CR-210-R0 baseline restoration module (BLR): application guide

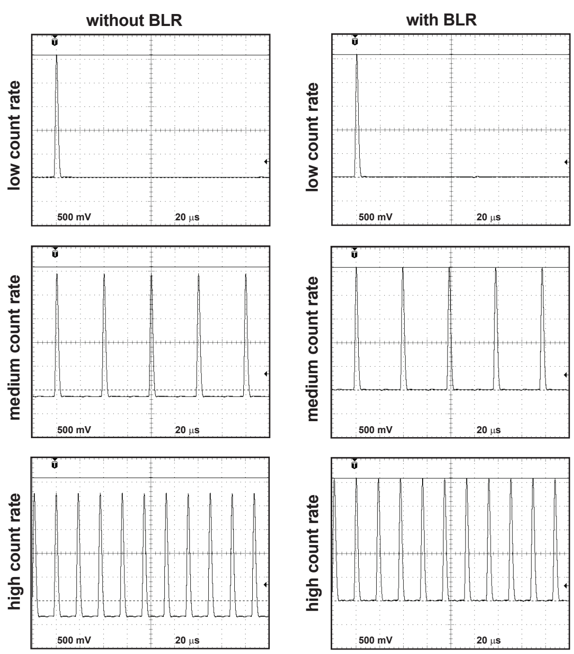
Oct. 2018

General Description

Cremat's CR-210-R0 is a single channel baseline restoration (BLR) module, intended for use with pulsed signals such as those produced by nuclear detection instrumentation. The CR-210-R0 corrects the baseline shift occurring in AC-coupled pulse amplifiers that may degrade the resolution of the acquired pulse height spectra.

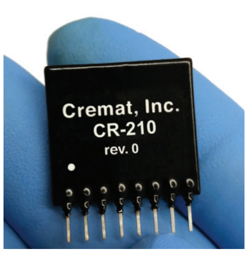
An illustration of the problem can be seen in the scope traces below, showing the output of a Gaussian shaping amplifier detecting pulses from a tail pulse generator. Most pulse detection electronics utilize AC-coupled amplification stages. As a result, the DC gain of these shaping amplifiers is zero and thus the time averaged output from the amplifier is at ground potential. While this is generally not a problem for detection instruments at low or perhaps medium count rates, at high count rates the baseline of the signal becomes significantly depressed, reducing the pulse height of the signals with respect to ground and degrading the pulse height spectrum.

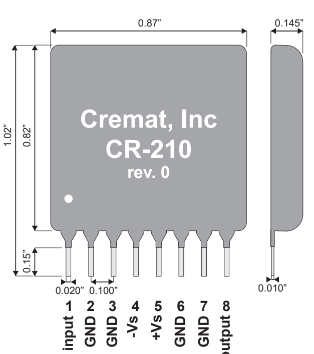
The scope traces below show the effect of the baseline depression with increasing counting rate, and the restorative effects of the CR-210-R0 BLR. The input of the CR-210-R0 BLR is connected to the output of an uncorrected Gaussian shaping amplifier (in this example a CR-200-1µs shaping amplifier module). As can be seen, the baseline of the signal at the CR-210-R0 output remains at ground potential even as the count rate increases to 50k/sec.



Package Specifications

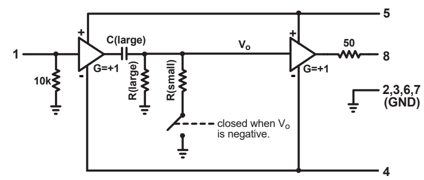
The CR-210-R0 circuit is contacted via an 8-pin SIP connection (0.100" spacing). Pin 1 is marked with a white dot for identification.





Equivalent circuit diagram

The figure to the right shows a simplified equivalent circuit diagram of the CR-210-R0.

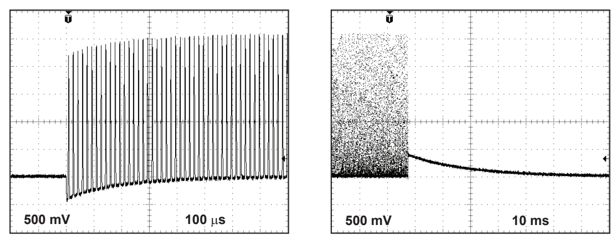


Implementation

The CR-210-R0 BLR stage should be configured to follow the shaping amplifier stage. The CR-210-R0 can be used with any of Cremat's shaping amplifiers, preserving the Gaussian signals with shaping times from 50 ns through 8 µs. Any DC offset present at the shaping amplifier output will be lost as the baseline is redefined in the CR-210-R0 circuitry. The CR-210-R0 works only with signals containing positive pulses.

Response to changing count rates

In situations where the count rate is changing, the baseline is of course redefined to accommodate this. The scope traces below show how quickly the baseline is redefined as a result of increasing count rate (correction increases the baseline with a time constant of 200 µs), and as a result of decreasing count rates (correction decreases the baseline with a time constant of 20 ms).

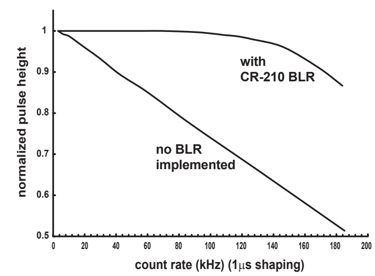


increasing count rate | decreasing count rate

BLR Efficacy

The figure on the right shows the efficacy of the CR-210-R0 circuit when implemented after a CR-200-1µs shaper amplifier. At count rates of approximately 120 kHz or more the Gaussian pulses start running together and the baseline can no longer be preserved.

For other shaping times, this figure can be used with the count rate scaled proportionally.



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Specifications

Assume temp =20 °C, V_S = ±12V, unloaded output unless stated otherwise

	CR-210	units
Number of channels	1	
Noise	50	nV $Hz^{-1/2}$
Signal gain	1	
Maximum output current	35	mA
Maximum output voltage	$+V_S$-0.6V	volts
Power supply voltage (V_s)		
maximum	V_s = ±13	volts
minimum	V_s = ±6	volts
Power supply current (pos)	17	mA
(neg)	13	mA
Operating temperature	-40 to +85	°C
Input impedance	10k	ohms
Output impedance	50	ohms