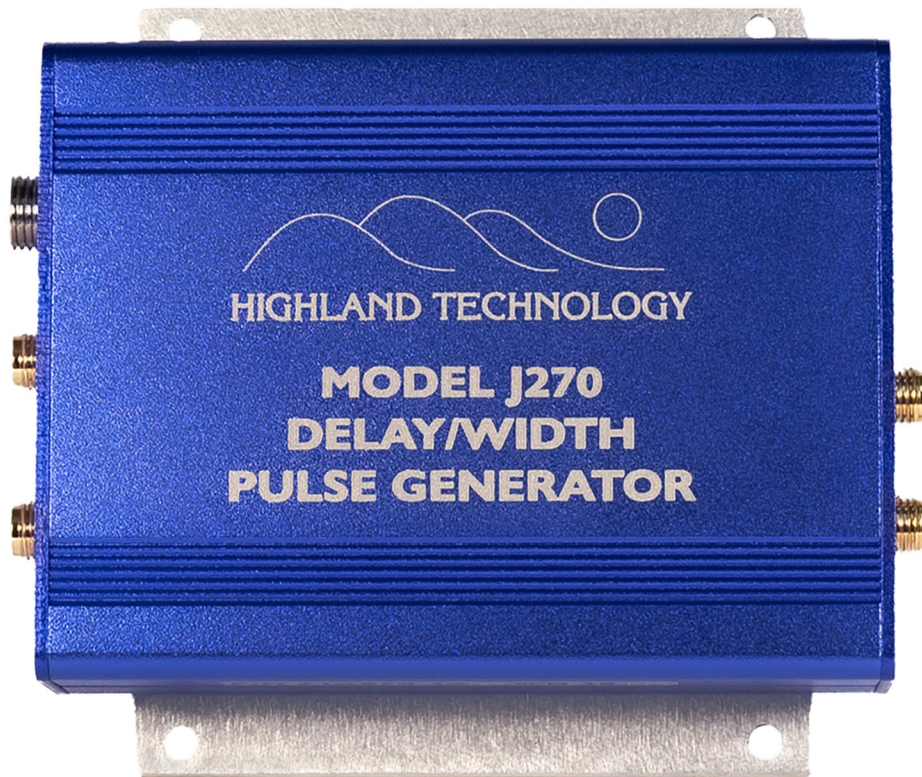


Model J270

Delay and Width Pulse Generator



Technical Manual

June 15, 2023

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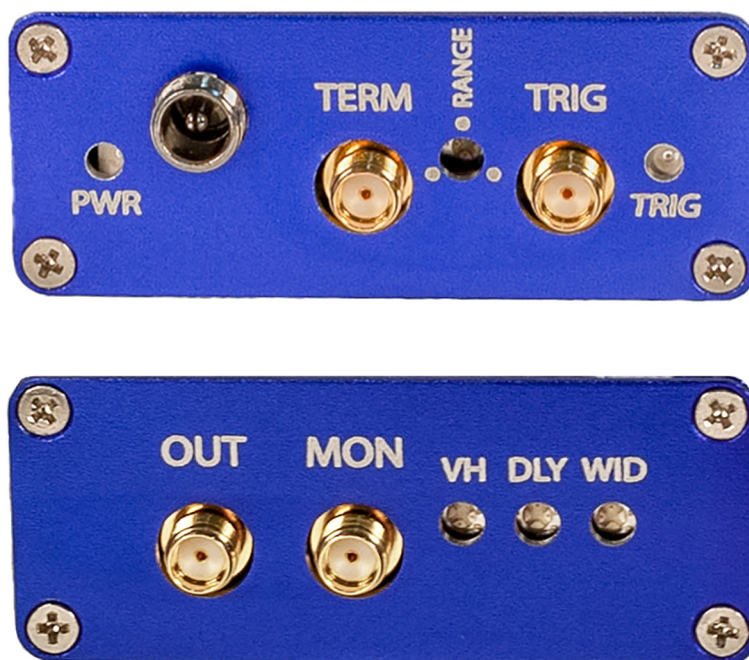
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1. INTRODUCTION

This is the technical manual for the Highland Model J270, a compact single-channel, adjustable delay and width electrical pulse generator.

Features of the J270 include:

- User-triggered 50 ohm pulse output
- Manual adjustment of delay, width, and output pulse voltage
- Three timing ranges from 25 nanoseconds to 2.5 microseconds, up to 20 MHz trigger rate
- 1 nanosecond typical rise/fall, < 2.5 nanoseconds typical minimum width, < 15 picoseconds RMS typical jitter (Range 1)
- Clean, fast pulse outputs adjustable from 0.8 volts to 20 volts
- Optional analog time modulation inputs
- Excellent laser, laser stack, optical modulator, PIN diode, microchannel plate, or SiC gate driver
- Compact 2" x 3" enclosure



2. SPECIFICATIONS

All specifications are typical unless noted.

FUNCTION	Single-channel delay-and-width pulse generator																			
INPUT TRIGGER	Positive pulse, SMA input and loop-through connectors +0.5 volt trigger threshold +5 volt max safe input Furnished with J48 removable SMA 50 ohm termination																			
TIME RANGES	<table><tr><td>Range</td><td>Min delay</td><td>Min width</td><td>Max frequency</td></tr><tr><td>25 ns</td><td>15 ns</td><td>2 ns</td><td>1 / (D+W+40ns) 20 MHz max</td></tr><tr><td>250 ns</td><td>30 ns</td><td>12 ns</td><td>1 / (D+W+65 ns) 10 MHz max</td></tr><tr><td>2.5 μs</td><td>220 ns</td><td>120 ns</td><td>1 / (D+W+350 ns) 1 MHz max</td></tr></table> Other ranges available for embedded applications				Range	Min delay	Min width	Max frequency	25 ns	15 ns	2 ns	1 / (D+W+40ns) 20 MHz max	250 ns	30 ns	12 ns	1 / (D+W+65 ns) 10 MHz max	2.5 μs	220 ns	120 ns	1 / (D+W+350 ns) 1 MHz max
Range	Min delay	Min width	Max frequency																	
25 ns	15 ns	2 ns	1 / (D+W+40ns) 20 MHz max																	
250 ns	30 ns	12 ns	1 / (D+W+65 ns) 10 MHz max																	
2.5 μs	220 ns	120 ns	1 / (D+W+350 ns) 1 MHz max																	
JITTER	Less than 500 ppm of Range delay, typ																			
OUTPUT	DC coupled, SMA connector 50 ohm source impedance, zero volt baseline Pulse adjustable from +0.8 to +20 volts (0.4 to 10 volts into 50 ohm load) Rise/fall 1 ns typ Switch selectable output polarity																			
MONITOR OUT	DC coupled, SMA connector 50:1 attenuated output pulse monitor, 50 ohm impedance 100:1 into external 50 ohm load																			
POWER IN	+24 VDC, 100 mA + average load current 2.1 mm x 5.5 mm threaded barrel receptacle, center positive J24 wall-plug universal-input power supply furnished																			
CALIBRATION INTERVAL	One year																			
PACKAGING	Aluminum enclosure, 2" x 3" x 1" J732 mounting flange included																			

3. BLOCK DIAGRAM

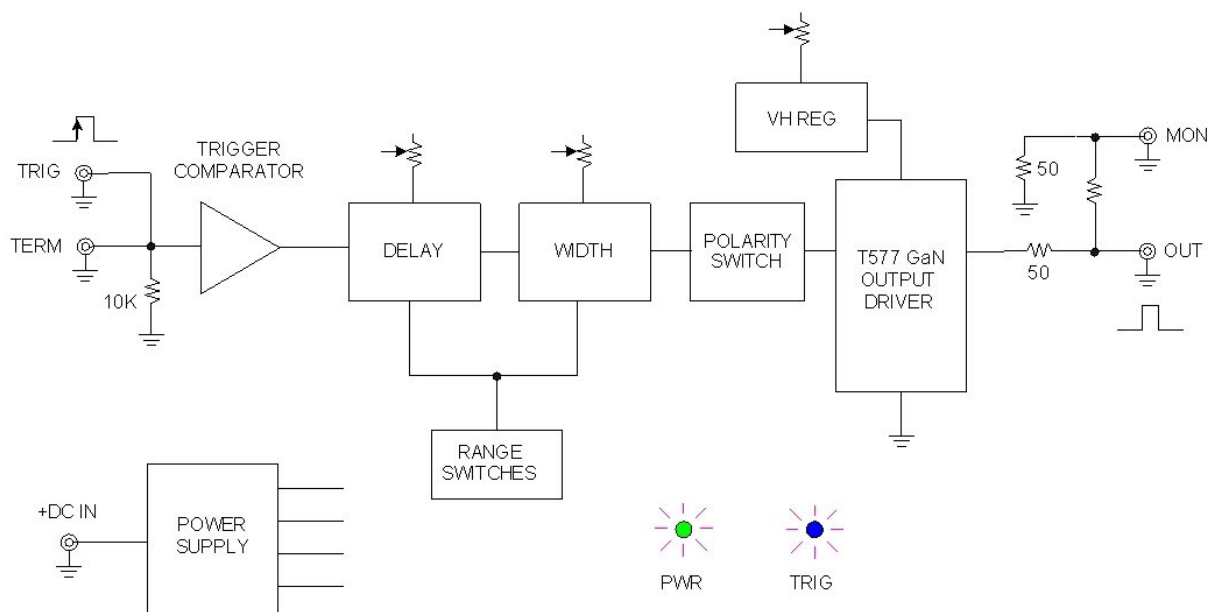


Figure 1: J270 block diagram

4. USER SETTINGS

All settings are manual switches or trimpots. A USB programmed version is planned.

5. TRIGGER INPUT

The user-furnished trigger input is two SMA female connectors, TRIG and TERM. The J270 is furnished with a J48, 50 ohm terminator installed at the TERM connector. If this terminator is removed, the input impedance is 10K to ground. The TERM connector may also be used as a loop-through to another J270 or to some other device.

The input trigger is a positive edge with +0.5 volt nominal threshold. The maximum safe input is +5 volts. There is no explicit ESD protection beyond the ESD ratings of the fast IC input comparator (EIAJ 0Ω 200 pF 900V, IEC direct 330Ω 150 pF 5kV)

6. TIME RANGES

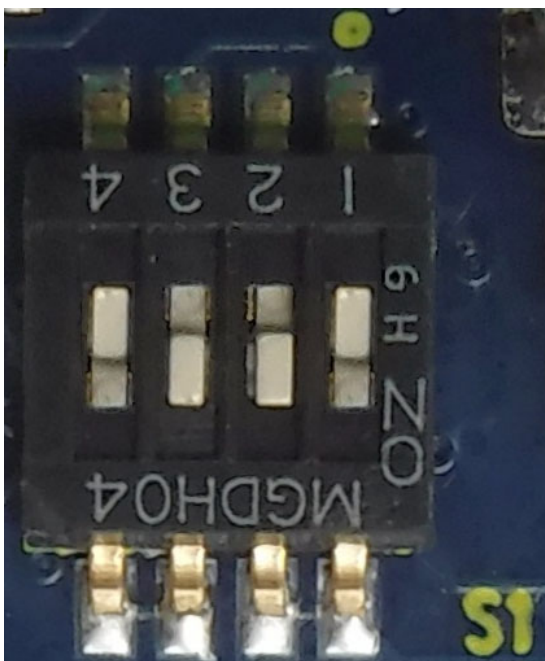
There are three timing ranges, selected by the RANGE rotary switch.

Each range defines the allowable sum of delay and width. Three dots on the end plate indicate the three positions.

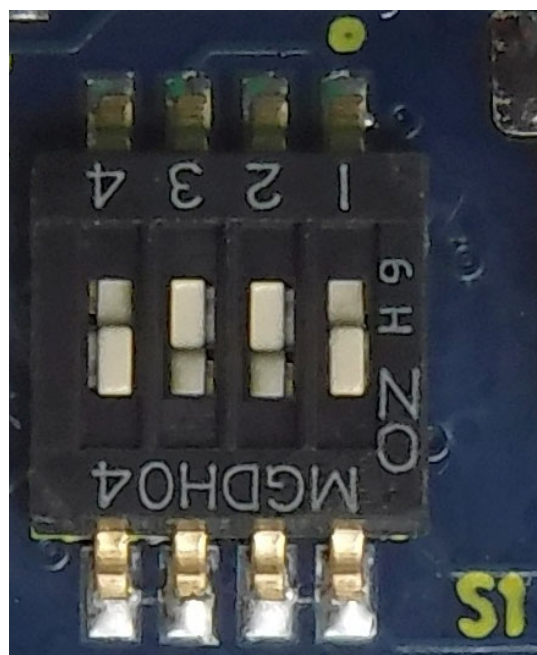
Within each range, the DELAY and WIDTH pots set respective timings, with the sum limited to the total range capability.

7. SIGNAL POLARITY INVERSION

Trigger input to output polarity is normally non-inverting, resulting in VH at the output when the input trigger signal level is above threshold. Polarity can be inverted relative to the input by changing the setting of an internal 4-position DIP switch. To access the switch, remove the top cover by first removing the two upper endplate screws on each side of the unit, then carefully lifting the cover straight up. The signal inversion switch reference designator is "S1", it is located near the center bottom of the unit, to the left of the T577 output stage. Use a small flat head screwdriver or tweezer tip to set the appropriate switch positions. Non-inverting polarity is set when the upper "1" and lower "4" switch positions are set "OFF", and the middle "2" and "3" switch positions are set "ON". Inverting polarity is set by sliding the two middle "2" and "3" switch positions "OFF" and the outer "1" and "4" positions "ON". Please remove power from the J270 before changing the polarity switch setting.



Non-inverting



Inverting

Figure 2: Signal Polarity Switch

8. OUTPUT

The output is a 50 ohm source from the GaN output stage. The base level is zero volts or slightly negative and the pulse high level is set by the VH trimpot. On the standard J270-1 version, an external 24 volt power supply is used and the pulse output is adjustable from +0.8 volts to +20 volts into a high impedance load, or +0.4 volts to +10 volts into an external 50 ohm load.

The output duty cycle is limited by the power capability of the internal power supplies and the output stage. The J270 will shut down if the supplies are overloaded or computed power dissipation in the 50 ohm equivalent source resistance exceeds about 4 watts. The POWER led will go off when overload is sensed, and the unit will resume operation after a recovery delay. The J270 can sustain 100 % duty cycle up to 20 volts output, 10 volts into an external 50 ohm load. Low impedance loads, shorts or lasers for example, will not damage the unit but can invoke shutdowns at high duty cycles. The maximum pulse repetition rate is limited to approximately 20 MHz. Pulsing at rates greater than 20 MHz for extended periods can overheat the output stage.

The pulse output stage is the Highland T577 GaN driver subassembly. It can make DC-coupled sub-ns pulses from a baseline of ± 5 volts and is available as an OEM product.

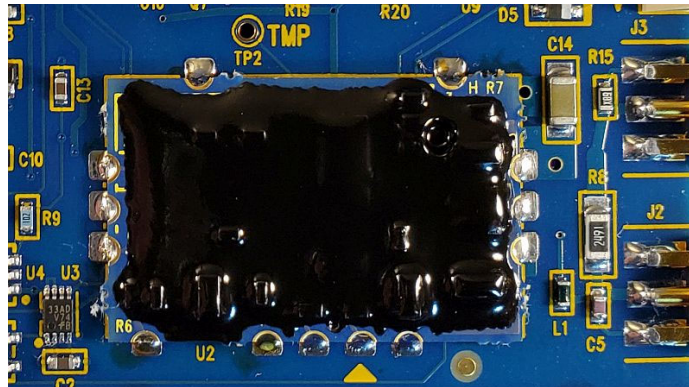


Figure 3: T577 GaN output stage

8.1 MONITOR OUTPUT

The MON output may be used to set the delay, width, and output level without disconnecting the load. It is 1/50 of the actual voltage at the output connector, measured with a hi-Z scope, or 1/100 into a 50-ohm scope.

9. LEDs

The green PWR LED indicates normal operation and the blue TRIG LED indicates triggers accepted. Both will go off briefly if thermal overload is sensed.

10. POWER

The J270-1 version requires +24 volts DC. The Highland J24 wall-wart is furnished. Current requirement is typically 100 mA plus average load current.

The model J27 locking cable is available for use with other power supplies.

11. MOUNTING

The J270 is furnished with the J732 mounting flange attached.

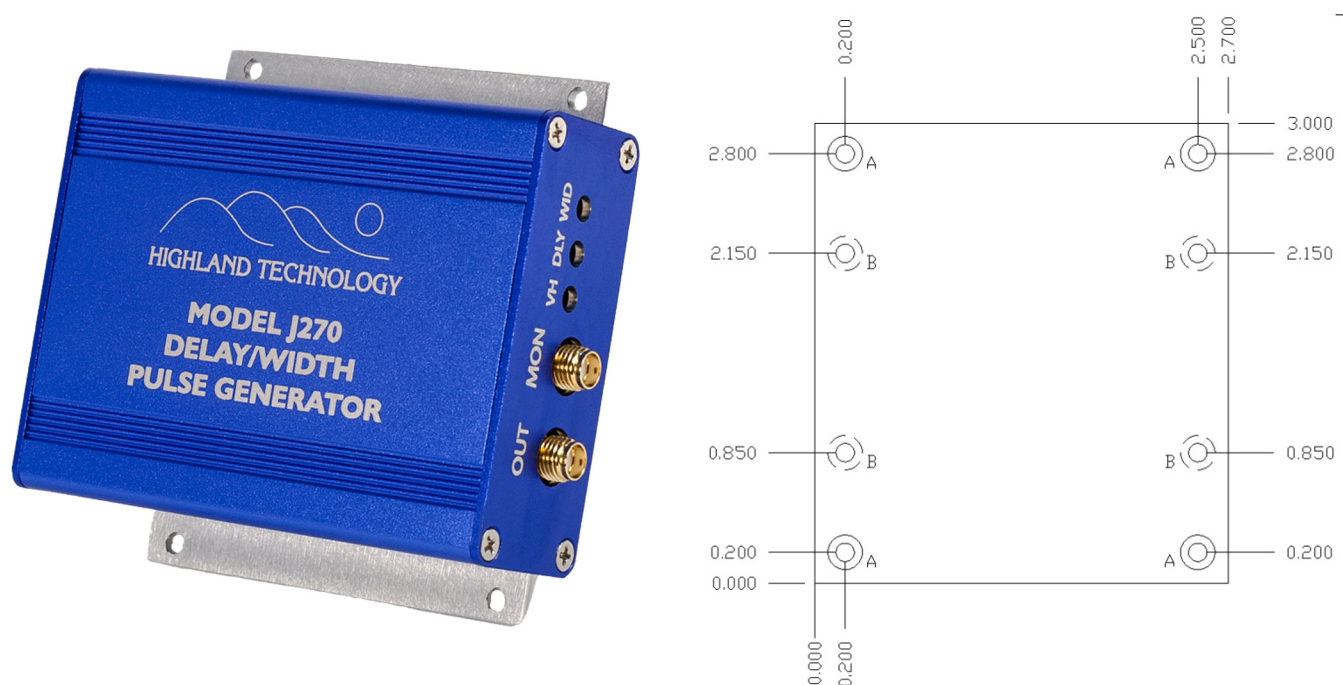


Figure 4: J270 assembly and J732 mounting flange

The J270 is secured with 4-40 screws through the four holes B-B. The four outer holes A-A can be used to mount the flange to a surface with 4-40 hardware.

The screws from the flange, or from any other mounting arrangement, must not penetrate the J270 enclosure more than 0.1 inches. Consult factory about custom mounting or packaging.

The J270 requires convection or conduction cooling (air flow, or surface mounting to a metal surface) to achieve rated pulse outputs. It does not need special cooling at 10 % or lower pulse duty cycles when loaded by 50 ohms.

CAUTION: The J270 case temperature could exceed 60 °C at high outputs without cooling.

12. TYPICAL OUTPUTS

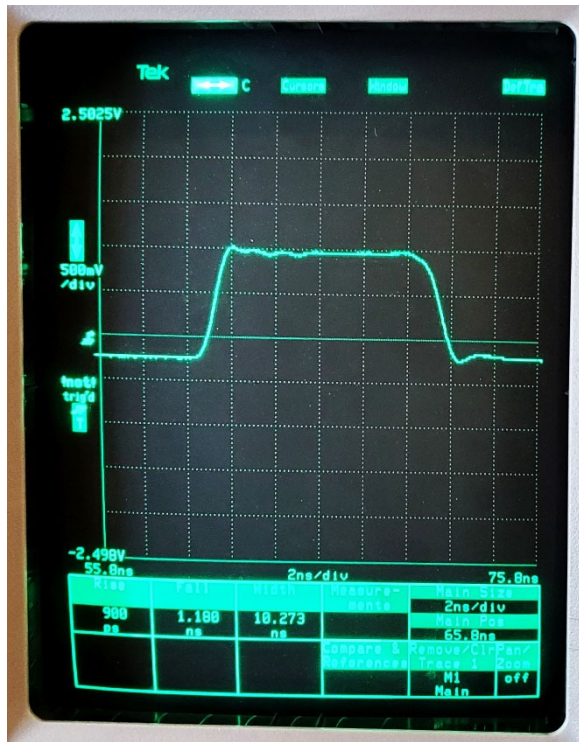


Figure 5: 1 volt pulse into 50 ohms

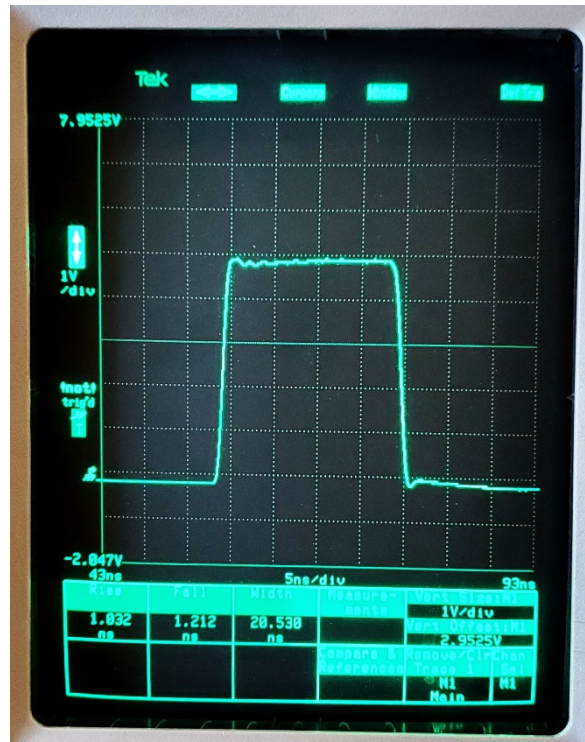


Figure 6: 5 volt pulse into 50 ohms

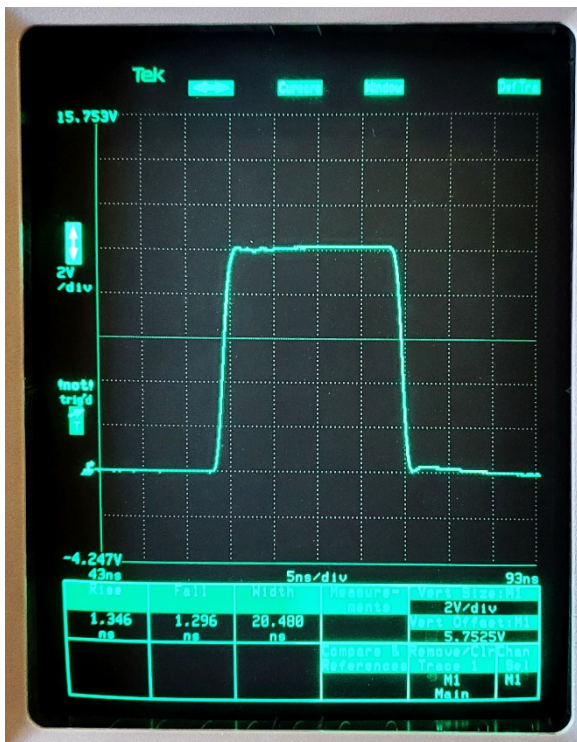


Figure 7: 10 volt pulse into 50 ohms

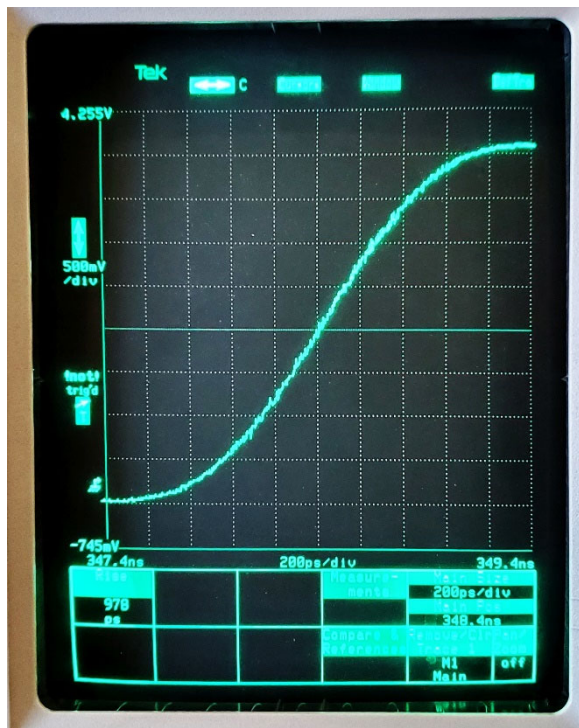


Figure 8: 4 volts into 50 ohms, range 1, 200 ps/div, unsmoothed

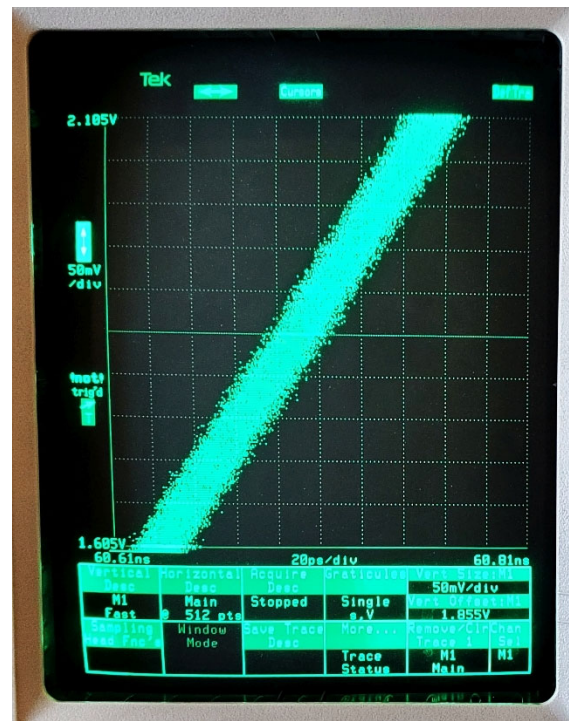


Figure 9: Zoomed rising edge, range 1, 100,000 point accumulation, Indicated p-p jitter is 30 ps, mostly scope

13. VERSIONS

J270-1: 24-volt compact single-channel adjustable delay and width electrical pulse generator

14. CUSTOMIZATION

Consult factory for information about additional custom versions.

15. REVISION HISTORY

21A270-1A	August 2020 Initial J270 release
28A270-1B	September 2022 Added polarity switch

16. ACCESSORIES

J24-1:	24 volt 1.2 amp power supply (included with purchase)
J27-1:	2.1 x 5.5 mm barrel to pigtail power cable
J44-1:	3' SMA to SMA cable
J48-1:	50 ohm SMA terminator
J732-1:	mounting flange (included with purchase)