LASER COMPONENTS®

Differential Pyroelectric Detectors

Unlike their thermopile cousins, pyroelectrics are still single-ended detectors; making them susceptible to electromagnetic interference from non-detector related noise. Processor clocks, line interference, and other sources of electromagnetic noise can still be coupled to their output causing unnecessary headaches during the design phases of new equipment.

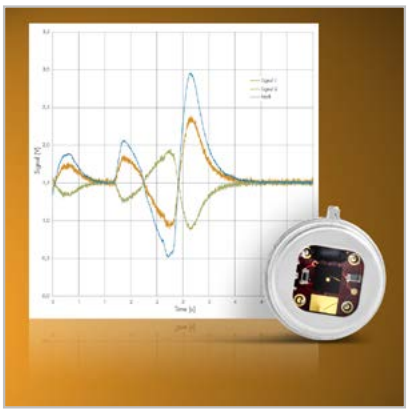
LASER COMPONENTS not only has developed a new and unique pyroelectric connection method to eliminate electromagnetic interference, our new, **patented**[1] detector configurations (Fig.1 & Fig.4) improves the Signal to Noise ratio by approximately 1.4!

When charges are generated on the pyroelectric crystal, positive and negative charges are generated on opposite sides (Fig. 2). Both sides of the crystal produce opposing signals of equal magnitude, and by using our unique scheme we can subtract the signals from each other (using a differential or instrumentation amplifier) eliminating the common mode noise from outside sources, but effectively doubling the output!

Although our detector signal increases twofold, our noise increases by a factor of only √2; **resulting in an overall signal to noise improvement of approximately 1.4**.

In Figure 3 we used one of our differential detectors and introduced common mode noise in the form of a 50Hz signal. As you can see signal 1 and signal 2 both demonstrate the noise; whereas the mathematically subtracted output does not. As well as giving a significantly increased output, the common mode noise has been eliminated.

Because this detector is also based on our Current Mode architecture, our differential detectors can be directly inputted in to modern ADCs and microcontrollers where this subtraction can be done in software; allowing you to cut out pre-amplification stages from your design, and cut down on development costs!



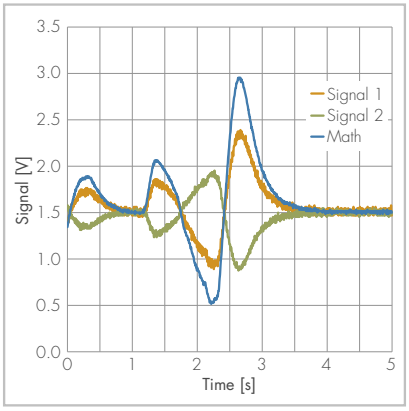


Fig.3: Common mode noise eliminated via differential detector.

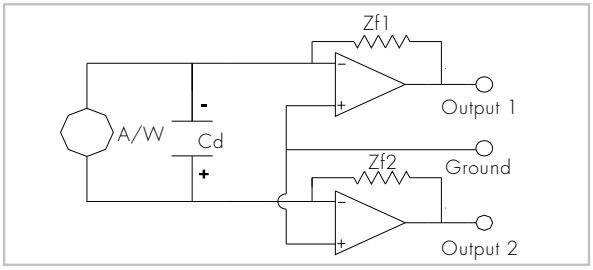


Fig.1: Circuit diagram of our CM based Differential Pyroelectric Detector.

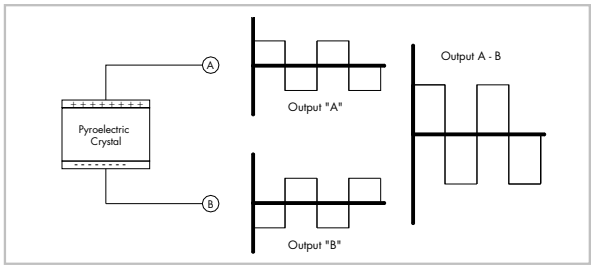


Fig.2: Demonstration of the effect on signal when both outputs are subtracted.

[1] Patent no.: US 10,302,500 B2 (May 28,2019)

Germany and Other Countries
Laser Components Germany GmbH
Tel: +49 8142 2864–0
Fax: +49 8142 2864–11
info@lasercomponents.com
www.lasercomponents.com

France
Laser Components S.A.S.
Tel: +33 1 39 59 52 25
Fax: +33 1 39 59 53 50
info@lasercomponents.fr
www.lasercomponents.fr

United Kingdom
Laser Components (UK) Ltd.
Tel: +44 1245 491 499
Fax: +44 1245 491 801
info@lasercomponents.co.uk
www.lasercomponents.co.uk

Nordic Countries
Laser Components Nordic AB
Tel: +46 31 703 71 73
Fax: +46 31 703 71 01
info@lasercomponents.se
www.lasercomponents.se

USA
Laser Components USA, Inc.
Tel: +1 603 821–7040
Fax: +1 603 821–7041
info@laser-components.com
www.laser-components.com

Voltage Mode Differential Detector

The Voltage Mode Differential Detector is offered with a DLaTGS crystal pyroelectric element. The signals from the top and bottom of the crystal are each sent to the gate of a low noise JFET. The outputs from the source of the JFET's need to be connected externally to the detector ground using (nominally) 47 kOhm resistors as shown in the Circuit Diagram. The two source output signals are of opposite polarity as is the case with the opamp outputs of the Current Mode Differential Detector Model LD2100. The two signals can be combined by subtraction, i.e., Final Output = Output 1 – Output 2. Since each of Output 1 and Output 2 are nominally equal in value (but 180 degrees out of phase) the Final Output is then double each output as with the LD2100.

The basic model for the Voltage Mode Differential Detector is the DD3151D1300 that is offered with a variety of IR windows for spectroscopic applications. The active DLaTGS element has a 1.3 mm diameter with absorbing metal black. For THz applications, the preferred detector is the DD3150D1300-p1, which detector has a nichrome metal electrode to absorb the incoming radiation, and a HDPE plastic window that is transparent at such long wavelengths. Other windows suitable for THz applications are polished, uncoated silicon and CVD diamond windows. The entire range of IR windows and filter windows available are listed and described in the Pyroelectric Detectors Filter and Window Selection Datasheet.

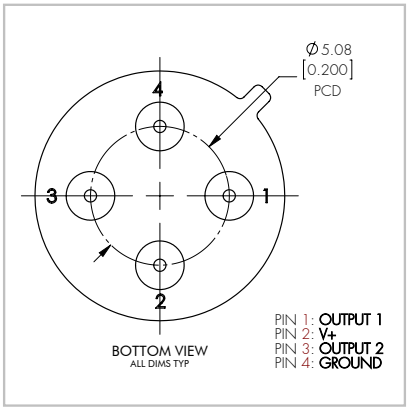


Fig.5:
Bottom View of Detector Model DD3151D1300.

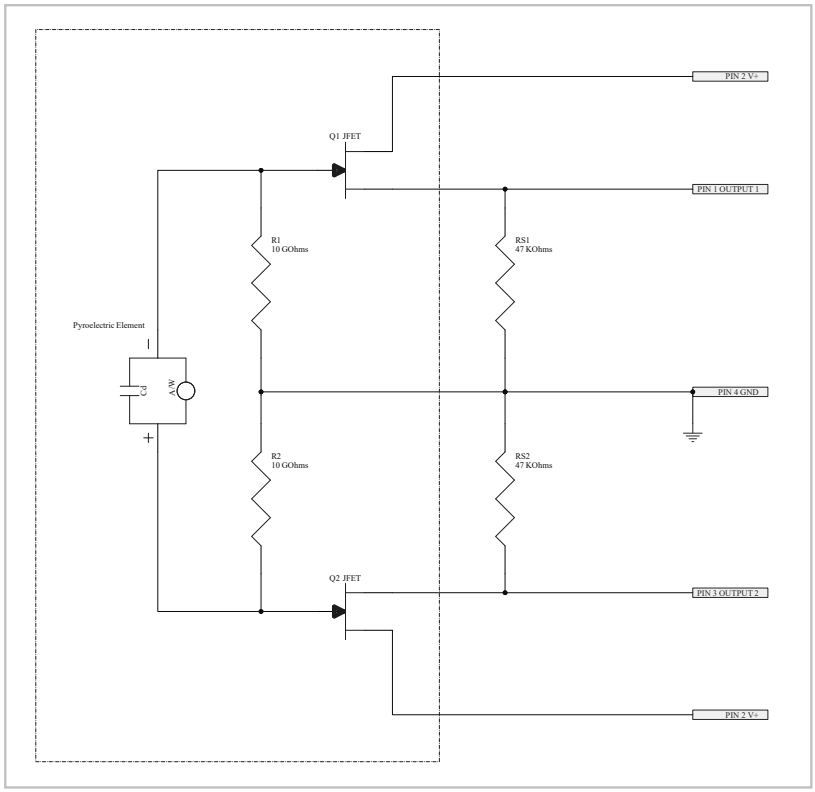


Fig.4: Circuit Diagram and Connections of the VM based Differential Detector.

Germany and Other Countries
Laser Components Germany GmbH
Tel: +49 8142 2864–0
Fax: +49 8142 2864–11
info@lasercomponents.com
www.lasercomponents.com

France
Laser Components S.A.S.
Tel: +33 1 39 59 52 25
Fax: +33 1 39 59 53 50
info@lasercomponents.fr
www.lasercomponents.fr

United Kingdom
Laser Components (UK) Ltd.
Tel: +44 1245 491 499
Fax: +44 1245 491 801
info@lasercomponents.co.uk
www.lasercomponents.co.uk

Nordic Countries
Laser Components Nordic AB
Tel: +46 31 703 71 73
Fax: +46 31 703 71 01
info@lasercomponents.se
www.lasercomponents.se

USA
Laser Components USA, Inc.
Tel: +1 603 821–7040
Fax: +1 603 821–7041
info@laser-components.com
www.laser-components.com