

# TL-1000 & TL-1000-ASOPS



- Repetition rate stabilisation
- Repetition rate offset locking
- Low residual timing jitter
- ASynchronous Optical Sampling (ASOPS)
- Time Domain Spectroscopy



TL-1000-ASOPS

## Overview

Laser Quantum offers the timing stabilisation units **TL-1000** and **TL-1000-ASOPS** as accessories to the **gigajet** series high-speed femtosecond oscillators, the **gecco** and the **taccor** femtosecond laser. The **TL-1000** allows the tight phase-lock of an oscillator repetition rate to an external reference such as a synthesiser or another modelocked laser, with a residual timing jitter below 100fs. **TL-1000-ASOPS** enables a repetition rate offset-lock between two femtosecond oscillators (e.g. contained in a **gigajet TWIN**) at a repetition rate difference between 2kHz and 20kHz. System parameters are accessible via a touchscreen and USB port.

Repetition rate stabilisation is essential for applications requiring a well-defined timing relation between a femtosecond oscillator and a reference signal. Such applications are for example two-color pump-probe spectroscopy using two synchronised mode locked lasers, optical experiments synchronised to a pulsed electron source, or high speed asynchronous optical sampling (ASOPS) experiments. ASOPS is an ultra-rapid and precise time-domain spectroscopy technique pioneered by Laser Quantum GmbH, outperforming classical approaches by orders of magnitude in measurement speed and noise performance.

The **TL-1000** and **TL-1000-ASOPS** are specifically designed to serve these applications. Repetition rate fluctuations of a free-running oscillator are efficiently suppressed with a residual timing jitter below 100fs. **TL-1000-ASOPS** permits high-speed ASOPS based ultrafast time-domain spectroscopy using two femtosecond oscillators with better than 60fs time-delay resolution.

## Optional features

### Low timing jitter option

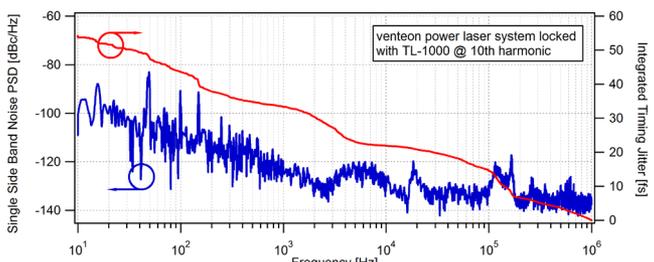
This option is available for the **TL-1000** timing stabilisation unit to suppress timing jitter to typically below 10fs (0.1Hz to 100kHz). A suitable 10GHz reference synthesiser must be provided by the customer. Stabilisation is performed at higher repetition rate harmonic.

### ASOPS experiment support

The **TL-1000-ASOPS** is capable of driving and monitoring a **PR-130** photoreceiver and a **Tera-SED** THz emitter element via its umbilical port. This feature is beneficial for high-speed ASOPS experiments.

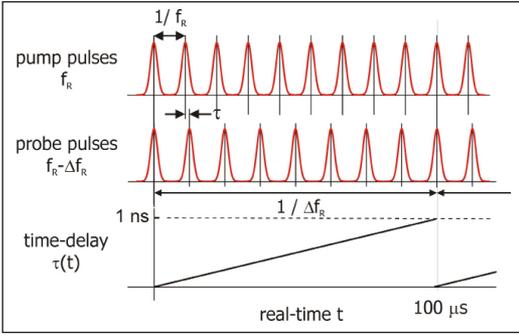


TL-1000



Timing jitter measurement of the pulse train emitted by a **venteon power** stabilised using the **TL-1000** unit.

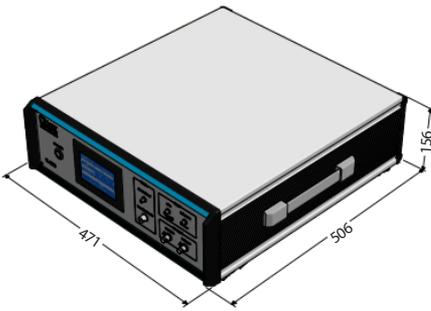
# TL-1000 & TL-1000-ASOPS



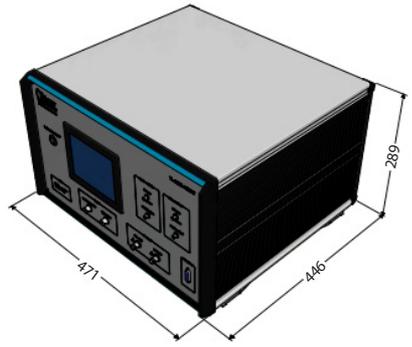
The **TL-1000-ASOPS** controls the time delay between pump and probe pulses by slightly differing repetition rates ( $f_r \sim 1\text{GHz}$ ). The difference in  $\Delta f_r$  determines the scan rate, while the measurement window is given by the inverse of the repetition rate  $1/f_r = 1\text{ns}$ . Here,  $\Delta f_r$  is 10kHz, i.e. the time-delay is repetitively ramped with a 100 $\mu\text{s}$  period.

This high-speed ASOPS scheme is used in the Laser Quantum **HASSP-THz** spectroscopy system to obtain spectral resolution of 1GHz.

## Dimensions (mm)



**TL-1000**



**TL-1000-ASOPS**

## Specifications\*

	<b>TL-1000</b>
Repetition rate range <sup>1</sup>	75MHz-1GHz
Timing jitter <sup>2,3</sup>	≤100fs (0.1Hz to 100kHz)
Power requirement	110/220 VAC (60/50Hz)

	<b>TL-1000-ASOPS</b>
Repetition rate <sup>4</sup>	498-502MHz 0.996-1.004GHz
Repetition rate offset	2 to 20kHz
Timing jitter <sup>2,3</sup>	≤100fs (0.1Hz to 100kHz)
Time resolution in high speed ASOPS	<60fs
Trigger signal	TTL level at offset frequency, ≤10ns rise time
Power requirement	110/220 VAC (60/50Hz)

<sup>1</sup> Below 333MHz repetition rate the customer supplied reference signal must be at a repetition rate harmonic with frequency above 333MHz.

<sup>2</sup> Relative to customer provided reference signal at +7dBm, 500hm with <-125dBc/Hz phase noise above 10kHz offset from carrier.

<sup>3</sup> If used with a femtosecond oscillator of the gigajet series and suitable built-in piezo backed cavity mirror(s).

<sup>4</sup> Range must be selected upon order.

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