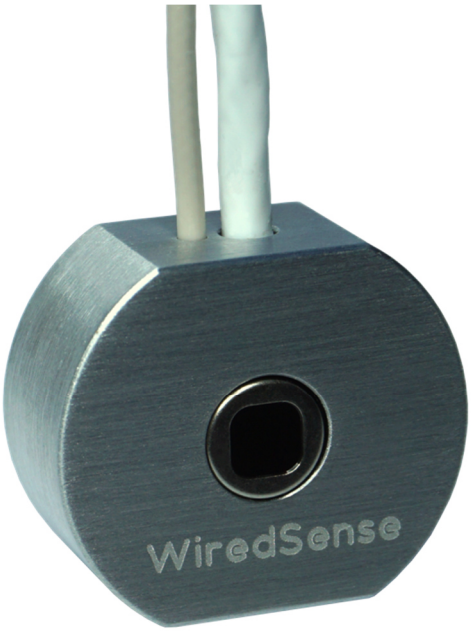
OPERATING MANUAL

SPY

SMALL PYROELECTRIC DETECTOR



WiredSense

Rev. 1.0

Warranty

This product is warranted to be free from defects for one (1) year from the date of initial purchase. Should such defects occur during this period, WiredSense's sole obligation shall be to repair the defective part or product or replace it with a comparable part at its own discretion. Damage caused by normal wear and tear is not covered by this or any other warranty. WiredSense assumes no liability for accidents, injuries, deaths, losses and other claims in connection with or in consequence of the use of this product. In no event shall WiredSense be liable for incidental or consequential damages in connection with or as a result of the use of this product or any part thereof.

Service

In case of repair the product must usually be sent in to WiredSense. If you have any questions about product defects, before returning them please contact us by e-mail at service@wiredsense.com.

Scope of Delivery

- SPY detector with attached cables
- Linear low noise power supply (Thorlabs LDS12B)
- Power cord for your country
- M4 set screw and washer made from PEEK for mounting

Vacuum version:

- Vacuum feedthrough: Lemo SWH.1S.304.CLLDV
- Power supply adapter cable with Lemo FFA.1S.304.CLAC42

Non-vacuum version:

- Power supply adapter cable with Lemo PCA.1S.304.CLLC42

Information in this document is subject to change without notice.

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1. General information

Pyroelectricity is a property of certain crystalline materials which generate a voltage when their temperature is changed. Thus, in a pyro-electric sensor even tiny temperature changes ΔT generate electrical signals that can be further amplified and evaluated electronically. Since the measured signal is proportional to the incident heat, pyroelectric detectors respond in a broad frequency range and can be used for the detection of long wavelength light (MIR, THz) as well as for visible and UV light.

In the detectors of the SPY series, this principle is used for highly sensitive radiation detection. The amplified thermoelectric signal can be evaluated using an analog-to-digital converter, an oscilloscope or a lock-in amplifier.

The SPY contains highly sensitive and fast amplification electronics and the **circuit board may never be touched** because moisture and grease on fingers will deteriorate the performance of the detector. In order to guarantee long-term reliability, we strongly recommend **not to open the rear panel of the detector housing**.

2. Handling Information

2.1 Assembly

Figure 1 displays the correct cabling of all components.

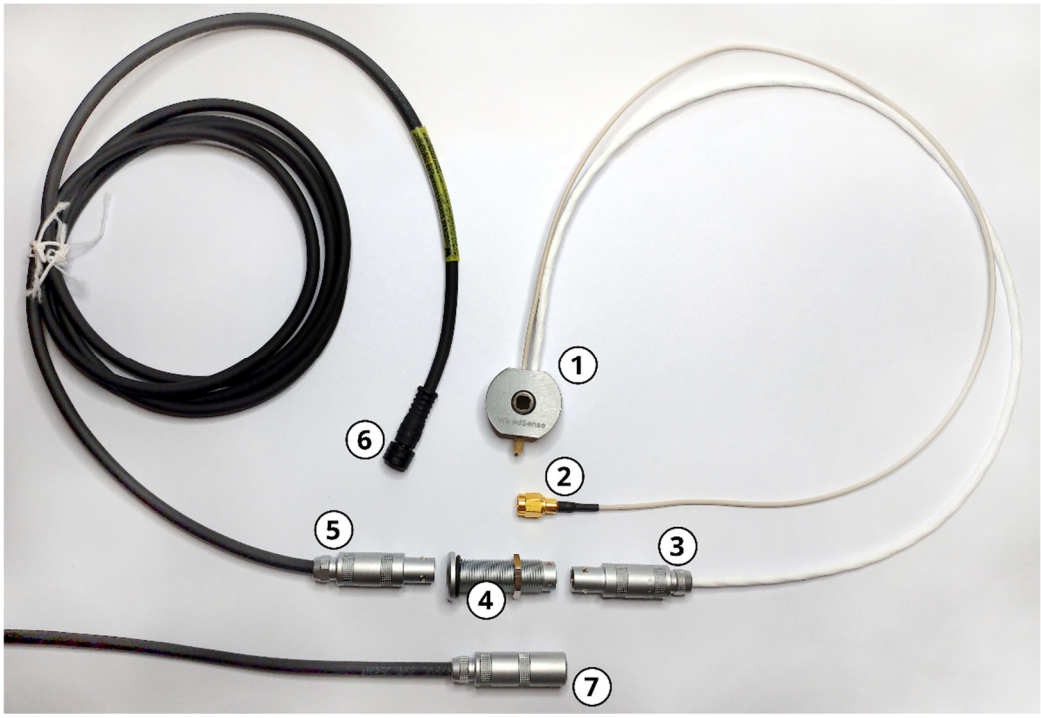

FIGURE 1: SCHEMATIC OF THE DETECTOR SPY ASSEMBLY

1. Vacuum compatible SPY-detector with HRFZ-Si window
2. Male SMA connector with detector output signal (note: a feedthrough for this is not contained in the delivery but can be obtained as a standard part from multiple suppliers.)
3. LEMO power plug connector (type: FFA.1S.304.CLAC42)
4. Vacuum power feedthrough (type: SWH.1S.304.CLLDV) with O-ring for installation in a vacuum chamber.
5. LEMO power plug power connector (type: FFA.1S.304.CLAC42) for use with vacuum feedthrough (ambient pressure side).
6. M8 plug for connection to power supply. The LDS12B power supply is not displayed but contained in the delivery.
7. Additional power cable with LEMO socket (type: PCA.1S.304.CLLC42). This can be used instead of the vacuum feedthrough (4) and connector (5) in case the detector is used outside the vacuum chamber. It is only included in the non-vacuum version where (4) and (5) are not needed.

2.2 Set-up and connection to the oscilloscope

<u>Important Notice:</u> Please check that the line voltage, as indicated on the rear of the power supply, matches your local AC mains voltage before plugging the unit it.

The detectors of the SPY-series are activated by switching the power supply to the "I" position (On). Immediately, temperature changes at the sensor head are output as an electrical signal via the male SMA plug. For optimum decoupling of the detector from electrical ambient noise, the supplied setscrew and washer made of PEEK should be used for mounting.

An oscilloscope should be connected to the SPY-detector with an input resistance of 1 MΩ via a 50 Ohm SMA-cable (not included) and an appropriate vacuum feedthrough (also not included). Furthermore, the oscilloscope should be triggered on the heat source irradiating the detector (e.g. the laser or chopper).

Please note that continuous sources cannot be measured as only temperature changes can be detected by the detector. Therefore, a pulsed source or a chopper are necessary.

Please also note the frequency dependence of the responsivity (Figure 1). The SPY detector has the highest sensitivity at a signal frequency < 100 Hz. Sensitivity decreases strongly at higher frequencies.

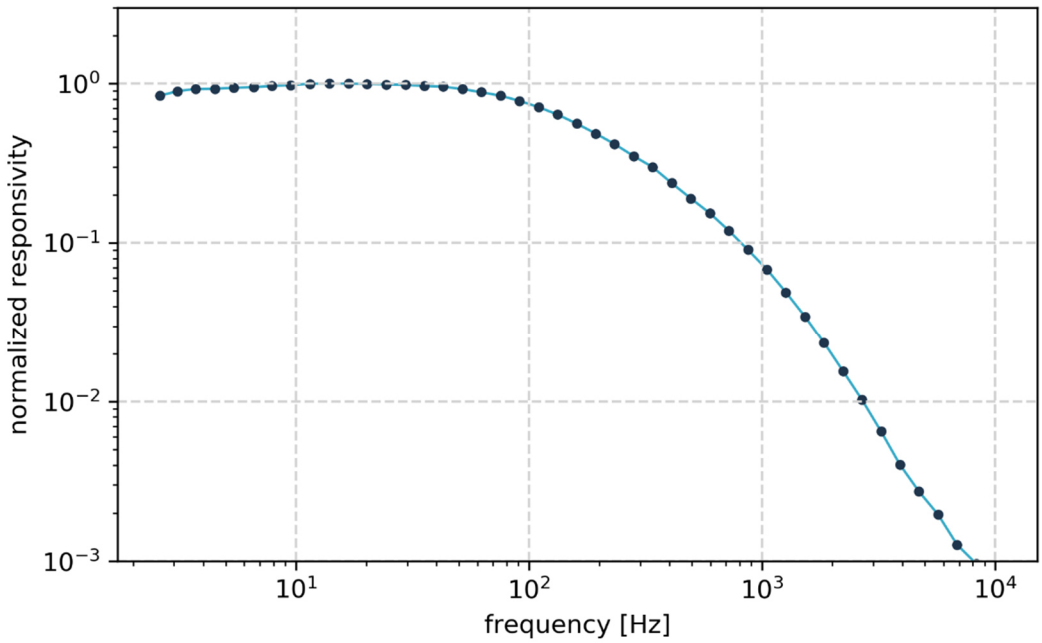

FIGURE 1: FREQUENCY DEPENDENCE OF RESPONSIVITY OF THE SPY-DETECTOR

3. Signal analysis

When used with the oscilloscope, an image similar to Figure 3 should appear. A positive change in IR flux is resulting in a negative signal. The amplitude of the signal (peak-to-peak or rms) is proportional to the radiated heat (Figure 4).

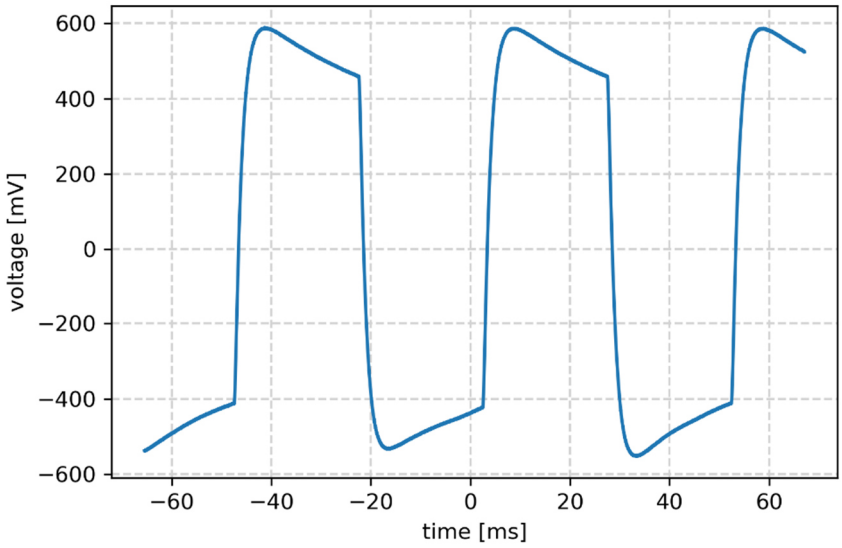

FIGURE 3: TYPICAL OSCILLOSCOPE TRACE OF THE SPY-DETECTOR AT 20 HZ

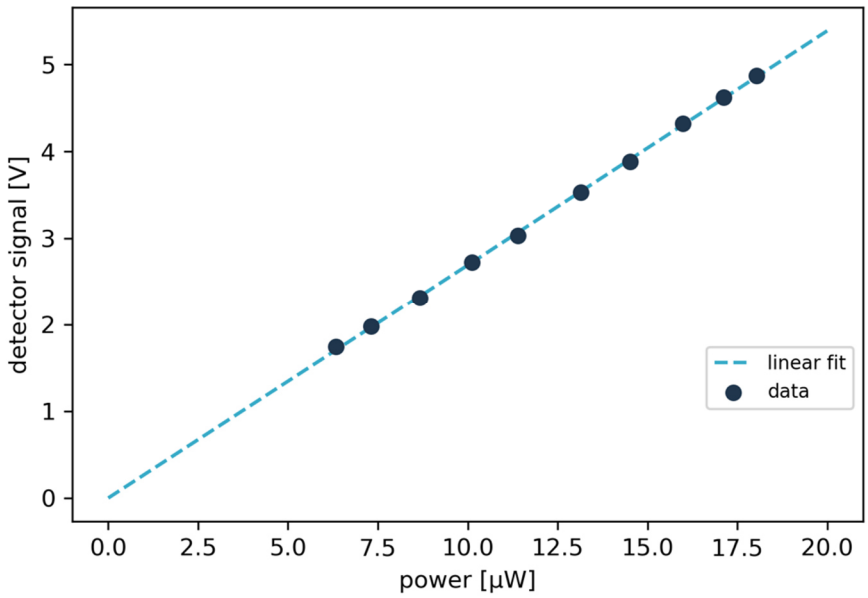

FIGURE 4: LINEARITY OF THE AMPLITUDE SIGNAL VS. INCIDENT POWER

4. Problem solving

4.1 General remarks about the power supply

The Lemo-plug of the adapter cable connected to the power supply should have the following connector voltages. If you can, make sure these voltages are present at the respective connector, the power supply is working properly.

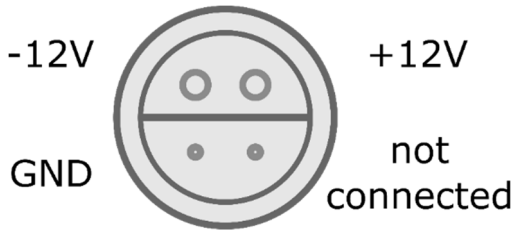

Figure 5: Schematic of Lemo plug type FFA.1S.304.CLAC42 on the power supply

4.2 Only a zero line appears on the oscilloscope

First make sure that the detector power supply is switched on and working properly (see 4.1). Check the connection between oscilloscope and detector again with a suitable SMA-cable and feedthrough and set a high-impedance input resistance on the oscilloscope (e.g. 1MΩ). Now switch the oscilloscope to a higher sensitivity (e.g. 5 mV/div). Move your hand up and down in front of the detector in a distance of about 10 cm. The resulting heat change on the detector is sufficient to generate a large signal. If you do not see a signal here, please contact service@wiredsense.com and describe your problem. We are glad to assist you.

4.3 The oscilloscope trace moves very irregularly with the signal

Especially with high-frequency signals (from 10kHz) and low signal levels, low-frequency thermal influences can interfere with the measurement. For example, if you put your hand near the detector, the signal can be much higher than the signal to be measured. In this case, the AC coupling of the oscilloscope input must be used. If your oscilloscope does not have an AC input, you can use a commercially available high-pass filter between detector and oscilloscope.