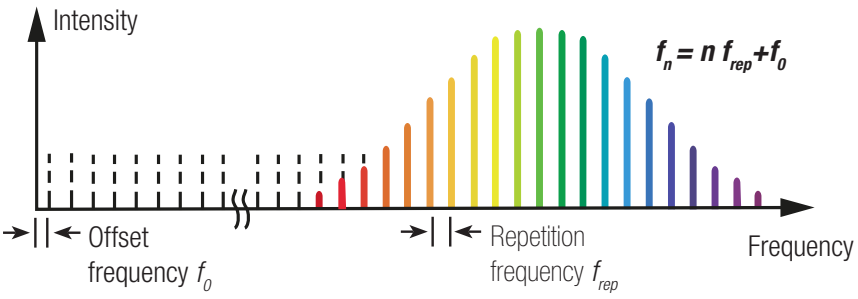
# SmartComb-ULN

## Compact Optical Frequency Comb
## Precision in Every Pulse




**All your comb applications at your fingertips:**

Menlo Systems introduces its newest platform for metrology: The SmartComb-ULN, a compact, robust, high-end, and fully-automated Frequency Comb system. This turn-key, all-in-one device, built with Menlo Systems' robust and reliable figure 9® fiber mode-locked oscillator technology, combines the unrivaled performance of our ultra-low-noise (ULN) frequency comb with a compact form factor of only 3 height units (3U) in a 19" rack format.
6 output ports are readily available to either directly interact with your application in the Er-band or seed spectral extensions and amplifiers, enabling experiments in the spectral range from 500 nm to 2100 nm. An input port for an optical lock at 1.5 µm is also included. The SmartComb-ULN ensures that spectral purity and stability are maintained throughout the entire covered spectral domain, making it ideal for use in both mobile and stationary applications, thus providing reliable performance for a wide range of scenarios. Furthermore, the underlying technology has already proven to be suitable for applications in demanding environments such as on-board aircraft and sounding rockets.




The optical comb frequencies $f_n$ are defined by the repetition rate frequency $f_{rep}$ = 250 MHz, the carrier envelope offset (CEO) frequency $f_0$ and an integer number n.

### KEY SPECIFICATIONS

- Comb Mode Spacing 250 MHz*
- Accuracy <1 x $10^{-17}$ (t > 100 s)
- Stability <5 x $10^{-17}$ in 1 s
- Turn-key, Fully Automated, Remotely Controlled, Continuous Operation
- Full Offset Frequency f0 Tunability

*Others on Request

### APPLICATIONS

- Optical Clocks
- Quantum Applications
- High Precision CW Laser Stabilization
- Calibration of CW Lasers
- Length Metrology
- Cold and Trapped Atoms and Ions
- LIDAR
- Low-noise Microwave Generation
- High Resolution Spectroscopy

### FEATURES

- Wide Comb Mode Spacing
- High Actuator Bandwidth >1 MHz for Repetition Rate and CEO Frequency
- Fully Fiber-coupled CEO Frequency Generation
- Spectral Purity Transfer: Transfer of Optical Reference Stability to all Comb Modes
- 6 Output Ports
- Optical Measurement Input (1.5 µm)
- Internal 10 MHz OCXO Reference

### OPTIONS

- PLUS Add-On for ultimate performance for a selected wavelength
- Compatible with all Amplifiers and Spectral Extensions, Delivering Light from 500 nm to 2100 nm
- GPS-based 10 MHz Frequency Reference
- Ultrastable Laser ORS-Mini-based Optical Input for Optical Locking

Technology protected by patents US8873601B2, US9705279B2, EP2637265B1, EP3041093B1, DE102014226973B4, JP5615397B2, JP6134773B2, CN103311780B, CN105720472B

# SmartComb-ULN

MenloSystems

## Compact Optical Frequency Comb

### COMPLETE SOLUTION:

The turn-key, fully hands-off optical setup is integrated into a 19”, 3U rack unit and offers unprecedented performance for its compactness. Even the stability of the highest performance optical clocks can be fully transferred via spectral extensions to your application over the spectral range from 500 nm to 2100 nm.

### OPTICAL SPECIFICATIONS FOR EACH OUTPUT PORT

| PROPERTY | | VALUE | | | |
|---|---|---|---|---|---|
| Comb Mode Spacing | | 250 MHz (others on request) | | | |
| Central Wavelength | | 1560 nm | | | |
| Average Power | | >10 mW | | | |
| Spectral Width @ 1560 nm | | >25 nm (FWHM) and >50 nm (-10 dB) | | | |
| Stability* (MDEV) | | **Optical Reference Lock** | | | **RF Reference Lock** |
| | in 1 s | $<5 \times 10^{-17}$ | $<5 \times 10^{-18}$ (+) | $<5 \times 10^{-18}$ ** | $<1 \times 10^{-13}$ |
| | in 1000 s | $<5 \times 10^{-18}$ | | $<5 \times 10^{-21}$ ** | $<5 \times 10^{-15}$ |
| Accuracy | | **Optical Reference Lock** | | | **RF Reference Lock** |
| | $\tau > 100$ s | $<1 \times 10^{-17}$ | $<1 \times 10^{-18}$ (+) | | $<1 \times 10^{-14}$ |
| Integrated Phase Noise* [100 Hz – 2 MHz] | | < 100 mrad | < 65 mrad (+) | < 50 mrad** | |
| Tuning Range of Comb Mode Spacing | | >4 MHz | | | |
| Tuning Range of CEO Frequency | | fully flexible | | | |
| Optical Outputs | | 6 | | | |
| Linewidth *Optical Reference Lock* | | <1 Hz for all comb lines and all wavelength extensions | | | |

(+) with PLUS Add-On  * Out-of-loop comb-comb-comparison if not specified otherwise  ** In-loop measurement

### SYSTEM FACTS

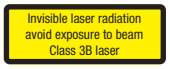
| | |
|---|---|
| Form Factor | 19” x 3U |
| Weight | <25 kg |
| Operating Voltage | 100…115 VAC or 230 VAC, 50…60 Hz |
| Power Consumption | <100 W |
| Operating Temperature | 25 ± 10 °C |
| Software | Includes full automation |
| Software Interfacing | Ethernet |

### ORDERING INFORMATION

| | |
|---|---|
| **Product Code** | SmartComb-ULN |

Please call for pricing. Specifications are subject to change without notice. Custom modifications are available, please inquire.






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