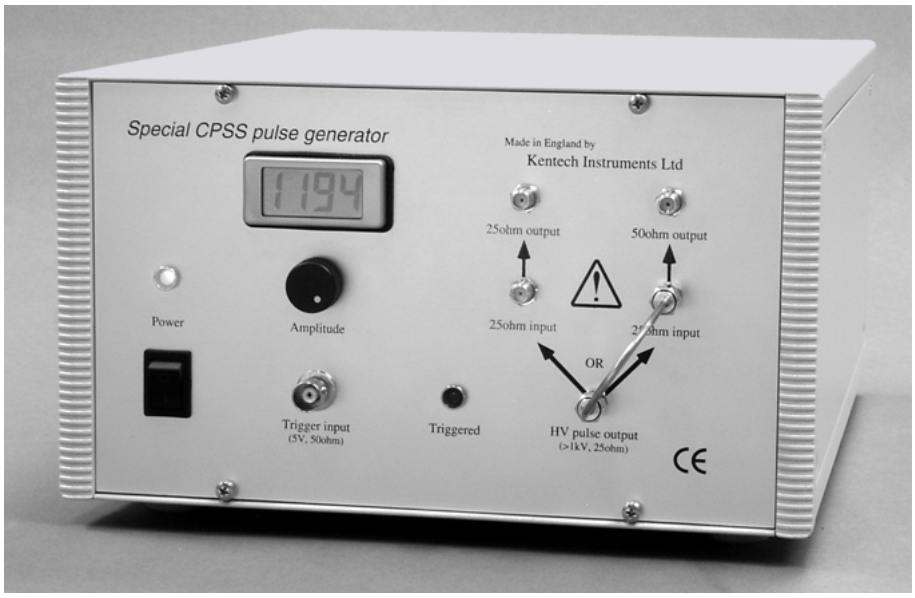
Notes on the use of

Kentech Instruments Ltd.
Special CPSS pulse generator
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 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 high voltages (4kv) 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 pulsers (ASG, SPS, HMPS and PBG 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 4kV 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.

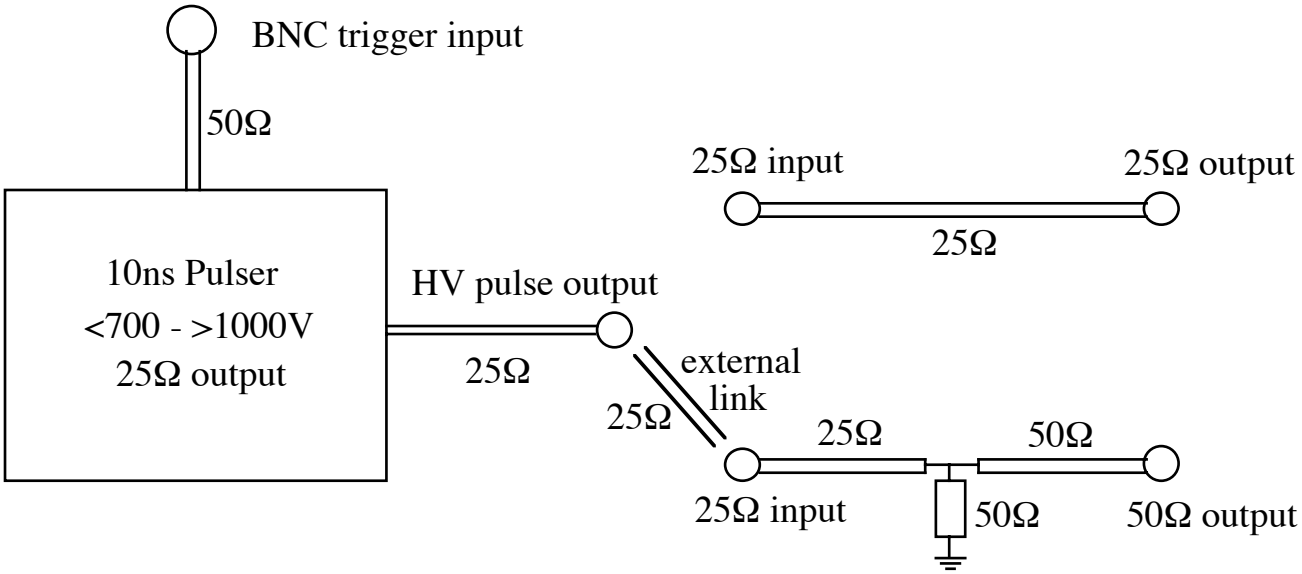
The standard drivers have a life of $>10^{10}$ pulses and typically have a PRF of ≥1000Hz, although special units with a PRF >50kHz can be supplied. The high repetition rates allow sampling oscilloscopes to be used to characterise a system and verify the pulse shape.

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 applied to the front panel trigger input (BNC) should be >5V into 50Ω with a fast rising edge (<5ns) to maintain the low jitter of the system. When triggered the triggered light on the front panel will flash.

The pulse output is a 10ns wide flat negative pulse which appears at the 'HV pulse output' front panel connector (SMA type) matched to 25Ω. The unit is supplied with a 100mm long 25Ω SMA to SMA semi rigid cable which is used to link the 'HV pulse output' to either of the 25Ω inputs as shown by the arrows on the front panel. The left hand '25Ω input' is connected to the '25Ω output' with an internal 25Ω cable. The right hand '25Ω input' is connected to the '50Ω output' with an impedence matching network. See the block diagram of the unit in figure 2. The pulse delay is the same for both 25Ω and 50Ω outputs.



Pulser block diagram figure 2

The output amplitude is adjustable from approximately 650 to 1100 volts into either 25Ω or 50Ω by means of a single turn front panel potentiometer. The set amplitude is indicated on the LCD digital meter above the potentiometer.

If it is necessary to monitor or characterise the pulse output then suitable attenuators should be used.

Caution

The output of this unit will damage or destroy many types of high voltage and high power attenuators. We recommend the use of a high voltage, high speed attenuator manufactured by Barth™ as the first in a series. Consult the attenuator manufacturer before using any other configuration.

The output may be observed with a high bandwidth oscilloscope. This may either be a fast (>3GHz) direct access type or a sampling type.

The trigger delay from trigger input BNC to either output is approximately 20ns. The jitter is ~20ps RMS with a suitably reproducible and fast rising trigger signal.

Lifetime

Solid state high voltage avalanche pulsers have a long but finite lifetime, generally characterised by the integrated number of output pulses. Fast risetime and high voltage lead to high electrical stress and such processes as partial discharges and other minor breakdown effects can gradually degrade insulation and reduce the lifetime.

With this in mind we recommend that pulsers are not operated unnecessarily and that arrangements are made to remove the trigger pulses when the pulse output is not required. This is most important when pulsers are operated near their maximum repetition frequency.

SPECIFICATIONS

General:

Output voltage	<700V to >1kV nominal into 25Ω and 50Ω.
Output polarity	Negative.
Pulse shape	Rectangular.
Pulse width	10ns FWHM.
Rise time	<1ns.
Trigger	>5V into 50Ω, <5ns rise time.
Jitter	<20ps RMS.
Trigger delay	~20ns (BNC trigger input to main outputs via link).
Repetition rates	≥100Hz.
Power supply	100-240V AC 50-60Hz Maximum power <25W.

Outputs:

HV pulse output	SMA type -1kV pulse into 25Ω.
25Ω output	SMA type -1kV pulse into 25Ω (fed from 25Ω input).
50Ω output	SMA type -1kV pulse into 50Ω (fed from 25Ω input).

Inputs:

Trigger input	BNC >5V into 50Ω, <5ns rise time.
25Ω input	SMA type -1kV pulse into 25Ω (input to 25Ω output).
25Ω input	SMA type -1kV pulse into 25Ω (input to 50Ω output).

Controls:

Power	Switches AC power in the pulser.
Amplitude	Single turn potentiometer

Indicators:

Power	Shows that AC power is applied and the unit is switched on.
Triggered	Illuminates while the unit is being triggered.
Amplitude	LCD DVM indicating nominal pulse output amplitude.

Environmental:

Ambient temperature	5 to 35°C.
Humidity	< 95% non-condensing.
Altitude	< 3000m.

Test data

Kentech Instruments Ltd. Special CPSS pulse generator Serial No. xxxxx

Test equipment:

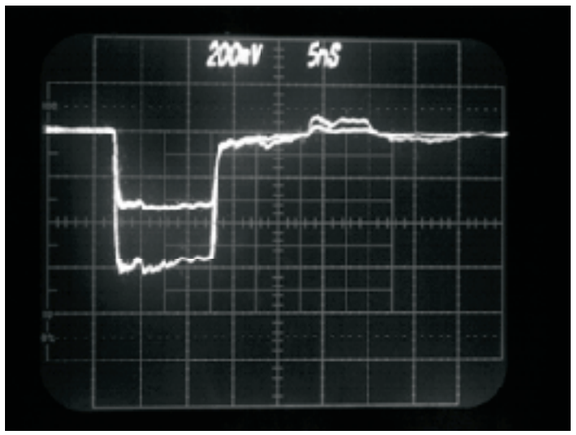
Scope: Tek 7438, 7S11+S4, 7T11

Attenuators: First - Barth 142(x10)
Second - Radial SMA (x2)
Third & fourth - Radial SMA(x10)

Trigger: Kentech APG1

Pulser output waveforms from '50Ω output'

Note: Waveforms from '25Ω output' identical.

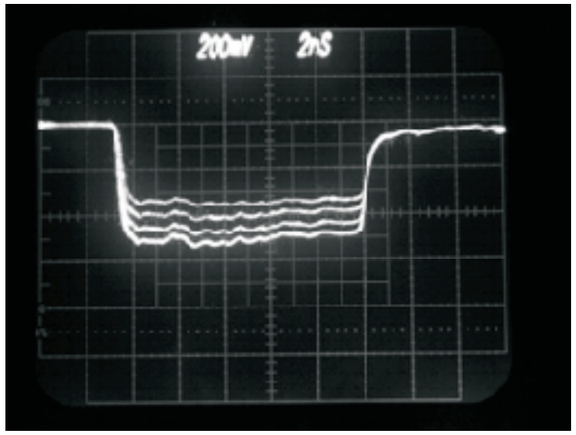


Pulse output from showing maximum and minimum output amplitude

Vertical: 400V/div

Horizontal: 5ns/div

Rep. rate: 200Hz

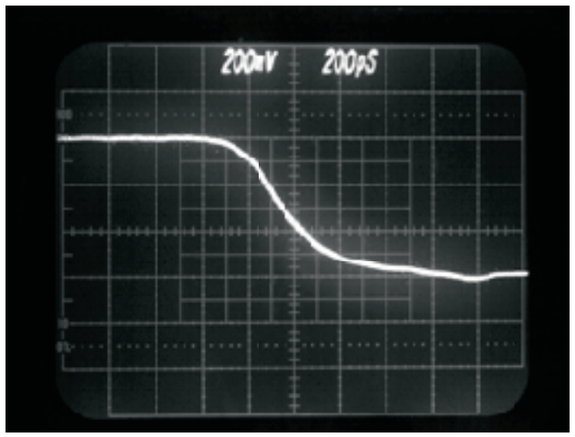


Pulse output showing the amplitude set at 700, 800, 900 and 1000Von the DVM.

Vertical: 400V/div

Horizontal: 2ns/div

Rep. rate: 200Hz

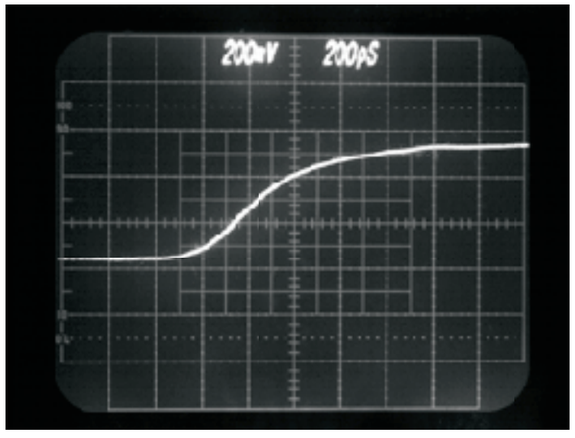


Rise time at maximum amplitude

Vertical: 400V/div

Horizontal: 200ps/div

Rep. rate: 200Hz



Fall time at maximum amplitude

Vertical: 400V/div

Horizontal: 200ps/div

Rep. rate: 200Hz