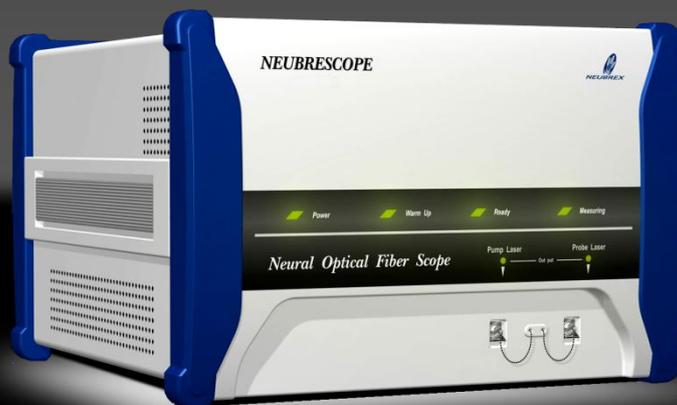


**Give you a feel<sup>®</sup>**  
When every point of the optical fiber is a sensor

Neural Optical Fiber Scope

## **NEUBREScope** NBX-7031

The Hybrid technology of Pulse-Pre-Pump BOTDA and Tunable Wavelength COTDR to measure and separate the distributed strain and temperature in single SM fiber.



**Enhanced TW-COTDR with higher accuracy and stability**

**Built-in control and data analysis units**

**Separation of strain and temperature**

Measurement mode: **PPP-BOTDA / TW-COTDR / BOTDR**

Spatial resolution: **2cm** / Sampling resolution: **1cm**

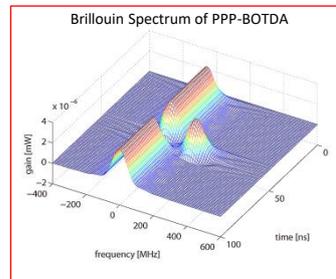
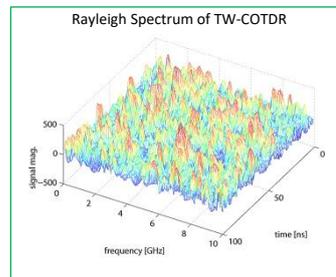
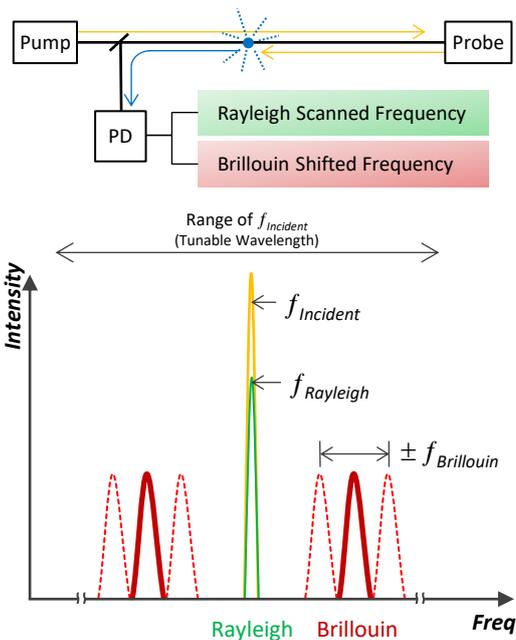
Measurement Repeatability: **5 $\mu\epsilon$  / 0.25 $^{\circ}$ C** (Hybrid mode)



## Key Features

- The state-of-the-art hybrid Brillouin and Rayleigh sensing technology in single interrogator.
- Improved TW-COTDR with enhanced accuracy and stability by absolute frequency calibration
- Separation of strain and temperature by Hybrid Measurement Mode in a SM fiber.
- Built-in control unit and remote access interface.
- New User Interface to add new functionality and improve workflows.

## The PPP-BOTDA and TW-COTDR



The Pulse Pre-Pump Brillouin Optical Time Domain Analysis (PPP-BOTDA) and Tunable Wavelength Coherent Optical Time Domain Reflectometry (TW-COTDR) are the two key technologies in the NBX-7031 instrument.

With the outstanding measurement performance, the cm-order resolution and the accuracy of  $10\text{ne}/0.001^\circ\text{C}$ , the NBX-7031 can be used in wide range of sensing and monitoring applications, providing unprecedented resolution and accuracy of the acquired data.

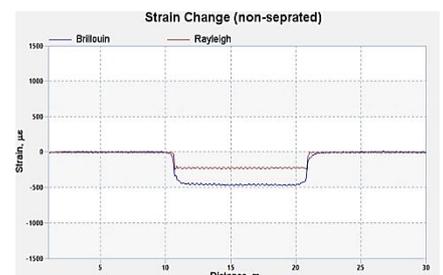
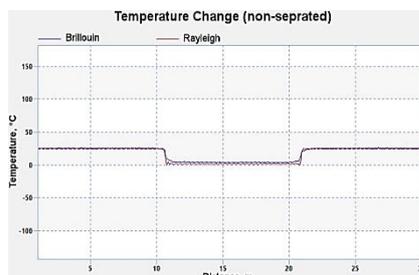
## Separation of Strain and Temperature

The Advanced Data Analysis (ADA) Studio is Neubrex software that accompanied with NBX-7031. With the correction and analysis function of ADA Studio, the separation of strain and temperature in a single fiber can be achieved.

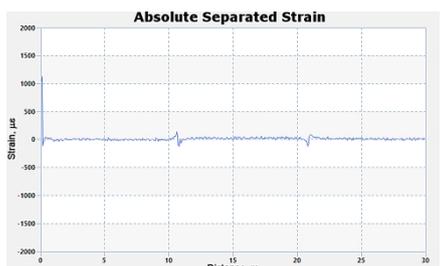
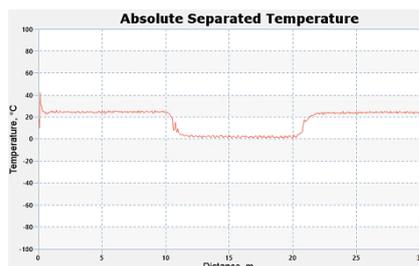
The fiber under test is immersed in the oil bath at  $0^\circ\text{C}$ . The external environment temperature is  $26^\circ\text{C}$ . The fiber in the bath is strain free.

The upper plots present the measured non-separated temperature and strain distributions for both Brillouin and Rayleigh measurements.

The lower plots show the separated, absolute temperature and strain, clearly demonstrating that fiber is in strain-free state while at different temperatures.



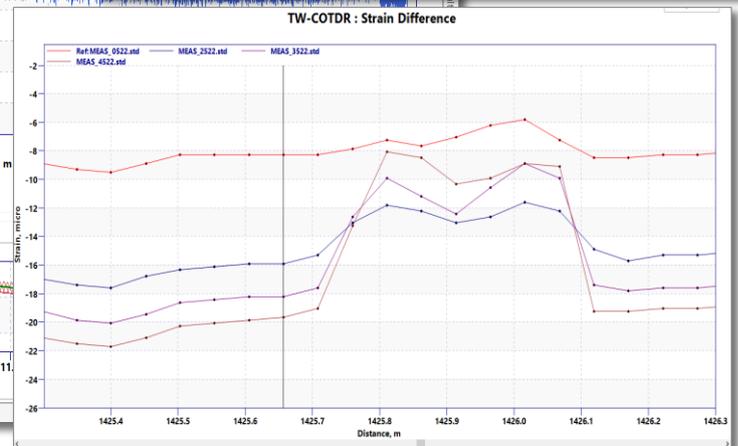
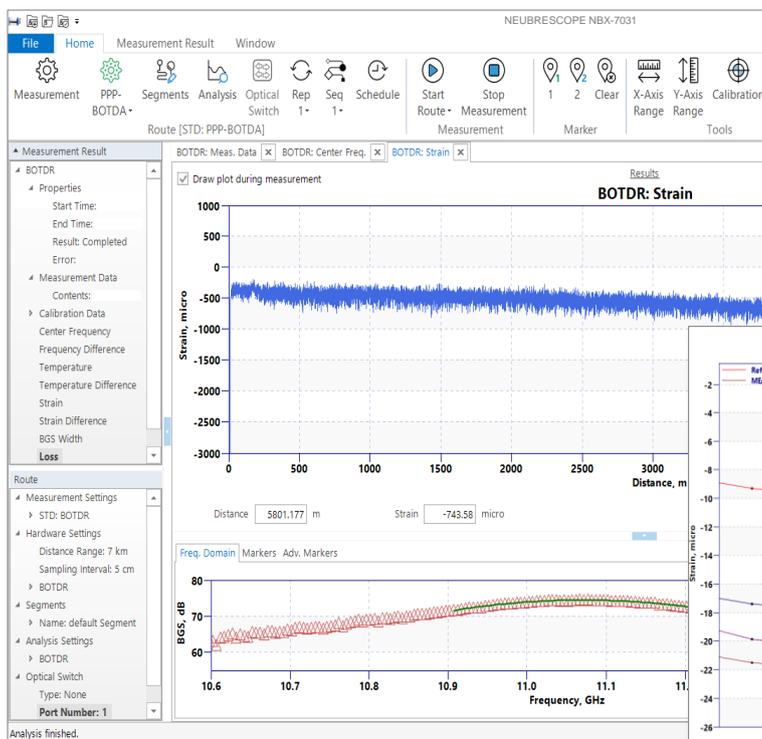
### Advanced Data Analysis



## Software and Operation User Interface

NEUBREScope NBX-7031 features redesigned User Interface, considerably improving user experience and productivity. The instrument is fully controlled via software. Moreover, software open-architecture allows one to extend this list and add support for any other format. Several USB and Ethernet ports are also available as well.

- Strain / Temperature waveform along with length of fiber.
- Gain of Frequency Shift.
- Comparison in between of multiple given measured data.
- Advanced Marker for cross reference easily and quickly.



## Configuration and Applications

- TW-COTDR**
  - Single-end fiber access.
  - High resolution.
  - Excellent sensitivity for Strain or Temperature.
- PPP-BOTDA**
  - Double-ended (Loop) fiber access.
  - High resolution.
  - Good accuracy and repeatability.
  - Frequency Sweep (FS) and Amplitude Transfer (AT) mode available for dynamic stain sensing.
- BOTDR**
  - Single-ended fiber access.
  - Good accuracy for Strain or Temperature.
  - Amplitude Transfer (AT) Mode available for dynamic strain sensing.



# Specifications NBX-7031

General Function	Separation of strain and temperature measured in single fiber, PPP-BOTDA / BOTDR / TW-COTDR / COTDR															
Function	BOTDR			PPP-BOTDA						TW-COTDR						
Laser Wavelength	1550 ± 2 nm									1556 ~ 1558 nm						
Distance Range	50m, 100m, 250m, 500m, 1km, 2.5km, 5km, 10km, 25km, 27km															
Frequency Range	9 ~ 13 GHz									192600 ~ 193000 GHz						
Frequency Scanning Step	1, 2, 5, 10, 20, 50 MHz									1, 2, 5, 10, 20, 50, 100, 200 MHz						
Range of Strain Measurements	-30,000 to +40,000µε (-3% to +4%)									-3,000 to +4,000µε (-0.3% to +0.4%)						
Readout Resolution	5 cm (default), 1cm (minimum)															
Sampling Points	600,000 (default), 3,000,000 (maximum)															
Average Count Settings	2 <sup>5</sup> ~ 2 <sup>23</sup> times (including Hardware Average count 2 <sup>5</sup> ~ 2 <sup>16</sup> )															
Function	BOTDR			PPP-BOTDA						TW-COTDR						
Pulse Width (ns)	5	10	20	0.2	0.5	1	2	5	10	0.2	0.5	1	2	5	10	
Spatial Resolution (cm)	50	100	200	2	5	10	20	50	100	2	5	10	20	50	100	
Dynamic Range (dB) <sup>*1</sup>	1	2	5	0.5	1	1.5	3	3.5	6	0.5	1	3	6	8	10	
Maximum Distance (km) <sup>*2</sup>	3	6	12	0.5	1	2	5	10	18	0.5	1	10	20	22	25	
Optical Budget (dB) <sup>*1 *8</sup>	3	6	9	1	2	5	7	10	12	1	2	5	7	10	13	
Accuracy (1σ) <sup>*3 *4</sup>	30µε/1.5°C			15µε/0.75°C		7.5µε/0.35°C		5µε/0.25°C		20nε/0.001°C						
Repeatability (1σ) <sup>*3 *4 *5</sup>	20µε/1.0°C			10µε/0.5°C		2.4µε/0.1°C		2µε/0.1°C		10nε/0.0005°C						
Measurement Time <sup>*6 *7</sup>	≥ 5 seconds									≥ 10 seconds						
Hybrid Mode Accuracy	-			10µε/0.5°C												
Hybrid Mode Repeatability	-			5µε/0.25°C												
Applicable Fiber	Single-mode Fiber															
Connector Type	FC/APC (factory default)															
Power Supply	AC100 ~ 240V, 50/60Hz, 250VA															
Laser Safety Class	Class 1 (IEC60825-1 : 2001)															
Dimensions / Weight	approx. 456 (W) × 485 (D) × 286 (H) mm / 30 kg															
Operating Temperature	10~40 °C, Humidity below 85% (no dew condensation)															
Storage Temperature	0 ~ 50 °C															
Input/output Interface	USB 3.0 x4, LAN x2, HDMI x1															
Place of Production	Japan															

\*1. Based on 2<sup>15</sup> average cycles.

\*2. Based on average fiber loss of 0.3dB/km using SM fiber(UV type).

\*3. Based on the measurement of strain free SM fiber(UV type).

\*4. Based on the measurement of strain-free SM fiber(UV type) and in constant temperature environment.

\*5. The maximum deviation range of measurement value for 5 consecutive measurements for 100 consecutive points.

\*6. Within the setting of 50m range, 2<sup>13</sup> count settings, 41scan steps except the time of Pre-Pump Adjustment. (for BOTDR and PPP-BOTDR)

\*7. Within the setting of 50m range, 2<sup>10</sup> count settings, 401scan steps except the time of Pulse Output Adjustment. (for TW-COTDR)

\*8. Within the allowable range being adjusted by the optical power, except the case of nonlinear phenomena.

\*1-\*5 are based on a frequency scan step of 5MHz when using PPP-BOTDA and with Pre-Pump Adjustment and Auto Frequency Adjustment on.

\*1-\*5 are based on a frequency scan step of 250MHz by using TW COTDR and with Pre-Pump Adjustment and Auto Frequency Adjustment on.

\* The specifications above and accessories layout are subject to change without notice. (20191118, A4)

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