Breakthrough Functionality in Fiber Optic Testing

LUNA TECHNOLOGIES
A Division of Luna Innovations Incorporated

OPTICAL BACKSCATTER REFLECTOMETER™
(Model OBR 4600)

KEY FEATURES AND PRODUCT HIGHLIGHTS

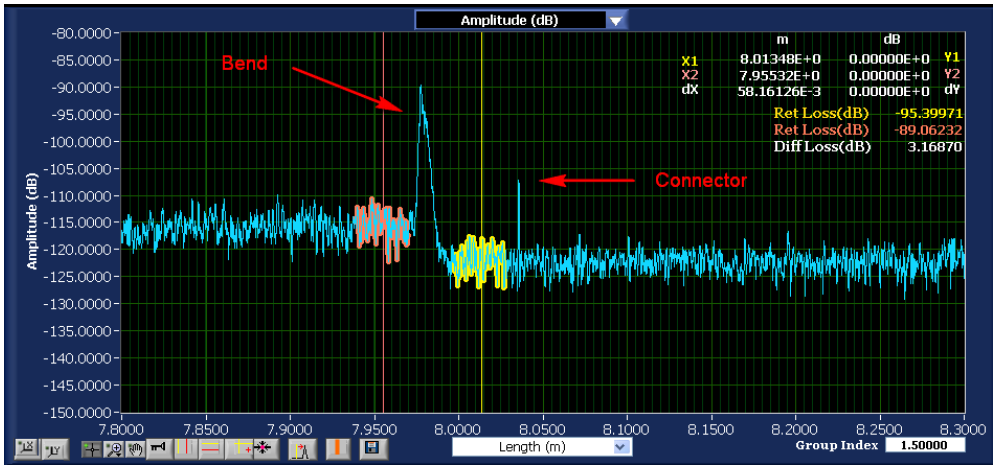
- **Easily locate, identify and troubleshoot macro-bends, splices, connectors and breaks**
- **Locate Insertion Loss points at every point in the network or assembly – eliminate cut-back**
- **Look inside components to evaluate each interface for RL and IL**
- **Measure 30 m with 10 µm resolution in less than 7 seconds**
- **Continuously measure a 1 m segment at up to 3 Hz**
- **Test and troubleshoot short-run networks (<2 km)**
- **Automate pass/fail verification of fiber assemblies**
- **Monitor distributed temperature and strain profiles along network or inside a component or module**

The **OBR 4600** is the latest model of Luna Technologies' award winning Optical Backscatter Reflectometer™ product line. Designed for component and short-run network testing and troubleshooting, the OBR 4600 enables ultra-high resolution reflectometry with backscatter-level sensitivity. With spatial resolution as fine as 10 microns, zero dead-zone, options for integrated temperature and strain sensing and extended device length mode, the OBR 4600 offers the ultimate in fiber diagnostics.

MEASUREMENT PERFORMANCE HIGHLIGHTS

- -130 dB sensitivity
- 70 dB dynamic range
- 2 kilometer length range with no dead-zone
- Micrometer resolution up to 70 meters
- < 0.05 dB insertion loss resolution

The OBR 4600 offers unbeatable testing and troubleshooting capabilities now at unprecedented measurement speeds.



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OBR 4600

PARAMETER	SPECIFICATION	UNITS
Maximum Device Length:		
Standard Mode	30 or 70	meters
Long Range Mode[10]	2000	meters
Spatial Resolution (two-point)[1]:		
	10 µm over 30 meters	
	20 µm over 70 meters	
	1 mm over 2 km	
Dead Zone:		
	Equals 2-pt spatial resolution	
Wavelength Range[2]:		
	1265-1335 or 1525-1610	nm
Wavelength:		
Resolution (max)	0.02	pm
Accuracy[3]	±1.5	pm
Integrated Return Loss Characteristics:		
Dynamic range[4]	70	dB
Total range	0 to -125	dB
Sensitivity	-130	dB
Resolution	±0.05	dB
Accuracy	±0.10	dB
Integrated Insertion Loss Characteristics:		
Dynamic range[5]	18	dB
Resolution	±0.05	dB
Accuracy	±0.10	dB
Group Delay:		
Accuracy	1.0	ps
Distributed Sensing[6,10,11]:		
Spatial Resolution	±1.0	cm
Temperature Resolution	±0.1	C
Temperature Accuracy[7]	±0.2	C
Strain Accuracy[7]	±1.0	µstrain

Measurement Timing[8]	**Standard**	**Fast[9]**	**Spot Scan[9]**	
5 nm scan time	3	1.6	0.3	s
Time vs. wavelength range	2.1 s+0.14 s/nm	1.3 s+0.06 s/nm	0.15 s+0.02 s /nm	-
Long Range (2 km) Scan Time		20		s

Specifications are for single-mode operation.
For multimode operation, specifications are nominal.
1 Over entire length range.
2 Ranges are nominal.
3 Accuracy maintained by an internal NIST-traceable HCN gas cell.
4 For the 2000 m option, return loss dynamic range is 60 dB.
5 The insertion loss dynamic range is the one-way loss that can be suffered before the scatter level of standard SMF (~ -100 dB/mm) is lower than the noise floor (~ -118 dB/mm).
6 Distributed sensing uses Rayleigh spectral shift method and is relative to reference scan.
7 Temperature and strain accuracies are calculated from spectral shift of Rayleigh scatter using 1 GHz = 0.8 C. [Othonos and K. Kalli, Fiber Bragg Gratings (Artech House, Boston, 1999)]. Spatial resolutions listed are ideal to get the Temperature and Strain Accuracies listed; they are not minimums or maximums.
8 Combined scan and analysis time in high-resolution mode. Times are for 30 m scan mode.
9 Times are with laser tuning speed set at 100 nm/s.
10 Extended range mode and distributed sensing are upgrade options.
11Maximum sensing length is 70m.

LTOBR4600 REV.001
Date of Revision 09/03/2010

CLASS 1 LASER PRODUCT

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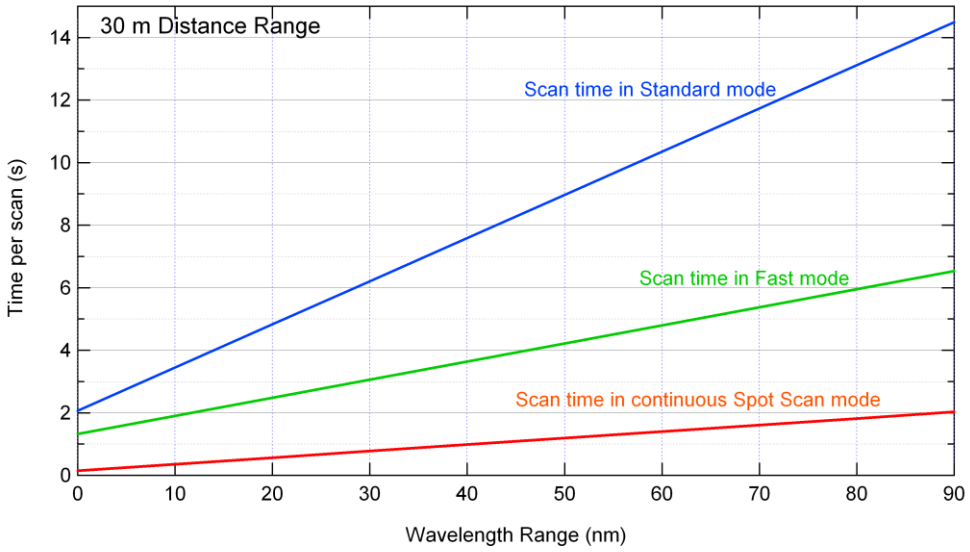
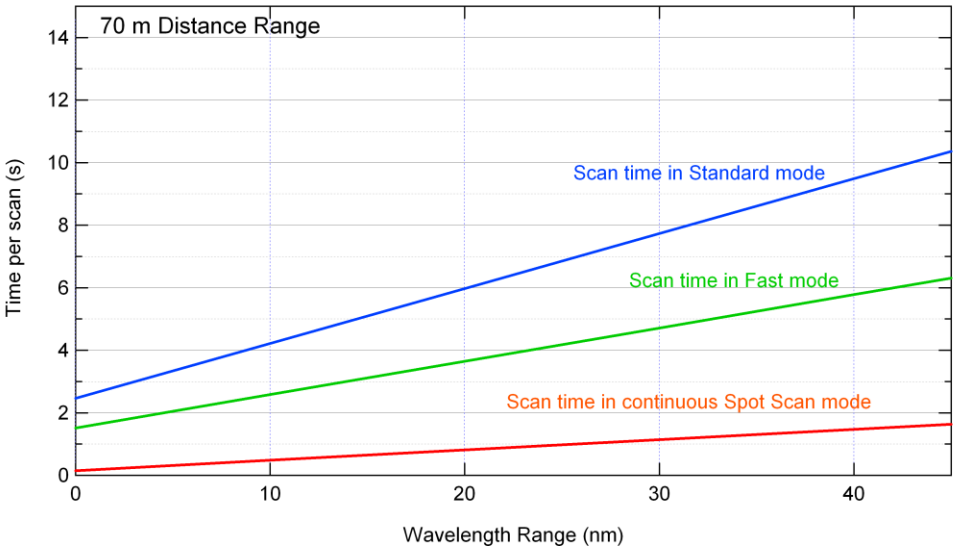
Measurement Timing Information



Time per scan vs. scan wavelength range for 30 m scans in standard operating, fast scanning and continuous spot scanning modes.



Time per scan vs. scan wavelength range for 70 m scans in standard operating, fast scanning and continuous spot scanning modes.

Wavelength Range (nm)	Spot Scan Rate (Hz) 30 m mode	Spot Scan Rate (Hz) 70 m mode
5	3.7	2.9
10	2.7	2.0
20	1.8	1.2
40	0.9	0.6
80	0.5	-

Scan repetition rates at various scan wavelength ranges for continuous spot scanning in 30 m and 70 m modes of operation. Rates are for laser tuning speed set to 100 nm/s.

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DISTRIBUTED TEMPERATURE AND STRAIN MEASUREMENT

Overview

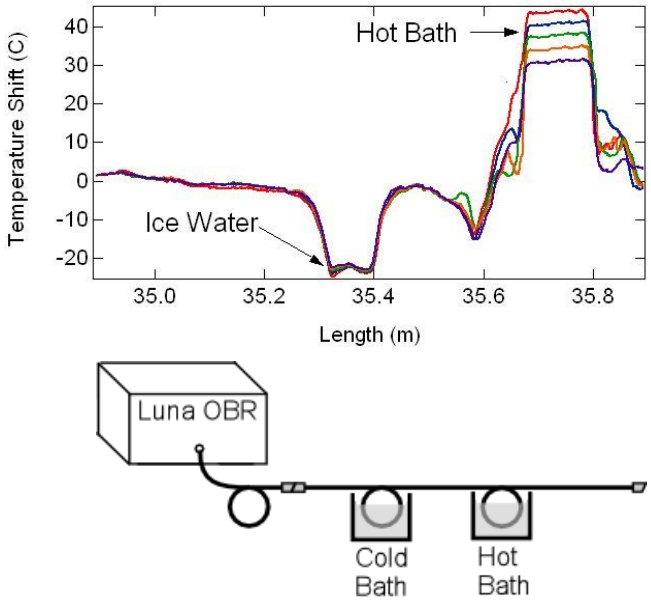
Luna Technologies' Distributed Temperature and Strain Sensing Software, when combined with the Optical Backscatter Reflectometer™ (OBR), transforms your *standard telecom-grade fiber* into a high spatial-resolution strain and temperature sensor.

The OBR uses swept wavelength interferometry (SWI) to measure the Rayleigh backscatter as a function of length in optical fiber with high spatial resolution. An external stimulus (like a strain or temperature change) causes temporal and spectral shifts in the local Rayleigh backscatter pattern. The OBR measures these shifts and scales them to give a distributed temperature or strain measurement. The SWI approach enables robust and practical distributed temperature and strain measurements in standard fiber with centimeter-scale spatial resolution up to 70 meters of fiber with strain and temperature resolution as fine as 1 µstrain and 0.1 °C.

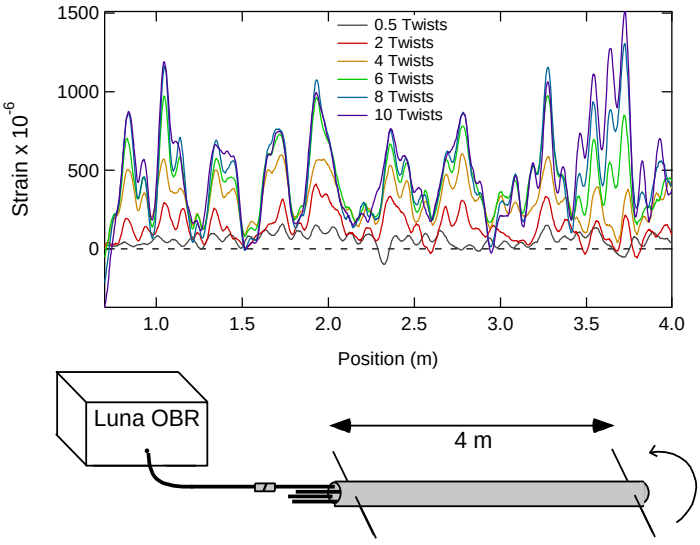
KEY FEATURES AND PRODUCT HIGHLIGHTS

- Uses standard telecom-grade fiber. Does not require specialty fiber or gratings.
- Highly distributed fiber sensing for strain and temperature
- Very high spatial resolution: down to 2 mm
- Centimeter resolution up to 70 meters
- +/- 0.1°C , +/- 1µstrain resolution at 1 cm
- High speed – Five second acquisition times at high resolution

TEMPERATURE MEASUREMENTS



STRAIN MEASUREMENTS



Using standard telecom-grade fiber, Luna's OBR monitors changes in the amplitude and phase of the light that is naturally back-reflected from standard optical fiber. Thus, Fiber Bragg Gratings are not required in the sensing fiber – *the fiber itself is the sensor*.

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