

DH-3 End-Window Multi-alkali Photomultiplier User Notes



Overview

The Bentham DH-3 houses an end-window multi-alkali (S20 photocathode) photomultiplier tube (PMT), typically mounted to the exit slit of any Bentham monochromator.

This device is responsive over the spectral range 160--850nm. This range can be extended to 930nm by cooling the device to -20°C (sold as DH50).

The DH-3 can be operated in either the DC or AC regimes; in the latter instance, a chopping frequency of 225Hz is suggested.

The housing is designed for optimal device performance, having a PCB-based dynode chain and fitted with a mu-metal shield to obviate the effects of extraneous magnetic fields.

Electrical

There are two labelled BNC ports on this device- signal and HV (high voltage). For the former is provided a standard BNC cable; for the latter, a thicker BNC cable with PTFE insert to avoid connecting a high voltage to the signal channel.

The anode current can be measured via a transimpedance amplifier, such as the Bentham 487.

This device requires a high voltage for operation, typically derived from the Bentham 215 module. It is suggested to operate this device at 750V.

It is of prime importance to ensure that the current amplifier is not exposed to this high voltage; Bentham recommend operating the device with the photocathode at negative HV, and the anode at ground.

Pin out of the HV port is:- inner pin negative HV, outer ground; pin out of the signal port is:- inner pin cathode, outer anode.

Mechanical

The DH-3 is mounted via an interface plate to the slit of any Bentham monochromator, between each interface a rubber O-ring ensures the prevention of light leak.

Detector specification

Type:	End window
Spectral response (room temperature):	185-90nm
Peak sensitivity wavelength (typ.):	420 nm
Dark current I_D (typ.):	500pA at 750V
Photosensitivity vs. temperature:	up to 1%/ °C at band edge
Number dynodes:	10
Maximum anode current:	0.1mA
Dynode chain resistance :	Linear: 750kΩ Pulse Counting: 3.92MΩ
Window material:	Quartz

Device Operation

The PMT comprises a photocathode front window, doped with material of low work function, held at negative high voltage, and a chain of dynodes which act as secondary electron emitters. The high voltage is dropped between the photocathode and anode, and divided between the dynodes by resistors of the dynode chain. There is therefore a voltage drop between the photocathode and the first dynode, between the dynodes and between the last dynode and the anode.

Light incident on the photocathode liberates an electron which is accelerated toward the first dynode. Collision liberates one or more electrons and the electron multiplication process continues up to the dynode, producing a gain of a factor 10,000 or more.

Since the work function of the photocathode is low, electrons can also escape via thermal mechanisms giving rise to a rapidly varying dark current, which increases with the ambient temperature.

The PMT being a particularly sensitive device, it should never be exposed to ambient light whilst the high voltage is applied.

It should be noted that the PMT is evacuated, and therefore the temperature of the device is only modified by conduction through the structures of the PMT.

WEEE statement:

Bentham are fully WEEE compliant, registration number is WEE/CB0003ZR.
Should you need to dispose of our equipment please telephone 0113 385 4352 or 4356, quoting account number 135419.



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