G-SERIES AND IGA-SERIES PSDS

OPERATING THE PSDS

GENERAL: This unit consists of a tetralateral-type position sensing photodiode which is typically operated with four independent transimpedance amplifier channels. It is designed for continuous beam position monitoring.

SETTING THE GAIN: The transimpedance gain should be chosen based on expected signal levels, photodiode shunt impedance and amplifier offset voltages.

POLARITY/BIAS: The standard polarity for the EOS silicon and InGaAs position sensing photodiodes is common cathode. This results in a negative-going signal at the output of the first amplifier stage. The germanium devices are common anode, resulting in a positive-going signal at the output of the first amplifier stage. The PSDs are designed normally for zero bias operation.

SIGNAL LEVELS/SATURATION: The PSDs are designed ideally for signal levels on the order of 100uW. Nonlinearity and eventual saturation will occur above 1mW.

DC OFFSETS: In the transimpedance amplifier configuration these units are DC-coupled and the amplifier offsets are multiplied at the output. In the case of the high shunt impedance silicon and InGaAs devices this is generally not a problem. With the low impedance germanium devices the offsets of each channel can be significant and the user may have to correct for these if a CW beam is being used.

POSITION RESOLUTION: The position resolution of the PSDs is a function of incident power, total system noise (and effective noise bandwidth), the size of the device, and to a lesser extent the size of the incident beam. In general, the resolution (`d) can be estimated as follows:

`d = (L x 2In) / (Is),

where L = active size of the PSD (usually 70% of the overall dia)
In = equivalent input noise current
(the equivalent noise current of the parallel combination of the interelectrode resistances, photodiode shot noise and the contribution from the amplifier's equivalent input noise)
Is = the signal current from the photodiode (0.9 A/W typical)

For the standard 5mm photodiode and the PSD-E4 amplifier module with 100uW of beam power, this results in approximately:

$$`d = (3.5\text{mm} \times 5 \times 10^{-11}\ \text{A/Hz}^{1/2}) / (0.9 \times 10^{-4})$$
$$= 2.0 \times 10^{-6}\ \text{mm/Hz}^{1/2}$$

Assuming the full module bandwidth of 50kHz (eq noise bandwidth = 70kHz) this gives a wideband resolution of $0.5\text{x}10^{-3}$mm, or 0.5um.

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