



## MODEL 4005 CALIBRATION SOURCE

### PRELIMINARY PRODUCT SPECIFICATION

#### Features:

- 9 ps Falltime
- Interchangeable Pulse Heads with Fixed Amplitudes of 5 V, 1.2 V, or 300 mV
- Adjustable Repetition Rate of 0.1 Hz to 1 MHz
- Internally or Externally Triggered

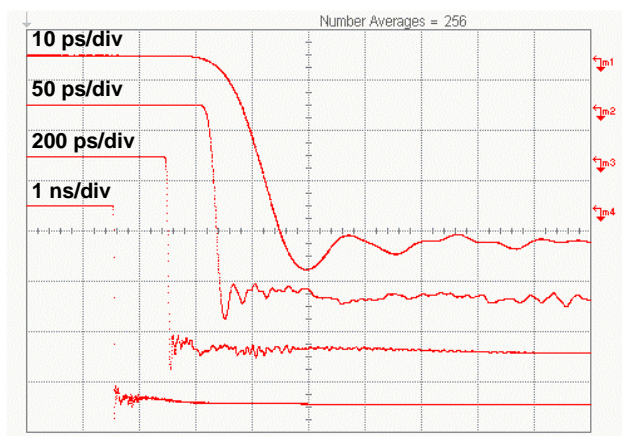


#### Applications:

- Risettime standard for testing oscilloscopes
- Impulse or step response testing of semiconductors, components, networks, etc.
- Very high resolution TDR/TDT measurements

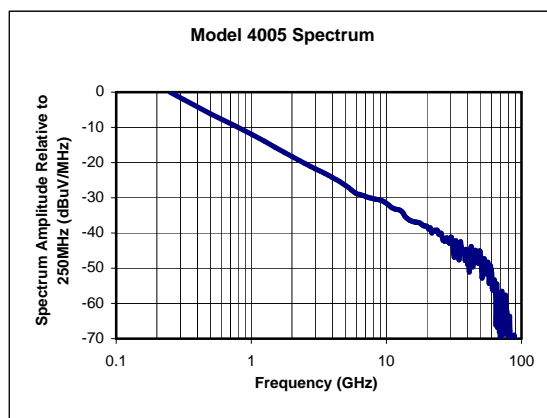
The Model 4005 Calibration Source produces an ultra-fast pulse with 9 ps falltime into an AC or DC coupled 50 $\Omega$  load. The pulse is generated in an external pulse head that is attached to the main unit via a coaxial cable. This allows the pulse head to be directly connected where it is needed, eliminating the risetime slowing effects of interconnecting coaxial cables. Pulse heads are interchangeable and available with fixed pulse amplitudes of 300 mV to 5 V.

### Typical Step Pulse Data



#### Measured on Agilent 70 GHz Sampling System

100 mV/div. Total measured falltime is 7.2 ps.



#### Frequency Spectrum Calculated Using FFT

Spectrum Amplitude calculated from 1 ns/div time domain waveform using MatLab script SpecAnalysisV2, which is available on the PSPL website.

Step Pulse Parameters [1, 2]	
<b>Waveform</b>	step pulse
<b>Falltime</b> (10% - 90%)	9 ps typical, 11 ps max.
<b>Amplitude</b>	Set by pulse head. -5 V max.
<b>Polarity</b>	Negative
<b>Baseline</b>	0 V
<b>Step Duration</b>	16 ns
<b>Risetime</b> (10%-90%)	70 ps
<b>Precursor</b>	< ±1%
<b>Overshoot</b>	20%
<b>Perturbations</b>	±8%, t < 1 ns
<b>Flatness</b>	±2%, t > 1 ns
<b>Impedance</b>	50 Ω

Trigger Output	
<b>Impedance</b>	50 Ω
<b>Coupling</b>	AC
<b>Amplitude</b>	400 mV
<b>Duration</b>	16 ns
<b>Risetime</b>	100 ps
Note: Not functional with ext. trigger	

External Trigger Input	
<b>Impedance</b>	50 Ω
<b>Coupling</b>	DC
<b>Slope</b>	Positive
<b>Amplitude</b>	200 mV to 2 V
<b>Signal Type</b>	Pulse only. Works with 200 mV TDR, PECL, CML
<b>Risetime</b>	< 3 ns max.
<b>Input Repetition Rate</b>	1 MHz max.
<b>Max. Input</b>	2 Vpp pulse, ±2 V DC max.
<b>Variable Trigger Level</b>	-1 V to +1 V

General Timing	
<b>Rep. Rate</b>	0.1 Hz to 1 MHz. Also single pulse and external trigger input.
<b>Delay</b>	60 ns with internal trigger
<b>Jitter (rms)</b>	< 1 ps, 1.5 ps max.

General Specifications	
<b>Connectors</b>	Front panel: SMA, Lemo pulse head output: 1.85 mm plug
<b>Controls</b>	Power, Mode, Single, Enable, and Vernier
<b>AC Power</b>	100, 117, 200 or 230 V AC, 50/60 Hz, 15 VA (60 Hz)
<b>Operating Environment</b>	Indoors, 0 C to 50 C, < 80%RH
<b>Safety Certifications</b>	Conforms to EN-061010-1 (CE mark) UL-1244 and IEC-348. Safety class I. For lab use only by qualified personnel
<b>EMI Certifications</b>	Conforms to EU Directive 89/336/EEC EN55011 and EN50082-1, CE mark
<b>Calibration</b>	Test report with waveforms included. NPL/NIST-traceable.
<b>Warranty</b>	One year. See Terms and Conditions of Sale for details.
<b>Accessories Included</b>	SMA and Lemo cables, power cord, and instruction manual.
<b>4005 Driver Dimensions</b>	3 x 7.5 x 10 in. (7.6 x 19 x 25.4 cm)
<b>Pulse Head Dimensions</b>	2.25 x 1 x 3 in. (5.7 x 2.5 x 7.6 cm)
<b>Weight</b>	8 lbs (3.6 kg), 11 lbs (5 kg) shipping

### Notes:

**[1]** These are typical performance parameters. Only the falltime is guaranteed to meet max/min limits. All other parameters are typical values only.

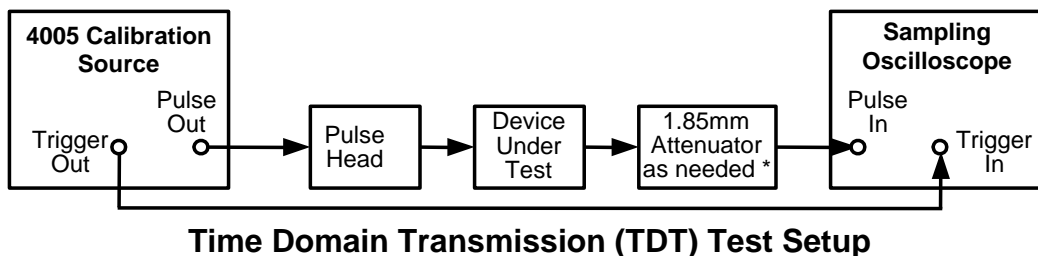
**[2]** The Root-Sum-of-Squares (RSS) approximation (given below) is used to extract the 4005 risetime from the total measured risetime. Note, total measured risetime includes risetime effects of the measurement instrument.

$$T_f(4005) = [ T_f^2(\text{measured}) - T_f^2(\text{system}) ]^{1/2}$$

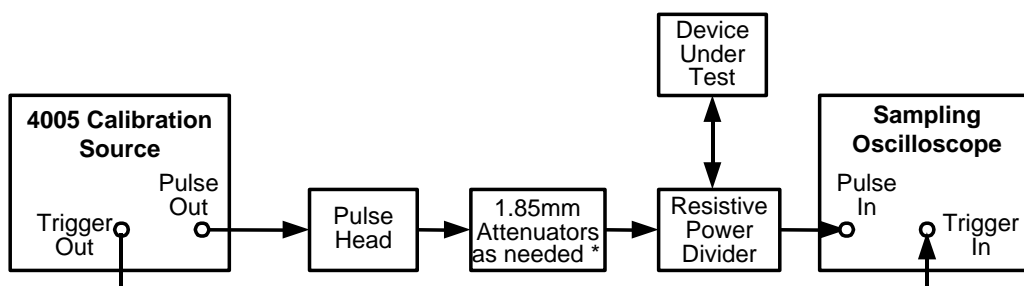
**[3] CAUTION:** The semiconductors in the external and internal pulse heads are fragile and susceptible to damage by static discharge. Use care when handling them. Always discharge cables and loads prior to connecting. These pulse heads can be damaged if an external voltage is applied. Since these items are subject to damage by the user, they have a limited 30-day warranty. If a DC voltage is present in the external circuit, use a DC blocking capacitor (for example, PSPL Model 5509-205-224) on the output of the external pulse head.

### Example TDT and TDR Set-Ups:

\* **Note:** To obtain the desired signal amplitude, attenuators may be placed before and/or after the Device Under Test.



**Time Domain Transmission (TDT) Test Setup**



**Time Domain Reflectometry (TDR) Test Setup**

**Note:** Please see Ordering Information for PSPL recommended accessories.

Ordering Information	
Model Number	Description
4005	Calibration Source
4005PH-307-5V	Pulse Head, 5 V
4005PH-307-1.2V	Pulse Head, 1.2 V
4005PH-307-300 mV	Pulse Head, 300 mV
Recommended Accessories	
Model Number	Description
5510V-302-20dB	20dB Attenuator, V Connector
5510V-302-10dB	10dB Attenuator, V Connector
5510V-302-6dB	6dB Attenuator, V Connector
5510V-302-3dB	3dB Attenuator, V Connector
5350-201	Resistive Power Divider, 2.4 mm