

COPY

Technical Description



Golay Cell – Manual (SN: 160735)

Figure 2



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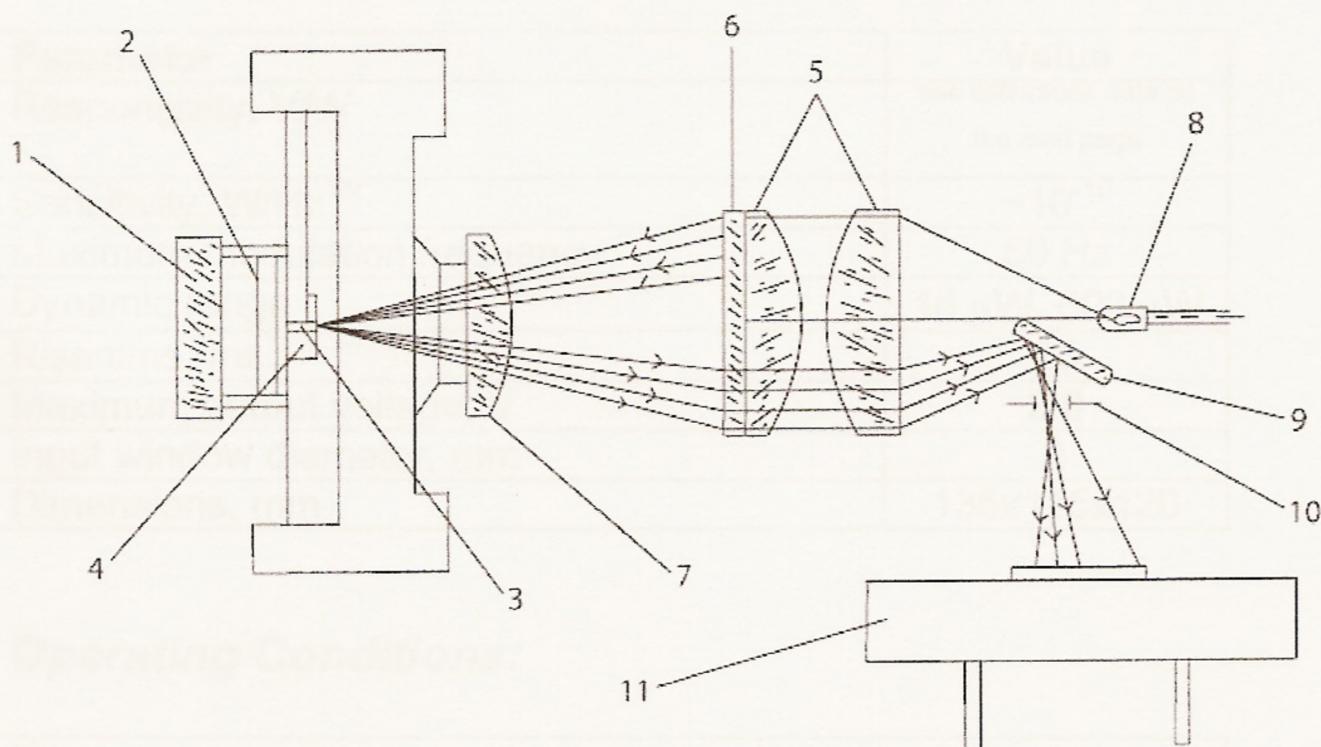
Technical Description

This detector was invented by M.J.E. Golay in 1947. It quickly came to wide use because it operates at room temperature and is sensitive, with good efficiency, to a wide range of wavelengths.

The Golay Cell detector is a sensitive photo-acoustic device coupled to the input beam via a 6mm diameter polyethylene window. It is designed to respond to signals at wavelengths in the range from $20\mu\text{m}$ up to a few millimeters. Alternative window materials can also be used to extend the wavelength range to approximately $1\mu\text{m}$.

The unit contains a sealed, gas-filled absorbing chamber, and optical microphone section, and a preamplifier. A sketch showing the optical arrangement is given in **Figure 1**. The basic component parts of the detector are numbered. The following notes on basic operation refer to this numbering system.

Figure 2



Modulated signal incident upon the window of the device (1) passes onto a semi-transparent film (2) located in the center of a sealed chamber. The energy absorbed in the film serves to heat the gas in the chamber, causing the pressure to rise. The pressure changes distort the shape of the membrane forming the wall of the chamber (4).

A light emitting diode (LED) (8) emits through re-focussing optics (5) and onto the mirrored back surface of the chamber containing the absorbing membrane. This radiation is reflected back through the lower half of the optics via a grating (10); as shown in the diagram and re-focussed onto a photodiode (11). The degree of illumination of the photodiode by radiation from the LED is a function of the shape of the front chamber.

A preamplification circuit is included in the device. This is based on an operational amplifier and double FET circuit which converts the output from the photodiode into a useful AC voltage output.

Product Description and Specifications

Golay Cell is an opto-acoustic detector designed for operation in the spectral range 0.2-20 THz

It is equipped with a 6 mm diameter polyethylene input window that provides for high transparency at frequencies up to 20 THz.

Golay Cell includes a build-in preamplifier.

Operation of a Golay Cell requires a three-unit power supply delivering the following: +15 V, - 15 V and 32 mA. Such a power supply is also available as an option

Performance of Golay Cells is detrimentally affected by mechanical vibrations. In order to reduce the impact of mechanical vibrations, Golay Cells can be mounted on vibration-isolation bases.

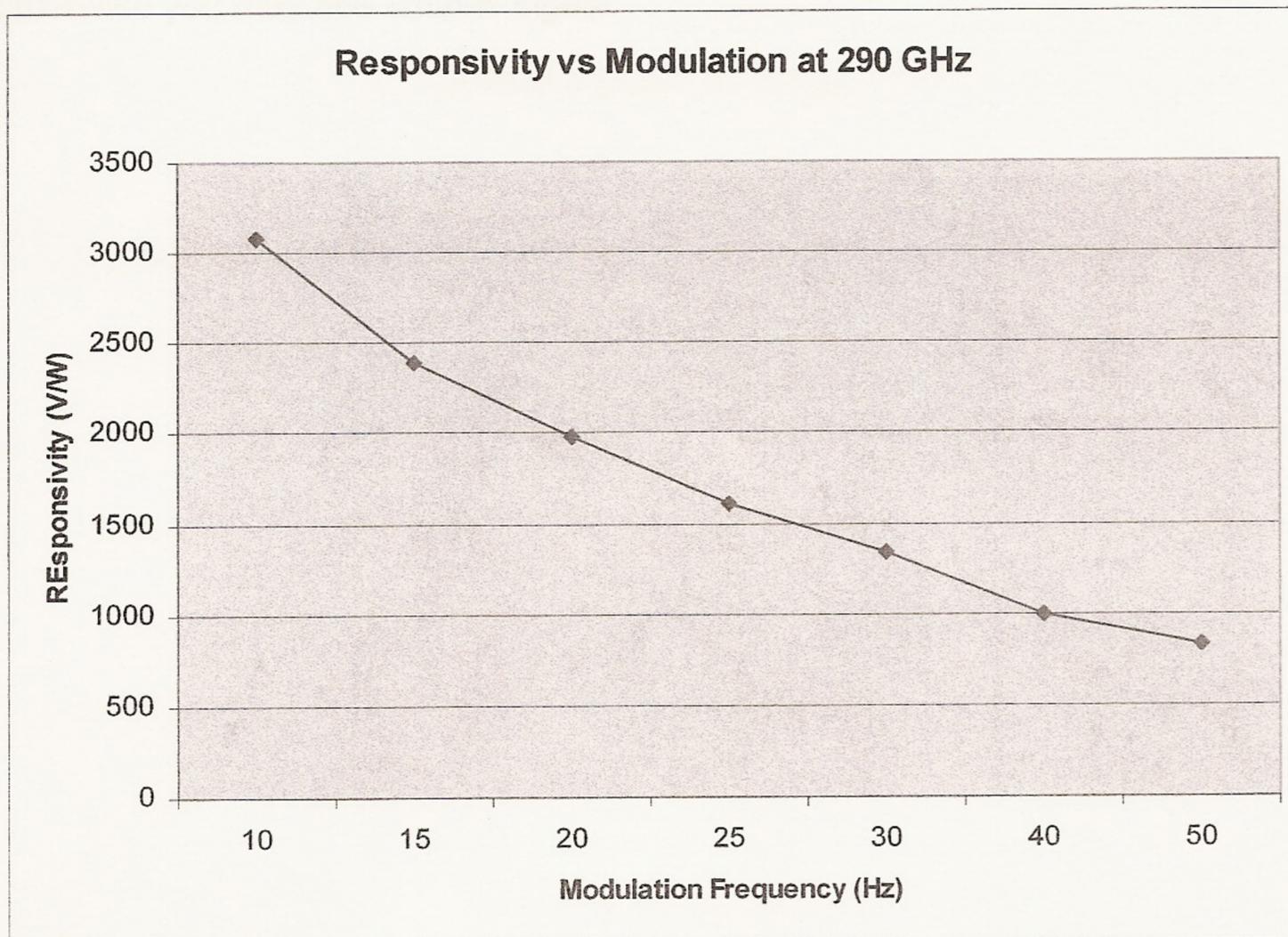
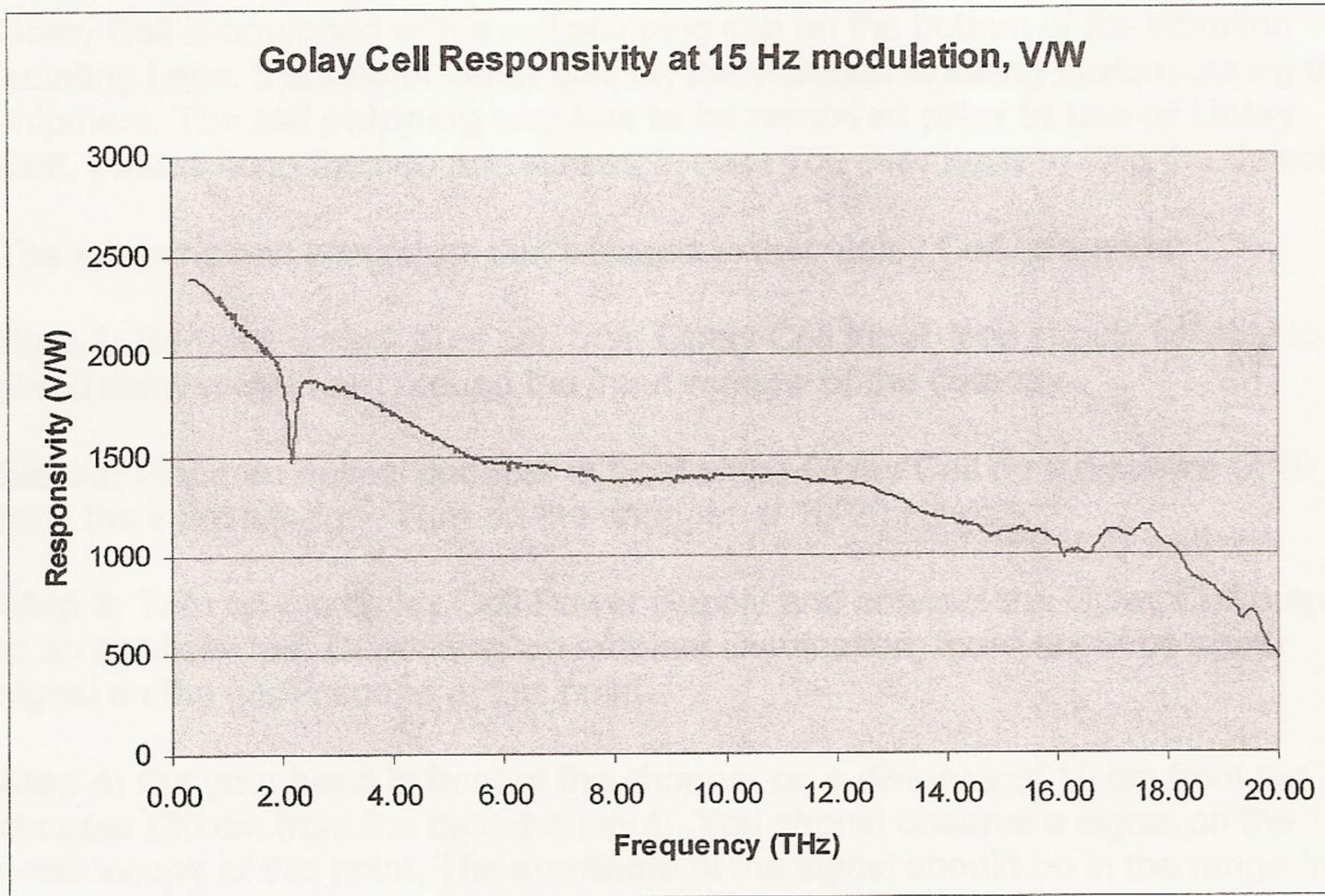
Technical Specifications:

| Parameter | Value |
|----------------------------------|---------------------------------------|
| Responsivity, V/W | see calibration data on the next page |
| Sensitivity, W/Hz ^{1/2} | ~10 ⁻¹⁰ |
| Maximum modulation frequency | 50 Hz |
| Dynamic range | 16 μW- 600 μW |
| Rise time, ms | 25 |
| Maximum output voltage, V | 2.0 |
| Input window diameter, mm | 6 |
| Dimensions, mm | 135x115x120 |

Operating Conditions:

| Parameter | Value |
|-----------------|---|
| Temperature, °C | +15 to +25 |
| Pressure, Pa | 8.4x10 ⁴ to 10.7 x 10 ⁴ |
| Humidity, % | 45 - 80 |

Calibration Data for Golay Cell SN: 16073



Installation and Test Procedure

Golay Cell is equipped with a red shipping cap on the bottom of the vibration isolating base. It supports Golay Cell on the vibration isolating system during the shipment. **The red shipping cap has to be removed prior to use of Golay Cell.** Please keep the cap and screws in case you ever have to ship the detector.

The following test procedure can be used to test Golay Cell operation:

Step 1: Remove a back dust cap from Golay Cell input. You should be able to see a shiny metal horn around the input window of the detector.

Step 2: Place an optical chopper in front of the Golay Cell on a distance of 10 cm from the input window. Turn on the chopper at 10-20 Hz rate.

Step 3: Turn on the Golay Cell Power Supply and connect the Golay Cell output to an oscilloscope. Depending on ambient illumination, there might be some signal on the oscilloscope at this point.

Step 4: Put your hand in front of the chopper on a distance of 10 cm from the chopper (20 cm from the detector input). You should observe a signal on the oscilloscope at this point. The amplitude of the signal should be in the range from 100 mV to 300 mV peak-to-peak.

Make sure that chopper blade is large enough to completely cover your hand, otherwise you may see smaller signal.