Model 400
Single Element UV/Vis/IR Pyroelectric Detector

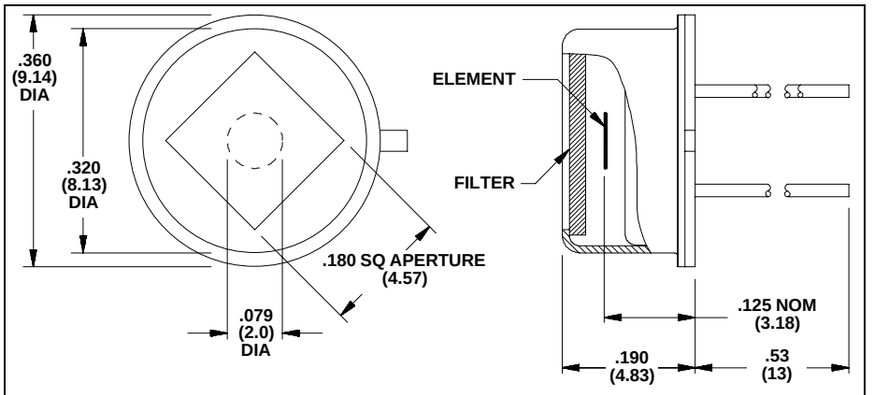
Manufactured under one or more of the following U.S. patents: 3,839,640 - 4,218,620 - 4,326,663 - 4,384,207 - 4,437,003 - 4,441,023 - 4,523,095

Model 400 consists of a single lithium tantalate sensing element sealed into a TO-5 transistor housing with an optical filter.

A patented element mounting technique is used to increase low frequency response and reduce effects of microphony.

Model 400 has a spectral response from 0.1 to 1,000 μm wavelength. An optical filter may be used to select spectral response and to protect the sensing element from physical damage, drafts, electrical noise and moisture (degradation of insulation resistance).

The inherent high impedance of the detector requires special consideration be given to matching circuitry. Some basic circuits are shown below.



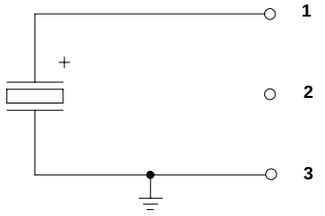
DIMENSIONS IN INCHES (mm) **PINS CIRCLE .200 (5.08); LEAD DIA .017 (0.43)**

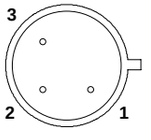
Characteristics		400	Unit	Test Conditions	ELTECdata Reference
Detector Type		Single			
Element Size		2.0	mm, Dia		
Optical Bandwidth		0.1 to 1,000	μm	Various Filters	101
Capacitance	(min)	20	pF		
	(typ)	30			
	(max)	50			
Current Responsivity	(typ)	0.75	μA/W	Without Filter, 1Hz to 1KHz	
Element Impedance	(typ)	>5 x 10^{12}	Ω		
Thermal Breakpoint f_T	(typ)	0.25	Hz		102
Incident Power Limit[1]		0.32	W/cm^2		109
Recommended Operating Temperature		-55 to +125	^oC	Functional	
Storage Temperature		-55 to +125	^oC	$\Delta T<50C^o$/min	
Output Protection		Short output leads together if ΔT exceeds $50C^o$/min			

Characteristics at 25^{o}C, with no filter.
Data is established on a sample basis and is believed to be representative.
[1]Dependent on pulse width & duty cycle.

Applications

- **Pyrometry**
- **Gas Analysis**
- **Instrumentation**
- **Low Power Laser Measurements**
- **Millimeter Wave Studies**





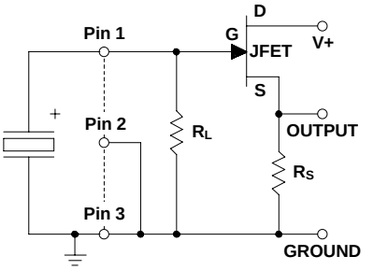
BOTTOM VIEW

PIN DESIGNATIONS

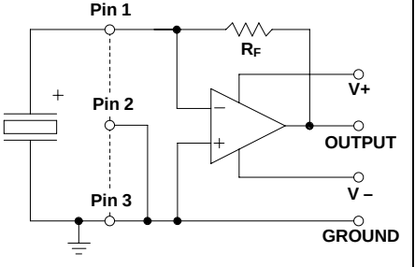
1. OUTPUT
2. N/C
3. OUTPUT – / CASE

SAMPLE CIRCUITS

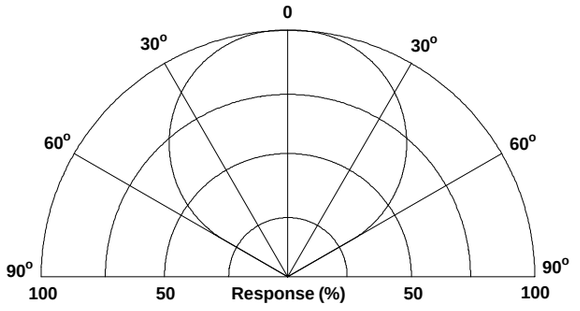
VOLTAGE MODE OPERATION



CURRENT MODE OPERATION



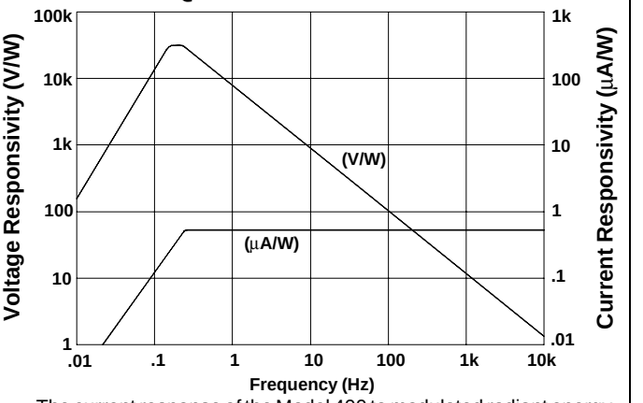
FIELD OF VIEW



For –3 filter only. For other filters, consider refractive index and thickness.

Symmetrical crystal gives same FOV in vertical and horizontal planes.

FREQUENCY RESPONSE



The current response of the Model 400 to modulated radiant energy (pulsed or chopped) is flat beyond the thermal break and is shown on the designated curve with appropriate dimensioning on the right ordinate axis. Response of the Model 400 through a source follower (ELTEC Model 320 set at $5x10^{10}$) is shown on the left ordinate axis.

For best results, the following precautions and recommendations should be observed. (See ELTECdata #101):

Mounting: Avoid mechanical stresses on case and leads.

Soldering: Detectors must be hand soldered to minimize the chance of destroying the internal components. Avoid machine or hot air soldering. Leave a minimum lead length of .250 inch (6.35mm). When soldering to detector leads, use a heat sink between the case and leads. Beware that the new RoHS compliant solders require a higher soldering temperature making heat sinking the detector extremely important.

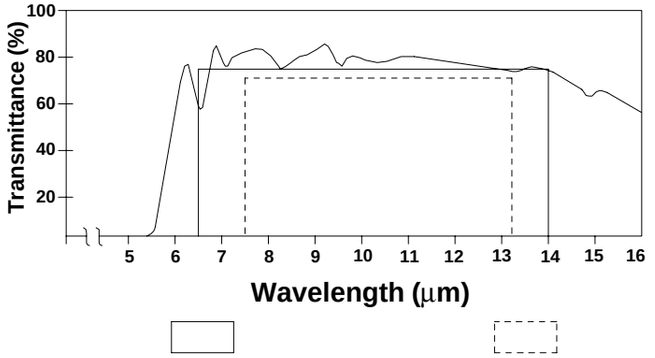
Static Discharge: Protect detectors from electro-static charges.

Thermal Shock: Temperature changes and rate of change must be kept to a minimum (<50C°/min.) to prevent damage.

Optical Filter: This Model can be used with any standard ELTEC detector filter. For more information, please refer to ELTECdata # 101.

Light Leakage: Slight sensitivity to visible light leaking through the glass-to-metal seal on the base may be observed.

Transmission Characteristics of –3 Filter (HP7)



75% Transmission Average **70% Transmission Absolute**

Transmission below cutoff is <1%

Noise: Noise is limited only by the external amplifier and not by the detector. Amplifiers with impedances over 10^9 Ω are not recommended, other than for experimental purposes, due to susceptability to electrical noise, EMI and current leakage. Contact ELTEC for help in choosing an appropriate pyroelectric detector with integrated high impedance amplifier.

As a resolution or lower information limit, noise is established not only by the detector. Other noise sources are:

- Radiated and conducted RF signals
- Subsequent amplification or signal conditioning stages
- Power supply noise
- Components, such as high value resistors and capacitors (tantalum and aluminum electrolytic)
- Mechanical contacts and weak solder joints
- Shock and vibration excited microphonics
- Outside thermal influences on the detector other than the desired infrared input, i.e. drafts

All of these noise sources should be considered carefully when the information signal is < 20 mV.

Calculations: When calculating response from the basic formula, (see ELTECdata # 100) use crystal thickness as 0.005 cm (0.002 inch) and use 30 pF capacitance.

Optical Design: Use of a detector with a filter in an optical system may require consideration of the image displacement toward the filter. This displacement (s) caused by the insertion of a planoparallel plate (filter thickness = t; refractive index = N) is given by s = (t/N)(N-1).

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