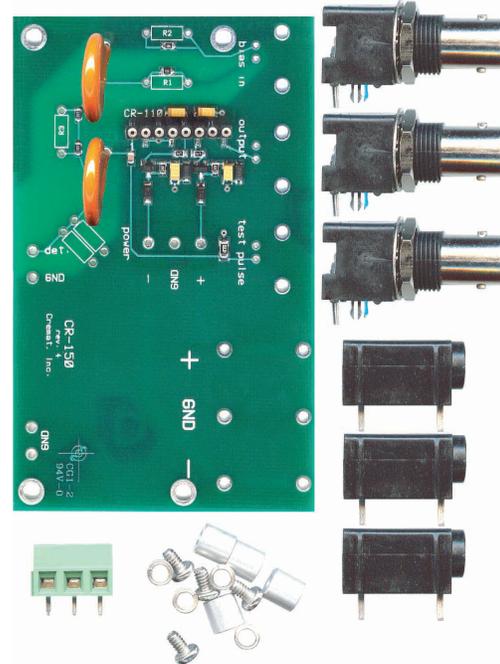
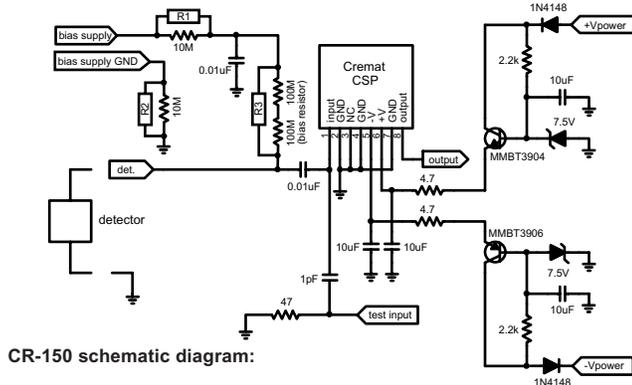


CR-150 evaluation board:

Board dimensions: 3.7 in. x 2.3 in x 0.063 in.

The CR-150 prototyping test board will aid the experimenter in using and evaluating Cremat's charge sensitive preamplifiers (CSPs). The board has an 8-pin socket for the insertion of the preamplifier, as well as power connectors, a power supply regulation circuit and other components needed to filter the detector bias.

The CR-150 board schematic is shown below. The CR-150 uses 'AC coupling' between the detector and preamplifier input.



AC-coupled circuits, such as the CR-150, use a 'bias resistor' through which bias is supplied to the detector. A voltage drop forms across this resistor due to the current flowing through it (which is the same as the detector current). If the voltage drop across the bias resistor is too small (less than about 100 mV), the electronic noise (thermal noise) of the bias resistor starts to become significant in the detection circuit. On the other hand, if the voltage drop across the bias resistor is too large, the voltage across the detector may be significantly (perhaps unexpectedly) less than the applied bias voltage. This is true because the bias supply filter resistors, the bias resistor, and the detector are all in series; voltage drops forming across the resistors subtract from the voltage across the detector. Keep in mind that most voltmeters cannot accurately measure voltage drops across very large resistances, so the best method is to use your knowledge of the approximate detector current to calculate this voltage drop.

The CR-150 comes with bias filter resistor values of 10 megohms and a bias resistor value of 200 megohms (realized on the board with two 100 megohm resistors in series). Regardless of how small the detector current is, it should not be necessary to *increase* these resistances above these values. However if the detector current is expected to exceed approximately 10 nA you may consider shunting the bias resistor and possibly the bias supply filter resistors to lower these resistances (reducing these voltage drops) and preventing them from becoming significant in your application. **The CR-150 board has resistor positions marked R1, R2, and R3 which are intentionally left empty.** These are positions intended to give the user the option to shunt the 200 megohm bias resistor (using R3) and the two 10 megohm filter resistors (using R1 & R2). Users should apply shunting resistors with the aim of producing voltage drops of approximately 0.5 volt across each of them. (note that it is not necessary to be precise in this value - achieving values within a factor of 3 or 4 of the target should be sufficient)

As an example, consider testing an avalanche photodiode (APD) having a leakage current of 100 nanoamps. This would theoretically create a voltage drop of 20 volts across the 200 megohm resistor and another 1 volt across each of the two 10 megohm filter resistors. This would be awkward because the gain of an APD is highly dependent on the bias voltage, and the actual APD bias is less than the applied bias by the amount of the voltage drops across these resistors. To improve the situation, the user should insert a 5 megohm resistor into position R3 reducing the voltage drop to 0.5 volts. R2 and R3 could be reduced to the same value, producing a total resistor voltage drop of 1.5 volts.

The following table may be used to determine appropriate values for the shunt resistors R1, R2, and R3:

leakage current range:	R1	R2	R3
0 to 10 nA	(left open)	(left open)	(left open)
10 nA to 30 nA	(left open)	(left open)	22M
30 nA to 100 nA	(left open)	(left open)	10M
100 nA to 300 nA	3.3M	3.3M	3.3M
300 nA to 1 μ A	1M	1M	1M
1 μ A to 3 μ A	330k	330k	330k
3 μ A to 10 μ A	100k	100k	100k
10 μ A to 30 μ A	33k	33k	33k

The voltage regulation circuits on the CR-150 produce a steady supply voltage to the CSP of ± 6.8 V. The user should provide supply voltage to the power input of the CR-150 within the range of ± 8 V to ± 15 V.

The CR-150 can be used with any of Cremat's charge sensitive preamplifiers (ie: CR-110, CR-111, CR-112 & CR-113). Cremat's shaping amplifiers (CR-200 series) **cannot** be used with the CR-150 board. The CR-200 shaping amplifiers have their own evaluation board: the CR-160. Attempting to operate a module in the wrong evaluation board will result in damage to both the modules and boards.

After soldering to the CR-150 board, be sure to clean any residue (such as the solder flux) from the board. Residue left at the 'detector' terminal or at the bias resistor shunt (R3) can significantly degrade the noise performance of the detection system. Also be careful to avoid moisture or other residue from forming at these positions.

The CR-150 board comes with the parts shown above. Because the user may not wish to use BNC connectors mounted on the board, the connectors have been supplied unassembled to the board. 'PCB-mount' banana connectors are also supplied (unassembled), allowing the user the option of supplying power via banana patch cables. Mounting hardware is also included, as well as an alternative power connector. These different connectors and mounting options are illustrated in the photos on the following page.

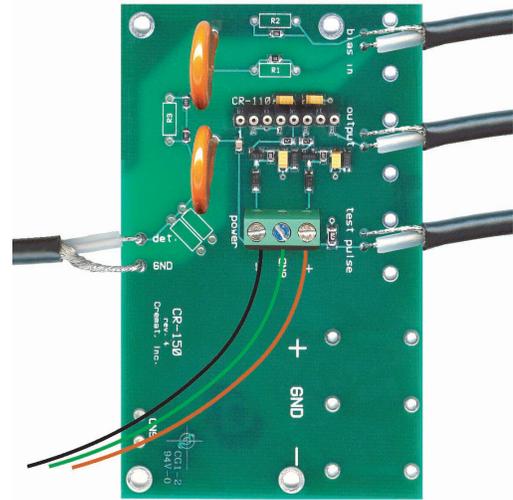
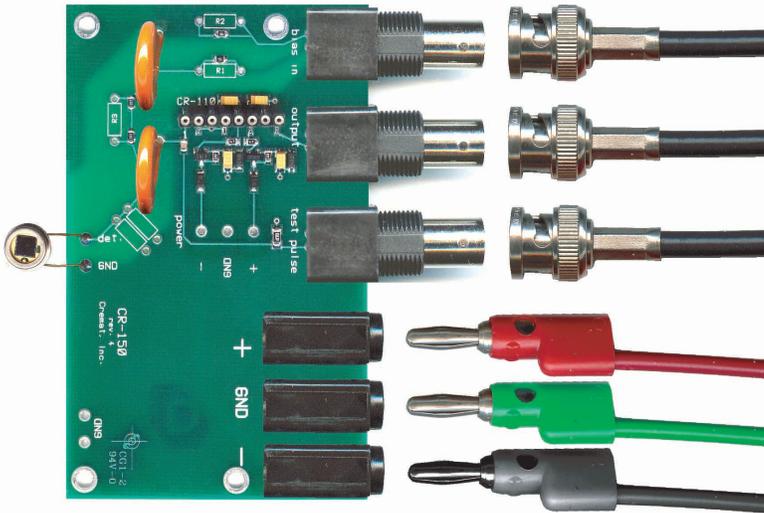
Electrical Shielding:

Cremat's CSPs are sensitive, and operating them in an unshielded environment will usually result in the amplification of unwanted stray signals. For this reason we recommend using any of Cremat's CSPs and the CR-150 board inside a shielded enclosure. We offer the CR-150-BOX (available separately) which provides shielding for the CR-150 board and is easily assembled and operated. For more information on this product, see our web site <http://cremat.com>

Caution: Set-up of the CR-150 board requires the user to be comfortable with soldering and connecting wires, cables, and connectors to PC boards. Also, the user may be exposed to the risk of electric shock, in particular the high voltages sometimes used in detector bias supplies. Furthermore, the user should keep in mind that the detector bias supply GND connection is connected to the CR-150 ground via a 10M resistor (or R2). Any voltage drop appearing across this resistor (due to detector current) will appear as a difference in ground potential between the power supply ground and CR-150 board ground. While this will normally not be a problem, if this voltage becomes sufficiently large it may become an unexpected source of electric shock.

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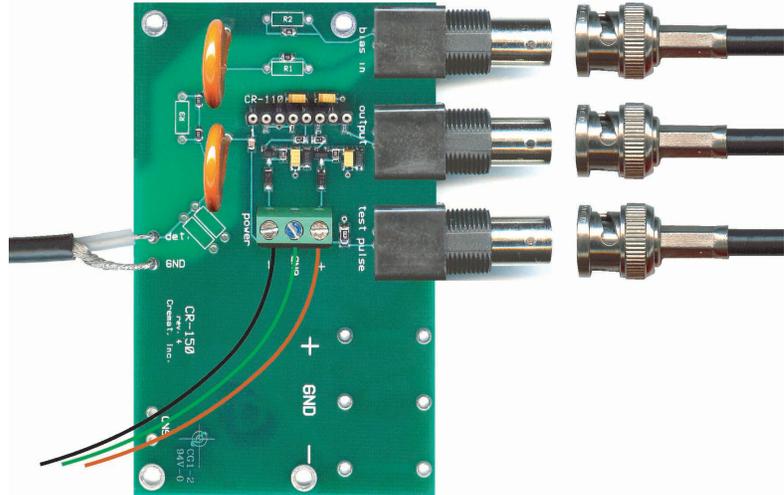




The CR-150 evaluation board can be set-up for use in a variety of ways; Three examples are shown here. Keep in mind that the board should be electrically shielded in order to prevent stray signals from being amplified. In order to simplify shielding the CR-150 board, Cremat now offers the CR-150-BOX (sold separately), which is a die-cast aluminum housing with holes for the connectors. For more information on this product see our web site: <http://www.cremat.com>

Voltage Rating

The CR-150 board can be used with detector voltages up to 2000V. BNC connectors, however, are only rated for voltages up to 500V. To use bias voltages higher than 500V, we recommend that SHV-type high voltage coaxial connectors be used instead of the BNC connectors in both the 'bias in' and 'detector input' positions. Unfortunately, SHV connectors are not available in a PC-mount version, so we recommend using a panel-mount version mounted onto a nearby panel. These can be purchased from Kings Electronics Co. <http://www.kingselectronics.com/>



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