TEMPORIS
PRECISE TIME MEASUREMENTS

Single-Channel Measurement System (SMS)

Currently under development

IN SHORT

- Measures up to 4 RF signals from 1 MHz to 100 MHz.
- Incredible performance at 100 MHz: $<1x10^{-16}$ /√τ (0.5 Hz BW) thanks to cross-correlation. ($<5x10^{-16}$ /√τ without cross-correlation).
- Multiple frequencies accepted with no limitations.
- Up to 4 simultaneous measurements.
- Can measure phase and amplitude noise above -185 dBc/Hz (1 DUT against 1 or 2 REFs). 10 MHz offset max.
- Can measure ensemble of inputs, such as 1 DUT against ensemble of 3 REFs.
- Track phase for up to 2 months, or indefinitely through external streaming.
- Ideal for research, oscillator manufacturing and residual noise measurements.

Temporis Solutio LLC Mission

Temporis is a new and innovative company in the time and frequency field. Its founder, Marco Pomponio, worked for over 6 years in the phase noise metrology group at the National Institute of Standards and Technology (NIST) alongside Craig Nelson and Archita Hati, two of the most experts in the field. Marco developed a new technology that unlocks unseen performance in the measurement of precision oscillators: Flicker Suppressed Direct-Digital (patent pending). Temporis' mission is to bring this technology to market in preparation to the next generation of atomic clocks.

The new Single-Channel Measurement System (SMS) designed by Temporis Solutio LLC is on track to be the industry standard for cutting edge research and oscillator manufacturing. It features a compact and fully independent design (no need for a PC to run measurements), 4 inputs at any frequency between 1 MHz and 100 MHz, and up to 4 simultaneous measurements. This instrument can track phase and frequency for up to 3 DUTs against one reference or measure small ensembles of DUTs and references.

Through Cross-Correlation and Cross-Spectrum, this instrument is also capable of performing 3 and 4 corner-hat measurements, full 3 corner-hats (all 3 oscillators are measured simultaneously), and phase and amplitude noise measurements above -185 dBc/Hz and up to 10 MHz offset.

The SMS measures all inputs against an internal signal through a new technique called Flicker Suppressed Direct-Digital (FSDD) and then performs the required digital scaling and measurements. FSDD allows to achieve astonishing performance never seen before, making this SMS future proof and compatible with the next generation of optical atomic clocks.

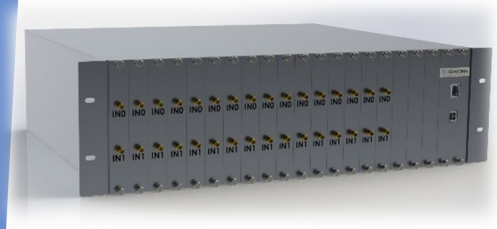
Target Specifications

Inputs	4
Frequency range	1 MHz – 100 MHz
Performance (0.5 Hz BW)	$<5x10^{-16}$ /√τ for 100 MHz carriers (any input to any input). $<1x10^{-16}$ /√τ when using two inputs for the DUT. $<5x10^{-15}$ /√τ for 10 MHz carriers (any input to any input). $<1x10^{-15}$ /√τ when using two inputs for the DUT. If carriers with different frequencies are measured, the lowest frequency dictates the overall performance.
Time Domain Measurements available (up to 4)	- ADEV, OADEV, MDEV with adjustable BW from 50 Hz to 0.5 Hz. - Phase and Frequency over time - Phase, Absolute Frequency and Fractional Frequency data stream output.
Frequency Domain Measurements	- Phase noise (max frequency offset of 10 MHz, residual white noise level of about -185 dBc/Hz) - Amplitude noise (max frequency offset of 10 MHz, residual white noise level of about -185 dBc/Hz) - Phase and Amplitude noise measures 1 DUT against 1 or 2 references.
Interfaces	Ethernet, USB, DisplayPort, Serial
Temperature	20 C – 25 C. Performance guaranteed with temperature swings less than 0.1 C.

For info and pre-orders email info@temporissolutio.com

TEMPORIS
PRECISE TIME MEASUREMENTS

Multi-Channel Measurement System (MMS)



Rack-mountable MMS concept

IN SHORT

- Measures up to 32 RF signals from 1 MHz to 100 MHz.
- Incredible performance at 100 MHz: $<5x10^{-16}/\sqrt{\tau}$ (0.5 Hz BW)
- Multiple frequencies accepted with no limitations
- Can measure phase and amplitude noise above -145 dBc/Hz for diagnostics
- Can ensemble clocks and provide up to 4 outputs or steer external oscillators.
- Standard 19-inch rack mountable.
- Designed to be reliable and modular. Isolates faults if present and modules can be hot swapped.
- Ideal for oscillator production and timescales

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The new Multi-Channel Measurement System (MMS) designed by Temporis Solutio LLC is on track to be the industry standard for oscillator manufacturing and timescales. It features a modular design in a standard 19-inch rack that can hosts up to 32 inputs. The MMS can perform phase noise, amplitude noise or time domain measurements of one or an ensemble of inputs against one or an ensemble of references. Input frequencies can be at any value between 1 MHz and 100 MHz. Up to 4 simultaneous and independent measurements are possible: no need to interrupt a measurement to start a new one.

On top of that, the MMS can provide up to 4 independent outputs (or steer external oscillators) such that the signal is a live representation of the ensemble. The MMS has also de-drift or offset removal features.

The MMS measures all inputs against an internal signal through a new technique called Flicker Suppressed Direct-Digital (FSDD) and then performs the required digital scaling and measurements. FSDD allows to achieve astonishing performance never seen before, making this MMS future proof and compatible with the next generation of optical atomic clocks.

Target Specifications

Inputs	Up to 32. 2 per module.
Frequency range	1 MHz – 100 MHz
Performance (0.5 Hz BW)	$<5x10^{-16}/\sqrt{\tau}$ for 100 MHz carriers (any input to any input) $<5x10^{-15}/\sqrt{\tau}$ for 10 MHz carriers (any input to any input) If carriers with different frequencies are measured, the lowest frequency dictates the overall performance.
Measurements available (up to 4 independent)	- Phase noise (max frequency offset of 100 kHz, residual white noise level of about -145 dBc/Hz) - Amplitude noise (max frequency offset of 100 kHz, residual white noise level of about -145 dBc/Hz) - Time domain measurements (ADEV, MDEV, etc.) with adjustable BW from 50 Hz to 0.5 Hz. - Baseband spectrum measurement of each input (frequency range is 1 MHz to 100 MHz) - Fractional frequency data stream output.
Ensemble outputs	Up to 4 independent. Some inputs become unusable when outputs are used. For 1 out, 31 inputs; 2 outs, 30 inputs; 3 outs, 27 inputs; 4 outs, 24 inputs.
Ensemble performance	Same performance as during measurements. The output is a representation of the ensemble starting from 0.1 second intervals. (Or limited by oscillator steering bandwidth if external oscillators are used).
Ensemble features	- Adjustable weights - De-drift - Frequency offsets (on inputs or outputs) - Output adjustable phase - Input clock failure detection (automatic removal of failed clock from ensemble)
Interfaces	Ethernet and serial
Temperature	20 C – 25 C. Performance guaranteed with temperature swings less than 0.1 C.

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