

A wide-angle photograph of a city skyline at night, with numerous skyscrapers and buildings illuminated by city lights. The sky is a gradient of orange and yellow, suggesting a sunset or sunrise. The city lights are reflected in the water in the foreground.

# Foxboro® Smart pH Sensor and Transmitter

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# Introducing the Foxboro Smart pH Family



DolpHin PH10 Sensor



876PH Transmitter

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# Overview

## > New Smart pH Sensor

- > Based on field proven PH10 DolpHin design
- > Sensor has electronics which converts signals to digital and provides memory
- > Smart sensor is used exclusively with new pH transmitter

## > New pH Transmitter

- > Based on field proven 876PH design
- > Loop powered, two-wire transmitter with HART communications
- > New pH transmitter is used exclusively with Smart pH sensor



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# DolpHin PH10 Smart pH Sensor

- > Smart electronics inside the sensor
- > Spherical and flat glass pH electrodes
- > Built-in temperature compensation
- > Double junction reference using Nafion ion barrier
- > PVDF (polyvinylidene fluoride, commercially known as Kynar) body with no metallic wetted parts
- > 121 °C (250 °F), 6.9 bar (100 psi)
- > Mounting accessories include bushings, insertion assemblies, flow chambers and more



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# Sensor Features

- > Field proven measurement system since 2002
- > Rugged PVDF\* sensor body
- > No metallic wetted parts, including solution ground
- > Built-in solution ground is standard
- > Flat, ruggedized pH electrode
- > Double junction reference using Nafion ion barrier

\*Polyvinylidene fluoride, commercially known as Kynar





# Sensor Features



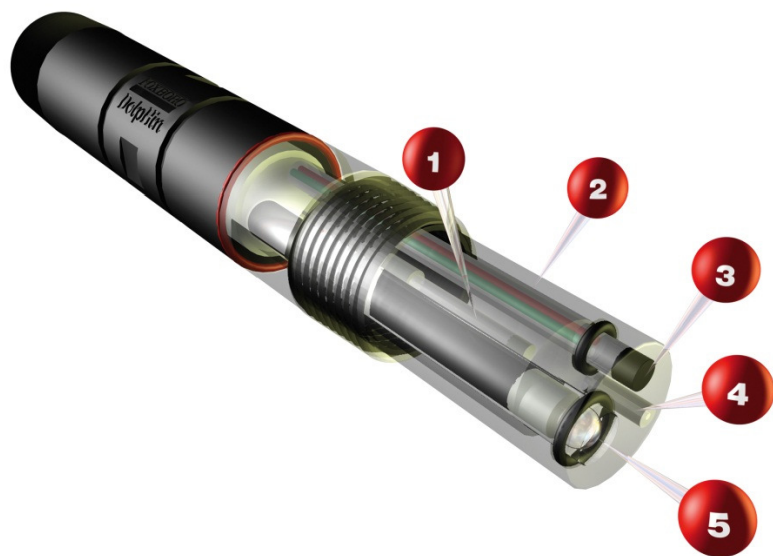
- > Fast temperature response and accurate temperature compensation due to proximity of RTD near electrodes/process
- > Easy to install, maintain and replace
- > Easy, fast, reliable calibrations
- > Long life in high temperature service
- > Ideal for chemicals, pulp & paper, textiles, other high temperature

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# Sensor Construction



1. Nafion tube with internal reference junction
2. High temperature gel
3. RTD and solution ground assembly
4. Ceramic reference junction
5. Unique glass pH electrode

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# Easy to Install, Maintain and Replace



- > Disposable type sensor
- > Universal bore piece mounting design eliminates cable wind-up
- > One sensor model fits all mounting accessories



- > Smart Connector
  - > Avoids replacing sensor cable
  - > Avoids opening analyzer
  - > Avoids using tools

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# The Foxboro Brand Advantage

- > Rugged PVDF sensor body
- > Conductive, nonmetallic (PVDF) solution ground
- > Flat, ruggedized pH electrode
- > Double junction reference using Nafion ion barrier
- > Built-in solution ground is standard

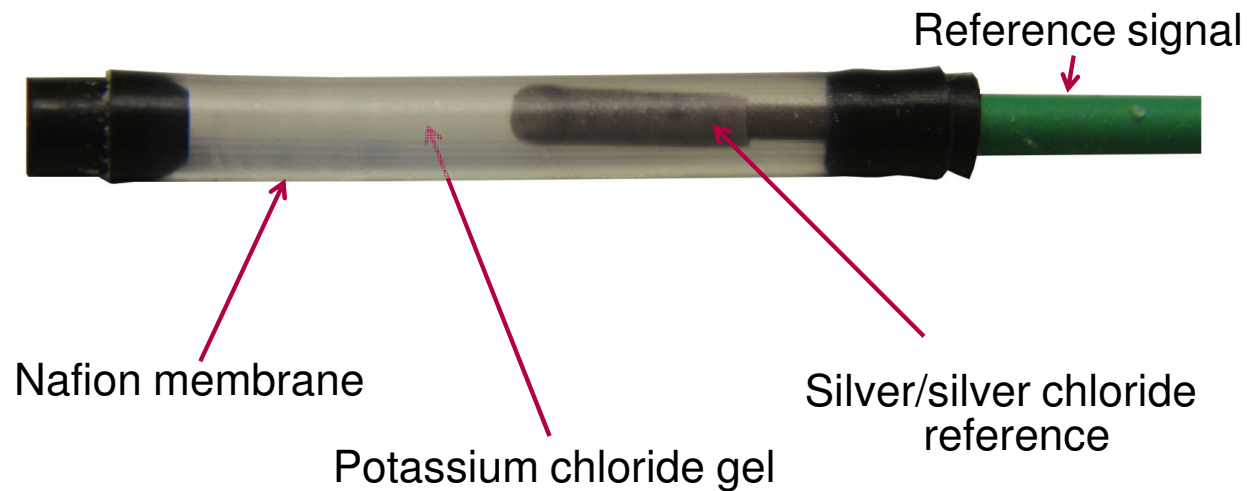


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# Nafion Reference Junction



- > Silver ion combines with chloride to form negatively charged complex
- > Negatively charged species cannot cross the membrane
- > Silver compounds cannot clog the outer reference junction

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# Delivering Measurement Value

> Lower cost of ownership compared to other Smart pH sensors

1. Lower maintenance costs

2. Longer service life

*Finally, a Smart pH sensor that is also robust*

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# Delivering Measurement Value

- > Lower cost of ownership compared to other Smart pH sensors

## 1. Lower maintenance costs

- > Unique **Nafion** ion barrier prevents reference junction fouling and **reduces the need for cleaning**
- > Enhanced Smart diagnostics **reduce the amount of time** required to assess sensor health
- > Unique sensor mounting design provides **faster insertion and removal** from the process
- > No glass sensor body and a flat, rugged electrode result in **reduced breakage** during handling

*Finally, a Smart pH sensor that is also robust*

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# Delivering Measurement Value

- > Lower cost of ownership compared to other Smart pH sensors

## 2. Longer service life

- > Rugged PVDF sensor body is chemical and abrasion resistant, resulting in **longer life**
- > No metallic wetted parts results in corrosion resistance and **longer life** in strong chemical solutions
- > Unique pH electrode formulations, both flat glass for abrasion resistance and domed glass for high temperature service, provide **long life**, as proven in thousands of installations

*Finally, a Smart pH sensor that is also robust*

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# 876PH Smart pH Transmitter



- > Enclosure meets IP66 and NEMA 4X
- > Two-wire loop powered intelligent transmitter
- > 4 to 20 mA output with HART
- > Transmitter and sensor diagnostics
- > Intrinsically safe for Zone 0 applications
- > FDT certified DTM
- > HART Device Description (DD) and HART AMS package



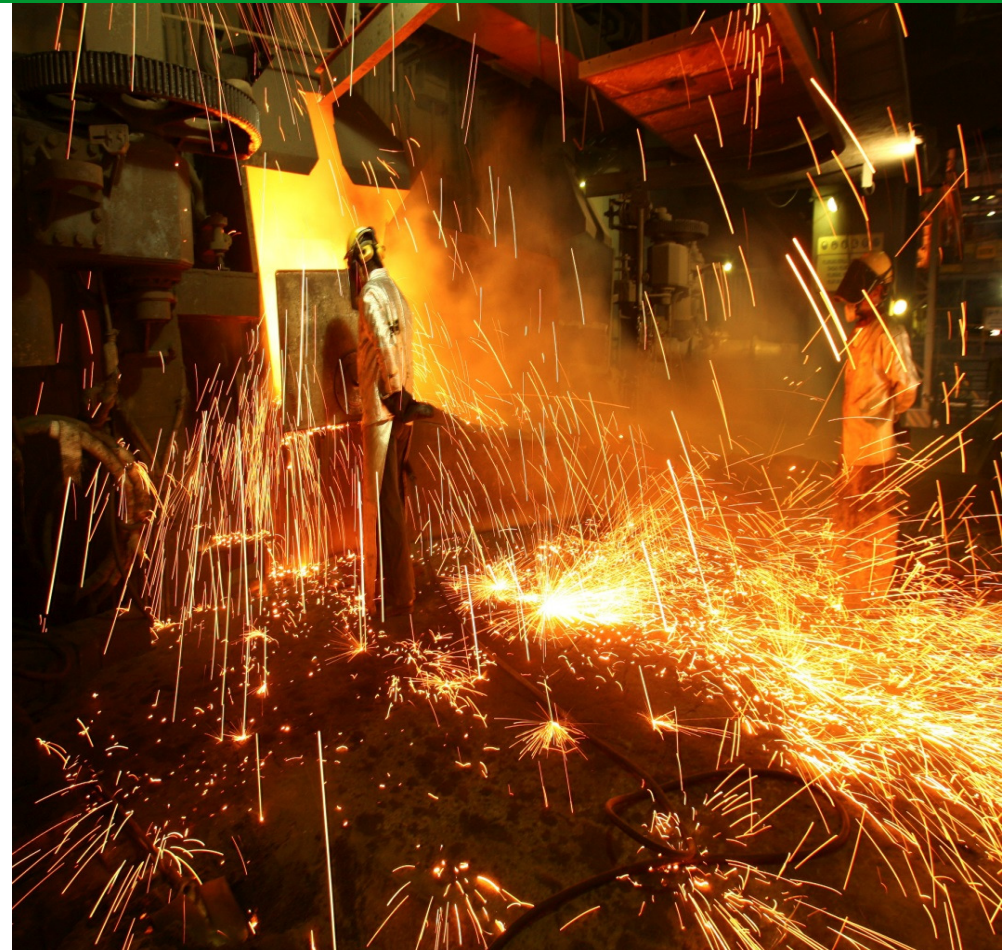
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# Transmitter Features

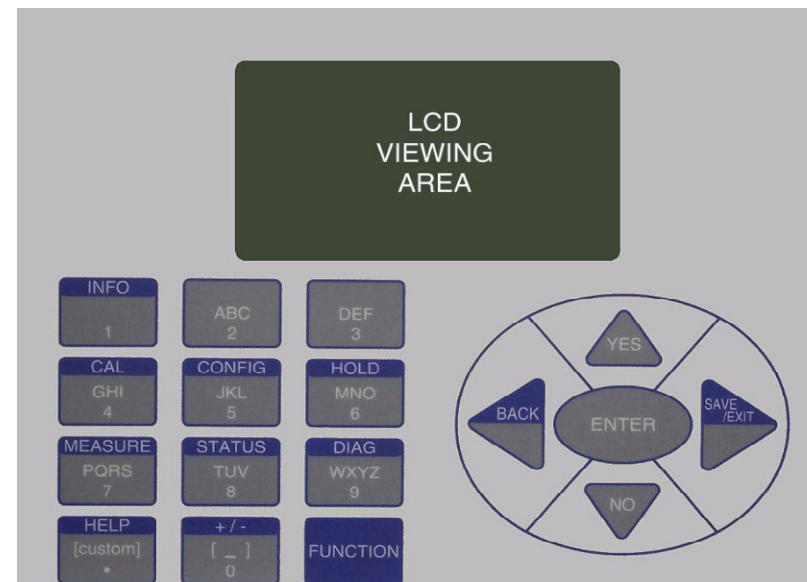
- > **Sensor and Transmitter Diagnostics**
  - > Examples: broken glass and coated reference
  - > Allows maintenance to be better managed
- > **Save and Restore Configurations**
  - > Up to two unique configuration profiles can be saved
- > **Easy Configurability**
  - > Alphanumeric keypad for local configuration
  - > DTM provides easy PC configuration and easy cloning of configurations for multi-device installations





# The Foxboro Brand Advantage

- > Unique user interface with both alphanumeric and navigational controls
  - > Fast and easy data entry
  - > Calibration values, tag data, passcodes
- > Ability to save and restore up to two sets of user defined configuration profiles



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# Sensor Management Using PC



- > Optional USB patch cord connects sensor to PC
- > Device Type Manager (DTM)  
Software is Field Device Tool (FDT)  
Group certified
- > Sensor can be calibrated and its history log read and saved to a file
- > Simplifies sensor calibration and diagnostic checking



# Sensor Overview



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# Calibrate

Warning: Loop should be removed from automatic control.

Calibration Setup

Date of Calibration 23/01/2015

Name of Operator Katy

Calibrate Measurement

Number of Calibration Points 2

Type of Calibration Manual

OK Cancel Next >

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# Diagnostic Configuration

**Sensor Overview**  
**Process Variables**  
Sensor Configuration  
    General  
    Measurement  
    Temperature  
    Temperature Compensation  
    Diagnostic Configuration  
    Passcode Access  
Calibration  
    Parameters  
    Calibrate  
Faults  
Sensor History Log  
Sensor Status  
Configuration Report  
Reference  
    Reference  
    Activity Log  
    Scratch Pad  
    Trending

**Diagnostics**

- ☐ Leakage
- ☐ ATC Short
- ☐ ATC Open
- ☐ Compensation Range
- ☐ Measurement Range
- ☒ Low Slope
- ☒ Coated Reference
- ☒ Broken Glass
- ☐ Aging

**Diagnostic Limits**

Glass Low Limit	1.000	MOhm
Glass Cutoff	122.00	degF
Slope Limit	80.0	%
Coat Limit	40	kOhm

OK Cancel Apply

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# Sensor History Log

The screenshot displays a software interface with a left-hand navigation pane and a main content area. The navigation pane includes sections like Sensor Overview, Process Variables, Sensor Configuration, Calibration, Sensor Status, Configuration Report, and Reference. The 'Sensor History Log' is selected and highlighted. The main content area shows a list of log entries with timestamps and status messages. A 'Save As' dialog box is open in the foreground, showing the file explorer view with a table of files and folders. The dialog box is titled 'Save As' and shows the current directory as '1501 Lynx > 15011 DTM > Probe DTM > Newest'. The file list includes 'Calibration Bug', 'pH and ORP', and 'Example Sensor History File'. The 'File name' field is set to 'Sensor History Export File' and the 'Save as type' is set to 'csv(\*.csv;)'.

**Sensor History Log**

Line	Timestamp	Status	Message
55	1:22:2015 13:10	Log cleared	
54	1:22:2015 13:13	Calibrated	Slope=96.8158 E0=6.3302
53	1:22:2015 13:13	Electrode Res Ref=29.0	Glass=2236.3
52	1:22:2015 13:13	Response Time	34 Seconds
51	1:22:2015 13:14	Service Soon	Sensor Coating: 0123 Sensor ID=4000227
50	1:22:2015 13:15	Failed	Analog Out of Range: 0080 Sensor ID=4000227
49	1:22:2015 13:15	OK	Analog Out of Range: 0000 Sensor ID=4000227
48	1:22:2015 13:15	OK	Sensor Coating: 0000
47	1:22:2015 13:26	Connected	HART ID=2 Ser
46	1:22:2015 13:26	OK	Temperature Overflow:
45	1:22:2015 13:27	Service Soon	Sensor Coatin
44	1:22:2015 13:27	OK	Sensor Coating: 0000
43	1:22:2015 13:31	Service Soon	Sensor Coatin
42	1:22:2015 13:31	Failed	Analog Out of Range
41	1:22:2015 13:31	Failed	Measurement Overflo
40	1:22:2015 13:31	OK	Measurement Overflo

**Sensor History Saved Files List**

Saved Sensor File Names: 0.csv

Buttons: All Logs and Create File, Calibration Log, Export History File

**Save As Dialog Box**

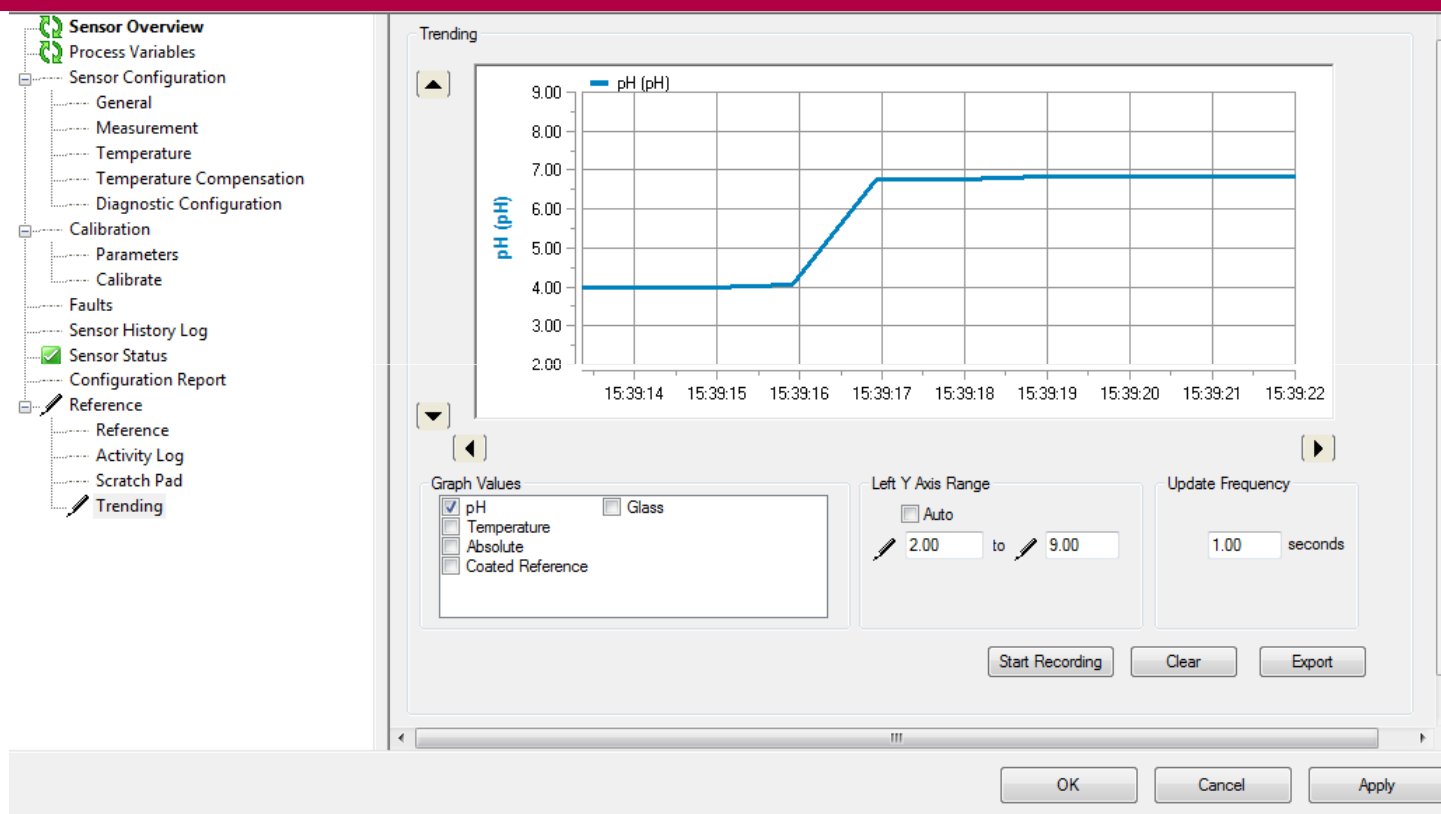
File name: Sensor History Export File

Save as type: csv(\*.csv;)

Name	Date modified	Type	Size
Calibration Bug	1/22/2015 4:14 PM	File folder	
pH and ORP	1/22/2015 12:48 PM	File folder	
Example Sensor History File	1/22/2015 4:10 PM	Microsoft Excel C...	1 KB



# Trending



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# Why Buy Foxboro?

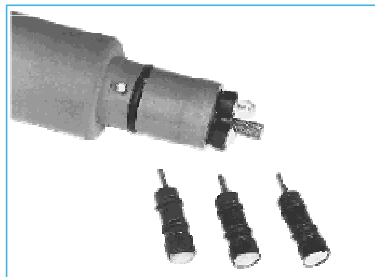
- > 24/7 Technical Assistance Center provides answers to your questions when you need them
- > Easy to use loop powered transmitters and line powered analyzers
- > Deep domain knowledge in the industry segments of chemicals, power, paper, mining, food and more
- > Broad range of rugged sensor solutions for pH, conductivity, resistivity and dissolved oxygen
  - > Wide range of materials, sizes, geometries
  - > Wide range of mounting methods and accessories
- > World class, worldwide support and delivery
  - > All the major certifications – FM, CSA, IECEx, ATEX, NEPSI and more

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# Glass Lab & Sensor Manufacturing in Foxboro, MA



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# Questions?





# Supplemental Slides



# Value of Smart Sensor Technology

**Customer Problem: Largest source of measurement error in electrochemical systems comes from an imperfect field system calibration**

Not allowing readings to stabilize

Performing single point calibration when a two point calibration is called for

Calibrating with a sensor which is approaching end of life

Using calibration solutions whose temperatures are changing

**Solution: Mitigate by performing a calibration under controlled conditions**

Perform the sensor calibration in an instrument shop, not in the field

Smart Sensor stores its calibration parameters in an on-board memory chip

Smart Sensor's calibration gets uploaded to the field transmitter upon connection

Result: Easier, faster and more reliable field calibration

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# Other Benefits of Smart Technology

- > Digital signal from sensor less prone to RFI/EMI interference than conventional analog signal
- > More efficient sensor management
  - > Sensor can be connected directly to a PC, making the user experience easier and faster
  - > A sensor that is trending toward end of life can be decommissioned in the instrument shop before reinstalling it in the process
  - > A sensor that is healthy does not have to be serviced unnecessarily
- > Less time is spent in the process areas, so a safer solution
- > Easier reordering due to storage of model code in sensor memory

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# What's Different

	Conventional	Smart
Sensor Signal	Analog	Digital
Termination	Integral cable or Variopin connector	Plastic connector with 3 pin connections
Cable	Thick with 6 to 9 wires	Thin, red with only 3 wires
Memory	None	Stores calibration and other data
Analyzers	Many types	Only new 876PH-S transmitter
Calibrate	Analyzer or transmitter	PC or transmitter
Diagnostics	Many	All previous and sensor calibration time
Cables	Standard and high temperature	One for all applications
Terminal Strip	Eleven positions	Three positions: 2 used (power+ and power-)
History Logs	One	Two
Real-time Clock	None	Included

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# What's the Same

- > Same sensor construction and wetted parts
- > Same selections of electrodes
- > Same mounting accessories for the sensor
- > Same enclosure for transmitter



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# Sensor Status Parameters

Measurements – absolute, temperature, temperature compensated measurement

Glass and reference resistance

Dynamic, live

Time in service

Slope and asymmetry

Sensor response time

Updated after calibration

Calibration date, operator, low and high points

Firmware version

Model code

Serial number

Sales order number

Date of manufacture

Loaded at the factory

*All these items  
are readable  
directly from  
the sensor.*

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# New Status Parameter – Sensor Calibration Time

- > New feature not previously available
- > Can be used as another predictive diagnostic to indicate coating or aging
- > Sensor calibration time is measured from the time the user presses “enter” on the second calibration solution to the time the sensor reaches stability. Stability is a user programmable parameter, and can be set over a wide range, depending on how precise the user wishes the calibration to be.

Status
Calibration Response
33 Seconds
Min: 1 Max: 500
Response Time Value

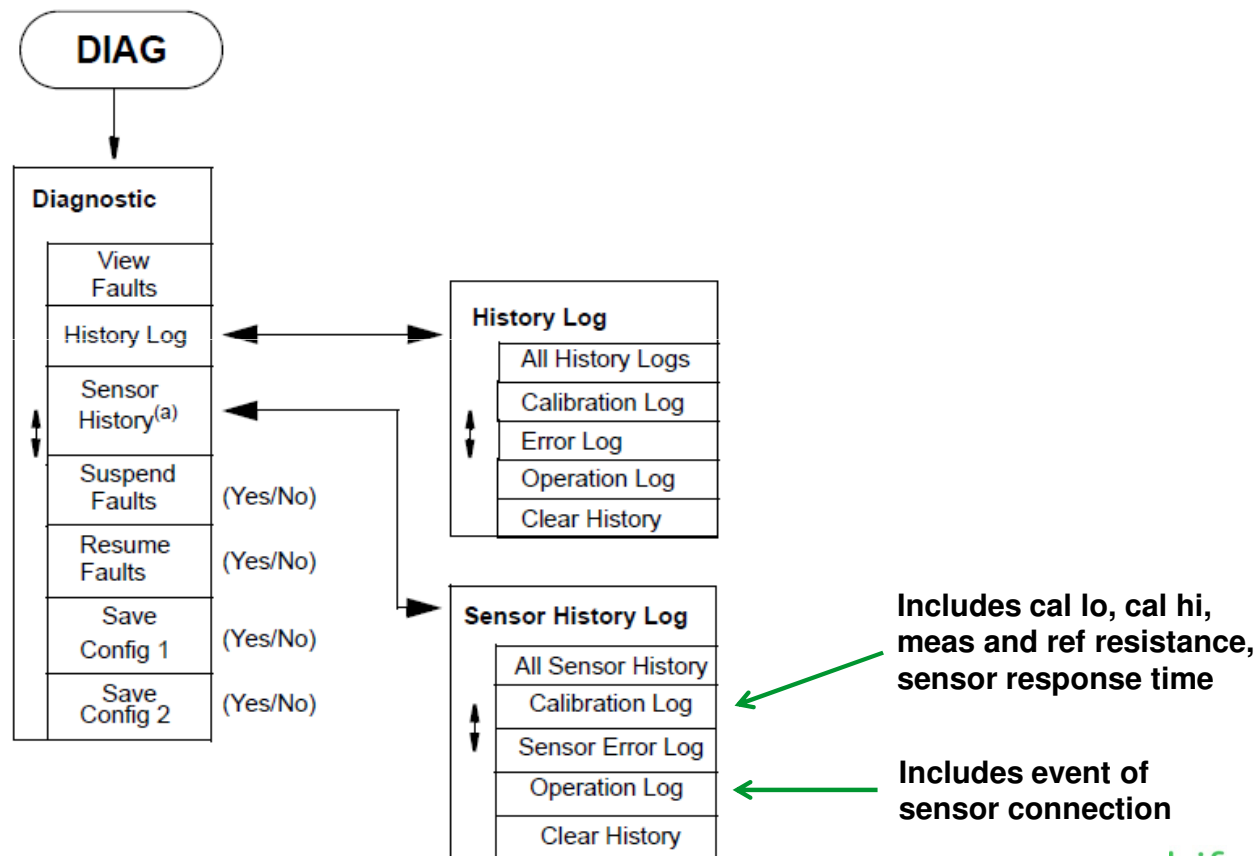
Cal Parameters	HOLD
Stability	
100.0	%
25.0 to 1000.0	
Calibration Stability	

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# History Logs



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# Foxboro pH Sensor Range



PH10 Analog and Smart



PH12



871PH



871A



EP462A

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