OPERATING THE PSD-E4 PHOTODIODE/AMPLIFIER MODULE

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

POWER SUPPLY: A bipolar power supply with central ground is required, +,- 6VDC to +,-15VDC, 40mA. Double check wiring prior to turning on power. Improper /reverse wiring will damage the unit.

GAIN: The unit is supplied with a fixed feedback resistance of 10^4 ohms for each channel. Other gain settings may be specified at the time of order.

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 and the E4 unit has no biasing provision.

SIGNAL LEVELS/SATURATION: The PSDs are designed ideally for signal levels on the order of 100uW. Nonlinearity and eventual saturation will occur above 1mW. The unit is threaded on the front (1.035-40) for an adapter to take a 1" diameter optical filter.

DC OFFSETS: Since these units are DC-coupled 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 levels being 1mV or less. With the low impedance germanium devices the offsets of each channel can be as high as +,- 10mV 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:

$$`d = (L \times 2I_n) / (I_s),$$

where L = active size of the PSD (usually 70% of the overall dia)

I_n = 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)

I_s = 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 0.5×10^{-3}mm, or 0.5um.

CONNECTION: A standard 9-pin D-stlye connector is used for the power inputs and signal outputs. See the data sheet for specific pin-outs. When ordered with a PS-1 power supply an adapter cable is provided for connection.