Kuang:

IT's important To know what The peak & Average currents coming out of The PMT are.

Looking AT The signal directly from The PMT using The oscilloscope (50Ω input) gives something like This:

Ohms law says $V_0 = IR$

$\therefore I_{peak} = V_0 / R$ where $R = 50\,\Omega$

The 'Average' current is just

I_{AV} = Total charge ΔQ That The PMT puts out in 1 sec.

$$I_{AV} = \frac{\Delta Q}{\Delta T} \quad \text{where } \Delta T = 1 \text{ sec.}$$

$$\frac{\Delta Q}{1\,\text{sec}} \approx \text{rep-rate} * I_{peak} * \Delta t$$

$$\therefore I_{AV} \sim \text{rep-rate} * I_{peak} * \Delta t$$

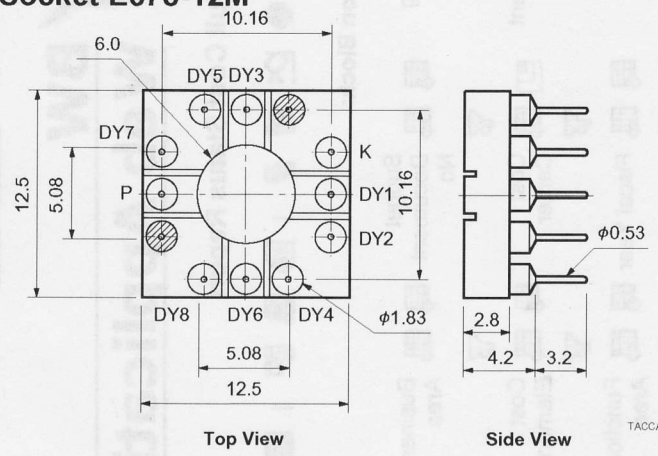
Compare I_{AV} to the value given in the R7400 spec sheet. The max. linear output of the PMT depends on the base we have. If we have the D Type Socket E5770/E5780 it's given as 13 μA.

Is $I_{AV} > 13\,\mu A$?

METAL PACKAGE PHOTOMULTIPLIER TUBE R7400U SERIES

ACCESSORIES OPTION

● Socket E678-12M



● D Type Socket Assemblies E5770/E5780

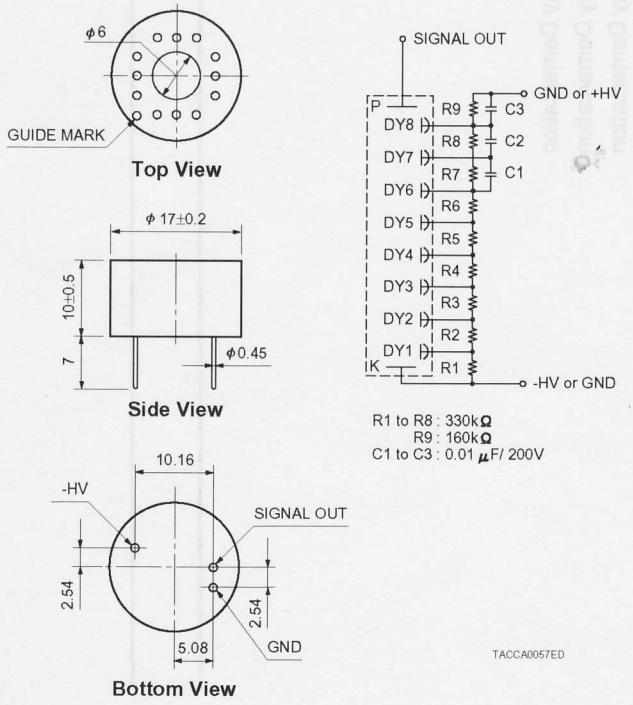
The E5770 and E5780 are compact socket assemblies incorporating a voltage divider circuit comprised of resistors and capacitors. These socket assemblies are designed to provide the output signal directly from the anode of the metal package photomultiplier tube.

Type No.	Grounded Electrode	Divider Resistance (Total)	Maximum Linear Output of Photomultiplier Tube (DC Mode)	Output Signal	
				Cathode Grounded	Anode Grounded
E5770	Anode/Cathode	2.8MΩ	13μA	Pulse	DC/Pulse
E5780	Anode			—	DC/Pulse

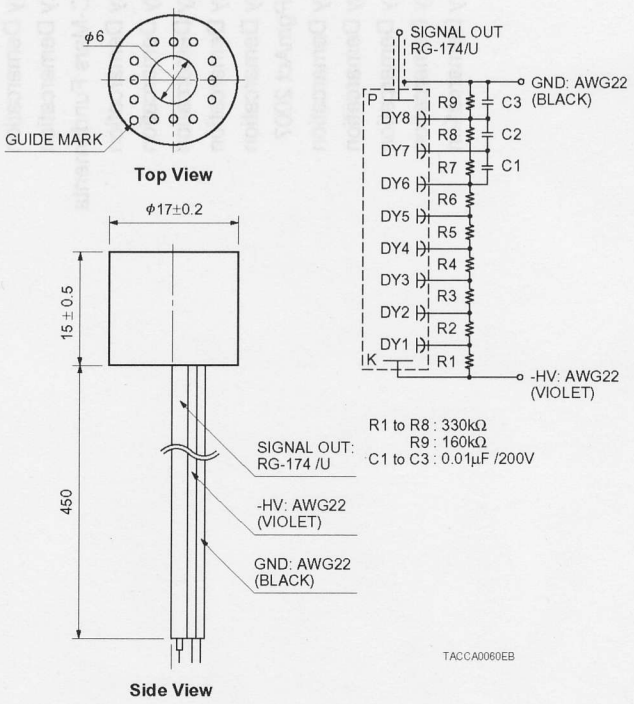
* When the E5770 is used with the anode at a positive high voltage, the negative high voltage (-HV) terminal should be grounded and a positive high voltage applied to the ground terminal. In this arrangement, a high voltage differential is generated between the output and an external amplifier, so use a decoupling capacitor that can withstand a high voltage.

** In the E5780, the shield of the signal output cable is connected to the grounded cable, so the E5780 can be used only for negative high voltage operation. Consult our sales office when the E5780 is needed for positive high voltage operation.

PC-board Mounting Type E5770



Cable Output Type E5780



Kuang:

For photon counting The peak current is just

$$I_{peak} = V_{peak} / R$$

where V_{peak} is the signal generated by a count viewed with a 50Ω load. If $V_{peak} = 0.1V$

$$I_{peak} = \frac{0.1}{50} = 2 \times 10^{-3} \text{ Amps}$$

The average current is related to The average number of counts & The laser repitition rate as follows.

N = Average number of counts per laser pulse

Q = Charge delivered by PMT to produce one count

$I_{AVG} \approx$ Charge delivered per second

$= 20 Hz \times N \times Q$

$Q = I_{PEAK} * \Delta t$

Where $\Delta t \sim 10$ nsec [pulse width]

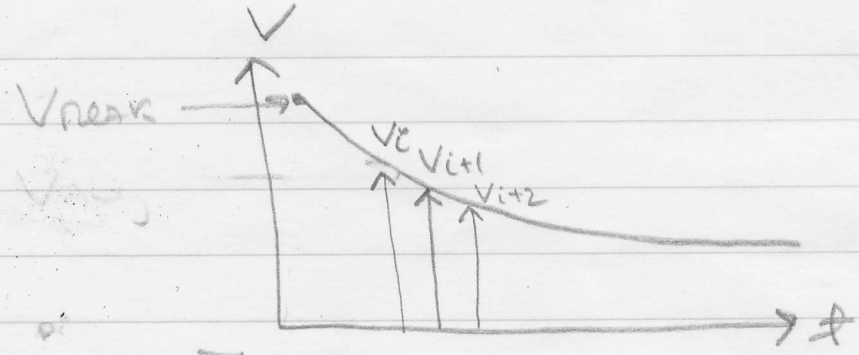
How many counts occur for each laser shot? If $N = 10^5$ Then

$$I_{Avg} = 20 \times 10^5 \times 2 \times 10^{-3} \text{ mA} \times 10^{-8} \text{ sec}$$
$$= 40 \times 10^{-6} \text{ Amp}$$
$$= 40 \mu \text{ Amp}$$

PMT should be $< 13 \mu A$

For analog detection

$$I_{peak} = \frac{V_{peak}}{R} \qquad R = 50\,\Omega$$



Where V_{peak} is the single shot peak value.

$$I_{Avg} \sim 20\,Hz * \frac{V_{Avg}}{50} \times \Delta T * \text{Number of bins}$$

Where ΔT is the resolution [$\Delta z/c$]
& V_{Avg} is the 'Average' value for the

Analog signal.

One way to define V_{Avg} is V_i

$$V_{Avg} = \frac{1}{N} \sum_{i=1}^{N} V_i$$

Where V_i is the single shot voltage for range bein 'i'.