

Notes on the use of

Kentech Instruments Ltd High voltage pockels cell driver



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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 (10kV) 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 coaxial cable, the cable outer must be carefully connected to the output connector at one end, and must be connected directly to the screened box containing the load at the point of entry. Flexible cables 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. These pulsers will find applications in many fields such as high speed camera research, electro-optic switching, triggering systems and radar.

Various configurations are available providing fixed and adjustable pulse lengths. Pulse lengths from 100ps to 100ns are covered by our range of avalanche and FET pulsers. There is very little jitter in the output of the pulsers and in some cases two independent pulsers can be used in parallel to drive low impedances. We are able to make impedance transformers with output impedances below 5Ω . This aspect makes the pulsers particularly useful for driving microchannel plate systems. Integrated pulse/HV psu systems are available for such applications.

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

The output of this unit will damage or destroy many types of high voltage and high power attenuators. Consult the attenuator manufacturer before applying the output signal to an attenuator other than that provided in the instrument itself.

The pulser is provided with an output lead capable of withstanding the high pulse voltage. If other leads are to be used ensure that the cable is suitable for 10kV impulses.

SPECIFICATION

Amplitude	>9kV adjustable
Load	50 ohms
Rise time	~4ns
Pulse duration	12ns to 60ns adjustable
Pulse controls	
Pulse width	12ns to 60ns (80ns slaved)
Delay	up to 400ns
Second pulse width	20ns to 60ns (80ns slaved)
Amplitude	0 - 9kV
Trigger jitter	
Single pulse	Typical 100ps + delay/1000 RMS
Double pulse	Typical 100ps + delay/1000 RMS for first pulse Typical 500ps + delay/1000 RMS for second pulse
Trigger delay	~85ns direct, ~105ns min delayed
Functions*	Slave trigger, single pulse Triggered, pulse width set internally Triggered, pulse width and delay set internally Slave trigger, double pulse Triggered, double pulse, pulse widths set internally Triggered, double pulse, pulse widths and delay set internally Triggering synced to RF input (eg mode locking signal) Overload trip (reset via front panel push button) Load fault (reset via front panel push button)

* see notes on triggering and timing diagrams below.

PRF	20Hz single pulse 10Hz double pulse
AC power	100-240V ac, <100VA
Cooling	Forced air

Controls

Pulse width	10t rotary
Delay	10t rotary
Delay 2	10t rotary
Amplitude	10t rotary
Mode	Rotary
AC power	Rocker
Fault reset	Push button

Connectors

AC power	IEC (rear panel)
Trigger	BNC
Aux trigger	BNC
Monitor	BNC
Pulse output	Lemo
Pulse return	Lemo
Pulse monitor	BNC

Indicators

Power	LED
Triggered/fault	LED

OPERATIONAL NOTES

Load

An internal 50ohms load is provided incorporating a 1000:1 attenuator. This will give a maximum output of 9V into 50ohms which may be monitored while the pulser is operating.

Triggering

There are several trigger modes which use the trigger and aux trigger inputs. The amplitude of any trigger pulses should be ~5V into 50ohms.

In the slave modes the output pulse length varies with the length of the trigger input pulse. The front panel shows the various trigger modes:

Mode	1	2	3	4	5	6	7	8	9	10
Slaved	x				x	x				
PW set by Pulse width		x	x	x			x	x	x	x
Delay by Delay 1			x	x						
Sync to RF into Aux trig				x						x
Double pulse					x	x	x	x	x	x
Aux trigger for 2nd pulse						x		x		
Second PW set by Delay 2							x	x	x	x
Inter-pulse delay by Delay 1									x	x

These will be most easily understood from the timing diagrams below. Note the following.

The first pulse can be triggered:

- directly from the trigger input
- after a delay set by delay 1
- from the trigger input but synchronised to an RF input applied to aux trigger

The second pulse can be triggered by:

- the trigger input, delayed by delay 1
- the trigger input, synchronised to RF applied to aux trigger
- the aux trigger input

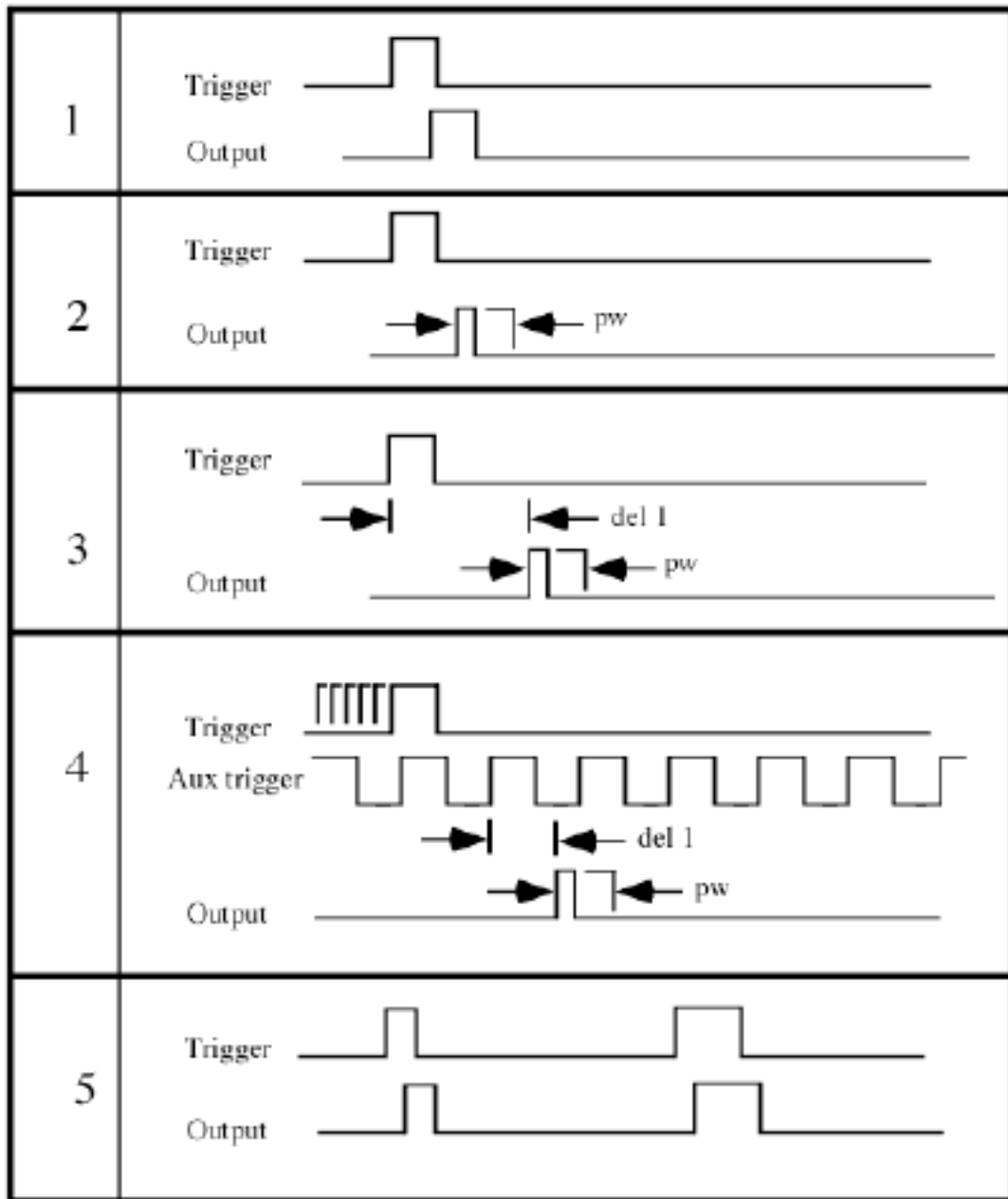
The first pulse width can be set by:

- the duration of the trigger input
- the setting of pw

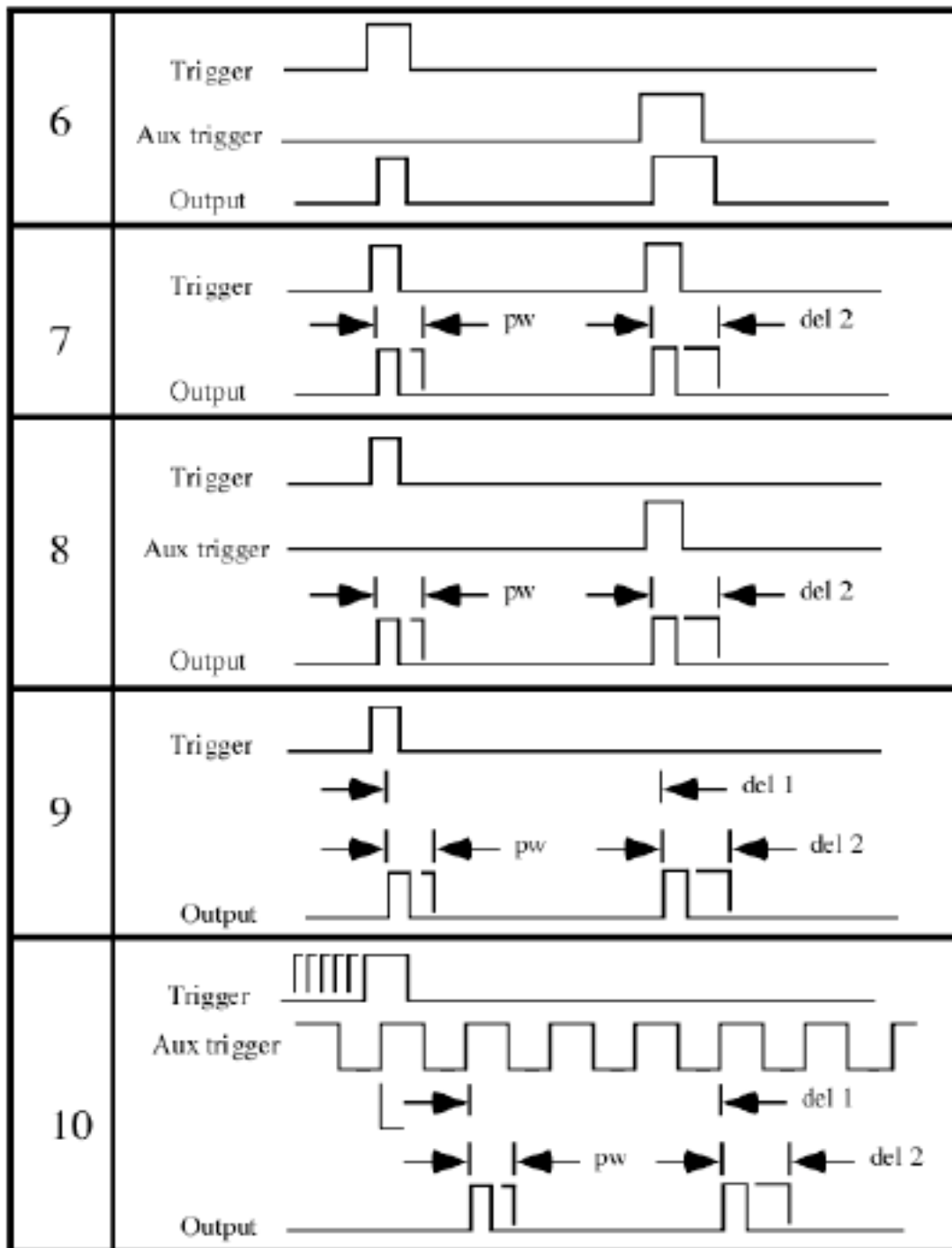
The second pulse width can be set by:

- the duration of the trigger input
- the duration of the aux trigger
- the setting of delay 2

Trigger mode timing diagram - modes 1-5.



Trigger mode timing diagram - modes 6-10.



Fault conditions

i) Load fault

The pulser will not operate unless there is a 50ohm path to ground applied to the output. If the pulser is switched on without a load connected a fault condition will occur and the trigger LED will flash with a fixed pattern until a correct load is applied and the fault condition is reset. The fault condition can be reset by:-

Removing AC power

Pressing the small button to the left of the Run input.

Applying 0V to the Run input (this is normally pulled to 5V internally).

ii) Overload fault.

The pulser will operate at 10Hz with all output pulse conditions and at 20Hz in single pulse modes. If the pulser is operated with maximum pulse width in double pulse mode excessive power will be drawn and the pulser will shut down to protect itself. This condition is shown by the trigger LED flashing with a fixed pattern This can be cleared by reducing the PRF and/or pulse width and then either:-

Removing AC power

Pressing the small button to the left of the Run input

or

Applying 0V to the Run input (this is normally pulled to 5V internally).

Internal load

The pulser is provided with an internal loop-back load which is able to withstand the full pulser output.

Pulse monitor output

There is an internal 1000:1 attenuator to provide the user with a monitor of the output pulser. The amplitude of this signal will be up to 9V into 50ohms and is determined by the amplitude setting.

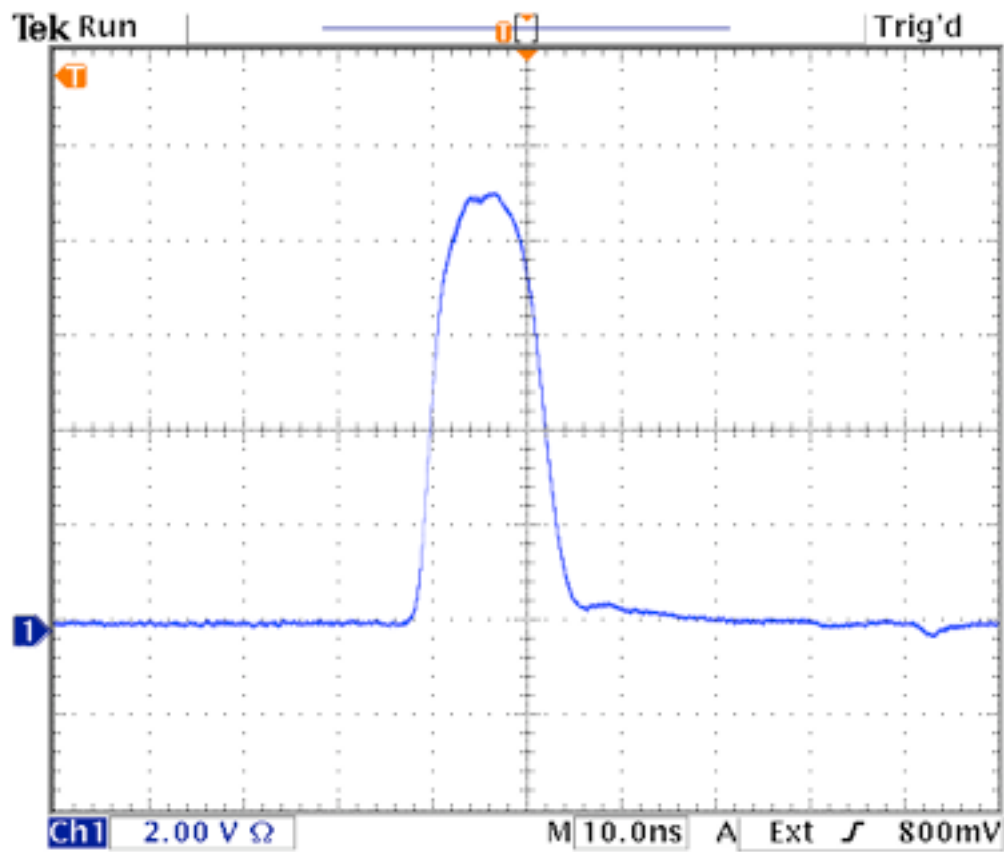
External enable

The Run input may be used to enable/disable the pulser remotely. When unconnected this input is pulled to 5V and the pulser operates. When it is pulled to 0V the pulser is disabled and any trip conditions are reset.

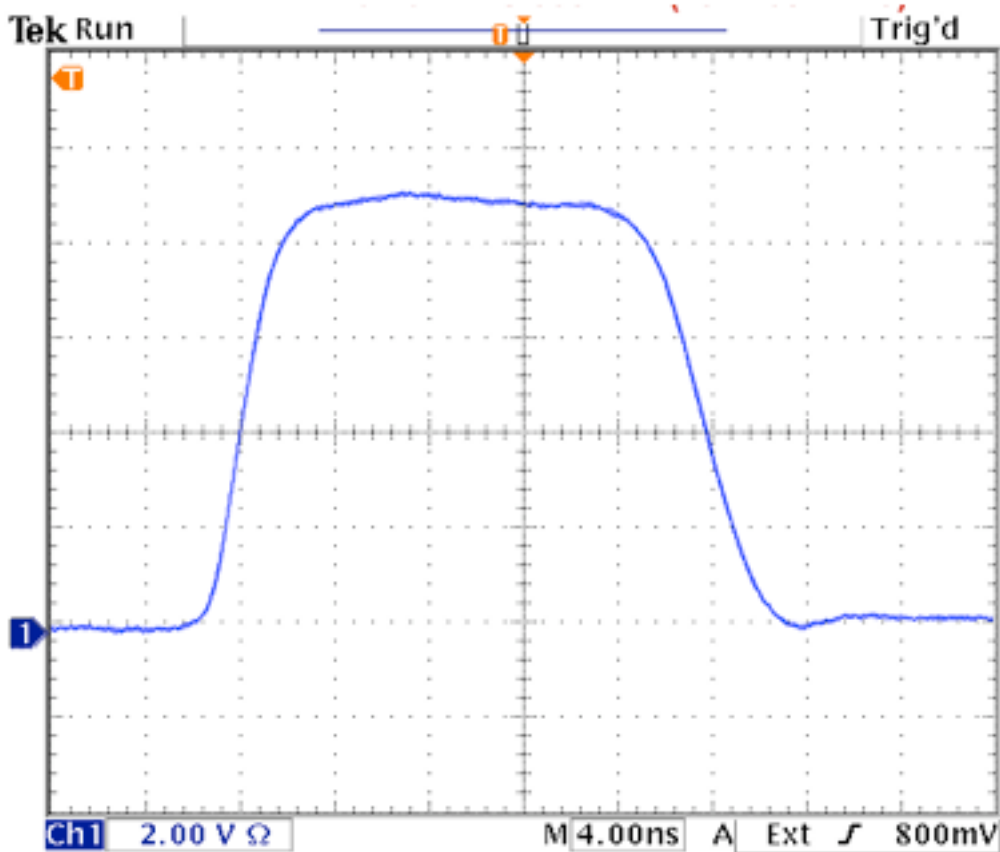
Monitor output

The TTL monitor output is the low voltage trigger signal which triggers the high voltage switch. The amplitude of this signal is not set by the output amplitude.

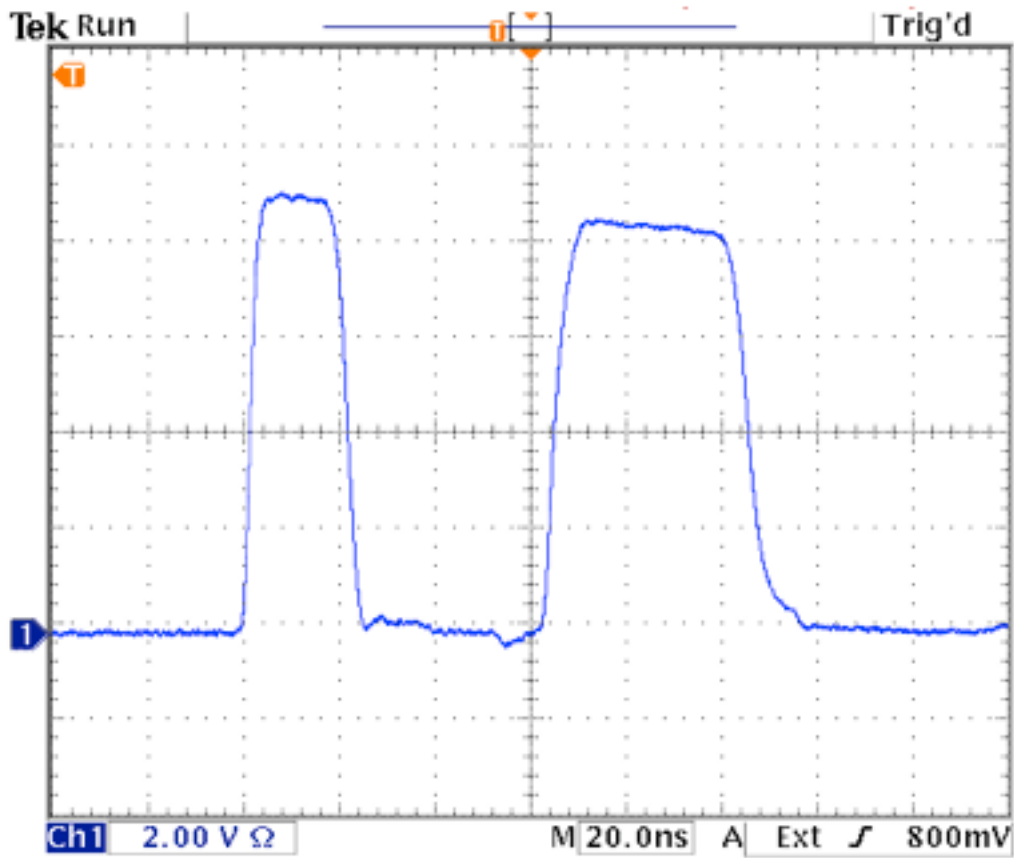
Typical test data



Mode 1 Minimum pulse width, 2kV per division, 10ns per division, 20Hz rep rate



Mode 2 Rise and fall - 20ns pulse width, 2kV per division, 4ns per division, 20Hz rep rate



Mode 9 Typical settings, 2kV per division, 20ns per division, 10Hz rep rate

Items supplied

- Pulser
- AC power lead
- HV pulse lead, 4 metres LEMO to LEMO, RG213 cable
- Manual

Declaration of Conformity

We:-

Kentech Instruments Ltd.,
The Isis Building,
Howbery Park,
Wallingford,
Oxon OX10 8BA, UK

Certify that this apparatus:-

Kentech HV Pockels Cell Driver serial no. _____ only.

Conforms with the protection requirements of European Community Directives:-

73/23/EEC

Low Voltage Directive

89/336/EEC

Electromagnetic Compatibility Directive

93/68/EEC

CE Marking Directive

The following harmonized standards have been applied:-

BS EN55011

Emissions Specification (Group 2 Class A)

Industrial, Scientific and Medical equipment

BS EN50082-2

Generic Immunity Standard Part 2 Industrial

BS EN 61010-1

Safety Requirements for Electrical Equipment for

Measurement, Control, and Laboratory Use

The following documents contain additional relevant information:-

Kentech file reference: _____

Name: _____

Signature: _____

On behalf of Kentech Instruments Ltd.

Position: _____

Issued: _____