

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 and the **taccor** femtosecond laser. The **TL-1000** can also be used for stabilisation of the **gecco** and **venteon** series of lasers. The **TL-1000** allows the tight phase-lock of an oscillator repetition rate to an external reference such as a synthesiser or another mode locked laser, with a residual timing jitter. **TL-1000-ASOPS** enables a repetition rate offset-lock between two femtosecond oscillators (e.g. two **taccor** lasers or the oscillators contained in a **gigajet TWIN**) at a repetition rate difference between 2 kHz and 20 kHz. It also permits synchronisation of two lasers with a jitter below 60 fs (synch. mode). System parameters are accessible via 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 <100 fs. **TL-1000-ASOPS** permits high-speed ASOPS based ultrafast time-domain spectroscopy using two femtosecond oscillators with >60 fs time-delay resolution.

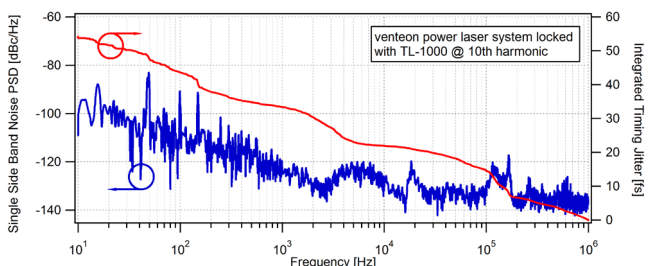
Optional features

Low timing jitter option

The low timing jitter option is available for the **TL-1000** timing stabilisation unit when used with lasers that have a repetition rate of >333 MHz, suppressing timing jitter to typically ≤ 10 fs (0.1 Hz to 100 kHz). A suitable 10 GHz reference synthesiser must be provided by the customer. Stabilisation is performed at higher repetition rate harmonic.

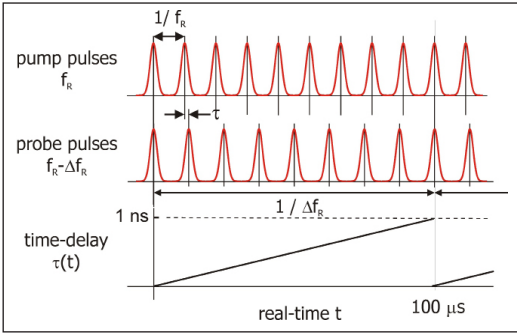
ASOPS experiment support

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.



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

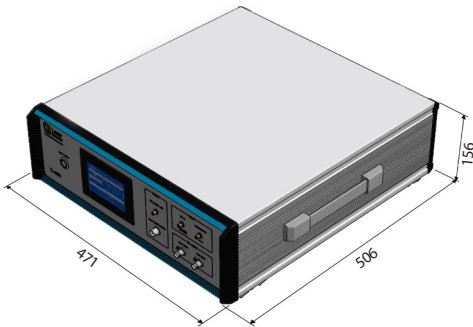
TL-1000 & TL-1000-ASOPS



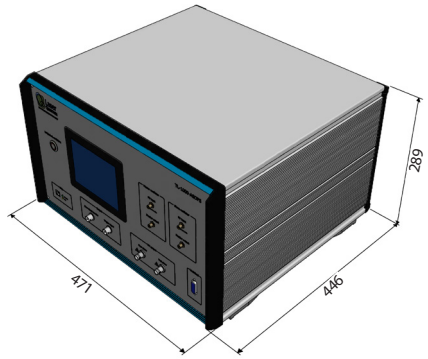
The **TL-1000-ASOPS** controls the time delay between pump and probe pulses by slightly differing repetition rates ($f_r \sim 1 \text{ GHz}$). The difference in Δf_r determines the scan rate, while the measurement window is given by the inverse of the repetition rate $1/f_r = 1 \text{ ns}$. Here, Δf_r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

Dimensions (mm)



TL-1000



TL-1000-ASOPS

Specifications*

	TL-1000	TL-1000 (Low jitter)
Repetition Rate range ¹	75 MHz to 1 GHz	333 MHz to 1 GHz
Timing jitter ^{2,3} : taccor/helixx models	<100 fs (0.1 Hz to 100 kHz)	≤10 fs (0.1 Hz to 100 kHz)
Timing jitter ^{2,3} : venteon/gecco models	<300 fs (0.1 Hz to 100 kHz)	≤100 fs (0.1 Hz to 100 kHz)
Power requirements	110 or 220 VAC (60/50 Hz)	

	TL-1000 ASOPS
Repetition Rate range ¹	498 MHz to 502 MHz 0.996 GHz to 1.004 GHz
Timing jitter in synch. mode ³	<60 fs (0.1 Hz to 100 kHz)
Repetition Rate offset	0 (synch. mode) or 2 kHz to 20 kHz
Time resolution in ASOPS	<60 fs
Trigger signal	TTL level at offset frequency, ≤10 ns rise time
Power requirements ⁴	110 or 220 VAC (60/50 Hz)

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

² Relative to customer provided signal at +7 dBm (50 Ohm) with <-125 dBc/Hz phase-noise above 10 kHz offset from carrier. Reference signal must be at the repetition rate harmonic nearest 10 GHz for the low jitter version.

³ If used with a Laser Quantum femtosecond oscillator and suitable built-in piezo supported cavity mirror(s).

⁴ Ranges must be selected upon order.

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