Quartzlock

PRECISE TIME & FREQUENCY INSTRUMENTATION NEWS RELEASE

STANDARDS • MEASUREMENT • DISTRIBUTION

Precision Measurement Science – BREAKTHROUGH: Frequency, Phase and Phase Noise measurement system achieves $5x10^{-14}$/s noise floor and 50 fs single shot resolution.

Quartzlock's class leading **A7** frequency and phase comparator has just been completely redesigned using entirely new circuit technologies to achieve better resolution of frequency and phase differences between highly stable oscillators and frequency standards at lower noise levels.

The A7-M (metrology) can resolve Δf to $1x10^{-15}$ in 100 second gate times (Active Masers have stability of 7E-15 over such periods, making the A7 low noise floor crucial for the highest level metrology applications)

Phase noise can also be calculated up to 0.01Hz from the carrier at very low levels (A7 has 1ms-3200s gate times allowing for conversion of time domain data to frequency domain data)
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For diverse applications of phase stability measurement in passive components and frequency sources, oscillators, quartz, rubidium and GPS timing references to caesium and hydrogen maser frequency standards the new A7-M will find itself with an overloaded work schedule in many laboratories and production test departments.

The instrument includes a moving coil meter for rapid, unambiguous display of Fractional Frequency Difference or *Relative* Phase Difference between two sources.

The A7 combines the production-oriented capability of rapidly adjusting a source within a certain tolerance using the panel meter, along with metrology capability (higher resolution) of a full time domain analysis of a source or passive component through data acquisition from the frequency counter.

Specification highlights include:

- Measurement times and resolution (***fig 1***)
- Noise Floor ($\tau = 10^{-4}$ to 10^{1})(***fig 2***)
- Noise Floor ($\tau = 10^{1}$ to 10^{4})***(fig 3)***
- Zero Drift (***fig 4***)
- Phase Noise (***fig 5***)

Automatic indication of input level acceptance from +6 to +13 dBm is provided for both device under test (DUT) and reference.
Built in distribution amplifier option with highly stable distribution characteristics enable the quality reference input to be available to 3 other users.

A high stability rubidium oscillator with $3x10^{-13}$ @ 200 - 2000 s Allan Variance is an option.

Glitchless, uninterruptible PSU facilities include low noise 115/ 230V AC PSU, external DC 24 V input with seamless switching automatically in case of AC failure or selection in case of lab supply noise problems to ensure trouble free long measurement runs.

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Fig 1

MEASUREMENT RESOLUTION				
a)	**Using external frequency/ time interval counter with 1ns or better time interval resolution**			
Frequency difference mode	High resolution	1×10^{-13}/gate time		
	Low resolution	1×10^{-12}/gate time		
	Gate times	1ms to 3200s		
Phase difference mode	**(High resolution: filter off)**			
RMS resolution (single measurement)	50fs (Measured as the standard deviation of 1000 phase difference measurements/ 1s)			
Short-term stability (Allan variance)	$<5\times10^{-11}$	1ms	$<1\times10^{-14}$	10s
	$<5\times10^{-12}$	10ms	$<2\times10^{-15}$	100s
	$<5\times10^{-13}$	100ms	$<5\times10^{-16}$	1000s
	$<5\times10^{-14}$	1s	$<1\times10^{-16}$	10000s
Sampling interval:	1ms to 1000s in decade steps			
Drift:	<1ps per hour typical at constant ambient temperature <5ps per day typical at constant ambient temperature			
Drift with temperature:	<2ps per °C			
b)	**Using internal moving coil meter**			
Frequency difference mode	Full scale ranges	+/- 1×10^{-7} to +/- 1×10^{-12} in decade steps		
	Time constant	20ms to 10s linked to range		
	Displayed noise	$<2\times10^{-13}$ peak		
	Zero drift	$<2\times10^{-13}$/ hour		
Phase difference mode	Full scale ranges	+/- 10us to +/- 100ps in decade steps		
	Displayed noise	TBD		
	Zero drift	TBD		

Fig 2

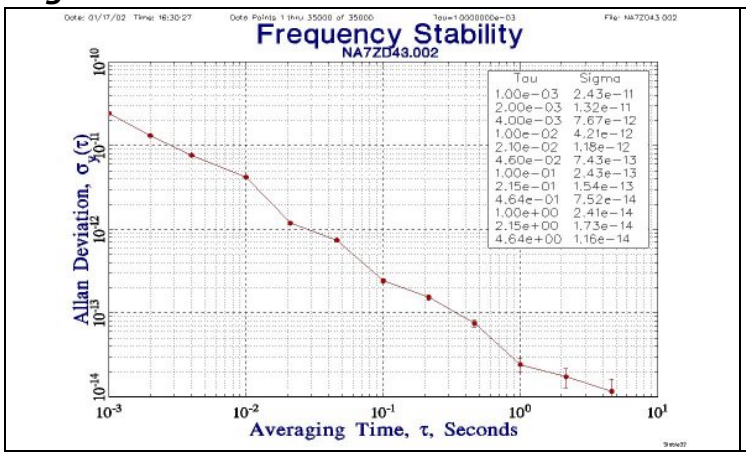

Fig 3

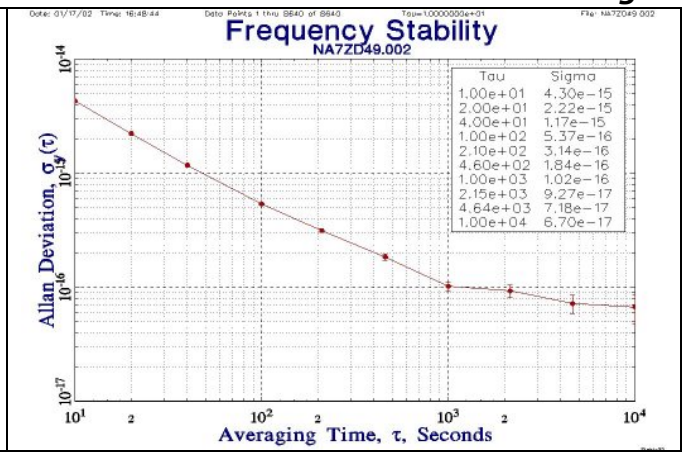

Fig 4

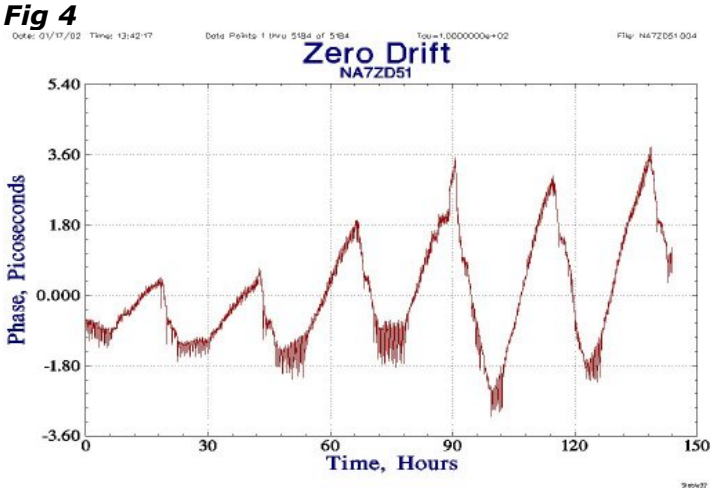

Fig 5