

Notes on the use of  
Kentech Instruments Ltd.  
APG1 pulser  
Serial number J05\*\*\*\*\*



31st March 2005

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# Caution

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.

With an appropriate load, 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, we recommend the use of a Barth 142B x10 attenuator as the first in a series string. 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 (3kV) PRESENT IN THIS PULSER WHEN THE UNIT IS OPERATING. DO NOT REMOVE COVERS.**

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.

## 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  $50\ \Omega$ , and with a pulse repetition frequency (PRF)  $>1\text{kHz}$  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  $5\Omega$  are available.

The standard drivers and speed-up modules have a life of  $>10^{10}$  pulses and have a PRF of  $\geq 1000\text{Hz}$ , although special units with a PRF  $>10\text{kHz}$  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 can be generated internally or applied externally. When external triggering is used, the trigger signal, which is applied to the trigger input (BNC), should be  $\geq 5$  volts with a fast rising edge ( $<5$ 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. An auxiliary 10V output is provided which has fixed timing with respect to the main output. It appears within  $\sim 5$ ns of the main output (except when "direct" mode is selected).

The main output of the unit appears at the front panel connector (SMA type). If it is necessary to monitor or characterise this pulse 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 ( $>3$ GHz) 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.

In the internal trigger, single shot and "delayed" modes there is an internal delay which may be adjusted by the user. There are coarse (10ns per step) and fine ( $\sim 12$ ns full scale) delay controls.

In "direct" mode the trigger is applied directly to the avalanche stack and the low level circuitry is bypassed. In this mode the trigger delay is at a minimum of  $\sim 10$ ns. There is no auxiliary or pretrigger output in this mode.

There are thermal drifts in the delay generator which will stabilise after the pulser has been switched on for  $\sim 20$  minutes.

## SPECIFICATIONS

Output voltage:	>150V, 50 Ω
Pulse Width:	<150ps FWHM
Polarity:	Positive
Trigger:	Requires ≥5V into 50Ω, ~5 ns rise time.
Jitter:	<10 ps RMS
Trigger delay:	~10 ns in direct mode
Repetition rates:	≤10,000 Hz
Power supply:	100 to 240V AC 50 to 60Hz

### **Outputs:**

Pulse output	SMA      150V pulse
Pretrigger output	BNC      10V into 50Ω, leads main output by the delay when the delay is active
Auxiliary output	BNC      10V into 50Ω, after delay (i.e. fixed timing with respect to main output)

### **Inputs:**

Trigger input	BNC      ≥5V, 50Ω
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### **Controls:**

Mode	Sets one of the following modes: Single shot (delay active) 1-10Hz (delay active) 10-100Hz (delay active) 100-1000Hz (delay active) 1000-10,000Hz (delay active) External trigger (delay active) "Delay" External trigger (delay inactive) "Direct"
Fine rate	Varies internal rate by a ratio of 10:1
Delay (and fine delay)	Sets internal delay, up to 100ns pretrigger delay
Single shot button	Depressing this button cause a single trigger when single shot mode selected
Power	Switches AC power in the pulser

### **Indicators:**

Power	Shows that AC power is applied and the unit is switched on
Triggered	Illuminates while the unit is being triggered

# ***Declaration of Conformity***

We:-

**Kentech Instruments Ltd  
Unit 9, Hall Farm Workshops  
South Moreton  
Didcot  
Oxon OX11 9AG, UK**

Certify that this apparatus:-

**Kentech APG1 Pulse Generator  
serial nos. J05\*\*\*\*\* only.**

Conforms with the protection requirements of European Community Directives:-

<b>73/23/EEC</b>	<b>Low Voltage Directive</b>
<b>89/336/EEC</b>	<b>Electromagnetic Compatibility Directive</b>
<b>93/68/EEC</b>	<b>CE Marking Directive</b>

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 J05\*\*\*\*\***

**Name:** P. F. Rouse

**Signature:**

On behalf of Kentech Instruments Ltd

**Position:** Engineer

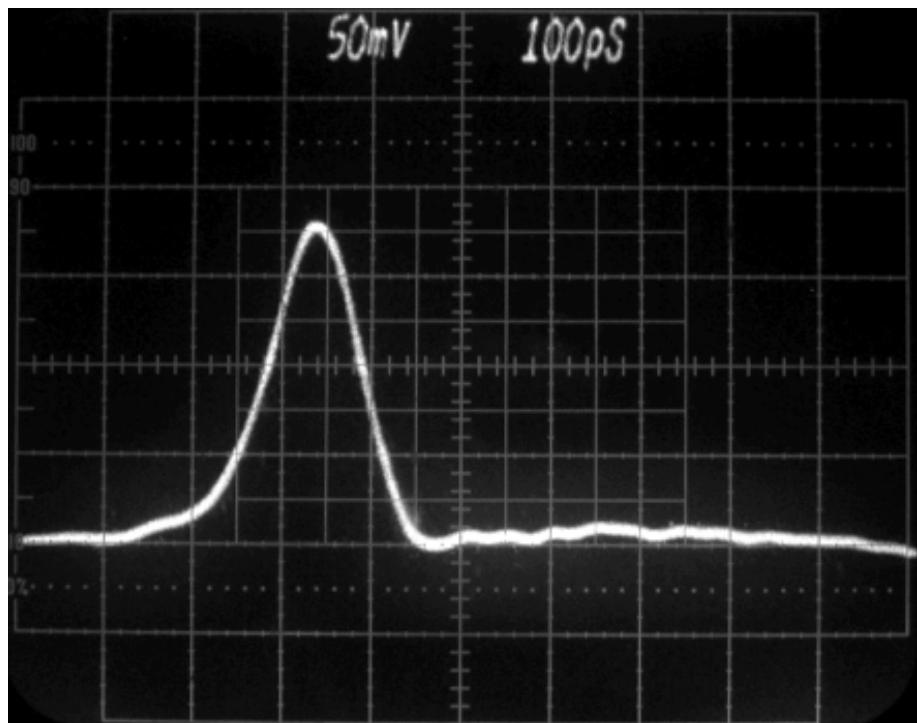
**Issued:** 31st March 2005

Test data

APG1 Serial number: J05\*\*\*\*\*

Test Equipment:- Tek 7834,7S11,7T11,S6, 1 x Barth 142 (x 10), 2 x Radial SMA (x 10)  
Total attenuation x 1000

50V/div 100ps/div rep rate: 10kHz



50V/div 500ps/div rep rate: 10kHz

