# Model 404

## Pyroelectric IR Detector with Both Voltage and Current Mode Electronics

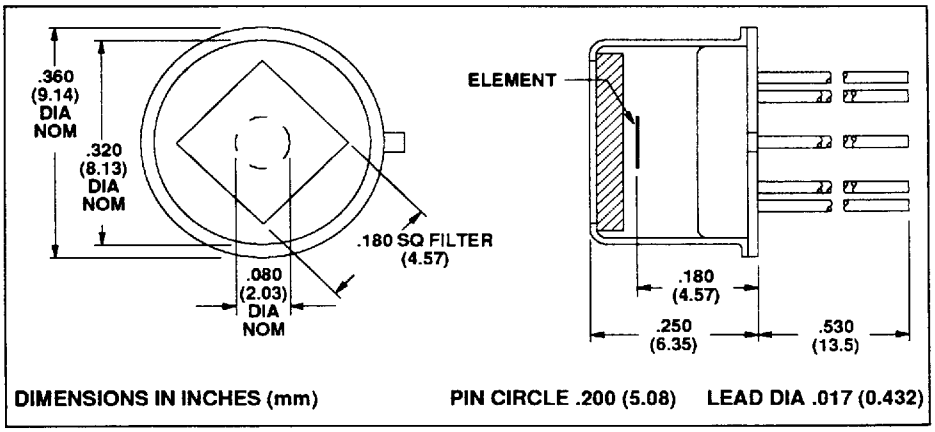
Manufactured under one or more of the following U.S. patents: 3,839,640 - 4,218,620 - 4,326,663 - 4,384,207 - 4,437,003 - 4,441,023 - 4,523,095

**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 thoughout 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).



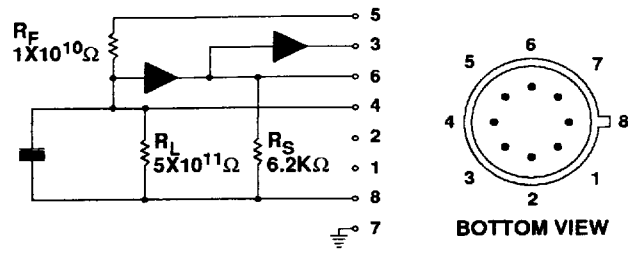

DIMENSIONS IN INCHES (mm) PIN CIRCLE .200 (5.08) LEAD DIA .017 (0.432)

| Characteristics | | Voltage Mode | Current Mode | Unit | Test Conditions | ELTECdata 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) | $3.78X10^{-10}$ | $5.21X10^{-10}$ | $W/\sqrt{Hz}$ | 7.6-14.6 μm 1Hz, BW 1Hz | 100 |
| NEP | (Typ) | $1.02X10^{-9}$ | $1.75X10^{-9}$ | $W/\sqrt{Hz}$ | 7.6-14.6 μm 10 Hz, BW 1Hz | 100 |
| D* | (Typ) | $4.69X10^{8}$ | $3.4X10^{8}$ | $cm\sqrt{Hz}/W$ | 7.6-14.6 μm 1Hz, BW 1Hz | 100 |
| D* | (Typ) | $1.74X10^{8}$ | $1.01X10^{8}$ | $cm\sqrt{Hz}/W$ | 7.6-14.6 μm 10 Hz, BW 1Hz | 100 |
| Operating Voltage | (Min) | + 5 | ± 5 | VDC | | 104 |
| | (Max) | + 15 | ± 15 | | | (4.1.c) |
| Operating Current | (Max) | 0.2 | 5.0 | mA | | 104 (4.1.c) |
| Offset Voltage | (Min) | 0.2 | — | V | $R_S$=6.2KΩ | 104 |
| | (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 | $R_L=5 \times 10^{11}\Omega$ $R_F=1 \times 10^{10}\Omega$ | 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**

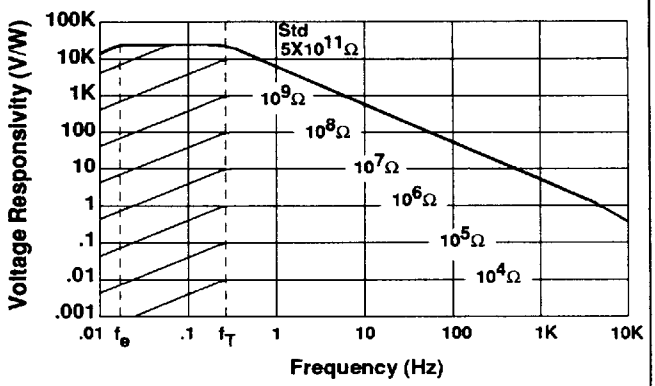



## Model 404 Pin Connections

| Pin | Detector | Detector with Voltage Mode Amplifier | Detector with Current Mode Amplifier |
|---|---|---|---|
| 1 | N/C | TO PIN 2 | - VDC |
| 2 | N/C | + VDC | + VDC |
| 3 | N/C | N/C | OUTPUT |
| 4 | OUTPUT | N/C | N/C |
| 5 | N/C | N/C | TO PIN 3 |
| 6 | N/C | OUTPUT | N/C |
| 7 | CASE | CASE | CASE |
| 8 | COMMON | COMMON | COMMON |

## FREQUENCY RESPONSE

**Voltage Mode Operation**




The voltage response of this detector is dependent on the pulse rate or equivalent frequency of input. The frequency response of the detector can be linearized by using a lower value resistor, but at the expense of a lower D*. Load resistor values other than the standard 5 X $10^{11}\Omega$ can be specified.

**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 (<50C°/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 KΩ.

**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 <1mV for voltage mode operation and <20mV 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).

**ELTEC Instruments, Inc. P.O. Box 9610 Daytona Beach, Florida 32120-9610 U.S.A.**
**Tel: (800) 874-7780 Fax: (904) 258-3791**