Kentech Instruments Ltd.

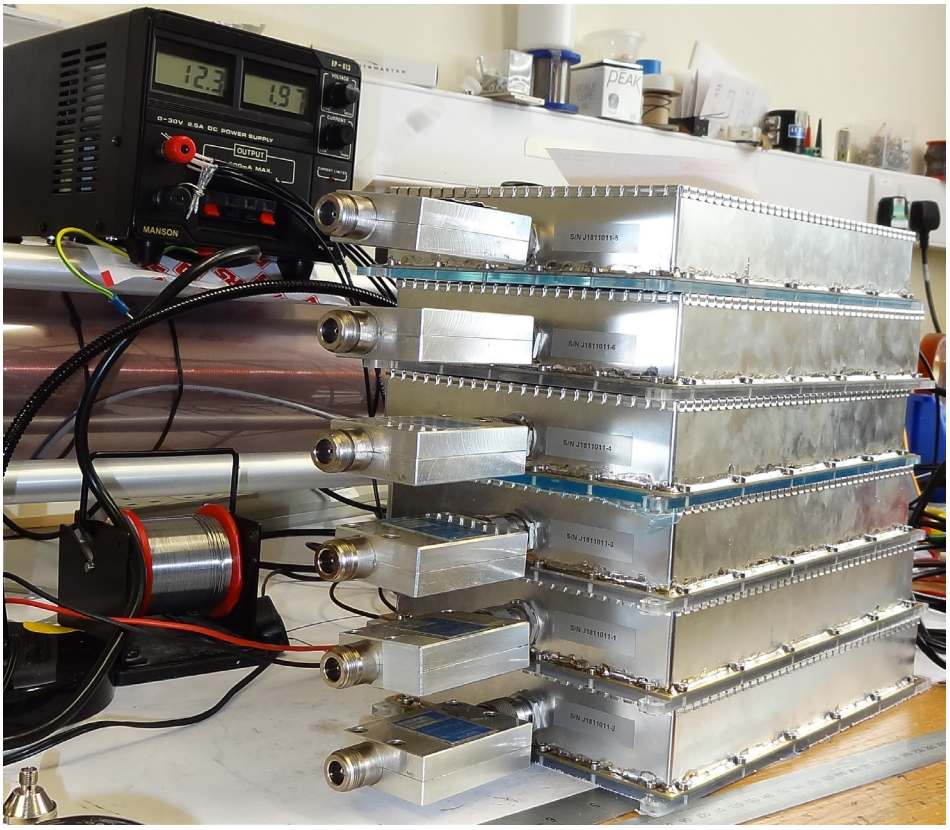
Notes on the use of

CPS3-S module

s/n J19xxxxx

Last Modified 11-2-20

PLEASE READ THIS MANUAL CAREFULLY BEFORE USING THE UNIT



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Contents

1 DECLARATION OF CONFORMITY

Declaration of Conformity

We:- Kentech Instruments Ltd.
The Isis Building
Howbery Park
Wallingford
Oxfordshire OX10 8BD, UK

Certify that this apparatus:-

Kentech CPS3-S Pulse Generator
serial no. J19xxxxx

Conform 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 harmonised standards have been applied:-

BS EN55011 Emissions Specification (Group 2 Class A) Industrial, Scientific and Medical equipment

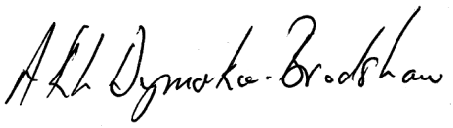
BS EN50082-2 Generic Immunity Standard

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 J19xxxxx

Signature:  Name: A.K.L. Dymoke-Bradshaw

On behalf of Kentech Instruments Ltd.

Position: Director

Issued: 11-2-20

2 DISCLAIMER

There are high voltage power supplies present in this instrument when the unit is operating. Do not remove any covers from the unit or expose any part of its circuitry. In the event of malfunction, the unit must be returned to Kentech Instruments Ltd. or its appointed agent for repair.

The accessible terminals of this instrument are protected from hazardous voltages by basic insulation and protective grounding via the power input connector. It is essential that the ground terminal of this connector is connected to the local earth/screened enclosure via the power lead to maintain this protection.

Kentech Instruments Ltd. accepts no responsibility for any electric shock or injury arising from use or misuse of this product. It is the responsibility of the user to exercise care and common sense with this highly versatile equipment.

Read this manual before unpacking and using the instrument. If cleaning is necessary this should be performed with a soft dry cloth or tissue only.

3 EMC CAUTION

This equipment includes circuits intentionally designed to generate short high energy electromagnetic pulses and the EM emissions will be sensitive to the details of the experimental set up.

In practice emissions may exceed E55011 and the unit may cause interference with other equipment in its immediate environment. It is therefore suitable for use only in a laboratory or a sealed electromagnetic environment, unless it is used in a system that has been verified by the system builder to comply with EC directive 89/336/EEC. Use of this apparatus outside the laboratory or sealed electromagnetic environment invalidates conformity with the EMC Directive and could lead to prosecution.

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. The use of semi rigid cables or conformable semi rigid cables will deliver lower EM radiation from the cabling than any flexible types.

Pockels cells will radiate through the optical windows and if this is an issue the laser system should be enclosed in a suitable EMC enclosure.

4 ABBREVIATIONS

EHT or eht	Extra High Tension (high voltage)
EMC	Electromagentic Compatibility
PRF	Pulse Repetition Frequency
PSU or psu	power supply unit
SD	Standard Deviation
w.r.t.	With Respect To

5 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 user's 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.

6 INTRODUCTION

Our range of solid state pulsers (ASG, CPS, 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 5 are available.

The standard drivers have a life of $>10^{10}$ pulses.

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.

7 OPERATION OF THE PULSER

7.1 GENERAL OPERATION

The pulser requires 12 volts D.C. power and a trigger signal to operate. The trigger signal applied to the rear 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 rear panel will flash.

The output of the unit is a nominal 3.6kV positive pulse which appears at the output front panel connector (N type). The pulse width is fixed at ~4ns.

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

Note that the supply voltage should be 12 volts at the input to the unit. If long power leads are used these may cause enough voltage drop to reduce the voltage at the pulser to < 12 volts. A slightly higher supply should then be used. If the unit is operated at less than about 11.9 volts the output amplitude may be reduced and the trigger delay increased.

Also note that the unit is fitted with a 13 volt zener diode which will protect the input against too high a voltage for a limited time. Do not leave more than 13 volts on the unit for an extended time or the zener diode might fail.

For future units we are considering a built in voltage regulator and more protection to improve the tolerance to the wrong input voltage.

CAUTION

The output of this unit will damage or destroy many types of high voltage and high power attenuators. We only 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.

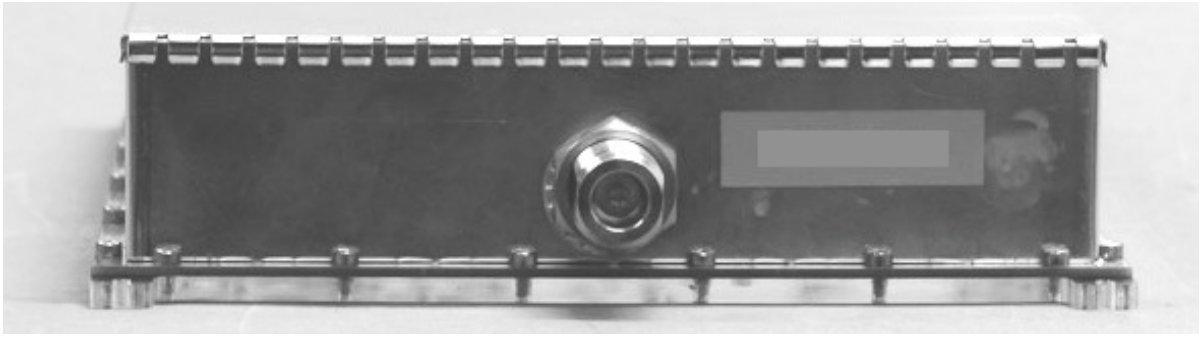
The output may be observed with a high bandwidth oscilloscope. This may either be a fast (>3GHz) direct access type or a sampling type.

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

7.2 CONNECTIONS

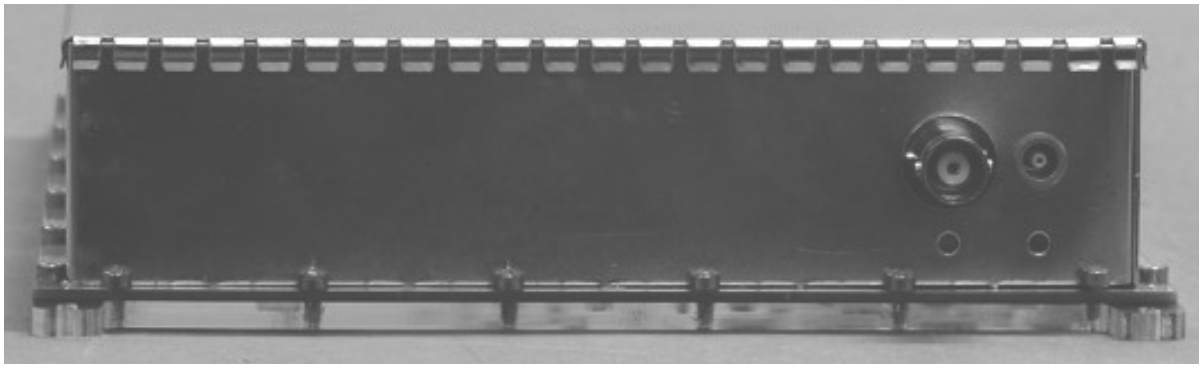
7.2.1 FRONT PANEL CONNECTIONS

This is an “N” type jack. It is important to keep the insulator clean. Light lubrication of the thread will stop metal particles from being generated.



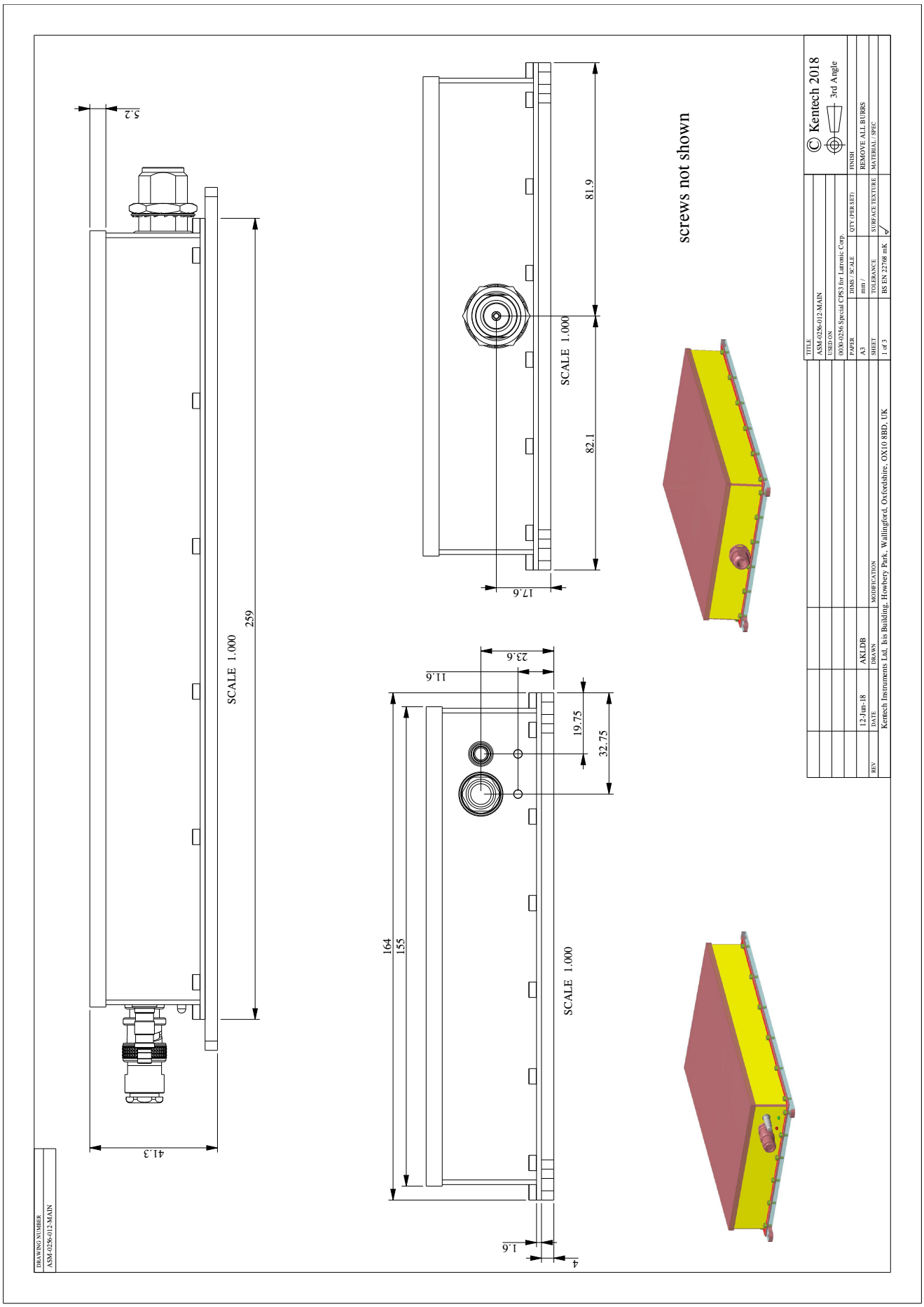
7.2.2 REAR PANEL CONNECTIONS

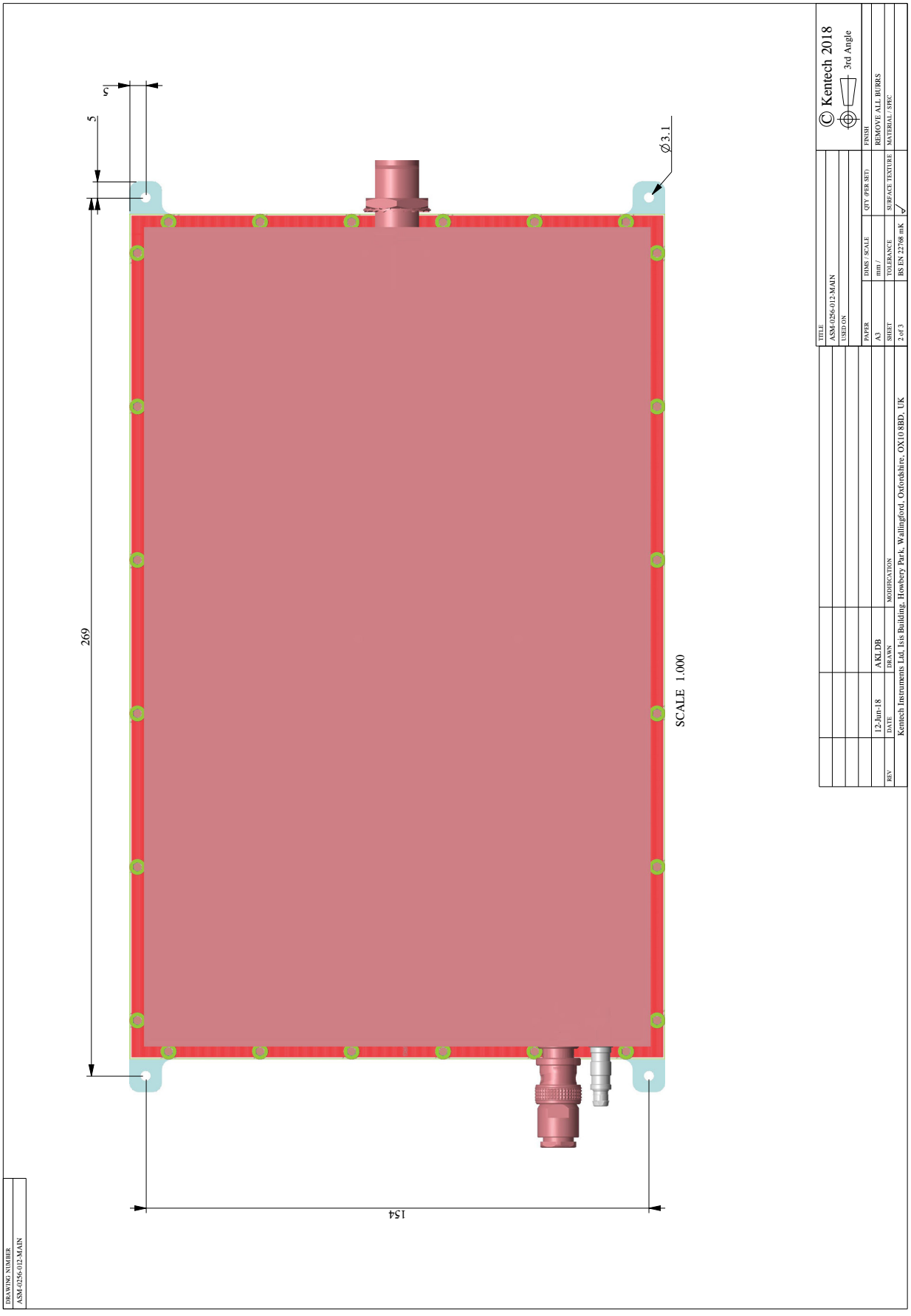
The rear panel has two inputs, a Lemo 00 socket for power and a BNC jack for the trigger. A flying lead for the Lemo socket is supplied.



7.2.3 DIMENSIONS AND MOUNTING

There are four mount holes on the base plate, see below.

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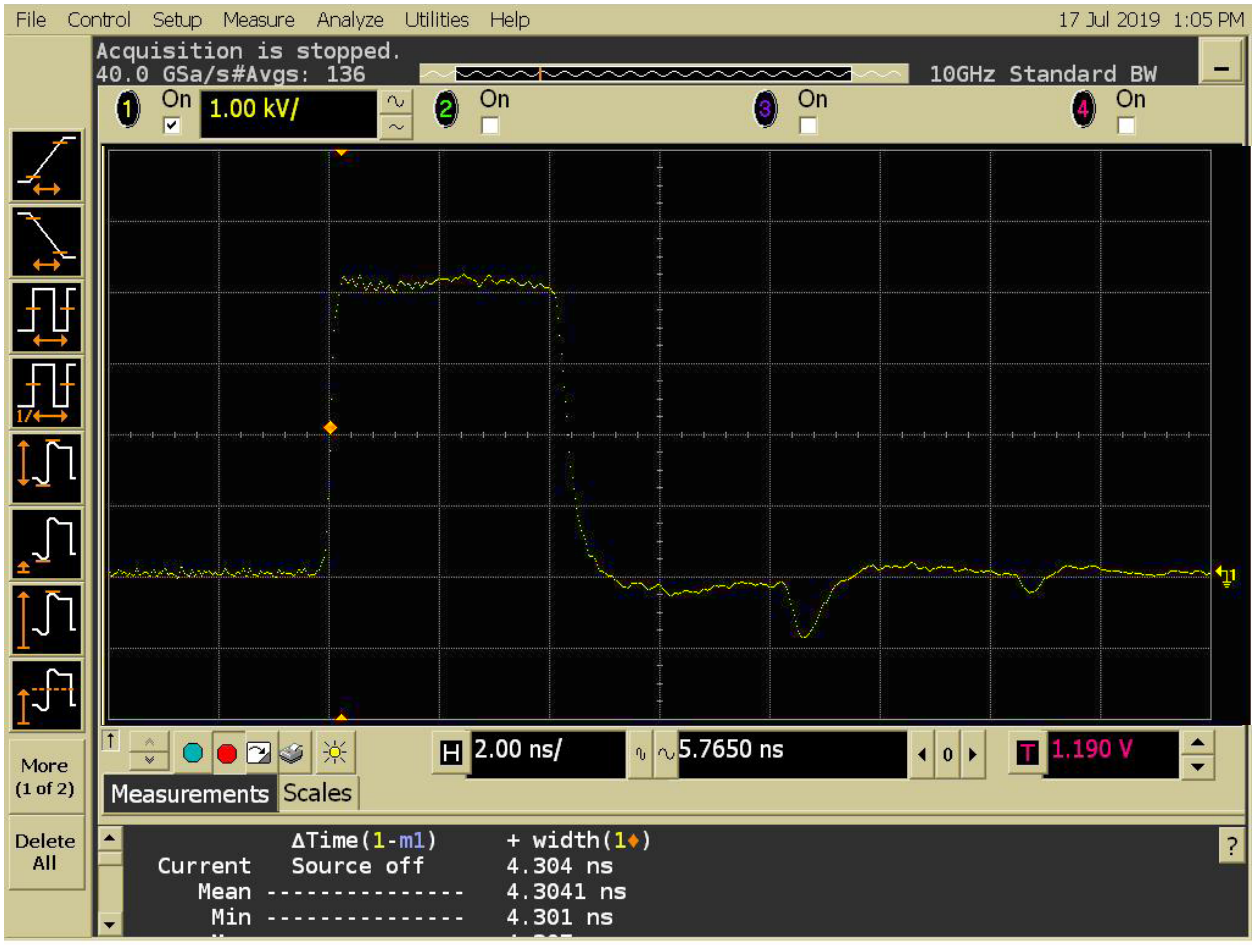
AKLDB
MODIFICATION
Kentech Instruments Ltd, Isis Building, Howbery Park, Wallingford, Oxfordshire, OX10 8BD, UK

8 SPECIFICATIONS

These are general specifications. Data on individual units is available on the CD that accompanies this manual.

Output voltage	~3.6kV maximum into 50Ω.
Output polarity	Positive.
Pulse shape	Rectangular.
Pulse width	4.3 ns
Rise time	~250ps
Fall time	~800ps
Trigger	2.5V into 50Ω, <5ns rise time[1]
Jitter	<20ps peak to peak, 3.4ps SD measured.
Trigger delay	nominally 20.5ns (BNC trigger input to main output).
Maximum repetition rate	≥30Hz.
Power supply	12 Volts DC @ >0.4 A
Maximum power	<7W
Outputs:	
Pulse output	N type 3.6kV pulse.
Inputs:	
Trigger input	BNC (jack) 5V into 50Ω, <5ns rise time.
Power	Lemo ERA.00.250.CTL Mating plug FFA.00.250.CTA.C33
Indicators:	
Power	Shows that DC power is applied.
Triggered	Illuminates while the unit is being triggered.
Environmental:	
Ambient temperature	5 to 35°C
Humidity	< 95% non-condensing
Altitude	< 300 m
Dimensions	Pulser: W164 x L290 x H42 mm^3 (over connectors)
Weight:	Pulser: 0.83kg

1 From J1904241 units are fitted with an adjustable trigger threshold. This has been preset to 1.25volts, i.e. half the trigger requirement of 2.5 volts into 50Ω.



Acquisition	Sampling mode real time Normal Memory depth automatic 1000 pts Sampling rate automatic Sampling rate 40.0 GSa/s Averaging on # of averages 1024 Interpolation off
Channel 1	Scale 1.00 kV/ Offset 1.920 kV Coupling DC Impedance 50 Ohms
Channel 4	Scale 10 mV/ Offset 1.190 V Coupling DC Impedance 50 Ohms
Time base	Scale 2.00 ns/ Position 5.7650 ns Reference center
Trigger	Mode edge Sweep triggered Sensitivity low Holdoff time 100 ns Source channel 4 Trigger level 1.1900 V Slope rising

Measure

	ΔTime(1-m1)	+ width(1♦)
Current	Source off	4.304 ns
Mean	----------	4.3041 ns
Min	----------	4.301 ns
Max	----------	4.307 ns
Range	----------	7 ps
Std Dev	----------	1.4 ps
# of Meas	----------	136

Figure 1 Pulse shape ~ 4ns

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Acquisition Sampling mode real time Normal
Memory depth automatic 1000 pts
Sampling rate automatic Sampling rate 40.0 GSa/s
Averaging off Interpolation off

Channel 1 Scale 100 V/ Offset 2.025 kV Coupling DC Impedance 50 Ohms

Channel 4 Scale 20 mV/ Offset 1.190 V Coupling DC Impedance 50 Ohms

Time base Scale 100 ps/ Position -65.0 ps Reference center

Trigger Mode edge Sweep triggered
Sensitivity low Holdoff time 100 ns
Source channel 4 Trigger level 1.1900 V Slope rising

Memory 1 Vertical scale 100 V/ Offset 2.02500 kV
Horizontal scale 50.0 ps/ Position -65.000000000000 ps

Measure

	ΔTime(1-m1)	+ width(1♦)
Current	6.84 ps	Edge?
Mean	13.614 ps	----------
Min	980 fs	----------
Max	33.07 ps	----------
Range	32.09 ps	----------
Std Dev	5.567 ps	----------
# of Meas	423	----------
From Num	1	
From Dir	Rising	
From Lvl	Middle	
To Num	1	
To Dir	Rising	
To Lvl	Middle	

Figure 2 Jitter ~ 5ps SD

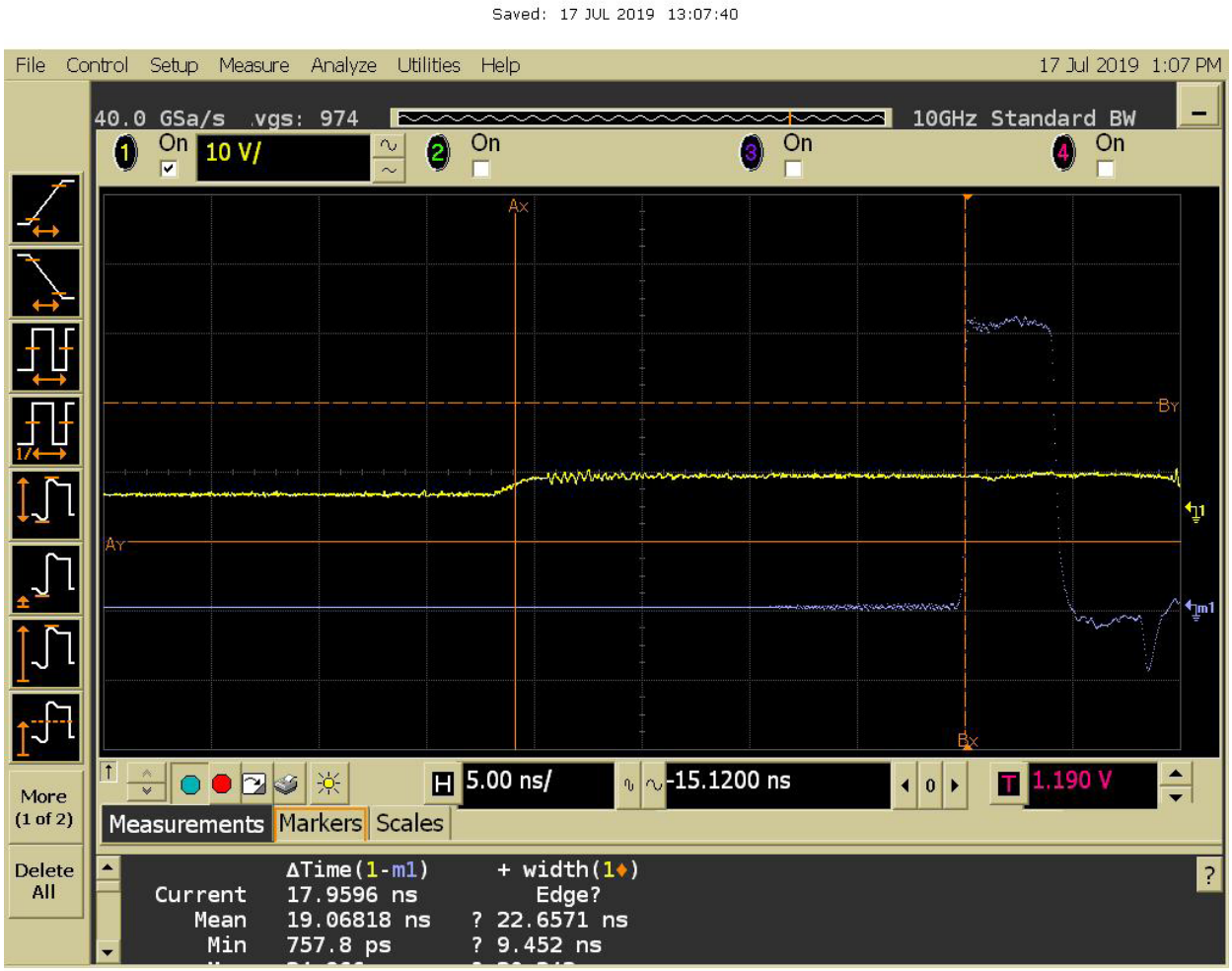

Figure 3 Trigger delay ~ 19ns

Acquisition
Sampling mode real time Normal
Memory depth automatic 2002 pts
Sampling rate automatic Sampling rate 40.0 GSa/s
Averaging on # of averages 1024 Interpolation on

Channel 1
Scale 10 V/ Offset 5 V Coupling DC Impedance 50 Ohms

Channel 4
Scale 10 mV/ Offset 1.190 V Coupling DC Impedance 50 Ohms

Time base
Scale 5.00 ns/ Position -15.1200 ns Reference center

Trigger
Mode edge Sweep triggered
Sensitivity low Holdoff time 100 ns
Source channel 4 Trigger level 1.1900 V Slope rising

Memory 1
Vertical scale 1.00 kV/ Offset 1.92000 kV
Horizontal scale 5.00 ns/ Position -15.120000000000 ns

Measure

	ΔTime(1-m1)	+ width(1♦)
Current	17.9596 ns	Edge?
Mean	19.06818 ns	? 22.6571 ns
Min	757.8 ps	? 9.452 ns
Max	34.966 ns	? 30.243 ns
Range	34.2081 ns	? 20.791 ns
Std Dev	1.71262 ns	? 9.7026 ns
# of Meas	975	4
From Num	1	
From Dir	Rising	
From Lvl	Middle	
To Num	1	
To Dir	Rising	
To Lvl	Middle	

Marker

		X	Y
Current	Source off	A——(1) = -21.0089 ns	-5.000 V
Mean	----------	B---(1) = -120.1 ps	15.000 V
Min	----------	Δ = 20.8889 ns	20.000 V
Max	----------	1/ΔX = 47.8723 MHz	
Range	----------		
Std Dev	----------		