Notes on the use of

Kentech Instruments Ltd.
Injector pulser
Serial No. *(special)*

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CAUTION

With an appropriate load, this 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. The output from this pulse generator will destroy some types of 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 high voltages present in this pulser when the unit is operating. Do not remove the covers, return to Kentech Instruments Ltd or its appointed agent for servicing.

The accessible terminals of this instrument are protected from hazardous voltages by basic insulation and protective grounding via the IEC power input connector. It is essential that the ground terminal of this connector is earthed via the power lead to maintain this protection.

If cleaning is necessary this should be performed with a soft dry cloth or tissue only.

RF emissions and EC directive 89/336/EEC

This equipment is a research tool that has been intentionally designed to generate short high energy electromagnetic pulses and the EM emissions will be highly sensitive to the load applied by the user, for example the radiation just from some types of output cable may exceed EC permitted levels.

The level of RF radiation generated by the circuit boards within the instrument is inevitably high but the emissions are largely contained by the instrument enclosure. It is therefore very important that all fasteners are securely fastened, do not operate the pulser with the covers removed. The pulser may still interfere with sensitive equipment at short range.

We believe that with this type of unit it has to be the system builders responsibility to verify that his pulser/load system complies with the EC directive unless the system is used in a screened electromagnetic environment.

We are not able to guarantee compliance with arbitrary loads but to minimise emissions we recommend:-

1) that any load is fully contained within a conductive metal screened box, with all joint surfaces gasketed or fitted with conductive fasteners at less than 5cm intervals.
2) that the load is connected to the pulser output with semi-rigid cable, the cable outer must be carefully connected to the N type output connector at one end, and must be connected directly to the screened box containing the load at the point of entry. Flexible cables should only be used with caution, in particular RG303 type cable will need additional screening to control emissions.

Introduction

Our range of solid state high voltage pulse sources (MPS and HMPS series) allows very high voltage, fast rising pulses to be obtained from compact bench top units. Voltage pulses as short as 100ps FWHM, in excess of 2kV peak voltage into 50Ω, and with a pulse repetition frequency (PRF) >1kHz can be produced. 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 and radar.

A large range of output pulse lengths can be provided by the incorporation of internal passive pulse forming networks. There is very little jitter in the output of the pulsers and two independent pulsers can be used in parallel to drive low impedances. This aspect makes the pulsers particularly useful for driving microchannel plate systems. Transformers with output impedances as low as 5Ω are available.

The standard drivers and speed-up modules have a life of $>10^{10}$ pulses and have a PRF of ≥100Hz, although special units with a PRF >2kHz can be supplied. The high repetition rates allow sampling oscilloscopes to be used to characterize a system and verify the pulse shape.

The pulsers can feed into a short circuit load without damage. This allows them to be used in sub-nanosecond pulse chopping systems by feeding through a pockels cell into a shorting stub. Variations on the standard driver are available.

Use

The pulser requires A.C. power and a trigger signal to operate. The trigger signal, when applied to the trigger input (BNC), should be 5 volts with a fast rising edge (<5ns) to maintain the low jitter of the system. The trigger pulse should be 10ns or longer.

The pulser triggers on the rising edge of the trigger signal and the output pulse length is fixed internally. The trigger delay is approximately 20ns

The main output of the unit appears at the four front panel connectors (SMA). If it is necessary to monitor or characterize this pulse suitable attenuators should be used. The output may be observed with a high bandwidth oscilloscope. This must have a bandwidth of ≥1GHz.

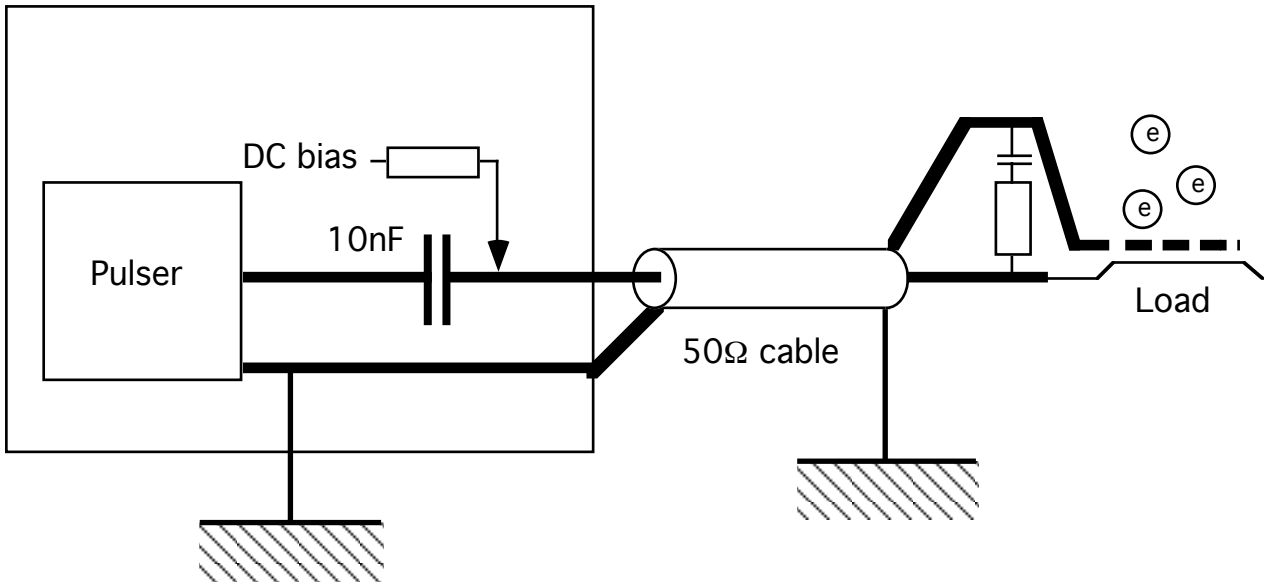
There is a DC bias superimposed on the pulse output. This is set via a front panel control and there is a divided down monitor output (10x, ~10kΩ output impedance). The impedance of the bias supply to the main output is ~100kΩ. If a bias is required then suitable decoupling arrangements must be provided at the load.

The triggered LED will illuminate each time an output pulse is produced.

The pulser is designed to produce a short burst of pulses. Each pulse required a separate trigger pulse. The minimum spacing between pulses is 50ns and there can be approximately 10 pulses in a burst. When a burst is required the trigger pulse should be set to 10ns to allow the trigger circuit to recover before the next pulse in the burst.

The average PRF is limited to approximately 100kHz. If this rate is exceeded an internal trip will occur and the output will disappear. To reset this trip switch the ac power on and off, after having first reduced the trigger rate.

Possible termination arrangements:



There is a resistor in series with a capacitor shown at the electron gun to make the load close to 50Ω. This must be chosen to minimise reflections up and down the connecting cable. (A typical value is 100Ω).

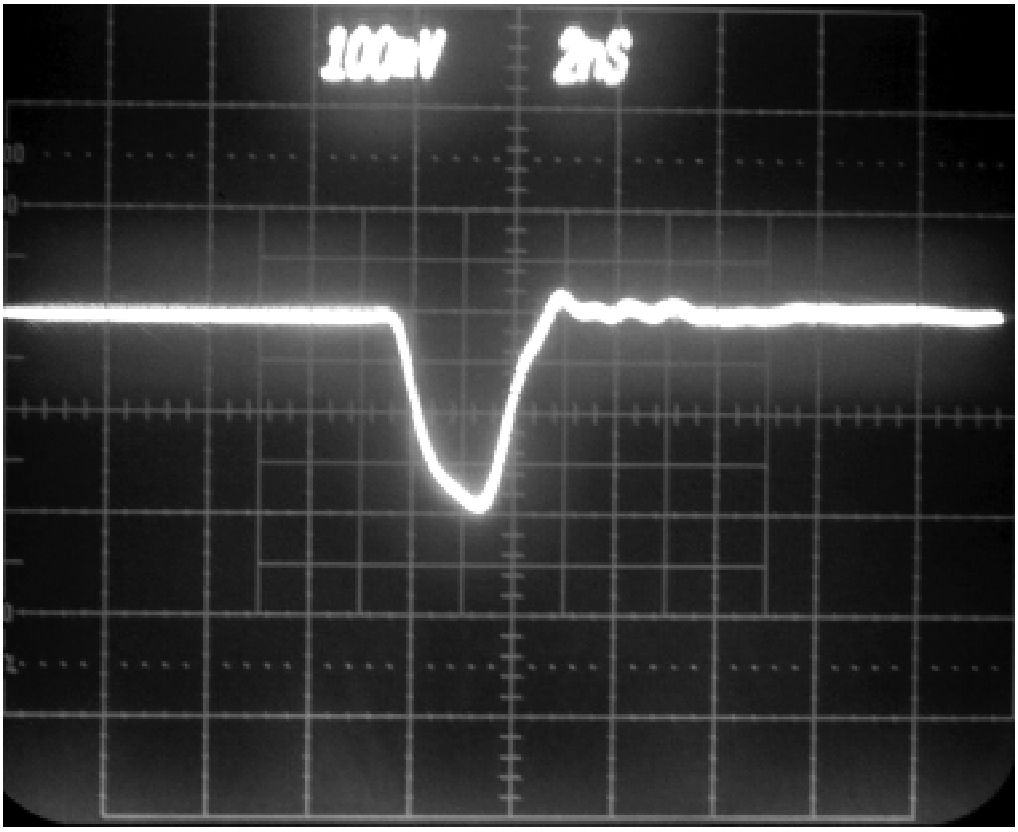
Specification

Output voltage	~180V, negative
Load	Decoupled 50Ω
Jitter	≤50ps
Bias	Internal, 0-100V, 100kΩ impedance
Internal bias capacitor	10nF
Trigger	5V, 50Ω, rising in 5ns
Pulse width	≤2ns, ≤2.5ns at zero volts (when bias is applied)
Rise time	1.5ns
Fall time	1ns
PRF average	100kHz
Min pulse spacing	50ns
Burst length	10 pulses
AC supply	100V to 240V AC, 50/60Hz

Connections and controls

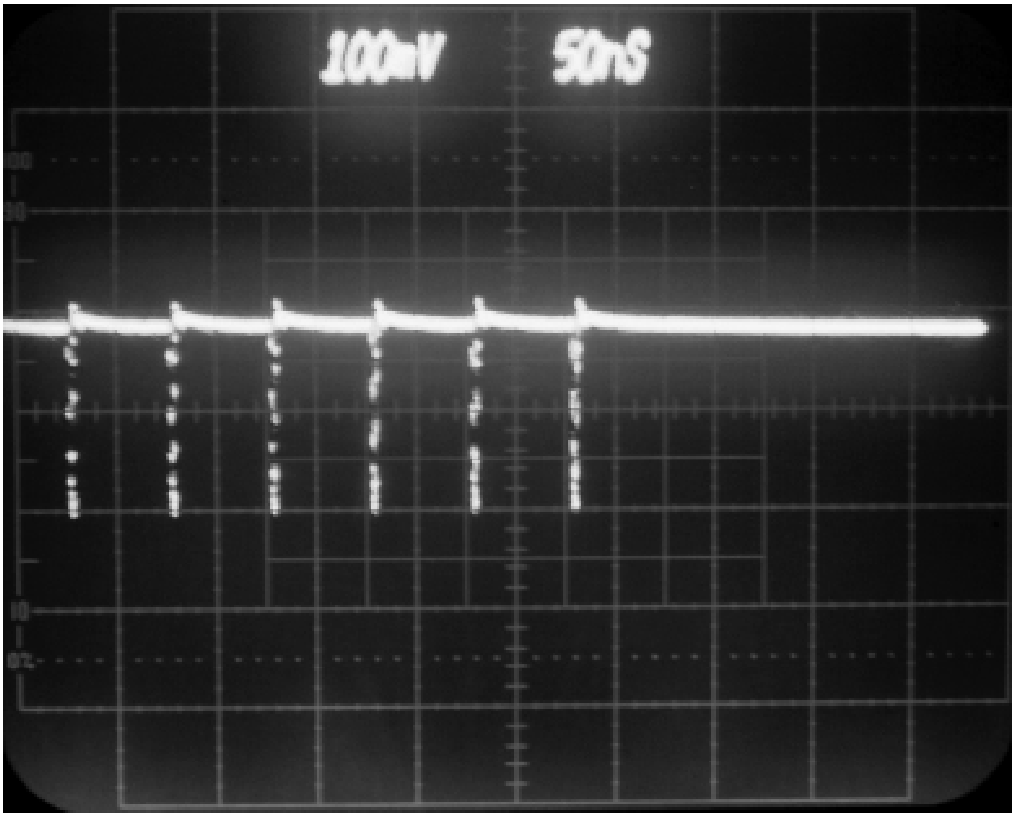
Output	SMA	-180V pulse plus DC bias
Bias monitor	BNC	≤10V from 10kΩ, (bias/10)
Trigger input	BNC	5V, 50Ω, +ve edge
Triggered light	LED (green)	
Power light	LED (red)	
AC power on/off	Rocker switch on front panel	
AC power input	Filtered IEC on rear panel.	

Typical output
1000x attenuation, Tek S4



100V per div

Showing a 20MHz burst



100V per div