gentec-eo
PARTNERS for ACCURACY
ENERGY DETECTORS

GMP
GENERAL MICROTECHNOLOGY & PHOTONICS

APPLICATION NOTE

HOW TO SET UP AND USE OUR QE-I-BNC DETECTORS WITH INTEGRATED ANALOG MODULE

BEFORE WE START

We will assume, for the sake of this article, that you have selected the appropriate Silicon or Pyroelectric detector for your particular application. We will also assume that you have installed the 9 Volt battery in the housing and/or are using the "battery eliminator" (DC voltage source). In either case, the "green" LED Power On light should be lit.

Checking and/or selecting the Voltage Responsivity (R_v) and Time Constant (Tau)

Prior to mounting the Joulemeter probe in your optical set up, remove the instrument's front bezel to expose the green PC board. Now, orient the probe so that you can easily read the text in the small silk screened table that is opposite the 4 position DIP switch (see figure 1 below). This table shows the DIP switch positions that correspond with a particular Rv and Tau. A DIP switch is either in the "1" (up) position or "0" (down) position.

Why select R_v High vs R_v Low?

Selecting high R_v will allow you to measure at the lowest pulse energy level possible, while selecting low R_v will allow you to measure a high energy pulse, giving the instrument more voltage head room.

Why select Tau at 5 msec vs 500 µsec?

The time constant determines the maximum pulse width that you can measure using our instrument. The pulse width should not be more than 10% of the time constant. So, Tau = 5 msec, Maximum Pulse Width = 500 µsec; Tau = 500 µsec, Maximum Pulse Width = 50 µsec. What is the minimum pulse width that can be measured? There is no minimum! As long as you can read the voltage output on your oscilloscope, you can measure the pulse energy.

Your options are as follows:

- 0001 - R_v High (50x) - Tau 5 msec
- 0010 - R_v High (50x) - Tau 500 µsec
- 0100 - R_v Low (1x) - Tau 5 msec
- 1100 - R_v Low (1x) - Tau 500 µsec

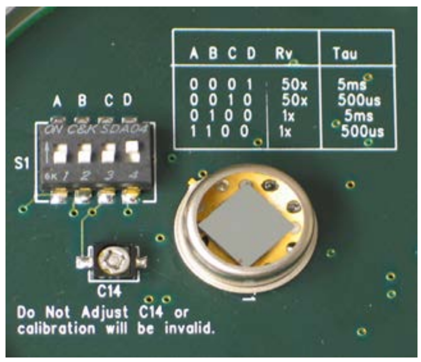

Figure 1: DIP Switch positions as indicated on the PC Board of a -BNC detector

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BEFORE WE GO ON WITH THE MEASUREMENTS

Now you can thread the front bezel (and aperture plate) back onto the housing. This is important as it is part of the EMI shield for the instrument. You're ready to mount it into your optical set up and prepare the oscilloscope for your pulse energy measurement.

Connecting your Analog Joulemeter Probe to your Oscilloscope

We'll assume you have a fairly standard analog or digital oscilloscope and that you've turned it on. Follow the steps outlined below to ensure that your scope is set up properly for our pyroelectric detector with integrated analog module.

1. Set the scope to the AC coupled mode (not DC coupled)
2. Set the scope input impedance to 1 MΩ (not 50 Ω)
3. Set the scope trigger to "internal" and "positive" slope
4. Now, if you have a good idea of the pulse energy, calculate the expected voltage output of the detector by multiplying the pulse energy by the R_v of the probe. Use this voltage to select the "voltage sensitivity" of the scope. In general, you'll try to maximize the voltage pulse on the scope.
5. Assuming you know the repetition rate of your source, adjust the "time base" to display at least two pulses (Check Figure 2 below). For a source pulsed at 10 Hz, set the time base to 20 msec/div.

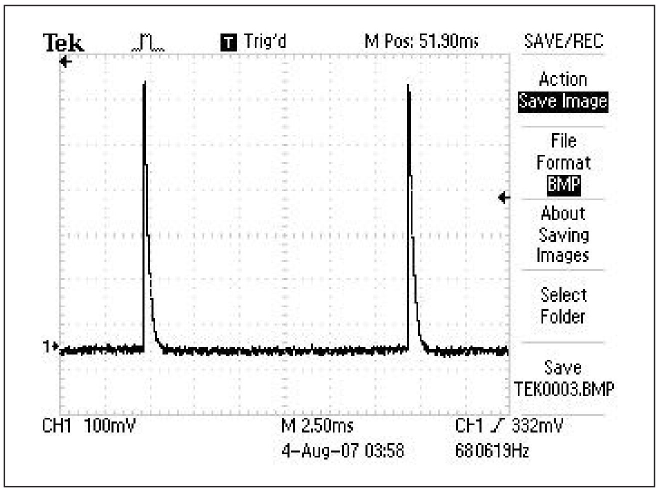

Figure 2: Time Base adjuted to have at least 2 pulses

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6. You should now see several pulses on the scope display. Use the "vertical adjust" to set the baseline of the pulses to coincide with a horizontal grid line. This grid line is used as the zero from which to measure the peak voltage. See Figure 3 below.

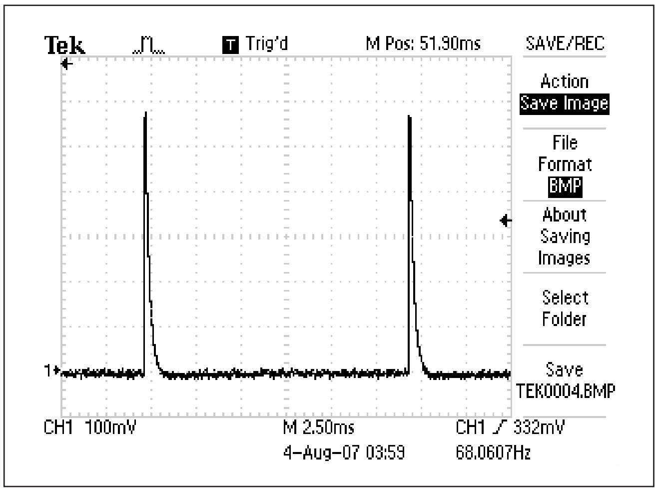

Figure 3: Baseline adjusted to a horizontal grid line.

7. Now, adjust the time base of the scope to show a single Joulemeter pulse. If you are using a digital scope, you may want to engage the "horizontal" cursors to assist you in reading the peak and baseline voltage. Divide this voltage (V base to peak) by the calibrat ed R_v factor (V/J) and you will have measured the pulse energy.

CAUTION: If your scope has a "measure" feature and you select "peak-to-peak", make sure that you are actually measuring from the "baseline" of the pulse at the "leading edge" and the peak. Another, safer, choice would be to measure the "amplitude" of the pulse.

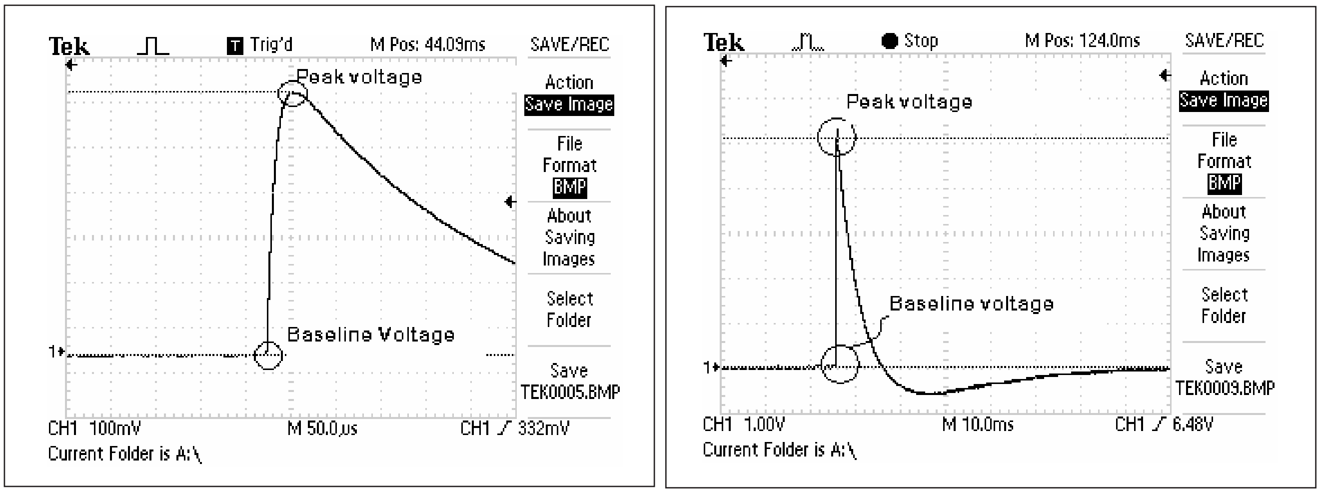

Figure 4: a. Scope adjusted to show a single pulse (zoomed-in), with baseline and peak voltages.
b. Scope adjusted to show a full single pulse, with baseline and peak voltages.

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OTHER CONSIDERATIONS:

Damage Threshold

50 mJ/cm^2 is the maximum damage threshold for our Pyroelectric Detectors with integrated BNC Modules of the series QE-I-BNC (QE8SP-I-MT-BNC and QE8SP-I-BL-BNC). Take a moment to calculate the expected energy density of the pulse you are about to measure. If it is well below the damage threshold, then continue with the set up. If it may be close to or above the damage threshold, then take advantage of the "damage test slide" we have provided. Probe the laser beam with the slide and observe the results. If the slide is not effected (i.e. does not show discoloration or ablation) you can proceed with the measurement. If the slide shows damage, you will need to consider using some form of optical attenuation.

EMI noise

Laser sources can have a high level of RF noise. Sensitive electronic circuits must be properly shielded to avoid noise pick up. It is important when using our detectors with BNC modules that the front bezel and aperture plate be screwed into place on the front of the device. It is acceptable to use optical accessories in place of the aperture plate, like ND filters, Fiber Optic connectors, etc.

Should you experience any set up or measurement problems please contact us at (503) 697-1870 or email to ddooley@gentec-eo.com