Ocean Insight

WONWOO SYSTEMS CO.,LTD

Introduction &
NeoFox Quick Start Guide

NeoFox Phase Measurement System

Benchtop and Handheld Electronics for Your Optical O2 Sensor

For oxygen sensing, the NeoFox® Phase Measurement System is our most popular fluorescence-based optical sensing system. Because of NeoFox's unique ability to improve overall system stability and make calibration easier for a wide variety of oxygen sensing setups, it is the choice for measuring fluorescence lifetime, phase and intensity. Plus, NeoFox is brilliantly suited for applications where sensitivity to drift and system stability are critical.

The NeoFox uses LED excitation and photodiode detection with filter-based wavelength selection for easy experimental setup and control. Because the unit is self-contained, it is invariant to fiber bending and stray light, and has a wide dynamic range of optical intensity as well as low optical and electronic crosstalk, and low drift and phase noise.

NeoFox is available in two popular models: NeoFox Benchtop and NeoFox Sport for handheld measurements. Both deliver outstanding response times and work with our proprietary sol-gel coating that can be applied to patches or probes. NeoFox kits are also available.

NeoFox Speci ications

	Benchtop Item Code: NEOFOX	Portable/Handheld Item Code: NEOFOX-SPORT
Dimension:	107.95 mm x 63.5 m x 38.1 mm	327.6 mm x 190.5 mm x 66.5 mm
Weight:	642 g	928 g
Principle:	Photoluminescence quenching using a ruthenium compound; sensor measures O2 partial pressure	Photoluminescence quenching using a ruthenium compound; sen-sor measures O2 partial pressure
Parameters measured:	Luminescence phase shift, AC luminescence intensity, tem-perature (via optional external thermistors) and pressure (via onboard pressure transducer)	Luminescence phase shift, AC luminescence intensity, temperature (via optional external thermistors) and pressure (via onboard pres-sure transducer)
Sensor coating formulations (sol gel-embedded dyes):	General purpose (FOXY), high-sensitivity (FOSPOR) and hydrocarbon-ready (HIOXY)	General purpose (FOXY), high-sensitivity (FOSPOR) and hydrocar-bon-ready (HIOXY)
Media:	Gases and liquids	Gases and liquids
Computer interface:	PC	PC for full range of functions No PC for limited range of functions, displayed on unit itself; also, calibration file shipped on SD card
Operating systems:	Windows 2000/XP (32-bit); also, Windows 7 (32-bit)	Windows 2000/XP (32-bit); also, Windows 7 (32-bit)
Power input:	5VDC, 500 mA steady state	5VDC, 500 mA steady state
Communications:	USB, analog out	USB, analog out

NeoFox Viewer Software

NeoFox Viewer is the Windows-based software that allows you to collect, manage and analyze data with your NeoFox or NeoFox Sport phase measurement system. This nimble software also makes it simple to configure your NeoFox and update firmware when necessary. Use NeoFox Viewer to get the most out of your NeoFox and to ensure reliability through each measurement.

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NeoFox Probe and Patch-Based Systems

Full System Performance Specifications

One of the biggest advantages our fiber optic oxygen sensors offer compared with electrodes and other optical sensors is the range of available sampling options. In the table below we've compiled performance data for NeoFox-based systems used with our two primary sampling choices: oxygen probes and patches. Please note that some performance paramaters vary according to the sensor format and coating formulation used.

Also, we've included information on sterilazation options below but direct you to pages 172-173 for a more detailed explanation of probe care and maintenance.

One other item of interest: The specifications for O2% and dissolved oxygen range are given for conditions at 1ATM (atmosphere). At 1 ATM (typical conditions on Earth), we breathe many molecules such as nitrogen, helium, hydrogen and oxygen. All these molecules make up the total pressure in the environment. The ruthenium in our sensors are sensitive only to oxygen, which is just one part of the total pressure in the environment. So, when we determine the percentage of oxygen present in the environment at 1 ATM, we're measuring part of the total pressure, hence the term "partial pressure."

Probe-based System	FOXY Formulation	FOSPOR Formulation	HIOXY Formulation
Recommended use:	General purpose coating	High-sensitivity coating for low-oxygen environments	Robust coating for hydrocarbon-rich environments
O2% range (at 1 ATM):	0-100%	0-<21%	0-20.9%
DO range (ppm at 1 ATM):	0-40 ppm	0-8 ppm	0-8 ppm
Temperature range:	-50-+80 ºC for probes	0-+60 ºC for probes	-50-+60 ºC
O2% resolution:	100 ppm in gas	10 ppm in gas	100 ppm
DO resolution (at room temp):	4 ppb	0.4 ppb	4 ppb
O2% accuracy:	≤5% of reading	≤5% of reading	≤5% of reading
DO accuracy:	≤5% of reading	≤5% of reading	≤5% of reading
Min. detectable level in gas:	0.01% - 0.05%	0.001% - 0.01%	0.01% - 0.05%
Response time:	<1 s in gas	<30-60 s in gas	<1 s in gas
	45-60 s with overcoating in gas	60-90 s with overcoating in gas	NA
	30-45 s in pure water	60-90 s in pure water	~45 s in pure water
Patch-based System	**FOXY Formulation**	**FOSPOR Formulation**	**HIOXY Formulation**
Recommended use:	General purpose coating	High-sensitivity coating for low-oxygen environments	Robust coating for hydrocarbon-rich environments
O2% range (at 1 ATM):	0-100%	0-10%	0-20%
DO range (ppm at 1 ATM):	0-40 ppm	0-4 ppm	0-8 ppm
Temperature range:	-20 to +60 ºC for patches	0 to +60 ºC for patches	0 to +60 ºC for patches
O2% resolution:	0.05% (at 20 s averaging)	0.01% (at 30 s averaging)	0.05%
DO resolution (at room temp):	20 ppb	4 ppb	20 ppb
O2% accuracy:	5% of reading	5% of reading	5% of reading
DO accuracy:	5% of reading	5% of reading	5% of reading
Min. detectable level:	0.1% O2	0.01% O2 (at 30 s averaging)	0.1% O2
Min. detectable level in water (at room temp):	40 ppb	4 ppb	40 ppb
Response time:	<1 s in gas	30-60 s	<1 s in gas
	~30-45 s with overcoating in gas	~60-90 s with overcoating in gas	NA
	~45 s in pure water	~60-90 s in pure water	~30-45 s in pure water
Stability (Continuous LED)	**FOXY Formulation**	**FOSPOR Formulation**	**HIOXY Formulation**
Lifetime stability (Tau):	0.0006 usec/hour	0.003 usec/ hour	0.0002 usec/hour
Oxygen stability %:	0.01% hour	0.005% hour	0.007% hour
Modulation range:	0.73 kHz-93.75 kHz	0.73 kHz-93.75 kHz	0.73 kHz-93.75 kHz

You're on your way to deeper insight into your oxygen measurements using high-speed optical technology. Follow this guide to quickly start turning the unknown into the known.

A complete NeoFox Installation and Operation Manual can be found on our website at OceanInsight.com.

Getting Started

The NeoFox connects to a PC via USB connection and saves your data in an easy-to-use Microsoft Excel format. NeoFox can be configured with single-channel LED excitation and detection. There is an on-board pressure transducer that measures atmospheric pressure.

System Contents

All NeoFox systems include:

- NEOFOX-GT Phase Fluorimeter
- Power Supply with International Adapters
- USB Cable

Depending on the sensor form-factor purchased, your system may also include:

- Optical Bifurcated Fiber Bundle (BIFBORO-###-2 or RE-BIFBORO-2)
- Splice Bushing (21-02, only with select probes)
- Sensor Probe
- Pack of Non-Invasive Oxygen Patches (used with RE-BIFBORO-2)
- Temperature Probe

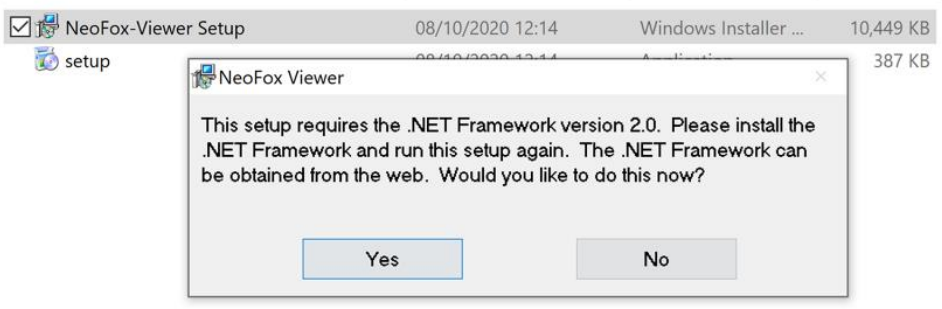
NOTE

The pink/red/orange coating at the tip is the oxygen responsive chemistry. DO NOT CLEAN OR ATTEMPT TO REMOVE!

Install NeoFox Viewer

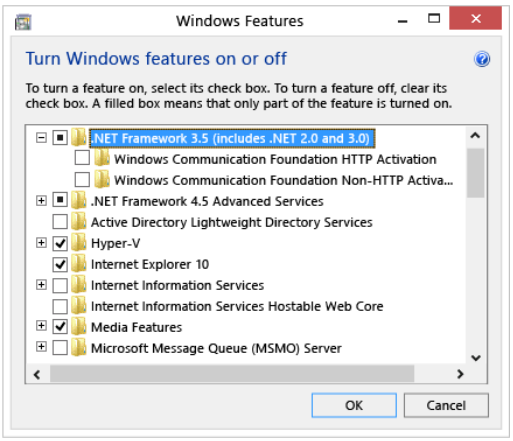
Download the installer at OceanInsight.com. Install this package before connecting the NeoFox hardware.

Are you seeing the .NET Framework error message?



The fix is simple! You can enable the .NET Framework 3.5 through the Windows Control Panel. This option requires an Internet connection.

1. In the search bar on your desktop, type "Windows Features", and press Enter. The Turn Windows features on or off dialog box appears.
2. Select the **.NET Framework 3.5 (includes .NET 2.0 and 3.0)** check box, select **OK**, and reboot your computer if prompted.



Hardware Setup

Warning

Ensure that the plastic caps are covering the two SMA connectors on the front of the NeoFox unit. Intense UV radiation is emitted from the LEDs when the unit is powered on. DO NOT look directly at the LED output with the naked eye.

NOTE

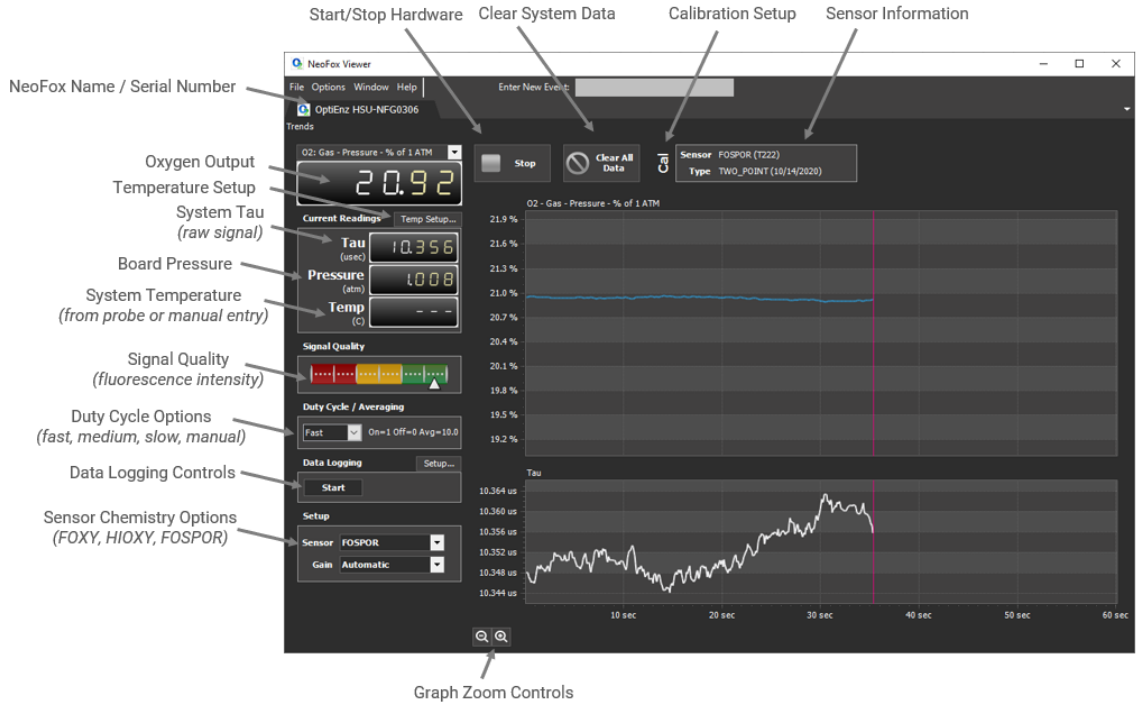
You must install the NeoFox Viewer operating software prior to connecting the NeoFox hardware to the computer. The NeoFox Viewer software installs the drivers required for NeoFox hardware.

1. Unpack the equipment and verify that you have all the necessary components.
2. Ensure the 2 SMA's on the NeoFox are covered with the provided plastic caps.
3. Connect the power cord from back of the NeoFox to an AC outlet. DO NOT look directly at the light being emitted with the naked eye.
4. Connect the NeoFox to your computer using the supplied USB cable.
5. Connect the temperature probe (if you have one) to the rear panel of the NeoFox.
6. Locate the bifurcated fiber that came with the system. This optical fiber assembly has a "Y" shaped design.
7. Connect one arm (it doesn't matter which one) of the bifurcated end of the probe fiber to the LED connector and the other arm to the Detector connector on front of unit.
8. If you are using an Oxygen probe, locate the 21-02 SMA Splice Bushing that came with the probe. Screw one end of the splice bushing into the SMA 905 connector on the end of the probe. If you are using the RedEye Patch, you don't need the splice bushing.

NeoFox Operation

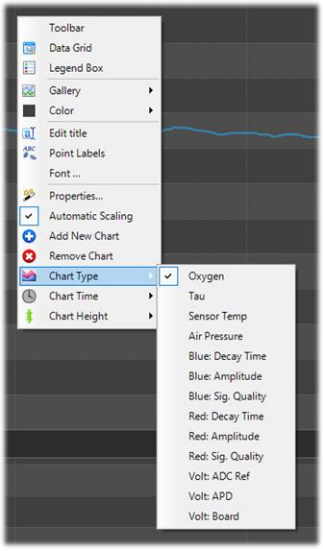
When the Neofox is connected to your computer, Windows will find the drivers and notify you that the device is ready.

On opening the NeoFox Viewer Software you will see the dark-themed dashboard described below:



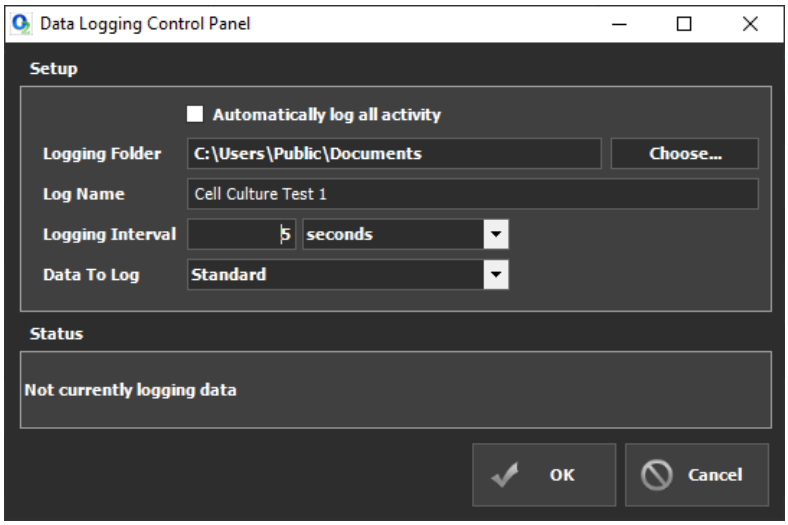
Graph Tools

Right-click anywhere on the graphs for complete control of what data is displayed and how.

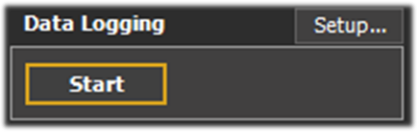


Data Logging

Click **Setup** on the Data Logging Controls tab. Proceed to enter data logging parameters before starting your study.



Be sure to click **Start** after setting up parameters.



Calibration Steps Required for Measurement

Your Neofox system is supplied with or without a factory calibration, depending on what you specified at purchase.

- **With Factory Calibration** (O2-CAL-STANDARD or O2-CAL-CUSTOM)
  - Your system is ready to plug & play!

NOTE

Disconnecting any fiber or probe connections will void the factory calibration. The system is calibrated with locked optical alignment.

- **Without Factory Calibration**
  - If no factory calibration was supplied then a 2-point calibration is required for accurate measurement.
  - Ocean Insight has a short video demonstrating the proper protocol for making a 2-point oxygen calibration in gas or liquid. Navigate to OceanInsight.com, scroll to the bottom of the page and click the link for Ocean Insight's YouTube channel. Within the YouTube channel search for NeoFox.
  - Summary of 2 point calibration: Under the Options drop down menu, select Oxygen Calibration to open the calibration window. Acquire and save Tau values at 2 known oxygen levels (reference points). Each fixed-point

concentration is entered in the table along with the corresponding tau value via the Use Current Tau button.

Notes on Oxygen Reference Points

A 0% oxygen reference is needed, for which any oxygen-free gas such as argon, nitrogen, helium would typically be used. Alternatively, 0% reference solution sachets can be purchased, or prepared by mixing a suitable Oxygen scavenging chemical with water.

The second calibration point can be any non-zero oxygen level within the limits of sensitivity of the sensor. Most commonly, 20.9% (atmospheric air) is selected as the standard second point oxygen concentration.

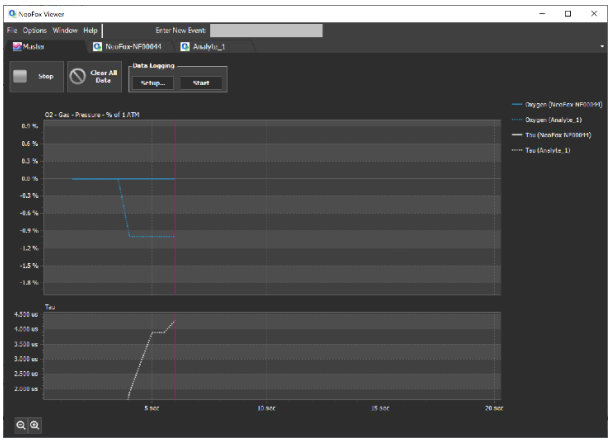
Take care that gas or liquid reference points are at one fixed temperature, which must be the same as that used in the experiment. Any changes in temperature will look to the sensor like a change in Oxygen concentration.

Be sure to allow sufficient time for the tau value to stabilize, which is displayed at the bottom of the calibration window.

Click **Download** to write the new calibration to the device.

Master Tab for Multi-Channel Support

A Master Tab is now displayed when multiple NeoFox's are connected, showing a conveniently combined graphical view of all channels.



Duty Cycle Options

The following pull-down options are made available on the main display:

Setting	LED On-Time (s)	LED Off-Time (s)	Total Cycle Time (s)	Averaging (s)
Fast	1	0	(always on)	10
Medium	3	7	10	3
Slow	5	25	30	5

Reduced Duty Cycle can help prolong sensor stability for long-term applications where the LED light may contribute to photobleaching drift over time.

Temperature Probe Assignment

You can assign one NeoFox temperature probe to another NeoFox or multiple units, eliminating the need for independent temperature probes attached to each channel.

Click the **Temp Setup** button under the oxygen display to open a new window for temperature value assignment.

Temperature values are only used for:

- Calculating oxygen if a Factory Multi-Point Calibration is loaded
- Logging temperature data relevant to the study

You can omit the temperature aspect, or enter a manual value, or choose not to use the temperature probe.

Unlock the Unknown

Ocean Insight exists to end guessing. We equip humanity with technology and data to make precisely informed decisions providing transformational clarity for human advancement in health, safety, and the environment.

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