

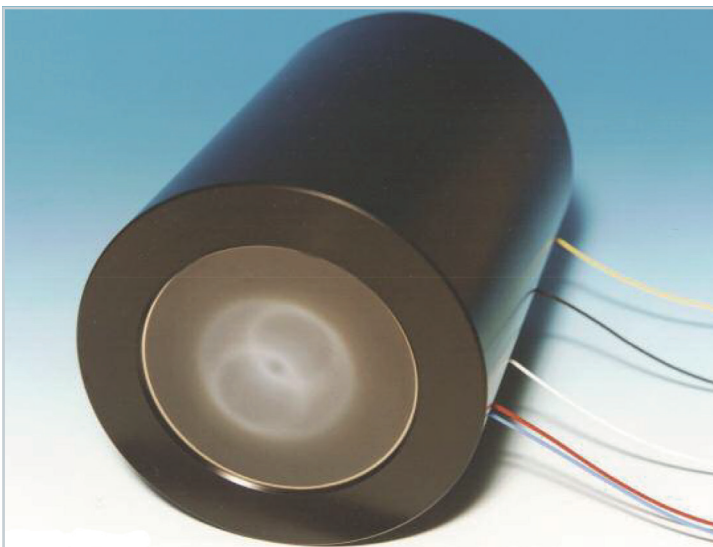


DATASHEET
DETECTORS
Demagnifiers

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Demagnifiers

Detection of light particles with reduction in image size



Demagnifiers are electrostatic focusing devices used for the detection of light particles where reduction in image size is required. The Photek Demagnifiers are available with either a 47 mm, 80 mm, or 150 mm diameter input window. They have high dynamic range, high resolution and are an efficient alternative to fibre optic tapers.

Rugged metal-ceramic tubes with tetrode electrostatic focusing, change of magnification is accomplished by simultaneously adjusting the voltage on three electrodes. The photocathode is remotely processed in a vacuum transfer, assuring high efficiency and low noise. It is processed on a plano-concave fibre optic window, with a maximum useful diameter of 45, 76, or 140 mm.

This range of demagnifying intensifier has no microchannel plate (MCP) - the photon gain is dependent only on operating voltage and the efficiency of the photocathode and phosphor screen. Compared to a fibre optic taper, the electrostatic tube offers a photon gain of around 100 photons/photoelectron at 10 kV with P43 phosphor; sufficient to overcome readout noise of scientific CCDs without degrading dynamic range or resolution, which is typically less than 20 microns at the output surface.

Key Attributes

- > 47 mm, 80 mm or 150 mm input
- > Magnification ratio from 0.1 to 0.6
- > Gateable
- > Distortion less than 5%
- > Gen I high dynamic range
- > Small amount of pin cushion distortion - almost zero at mid-range magnification
- > Construction minimises sheer distortion and blemishes

Applications

- > X-ray imaging
- > Beta autoradiography
- > Dynamic X-ray TV
- > Nuclear physics
- > X-ray crystallography
- > Non-destructive testing

Operating Modes

FIXED INPUT FORMAT

The image input size is assumed to be frozen at a defined input diameter. The size of the output image can be adjusted in the range 0.6 to 0.1 by controlling the focus voltages. The tube can be operated from a fixed voltage divider chain at any chosen magnification.

Magnification	0.1	0.25	0.4	0.5	0.6
DM47	4.7	11.7	18.8	23.5	2
DM80	8	20	32	40	-
DM150	15	37.5	-	-	-
Distortion	5%	0%	2.6%	5%	5%

FIXED OUTPUT FORMAT

If the desired output format is assumed to be frozen by, for example, an 11 mm diagonal CCD, then the size that this maps onto the photocathode can be changed by adjusting the voltages on the focus electrodes within the range 1.6 to 10 times bigger than the output.

DYNAMIC RANGE

The dynamic range of the demagnifying image intensifier has been independently measured and shows that good results can be obtained over a 5 order of magnitude range.

RESOLUTION

Resolution of these detectors is dependant on a number of factors including: the electron optic design, the operating voltages, the magnification, and the phosphor screen. The table below shows typical figures for S20 cathode, P43 phosphor and 10kV operating voltage.

Magnification	0.1	0.25	0.4	0.6
Cathode (lp/mm)	6	12	18	32
Screen (lp/mm)	60	48	45	53

Distortion

The distortion of this detector is less than 5% over the majority of the active area, however, at certain magnifications, the distortions at the very edge does increase to higher levels. If image distortion is of great concern it is recommended that the active area be limited to 42 mm for the DM47-025 and 70 mm for the DM80-040.

Photocathodes

Photek can offer a range of photocathodes including Bialkali, low noise S20, S20, and S25. Please refer to our separate photocathode datasheet for further details.

Phosphor Screens

Photek can offer a large range of phosphor screens including P11, P20, P31, P46, and P47. Please refer to our separate phosphor datasheet for further details.

Operating Voltage

Typical operating voltages are shown in the table below. For most customers, the tube will be supplied with a resistor network encapsulated with the tube to work at a defined magnification. Alternatively access can be given to all electrodes to enable the tube to be used in zoom mode from programmable power supplies.

Magnification	0.1	0.25	0.4	0.6
Cathode	0	0	0	0
Uf 1 (Gated On)	73	57	110	330
Uf 1 (Gated Off)	-300	-320	-500	-1,000
Uf 2	360	120	270	730
Um	460	1,540	4,250	10,000
Anode	10,000	10,000	10,000	6,000

Uniformity and Blemishes

Typical uniformity and blemishes at 0.6 magnification are shown in the table below. Please note that the majority of blemishes are associated with defects in the large fibre optic input windows. The size that these blemishes are measured at the screen will decrease as the magnification moves towards 0.1.

	Uniformity	>0.25	0.25 to 0.075	0.15 to 0.075	<0.075
DM47	± 15%	0	3	8	Unlimited
DM80	± 15%	1	6	16	Unlimited
DM150	± 15%	TBD	TBD	TBD	Unlimited

Gating

A gating pulse unit is available for this tube, which has a rise time/fall time of about 0.2 µs and is suitable for gating in the micro-second range.

Gain

The gain of these demagnifying image intensifiers is related to:

- > the QE of the photocathode
- > the efficiency of the phosphor screen
- > the operating voltage
- > the magnification of the detector

For a low noise S20 cathode and P43 phosphor at 0.25 magnification and operating at 10 kV the photon gain is typically 100 to 200 photons/photoelectron (10 to 20 photons/photon with a 10% QE cathode).

It is worth remembering that the phosphor screen will appear much brighter at 0.1 magnification than it does at 0.6 magnification because the electrons are concentrated on a much smaller area of the phosphor screen.

Mechanical

	DM47	DM80	DM150
Length (mm)	123	180	376
Diameter (mm)	77	110	250
Max Diameter (mm)	47	80	150
Quality Diameter (mm)	45	76	140
Active Output (mm)	25	40	40

**DATASHEET**
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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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