Specifications NBX-6065

Laser Wavelength	1550 ± 2 nm						
Measurement Mode	PPP-BOTDA, BOTDR						
Distance Range	50 m, 100 m, 250 m, 500 m, 1 km, 2.5 km, 5 km, 10 km, 25 km						
Measurement Frequency Range	9 ~13 GHz						
Range of Strain Measurement	-30,000 to +40,000 με (-3 % to +4 %)						
Measurement Frequency Scan Step	1, 2, 5, 10, 20, 50 MHz						
Readout Resolution	5 cm (minimum)						
Sampling Points	600,000 (defalut)						
Average Count Settings	2^5 ~ 2^{23} times (inc. Hardware Average Count 2^{16})						
Function	PPP-BOTDA			BOTDR			
Pulse Width	2 ns	5 ns	10 ns	5 ns	10 ns	20 ns	50 ns
Spatial Resolution	20 cm	50 cm	100 cm	50 cm	100 cm	200 cm	500 cm
Dynamic Range (1)	2 dB	3 dB	6 dB	2 dB	3 dB	5 dB	7 dB
Max. Measurement Distance (approx.)(2)	5 km	10 km	20 km	5 km	10 km	15 km	20 km
Optical Budget(1)(6)	7 dB	8 dB	10 dB	4 dB	5 dB	7 dB	8 dB
Measurement Accuracy(3)(4)	15 με / 0.75 ºC			75 με / 3.5 ºC	50 με / 2.5 ºC	30 με / 1.5 ºC	
Repeatability(3)(4)(5)	10 με / 0.5 ºC			20 με / 1 ºC			
Measurement Time(7)	5 seconds (minimum)						
Measurement Speed — FS mode(8)	15 Hz (maximum)						
Measurement Speed — AT mode(9)	550 Hz (maximum)						
Suitable Fiber	Single mode optical fiber						
Power Supply	AC100~240V 50/60Hz 250VA						
Laser Class	Class 1 (IEC60825-1: 2001)						
Dimensions / Weight	approx. 456 (W) × 485 (D) × 286 (H) mm / 30 kg						
Operating Temperature	10~35 ºC, Humidity below 85 % (no dew condensation)						
Storage Temperature	0~50 ºC						
Place of Production	Japan						

(1) Based on 2^{15} average cycles (BOTDR) / Based on 2^{15} average cycles in progressive measurement mode (PPP-BOTDA).
(2) Based on average fiber loss of 0.3 dB/km using Single mode fiber.
(3) Based on the measurement of strain-free, UV-coated fiber.
(4) Based on the measurement of strain-free, UV-coated fiber and in constant temperature environment.
(5) The maximum standard deviation of measurement value in 5 consecutive measurements for 100 consecutive points.
(6) Within the allowable range adjusted by the optical power excluding the case of nonlinear phenomena.
(7) The settings of 50 m distance range, 2^{14} count settings, 41 scanning steps excluding the time for Pulse Adjustment.
(8) The settings of 50 m range, 2^8 count settings, 41 scanning steps in batch processing mode (PPP-BOTDA only).
(9) The settings of 50 m range, 2^8 count settings, 1 scanning step in batch processing mode.
(1) - (6) are all based on a frequency scan step of 5 MHz and with Pulse Adjustment and Auto Frequency Adjustment on.

*Specifications are subject to change without notice.

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***Give you a feel*®**
When every point of the optical fiber is a sensor

Neural Optical Fiber Scope

NEUBRESCOPE NBX-6065

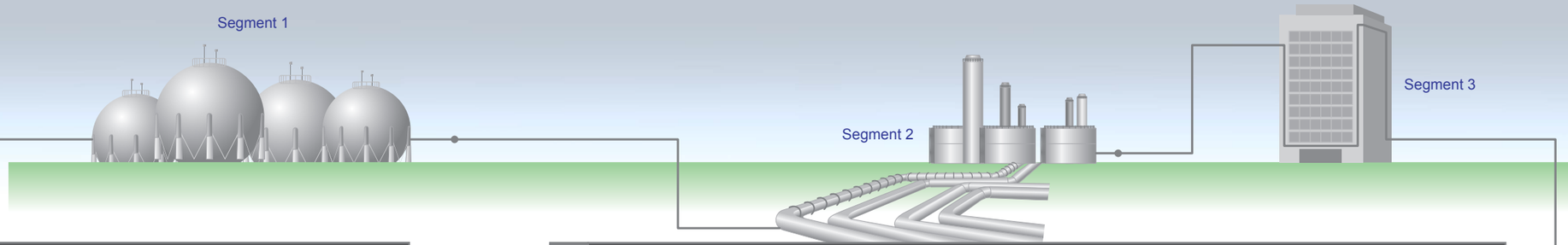
NEW

Single End & Double End to measurement strain and/or temperature

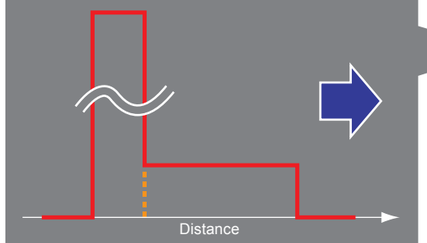
Now operated from laptop computer for easy in-the-field use

- Measurement Mode: **PPP-BOTDA / BOTDR**
- Spatial resolution: **20 cm** / Sampling resolution **5 cm**
- Repeatability : **10 με / 0.5 °C** (PPP-BOTDA)
- High Speed Measurement: **15 Hz** (FS mode) / **550 Hz** (AT mode)
- NBX-7000 series Upgrade Option Available

NEUBREX®

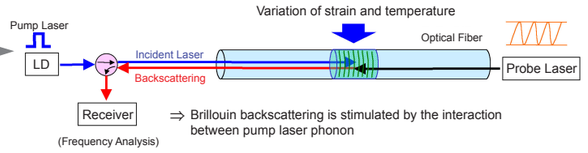


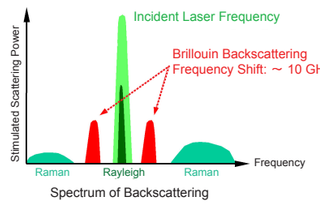
Principle of PPP-BOTDA

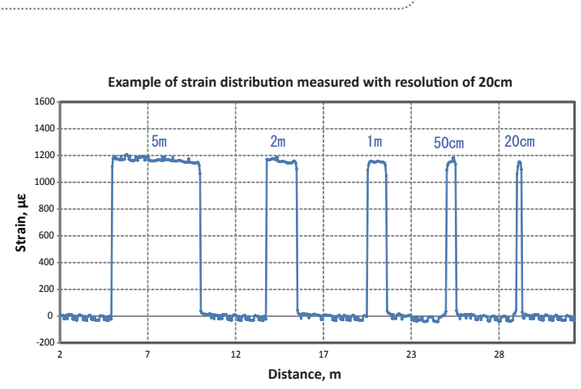


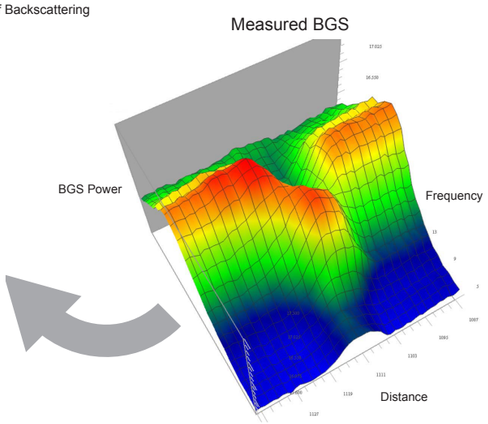
Pulse-PrePump (PPP) was adapted to achieve very high resolution

[patented technology]



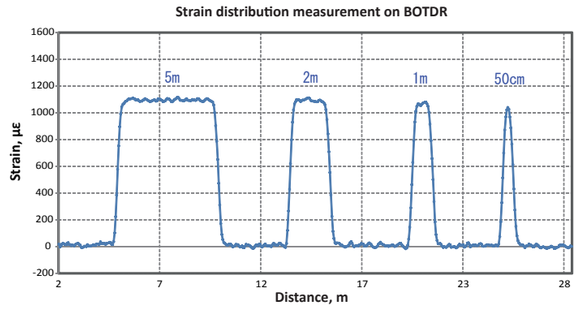




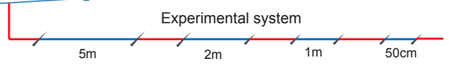


Neubrex technology of PPP-BOTDA successfully increases the spatial resolution and strain accuracy one-order higher than previous products. This is the only one technology in the world.

Single-end access BOTDR

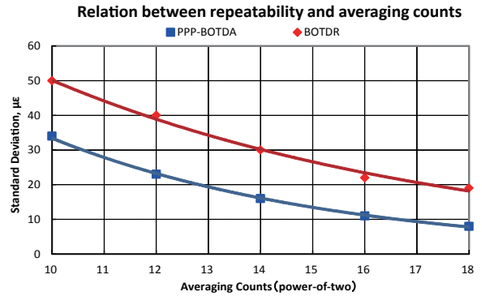


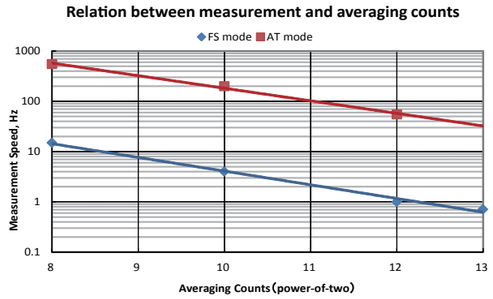
Conditions:
- Spatial resolution: 50 cm
- Sampling rate: 5 cm
- Averaging counts: 2^{15}



- NBX-6065 provides both double-end (PPP-BOTDA) and single-end (BOTDR) access
- useful also as a backup in cases the optical fiber loop is broken

Performance





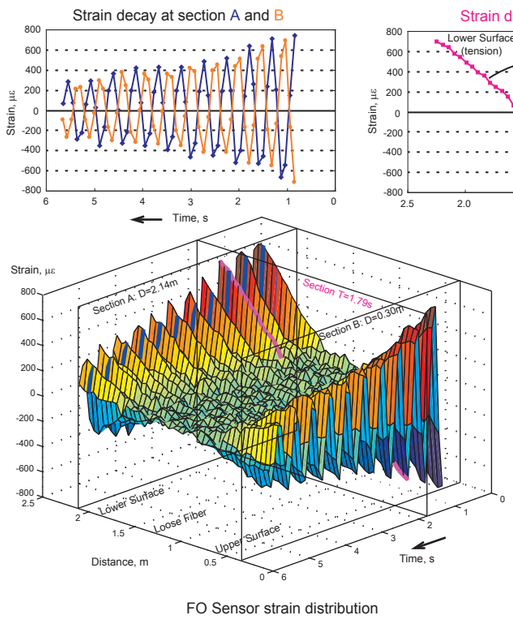
Frequency scan step	10 MHz (frequency counts 41)			5 MHz (frequency counts 81)		
Averaging counts	2^{12}	2^{14}	2^{16}	2^{12}	2^{14}	2^{16}
Accuracy (με)	±18.0	±13.5	±11.2	±15.0	±10.5	±7.5
Repeatability (με)	±20.1	±10.9	±5.5	±17.1	±6.7	±3.6
Speed (sec)	5	9	20	13	25	50

Speed-accuracy trade-off for different frequency steps on BOTDR

The table and plots above present the trade-off between measurement speed, average count, and frequency step size. Additionally, the difference in accuracy between double-end (PPP-BOTDA) and single-end (BOTDR) is included.

Model NBX-6065 offers two high speed measurement modes, the Frequency Scanning (FS) and Amplitude Transfer (AT) one. FS mode is the standard processing mode, capable of measuring strain / temperature at the rate up to 40 Hz. In AT mode, instead of frequency scanning, the amplitude of single frequency is measured and frequency shift obtained using pre-determined Brillouin power spectrum shape. AT mode delivers distributed strain / temperature data at the unprecedented rates, reaching 550 Hz.

Experimental Case

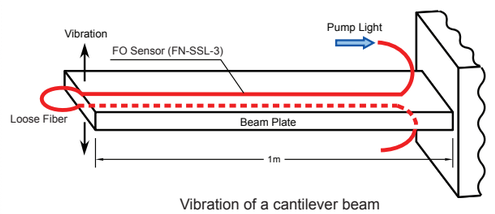


FO Sensor strain distribution

Conditions:
- Spatial resolution: 10 cm
- Sampling rate: 5 cm
- Measured strain range: ±1500 με
- Averaging counts: 2^8

Range	50m	100m	500m
Repeatability (με)	50	50	50
Speed (sec)	0.089	0.11	0.25

Speed-accuracy trade-off for different distance range



Vibration of a cantilever beam

The example demonstrates first ever distributed measurements during vibrations. The dynamic behavior of specimens as long as 100 m can be recorded with 10 Hz speed, each measurement containing up to 2,000 sampling points.