**The Image Diode is a proximity focussed diode vacuum photo-tube, otherwise known as a Generation 1 Proximity Image Intensifier. Image Diodes do not contain Microchannel Plate (MCP) electron multipliers.**

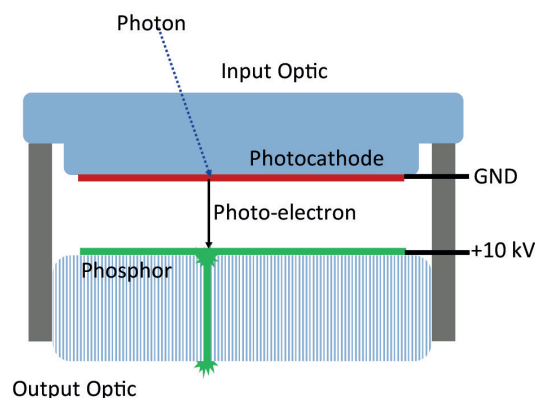
Instead, light gain is accomplished solely through the acceleration of photoelectrons to roughly 10 keV and the subsequent conversion of the electron energy into light via a phosphor screen. Light gain is typically >10X, and is determined by the photocathode, phosphor and applied voltage. Image Diodes have excellent spatial resolution and dynamic range compared to MCP based image intensifiers. They are often used as “Booster Tubes” where they are fibre-optically coupled to the output of an image intensifier. This provides a brighter image with higher dynamic range that is often required for intensified cameras operating at > 300 fps. Another common use of Image Diodes is for the conversion of Ultraviolet or Infrared light into visible light for viewing by eye or a CCD/CMOS camera. In this application Image Diodes are often referred to as “Converter Tubes.” Photek’s line of Image Diodes are available in 18 mm, 25 mm and 40 mm formats. Other formats are available, as well as our Demagnifying Image Intensifier.

## Key Attributes

- > 18, 25 and 40 mm active areas, other sizes available on request
- > Wide range of photocathodes including UV, solar blind, visible and NIR response
- > Very high resolution
- >  $\geq 10$  photon gain
- > High dynamic range
- > Any combination of Fibre Optic and Glass input and output optics are available

## Applications

- > High Speed Intensified Imaging (Booster Tube)
- > Wavelength conversion, from UV or Infrared to Visible (Converter Tube)



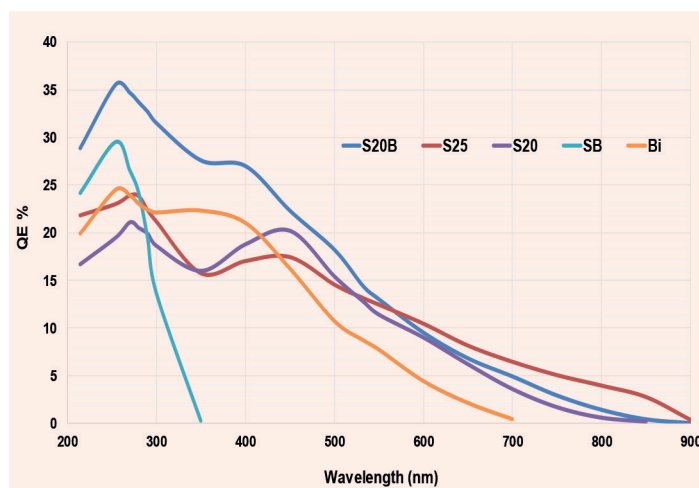
## Environmental

Operational Limits: -40°C to +45°C

Storage: -40°C to +60°C

## Quantum Efficiency Curves

The spectral graphs shown below are representative of standard detectors and are for indication only. Detectors with Fibre Optic input windows will have no response below 300 nm. Please contact the Sales office to discuss your exact requirements.



## Mechanical

Minimum sensitive input area of each Image Diode is given in the first column of each table below.

### FIBRE OPTIC IN, GLASS OUT

Dimensions						
Diameter (mm)	A	B	C	D	E	F
18	40	31	20	8.75	19	5.35
25	52.6	41	18	11	28	0.8
40	71	60.6	26	14.6	45	5.5

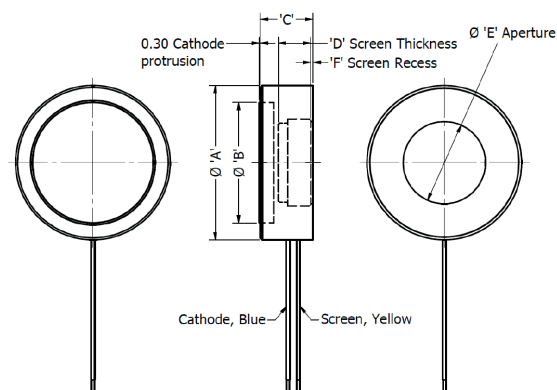
## Phosphor Screen

Photek can offer two types of phosphor screen substrates; glass or fibre optic. Our standard Image Diode phosphors include P20, P43, P46 and P47 depending on the brightness and decay time required. Other phosphors are available on request.

### PHOSPHOR OPTIONS

Type Wavelength (nm)	Photons/ Electron @ 5kV	Decay Characteristic
P20 (540)	320	Fast initial decay with long decay at low level. 1ms to 1%
P43 (548)	240	1.2 ms/decade, true exponential
P46 (530)	55	300 ns
P47 (410)	64	80 ns

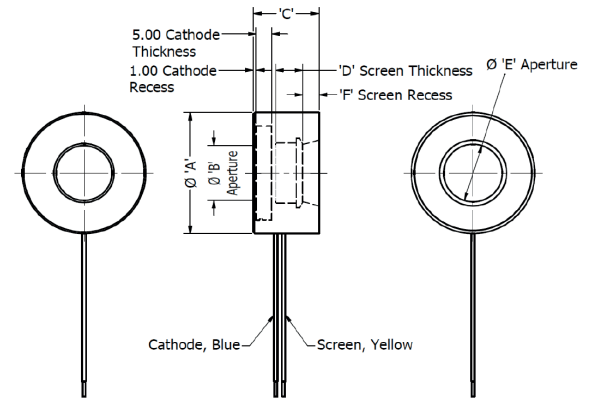
Photon gain ( $\lambda$ ) = photocathode QE ( $\lambda$ ) x phosphor gain x window transmission



## Mechanical

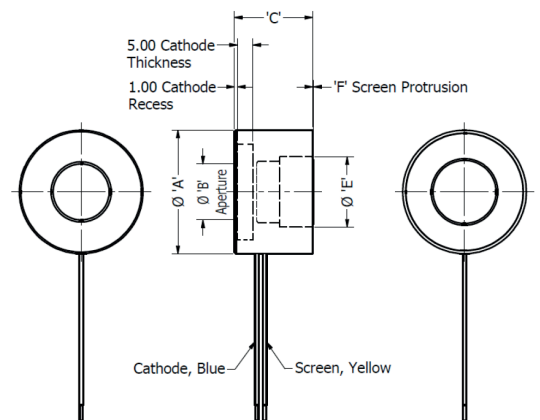
### FUSED SILICA IN, GLASS OUT

Dimensions						
Diameter (mm)	A	B	C	D	E	F
18	40	18.1	21.3	8.75	19	5.35
25	52.6	25	20.9	11	28	0.8
40	71	40	27.3	14.6	45	5.5



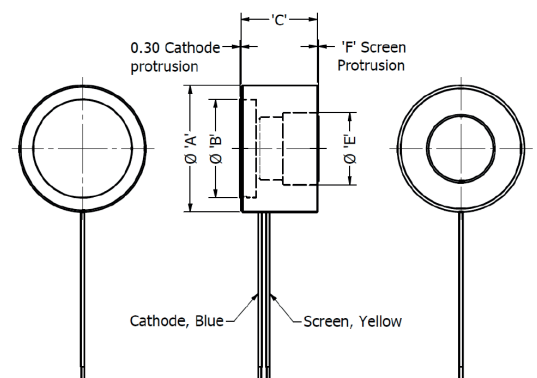
### FUSED SILICA IN, FIBRE OPTIC OUT

Dimensions						
Diameter (mm)	A	B	C	D	E	F
18	40	18.1	25.3	-	22.8	0.3
25	52.6	25	24.6	-	29.7	0.3
40	71	40	21.5	-	45	0.3



### FIBRE OPTIC IN, FIBRE OPTIC OUT

Dimensions						
Diameter (mm)	A	B	C	D	E	F
18	40	31	24	-	22.8	0.3
25	52.6	41	22.7	-	29.7	0.3
40	71	60.6	20.2	-	45	0.3



## Booster Tube Configurations

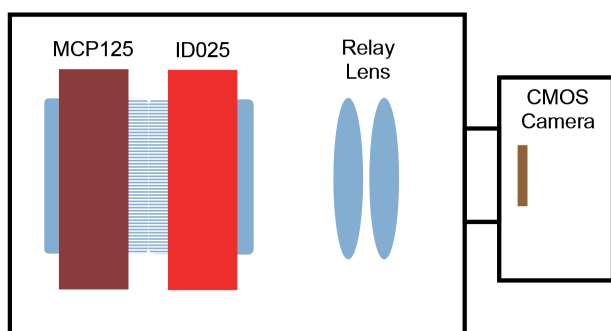
In a standard Booster Tube configuration the Image Diode is fibre-optically coupled to a single stage Image Intensifier. The Image Diode's photocathode is matched to the wavelength of the Image Intensifier's phosphor emission.

Below are several examples of common Image Diode - Image Intensifier pairings.

Contact Photek's technical team for requirements specific to your application or a complete solution including a camera of your choice.

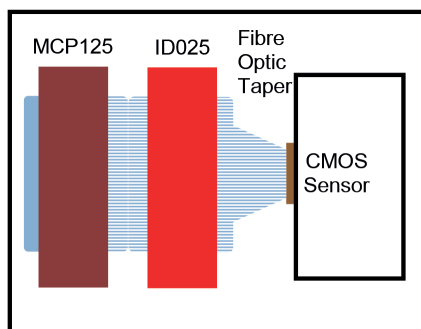
**Note:** For a fibre optic output window, the photon gain will be lower

Phosphor of the Coupled Image Intensifier	Peak phosphor Wavelength	Image Diode Photocathode	Image Diode Phosphor	Typical Image Diode Photon Gain (glass output)	Typical Voltage
P43	548	S20	P43	102	+8 kV
P46	530	S20	P46	27	+8 kV
P47	410	S20B	P47	65	+8 kV



### Typical configuration for an Intensified High Speed Camera.

Shown is an MCP125 image intensifier with Fibre Optic output coupled to an ID025 Image Diode having a Fibre Optic input. The MCP125 and ID025 are bonded together providing high optical gain and dynamic range suitable for high speed imaging. A Glass output on the ID025 is coupled to a high speed camera using a relay lens, typically via a lens mount. The camera can be used with or without the intensifiers.



### Alternative configuration for an Intensified High Speed Camera.

Shown is an MCP125 image intensifier with fibre optic output coupled to an ID025 Image Diode having both Fibre Optic input and output. The MCP125 and ID025 are bonded together providing high optical gain and dynamic range suitable for high speed imaging. A Fibre Optic is used to couple the output of the ID025 to a high speed CMOS sensor resulting in a compact but permanent solution.

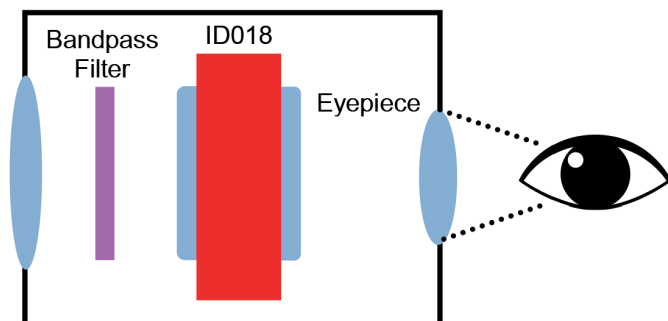
## Converter Tube Configurations

In a standard Converter Tube configuration the Image Diode has a quartz input, with the image being viewed lens focussed onto the photocathode. The Image Diode's photocathode is matched to the wavelength of interest, often with additional optical filters in the light path to provide out-of-band rejection. The output of the Image Diode is either configured with glass for direct view via an eyepiece or fibre-optically coupled to a CCD/CMOS camera.

Below are several examples of common Converter Tube applications. Contact Photek's technical team for requirements specific to your application.

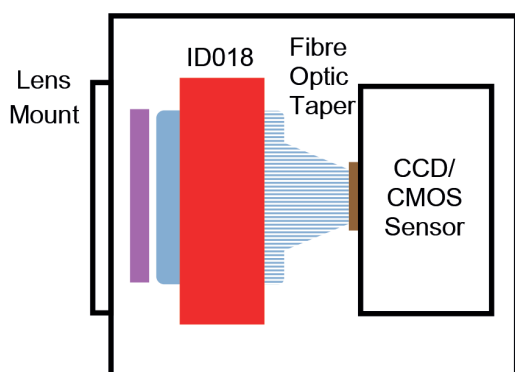
**Note:** For a fibre optic output window, the photon gain will be lower

Conversion	Photocathode	Typical Applied Voltage	Quantum Efficiency (QE)		Photon Gain with glass output (at stated wavelength) (W/W)		
			(%)	(nm)	P20	P43	P46
Deep UV	SB	+8kV	30	254	365	274	65
Broad UV	S20B	+8kV	28	350	342	255	57
NIR	S25	+8kV	4	800	49	38	8



Typical configuration for a direct view Image Converter.

Shown is an ID018 Image Diode with glass input and output optics. The Image Diode converts either Ultraviolet or Near Infrared to visible wavelengths for viewing by eye. Often a bandpass filter is used to reject light at wavelengths that are not of interest.



Alternative configuration for an Image Converter with integral CCD/CMOS camera for applications where direct viewing is not required.

Shown is an ID018 Image Diode having a Glass input and Fibre Optic output. A Fibre Optic taper is used to couple the output of the ID018 to a CCD/CMOS sensor resulting in a compact digital output image converter.

**DATASHEET**  
Image Diode**About Photek**

**Photek is a specialist manufacturer of vacuum based tubes and camera systems for photon detection.**

Our product range includes; Camera Systems, Image Intensifiers, Photomultiplier Tubes, Streak Tubes plus a range of associated electronics.

We are experts in large area and ultra-high speed imaging and advanced photon counting camera systems.

Our continuing success is built upon continuous innovation and product development, and by harnessing and applying knowledge to find solutions for all of our customers' applications.

**Photek is accredited to ISO 9001 and ISO 14001.**

**Contact Us**

**Our team of specialist engineers and scientists are ready to discuss your application requirements in depth.**

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