Notes on the use of

Kentech Instruments Ltd.

Special HMP1/Q pulser

Serial No. *(special)*

4th July 2002

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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 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 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 emissions from the pulser itself have been tested and found to be within certain EC limits, see the Declaration of Conformity. These tests were performed with a dummy load on the output. 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 and may 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 and speed-up modules have a life of $>10^{10}$ pulses and 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 input should be a 5V pulse minimum with a fast rising edge (<5ns) to maintain the low jitter of the system.

The pulser output may be continuously adjusted for amplitude by means of a single turn front panel potentiometer from approximately 3.5kV to above 5kV. The output pulse risetime is optimised on this unit to be approximately 80ps (10 to 90%).

The internal trigger delay is approximately 18ns. The jitter is ~20ps RMS with a suitably reproducible and fast rising trigger signal.

If it is necessary to monitor or characterise the pulse output from the pulser and attenuators then additional suitable attenuators should be used. We recommend the use of a high voltage, high speed attenuator manufactured by Barth™ as the first attenuator in a series.

The high voltage pulse from this unit is capable of destroying lower power attenuators.

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

If the output of the pulser is to be used directly or via any passive network it is essential that cable lengths are kept as short as possible and that only high quality cable is used. This will enable the fast rising edge generated by the unit to reach the load without serious degradation.

SPECIFICATIONS

General:

Number of outputs	One positive.
Output voltage	≥5kV to ≈3.5kV.
Pulse shape	Fast rise, exponential decay.
Pulse width	~3ns FWHM.
Rise time	~80ps.
Jitter	<20ps RMS.
Trigger	5V into 50Ω, <5ns rise time.
Trigger delay	~18 ns
Max repetition rate	≥100Hz
Power supply	100 to 240V AC

Outputs:

Pulse outputs	N	5kV pulse

Inputs:

Trigger input	BNC	5V, 50Ω

Controls:

Amplitude	Single turn potentiometer adjusts output pulse amplitude
Power	Switches AC power in the pulser

Indicators:

Power	Shows that AC power is applied and the unit is switched on
Triggered	Flashes when pulser is triggered

Environmental:

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

Test data

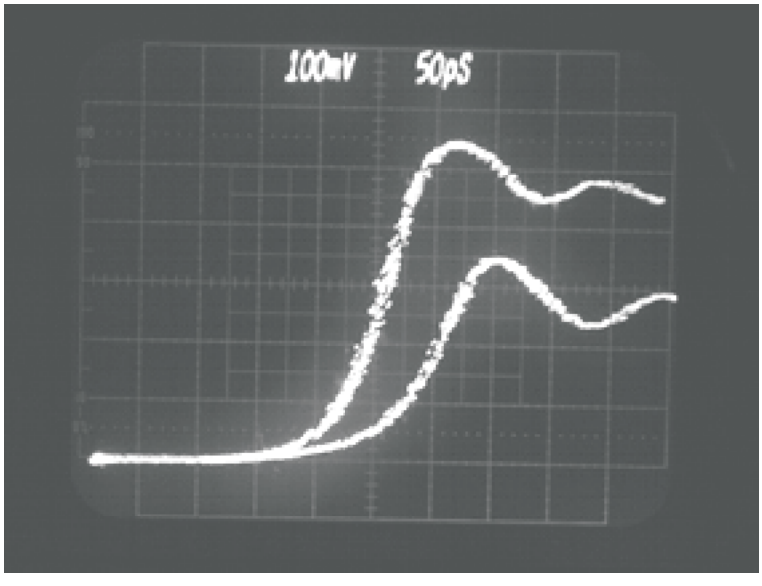
HMP1 Pulse generator Serial No. xxxxx

Test equipment Scope: Tektronix 7834 mainframe, 7S11 + S4 head, 7T11

Attenuators: First two: BARTH 142 (x10)
Second two: Radial SMA
(Total attenuation: x10000)

Trigger source: Kentech APG1

Output waveforms

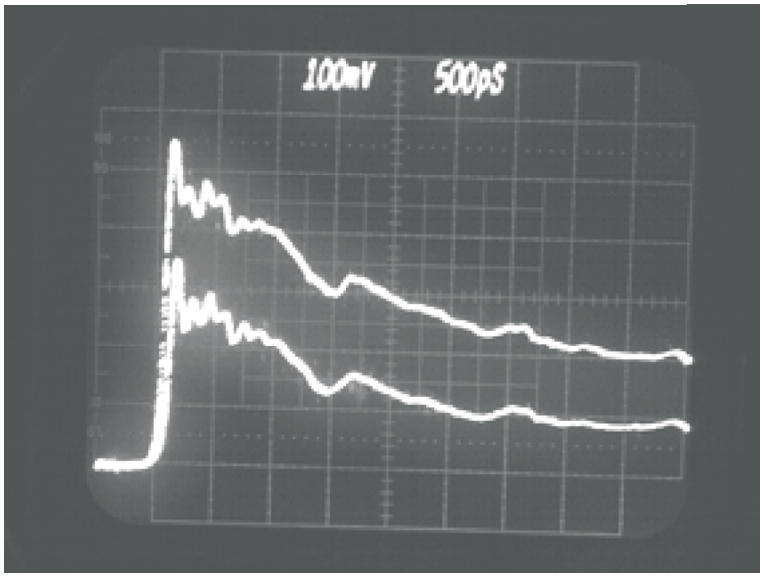


Risetime and Jitter
Showing maximum and minimum amplitude

Vertical: 1kV / div.

Horizontal: 50ps / div

Rep. rate: 100 Hz



Pulse shape
Showing maximum and minimum amplitude

Vertical: 1kV / div.

Horizontal: 500ps / div

Rep. rate: 100 Hz