

BOM-PD

Balanced Optical to Microwave Phase Detector



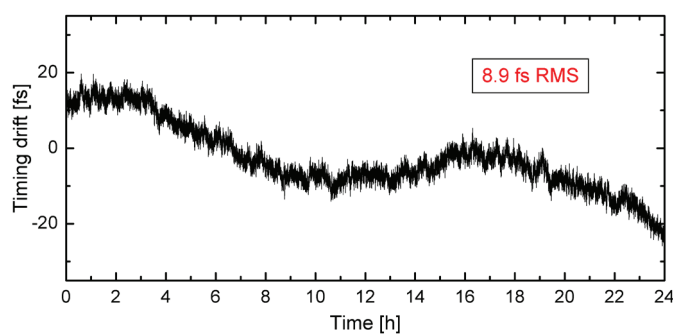
The Balanced Optical Microwave Phase Detector (BOM-PD) is a high resolution stand-alone external phase detector engineered for ultra-low noise detection of the phase between optical and RF signals. Due to its improved balanced Sagnac-interferometer technology this device is intrinsically low drifting while having large detection sensitivity. The BOM-PD does not only allow an outstanding synchronization of a laser source to a custom reference frequency, it can also be used to synchronize a low noise voltage controlled oscillator (VCO) to the laser source for a radio frequency synthesis.

APPLICATIONS

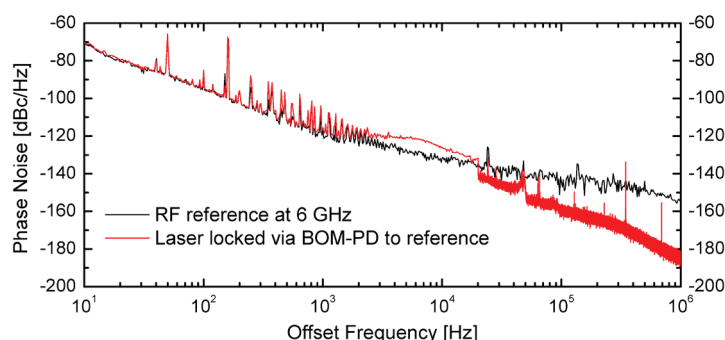
- Synchronization of ultrafast lasers to RF signals in a timing distribution system
- Synchronization of RF signals to ultrafast lasers in a timing distribution system
- Synchronization of RF signals to the output of stabilized fiber links
- Synchronization of voltage controlled oscillators (VCO) to an ultrafast laser for low noise RF-extraction

MEASUREMENT DATA:

Out-of-loop timing drift between optical pulses and RF-Reference:



Out-of-loop timing jitter spectral density: comparison between reference at 6 GHz and laser locked to reference:



Balanced Optical to Microwave Phase Detector

SPECIFICATIONS	BOM-PD 800 NM	BOM-PD 1060 NM	BOM-PD 1560 NM
Timing resolution*	<10 fs	<10 fs	<10 fs
Relative jitter [3 Hz-1 MHz]	<30 fs	<30 fs	<10 fs
Relative drift (RMS over 8 hours; ambient temperature stability $\pm 1^\circ\text{C}$)	<30 fs	<30 fs	<10 fs
Locking bandwidth**	≥ 6 kHz	≥ 6 kHz	≥ 6 kHz
Temperature drift (RMS over 8 hours)***	<10 mK	<10 mK	<10 mK
Control system interfaces	no active control of the BOM-PD is necessary		
Auto lock	optional, can be implemented only when using Menlo Systems SYNCRO platform		
OPTICAL INPUT			
Spectral range	745 – 825 nm	1000 – 1100 nm	1530 – 1590 nm
Max. incident power	100 mW	100 mW	100 mW
Fundamental design frequency****	50 – 250 MHz	50 – 250 MHz	50 – 250 MHz
Optical input type	Fiber (Nufern PM780-HP) or free space	Fiber (PM980XP) or free space	Fiber (SMF28 or PM Panda) or free space
ELECTRICAL INPUT			
RF input frequency range	1 - 6 GHz	1 - 6 GHz	1 - 6 GHz
RF input power (50 Ω impedance)	10 - 15 dBm	10 - 15 dBm	10 - 15 dBm
RF stability (RMS)	<0.1 %	<0.1 %	<0.1 %
RF connector	SMA	SMA	SMA
ELECTRICAL OUTPUT			
Error signal amplitude (PP, sine wave)	>400 mV	>400 mV	>400 mV
Output impedance	50 Ω	50 Ω	50 Ω
Detection sensitivity @ 3 GHz reference, 10 dBm	> 0.3 V/rad (80 mW optical input)	> 0.3 V/rad (80 mW optical input)	> 1 V/rad (20 mW optical input)
Error signal shape	square	square	square
Error signal output connector	SMA	SMA	SMA

*relative timing jitter between two lasers stabilized using the BOM-PD **or same as actuator resonances whichever applies first ***when using Menlo Systems SYNCRO platform for the temperature controller ****repetition rate of the laser, design frequency to be specified prior to system order

UTILITY AND ENVIRONMENTAL REQUIREMENTS

Ambient temperature	20 – 25 $^\circ\text{C} \pm 1^\circ\text{C}$	20 – 25 $^\circ\text{C} \pm 1^\circ\text{C}$	20 – 25 $^\circ\text{C} \pm 1^\circ\text{C}$
Supply voltages	-15 VDC, GND, +15 VDC	-15 VDC, GND, +15 VDC	-15 VDC, GND, +15 VDC
Current consumption	<1 A @ ± 15 V	<1 A @ ± 15 V	<1 A @ ± 15 V
Length of connecting cable to SYNCRO-RRE	4 m	4 m	4 m
Device dimensions	413 x 178 x 120 mm ³	413 x 178 x 120 mm ³	413 x 178 x 120 mm ³

RF EXTRACTION OPTION FOR BOM-PD @ 800/1060/1560 NM

VCO	included	frequency to be defined prior to system order
Integrated PID loop	included	
Relative timing jitter	<15 fs	
RF output frequency range	1 - 6 GHz	
RF output power	>3 dBm	
RF output stability	<1 %	RMS in 1 day continuous operation

