Kentech Instruments Ltd

OPERATIONAL NOTES
for
250kHz Time of Flight
Deflection Pulser
(SN - *special*)

21/7/04

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Caution

Special 250kHz Pulser Serial No. xxxxx

This equipment is a research tool that has been intentionally designed to generate high energy electromagnetic pulses and the EM emissions will be highly sensitive to the load applied by the user. Within the EU it is suitable for use only in a sealed electromagnetic environment, unless it is used in a system that has been verified by the system builder to comply with EU directive 89/336/EEC.

With an appropriate load and adequately insulated connecting leads, the unit is safe for use by an educated user in a laboratory environment. You are warned however that the radiation from the system with an antenna or inappropriate load attached can damage sensitive equipment and corrupt data stored in computer and microprocessor based systems. It can cause terminal failure of vital medical electronic systems such as pacemakers. This equipment is be supplied on the understanding that the user will analyse these risks, accept responsibility for them and take appropriate precautions in the use of this instrument.

The output from this pulse generator will destroy many types of power attenuators and electronic test equipment. It is the users responsibility to ensure that any apparatus connected to the output is suitably rated.

Kentech Instruments Ltd accepts no responsibility for any damage or liabilities incurred in the operation of this equipment.

Please read the manual before applying power.

THERE ARE DANGEROUS HIGH VOLTAGES (1kV) PRESENT IN THIS PULSER WHEN THE UNIT IS OPERATING. DISCONNECT THE POWER SUPPLY BEFORE REMOVING THE COVERS.

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DISCLAIMER

This equipment contains high voltage power supplies. Careless can result in electric shocks. It is assumed that this highly specialised equipment will only be used by qualified personnel.

Kentech Instruments Ltd accepts no responsibility for any electric shock or injury arising from use or misuse of this product. It is the responsibility of the user to exercise care and common sense with this highly versatile equipment.

The main output can be very dangerous, particularly when the pulser is triggered at a high frequency. Take great care to insulate the output adequately.

Introduction

Our range of solid state high voltage pulse sources allows very high voltage, fast rising pulses to be obtained from compact bench top units. Our avalanche technology allows the generation of 10kV voltage pulses rising in 100ps into 50W. Our Range of FET pulse generators provides sub-nanosecond switching speeds, kilovolt amplitudes and repetition rates in excess of 1MHz. The performance of our compact, convenient and reliable pulsers is to our knowledge exceeded only by laser driven photoconductive switches in terms of voltage switching speeds. These pulsers will find applications in many fields such as high speed camera research, electro-optic switching, triggering systems, time of flight mass spectroscopy and radar.

SPECIFICATIONS

Switched voltage	50 to 250V, adjustable
Load 2 metre	100ohm cable, load capacitance <= 20pF
Rise/fall	10ns
Pulse shape	Positive impulse, width adjustable from <30ns to 200ns from the front panel
Bias	Internally generated -ve bias, adjustable from 0 to -300V from the front panel, Output impedance ~1Mohm
Bias monitor	1/100 bias monitor output, 10kohms
Trigger output	-0.8V into 50ohms, ~30ns pulse width
Trigger input	TTL, +ve edge triggered, 50ohm terminated
Trigger modes	Internal (rate adjustable from 25Hz to 250kHz)
	External (any rate up to 250kHz)

Controls and connections:

Power	LED Toggle
Power on/off	LED
Trigger	BNC (TTL, 50ohms input impedance)
Trigger monitor	BNC (NIM)
Trigger monitor	BNC (TTL)
Trigger LED	LED
Trigger mode	Front panel control
Internal rate	Front panel control
Bias	Front panel control
Bias monitor	BNC (1/100, 10kohm)
Pulse output	SHV (2 metre 100ohm cable provided)
Pulse height	Front panel control
Pulse width	Front panel control

Use

The pulser requires A.C. power and a trigger signal to operate. The trigger signal can be generated internally or applied externally. When external triggering is used, the trigger signal, which is applied to the trigger input (BNC), should be TTL compatible. The pulser is triggered on the rising edge of the trigger pulse.

When the pulser is triggered the "triggered" light on the front panel will flash. There are two monitor outputs, one each of NIM and TTL compatible voltage levels. The NIM output provide a ~30ns duration pulse, synchronised with the leading edge of the output pulse and will typically be used to trigger external equipment such as a scope or a TDC. The duration of the TTL output pulse is slaved to the HV output pulse.

The output is connected to the load via a 100W open circuit cable. The maximum cable length is 2 metres. The load must be purely *capacitive*. The pulser is characterised into a load of 20pF, typical of a beam deflection structure. Do not drive the pulser into a resistive load or a short circuit or it may be damaged. The bias voltage is supplied from a high impedance internal supply (~1MW). A high impedance probe should be used if this signal is to be monitored. Oscilloscope probes should be 100MW or greater, high voltage DC probes should be 1GW or greater. There is a divided down bias monitor output to which an external DMM may be connected. Note that the bias defines the average output voltage.

The internal trigger rate is set by a coarse and a fine control allowing the rate to be set between 25Hz and 250kHz. The pulse duration is set by a coarse control (20ns steps) and a fine control (approx 25ns continuous adjustment).

Description of the modes

i) Stop
The pulser circuit is inactive but the bias is present

ii) Int. Trig
The internal oscillator triggers the pulser.

iii) Ext. Trig
The pulser is triggered on a +ve edge of the TTL trigger input. The maximum PRF is limited to 250kHz.

Description of the controls

i) Front Panel Controls

Power	Turns the unit on or off.
Rate	Internal Pulse frequency 2.5 Herz to 25 kHertz in decade steps..
Fine Rate	Continuously adjustable 1 to 10 times the Rate switch setting..
Pulse Width	HV output pulse length and TTL output pulse width setting 0 to 200 nanoseconds in steps of 20 nanoseconds added to the minimum pulse width.
Fine Pulse Width TTL	Continuous adjustment of the HV output pulse width and the output pulse width. 0 to ~25 nanoseconds adjustment.
Pulse Height Height	HV output pulse height adjustment added to the Fine Pulse setting in steps from 0 to 245 Volts**.**
Fine Pulse Height	Continuous adjustment of the HV output pulse Height 0 to 30 Volts
Mode	Stop The pulser circuit is inactive but the bias is present Int Trig The internal oscillator triggers the pulser Ext. Trig The pulser is triggered on a +ve edge of the TTL trigger input. The maximum PRF is limited to 250kHz.
Bias	Continuous adjustment of the Bias voltage applied to the HV output signal. Note this is the average level of the output signal and is slightly affected by the pulse width & Pulse rate particularly at the highest rate setting.

ii) Front panel lights (LEDs)

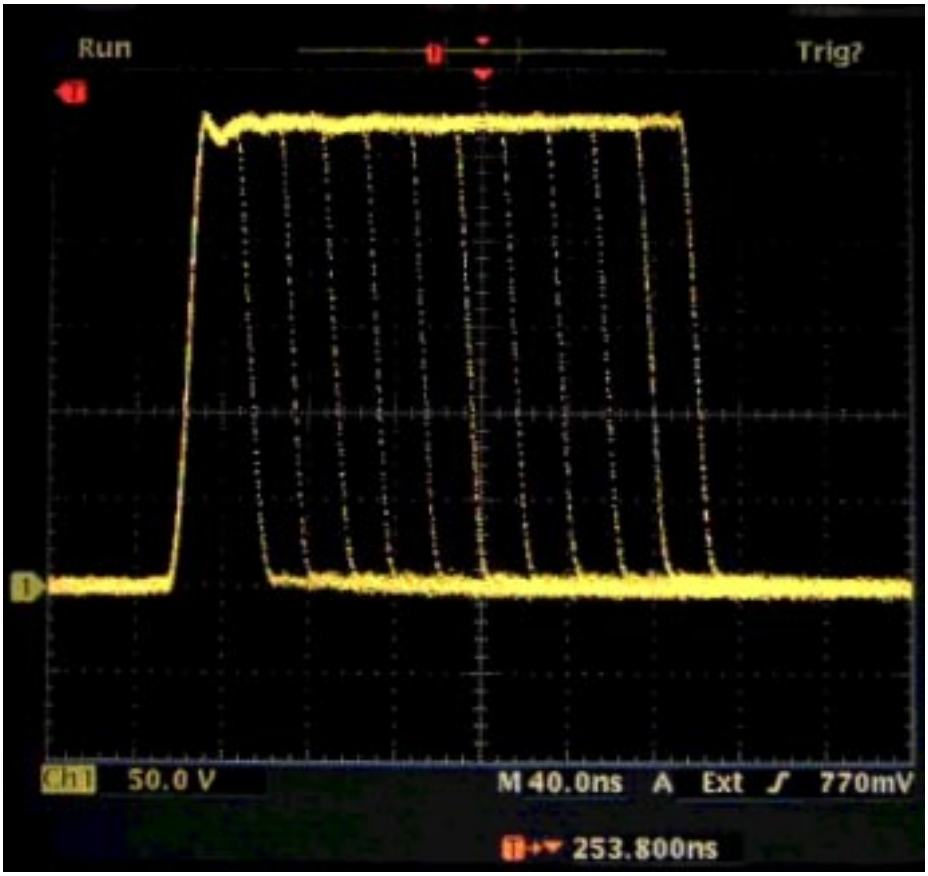
•Power	AC power is applied and pulser is switched on
•Triggered	This light flashes for approximately 0.5s when the pulser is triggered.

iii) Connectors

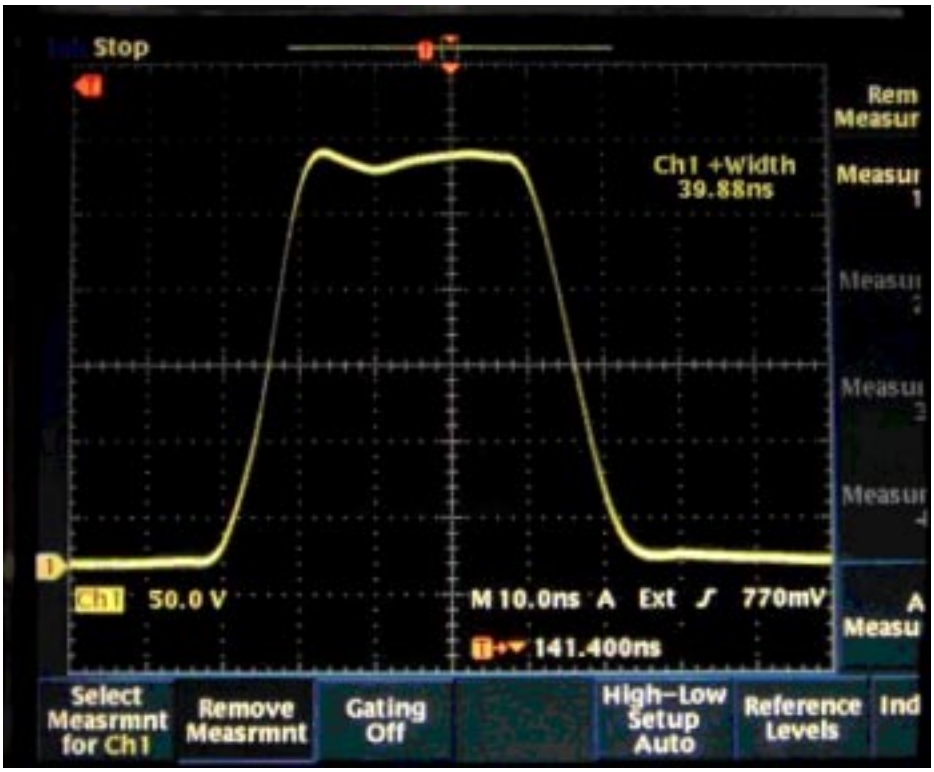
•AC power	IEC connector, rear panel, universal input
•Trigger	Input BNC, front panel, TTL, 50W. The required trigger signal is 5V.
•Monitor outputs	
Bias Monitor	DC output 10KW 1/100 of Bias voltage for measurement with a high impedance DVM or Oscilloscope probe.
NIM	BNC 50W This outputs provide a -0.8V pulse ~30 nsec long.
TTL	BNC 50W TTL signal level, slaved to HV output pulse duration
•Output	
HV output	SHV Capcitive load only. 250V +ve pulse on an average bias signal 0 to -300VDC.

Test data xxxxx

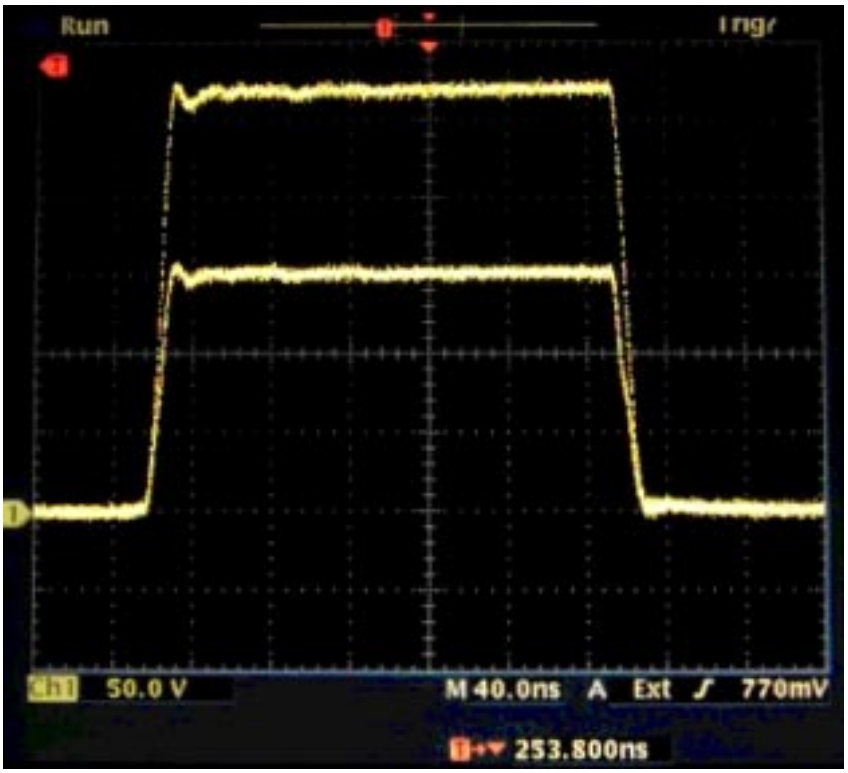
2 metre x RG62AU cable , 20pF load



Pulse widths between 30ns and 200ns

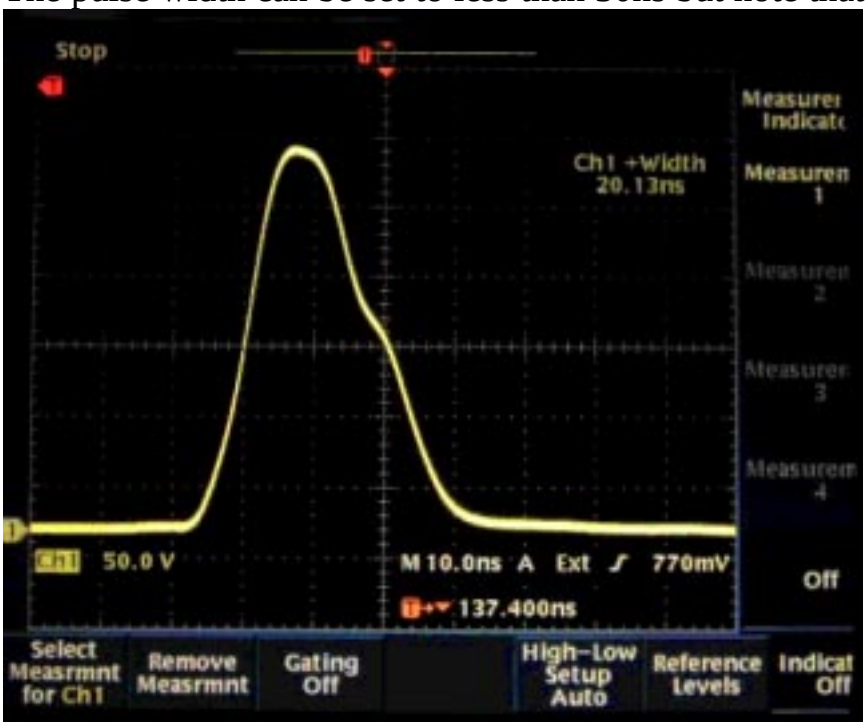


40ns pulse width

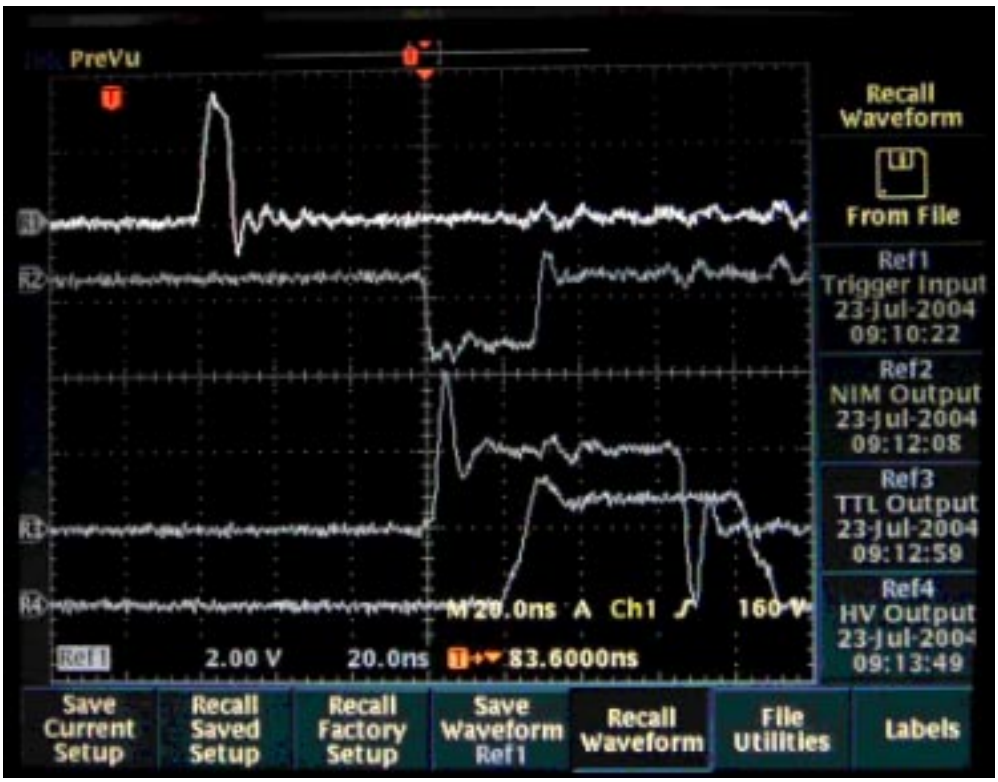


Different amplitude pulses

The pulse width can be set to less than 30ns but note that the fall time is slightly increased:



20ns pulse width.



Showing the relative timing of the trigger, monitor and HV output signals **at the front panel.**

These signals were obtained with a high impedance probe at the front panel. The TTL output is not reverse terminated and shows overshoot. This is not present when the output drives a 50ohm load.

The trigger delay from the input trigger to the HV output is approximately 80nsecs. The TTL monitor output leads the HV output by approximately 20nsecs.

When the pulser is used in internal trigger mode the relative timing between the HV output and the TTL and NIM monitors is the same.