Boston Electronics

gentec-eo
PARTNERS for ACCURACY

THz Detectors - Pyroelectric
&
Power Measurement Instruments

www.boselec.com | shop.boselec.com | thz@boselec.com | +1 617-566-3821

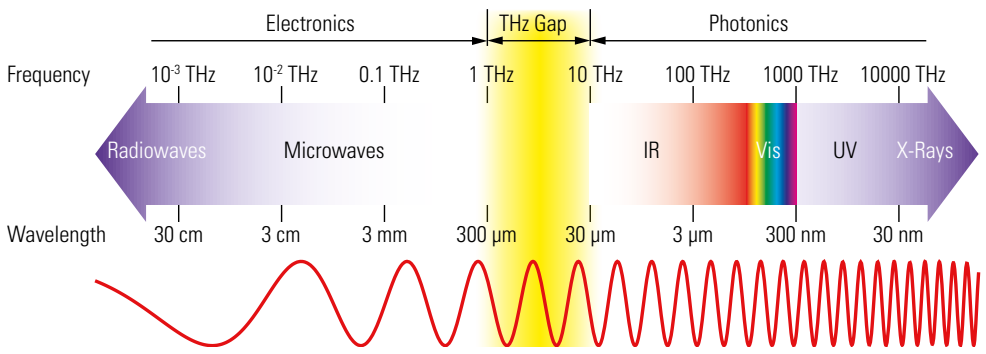
TERAHERTZ DETECTORS

Overview of the different models

Boston Electronics

WHAT IS TERAHERTZ RADIATION?

The THz portion of the electromagnetic spectrum fills the gap between the far infrared and the microwaves. More precisely, it is nestled between the high-frequency edge of the microwave band, 300 GHz (3×1011 Hz), and the long-wavelength edge of far-infrared light, 3000 GHz (3×1012 Hz or 3 THz). In wavelengths, this range corresponds to 0.1 mm (or 100 µm) infrared to 1.0 mm microwave. The THz band is set in the region where electromagnetic physics can best be described by its wave-like characteristics (microwave) and its particle-like characteristics (infrared).



WHAT IS IT USED FOR?

THz radiation is interesting because of the way it interacts with matter:

- It can penetrate things like wood, plastics, clothing, and other materials.
- It is also absorbed by water, or a material that contains water, like human skin.
- It is non-ionizing and therefore not harmful to humans like X-rays can be.

One of the first uses is the “full body scan” used at airports. It also has uses in medical applications for early detection of cancer cells.

HOW IS IT MEASURED?

THz sources range in power from nW to mW and in energy from nJ to mJ. Like most electromagnetic sources, they must be characterized for performance and/or control.

Older THz detection methods include:

- Golay cells
- Microbolometers
- Electronic antennas

Newer THz detection methods include:

- Pyroelectric detectors
- Schottky diode detectors
- Photoacoustic detectors

WHY ARE GENTEC-EO PRODUCTS BETTER?

Golay cells are large, fragile, costly and have a limited measurement range.

Pyroelectric detectors (like the ones used in our THZ detectors) are small, sensitive, durable and less costly. Some of their advantages are:

- High performance in a small package
- Broad spectral response (from 0.25 to 3000 µm)
- Wide dynamic range (from nW to mW)
- Rugged and durable
- Very cost-effective

www.boselec.com | shop.boselec.com | thz@boselec.com | 617 566 3821

TERAHERTZ DETECTORS

Overview of the different models

We have a unique line of sensors and meters for the terahertz region. You can choose either a standalone device with on-board electronics or go with our T-Rad meter and a separate sensor. We also have small terahertz detectors that come as discrete pyroelectric units for integration.

THZ-B

- Large apertures: 5 mm and 9 mm Ø
- Wide dynamic range: 50 nW to 200 mW
- Choice between analog and digital versions
- User-friendly software (when used with the T-Rad module)

WORKS WITH OUR T-RAD AND T-RAD-ANALOG MODULES

THZ-I-BNC

- Sensitive 5-mm detector integrated with low-noise amplifier
- Wide dynamic range from nW to µW
- Battery or AC powered
- Compatible with an oscilloscope or lock-in amplifier

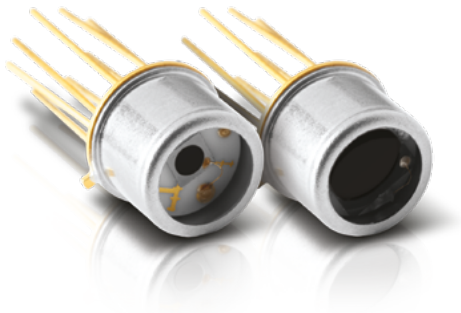
INTEGRATED BNC MODULE

THZ-D

- Flat spectral response: Get the best precision accross the entire THz range
- Works with our standard universal displays & PC interfaces.
- Large apertures of 9 and 12 mm Ø

FLATEST SPECTRAL RESPONSE IN THE THZ

WORKS WITH OUR STANDARD DISPLAYS & PC INTERFACES



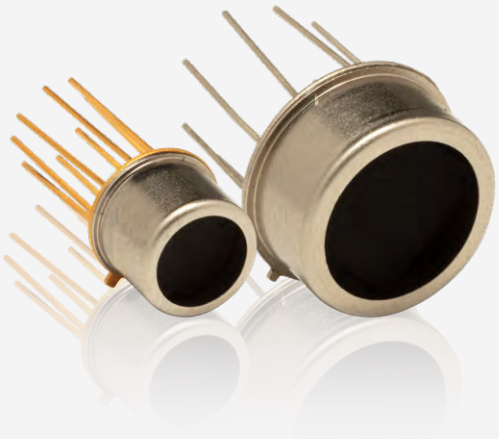
QS-THZ

- Easily integrated into a THz measurement instrument or set-up
- Small TO5/TO8 packages
- Available in 2 sizes: 5 and 9 mm Ø apertures
- Wide dynamic range from nW to mW
- Plug-and-play with QS-I-TEST evaluation test box

DISCRETE PYROELECTRIC DETECTORS

QS-THZ
Hybrid THz detectors

Boston Electronics



* Pictures for indicative purposes only

PERMANENT IR WINDOW OPTIONS

Every model can be fitted with a permanent IR window to narrow the wavelength range:

- S5/8: sapphire (0.3 - 4.5 and 100 - 1000 µm)
- Q5/8: quartz (0.25 - 3.0 and 50 - 1000 µm)
- Si5/8: silicon (1.2 - 8.0 and 50 - 1000 µm)

KEY FEATURES

RELATIVE MEASUREMENTS FROM 0.1 TO 30 THZ
Broadband, room temperature operation, easier to use and less expensive than a Golay cell

EASY TO INTEGRATE FORMAT
TO5 and TO8 packages make the QS-THZ detectors small and easy to integrate in an existing system

SEVERAL SENSOR SIZES AVAILABLE
Choice of 5 and 9 mm Ø

CALIBRATED AT 0.63 µm
All THz detectors are calibrated at a single wavelength (0.63 µm) and include a typical wavelength correction data from 0.25 to 440 µm. They are used for relative measurements outside that range.

TEST BOX AVAILABLE
Can be used with our QS-I-TEST test box which provides mounting and power supply

ACCESSORIES

QS-I-Test evaluation test box

Permanent IR Windows (Various types available)

SDC-500 digital optical chopper

Pelican carrying case

QS-THZ
Specifications

CE NIST* Traceable WEEE/RoHS COMPLIANT

*Also traceable to NRC-CNRC

	QS5-THZ-BL	QS9-THZ-BL
VOLTAGE RESPONSIVITY	120 kV/W	30 kV/W
EFFECTIVE APERTURE	5 mm Ø	9 mm Ø
PACKAGE	TO5	TO8
MEASUREMENT CAPABILITY		
Spectral range [a]		
Frequency	0.1 - 30 THz	0.1 - 30 THz
Wavelength	3000 - 10 µm	3000 - 10 µm
Max power density	50 mW/cm²	50 mW/cm²
Noise equivalent power	1 nW	3 nW
Detectivity [b]	4.10^8 cm(Hz)^{½} /W	$2.7.10^8$ cm(Hz)^{½} /W
Voltage responsivity [b]	120 kV/W	30 kV/W
PHYSICAL CHARACTERISTICS		
Effective aperture	5 mm Ø	9 mm Ø
Package	TO5	TO8
Sensor	Pyroelectric	Pyroelectric
Absorber	BL	BL
Dimensions (excluding pins)	9.1Ø x 6.4D mm	15.2Ø x 6.4D mm
Weight	45 g	45 g
ORDERING INFORMATION		
Product page		

a. Projected Spectral Range.
From 10 to 440 µm, spectrometer measurement.
From 440 to 3000 µm, relative measurement only.
This spectral range is subject to change.
b. 630 nm, 5 Hz

QS-I-TEST EVALUATION TEST BOX

	QS-I-TEST
Batteries	+9V/-9V
R_f resistors	105 - 1010 Ω
C_f compensating	YES
Package	101.6H x 127W x 58.4D
Optical mount	¼-20 threaded
Front bezel	SM1 (1.035-40)
Product number	201693

** For details, contact your Gentec-EO representative*

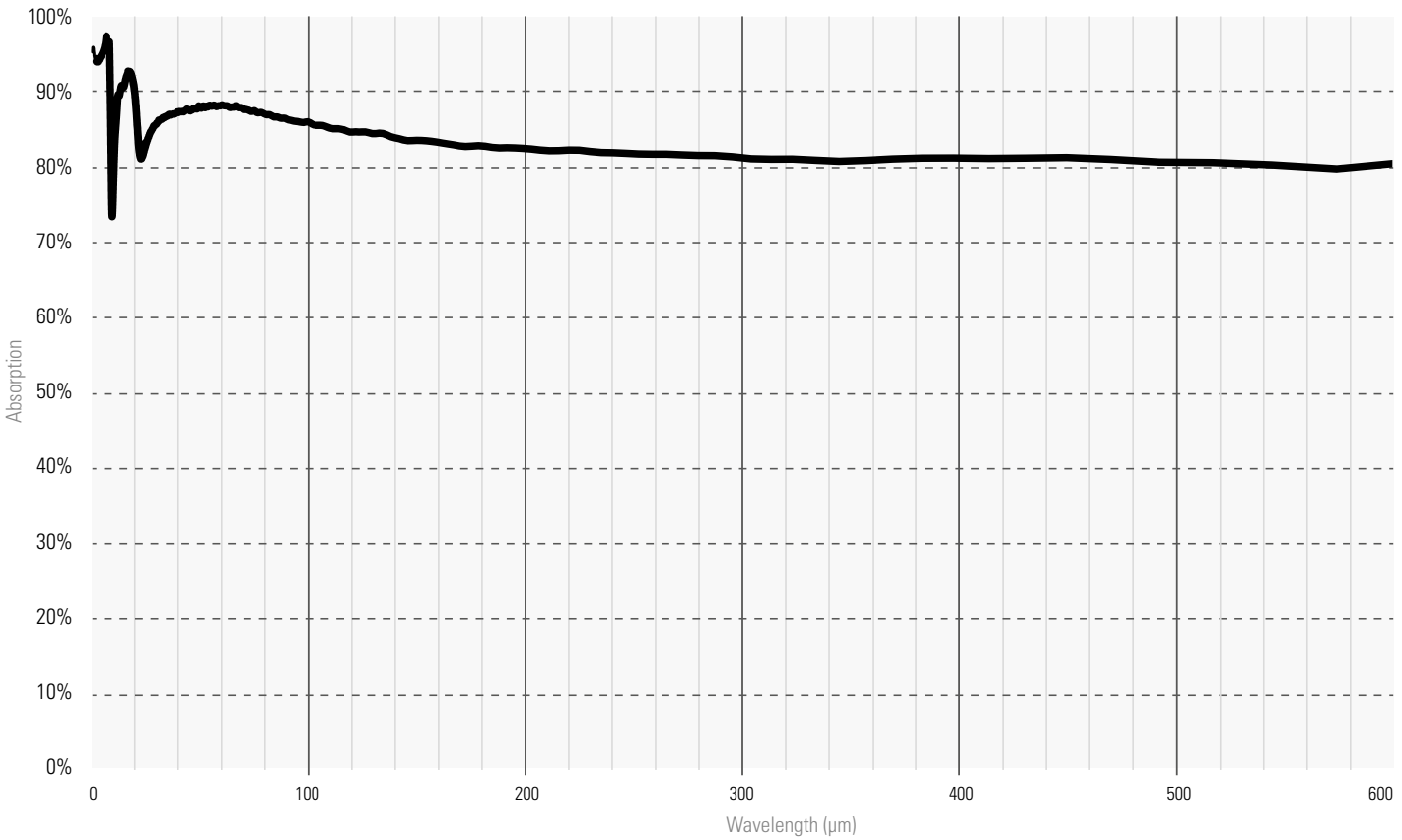
T 418.651.8003 | info@gentec-eo.com

ABSORPTION CURVES

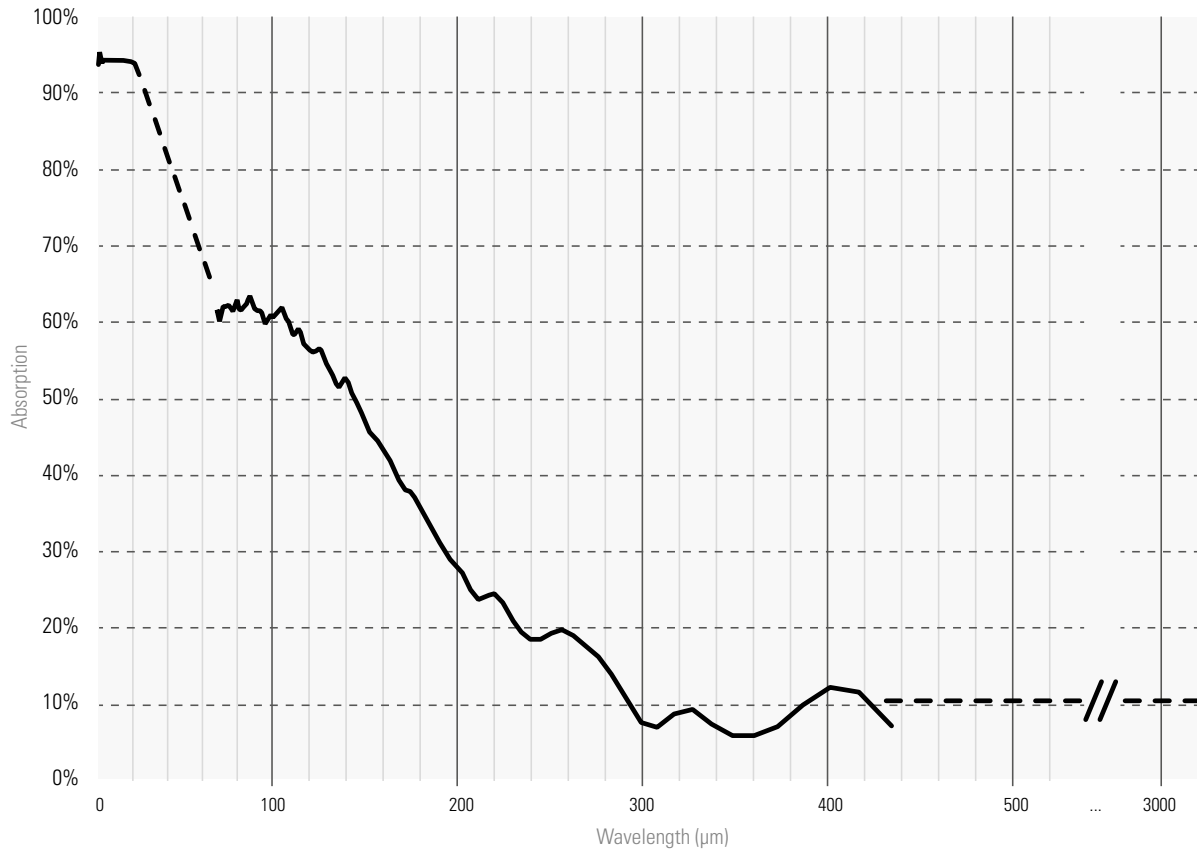
Specifications

Boston Electronics

VP ABSORBER



THZ-BL, THZ-I-BL & QS-THZ-BL



QS
Discrete pyroelectric sensors

Boston Electronics

OUTPUT OPTIONS

CHOOSE YOUR CONFIGURATION

- QS-L: Passive discrete pyroelectric detectors with thermally isolated crystal for high sensitivity (low noise) at low frequencies
- QS-H: Passive discrete pyroelectric detectors with heat sink for high average power and high frequency operation
- QS-IL: Current-mode hybrid sensors designed for high sensitivity, low bandwidth applications

SEVERAL IR WINDOWS IN OPTION

- Quartz: 0.2 - 3.0 µm
- Barium fluoride: 0.2 - 17.5 µm
- Sapphire: 0.1 - 7.0 µm
- Silicon: 1.1 - 9.0 µm and 50 - 1000 µm
- AR germanium: 8 - 14 µm

KEY FEATURES

BROAD SPECTRAL RESPONSE
From 0.1 to 1000 µm

EASY TO INTEGRATE FORMAT
TO5 and TO8 packages make the QS detectors small and easy to integrate in an existing system

LARGE AREA SENSORS
5 mm Ø and 9 mm Ø diameter pyroelectric sensors make optical alignment easier.

TEST BOX AVAILABLE
Can be used with our QS-I-TEST test box which provides mounting and power supply

ROOM-TEMPERATURE OPERATION

FAST RESPONSE

ACCESSORIES

QS-I-TEST
Evaluation test box (current)

Permanent IR windows
(Various types available)

Pelican carrying case

QS-I-TEST EVALUATION TEST BOX

	QS-I-TEST
Batteries	+9 V / -9 V
R_f resistors	10^5 - 10^{10} Ω
C_f compensating	Yes
Package	101.6H x 127L x 58.4P
Optical mount	¼-20 threaded
Front bezel	SM1 (1.035-40)
Product number	201693

** For details, contact your Gentec-EO representative*

QS
Specifications

CE NIST* Traceable WEEE/RoHS COMPLIANT

*Also traceable to NRC-CNRC

	QS5-L	QS9-L	QS5-H	QS9-H	QS5-IL	QS9-IL
MAX AVERAGE POWER	50 mW	50 mW	500 mW	500 mW	50 mW	50 mW
EFFECTIVE APERTURE	5 mm Ø	9 mm Ø	5 mm Ø	9 mm Ø	5 mm Ø	9 mm Ø
PACKAGE	TO5	TO8	TO5	TO8	TO5	TO8
MEASUREMENT CAPABILITY						
Spectral range	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm
Max average power	50 mW	50 mW	500 mW	500 mW	50 mW	50 mW
Noise equivalent power[a]	N/A	N/A	N/A	N/A	6x10-9 W/(Hz)$^{1/2}$	6x10-9 W/(Hz)$^{1/2}$
Detectivity[a]	N/A	N/A	N/A	N/A	7.0x107 cm(Hz)$^{1/2}$/W	1.3x107 cm(Hz)$^{1/2}$/W
Capacitance (at 1000 Hz)	90 pF	250 pF	90 pF	250 pF	90 pF	250 pF
Current responsivity (at 630 nm)	0.25 µA/W	0.25 µA/W	0.25 µA/W	0.25 µA/W	0.25 µA/W	0.25 µA/W
Voltage responsivity[b]	N/A	N/A	N/A	N/A	13 kV/W	13 kV/W
Thermal frequency (3 dB)	0.5 Hz	0.25 Hz	5 Hz	5 Hz	0.5 Hz	0.25 Hz
Temperature coefficient	0.2 %/°C	0.2 %/°C	0.2 %/°C	0.2 %/°C	N/A	N/A
Feedback resistor	100 GΩ	100 GΩ	100 GΩ	100 GΩ	100 GΩ	100 GΩ
Supply voltage	± 5 TO ± 12 V	± 5 TO ± 12 V	± 5 TO ± 12 V	± 5 TO ± 12 V	± 5 TO ± 12 V	± 5 TO ± 12 V
PHYSICAL CHARACTERISTICS						
Effective aperture	5 mm Ø	9 mm Ø	5 mm Ø	9 mm Ø	5 mm Ø	9 mm Ø
Package	TO5	TO8	TO5	TO8	TO5	TO8
Sensor	Pyroelectric	Pyroelectric	Pyroelectric	Pyroelectric	Pyroelectric	Pyroelectric
Absorber	MT	MT	MT	MT	MT	MT
Dimensions	9.1Ø x 6.4D mm	15.2Ø x 6.4D mm	9.1Ø x 6.4D mm	15.2Ø x 6.4D mm	9.1Ø x 6.4D mm	15.2Ø x 6.4D mm
Weight	1.0 g	1.5 g	1.0 g	1.5 g	1.0 g	1.5 g
ORDERING INFORMATION						
Product page						

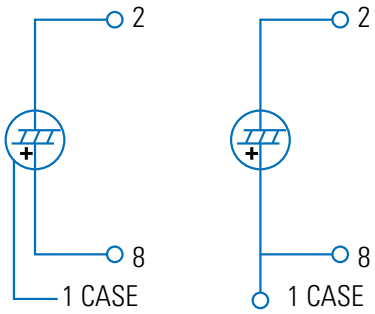
a. 630 nm, 5 Hz, 1 Hz bandwidth
b. 630 nm, 15 Hz

Specifications are subject to change without notice

T 418.651.8003 | info@gentec-eo.com

PYROELECTRIC THERMAL DETECTORS

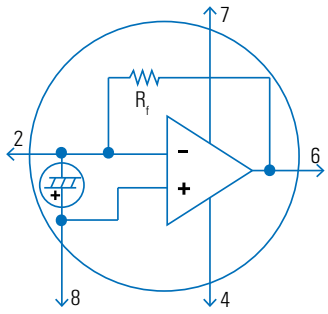
Our pyroelectric detectors are a class of room temperature thermal detectors that produce a current output that is directly proportional to the rate of change of temperature when exposed to a source of radiation. They are best described by an AC current source, capacitor and resistor. Their current output is governed by the equation ***I = p(T)·A·dT/dt,*** where ***I*** is current, ***p(T)*** is the pyro coefficient, ***A*** is the area as defined by the front electrode, and ***dT/dt*** is the rate of temperature change of the pyro crystal. The advantages of a pyroelectric detector over other IR detectors are: room temperature operation, broad spectral response, high sensitivity (D*) and fast response (sub-ns into 50 Ω).



QS-L (left) and QS-H (right) pin-outs

QS-L AND QS-H DISCRETE PYROS

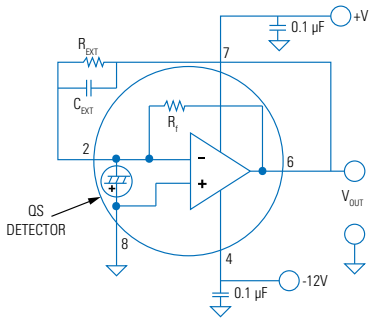
Our passive discrete pyroelectric detectors range from 5 to 9 mm in diameter and are provided in two configurations: high sensitivity or high average power. They present a pyroelectric detector element covered with our metallic coating (MT) and are packaged in a miniature TO-5 or TO-8 can. The diagram shown left identifies the pin-out for both types of detectors. Our organic black coating (BL), increases the optical absorption and helps flatten the spectral response. We also offer a number of permanent IR Windows that can be added to the TO can. These discrete pyro detectors are ideal for pulsed laser applications.



QS-IL pin-out

QS-IL CURRENT MODE HYBRID PYROS

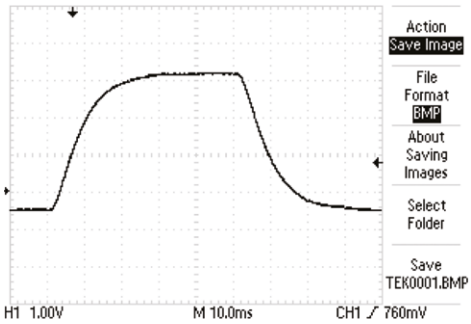
These detectors offer high gain (>10^5 V/W) and/or high bandwidth (>10 MHz). In this configuration, the pyroelectric detector element is combined to a low noise operational amplifier. The QS-IL models are designed for high performance at low to medium frequencies. These detectors are very easy to use. Simply supply the +/- 10 to 15 V to power the operational amplifier and add an external resistor, if required, to adjust the bandwidth and you are ready to measure pulsed, modulated or chopped sources, from nJ to mJ and nW to W. These detectors also make great candidates for any variety of broadband analytical instruments or laser measurement products.



QS-IL circuitry

VOLTAGE OUTPUT VS. FREQUENCY

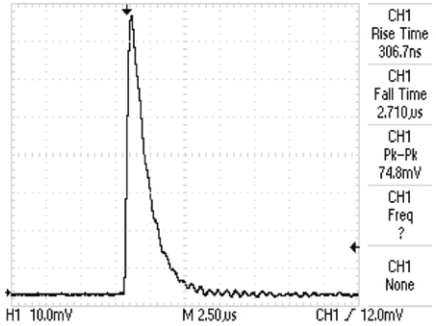
Our QS-IL hybrid detectors are designed to maximize voltage output at low frequencies and therefore include load and feedback resistors in the 100 GΩ to 300 GΩ range. They are also designed into 8-pin TO packages that allow the addition of an "external resistor" to lower the output and increase the bandwidth. The circuit diagram at the left shows a typical hook up for our QS5-IL detector (with our MT coating), using external resistors and capacitors.



Typical QS-IL voltage output in power measurement mMode

OPERATION IN POWER MEASUREMENT MODE

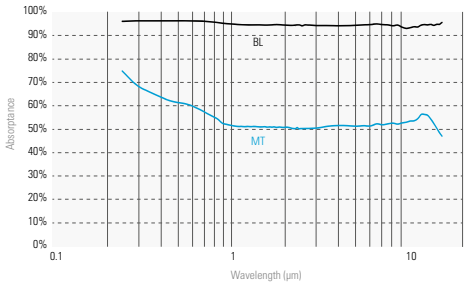
When using our QS-IL hybrid detector to measure the power (in W) of your CW or high repetition rate source (quasi-CW), you will need to employ an optical chopper. The diagram at the left shows the typical voltage output of a QS5-IL when used with our QS-I-TEST evaluation test box. Note that the voltage output is an approximate "square wave" whose rise and fall times are governed by the RC time constant of the circuit. The optical power is directly proportional to the peak voltage minus the baseline voltage. We calibrate these devices when operating in this mode.



Typical QS-IL voltage output in energy measurement mode

OPERATION IN ENERGY MEASUREMENT MODE

Our pyroelectric detectors are an ideal choice when measuring the performance of your pulsed laser in the range of nJ to mJ, across the full spectrum! The scope trace at the left represents the typical output from a QS9-IL, when used with our QS-I-TEST set up as an integrating joulemeter. Note the fast rise to a peak and then slower decay governed by the RC time constant selected for the integrating circuit. In this configuration you can measure absolute pulse energy, rep rate, and pulse-to-pulse stability. The maximum pulse width of your source is determined by the RC time constant you select and there is no limit as to how short the pulse can be!



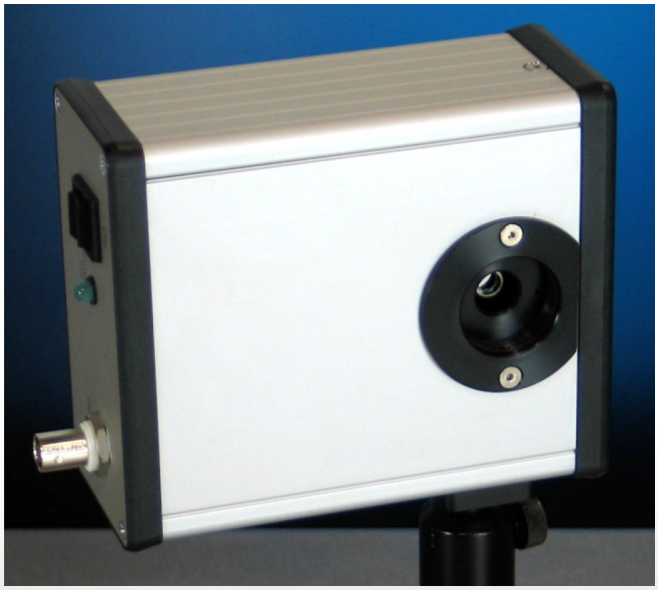
Absorption curves of QS pyroelectric detectors

BROAD SPECTRAL RESPONSE

Unlike photoconductive and photovoltaic detectors, our pyroelectric thermal detectors are not limited to a small part of the electromagnetic spectrum. They are truly broad spectrum detectors, sensitive from 0.1 µm to 3000 µm (EUV, FAR IR, and THz). Any and all radiation absorbed by our coatings or pyro crystal will result in a measurable signal. The two plots at the left show the relative spectral response of detectors with MT and BL coatings. Note that the well documented, NIST traceable calibrated portion of these curves runs from 0.25 µm to 15 µm. There are currently no traceable optical standards for measurements > 15 µm.

TECHNICAL NOTE

QS-I-TEST SPECIFICATIONS



Our **QS-I-TEST Evaluation Test Box** is a handy device that supports the use of our family of QS-IL, QS-IF and QS-THZ Hybrid Pyroelectric Detectors. It includes two 9V batteries that provide low noise power to the current mode circuit in the detector and a convenient analog BNC voltage output. It also includes SM1 threaded front bezel and removable aperture for the addition of optical components like IR windows. Note that the cover must be in place to provide EMI shielding and hold the batteries in place.

It is designed to allow you to plug in one of our many current mode pyroelectric detectors, large or small, add a window or filter, and mount it in your optical set up. You can select one of 6 feedback resistors to change the voltage responsivity and/or response time of the detector simply by moving a jumper between pins. You can add a small capacitor to convert the detector and test box into a Joulemeter (see Application Note 201925 and the picture below).

FEATURES

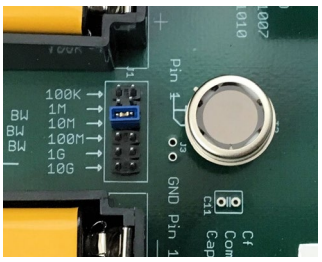
- Designed for use with our broadband pyroelectric detectors: QS-IL, QS-IF and QS-THZ
- Provides power to the detectors and an analog output
- Includes power ON/OFF switch and power on lamp
- Has a 1 inch diameter, threaded front bezel (1.035-40) for easy addition of windows and filters
- Includes a removable, 11 mm front aperture plate
- Bench mount ¼-20 threaded adaptor
- Includes 6 decades of feedback resistors from 100 kΩ to 10 MΩ
- Can add capacitor (C11) to create a Joulemeter or to prevent oscillation in radiometer mode

APPLICATIONS

- Measure Power, nW to mW
- Measure Energy, nJ to mJ
- Use with some of our THz probes
- Measure from 0.1 to 3000 μm with our QS sensors

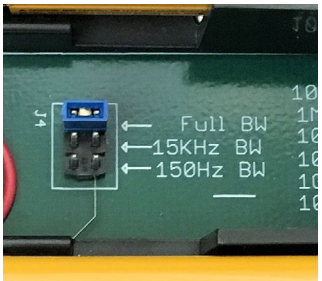
CREATE A JOULEMETER

Add a small (~1.0 pF) capacitor to the PCB at C11 to create and control the Rv in V/J of the test box. Move jumper to select Rf to achieve desired fall time.



MODIFY THE Rv OF THE PYRO DETECTOR

QS-I-TEST includes 6 resistors from 100 KΩ to 10 GΩ which can be selected by moving the blue jumper between the pins provided.

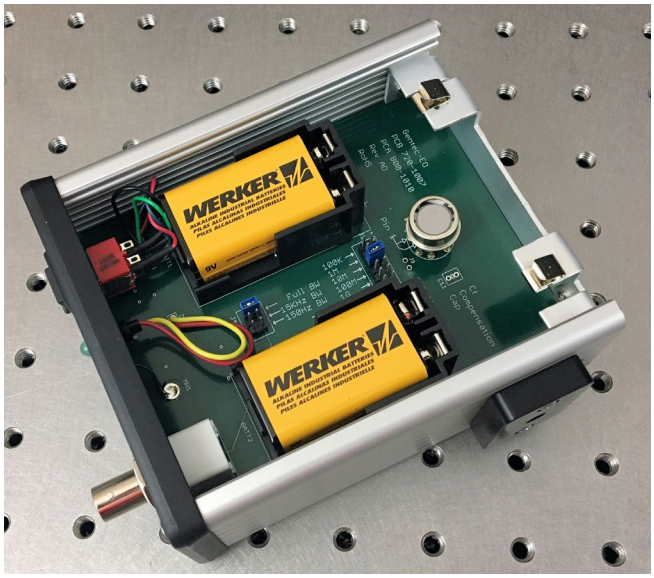


MODIFY THE BANDWIDTH OF THE PYRO DETECTOR

QS-I-TEST includes three bandwidth choices:
150 Hz, 15 kHz, or Full. This is selected by moving the blue jumper on the PC board to the desired position. The jumper must be placed for the testbox to function.

TECHNICAL NOTE

QS-I-TEST WITH TOP REMOVED



To open the QS-I-TEST simply remove the two thumb screws from the end cap and slide the top off. This gives you access to replace batteries and to plug your pyro detector into the PCB. It also lets you get at the "blue jumpers" when modifying the bandwidth and Rv or when adding a capacitor (C11). PIN 2 should be plugged into the PCB when using the jumpers, but left out when not, to achieve the best radiometric performance. When done, slide the top back into the box and add the end cap and screws.

DESCRIPTION	SPECIFICATION
Battery Power	± 9 V
Selectable Rf	10^5-10^{10} Ω
Front Bezel	SM1 thread (1.035-40)
Optical Mounting	¼ -20 threaded hole
Detector Position	1.0 inch from top of the black front bezel
Size	101.6H x 127W x 58.4D mm

COMPATIBLE DETECTORS

Here are the Hybrid Detectors that can be used with **QS-I-TEST**:

- QS1-IL, QS2-IL, QS3-IL, QS5-IL, QS9-IL
- QS1-IF, QS2-IF, QS3-IF, QS5-IF, QS9-IF
- QS2-THZ-BL, QS5-THZ-BL, QS9-THZ-BL

TYPICAL SYSTEM SETUPS

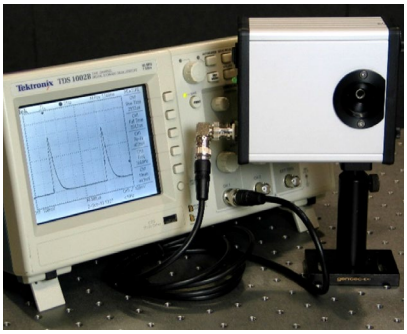


Fig. 1
QS-I-TEST and detector setup in Joulemeter mode for pulse energy measurement (J) of a pulsed source.

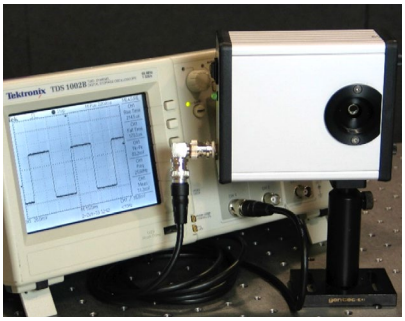


Fig. 2
QS-I-TEST and detector setup in the Radiometric mode for power measurement (W) of a chopped or modulated source.

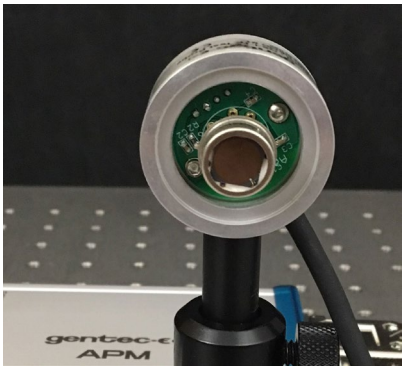
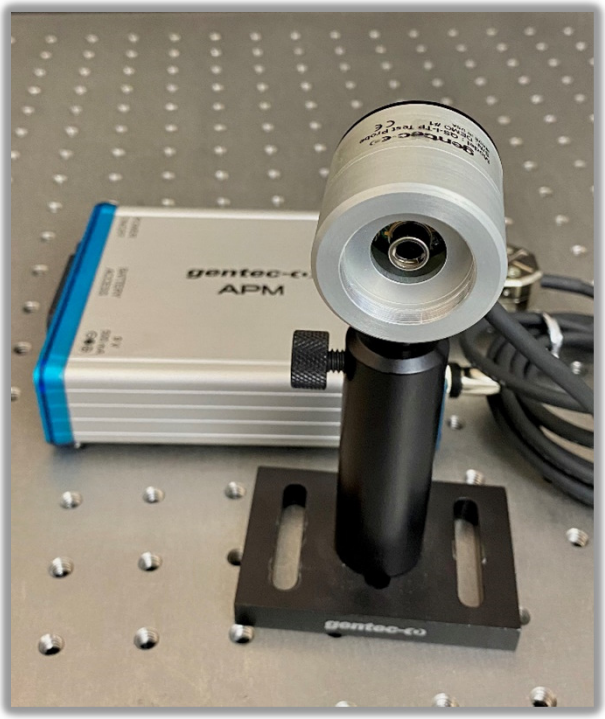


Fig. 3
QS-I-TP Test Probe is an option if the QS-I-TEST is too large for your set up. Notice that it is used with the APM power supply. For more info request a copy of the QS-I-TP data sheet.

BostonElectronics

gentec-eo

PARTNERS for ACCURACY



"Model QS-I-TP Test Probe"

Our new **QS-I-TP** (202430) is a handy device that supports the use of our family of **QSx-IL, QSx-IF** and **QSx-THZ** Hybrid Pyroelectric Detectors. It is similar in function to our QS-I-TEST Evaluation Test Box but in a much smaller package to more easily fit into your optical set up. It is powered by an external analog power supply, Model APM-D (201848B), that allows long term use without concern for battery life.

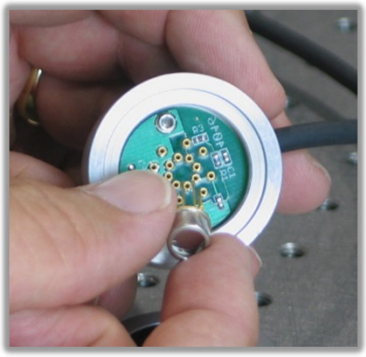
It is designed to allow you to plug in one of our many Pyroelectric detectors. Add a window or filter, mount it in your optical set up, and then plug it into our APM(D) for operation. It can be configured as a sensitive radiometer for power measurements, a joulemeter for pulse energy measurement or a fast detector for temporal measurements of modulated sources. Customization is easy, but you will some surface mount capacitors and resistors and soldering skills.

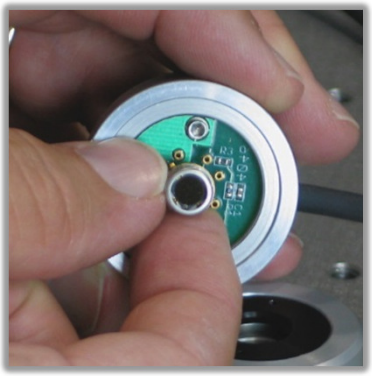
Features

- Designed for use with our broadband pyroelectric detectors …QSx-IL, QSx-IF and QSx-THZ
- Includes an SM1 threaded front aperture for addition of windows, filters, optics and fiber optics
- ¼-20 and M6 optical post mounting holes
- Shielded cable with DB15 connector
- It must be used with our APM Analog Power Module (p/n 201848)
- The APM provides power to the hybrid detector op amp and an analog output

Applications

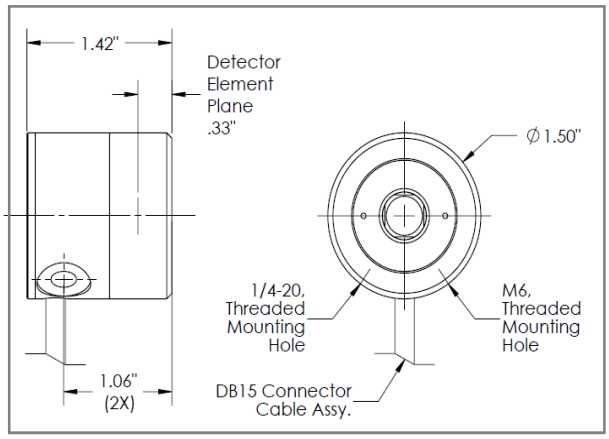
- Measure power, nW to mW
- Measure energy, nJ to mJ
- Measure from 0.1 to 3000 µm with our Pyroelectric Detectors





How to use it!

Remove the front portion of the housing, align the TO5 or TO8 header tab with the silkscreened white tab shown on the PCB and then insert the detector. Push it down until it stops. Now replace the front housing and you're done. Mount the QS-I-TP and make your power or energy measurement.



Description	Specification
Voltage Required	+/- 5 V provided by model APM(D)
Detector Compatibility	QSx-IL, QSx-IF and QSx-THZ Pyroelectric Detector Hybrids
Size	1.5 ” diameter x 1.34 “ long
Mounting Holes	¼-20 and M6
Cable	5 foot long with DB15 connector

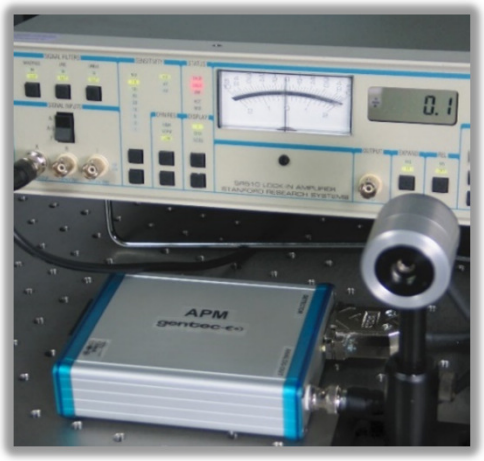


Fig. 1 Typical set up of the QS-I-TP with your Lock In Amplifier when measuring the power of an optically chopped source.

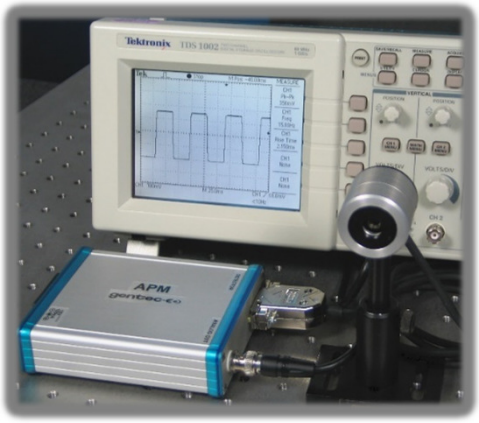


Fig. 2 Typical set up of the QS-I-TP with your Oscilloscope measuring power or temporal shape of a chopped or modulated source.

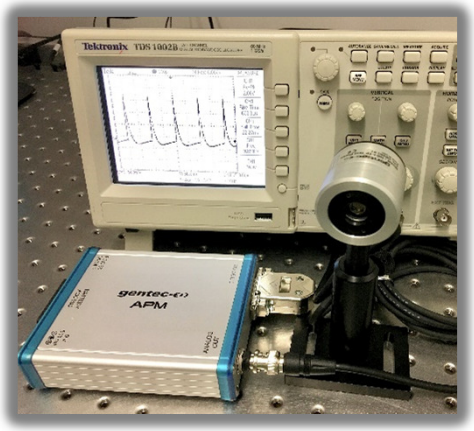


Fig. 3 Typical set up of the QS-I-TP with your Oscilloscope in the Joulemeter mode to measure energy of a pulsed source.

Compatible Detectors

The following models of our Hybrid Detectors can be used with **QS-I-TP**:

High Sensitivity Pyro Detectors

QS2-IL, QS3-IL, QS5-IL, QS9-IL

High Bandwidth Pyro Detectors

QS2-IF, QS3-IF, QS5-IF, QS9-IF

Sensitive THz Pyro Detectors

QS5-THZ-BL, QS9-THZ-BL

5825 Jean Rd, Lake Oswego, OR 97035 (503)697-1870 info@gentec-eo.com

APPLICATION NOTE

SDC-500 DIGITAL OPTICAL CHOPPER 4 HZ - 500 HZ

- Wide Frequency Range 4 Hz to 500 Hz
- Large 25 mm Ø Aperture
- Large 5-Digit LED Display
- Frequency Resolution of 0.01 Hz
- Incredibly Stable
- External Clock Synchronization
- Serial Computer Interface
- Enclosed Chopper Blade
- External Sync Output

HOW IT WORKS

The SDC-500 is a high quality digital optical chopper designed for use with our Broadband Pyroelectric and THz Detectors and Instruments. Pyroelectric detectors are AC coupled, thermal sensors that are intended for use with modulated or chopped continuous sources, like lasers, black body emitters, and THz sources. They do not work with steady state sources.

The SDC-500 is equipped with a controller that features a large five-digit LED readout, frequency adjustment knob and sync output BNC connector. Additionally, the SDC-500 is equipped with a bidirectional RS-232 port that equips the user to set the desired chopping rate to a resolution of 0.001 Hz and to read the status of the instrument. As the unit is designed with a phase-locked-loop control system, the chopping rate may also be synchronized to a user-supplied external clock ranging from 4 Hz to 500 Hz. The controller is then used to read the frequency of the external clock.

The SDC-500 chopping head is attached to the controller by means of a 10 foot coiled cord. The precision etched blade is fully enclosed for protection from inadvertent damage. There is a large 25 mm diameter aperture and a 3 slot blackened blade.

The small 120 mm square outline and 63.5 mm maximum depth allows easy integration into compact optical setups. Dual 8-32 mounting holes allow the aperture to be placed at a height as low as 19 mm above an optical bench or, with the included ½inch post and stand, as high as 33 cm above the mounting surface.

APPLICATION NOTE

SPECIFICATIONS

SDC-500 Digital Optical Chopper	
Frequency Range	4.0 to 500 Hz
Frequency Accuracy	0.01% of setting
Frequency Stability (Internal Clock)	+25 ppm over temperature range
Frequency Setting Resolution	0.01 Hz - low speed range
	0.001 Hz - via RS-232 port
Phase Jitter	0.1% peak-to-peak, 3 slot aperture
Settling Time to Lock	<5 sec, for full scale change
	<1 sec for 10% change
External Frequency Input	TTL/CMOS Compatible, 4 to 500 Hz
Display	5-Digit LED, Green (565 nm), 0.56 in high
RS-232 Port	9600 Baud, N-8-1, 3 wire
Aperture Size	25 mm Ø
Operating Temperature	0-40°C
Power Requirements	95 to 260 VAC, 50-60 Hz, <15 W
Size	Controller: 71.1H x 190.5W x 215.9D mm
	Head: 114.3H x 114.36W x 63.5D mm
Weight	2.25 kg
Full Product Name	SDC-500
Product Number	202171

RECOMMENDED FOR THE FOLLOWING PRODUCTS:

QS Series	Pyroelectric Discrete & Hybrid Detectors
UM-B	Pyroelectric Radiometer
THZ-B + T-Rad-USB	THz Radiometer
THZ-I-BNC	THz Radiometer with Integrated Analog Module
QUAD-P	Position Sensing Power Detectors

THZ-B

THz-B detectors and T-Rad modules

Boston Electronics

T-Rad Module

KEY FEATURES

- **COVERS THE ENTIRE THZ SPECTRUM**
  Get the best precision across the entire wavelength range and relative measurements from 30 THz to 0.1 THz.
- **ROOM TEMPERATURE OPERATION**
  Easier to use and less expensive than a Golay cell.
- **MEASURE POWER FROM nW TO mW**
  With state of the art pyroelectric sensors, measure down to 10 nW with 1 nW NEP
- **USE WITH T-RAD THZ MODULE OR T-RAD-ANALOG POWER MODULE**
  Each head can be connected to an oscilloscope using the analog power module (T-Rad-Analog) or directly to a PC with the digital power module (T-Rad)
- **SEVERAL SENSOR SIZES AVAILABLE**
  Choice of 5 mm and 9 mm diameter
- **CALIBRATED AT 0.63 µm**
  All THz detectors are calibrated at a single wavelength (0.63 µm) and include a typical wavelength correction data from 0.25 to 440 µm. They are used for relative measurements outside that range.
- **SDC-500 OPTICAL CHOPPER**
  All THZ-B detectors require the use of an optical chopper, like our SDC-500, to sync the signal at either 5 Hz (DA models) or 25 Hz (DZ models)

OUTPUT OPTIONS

- **SMART DB15 CONNECTOR**
  Contains all the calibration data
- **TWO DETECTOR TYPES AVAILABLE:**
  - "DZ": digital output, used with T-RAD digital power module
  - "DA": analog output, used with T-RAD-ANALOG analog power module

COMPATIBLE DISPLAYS & PC INTERFACES

T-RAD
(for "-DZ" models only)

T-RAD-ANALOG
(for "-DA" models only)

ACCESSORIES

Stand with delrin post

Removable IR windows
(Various types available)

SDC-500 digital
optical chopper

Winston cone

Pelican carrying case

THZ-B
Specifications

*Also traceable to NRC-CNRC




	THZ5B-BL-DZ	THZ5B-BL-DA	THZ9B-BL-DZ	THZ9B-BL-DA
MAX AVERAGE POWER	20 mW	25 µW	20 mW	125 µW
EFFECTIVE APERTURE	5 mm Ø	5 mm Ø	9 mm Ø	9 mm Ø
COMPATIBLE MODULES	T-Rad	T-RAD-ANALOG	T-Rad	T-RAD-ANALOG
MEASUREMENT CAPABILITY				
Spectral range [a]				
Frequency	0.1 - 30 THz	0.1 - 30 THz	0.1 - 30 THz	0.1 - 30 THz
Wavelength	3000 - 10 µm	3000 - 10 µm	3000 - 10 µm	3000 - 10 µm
Max measurable power	20 mW	25 µW	20 mW	125 µW
Noise equivalent power (NEP)	5 nW	1 nW	50 nW	3 nW
Rise time (0-95%)	≤ 0.2s	≤ 0.2s	≤ 0.2s	≤ 0.2s
Sensitivity (Typical)	N/A	140 kV/W	N/A	20 kV/W
Chopping frequency [b]	25 Hz	5 Hz	25 Hz	5 Hz
DAMAGE THRESHOLDS				
Max average power density (at 1064 nm)	10 mW/cm²	10 mW/cm²	10 mW/cm²	10 mW/cm²
PHYSICAL CHARACTERISTICS				
Effective aperture	5 mm Ø	5 mm Ø	9 mm Ø	9 mm Ø
Sensor	Pyroelectric	Pyroelectric	Pyroelectric	Pyroelectric
Absorber	BL	BL	BL	BL
Dimensions	66.0Ø x 46.5D mm	66.0Ø x 46.5D mm	66.0Ø x 46.5D mm	66.0Ø x 46.5D mm
Weight	227 g	227 g	227 g	227 g
ORDERING INFORMATION				
Compatible stand	STAND-D-233	STAND-D-233	STAND-D-233	STAND-D-233
Product page				

a. Projected spectral range.
From 10 to 440 µm, spectrometer measurement.
From 440 to 3000 µm, relative measurement only.
This spectral range is subject to change.
b. SDC-500 digital optical chopper sold separately.

THZ-B
Specifications

T-Rad

The T-Rad is a microprocessor-based digital radiometer that includes a 12-bit ADC and unique DSP Lock-In Software. It is powered by a USB connection, which also acts as a Virtual COM port. When a THZ-B Terahertz Pyroelectric detector is plugged into the T-Rad module, the module reads the content of the head's EEPROM, which identifies the detector and provides calibration and wavelength correction data. The LabVIEW Software supplied with the device makes it very easy to set up the radiometer, measure a THz or broadband source and record data. The software is compatible with Windows 7, 8 & 10.

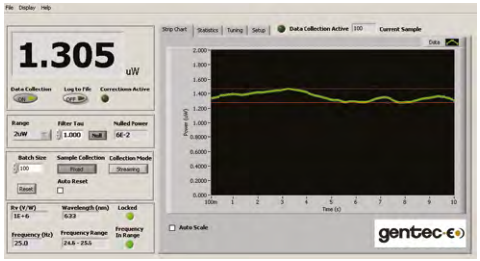
T-Rad
(rear view)

T-Rad-Analog
(front view)

SPECIFICATIONS & FEATURES

	T-RAD	T-RAD-ANALOG
Compatible detector heads	THZ-B-DZ	THZ-B-DA
Full scale ranges	200 nW - 200 mW*	N/A
Power on light	Green	Green
Analog output	0 to 3.6V, BNC	± 4.88 V, BNC
PC connection	USB 2.0	None
Trigger input (TTL)	BNC connector	None
Power supply	USB 2.0	External, 100/240 VAC 50 - 60 Hz, and 9V battery (both included)
Product number	201849	202306

** Actual ranges vary based on the THZ-B detector selected*



INSTRUMENT CONTROL AND STRIP CHART

Instrument controls and the radiant power measurement are always visible, making it easy to change the radiometer settings, no matter which display tab is selected. Instrument controls include: Range, Filter Tau, Batch Size, Data Collection Mode, Reset Options, and a Null button for background cancellation. In addition, there are more set up and operation status indicators including: detector Rv, Wavelength, Frequency (actual), Locked and Frequency in Range lights. The Strip Chart displays the Radiant Power measurement in Watts, either continuously or by the batch. Select full scale, auto scale or use our manual scaling option.

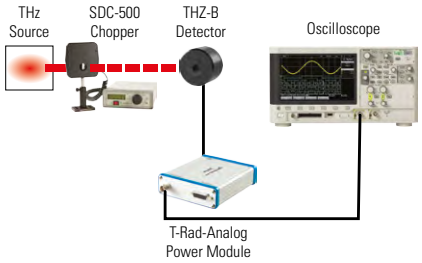
INSTRUMENT CONTROL AND TUNING NEEDLE

The "TUNE" tab selects the very useful "Tuning Needle" display. This is a simulated analog meter whose speed is determined by the "filter tau" setting. It is expected to be used during the set-up of a radiometer with a source. The "tau" value is usually set to a small value when aligning the probe to the source (i.e. when peaking the reading). There is a button control to select "full scale", "min-max" or "reset". In the "min-max" mode, the indicators are "blue" for the minimum power and "red" for the maximum power.

THZ-B
Specifications

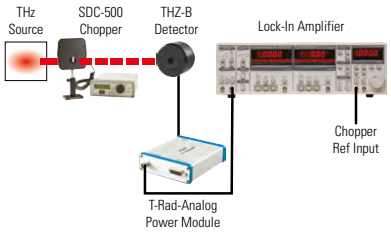
INSTRUMENT CONTROL AND STATISTICS

In the "Statistics" tab there are 4 large windows that contain the statistics for the selected batch, including: Minimum, Maximum, Standard Deviation and Mean, expressed in Engineering Notation. Standard Deviation can be displayed in Watts or as a % that is user-selectable. There is also a window that shows the bandwidth of the Digital Band Pass Filter based on the user selected "Filter Tau" (0.100 to 100 seconds). A lower time constant is helpful when setting up, and a longer one when making measurements, especially on the lower ranges of the instrument.



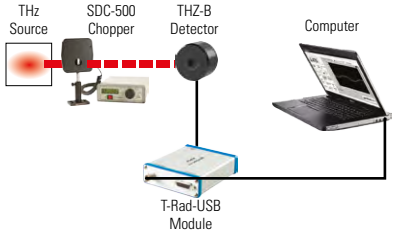
THZ-B-DA DETECTOR AND OSCILLOSCOPE

Here is a basic analog set up that would be useful if the optical power of the source was about 5 µW or greater. The output of the THZ5B-BL-DA detector would be approximately 600 mV at 5 Hz chopping frequency, giving plenty of signal for an oscilloscope. Simply read the voltage output and divide by the Rv factor (V/W) of the detector to measure the intensity of the source in Watts. Also consider applying a wavelength correction factor under certain circumstances.



THZ-B-DA DETECTOR AND LOCK-IN AMPLIFIER

This is another analog set-up option that we recommend if you have to measure very low power levels (i.e. less than 5 µW) where the signal may be buried in the broadband noise. The voltage output of the analog THZ-B-DA detector, powered by our T-Rad-Analog, is routed to the Lock-In Amplifier input, and the Sync Output of our SDC-500 Chopper is connected to the reference input. The Lock-In Amplifier will lock on the chopping frequency and you can dial in a long integrating time and measure a very low RMS voltage. The voltage divided by our Voltage Responsivity (V/W) equals the power of the source.



THZ-B-DZ DETECTOR AND T-Rad MODULE

Although analog solutions are available, for simplicity, convenience and sensitivity, we recommend you choose our THZ-B-DZ detectors and the T-Rad Digital Radiometer. Our unique DSP Lock-In Amplifier software provides a function much like the Analog Lock-In, but is so much easier to use. It also addresses thermal drift of the sensor and allows you to display the power measurement and complete statistics directly in digital and graphic formats. Set the range, null the background, set the filter tau (bandwidth) and make the measurement. It's that easy!

THZ-I-BNC

THz detectors with integrated analog module

Boston Electronics

OUTPUT OPTIONS

- **ANALOG OUTPUT**
  Plug the device directly into your oscilloscope or lock-in amplifier with the BNC output

KEY FEATURES

- **COVERS THE ENTIRE THZ SPECTRUM**
  Measure accurately from 0.25 to 15 µm and from 30 THz to 0.1 THz in relative terms
- **MEASURE POWER FROM nW TO µW**
  Make low-level measurements with an NEP of 1.0 nW
- **MEASURE ENERGY FROM nJ TO µJ**
  Can be used with low repetition rate pulsed THz sources to measure pulse energy up to 40 Hz
- **INTEGRATED ANALOG MODULE**
  Plug the device directly into your oscilloscope or Lock-In Amplifier
- **BATTERY OR EXTERNAL POWER**
  Includes 9V battery and an external power supply
- **CALIBRATED AT 0.63 µm**
  All THz detectors are calibrated at a single wavelength (0.63 µm) and include typical wavelength correction data from 0.25 to 440 µm. They are used for relative measurements outside that range.
- **SDC-500 OPTICAL CHOPPER**
  The THZ-I-BNC models require the use of an optical chopper, like our SDC-500, running at 5 Hz.

ACCESSORIES

Stand with delrin post

Removable IR Windows (Various types available)

SDC-500 digital optical chopper

Pelican carrying case

THZ-I-BNC

Specifications

*Also traceable to NRC-CNRC

	THZ5I-BL-BNC
MAX AVERAGE POWER	62.5 µW
EFFECTIVE APERTURE	5 mm Ø
INTEGRATED MODULE	Analog (BNC)
MEASUREMENT CAPABILITY	
Spectral range [a]	
Frequency	0.1 - 30 THz
Wavelength	3000 - 10 µm
Max measurable power	62.5 µW
Noise equivalent power [b]	1.0 nW
Rise time (0-100%)	≤ 0.2s
Sensitivity (Typical)	140 kV/W
Chopping frequency	5 Hz (Required)
Calibration uncertainty	Contact us
Energy mode	
Maximum measurable energy	2 µJ
Noise equivalent energy	1.0 nJ
Minimum pulse width	1.0 µs
Maximum repetition rate	40 Hz
DAMAGE THRESHOLDS	
Maximum average power density (1064 nm)	50 mW/cm²
PHYSICAL CHARACTERISTICS	
Effective aperture	5 mm Ø
Sensor	Pyroelectric
Absorber	BL
Analog output	0-10 V
Dimensions	81.3Ø X 99.3D mm
Weight	500 g
ORDERING INFORMATION	
Compatible stand	STAND-D-233
Product page	

a. Projected spectral range.
From 10 to 440 µm, spectrometer measurement.
From 440 to 3000 µm, relative measurement only.
This spectral range is subject to change.

b. At 632 nm and a chopping frequency of 5Hz.

THZ-D

THz detectors for use with our universal displays & PC interfaces

Boston Electronics

KEY FEATURES

- **COVERS THE ENTIRE THZ SPECTRUM**
  Get the best precision across the entire wavelength range and relative measurements from 30 THz to 0.1 THz.
- **ROOM TEMPERATURE OPERATION**
  Easier to use and less expensive than a Golay cell.
- **CALIBRATED AT 10.6 µm**
  THZ-D detectors are calibrated at a single wavelength 10.6 um (30 THz) and at 10 Hz chopping frequency for the THZ9D. Both include typical wavelength correction data from 10.6 to 440 µm. They are used for relative measurements outside that range.
- **LARGE AREA**
  Models range from 9 mm Ø for the THZ9D and 12 mm Ø for the THZ12D.
- **WIDE RANGE OF MEASUREMENTS**
  Measure from 100 uW to 3 W of continuous power with the THZ12D model, the highest in our terahertz range of products, and down to 5 uW to 25 mW with the THZ9D model.
- **USE WITH A UNIVERSAL DISPLAYS & PC INTERFACE**
  No need for an exclusive monitor. These unique THz detectors work with our display & PC interface.
- **SDC-500 OPTICAL CHOPPER**
  The THZ9D model requires the use of an optical chopper, like our SDC-500, running at 10 Hz.

OUTPUT OPTIONS

- **SMART DB15 CONNECTOR**
  Contains all the calibration data
- **ANALOG OUTPUT**
  When used with APM (D) analog power supply module
- *integra* **ALL-IN-ONE-METER** (for THZ12D only)
  Connects directly to a PC
  Two models available:
  - USB output (-INT)
  - RS-232 output (-IDR)

COMPATIBLE DISPLAYS & PC INTERFACES

MAESTRO

U-LINK

M-LINK
(for THZ12D)

APM (D)
analog power module
(for THZ9D)

ACCESSORIES

Stand with steel post
(for THZ12D)

Stand with delrin
(for THZ9D)

SDC-500 digital
optical chopper

Pelican carrying case

Extension cables
(4, 15, 20 or 25 m)

Extra isolation tube

Fiber adaptors & connectors
(FC, ST and SMA)

THZ-D
Specifications

*Also traceable to NRC-CNRC

	THZ9D-20mS-BL	THZI2D-3S-VP
MAX AVERAGE POWER	25 mW	3 W
EFFECTIVE APERTURE	9 mm Ø	12 mm Ø
COMPATIBLE DISPLAYS & PC INTERFACES	MAESTRO, U-LINK & APM (D)	MAESTRO, U-LINK & M-LINK
MEASUREMENT CAPABILITY		
Spectral range [a]		
Frequency	0.1 - 30 THz	0.1 - 30 THz
Wavelength	3000 - 10 µm	3000 - 10 µm
Maximum average power		
with MAESTRO	20 mW	3 W
with U-LINK	25 mW	3 W
Noise equivalent power [b]	300 nW	0.5 µW
Minimum measurable power [c]	N/A	50 - 100 µW
Thermal drift	N/A	12 µW/°C
Rise time (nominal) [d]	< 0.2 s	3 s
Minimum repetition rate [f]	1000 Hz	7 Hz
Chopping frequency	10 Hz (required)	N/A
Calibration uncertainty [g]	± 5.0% at 10.6 µm; ± 15% at 10.6 - 440 µm [a]	± 3.0% at 10.6 µm ± 8.0% at 10.6 - 300 µm ± 15% at 300 - 440 µm
Repeatability	±0.5%	±0.5%
DAMAGE THRESHOLDS		
Maximum average power density [h]	50 mW/cm²	30 W/cm²
Maximum energy density	< 0.1 J/cm²	< 1 J/cm²
PHYSICAL CHARACTERISTICS		
Effective aperture	9 mm Ø	12 mm Ø
Absorber	BL (Black Absorber)	VP (Volume Absorber)
Dimensions	38.1Ø x 79 mm	73H x 73W x 20D mm (72D mm with tube)
Weight (head only)	91 g	320 g
ORDERING INFORMATION		
Compatible stand	STAND-D-233 or STAND-D-233-M	STAND-D-233
Product page		

a. From 10 to 440 µm, spectrometer measurement with multiple laser references validation.
From 440 to 600 µm, spectrometer measurement only.
From 600 to 3000 µm, relative measurement only.
This spectral range is subject to change.
b. Nominal value, actual value depends on electrical noise in the measurement system.
c. Actual value depends on ambient conditions and the measurement system.
d. With anticipation
e. Maximum output voltage = sensitivity x maximum power.
f. Minimum repetition rate for stable average power measurements.
g. Including linearity with power.
h. At 1064 nm, 1 W CW.

DISPLAYS & PC INTERFACES

Overview of the PC interfaces

Boston Electronics

PC INTERFACES

While the vast majority of Gentec-EO detector heads are compatible with the U-LINK and S-LINK PC interfaces, a few of our specialized detectors require different data processing methods. In this case, we offer dedicated PC interfaces that are optimized for these measurements.

- HIGH-PERFORMANCE ELECTRONICS FOR SPECIALIZED MEASUREMENTS

DEDICATED PC INTERFACES





	T-RAD	T-RAD-ANALOG	QUAD-4TRACK	MACH 6	APM (D)
Detector compatibility					
Power measurement	THZ-B series (-DZ models)	THZ-B series (-DA models)	QUAD-P series	N/A	UM-B series & THZ9D
Energy measurement	N/A	N/A	QUAD-E series	M6 series	M6 (with adaptor), QE-B & PE-B series
Output	USB & analog output	Analog output	USB & analog output	USB & analog output	Analog output
External trigger	Yes	Yes	Yes	Yes	N/A
Maximum repetition rate	N/A	N/A	1 kHz	200 kHz	Depends on the detector
Number of channels	1	1	4 (1 detector)	1	1

TECHNICAL NOTE

HOW TO SET UP AND USE OUR THZ-B-DA AND THZ-I-BNC ANALOG RADIOMETER PROBES

Our line of THz Analog Radiometers was designed for use with both an Oscilloscope and Lock-In Amplifier (LIA). They are basically composed of a Pyroelectric Detector, with an organic black coating (BL), mated to a low noise current mode amplifier. The voltage output is maximized at a 5 Hz chopping frequency. The R_v of these probes, is very high and can be in the range of 20 kV/W to 400 kV/W.

As these THz Probes are very sensitive "thermal" detectors, great care must be taken when setting them up in your lab. You will want to avoid placing them close to sources of heat (IR radiation) like large power supplies or human bodies.

In addition, Pyroelectric detectors also exhibit "piezoelectric" properties and will respond to acoustic waves and/or mechanical vibration, so beware of air conditioning vents and mechanical pumps.

OK, now we're ready to walk through a typical optical set up.

APPLIES TO MODELS:

- THZ1.5B-BL-DA
- THZ5B-BL-DA
- THZ9B-BL-DA
- THZ2I-BL-BNC
- THZ5I-BL-BNC

NOTE:

Our THZ-I-BNC probes include batteries and an AC voltage supply.

Our THZ-B-DA probes require use of our external battery and AC supply T-Rad-Analog.

T 418.651.8003 1888 5GENTEC F 418.651.1174 www.gentec-eo.com info@gentec-eo.com

TECHNICAL NOTE

STEP-BY-STEP INSTRUCTIONS:

1. Mount the probe in your optical set up.
Using our Delrin post, mount the detector and align it to the optical axis of your THz source.

2. Connect analog output to Scope or LIA.
For THZ-I-BNC probes, the BNC analog output is located on the side of the housing. For THZ-B probes, the BNC analog output is located on the T-Rad-Analog power module.

3. Power up the probe.
There is a rocker on/off switch on the body of the THZ-I-BNC probe and the power module of the THZ-B probe. A green power light should illuminate.

4. AC power option.
Both models of THz probes work off batteries or an AC wall wart. Simply chose which option you prefer.

5. Need for an optical chopper.
Our detectors require use of an optical chopper running at 5 Hz. The Voltage Responsivity is measured at that chopping frequency.

6. Using an Oscilloscope.
Set the scope to "DC coupled", the voltage scale to 1 V/Div, and the time base to 100 msec/Div. When the probes are first powered up, the voltage output may be a large negative number, like -10 V (see fig.1). As the probe comes to thermal equilibrium (~5 minutes), the voltage output will move to a final value of ~+200 mV and stabilize (see fig. 2).

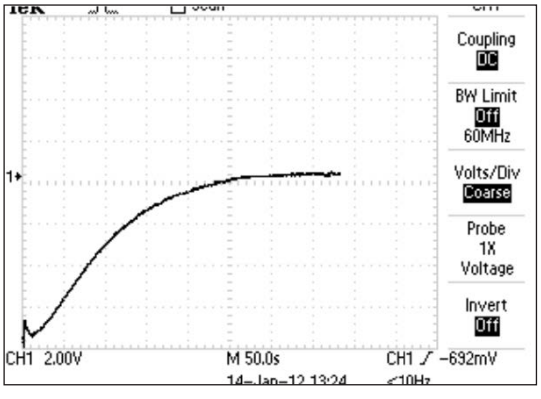


Figure 1: Power ON

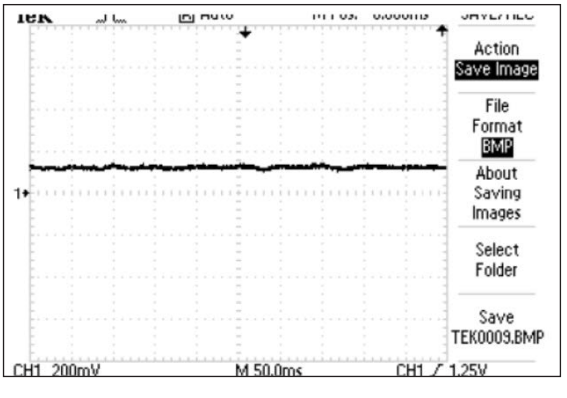


Figure 2: Beam blocked

TECHNICAL NOTE

7. Expose the probe to your source.

Now you can unblock your source and measure its power. Adjust the scope's voltage sensitivity until you get a good saw tooth voltage output (see fig. 3).

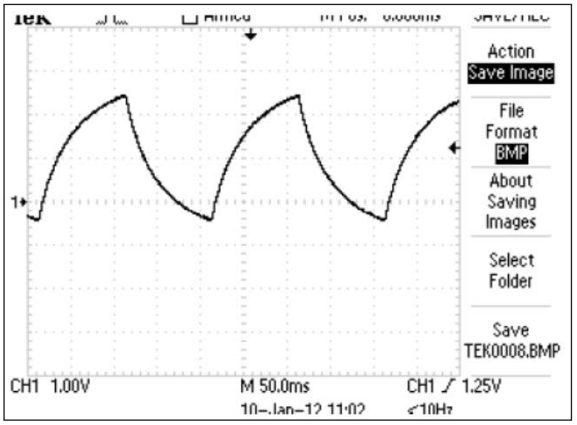


Figure 3: Measuring Power

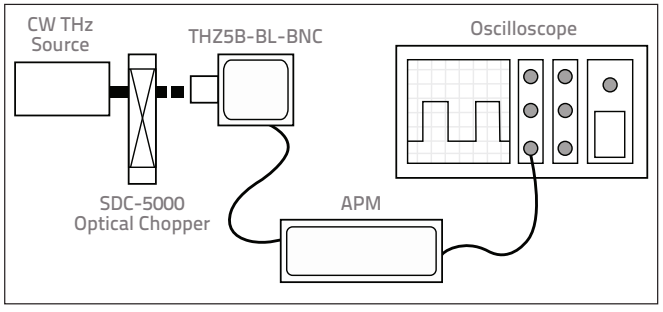
8. Now measure the voltage output.

Always measure the peak voltage and subtract the base voltage (this takes care of thermal drift) and then divide by the R_v (V/W) of the THz probe to determine Power in Watts.

9. Collect all of the radiant output.

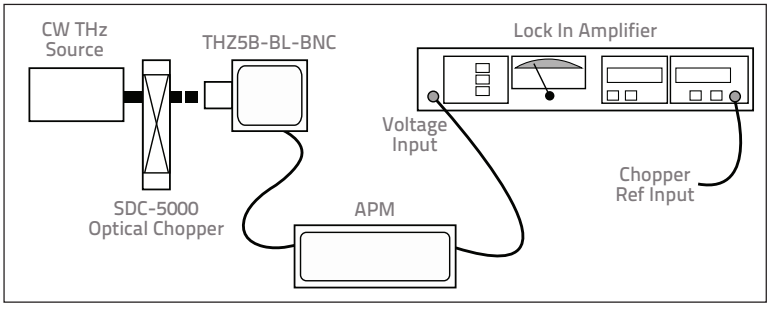
Make sure you are not overfilling the detector and losing some of the THz power.

OSCILLOSCOPE SETUP



Here is a look at a THZ5B set up with an Oscilloscope for optical power measurements. For lower power levels, the "sync" output of the chopper could be used to trigger the scope.

LOCK-IN AMPLIFIER SETUP



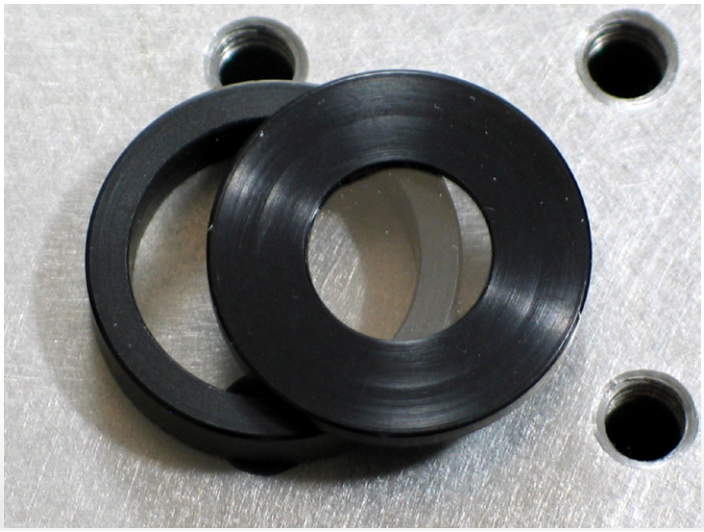
Here is a look at a THZ5B set up with LIA for optical power measurements. In this case you will need to use the chopper's "sync" output as the reference. Using the LIA will allow you to measure at the lowest level.

For more information about these products, check out the website at gentec-eo.com or give us a call.

Don Dooley
General Manager, Gentec-EO USA
ddooley@gentec-eo.com
(503) 697-1870

TECHNICAL NOTE

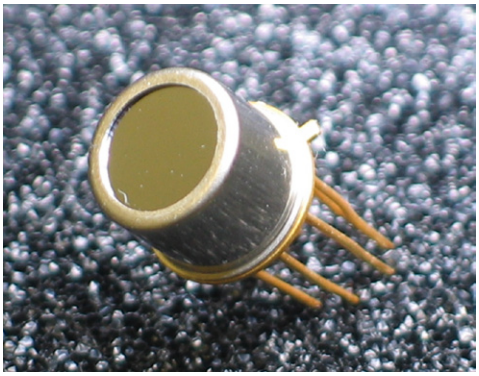
PERMANENT AND REMOVABLE IR AND THz WINDOWS FOR OUR QS PYROELECTRIC DETECTORS



For some applications, it may be useful to use an IR or THz window with our broadband (0.1 µm to 3000 µm) pyroelectric detectors. The windows we offer are typically 0.5 mm thick. In the photo on the left, it is possible to see the components that make up our QW quartz "removable window". This technical note will give you more information about these components.

PERMANENT WINDOWS

The permanent windows can be used with any product of our QS series of discrete and hybrid pyroelectric detectors. There are two sizes available, one for TO5 (x5) detectors and one for TO8 (x8) detectors. The permanent windows are glued into a TO can and then bonded to the TO header of the detector. In the photo on the right, it is possible to see a **S5** silicon window combined with one of our detectors.



REMOVABLE WINDOWS

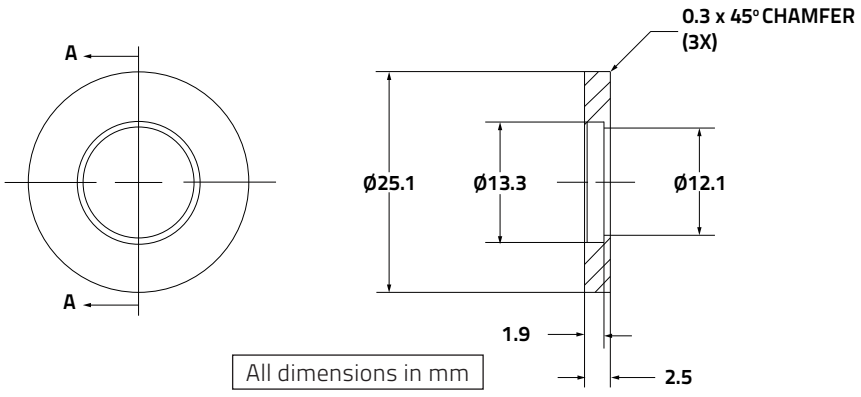
The removable windows can be used with any of our pyroelectric UM-B, THZ-B and THZ-I-BNC detectors. They are mounted in a 25 mm holder, are designed to be inserted into the front bezel of these detectors with the appropriate spacer, and are held in place by the front aperture plate. In the photo on the right, it is possible to see a **TPXW** window added to our THZ9B-BL-DZ detector.

TECHNICAL NOTE

TABLE 1: LIST OF ALL AVAILABLE WINDOWS

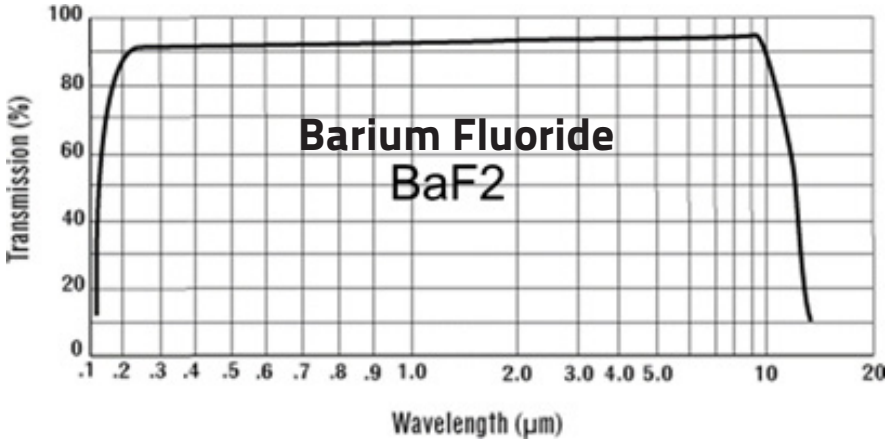
PERMANENT	REMOVABLE	MATERIAL	SPECTRAL RANGE (TYP.)
B5 or B8	BW	Barium Fluoride	0.2 – 17.5 µm
G5 or G8	GW	Germanium	8 – 14 µm
Q5 or Q8	QW	UV Grade Quartz	0.25 – 3.0 µm
S5 or S8	SW	Sapphire	0.1 – 7 µm
Si5 or Si8	SiW	Silicon (OC_z)	1.1 – 9 µm and 50 – 1000 µm
Z5 or Z8	ZW	Zinc Selenide	0.6 – 22 µm
	SCQW	Single Crystal Quartz	0.2 to 3 µm and 50 – 3000 µm
	PEW	High Density Polyethylene	10 – 1000 µm
	TPXW	Rexolite	50 – 2000 µm
	HRSFW	Silicon (HRSF)	30 – 1000 µm

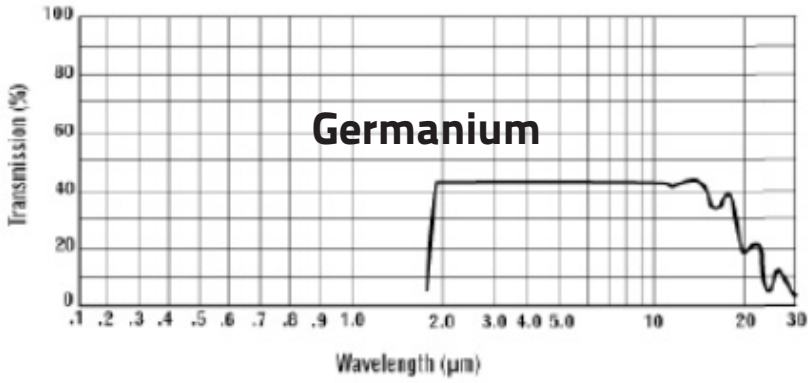
REMOVABLE WINDOW MECHANICAL DIAGRAM

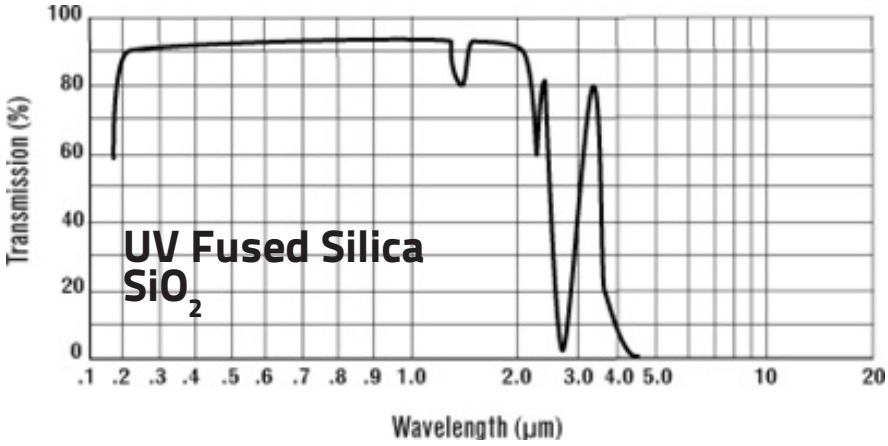


TECHNICAL NOTE

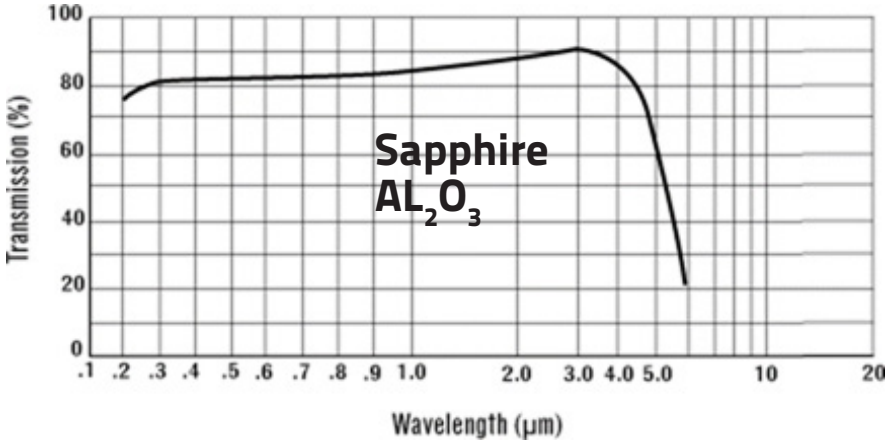
RELATIVE SPECTRAL CURVES FOR IR WINDOWS

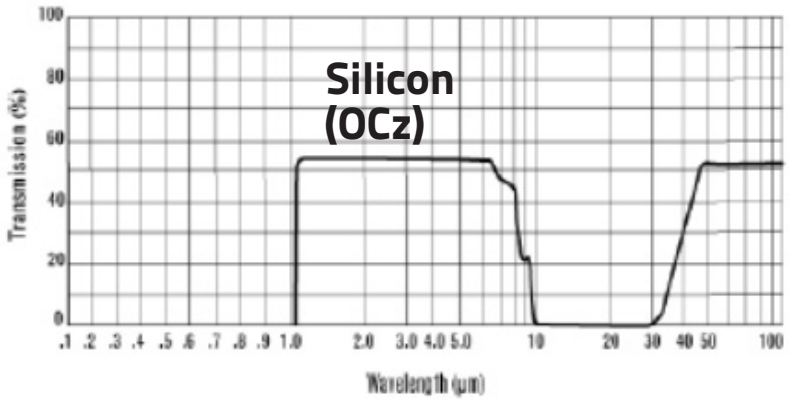


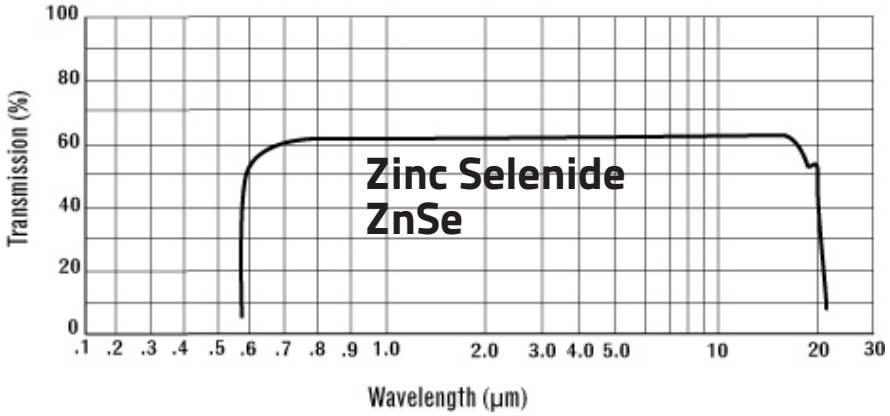




TECHNICAL NOTE

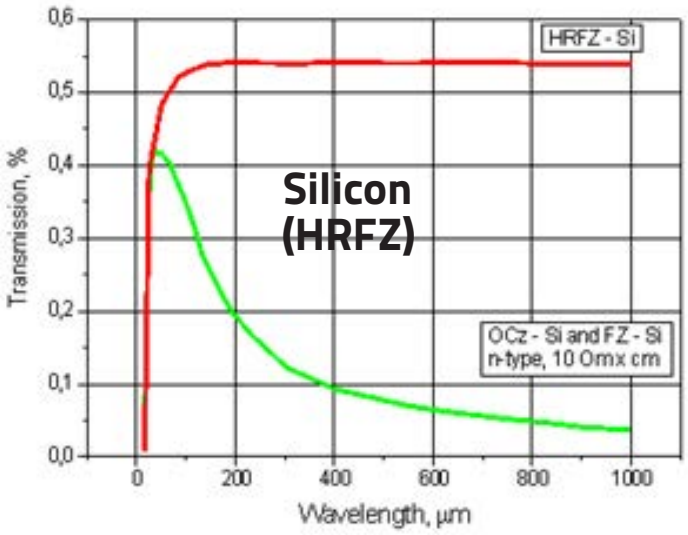


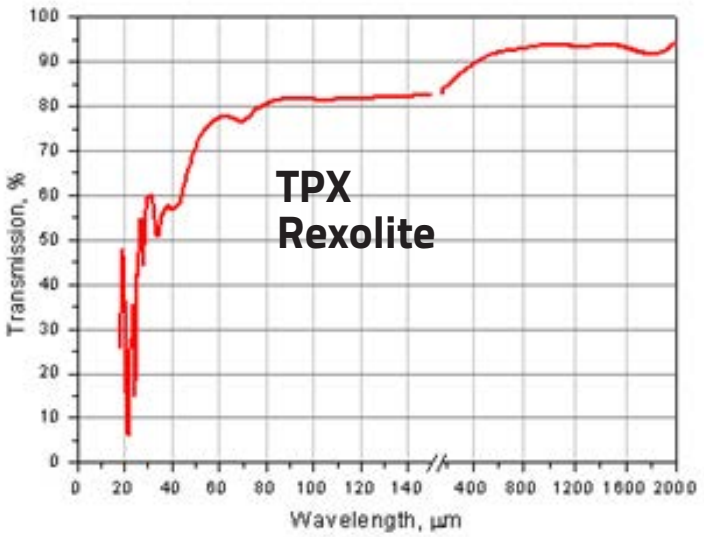


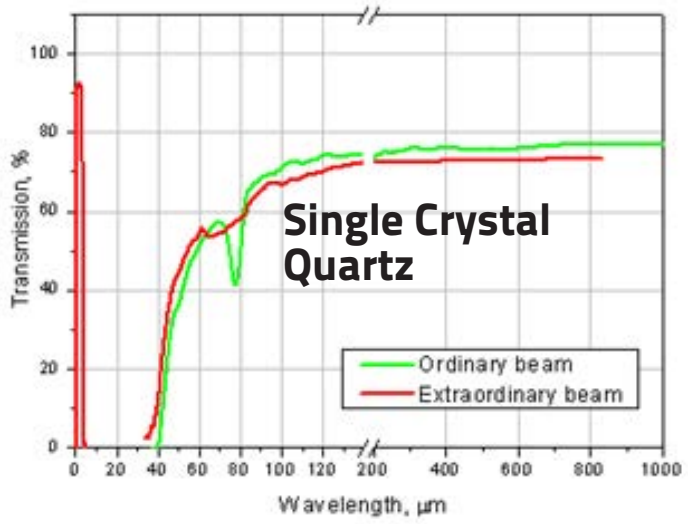


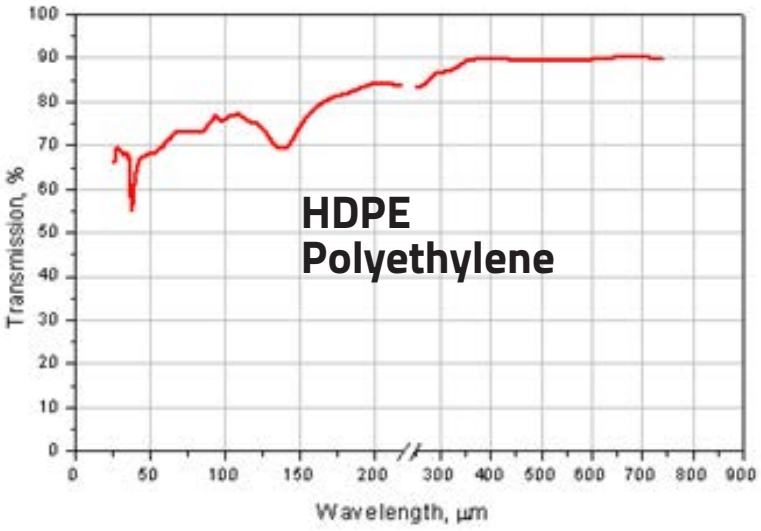
TECHNICAL NOTE

RELATIVE SPECTRAL CURVES FOR THZ WINDOWS









NOTE:

The relative spectral transmission values presented in this technical note are approximate values. They will vary depending on window thickness and material quality.

References: www.tydex.ru and www.rmico.com

APPLICATION NOTE

QS DETECTORS PIN-OUTS AND DESCRIPTIONS

QS-IL, QS-IF AND QS-THZ HYBRID PYROELECTRIC DETECTORS

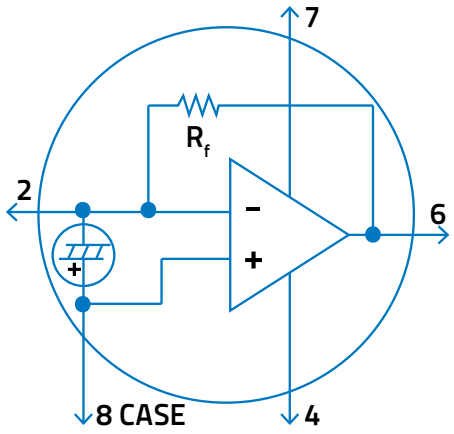


Figure 1: QS-IL, QS-IF and QS-THZ Pin-Out

CAUTION: Please review our Application Note 202181 on Handling Sensitive Pyro Detectors.

PIN-OUT

These three families of Hybrid Pyroelectric Detectors include a $LiTaO_3$ detector element, a low noise Current Mode op amp and a large feedback resistor. The QS-IL and QS-THZ are designed for optimum R_V and NEP at 5 Hz. The QS-IF incorporates a high bandwidth op amp and a slightly smaller feedback resistor for flat voltage output up to 1000 Hz.

The three series share the same Pin-Out, as shown in Fig. 1. Note that Pins 1, 3, and 5 are not connected inside the TO package and therefore are not part of the electronics.

SCHEMATIC OF OPERATION

The circuit on Fig. 2 shows the typical connections made to the hybrid detector. +/- 12 V powers the op amp. You can add an external feedback resistor to increase the bandwidth of the detector and/or lower the voltage responsivity. We recommend cutting pin 2 off if there is no plan to use an external component. This way, the detector's performance will be optimized.

CAUTION: Make sure to apply the +Voltage to PIN 7 and -Voltage to PIN 4 to avoid damaging the op amp circuit.

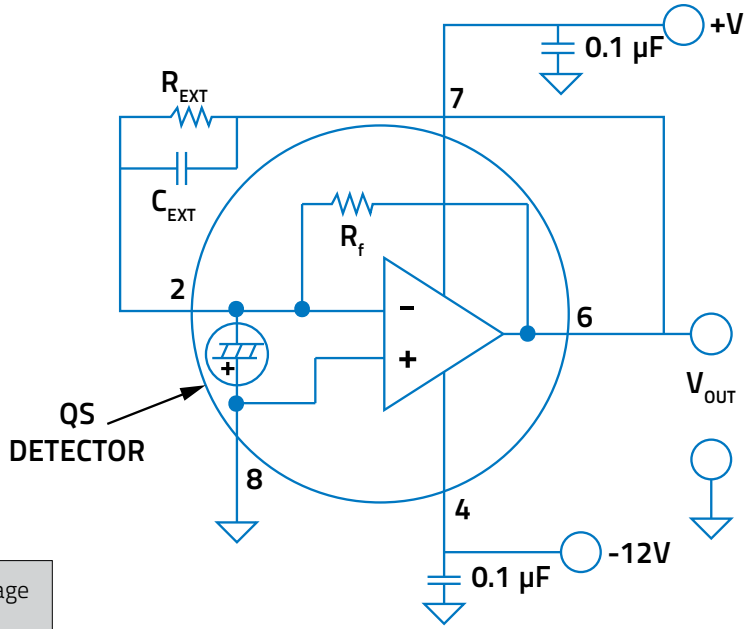


Figure 2: QS-IL, QS-IF and QS-THZ circuitry

APPLICATION NOTE

QS-VL HYBRID PYROELECTRIC DETECTORS

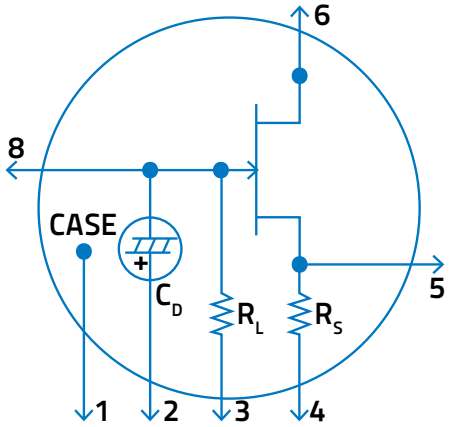


Figure 3: QS-VL Pin-Out

CAUTION: Please review our Application Note 202181 on Handling Sensitive Pyro Detectors.

PIN-OUT

This family of Hybrid Pyroelectric Detectors includes a $LiTaO_3$ detector element, a low noise FET Voltage Mode preamp and a large feedback resistor. The QS-VL detectors are designed for optimum R_V and NEP at 5 Hz.

The Pin-Out is shown in Fig. 3. Note that Pin 7 is not connected inside the TO package and therefore is not part of the electronics.

SCHEMATIC OF OPERATION

The circuitry on Fig. 4 shows the typical connections made to the hybrid detector in a source follower circuit. You can add an external Load Resistor between Pin 8 and GND. This effectively allows you to change the voltage responsivity and/or the bandwidth of the detector.

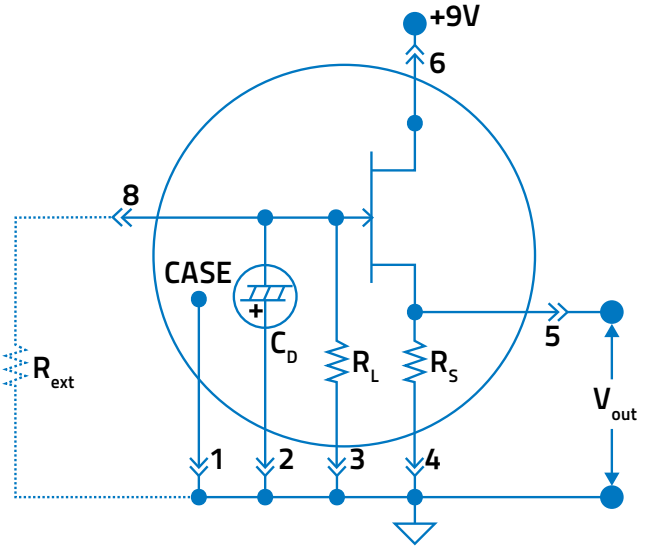


Figure 4: QS-VL circuitry

APPLICATION NOTE

QS-L AND QS-H DISCRETE PYROELECTRIC DETECTORS

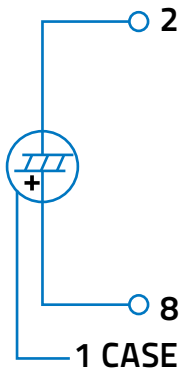


Figure 5: QS-L Pin-Out

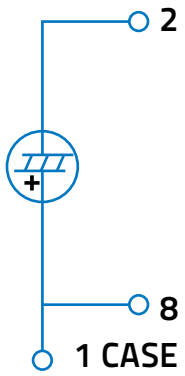
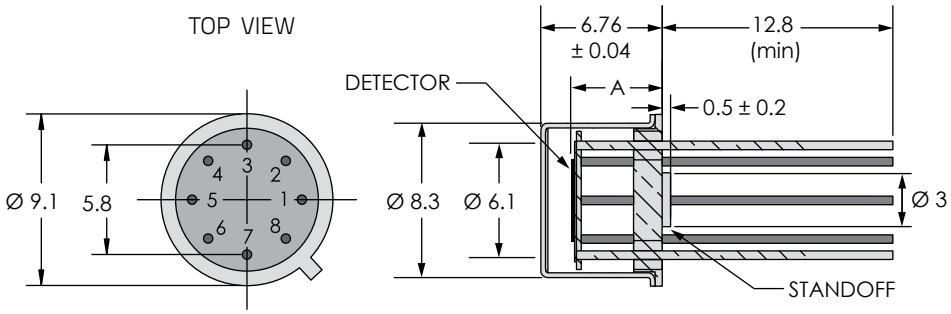


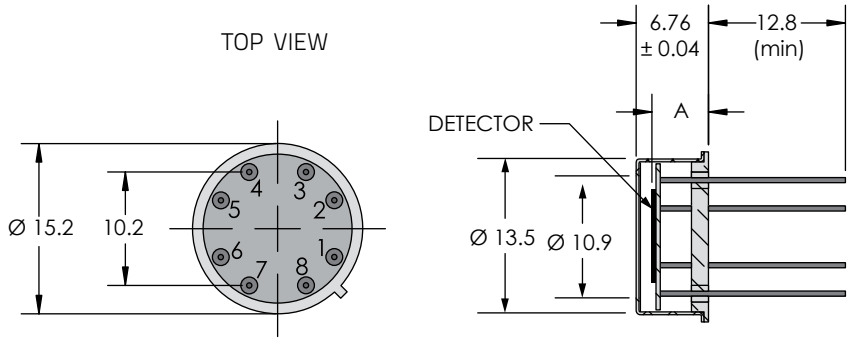
Figure 6: QS-H Pin-Out

MECHANICAL DETAILS OF THE QS DETECTORS



MODEL	DIM. A
QS-L	4.6
QS-H	2.0
QS-VL	4.6
QS-IF	4.6
QS-IL	4.6

Figure 7: QS detectors mechanical details (TO5-Based)

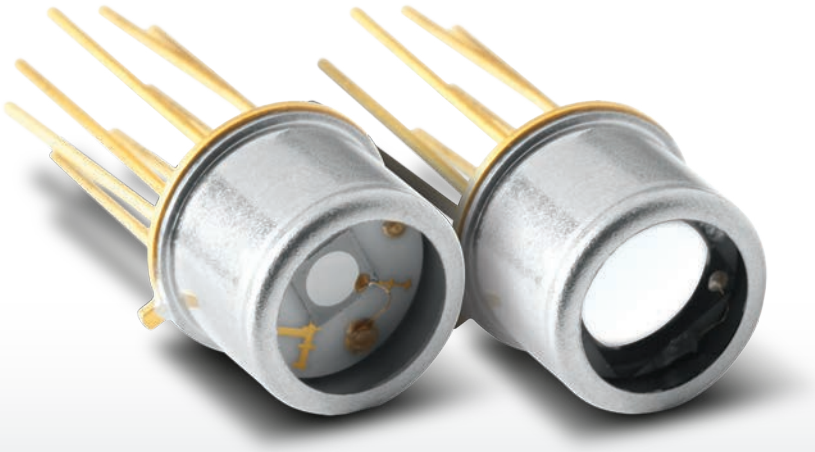


MODEL	DIM. A
QS-L	4.6
QS-H	2.0
QS-VL	4.6
QS-IF	4.6
QS-IL	4.6

Figure 8: QS detectors mechanical details (TO8-Based)

TECHNICAL NOTE

PYROELECTRIC DETECTORS
HOW TO HANDLE THOSE SENSITIVE DETECTORS



Our high performance Pyroelectric Detectors are quite fragile and require special handling when preparing for shipment, receiving, lab use and/or soldering.

APPLIES TO MODELS

- QS-H Discrete Pyros
- QS-L Discrete Pyros
- QS-IL Hybrid Pyros
- QS-FL Hybrid Pyros
- QS-VL Hybrid Pyros
- QS-THZ THz Hybrid Pyros

TECHNICAL DESCRIPTION

Our detectors are made from very thin pyro crystals which are mounted onto a TO header or metalized ceramic. They are packaged in a TO5 or TO8 housing which does not include a window or filter (unless you order one). This is to take advantage of their broad spectral response. The detector crystal is usually mounted forward in the package close to the opening in the TO can. This results in a wide field of view, but also leaves the detector element somewhat exposed. Our Hybrid detectors include a very sensitive current or voltage mode circuit inside. The devices are quite sensitive to static electricity (ESD).

PACKAGING

To minimize the chance of damage due to static electricity, we always place our detectors in a black anti-static box, with their TO header pins pushed into conductive foam.

Anti-static foam and box

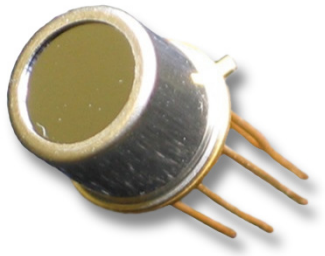
REMOVAL FROM PACKAGE

For our Hybrid Detectors (QS-IL, QS-IF and QS-VL), we suggest you transport the device to where it will be used, in its anti-static packaging. Once you're ready to remove it, make sure you're using an *earth ground strap on your wrist*. Carefully insert the QS detector into your circuit board or our QS-I-TEST or QS-V-TEST test box. For our discrete QS-L or QS-H detectors, it is not critical to wear a ground strap as they do not include an Op Amp or FET.

TECHNICAL NOTE

PHYSICAL HANDLING

As these devices are typically windowless, you must be careful not to touch the Pyro crystal with your fingers or any other tool when holding, installing or transporting them. You could otherwise break the crystal. If you've acquired a detector that includes a permanent window, you'll only have to worry about damaging the window. We recommend that you do not put much downward pressure on the window which is glued in place.



Pyro with Si5 Window

ADVICE ON CLEANING

For windowless detectors, the best way to remove dust or contaminants from the detector element is to use a compressed dry nitrogen purge. Do not make contact with the element. If you have a windowed detector then we'd recommend you use acetone and a cotton swab to remove finger prints or other materials. Do not attempt to clean these detectors by emersion into a fluid (like ultrasonic baths). Even our windowed detectors can be damaged as they are not hermetically sealed. They must be carefully cleaned by hand.

SOLDERING GUIDELINES

If you plan on soldering these detectors into a circuit board, you must do it manually! Our detectors will not survive a wave soldering process.

- Do not use soldering irons of more than 25 Watts
- Use adequate heat sinking when soldering the pins
- Do not exceed 3 seconds at 280°C or 5 seconds at 240°C
- Be careful not to short the TO header to other traces on your PCB

Please refer to our Application Note 201931 before assembling these detectors into your PCB

THERMAL SATURATION

Please see our Application Note 201926 on "Thermal Saturation with QS-IF and QS-IL".

Questions? Don't hesitate to contact us at (503) 697-1870 or ddooley@gentec-eo.com.