

# Kentech Instruments Ltd.

## Notes on the use of HMPS pulsers

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## Introduction

Our range of solid state High voltage Modular Pulse Sources (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 50 $\Omega$ , and with a pulse repetition frequency (PRF) >2kHz 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 6 $\Omega$  are available.

The standard drivers and speed-up modules have a life of >10<sup>9</sup> 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 driver unit requires A.C. power and a trigger signal to operate. The trigger signal, which is applied to the trigger input (BNC), should be approximately 10 volts with a fast rising edge ( $<5\text{ns}$ ) to maintain the low jitter of the system

When triggered the "triggered" light on the front panel will flash. A monitor pulse is available to establish remotely that the unit has triggered. This monitor may also be used to trigger ancillary pieces of equipment, e.g. intensifiers etc.

The main output of the unit appears at the front panel connector (N). If it is necessary to monitor or characterize this pulse suitable attenuators should be used. We recommend the use of a high voltage, high speed attenuator manufactured by Barth<sup>TM</sup> as the first attenuator in a series.

The high voltage pulse from this unit is capable of destroying many lower power attenuators including GR types.

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

If the output of the HMPS 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.

The delay switch when set to the IN position inserts a  $\sim 100\text{ns}$  delay between the input trigger and pulse output. The monitor is NOT delayed and may be used for pre-triggering when the delay is selected.

The trigger source switch selects between the internal oscillator (INT) and the external trigger input (EXT).

The audio monitor control sets the volume of the audio signal which occurs when the pulser is triggered.

The amplitude control (when this option is specified) allows the output amplitude to be varied from ~60% to 100% of the maximum signal.

For speed up units and transformers with multiple outputs it is necessary to terminate all outputs correctly in order to maintain the pulse shape. For units with bias insertion it will also be necessary to decouple these terminations as they will otherwise load the bias voltage supply excessively. An alternative is to terminate with cables which are sufficiently long that the reflections from the open circuit ends arrive back at the speed-up unit (or transformer) at a time when they will have no effect, e.g. after the event to be diagnosed has finished.

## HMPS SPECIFICATIONS

Output channels:	1 or 2
Output voltage:	4 kV, 50 $\Omega$ or >2kV, 50 $\Omega$ if square pulse option is selected
Rise time:	$\leq 120$ ps
Pulse length:	$\sim 5$ ns with an exponential fall or, if the square pulse option is specified, square pulse with duration fixed in the range 200ps to 2ns (selected at manufacture)
Polarity:	Selected at manufacture
Trigger:	Requires 10 V into 50 $\Omega$ , <5 ns rise time.
Jitter:	$\sim 20$ ps RMS, 50ps peak
Trigger delay:	$\sim 25$ nsec
Repetition rate:	100 Hz min
Power supply:	90-105 V AC
Package size:	20 cm X 10 cm X 26 cm (approximate).

### Outputs:

Pulse output	N 4kV pulse
Monitor output	BNC $\sim 10$ V into 50 $\Omega$ . When the trigger delay is switched IN the pretrigger delay is $\sim 100$ ns

### Inputs:

Trigger input	BNC 10V, 50 $\Omega$ to trigger pulser
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### Controls:

Internal rate	Sets internal rate generator frequency - up to 100Hz
Trigger source	Toggle switch, selects external (single shot also) or internal oscillator for triggering
Delay (option)	When set to IN the output is delayed approximately 100ns with respect to the OUT position. The monitor output leads the main output by $\sim 100$ ns when the delay is IN the output may be used to trigger a sampling system.
Amplitude (option)	Varies the output amplitude from $\sim 60$ to 100%
Audio mon (option)	Sets the volume of the audio signal
Single shot button	Depressing this button cause a single trigger (maximum rate $\sim 1$ Hz)
Power	Switches AC power in the pulser