

Kentech Instruments Ltd.

Notes on the use of Solid State Ion Beam Deflection Pulser



March 1996

Caution

Special 50kHz Pulser Serial No. J95****

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 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.

DISCLAIMER

This equipment contains high voltage power supplies. Careless use 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.

DO NOT OPERATE THE UNIT WITH ANY COVER REMOVED

The main high voltage output is dangerous. The HV output leads are supplied unterminated. They must not be used until a suitable HV termination is provided by the user. Take great care to insulate connections to the output and leads from the output adequately.

ENSURE THAT THE HIGH VOLTAGE OUTPUT SIGNAL IS INSULATED 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 voltage pulses as short as 100ps FWHM, in excess of 2kV peak voltage into 50 Ω and with a pulse repetition frequency (PRF). Our Range of MOSFET pulse generators provides nanosecond switching speeds, kilovolt amplitudes and repetition rates in excess of 50kHz. 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.

Use

The pulser consists of two independent bipolar HV switches together with low level triggering control circuitry. The switches each will switch a capacitive load between 0 and 950V in response to a TTL input trigger signal. The pulser is to be connected to the load (typically a deflection plate in a ion optical system) via 100 Ω cable ($\leq 1.2\text{m}$) in length. Suitable leads are supplied with SHV connectors at the pulser end. Note that the load end is unprepared and the user must take care that adequate screening and insulation is provided at the load end to avoid a shock hazard.

The low level circuitry includes a rate generator, a delay generator, phase switching (0 or 180°) and mode switching (high, triggered or low output). The various sections are connected via the front panel BNC connectors. The HV output is provided on the rear panel.

For stand alone use the pulser will be connected as follows:

One of the rate outputs is used to drive the delay input, the other is available for external use, such as scope triggering. Note that the phases are different. The two outputs from the delay generator (delayed and direct) are used to drive each of the two pulser trigger inputs (channels 1 and 2). The direct output is a zero time reference and the relative delay of the delayed output is adjusted with the coarse and fine delay controls. The fine control gives a little more than 50ns adjustment to allow for continuous delay adjustment between the coarse (50ns) steps. The trigger phase controls allow the phase of each HV output to be inverted with respect to the trigger input. The mode controls allow each output to be forced low or high or to be slaved to the trigger input.

Normally the HV output is DC coupled however there is provision for the user to apply a DC bias to the switched output voltage. The use of an external bias will require the moving of internal links*. As shipped the BNC bias inputs on the rear panel are disconnected and the HV output is DC coupled.

The pulser is fan cooled and air flow must be allowed around the rear and base of the unit.

SPECIFICATION

General

PRF	Up to 50kHz
Amplitude	Up to 950V, 100 Ω reverse terminated
Load	Capacitive load only, C ~20pF coupled with 1.2 metre 100 Ω cable

Inputs (Front panel)

Delay input	BNC	TTL - Trigger to delay generator
Trigger input x 2	BNC	TTL - Trigger to HV switch channels

Outputs (Front panel)

Rate	BNC	TTL - Internally generated rate signal
Rate (opposite phase)	BNC	TTL - As above, inverted
Direct	BNC	TTL - Zero delay reference trigger output
Delayed	BNC	TTL - Trigger output, delayed WRT above

Inputs (Rear panel)

Power	IEC	220-240V ac supply
External bias x 2	BNC	0 to +/-950V

Outputs (Rear panel)

Output x 2	SHV	Up to 950V Rise/fall times ~8ns
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Front panel controls and indicators

Power	Toggle	Power On/Off
Power indication	LED	Illuminated when unit is powered
Trigger phase x 2	Toggle	0° or 180° phase
Trigger mode x 2	Toggle	Force HV output high, force low or trigger
Rate	Rotary	100Hz to 50kHz internal rate control
Amplitude	10t rotary	Sets output amplitude, (200 to 950Volts)
Delay (fine)	1t rotary	~60ns continuous delay adjustment
Delay (coarse)	Rotary	50ns delay steps

* **Switching the bias links**

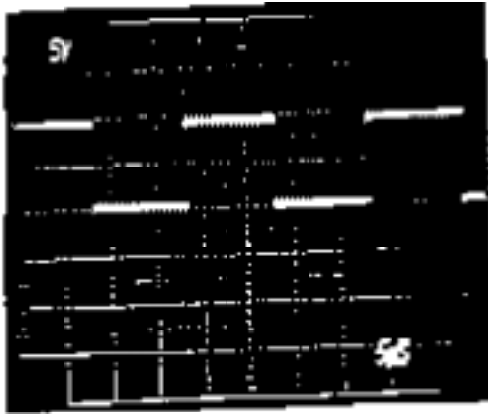
Before removing any cover the unit must be switched off and the power lead removed. The two PCB links may be found by removing the top cover. The small red link plugs are situated close to the point where the SHV output connectors on the rear panel are connected back onto the pulse output board. (These SHV connectors are linked back to the PCB by semi-rigid cables ending in BNC circuit board connectors and the links are close to these two circuit board BNC connectors.) The small red links should be removed, rotated by 90° and replaced for external bias operation.

The orientation of the links for DC coupling (no external bias) is front-back. The orientation for AC coupling with external bias is left-right.

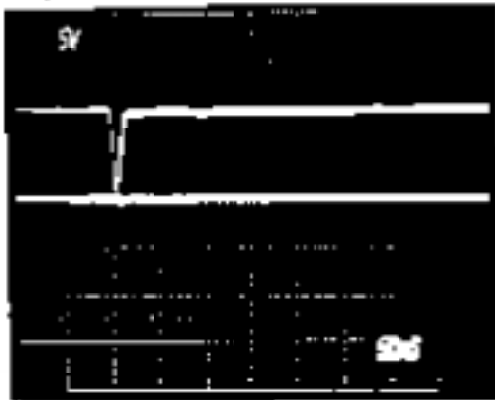
The maximum external bias input is +/-1000V.

DO NOT USE THESE LEADS UNTIL THEY HAVE BEEN FITTED WITH ADEQUATE HIGH VOLTAGE CONNECTORS AT THE LOAD END.

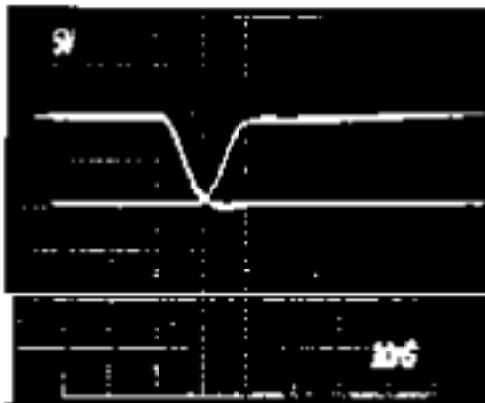
Test data SN - J951207



50kHz drive 13-6-2000
500V/div, 5µs/div



Switching phase
500V/div, 50ns/div



Rise/Fall time
500V/div, 10ns/div



Coarse

Delay adjustment
500V/div, 100ns/div

Fine