

NEAR-IR GRENOUILLES

THE WORLD'S MOST POWERFUL AND EASIEST TO USE
ULTRASHORT-LASER-PULSE MEASUREMENT DEVICE

As a **FROG** device, GRENOUILLE yields the pulse intensity and phase vs. time and spectrum and spectral phase with great accuracy and reliability, requiring no assumptions about the pulse. It measures the actual pulse, not the coherent artifact.

In addition, GRENOUILLE also measures the **beam spatial profile**.

What's more, it also simultaneously yields the otherwise-difficult-to-measure spatio-temporal distortions, **spatial chirp** and **pulse-front tilt**, which occur in most ultrashort pulses but are almost never measured. GRENOUILLE is the only commercially available device to measure these distortions and the most accurate diagnostic for pulse-front tilt ever developed.

It yields the approximate pulse **absolute wavelength**, too.

Remarkably, GRENOUILLE **needs no internal alignment—ever!** Even placing it in the beam is amazingly easy.

GRENOUILLE tells you more about your pulse with less effort than ever imagined!

And weighing as little as 1 kg, it's light and compact, with a footprint smaller than a foot!

Note: currently, the Model 8-4-USB is only available as a kit.



FROG/GRENOUILLE AT A GLANCE

- **The pulse intensity and phase vs. time**
- **The pulse spectrum and spectral phase vs. wavelength**
- **Measurements are of the actual pulse, not the coherent artifact**
- **The beam spatial profile**
- **The approximate spatial chirp**
- **The pulse-front tilt**
- **The autocorrelation**
- **No assumptions**
- **No alignment**
- **High sensitivity**
- **Real-time intensity and phase retrieval**
- **Minimal weight and size**
- **Laptop-friendly**

A single GRENOUILLE can measure pulses from a wide variety of sources, from the lowest-energy oscillator to the highest-intensity amplifier.

Voted one of the 100 most important inventions of the year (across all fields) by R&D Magazine, and one of the top 25 optics inventions of the year by Photonics Spectra, GRENOUILLE represents a huge leap forward in ultrashort-pulse-measurement technology.



NEAR-IR GRENOUILLE MODELS AND SPECIFICATIONS

FROG/GRENOUILLE model	8-4	8-9-USB	8-20-USB	8-50-USB
Center-wavelength range	700 - 900 nm	700 - 1100 nm		
Pulse-length range @ 800 nm	~4 - ~80 fs	~10 - ~100 fs	~19 - ~340 fs	~35 - ~680 fs
Pulse-length range @ 1050 nm	NA	~8 - ~80 fs	~15 - ~160 fs	~21 - ~320 fs
Delay increment	0.4 fs/pixel	0.8 fs/pixel	0.9 fs/pixel	1.2 fs/pixel
Temporal range ¹	250 fs	460 fs	500 fs	1900 fs
Spectral resolution @ 800 nm	4 nm	0.7 nm	1.4 nm	0.7 nm
Spectral resolution @ 1050 nm	NA	0.9 nm	5.2 nm	2.6 nm
Spectral range @ 800 nm ¹	600 nm	250 nm	140 nm	50 nm
Spectral range @ 1050 nm ¹	NA	330 nm	360 nm	130 nm
Pulse complexity	Time-bandwidth product < ~10			
Intensity accuracy	2%			
Phase accuracy	0.01 rad (intensity-weighted phase error)			
Single-shot operation?	Yes	Optional ²	Yes	
Sensitivity (single-shot)	200 μJ	100 μJ	1 μJ	
Sensitivity (at 10 ³ pps)	100 mW (100 μJ)	500 μW (500 nJ)	100 μW (100 nJ)	
Sensitivity (at 10 ⁸ pps)	300 mW (3 nJ)	50 mW (500 pJ)	10 mW (100 pJ)	
Spatial chirp accuracy (dx/dλ)	NA	1 μm/nm		
Pulse-front tilt accuracy (dt/dx)	NA	0.05 fs/mm		
Required input polarization	Vertical	Any (Just rotate GRENOUILLE)		
Required input-beam diameter	> 2 (collimated)			
Number of alignment knobs	Several	Zero		
Time to set up	Contact us ³	~30 minutes		
Dimensions (L x W x H) w/camera	45x45x15 cm	33x7.5x17 cm	26x4.5x11.5 cm	
Weight	~10 kg	3 kg	1.2 kg	

1. Temporal and spectral ranges are the full-scale ranges, not the pulse FWHM (which is typically a factor of ~3 smaller).
2. The Model 8-9-USB can be modified to allow single-shot measurement using a thinner crystal, yielding somewhat lower sensitivity.
3. Model 8-4 requires on-site installation and training by a Swamp Optics scientist.

ADDITIONAL NOTES

- Spatial chirp is easily revealed by tilt in the otherwise symmetrical measured trace.
- Pulse-front tilt is easily revealed by a displacement of the trace along the delay axis.
- Absolute wavelength is indicated to a few nm by the crystal-angle dial.
- FROG & GRENOUILLE have a (removable) ambiguity in the direction of time. (In contrast, other methods have infinitely many ambiguities.)
- Triggered single-shot operation is now standard on all models, except for the 8-9-USB, when using an angle-dithered crystal.
- Comparison of the retrieved and measured traces confirms the measurement.
- Input-beam mode quality should be good; GRENOUILLE's spatial-profile measurement helps to ensure this.
- Just connect to your computer's USB port; no power supply needed.
- The Model 8-50-USB has one camera, which is switchable between temporal and spatial profiles. Model 8-4 has one camera, only for temporal profile. All other Ti:Sapphire FROG and GRENOUILLE models use two cameras for simultaneous display of spatial and temporal profiles.
- Models 8-20-USB, 8-50-USB are GRENOUILLE designs. Models 8-4-USB and 8-9-USB are FROGs with a built-in spectrometer for spectral resolution.
- Model 8-4: The FROG algorithm to be used for this model requires an independent spectrum measurement, acquired with a response-calibrated spectrum.



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