



# Calibration-free pH Sensors

E00S – Technology Forum

Monica Miranda, March, 2022

# Calibration-free pH Sensors



**CALIBRATION-FREE**  
no end user calibrations



**FULL SALINITY RANGE**  
no intervention required



**AUTOSTART MONITORING**  
quick and simple



**TEMPERATURE SENSOR**  
onboard temperature measurement

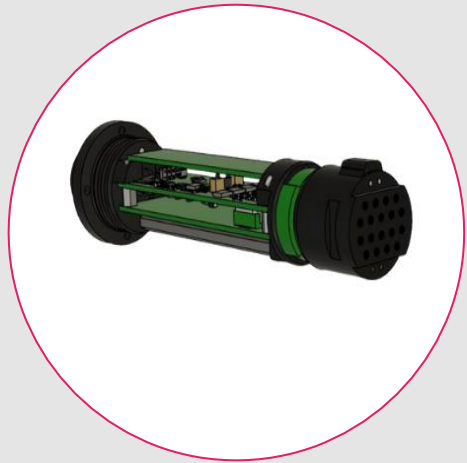


**REAL TIME FEEDBACK**  
sensor performance report



**EASY STORAGE**  
can be stored wet or dry

# Product Portfolio

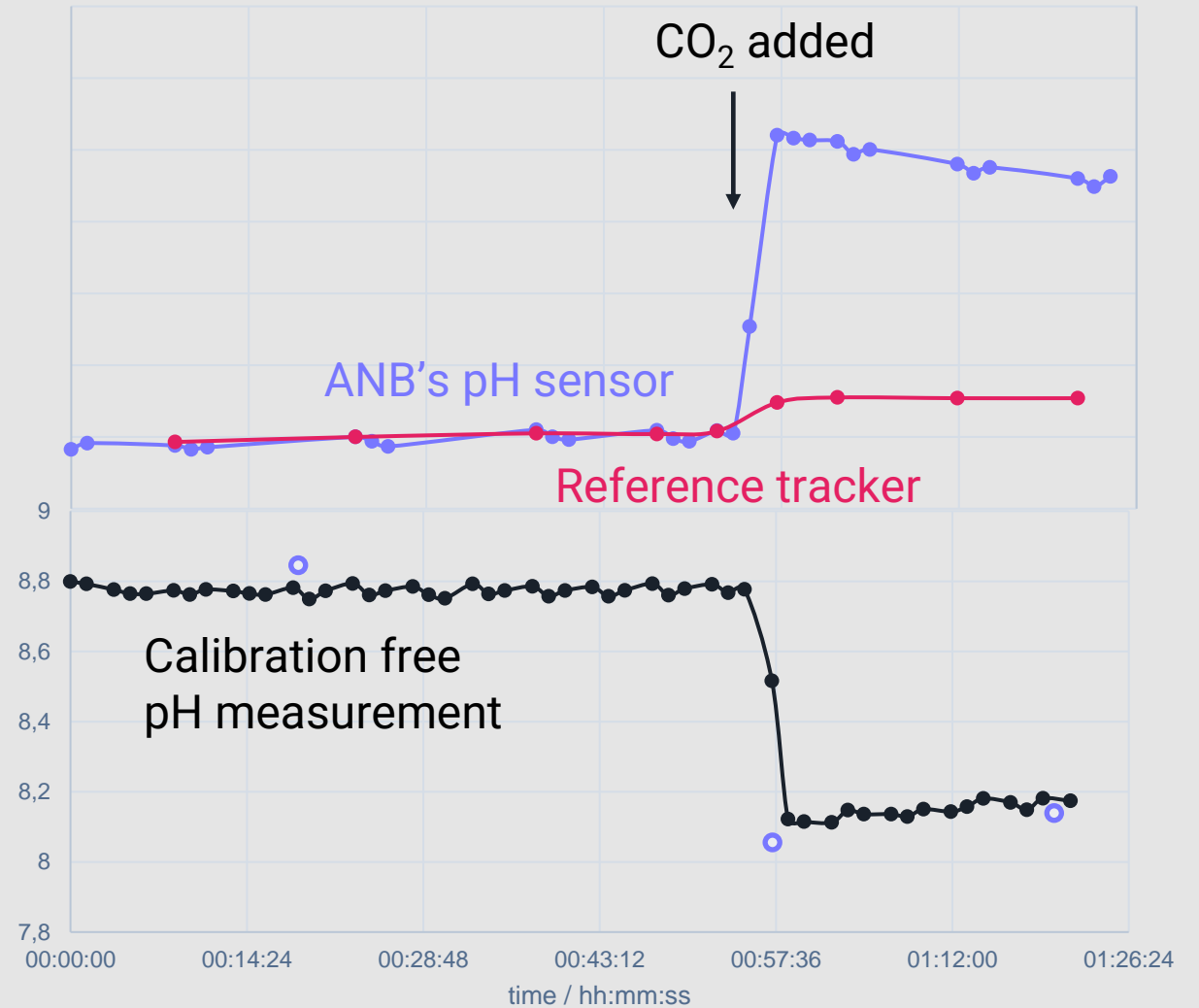
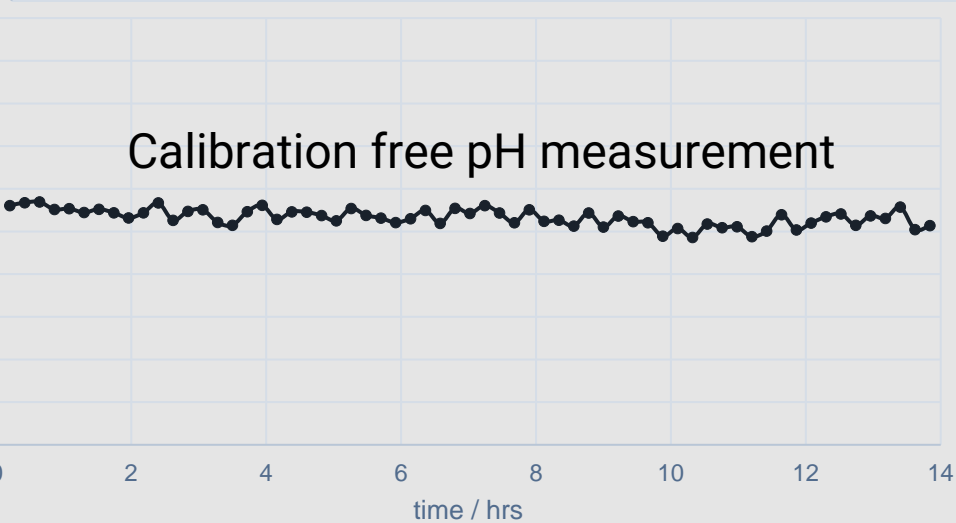
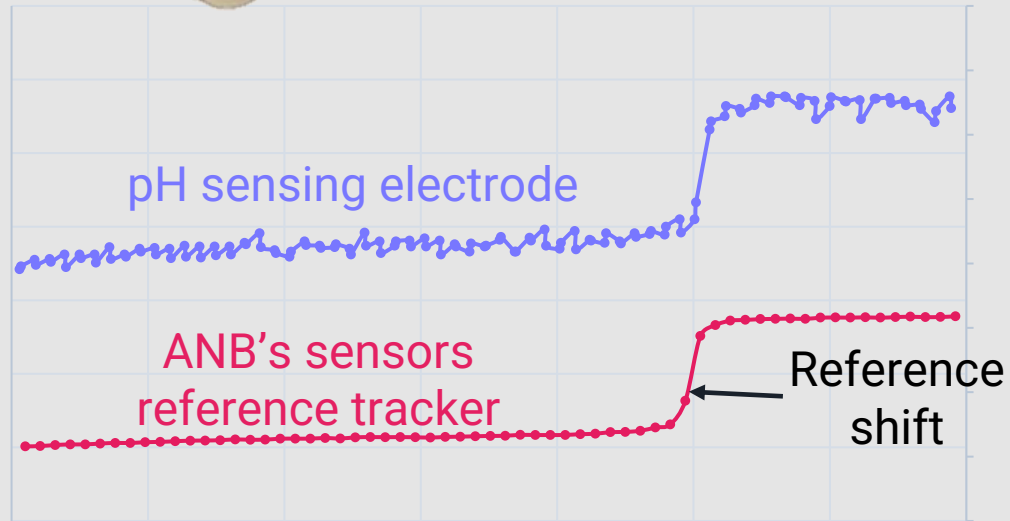
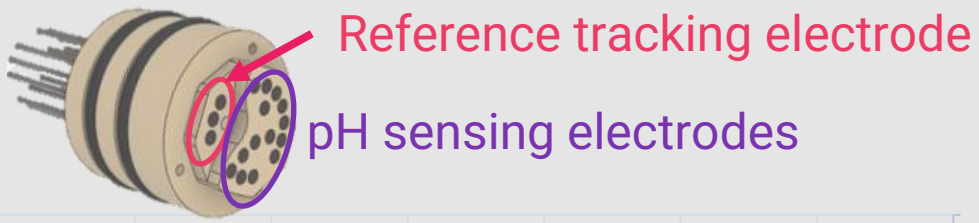


Sensor	Depth	Use
AQi	-	Integration kit
AQ5	5m	RAS systems, shallow aquaculture
AQ50	50m	Sea cages, Coastal monitoring
OCi	-	Underwater vehicles, sondes
OC300	300m	Buoy deployment, profiling
OC1250	1250m	Deep water monitoring

## Specs

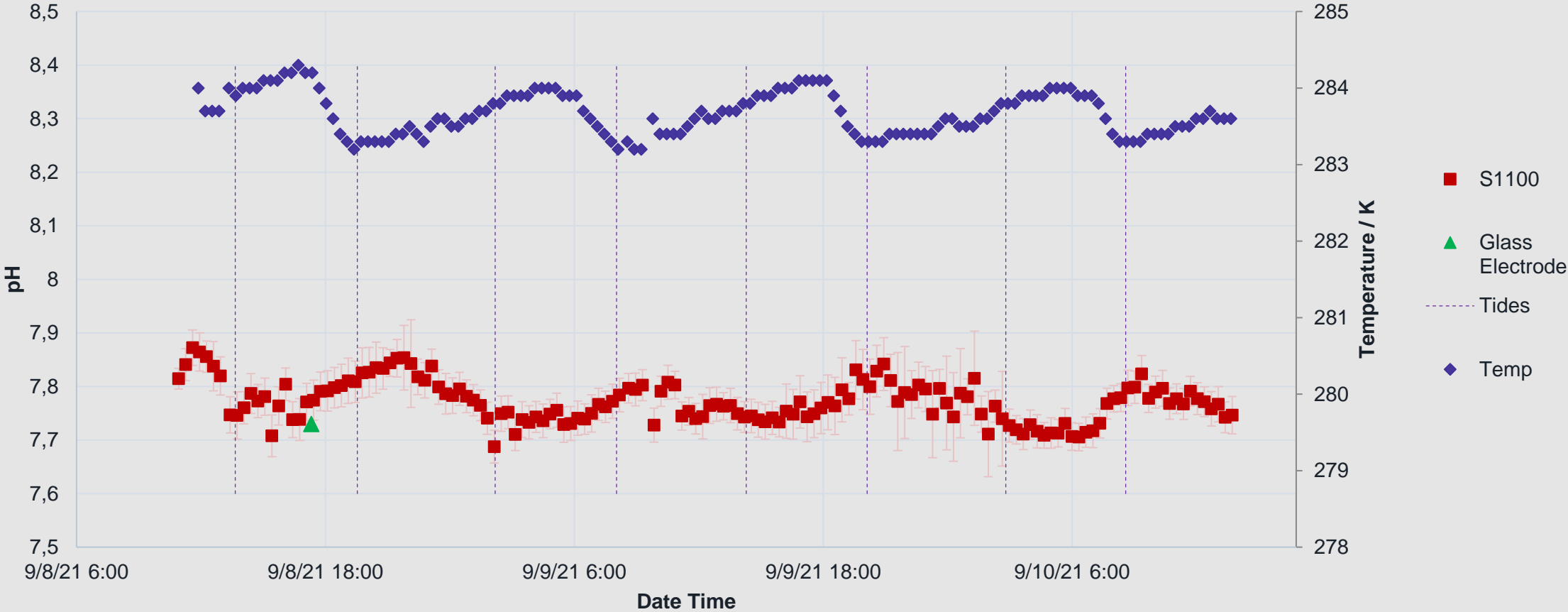
pH RANGE: 2 - 10  
RESOLUTION: 0.01 pH  
ACCURACY: 0.05 pH  
RESPONSE: instantaneous  
SALINITY: 0 - 36 ppt  
OPERATIONAL TEMP: -5 to 40C

# Technology in action



# Field Trial Data

- sensor measuring every 15 mins



- S1100
- ▲ Glass Electrode
- - - Tides
- ◆ Temp

# Transducer Lifetime



- Lifetime is scan dependent
- Quick abrasion of surface with abrasion block is all the maintenance needed, no recalibration required
- Sensor will tell customer when abrasion is necessary
- After ~20 abrasions, transducer requires replacement
- Transducer easy to replace



15,000 measurements between abrasions:

continuous scanning: 5 days  
scan every 15 min: 52 days

# Articles

## ELECTROANALYSIS

An International Journal Devoted to Electroanalysis, Sensors and Biodevices

Research Article

### Nafion® Coated Electropolymerised Flavonone-based pH Sensor

Monica Miranda, Clara Caravita, Neel Sooda, Luke Shirley, Cristina D. Day, Kay L. McGuinness, Jay D. Mathias, Nathan S. Lawrence

First published: 09 January 2022 | <https://doi.org/10.1002/elan.202100652> | Citations: 1

Read the full text >

#### Abstract

This work summarizes the electrochemical response of flavonone carbon composite electrodes in comparison with Nafion®-coated flavanone carbon composite electrodes, for use as voltammetric pH sensors in both buffered and low-buffered media. Square wave voltammetric measurements suggest the peak potential achieved from the

scientific publication

<http://doi.org/10.1002/elan.202100652>

## Aquabuzz

news article



January 17, 2022

Water Quality Monitoring for the Aquaculture Industry



## Next Generation



## Applied Technology Review

### ANB Sensors: The Next Wave of Ocean pH Technology



Nathan Lawrence, Founder and CEO, Kay McGuinness, Founder and Director

Ocean pH is an extremely important variable to measure. Monitoring pH is critical for Ocean

If there is an issue with the sensor, the device can seamlessly communicate with operators in real-time and flag the issue to end-users proactively. This functionality sets ANB sensors far ahead in the curve when compared to traditional, single-point systems that offer little to no transparency and connectivity to users.

One of the main targets of ANB Sensors is both inland and offshore aquaculture monitoring markets, as the sensor can measure the salinity ranges across all water bodies. The company also targets other key industries like the wastewater and environmental monitoring markets, and they are even developing a pH sensor for monitoring in the cow's stomach where having an accurate measurement of pH will allow farmers to make real time feed decisions to impact milk production and harmful methane emissions.

ANB Sensors was founded when the company earned the runner-up spot for the Wendy Schmidt ocean health XPRIZE competition. Since then, the company has gone out to secure approximately 1.3 million pounds of funding after their proposal was granted by both the European Union and

ANB Sensors

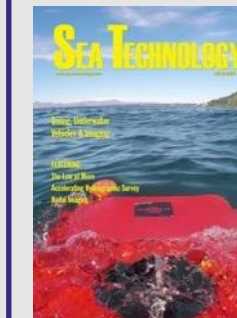
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ANB Sensors



case study

### Simplifying Ocean pH Sensing

Introducing the S Series Calibration-Free pH Sensors

By Nathan Lawrence • Kay McGuinness

Since the beginning of the Industrial Revolution the ocean has become increasingly more acidic due to uptake of atmospheric carbon dioxide. It is evident there is an urgent need for in-situ pH measurements to provide high spatial and temporal resolution. However, today's ship-based and bottom mooring measurements cannot achieve this, and while the introduction of intelligent and low-cost underwater vehicles (UUV) provide the platform to obtain the data, the development of small, fast, low-power and reliable pH sensors for deployment on these smaller UUVs is lagging behind.

#### Current Technology

Today's ocean pH sensors include optical sensors that use a dye that changes color in different pH test fluids, an ion-selective field effect transistor (ISFET) system, where the current through a semiconductor device changes when hydrogen ions are present in the test fluid; and the standard glass electrode, which uses electrochemical technology, placed in a suitable housing.

The colorimetric systems, while being very accurate, are generally large and expensive, require replacement the bags and have relatively long measurement times (since 5 min). Such technology does not measure at a

tion free, robust and small, with no storage issues, and easy to use and maintain.

The S Series pH sensors are based on patented electrochemical technology to provide a calibration-free sensor. The biggest reason why electrochemical-based pH sensors require frequent recalibrations is reference electrode drift, where the reference to which the pH is measured against is not stable and moves with time, making the measurement inaccurate until the sensor is recalibrated. ANB's technology contains an innovative reference bracket, which follows any drift in the reference and accounts for it in-situ, removing the need to manually recalibrate. The S Series is made from robust materials and is all-steel (IP67), making it ideally suited for the extreme environments found in the world's oceans.

The key element of the S Series is its sensing transducer which is where ANB's innovative sensing chemistry is based. It contains a series of solid-state carbon-impregnated electrodes from which the electrochemical measurements are conducted. The onboard computer on the sensor analyzes the electrochemical measurement and the temperature of the solution and combines these factors to produce a pH, with no compensation for depth required. The outputs of the sensor are time, pH, tem-



# Thank you

 @ANBSensors

 [www.anbsensors.com](http://www.anbsensors.com)