CURRENT PULSE GENERATOR

FOR RADSENS-2

- Designed for No-Fire Threshold Energy calibration/characterization and electromagnetic pulse susceptibility of electro-explosive devices

- Pulse current up to 10,000 mA

- Pulse energy/load up to 50 mJ/ohm

- Pulse duration of 20 µs to 500 µs

- Accurate 4-wire measurement method for real time monitoring of injected current, voltage drop, instantaneous load & power, and total dissipated energy in the bridgewire of the electro-explosive device

RSC-PG CURRENT PULSE GENERATOR MODULE FOR RADSENS-2 SYSTEM

DESCRIPTION

The Current Pulse Generator RSC-PG has been specifically designed for addressing the RADHAZ effects of short bursts of electromagnetic energy, called EMP (for electromagnetic pulse), on ordnance. An EMP can come from a radar pulse, a lightning strike, an electrostatic discharge, a nuclear electromagnetic pulse, etc. When a bridgewire electro-explosive device (BW EED) is subjected to an electrical stimulus resulting from exposure to an EMP, the power dissipated in the bridgewire is likely to be shorter than the BW thermal time constant. In this short pulse duration stimulus condition (also called constant energy regime) a different approach for EED assessment and calibration is required. In this situation, the temperature rise of the instrumented EED is calibrated based on the energy rather than the power dissipated by the EED bridgewire.

By delivering current pulses up to 10,000 mA, with a duration of 20 µs to 500 µs, the current pulse generator is the ideal tool for calibration/ characterization of the BW EED's no-fire threshold energy (NFTE). With its 4-wire measurement method, it accurately monitors (at a sampling rate of 3.6 MHz) the injected current and the voltage drop at the EED's electrical input pins during the entire pulse duration, allowing for accurate measurement of the energy dissipated in the EED's bridgewire. The instrumentation of EED is performed with the same fiber optic temperature sensors (OTG-R series) used with the RadSens-2 RSC-CS current source module. To take advantage of the 4-wire method, special electrical leads are required and, for this purpose, the RSC-PG module is supplied with a pair of electrical leads mounted with Kelvin clamps used to connect the electrical pins of the EED to the current and voltage terminals of the RSC-PG module

The RSC-PG module is available with the PulseSens embedded software application (as an option) from Opsens Solutions. This application offers many features such as automatic energy calibration of the EED (in °C/µJ) as well as measurements of the EED susceptibility to EMP or their induced effects. The PulseSens application provides the user with numerous information such as real time data of the injected current, voltage drop, instantaneous power, instantaneous load (BW resistance may vary during the pulse duration due to temperature effects) as well as the pulse duration (at FWHM) and total energy dissipated in the bridgewire. The PulseSens application also perform active load monitoring (with the 4-wire method) at all time.

APPLICATIONS

- No-Fire Threshold Energy calibration/characterization (NFTE) of electro-explosive devices

- Measurements of susceptibility or induced effects on electro-explosive devices due to:

  - Lightning strike
  - Electrostatic discharge (ESD)
  - High-power microwave pulse (HPMP)
  - Radar pulse
  - Various types of EMP
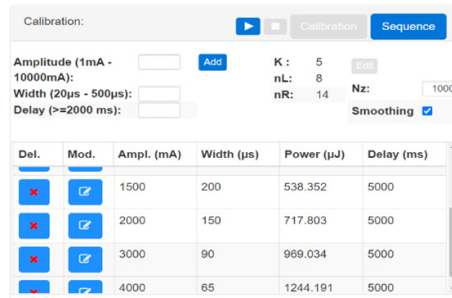 - Nuclear electromagnetic pulse (NEMP)
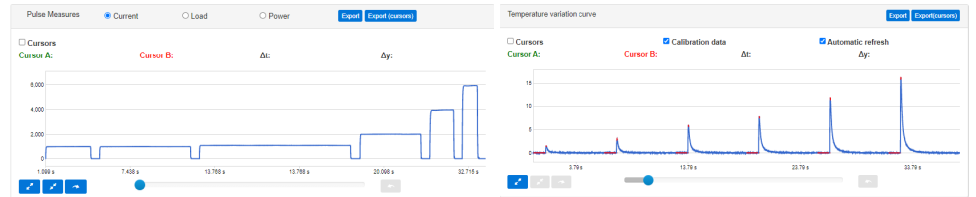
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RSC-PG

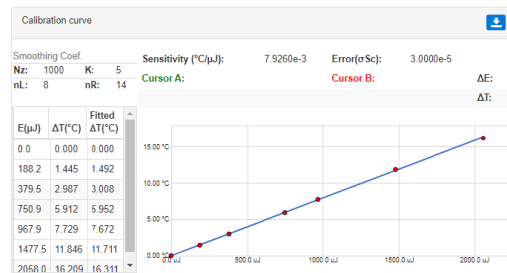## CURRENT PULSE GENERATOR MODULE FOR RADSENS-2 SYSTEM

1) User-defined calibration sequence (Current pulse amplitudes and durations)

2) Current pulse generation and temperature rise measurements

3) Energy calibration curve and energy sensitivity coefficient (°C/µJ)

SPECIFICATIONS

ELECTRICAL OUTPUT SPECIFICATIONS	
Pulse current amplitude range	1 mA to 10,000 mA
Pulse duration range	20 µs to 500 µs
Pulse energy/load range	up to 50,000 µJ/ohm
Permissible load range (BW resistance)	0.01 ohm to 5 ohm
Pulse rise and fall time	≤ 2 µs
Minimum time delay between two sequential pulses	10 ms
Pulse amplitude deviation*	≤ 3 %
Applied current during active load monitoring**	1 mA for load ≥ 0.5 ohm 10 mA for load < 0.5 ohm

ELECTRICAL MONITORING PARAMETER SPECIFICATIONS***	
Monitored parameters at the EED electrical pins**	Injected current $I(t_i)$
	Voltage drop $U(t_i)$
Derived monitoring parameters	Instantaneous load $R(t_i) = U(t_i) / I(t_i)$
	Instantaneous power $P(t_i) = U(t_i) \times I(t_i)$
	Pulse duration (at FWHM) $T = \Sigma_i \Delta t_i$
	Pulse energy $E = \Sigma_i (U(t_i) \times I(t_i) \times \Delta t_i)$
Monitored current accuracy	≤ 1% of measured current
Monitored voltage drop accuracy	≤ 1% of measured voltage
Minimum measurable load during active load monitoring	0.01 ohm

* This parameter is of no consequence because the BW response to the EMP does not depend on the shape of the pulse and also because the pulse energy is accurately calculated using the injected current and voltage drop recorded during the entire pulse duration.

** Active load monitoring is carried out at all times when using the 4-wire method. It allows the load value to be displayed when no current pulse is outputted by the module.

*** When using the 4-wire method only. Injected current and voltage drop are recorded at 3.6 MHz sampling rate.
  (i.e. at a sampling period Δ t of 275 ns)