Novanta

ENGINEERED BY LASER QUANTUM

## TL 1000 & TL 1000 ASOPS REPETITION RATE STABILIZATION

# WELL-TIMED FEMTOSECOND PULSES

Novanta develops high-precision lasers and essential accessories for cutting-edge ultrafast scientific and academic research through our globally recognized brands like Laser Quantum. Designed and built for accurate results, reliable operation, and straight-forward integration, our ultrafast lasers can be found in research and development facilities around the globe.

## REPETITION RATE STABILIZATION

Novanta offers the timing stabilisation units TL-1000 and TL-1000-ASOPS as accessories to the its series of femtosecond 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. TL-1000-ASOPS enables a repetition rate offset-lock between two femtosecond oscillators (e.g. two taccor lasers or two gecco lasers) at a repetition rate difference between 20 Hz 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, outperforming classical approaches by orders of magnitude in measurement speed and noise performance.

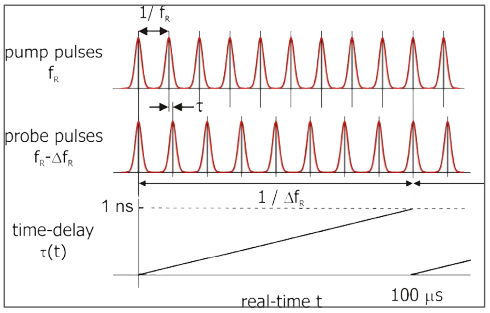
The TL-1000 and TL-1000-ASOPS are specifically designed to serve these applications. Repetition rate fluctuations of a free-running oscillator are efficiently suppressed. TL-1000-ASOPS permits high-speed ASOPS based ultrafast time-domain spectroscopy using two femtosecond oscillators with >60 fs time-delay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

## OPTIONAL FEATURE & FUNCTIONALITY

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

**Functionality**

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

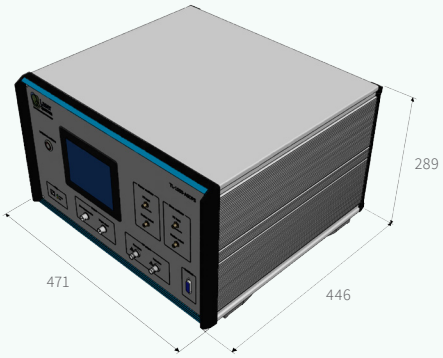



The TL-1000-ASOPS controls the time delay between pump and probe pulses by slightly differing repetition rates ($f_R$ ~1 GHz). The difference in $\Delta f_R$ determines the scan rate, while the measurement window is given by the inverse of the repetition rate $1/f_R$=1ns. Here, $\Delta f_R$ is 10 kHz,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

# TL-1000 & TL-1000 ASOPS SPECIFICATIONS

## DIMENSIONS (mm)


TL-1000




TL-1000-ASOPS

## SPECIFICATIONS

| Specification* | TL-1000 | TL-1000-ASOPS |
|---|---|---|
| Repetition Rate range[1] | 75 MHz to 10 GHz | 79.68 MHz to 80.32 MHz<br>0.996 GHz to 1.004 GHz |
| Timing jitter[2,3]: taccor models | ≤ 100 fs (0.1 Hz to 100 kHz) | n/a |
| Timing jitter[2,3]: venteon/gecco models | ≤300 fs (0.1 Hz to 100 kHz) | n/a |
| Timing jitter in sync mode[3] | n/a | < 60 fs (0.1 Hz to 100 kHz) @ 1 GHz<br>< 100 fs (0.1 Hz to 100 kHz) @ 80 MHz |
| Repetition Rate offset | n/a | 0 (synch. mode) or 20 Hz to 20 kHz |
| Time resolution in ASOPS | n/a | < 60 fs @ 1 GHz<br>< 100 fs @ 80 MHz |
| Trigger Signal | n/a | TTL level at offset frequency, ≤10 ns rise time |
| Power Requirements | 110 or 220 VAC (60/50 Hz) | 110 or 220 VAC (60/50 Hz) |

*Notes:*

*1 - Ranges must be selected upon order.*

*2 - Relative to customer provided signal at +7 dBm (50 Ohm) with <-125 dBc/Hz phase-noise above 10 kHz offset from carrier.*

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

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