

Model 404

Pyroelectric IR Detector with Both Voltage and Current Mode Electronics



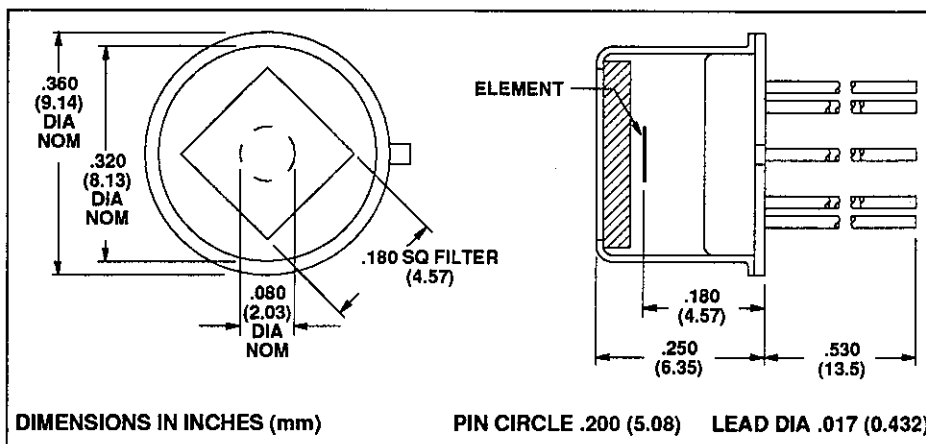
Manufactured under one or more of the following U.S. patents: 3,839,640 - 4,218,620 - 4,326,663 - 4,384,207 - 4,437,003 - 4,441,023 - 4,523,095

Model 404 consists of a single lithium tantalate sensing element and electronics configured for 3 modes of operation sealed into a modified TO-99 transistor housing with optical filter.

(1) The voltage mode circuit: Configured as a JFET source follower with source resistor, provides a voltage output with the best possible signal-to-noise (S/N) ratio throughout a frequency range of .1 to 1000 Hz.

(2) The current mode circuit: Functions as a current-to-voltage converter and provides substantially higher voltage responsivity with slightly lower S/N performance.

(3) Model 404 may also be operated as a detector without internal electronics (see "Pin Connections" table on reverse).

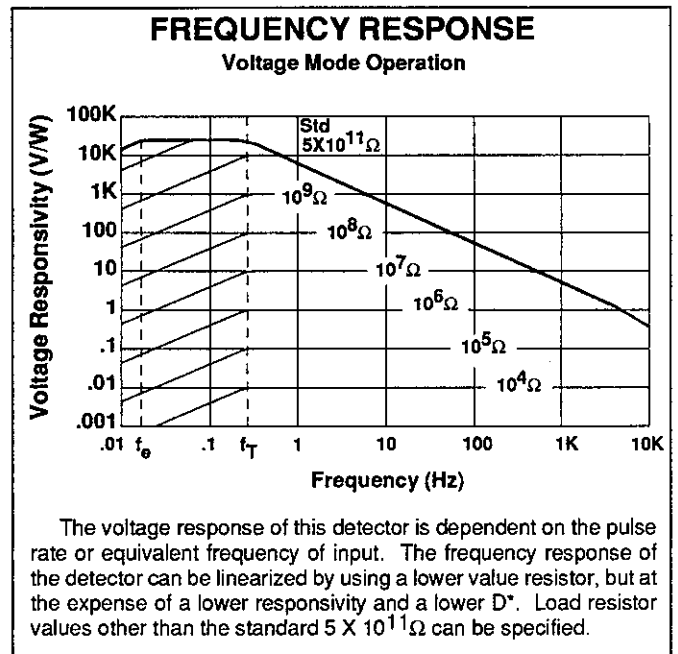
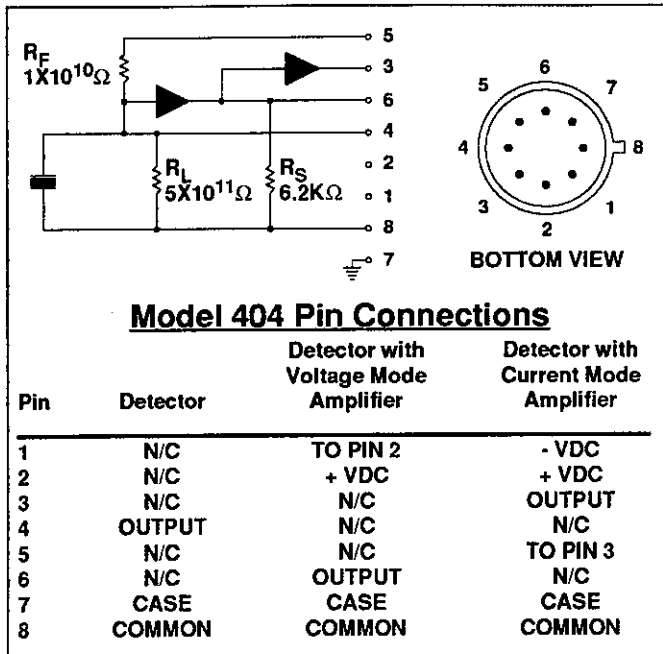


Characteristics	Voltage Mode	Current Mode	Unit	Test Conditions	ELTEC data Reference
Detector Type	Single	Single	—		
Element Size	2.0	2.0	mm, Dia	Nominal	
Optical Bandwidth	0.0001 to 1000	0.0001 to 1000	μm	Without filter	101
Responsivity (Typ)	1,840	12,100	V/W	7.6-14.6 μm, 1Hz	
Responsivity (Typ)	236	7,430	V/W	7.6-14.6 μm, 10Hz	
NEP (Typ)	3.78X10 ⁻¹⁰	5.21X10 ⁻¹⁰	W/√Hz	7.6-14.6 μm 1Hz, BW 1Hz	100
NEP (Typ)	1.02X10 ⁻⁹	1.75X10 ⁻⁹	W/√Hz	7.6-14.6 μm 10 Hz, BW 1Hz	100
D* (Typ)	4.69X10 ⁸	3.4X10 ⁸	cm√Hz/W	7.6-14.6 μm 1Hz, BW 1Hz	100
D* (Typ)	1.74X10 ⁸	1.01X10 ⁸	cm√Hz/W	7.6-14.6 μm 10 Hz, BW 1Hz	100
Operating Voltage (Min)	+ 5	± 5	VDC		104
Operating Voltage (Max)	+ 15	± 15			(4.1.c)
Operating Current (Max)	0.2	5.0	mA		104
Offset Voltage (Min)	0.2	—	V	R _S =6.2KΩ	104
Offset Voltage (Max)	1.2	0.1			Fig. 4
Output Impedance	<6.2K	< 100	Ω		
Thermal Breakpoint f _T (Typ)	0.25	0.25	Hz		102
Electrical Breakpoint f _e (Typ)	0.01	20	Hz	R _L =5 X 10 ¹¹ Ω R _F =1 X 10 ¹⁰ Ω	102
Recommended Operating Temp.	-10 +40	-10 +40	°C		
Storage Temperature	-55 +125	-55 +125	°C	ΔT<50C°/minute	

Characteristics at 25°C, with - 3 filter, V_S = 10 VDC for VM; ±10 VDC for CM. Data is established on a sample basis and is believed to be representative.

Applications

- Pyrometry
- FT Spectroscopy
- Gas Analysis
- Materials' Transmission / Reflectance Studies
- UV Curing Instrumentation
- Total Energy Plasma Studies



Field of View: Approximately 110° (50% power points).

Mounting: Avoid mechanical stresses on case and leads.

Soldering: Use minimum heat and a heat sink between case and leads. Leave minimum lead length of .25 inch (6.0mm). DO NOT MACHINE SOLDER.

Static Discharge: Protect detectors from electrostatic charges.

Thermal Shock: Temperature changes and rate of change must be kept to a minimum ($<50^\circ\text{C}/\text{min.}$) to prevent damage.

Power Polarity: Carefully note power supply polarity connections to avoid damage to internal op amp.

Output Protection: Output is short circuit protected in both current and voltage modes.

Current Mode Output: Output in the current mode is inverting (negative output for positive temperature change).

Voltage Mode Output: No external resistor is needed in the voltage mode because the Model 404 contains an internal source resistor of $6.2 \text{ K}\Omega$.

Optical Filter: This Model can be used with any standard ELTEC detector filter or used without a filter. For more information, please refer to ELTECdata #101.

Noise: As a resolution or low level 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
- 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 $<1 \text{ mV}$ for voltage mode operation and $<20 \text{ mV}$ for current mode operation.

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

Calculations (for operation with only crystal and load resistor): When calculating response from basic formulae, (see ELTECdata #100) use crystal thickness as 0.005 cm and use 30 pF capacitance for crystal.

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 $s = (t/N)(N-1)$.