

pH

Dissolved Oxygen

Temperature

Redox

Cell Density

BioProcess Technologies™

Bioprocess Analytical Measurements Catalog

2003



Special Feature
HART® and
FOUNDATION™
fieldbus
Explained
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Diagnostics
with AMS
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Bioprocess
SIP/CIP
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Probe
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Your First Source for BioProcess Control Equipment and Supplies

This catalog is a source for instruments, sensors, tools, accessories and maintenance supplies for use in microbial fermentation and cell culture bioprocess applications. Special emphasis is given to the areas of measurement and control of environmental conditions inside fermentation vessels and bioreactors. Key products and supplies are stocked for next day delivery to provide timely backup to round-the-clock production activities. The catalog, and its personnel, strive to be an informed source of application support for the products offered. Broadley Technologies sells over 2,000 different items and offers many custom options for your specific application.

Introducing New and Useful BioProcess Products

Broadley Technologies is always looking for new products that provide new functionality, additional features and improved flexibility to the customer's existing bioprocess systems. Please let us know what products you would like to see the catalog stock for your particular application and maintenance requirements.

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The BioProcess Technologies Catalog
Offers Products For BioProcess Measurement
And Control, Operation And Maintenance



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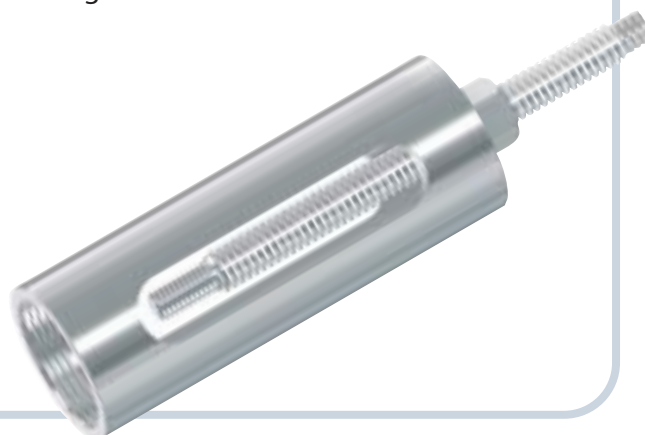


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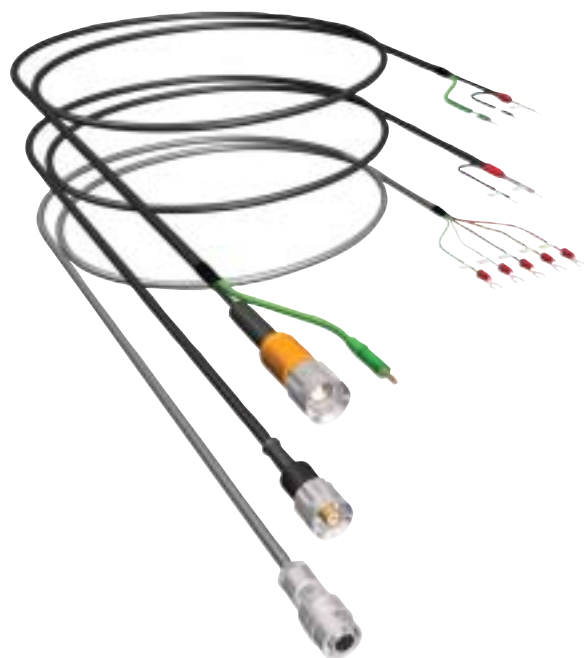
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Engineering Solutions

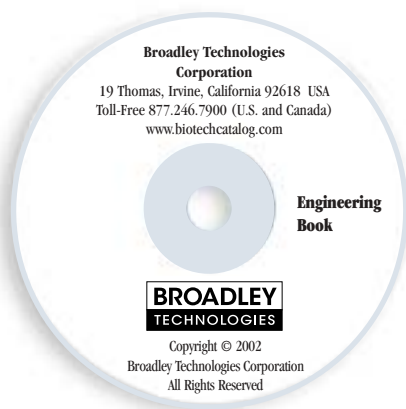


Now Available

Biotech Engineering Book and CD

pH & D.O. Measurement Solutions for BioProcess Applications

The Biotech Engineering Book is a compilation of pH and dissolved oxygen measurement loop solutions for FOUNDATION™ fieldbus, HART®, and 4-20 mA applications. It includes ISA data sheets on both instruments and sensors, certified dimensional drawings, and detailed product specifications.



The entire book is available in PDF on a CD.

Are you engineering a new bioprocess loop or upgrading an existing one?

If so, we have the tools to make your job easier. Our Biotech Engineering Book has the complete loop solutions for FOUNDATION™ fieldbus, HART®, and 4-20 mA applications of pH and dissolved oxygen measurements.

On-site Seminars

We will visit your location to deliver a complementary, highly informative presentation encompassing the above pH and D.O. communication solutions as well as Asset Management Solutions for predictive maintenance. Furthermore, we will discuss emerging technologies in the measurement and control of fermentation and cell culture processes.

C o n t e n t s

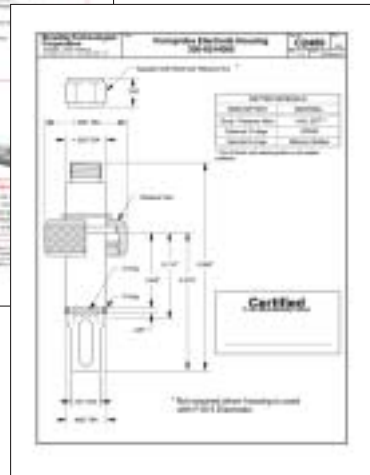
- 1. FOUNDATION™ fieldbus pH Loop
- 2. FOUNDATION™ fieldbus Dissolved Oxygen Loop
- 3. HART® pH Loop
- 4. HART® Dissolved Oxygen Loop
- 5. 4–20 mA Communication
- 6. Custom Assemblies for B.Braun Biotech Vessels
- 7. Optional Designs for pH Housings & Dissolved Oxygen Sensors
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Specification Sheets



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Section One

Communication Solutions



HMI
Human Machine
Interface
Workstation



AMS
Asset Management
Solutions Workstation

DeltaV™
Control System



4-20 mA
Model 30
Transmitter



HART®
Model 40
Transmitter

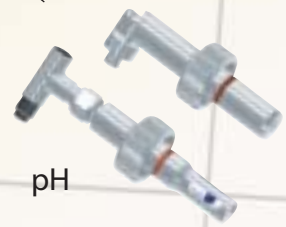


FOUNDATION™ H1
Model 50
Transmitter



pH

D.O.



pH

D.O.

Bioprocess Communication Solutions

Communication Solutions For Bioprocess On-line Analytical Instrumentation

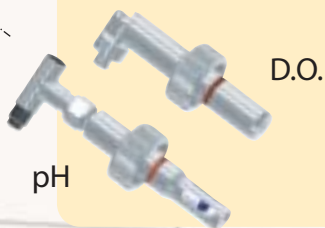
pH and dissolved oxygen are mission critical variables for the successful control of fermentation and cell-culture bioreactors. While many other control measurements are needed to support the bioreactor, such as temperature, agitation speed, and gas regulation, it is the pH and dissolved oxygen measurements that are the primary windows through which the metabolic activity within the bioreactor is evaluated and regulated.

Any technology that can enhance the reliability and the validity of pH and D.O. data will advance the state of the art of bioreactor control and increase yields. To this end, there are now digital communication protocols for industrial analytical pH and D.O. transmitters that allow the concurrent transmission of more than just the primary variables, pH and D.O., from the sensors to the control system. Simultaneous transmission of secondary variables, such as the sensor's raw millivolt (mV) or nanoamp (nA) output, enables advanced sensor diagnostics that can evaluate the sensor's health and validate the primary measurement.

What is a fieldbus?

Fieldbus is a generic term that is used to describe digital communication networks that are being used to replace existing 4-20 mA analog systems. These "fieldbus" networks include FOUNDATION fieldbus and HART. Strictly speaking, both of these fieldbus networks are communication protocols that are used to send bi-directional digital information over a plant-wide network of field devices, actuators, controllers, and remote PC based workstations. In general use, both communication protocols have come to be referred to as fieldbus network solutions for process control applications.

This catalog presents three distinct choices of communication protocols to consider when choosing the best pH and D.O. transmitters for a bioprocess application. Each protocol has very specific features and benefits to offer, which are discussed throughout this catalog section.



Choosing a communication protocol

4-20 mA

- Analog signal
- Current is proportional and scalable to sensor signal
- Carries one measured variable in one direction
- Historical standard for measurement & control




4-20 mA
current signal

HART®

- Digital signal superimposed over standard analog 4-20 mA signal
- 4-20 mA signal carries primary variable, digital signal carries other measurement and configuration data
- Bi-directional digital communication enables remote process monitoring and field configuration
- Process data can be recorded and trended in a 21 CFR Part 11 compliant format with an interface software package



Digital signal superimposed via frequency shift keying (FSK)



4-20 mA current signal

FOUNDATION™ fieldbus

- Purely digital bi-directional communication network connecting field devices and control system
- Field devices transmit multiple variables which enable advanced control and diagnostics
- Plug-and-Play enabled field devices connect to control network and allow ease of configuration
- Field devices utilize a single standard cable for data transfer and to provide power



FOUNDATION H1
digital network

The standard analog communication protocol for over 20 years. The primary variable is transmitted via a 4-20 mA current loop from the field device to the control system. Only one variable can be transmitted per loop. No secondary data is available for the control system, and the field devices can only be calibrated and configured at the device itself in the fermentation or cell culture suite.



For Installation Schematic

see page 12

For pH & D.O. Transmitter

see page 14

A natural evolution of the 4-20 mA protocol, HART is a digital protocol that is superimposed over a conventional 4-20 mA signal, which still carries the primary variable. This digital signal allows the simultaneous transmission of additional measurements to the control system that will enable advanced sensor monitoring and diagnostics. The digital signal is bi-directional which allows the remote monitoring and configuration of the field device by the use of Asset Management Solutions (AMS) software on any networked PC and thus enables remote troubleshooting and reduces false alarms which waste valuable time.



For Installation Schematic

see page 16

For pH & D.O. Transmitters

see page 18

FOUNDATION fieldbus is a fully digital, bi-directional, communications protocol used for communications between field devices and control systems. The protocol allows for these devices to be drop connected along one field network and loop powered. Additionally they transmit multiple measurement variables to the control system and to other devices for true distributed control. Remote PC workstations can view data trends, perform diagnostics, view alarms, and reconfigure the field device without having to enter the fermentation or cell culture suite.



For Installation Schematic

see page 24

For pH & D.O. Transmitters

see page 26

What is 4-20 mA?

What is 4-20 mA?

- Variable 4-20 mA current is used for analog data transmitted over long distances
- Transmitted current is proportional and scalable to the input signal of the sensor
- Transmitted current is carried via a twisted pair of wires for each device measurement
- 4 mA represents "live zero" or bottom of scale & 20 mA represents full scale

Features and Limitations

Single Communication Channel

The 4-20 mA transmitted signal carries a single piece of information and only in one direction. This information, the primary measured variable, is transmitted from the field device to receiving instruments such as recorders and controllers.

Extensive Installed Base

The 4-20 mA standard for field devices is the most reliable analog solution to long distance signal transmission and has an extensive installed base.

Manual Diagnostics and Configuration

The operator can neither "view" the secondary device variables nor perform configuration or diagnostics tasks remotely. Operators must travel to the installation site to view anything other than the primary data and manually configure the transmitter.

Vulnerability of Transmitted Signal

The 4-20 mA analog current is subject to electrical interference (noisy signal) that may distort the signal. An analog signal is a varying current, and there is no good way to tell if the process signal is in error or if it is from a correct measurement.

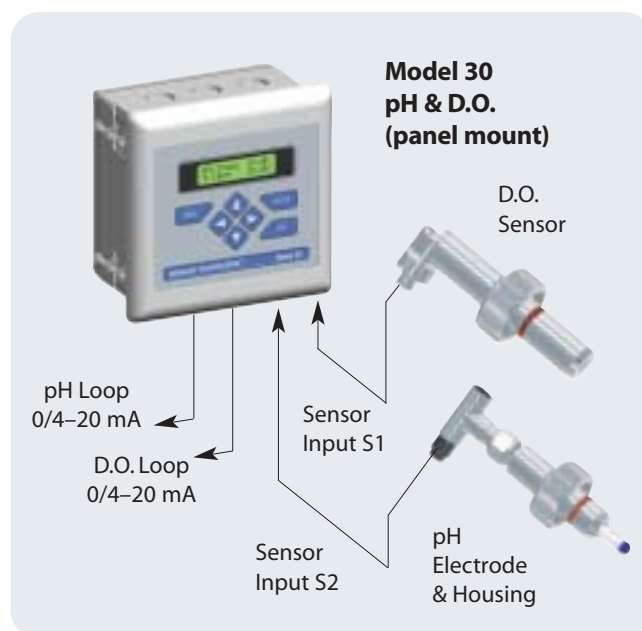
How It Works

DeltaV™
Workstation



Monitor the primary bioprocess measurement from your control system workstation

The control system, connected to all of the field devices, facilitates digital integration of the the 4-20 mA analog signal into the entire plant operation and brings primary measurement data into the control room.



Recent Advances in Control System Solutions

The state of the art in control system design now enables end users to utilize an array of communication options in a modular format. One control system may be able to accept any of the leading communication protocols.

- Compact, modular design
- Mix and match communication modules
- Extensive array of communication options
 - FOUNDATION™, HART®, 4-20 mA, and a host of others

Ethernet

DeltaV™
Control System



4-20 mA control system module

The transmitter connects directly into the 4-20 mA module of the control system.

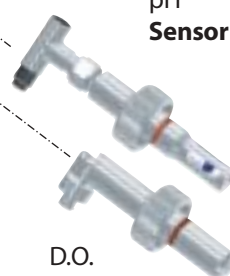
4-20 mA (pH)
4-20 mA (D.O.)

4-20mA
Model 30 pH & D.O.
Transmitter (pipe mount)



pH
Sensor

D.O.
Sensor



Dual pH and D.O. Transmitter

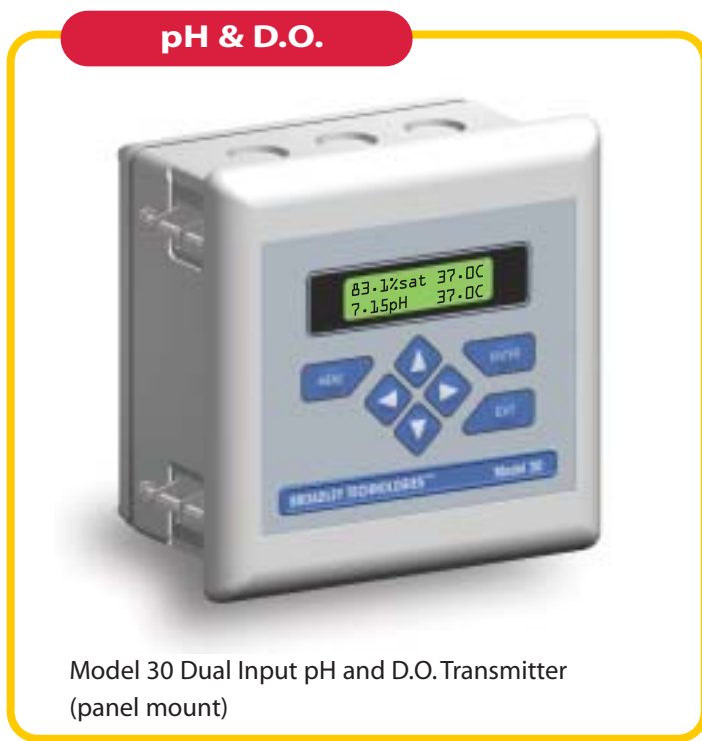
The Model 30 dual input pH and D.O. transmitter connects to the 4-20 mA module of the control system. The primary measurement variables of pH and percent saturation are transmitted on separate 4-20 mA analog signals.



pH & D.O. DUAL Input 4-20 mA Transmitter

Model 30 — pH & D.O. Transmitter

- DUAL INPUT transmitter with two independent sensor inputs to monitor both pH and D.O. simultaneously.
- DUAL OUTPUT transmitter with two 4-20 mA outputs that can be independently programmed to correspond to any selected measurement or temperature. Simultaneously measures and displays both pH and D.O. variables.
- CHOOSE PANEL MOUNT OR PIPE MOUNT enclosure. Both mounting options meet NEMA 4X/CSA 4 (IP65) requirements.
- SECURITY allows for two levels of data protection.



Model 30 Dual Input pH and D.O. Transmitter (panel mount)

Features & Applications

QUICK START PROGRAMMING:

Exclusive Quick Start screen appears the first time the Model 30 is powered up. Screen prompts direct the user to register the number of sensors, the measurement unit(s) and the language to display. The measurement loop is ready for use in a matter of minutes.

DISPLAY:

As many as 14 user selectable display screens are available, but the most useful is the one that shows both pH and D.O. at the same time. The two-line, 16-character, back-lit display can be customized to meet user requirements. All operations and descriptive messages can be field selected for English, French, German, Italian,

Spanish, or Portuguese. Informative screens, which permit data not shown in the regular display, may be seen at the push of a button.

DUAL INPUT & OUTPUT:

The Model 30 accepts single or dual sensor input. The two 4-20 mA outputs can be independently programmed to correspond to any selected measurement or temperature. Output dampening and linear or log output may also be field selected.

ENCLOSURE:

The panel mount version (155 x 155 x 94.5 mm) fits standard 1/2 DIN panel cutouts, and its shallow depth is ideally suited for easy mounting in

Hoffman-type enclosures. A panel mount gasket is included to maintain the weather rating of the panel. The wall/pipe mount version includes self-tapping screws for surface mounting. A pipe mounting accessory kit is available for mounting to a 2-inch pipe.

MENUS:

The Model 30 features an easy-to-use, intuitive menu that makes advanced programming and calibration simple. On-screen full text and phrase prompting does away with cryptic mnemonic based instrument displays. There are no service codes to enter before gaining access to menus. Easy to incorporate into your Standard Operating Procedures.

Specifications

Sensor Input S1

Specifications

D.O. Measurement Range	0 to 250.00% sat
Temperature Measurement Range	0 to 50° C
Display Resolution	0.1% sat
Output Repeatability	± 1% of full scale
Temperature Compensation	Automatic & Manual

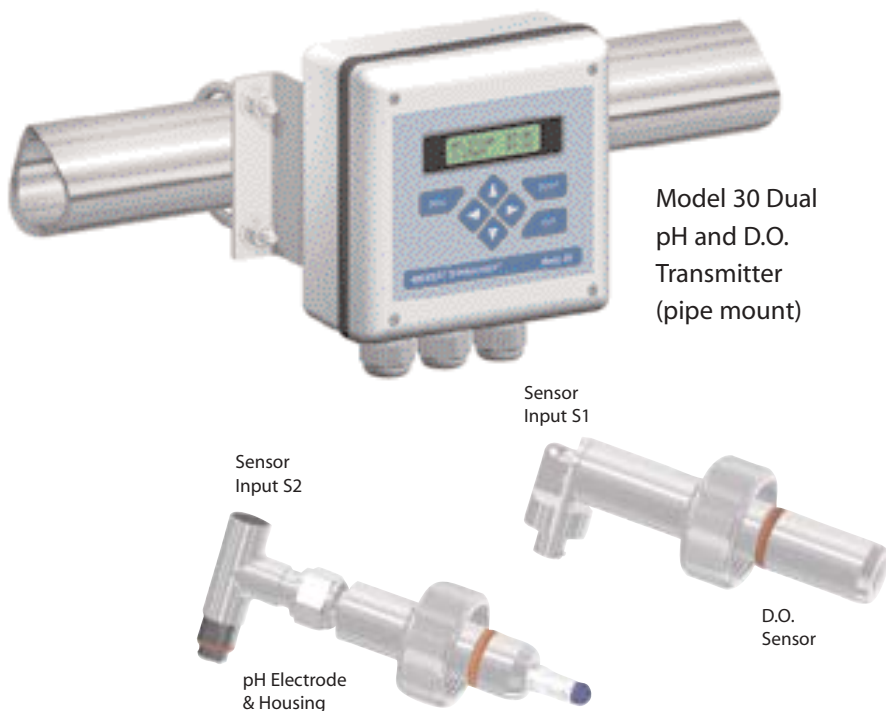
Dissolved Oxygen

Sensor Input S2

Specifications

pH Measurement Range	0 to 14 pH
Temperature Measurement Range	-15 to 100° C
Display Resolution	± 0.01 pH
Output Repeatability	± 0.01 pH
Temperature Compensation	Automatic & Manual

pH



FEATURE SPOTLIGHT

User Selectable Displays

The 3 Most Popular Displays:
The Model 30 dual pH & D.O. transmitter has several display options.

50.0%sat 22.0C
7.30pH 22.0C

1. Default Dual Display
Display both pH and D.O. simultaneously.

50.0 %sat
22.0°C In: 32nA

2. Sensor 1 Display
Display D.O. with a continuous display of the sensor signal in raw nanoamps (nA).

S2 7.30 pH
22.0°C -18mV

3. Sensor 2 Display
Display pH with a continuous display of the electrode signal in raw millivolts (mV).

ordering information

Part Number	Description	Price
30-A-PH/DO	Model 30 Dual pH & D.O. Transmitter, Panel Mount	
30-B-PH/DO	Model 30 Dual pH & D.O. Transmitter, Pipe Mount	
30-A-PH	Model 30 Single pH Transmitter, Panel Mount	
30-A-DO	Model 30 Single DO Transmitter, Panel Mount	
AM-9385	Power Cord, 6 ft, 115 VAC, 3 prong U.S.	
AM-9377	Cable Grips, Package of 3	

What is HART® ?

What is HART?

- Digital signal superimposed over a conventional analog 4-20 mA signal
- Two channels of communication to the control room, one analog and one digital
- 4-20 mA signal carries the primary variable, digital signal carries secondary variables
- Bi-directional communication between the device and the control system

Features and Benefits

HART Provides two data channels

One analog 4-20 mA channel and one superimposed bi-directional digital channel link the field device to the control system. The analog 4-20 mA signal carries the primary variable while the digital signal carries secondary variables, device configuration data, and diagnostic alerts.

Advanced Sensor Diagnostics

Digital channel provides secondary variables for implementation of advanced sensor diagnostics which allows for improved performance and greater reliability.

Remote Viewing of Data

Remote viewing of measurement data and remote reconfiguration of field device made possible over the bi-directional digital channel by any PC based workstation with an interface software package such as Asset Management Solutions (AMS).

Compatible with 21 CFR Part 11 Compliant Software

The HART digital signal enables the recording of measurement variables into a 21 CFR Part 11 compliant software package, reducing labor hours in the collection and documentation of measurements by operators.

How It Works



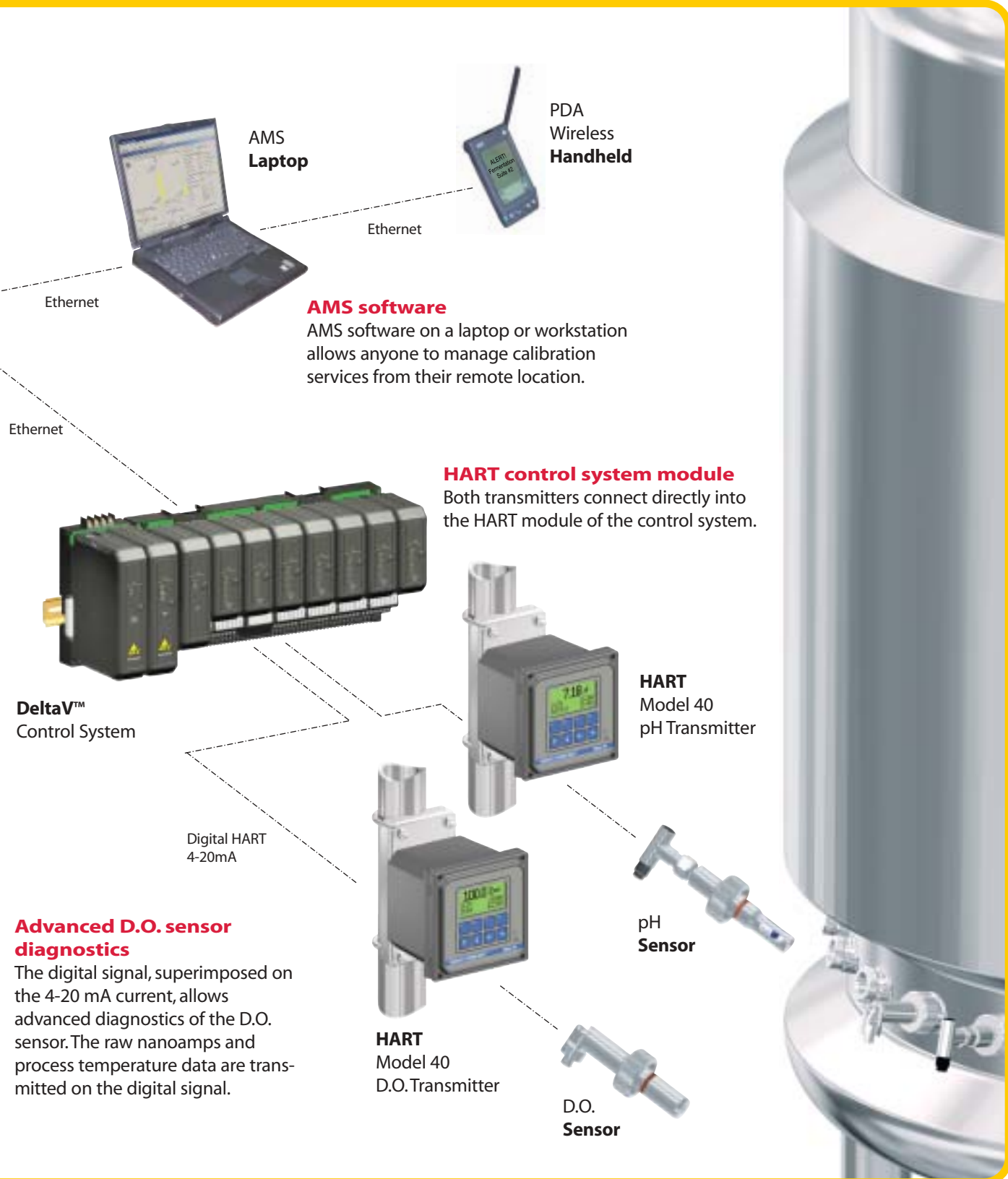
Monitor the ENTIRE bioprocess loop from your control system workstation

The control system, connected to all of the smart devices, facilitates digital integration of the 4-20 mA analog signal into the entire plant operation. In addition, it brings extensive field device data into the control room in a manner that can meet the guidelines of 21 CFR Part 11.



HART, with an interface software package such as AMS, allows a supervisor to monitor the entire bioprocess loop from an office workstation or laptop, minimizing trips into the cleanroom.

See page 28 for details on AMS software.



HART® pH Transmitter



Model 40 — pH/ORP Transmitter

- HART PROVIDES TWO DATA CHANNELS, one 4-20 mA analog channel, transmitting the primary measurement variable, and one digital channel, superimposed on the 4-20 mA analog signal, transmitting additional data.
- REMOTE VIEWING OF MEASUREMENT DATA and remote configuration of field device, made possible over the bi-directional digital channel.
- IMPROVED SECURITY ENHANCES RELIABILITY and validity of the data, and allows assignment of access to the transmitter via user selected security codes. All output configurations are locked behind security.
- ADVANCED pH SENSOR DIAGNOSTICS warn user of the need for calibration, maintenance, or sensor replacement with data transmitted over the digital channel.



Model 40 pH Transmitter
(panel mount)

Features & Applications

HART: The Model 40 is the pH solution for biotech installations requiring HART communication.

This solution offers:

- Speed - 1.2 kbit/s
- Bidirectional Communication of Process Data
- Digital Information Riding on 4-20 mA Signal
- Remote Configuration & Calibration

CLEAR BACK-LIT DISPLAY:

Clear, easy-to-read, back-lit dot-matrix LCD display, with fully descriptive diagnostic messages and easy-to-use interface, spells out each operation in English, French, German, Italian, or Spanish. The display continuously

indicates the measured variable in large numerals, along with the temperature, output value and two user selectable process parameters.

AUTOMATIC CALIBRATION:

The automatic buffer recognition feature uses stored buffer values and their temperature curves for the most common buffer standards available worldwide.

ADVANCED DIAGNOSTICS:

The state-of-the-art, continuous diagnostic capability of the Model 40 transmitter eliminates troubleshooting guesswork by alerting the user to the following problems:

- Cracked or broken pH electrode
- Aged glass

- Non-immersed electrode
- Poisoned reference (offline only)
- Faulty temperature element
- pH electrode slope error (offline)
- Analyzer electronics failure

In the event of one of these conditions, the transmitter will display a descriptive message of the problem, illuminate a red LED on the front panel, and alarm at the remote monitoring workstation.

COMPATIBLE WITH 21 CFR 11 COMPLIANT SOFTWARE:

The HART digital signal enables the recording of measurement variables into a 21 CFR Part 11 compliant software package, reducing labor hours in the collection and documentation of measurements by operators.



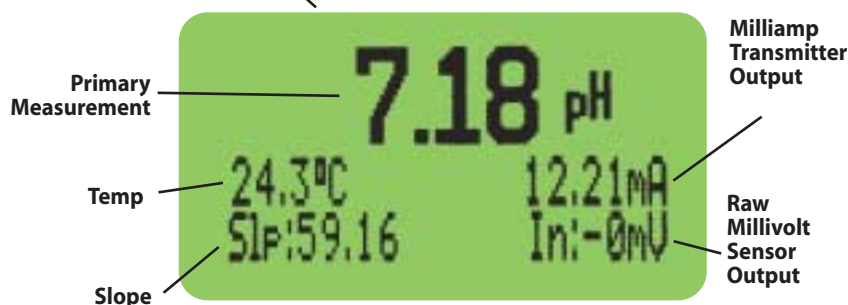
Feature Spotlight

Clear, Easy to Read Display:

The Model 40 pH transmitter has an extra large, back-lit display with adjustable brightness (shown actual size).

Line 2 of Main Display

The process temperature and the milliamp transmitter output are always shown on line 2 of the main display.



Line 3 of Main Display

The user may choose which items to show on the third line of the main display from slope of electrode, raw millivolt sensor output, reference impedance, bulb impedance, and alarm setpoints.



Model 40
pH Transmitter
(pipe mount)



pH Electrode
and Housing

Ordering Information

Part Number	Description	Price
40-A-PH	Model 40 pH Transmitter, Panel Mount	
40-B-PH	Model 40 pH Transmitter, Pipe Mount	
AM-9490	Pipe Mount Kit	
AM-9385	Power Cord, 6 ft, 115 VAC, 3 prong U.S.	
AM-9377	Cable Grips, Package of 3	

SPECIFICATIONS:

Measurement Range:

0 to 14 pH

Accuracy:

± 0.01 pH

Repeatability:

± 0.01 pH

Stability:

± 0.01 pH/month, non-cumulative

Outputs:

Two 4-20 mA or 0-20 mA isolated outputs. Output 1 includes digital signal 4-20 mA superimposed HART.

Digital Data Transmission Speed:

1.2 kbit/s

Clear Back-lit Display:

Back-lit dot matrix LCD (7.0 x 3.5 cm), blue on gray-green. The display contrast is compensated for ambient temperature.

Security:

Three levels of password protection.

Power:

100 to 127 VAC, 50/60 Hz, 6 watts max.

Rugged Metal Case:

The analyzer is housed in a rugged NEMA 4X (IP65) weatherproof, corrosion resistant enclosure of epoxy-painted aluminum. The membrane keyboard has tactile feedback.

Dimensions:

5.7 x 5.7 x 5.2 in.
DIN size (144 x 144 x 132 mm)

Weight/Shipping Weight:

2.5 lb/3.5 lb (1.1 kg/1.6 kg)



HART® D.O. Transmitter

Model 40 — D.O. Transmitter

- HART PROVIDES TWO DATA CHANNELS, one 4-20 mA analog channel, transmitting the primary measurement variable, and one digital channel, superimposed on the 4-20 mA analog signal, transmitting additional data.
- REMOTE VIEWING OF MEASUREMENT DATA and remote configuration of field device, made possible over the bi-directional digital channel.
- EXPANDED RANGEABILITY enables the Model 40 to go from 0-999% saturation.
- IMPROVED SECURITY ENHANCES RELIABILITY and validity of the data, and allows assignment of access to the transmitter via user selected security codes. All output configurations are locked behind security.

Dissolved Oxygen



Model 40 D.O. Transmitter
(panel mount)

Features & Applications

HART: The Model 40 is the D.O. solution for biotech installations requiring HART communication.

This solution offers:

- Digital Information Riding on 4-20 mA Signal
- Bidirectional Communication of Process Data
- Digital Data Speed - 1.2 kbit/s
- Remote Configuration & Calibration

CLEAR BACK-LIT DISPLAY:

Clear, easy-to-read, back-lit dot-matrix LCD display, with fully descriptive diagnostic messages and easy-to-use interface, spells out each operation in English, French, German, Italian, or Spanish. The display continuously indicates the measured variable in large

numerals. The temperature and output current are shown in smaller numerals on the second line, and two user-selectable variables, such as nanoamps, can be displayed on the third line.

ADVANCED DIAGNOSTICS:

The state-of-the-art, continuous diagnostic capability of the Model 40 eliminates troubleshooting guesswork. The digital signal, superimposed on the 4-20 mA current, allows advanced diagnostics of the D.O. sensor for improved performance and greater reliability. The raw nanoamps and process temperature data are transmitted on the digital signal.

AUTOMATIC CALIBRATION:

Calibrating the D.O. sensor requires exposing it to a solution containing no oxygen (zero standard) and to a solu-

tion containing a known amount of oxygen (full-scale standard). The sensor may also be calibrated in "process."

RUGGED METAL ENCLOSURE:

Rugged NEMA 4X enclosure is a weatherproof and corrosion resistant epoxy-painted cast aluminum. The panel mount version fits standard DIN panel cutouts. There are five electrical conduit places for PG13.5 cable glands or 1/2" fittings. A hinged front cover provides convenient access to wiring.

COMPATIBLE WITH 21 CFR 11 COMPLIANT SOFTWARE:

The HART digital signal enables the recording of measurement variables into a 21 CFR Part 11 compliant software package, reducing labor hours in the collection and documentation of measurements by operators.



Feature Spotlight

Clear, Easy to Read Display:

The Model 40 D.O. transmitter has an extra large, back-lit display with adjustable brightness (shown actual size).

Line 2 of Main Display

The process temperature and the milliamp transmitter output are always shown on line 2 of the main display.



Line 3 of Main Display

The user may choose which items to show on the third line of the main display from nanoamp input and alarm setpoints.



Model 40 D.O. Transmitter (pipe mount)



D.O. Sensor

SPECIFICATIONS:

Measurement Range:

0 to 999% saturation

Accuracy:

±1% of full scale

Repeatability:

±1 nanoamp (nA)

Stability:

±1 nanoamp/month @ 25°C

Pressure Range:

0 to 9 bar

Outputs:

Two 4-20 mA or 0-20 mA isolated outputs. Output 1 includes digital signal 4-20 mA superimposed HART.

Digital Data Transmission Speed:

1.2 kbit/s

Clear Back-lit Display:

Back-lit dot matrix LCD (70 x 35 mm), blue on gray-green. The display contrast is compensated for ambient temperature.

Security:

Three levels of password protection.

Power:

100 to 127 VAC, 50/60 Hz, 6 watts max.

Rugged Metal Case:

The analyzer is housed in a rugged NEMA 4X (IP65) weatherproof, corrosion resistant enclosure of epoxy-painted cast aluminum. Membrane keyboard has tactile feedback.

Dimensions:

5.7 x 5.7 x 5.2 in.
DIN size (144 x 144 x 132 mm)

Weight/Shipping Weight:

2.5 lb/3.5 lb (1.1 kg/1.6 kg)

Ordering Information

Part Number	Description	Price
40-A-DO	Model 40 D.O. Transmitter, Panel Mount	
40-B-DO	Model 40 D.O. Transmitter, Pipe Mount	
AM-9490	Pipe Mount Kit	
AM-9385	Power Cord, 6 ft, 115 VAC, 3 prong U.S.	
AM-9377	Cable Grips, Package of 3	

What is a HART® Interface Module?



Convert the HART digital data to 3 new 4-20 mA analog signals

Primary and Secondary Measurements

Moore Industries' HART Interface Module connects "transparently" onto the Model 40 HART transmitter. Using the HART digital data that "rides" on the 4-20 mA wires, it "breaks out" up to three analog signals representing any combination of the secondary variables.

Alarms Indicate Malfunctions

One or two alarms can be individually configured to alert the user if the sensor or the transmitter is in a fault condition, indicating a field device malfunction or that the primary analog output is fixed, saturated or out of limits.

Configuration Software

The HART Interface Module sets up quickly and easily with the single-window PC configuration software equipped with a comprehensive, searchable help system that smoothly guides the user from hook-up to start-up.

Rugged Metal Enclosure

The compact, DIN-rail-mount module mounts in rugged field conditions in the metal enclosure with clear polycarbonate cover.

Ordering Information

Part Number	Description	Price
HIM-HART-3AO	HART Interface Module	

Configuration software and cable are included

How it works

Primary
4-20 mA
Output

Percent saturation

The primary measurement variable is available with or without the HART Interface Module

4-20 mA

Raw Sensor Nanoamp Value

An alarm will trip if the nanoamp output does not match the primary percent saturation measurement.

4-20 mA

NEW
Secondary
4-20 mA
Outputs

Temperature

Continually monitor the process temperature on one of the analog output signals.

4-20 mA

Milliamp Transmitter Output

Monitor the milliamp transmitter value on one of the 4-20 mA analog outputs.

4-20 mA

Specifications

Case:

Universal DIN-style compact metal housing mounts on a standard DIN-rail or on a surface.

Dimensions:

2.56 x 3.94 x 5.45 in. (65 x 100 x 138 mm).

Display:

Two line LCD, black digits on a reflective background.

Ambient temperature:

-25 to 70°C (-13 to 158°F). Unit operable from -40 to 85°C.

Convert the HART digital data to 3 new 4-20 mA analog signals

The HART Interface Module converts the HART digital data that is continuously being transmitted over the Model 40 transmitter's analog loop wires to separate individual 4-20 mA signals. These signals can be accepted by a Distributed Control System (DCS) or Programmable Logic Controller (PLC). This allows the user to track the transmitter's secondary variables.

HART Interface Module



Digital HART
4-20 mA

HART
Model 40
D.O. Transmitter
(pipe mount)



D.O.
Sensor



Output:

Three programmable analog output channels, 0/4-20 mA. One or two programmable alarm outputs.

Output Accuracy:

±0.015% of maximum output span (20 mA).

Relative humidity:

0 to 95%, non-condensing.

Power:

24 VDC, ±10%.

What is FOUNDATION™ fieldbus?

What is FOUNDATION?

- Pure digital signal enables high speed communication of process measurements
- A single cable carries both power and communications to the instrument
- Digital signal carries an extensive array of measurement variables
- FOUNDATION instruments enable truly distributed process control

Features and Benefits

Pure Digital Communication

The digital signal transmits an array of measurements for pH and D.O., including pH, percent saturation, temperature, nanoamps, and reference offset. In addition, an operator can access application notes and SOPs online.

Real Time Control of Process

FOUNDATION fieldbus is designed to support mission-critical applications where the high-speed transfer and handling of data is essential. The availability of high speed communication coupled with distributed control to the device level allows for real time control in a true distributed format.

Remote Monitoring and Control

The pure digital FOUNDATION fieldbus system allows monitoring and control from a remote computer or any workstation. Additionally, critical measurements can be alarmed and assigned to a paging system.

Reduced Installation Costs

The plug and play design and standardized wiring of FOUNDATION devices allows for quicker installation and reduced configuration costs. A single cable carries both power and communications to the device, eliminating the need for a power cable.

How it Works



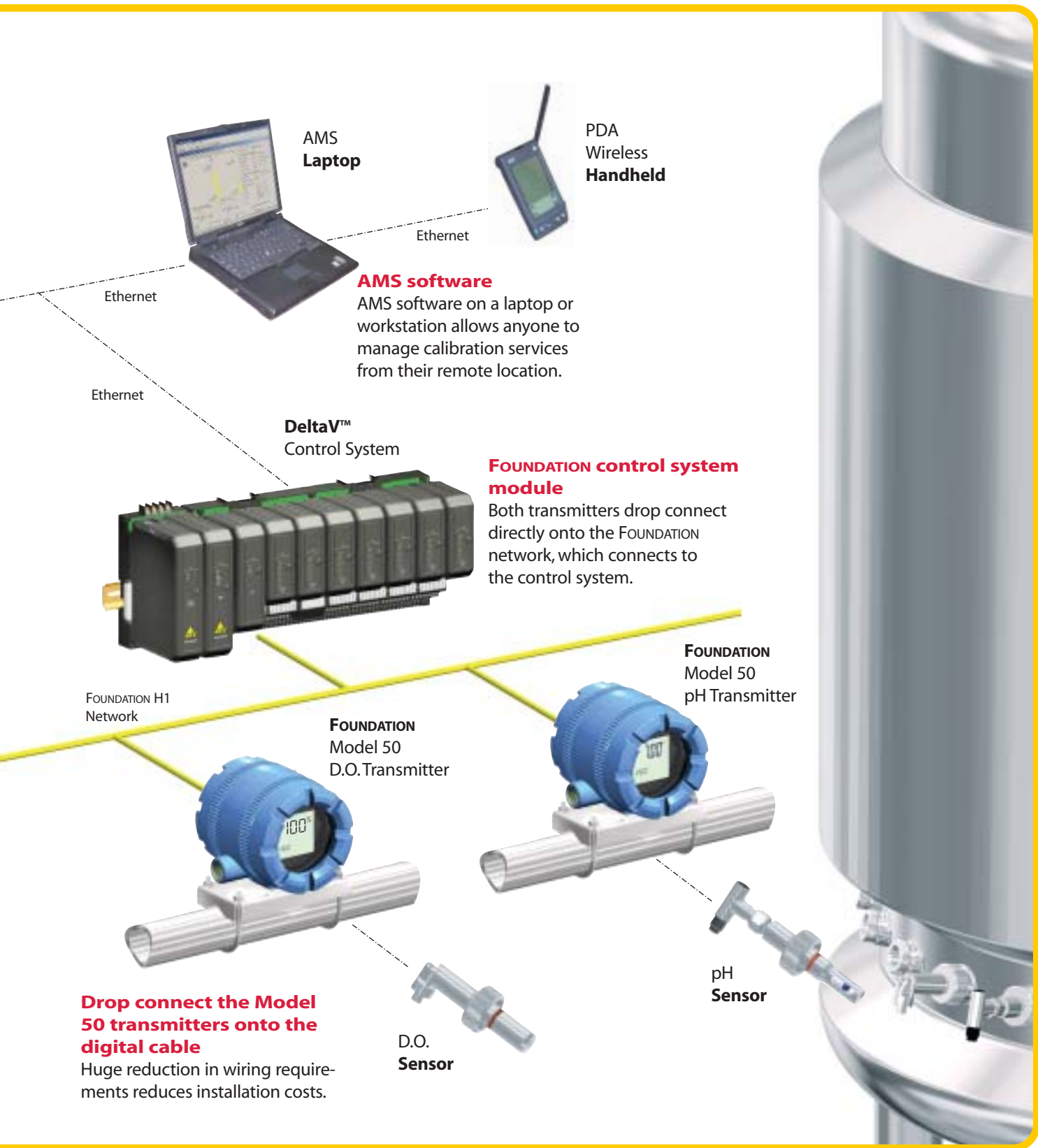
Monitor the ENTIRE bioprocess loop from your control system workstation

The control system, connected to all of the smart devices, brings full field device data into the control room.

Remote Process Monitoring



Active process measurement and monitoring via an interface software package, such as Asset Management Solutions (AMS), enables the simultaneous viewing of process data such as % sat, raw nA, temperature, pH, and mV.



AMS Laptop

PDA Wireless Handheld

AMS software
AMS software on a laptop or workstation allows anyone to manage calibration services from their remote location.

DeltaV™
Control System

FOUNDATION control system module
Both transmitters drop connect directly onto the FOUNDATION network, which connects to the control system.

FOUNDATION H1 Network

FOUNDATION Model 50
D.O. Transmitter

FOUNDATION Model 50
pH Transmitter

Drop connect the Model 50 transmitters onto the digital cable

Huge reduction in wiring requirements reduces installation costs.

D.O. Sensor

pH Sensor



FOUNDATION™ fieldbus pH Transmitter

pH



Model 50 pH Transmitter (pipe mount)

Model 50 — 2-wire pH/ORP Transmitter

- **COMPREHENSIVE pH SENSOR DIAGNOSTICS** warn user of the need for calibration, maintenance, or sensor replacement.
- **EASY TO USE MENUS** with plain language prompts guide the user through calibration and programming procedures.
- **INTRINSICALLY SAFE DESIGN** allows the transmitter to be used in hazardous environments (with appropriate safety barriers).
- **REMOTE COMMUNICATION IS SIMPLE**; use the hand-held infrared remote controller or FOUNDATION™ fieldbus host.

ordering information

Part Number	Description	Price
50-B-PH	Model 50 pH Transmitter	
AM-9490	Pipe Mount Kit	
AM-9377	Cable Grips, Package of 3	

Specifications

	pH
pH Measurement Range	0 to 14 pH
Temperature Measurement Range	-15 to 100° C
Display Resolution	± 0.01 pH
Output Repeatability	± 0.01 pH

FEATURES & APPLICATIONS FOR pH AND D.O. TRANSMITTERS

FOUNDATION FIELDBUS:

The Model 50 is the pH and D.O. solution for biotech installations requiring FOUNDATION fieldbus communication. This solution offers:

- Speed - 31.25 kbit/s
- Bidirectional Communication of Process Data
- Pure Digital Format for Data Transmission

- Automatic Device Detection and Addressing
- Remote Configuration and Calibration
- Active Measurement, Monitoring and Control

REMOTE COMMUNICATIONS:

The push button infrared remote controller works from as far away as six feet. The Model 50 also commu-

nicates via any FOUNDATION fieldbus host.

DIAGNOSTICS:

The internal diagnostics can detect:

- Calibration Error
- High Temperature Error
- Line Failure
- ROM Failure
- Low Temperature Error
- Sensor Failure



FOUNDATION™ fieldbus D.O. Transmitter

Model 50 — 2-wire D.O. Transmitter

■ CONTINUOUS D.O. SENSOR DIAGNOSTICS monitor D.O. sensor performance and warn user of impending problems.

■ ROBUST NEMA 4X and EXPLOSION PROOF enclosure protects the Model 50 transmitter from harsh plant environments.

■ DIFFERENT LEVELS OF SECURITY allow restricted access to the transmitter configuration and reconfiguration modes via user security codes.

■ REMOTE COMMUNICATION IS SIMPLE; use the hand-held infrared remote controller or FOUNDATION™ fieldbus host.

Dissolved Oxygen



Model 50 D.O. Transmitter (pipe mount)

Specifications

	D.O.
D.O. Measurement Range	0 to 999.99% sat
Temperature Measurement Range	0 to 50° C
Pressure Range	0 to 9 bar
Display Resolution	0.1% sat
Output Repeatability	± 1% of full scale

ordering information

Part Number	Description	Price
50-B-DO	Model 50 D.O. Transmitter	
AM-9490	Pipe Mount Kit	
AM-9377	Cable Grips, Package of 3	

- CPU Failure
- Input Warning

Once one of the above is diagnosed, the LCD will display a message describing the failure/default, and an alarm will display at the remote monitoring workstation.

CALIBRATION: To reduce errors the Model 50 does not accept calibration data until programmed sta-

bility limits have been met. If the data is not acceptable, the transmitter displays an error message and does not update the calibration.

DISPLAY: The 0.8-inch high LCD main display means values are easy to read even at a distance.

SECURITY: Access to configuration and reconfiguration modes

may be restricted via three levels of user selected security codes.

CASE: Epoxy painted aluminum.

POWER: A power supply voltage of 9 VDC to 32 VDC at 22 mA is required.

more information is available at www.biotechcatalog.com

What is AMS?

Asset Management Solutions

■ AMS refers to a broad selection of third party Asset Management Solutions (AMS) software applications that can be installed on the control system PC or any remote PC and can be used to monitor the digital data from any HART® or FOUNDATION™ fieldbus enabled field device.

■ AMS software provides an operator interface between the HART or FOUNDATION fieldbus enabled field device and the remote PC, which is networked to the control system via simple Ethernet.

■ AMS software provides the remote operator with complete access to both the primary variable and many secondary variables transmitted digitally by the HART or FOUNDATION fieldbus enabled field device.

■ AMS software enables the remote operator to check the field device measurement output, reconfigure the device, check calibration logs, and check error alerts without having to be present in the fermentation or cell culture suite.

■ AMS software allows the operator to associate SOPs, device drawings, and notes with a particular device. The operator can also cut, copy, paste, scan, link or enter information about a particular device in its Drawings/ Notes area.

■ AMS software applications have the potential to greatly aid the implementation of 21 CFR Part 11 compliance. In the near future, AMS applications will offer additional features such as name and password security, signature linking, and data encryption tools.

Reduce Costs, Improve Performance

AMS software applications are money-saving predictive-maintenance tools. Installed on networked workstations, these PC based software solutions are designed to streamline all maintenance activities related to both the instrumentation and the sensors. These AMS software applications provide operators with remote access to HART and FOUNDATION fieldbus enabled field devices and automatically capture all instrument maintenance infor-



AMS Software
(installed on a laptop
and networked to the
DCS control system)

mation including logs of calibration procedures. Maintenance activities can be validated and better scheduled with AMS activity logs. Furthermore, with access to both primary and secondary variables provided by the field device via the HART or FOUNDATION fieldbus digital signal, the AMS software can perform advanced diagnostics of the transmission line, the instrument, and the sensor itself.

AMS changes the way the operator views the bioprocess facility by allowing the operator to review the online performance of a large number of field analyzers from a remote workstation. Error alerts from any field analyzer can be viewed from the desktop PC and actions immediately initiated without having to first visit the fermentation or cell culture suite and inspect the instrument display. This saves time and resources and enables quicker response to rapidly changing situations.

AMS works together with HART and Foundation fieldbus enabled analyzers to provide operators with more information to make the best decision in the shortest amount of time. The AMS software application is a powerful tool for the bioprocess operator to use for field device configuration, documentation, calibration management, and diagnostics.

TIPS & HINTS

Reduce Trips into the Suite



A supervisor is able to monitor the entire bio-process loop from an office workstation or laptop, minimizing trips into the fermentation or cell culture suite.

No more gowning up several times a day just to check on the process.

REMOTE CONFIGURATION

Using AMS software, maintenance technicians can check a device remotely, configure, update calibration results, and

maintain an audit trail on calibrations.

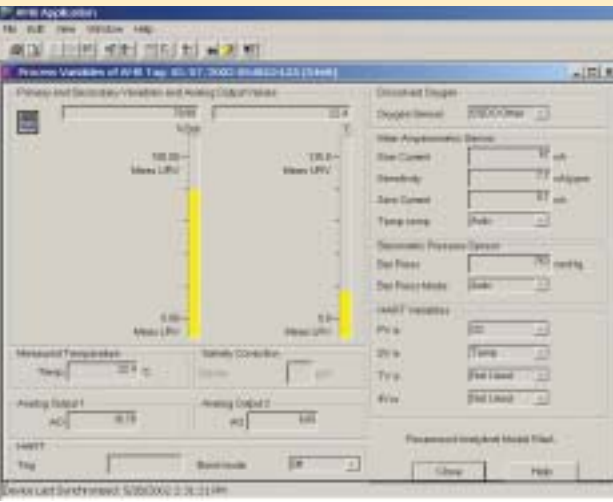
CONTINUAL MONITORING ONLINE

People in maintenance or manufacturing can also use AMS software to continually monitor critical measurements to know immediately if there is a problem. All of this adds up to significant savings as problems are intercepted before they cause major process upsets.

SAVE TIME

In the area of device diagnostics, AMS software accesses the information embedded in the HART and fieldbus devices. This information allows you to troubleshoot "problem" instruments remotely, so you are not wasting time entering the fermentation or cell culture suite.

FEATURES AND BENEFITS



WINDOWS BASED SOFTWARE

AMS lets you build a powerful database of equipment and information that offers Windows Explorer-style drag-and-drop configuration and calibration test definitions.

STANDARD LOOK AND FEEL

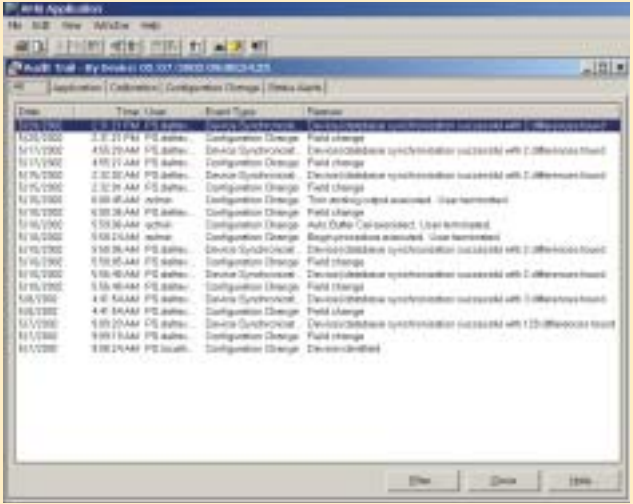
You can use AMS for HART and fieldbus devices. In the area of configuration, there is a standard look and feel. This means you have access to multiple field device parameters in which to read and write information on a single, easy to use screen.

EASY INSTALLATION AND STARTUP

AMS software gives you better visibility to each device in your plant. Payoffs include easier installation and startup, lower maintenance costs, and improved device performance — all with a direct impact on your bottom line.

AUDIT TRAIL

The audit trail feature of AMS software allows automated tracking of calibration procedures, such as As Left and As Found.



Section Two

FermProbe® pH Electrodes

Steam Sterilizable and Autoclavable

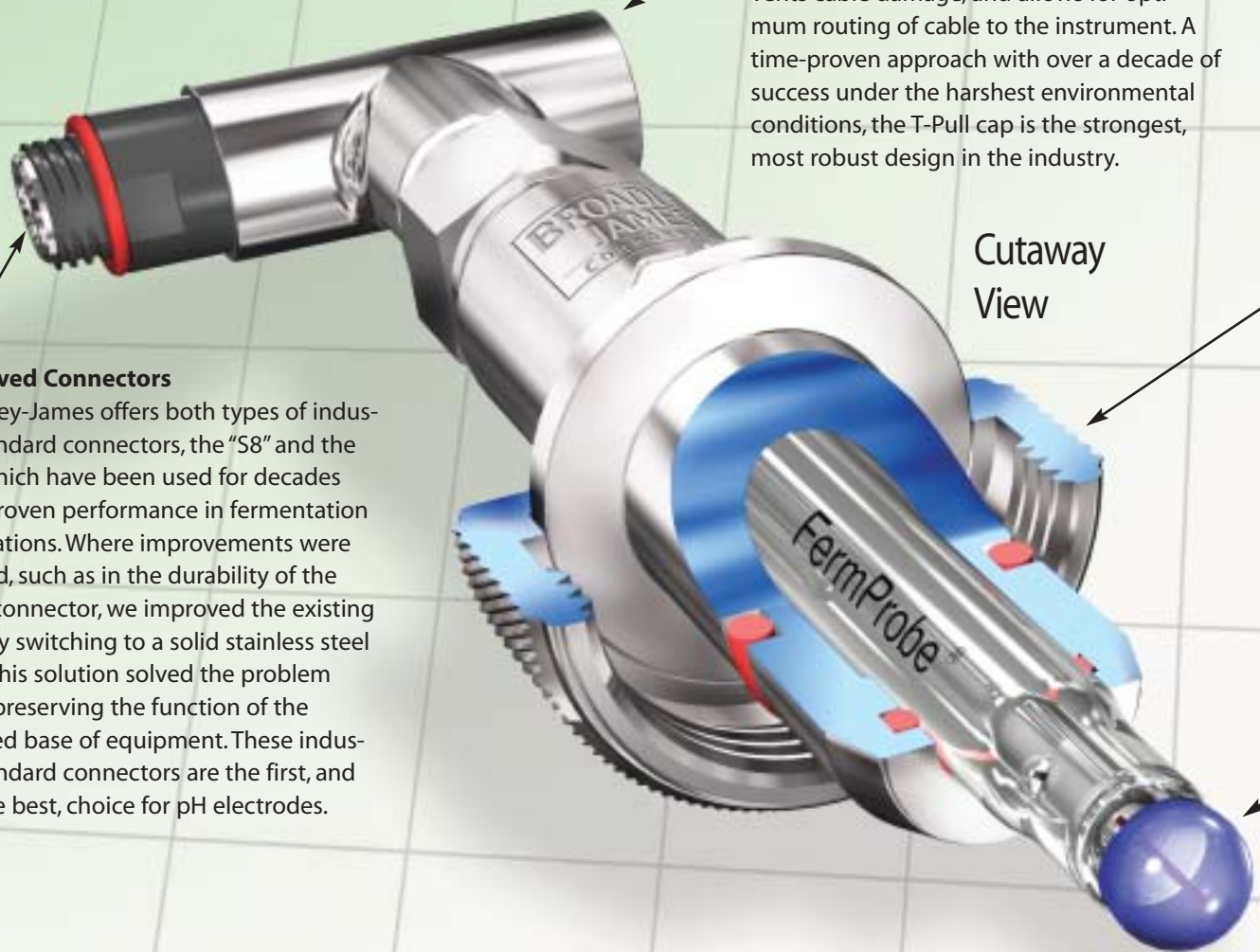
Original T-Pull® Cap

A concept pioneered by Broadley-James, this unique approach greatly improves the serviceability of pH electrodes. The rugged cap facilitates removal from the vessel, prevents cable damage, and allows for optimum routing of cable to the instrument. A time-proven approach with over a decade of success under the harshest environmental conditions, the T-Pull cap is the strongest, most robust design in the industry.

Cutaway View

Improved Connectors

Broadley-James offers both types of industry standard connectors, the "S8" and the "K9", which have been used for decades with proven performance in fermentation applications. Where improvements were needed, such as in the durability of the cable connector, we improved the existing style by switching to a solid stainless steel shell. This solution solved the problem while preserving the function of the installed base of equipment. These industry standard connectors are the first, and still the best, choice for pH electrodes.



Suitable for Hygienic Applications.

The FermProbe withstands Steam in Place (SIP) and caustic Clean in Place (CIP) applications. FDA compliant o-rings are used throughout.

Extra Rugged Design

The Broadley-James traditional 25 mm housing body provides a physically robust electrode-housing combination for harsh industrial production environments.

New and Improved pH Glass Bulb

The Broadley-James cobalt blue pH bulb offers the optimum blend of fast response and physical durability. Other manufacturers may have a very thick glass membrane, allowing for better survival of "accidents". However, these thick bulbs slow response and lead to noisy fluctuating readings. The current formula is the result of thousands of tests, subjecting the pH electrodes to 130°C steam for an hour, then quenching in cool water. Every FermProbe shipped is required to pass this test, and can be trusted to work out of the box, and keep on working while retaining its fast response.

pH Electrode Design**USP Pharmaceutical Grade Electrolyte Thickener**

To achieve longer life, the electrolyte inside a pH electrode is thickened with an additive. Broadley-James understands that anything that comes into contact with a product should be as safe as possible. For that reason Broadley-James does NOT use polyacrylamide gel like most other manufacturers. The residual acrylamide, which is always present, poses an unacceptable risk of contamination. Broadley-James uses only the purest form of CMC, the same material used in the coating and binding of pharmaceutical tablets.

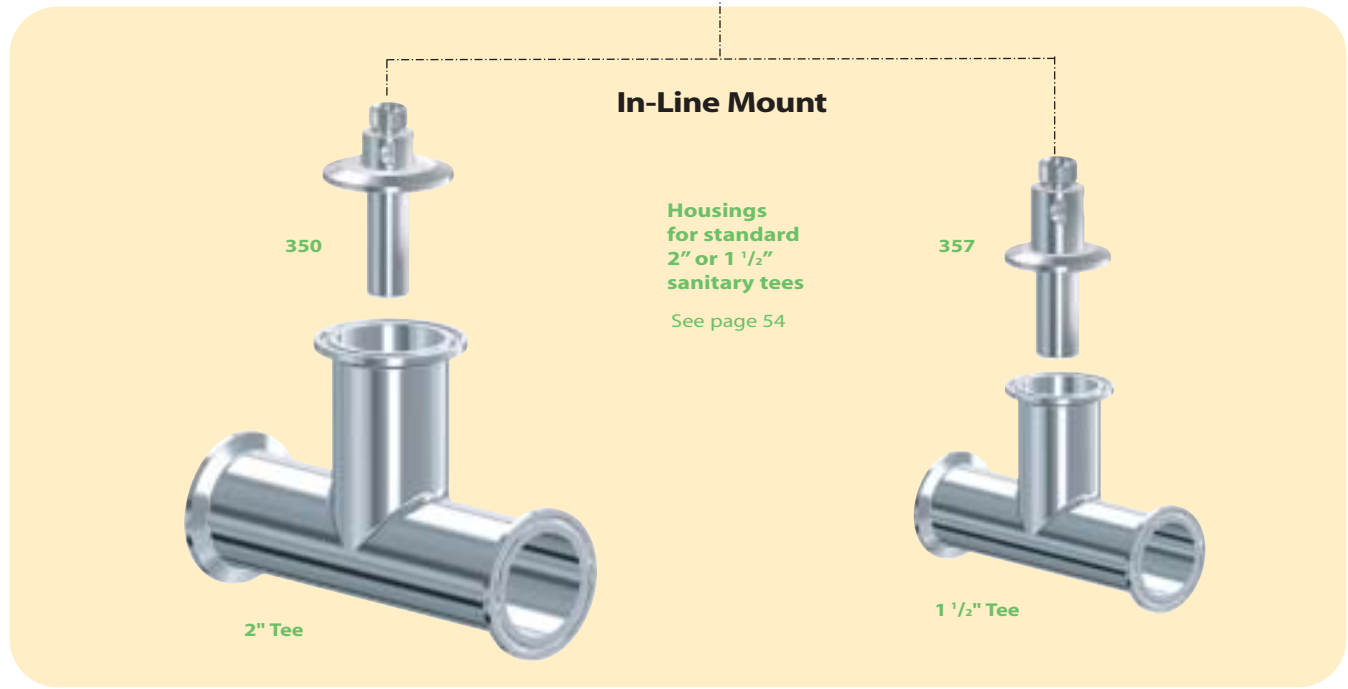
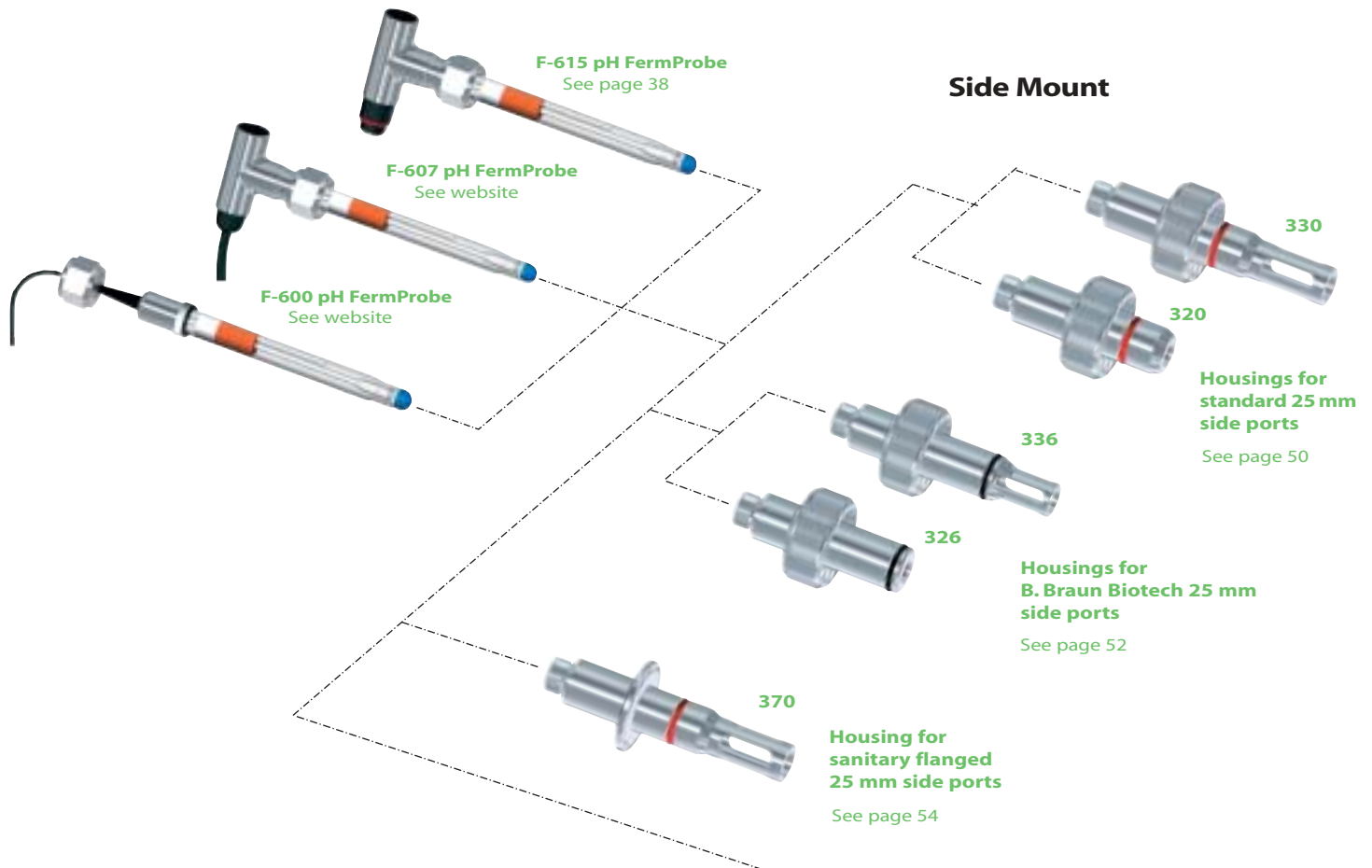
Universally Compatible

All Broadley-James pH electrodes work with existing biotech equipment, no proprietary electronics or cables are required. Broadley-James designs are intended to fit both existing and future requirements, without introducing any unnecessary changes in hardware or cabling. Reduces inventory and confusion, increases flexibility and cost savings.

The Market Leader in pH Electrode Design

Unlike other manufacturers, Broadley-James does not believe in changing the basic design every few years forcing customers into buying new equipment to keep current. Instead, Broadley-James strives to make improvements "backwards compatible" so they can be used with new electronics as well as the old. No changing of connectors which would require new cabling to be run throughout the suite, no unnecessary internal RTD's that would require new SOP's and increase risk of failure. Instead, Broadley-James strives to protect investments, and help leverage them into the future. Improvements are made with your process in mind.

FermProbe® pH Electrode and Housing System Overview



F-695 FermProbe with K9 cap
See page 42

F-635 FermProbe with S8 cap
See page 40

Side Mount

335

325
Standard 25 mm
See page 56

356

346
B. Braun Biotech
See page 52

Metric Housings for 25 mm side ports

Headplate with Pg 13.5 threads

Top Mount

380
Short

380
Extended

381

382

383

Metric Housings for 3/4" DIN Ports
See website

Metric Housings for 19 mm Ports
See website

How to Select a FermProbe® pH Electrode

STYLE 1 (see page 38)

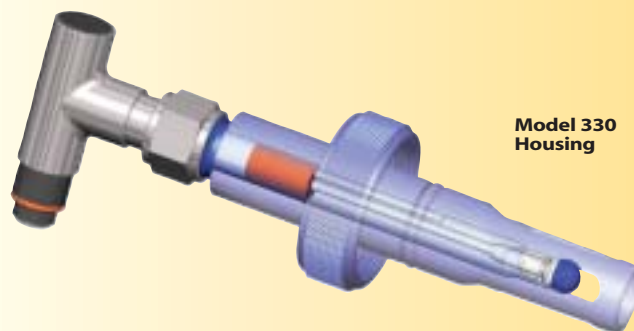
FermProbe® pH Electrodes with T-Pull® Cap

The T-Pull cap eases installation and removal of the electrode from the housing and greatly reduces fatigue of the extension cable. The electrode can be removed from the housing without rotating the electrode and twisting the cable, further reducing cable fatigue.

Features:

- Rugged T-Pull cap eases electrode removal. No tools required.
- T-Pull design greatly reduces cable fatigue.
- Electrode retainer nut is part of handle. Cannot be lost or misplaced.
- Standard S8 detachable cable connection
- Available in both disconnect cap and integral cabled versions.

F-615 pH electrode with T-Pull cap



Model 330 Housing

Model F-615 pH FermProbe

STYLE 2 (see page 40)

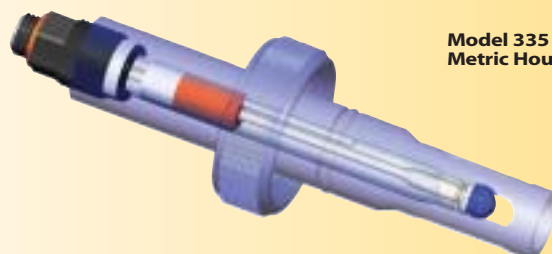
FermProbe® pH Electrodes with Standard S8 Metric Cap

This FermProbe style features a standard S8 detachable cable connection on a metric threaded polymer cap that allows the electrode to be used with European style electrode housings. The design requires the rotation of the electrode during installation. It is compatible with Euro-designed housings requiring a metric Pg13.5 threaded electrode cap.

Features:

- Standard S8 detachable cable connection
- Polymer disconnect cap with metric Pg13.5 threads.
- Compatible with European designed bioprocess housings.

F-635 pH electrode with S8 metric cap



Model 335 Metric Housing

Model F-635 pH FermProbe

STYLE 3 (see page 42)

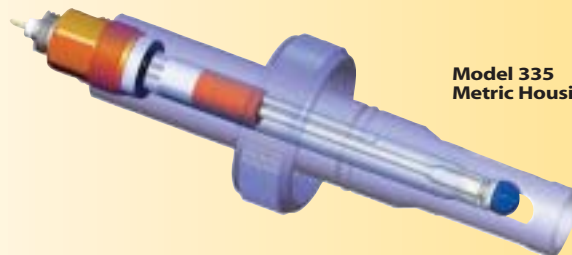
FermProbe® pH Electrodes with K9 Metric Cap

This FermProbe style features a K9 detachable cable connection on a metric threaded polymer cap that allows the electrode to be used with European style electrode housings. The design requires the rotation of the electrode during installation. It is compatible with Euro-designed housings requiring a metric Pg13.5 threaded electrode cap.

Features:

- K9 detachable cable connection
- Polymer disconnect cap with metric Pg13.5 threads.
- Compatible with European designed bioprocess housings.

F-695 pH electrode with K9 metric cap



Model 335 Metric Housing

Model F-695 pH FermProbe

How to Match Electrodes to Housings

Housings and FermProbe® pH electrodes are offered in a variety of lengths. This enables fermentation operators to select the optimum insertion length for the application at hand. The housing *ordering information* box lists the suitable electrode models and lengths for each particular housing style.

There is another way to match electrodes to housings. Each housing length is given a letter classification, i.e., "A", "B", "C". Each electrode length is given a similar letter classification. Any Class "A" pH electrode will fit into any Class "A" housing listed in this catalog. Similarly, any Class "B" electrode will fit into any Class "B" housing. By matching the classifications, the electrode and housing will match.

The class information is found in the *ordering information* box for any electrode or housing in this catalog. If the class letters are the same for an electrode and a housing then the two can be used together. See the illustrated example below:

For a Perfect Match Every Time:

- (1) Choose a housing for the vessel and application.
- (2) Note the class of the housing (i.e., A, B, C) in the *ordering information* box.
- (3) Choose a style and model of electrode (see opposite page).
- (4) Find the class of electrode that matches the class of the chosen housing.

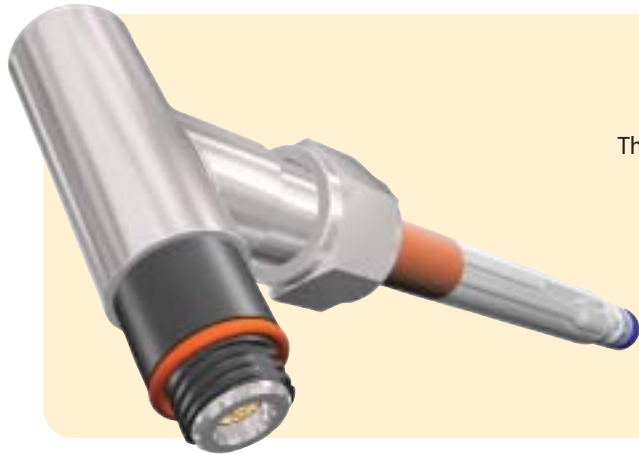
SEE EXAMPLE BELOW



ordering information						
Housing Model	Class	Vessel Insertion Length		Used With These pH Electrode Models	Use With This Electrode Length	Housing Part Number
Housings Without Protective Bulb Guards						
320	A	38 mm	1.5"	F-615, F-607, F-600	130 mm	320-61-H070
320	B	66 mm	2.6"	F-615, F-607, F-600	160 mm	320-61-H100
320	C	114 mm	4.5"	F-615, F-607, F-600	210 mm	320-61-H150
Housings With Protective Bulb Guards						
330	A	53 mm	2.1"	F-615, F-607, F-600	130 mm	330-61-H070
330	B	81 mm	3.2"	F-615, F-607, F-600	160 mm	330-61-H100
330	C	127 mm	5.0"	F-615, F-607, F-600	210 mm	330-61-H150

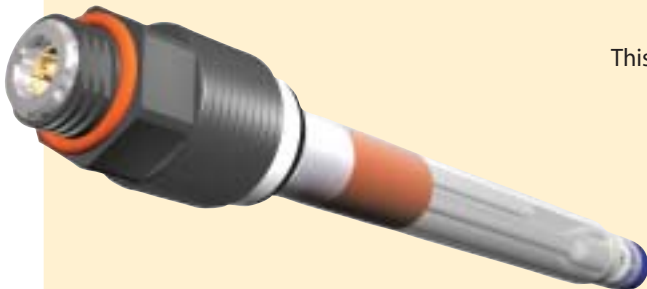
ordering information						
Electrode Model	Class	Use With These Housing Models			Electrode Length	Electrode Part Number
Model F-615 pH FermProbe with T-Pull Handle & Disconnect Cap						
F-615	A	320, 330, 326, 336, 350, 357, 370			130 mm	F-615-B130-DH
F-615	B	320, 330			160 mm	F-615-B160-DH
F-615	C	320, 330			210 mm	F-615-B210-DH

What's the difference between the 3 cap styles?



T-Pull® Cap

The T-Pull handle eases installation and removal of the electrode from the housing and greatly reduces fatigue of the extension cable. The electrode can be removed from the housing without rotating the electrode and twisting the cable. Also, the retainer nut is part of the handle and cannot be lost or misplaced. This FermProbe® style has a standard S8 detachable cable connection on a metric threaded polymer cap that allows it to be used with European style electrode housings.



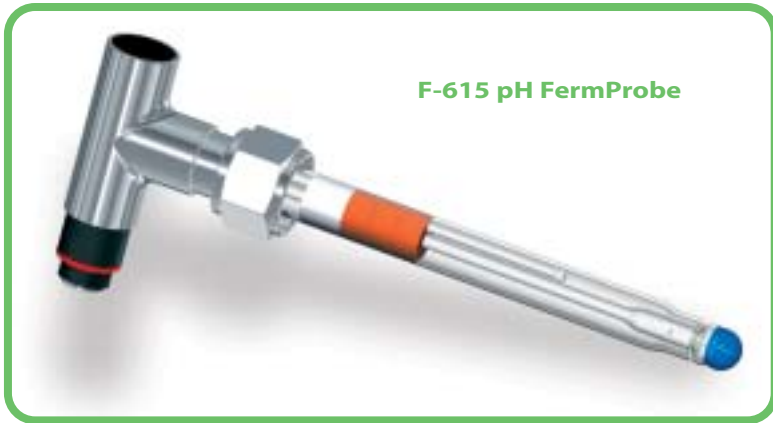
Standard S8 Metric Cap

This FermProbe® style features a standard S8 detachable cable connection on a metric threaded polymer cap that allows the electrode to be used with European style electrode housings. The standard metric cap is a newer autoclavable design that protects the connector pin from breakage. The design requires the rotation of the electrode during installation. It is compatible with Euro-designed housings requiring a metric Pg13.5 threaded electrode cap.

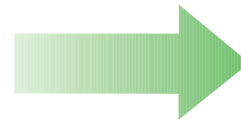


K9 Metric Cap

The original K9 autoclavable cap design is still used in many existing bioprocess systems. This FermProbe® style features a K9 detachable cable connection on a metric threaded polymer cap that allows the electrode to be used with European style electrode housings. The design requires the rotation of the electrode during installation. It is compatible with Euro-designed housings requiring a metric Pg13.5 threaded electrode cap.



T-Pull[®]
cap style



For electrode
see page 38

For cable
see page 98



Standard S8 Metric
cap style



For electrode
see page 40

For cable
see page 98



K9 Metric
cap style



For electrode
see page 42

For cable
see page 100

T-Pull[®] pH FermProbe[®] — Style 1

The T-Pull style FermProbe pH electrodes are designed to be used in bioprocess applications where CIP/SIP procedures are used. Built to withstand repeated steam sterilization cycles, the FermProbe quickly stabilizes after steam exposure to be back on-line in half the time of other electrodes. This rugged, low impedance, process pH electrode continues to provide fast and precise pH measurements even after harsh use and prolonged steam exposure.

The FermProbe design specifies that the pH electrode be secured to the housing by a free-spinning threaded retainer nut. This allows the electrode to be installed or removed from the housing without twisting or disconnecting the electrode cable.

FermProbe pH electrodes are available in various lengths to accommodate particular applications and housings.



Model F-615
pH FermProbe
with T-Pull cap

130 mm
length

FermProbe pH Electrode Specifications:

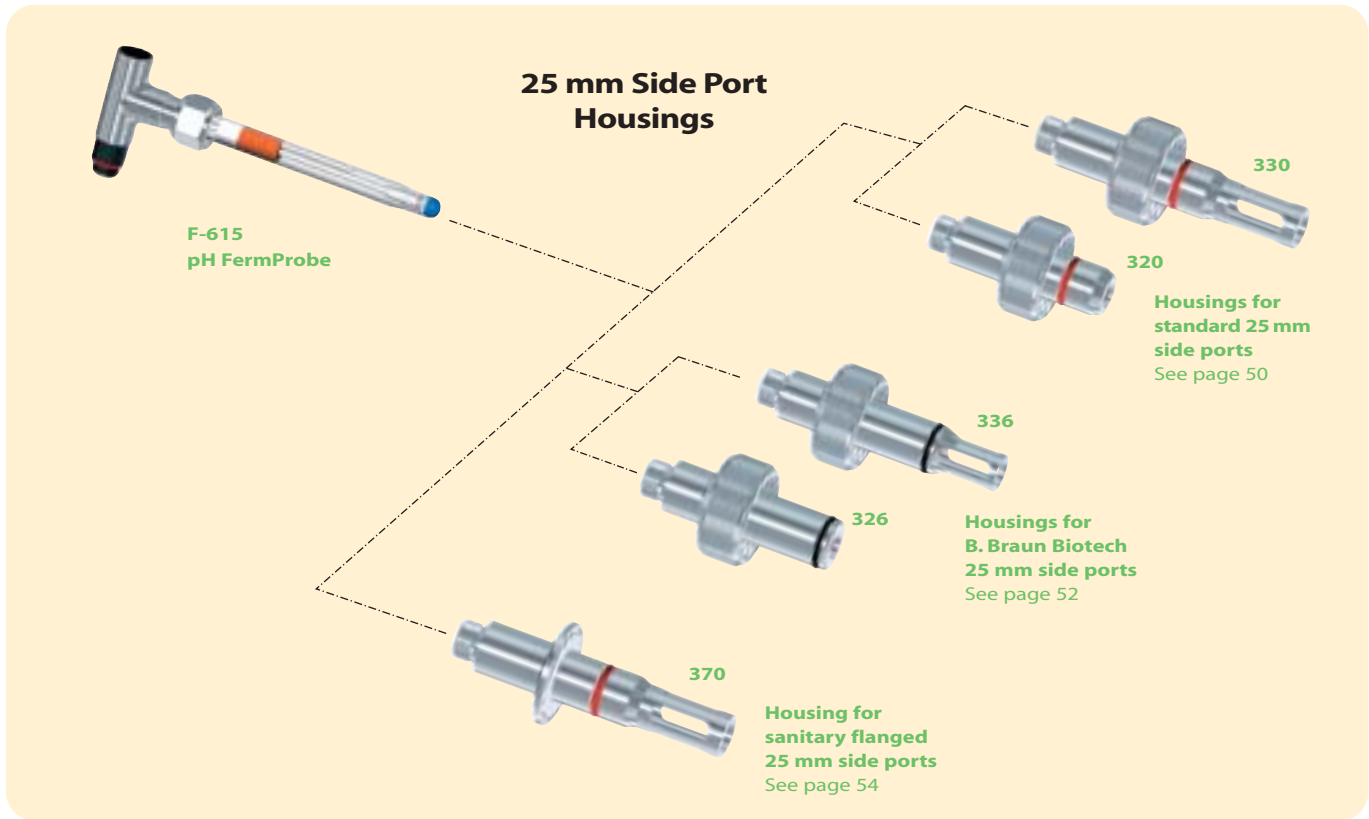
- 0–14 pH range
- Steam sterilizable to 135° C
- 150 psig maximum pressure
- Double junction, Ag-AgCl reference system
- Electrode secures to housing with threaded retainer nut
- S8 disconnect connector in T-Pull cap

FermProbe pH Electrodes with T-Pull Cap

The T-Pull cap eases installation and removal of the electrode from the housing and greatly reduces fatigue of the extension cable. The electrode can easily be removed from the housing without rotating the electrode or twisting the cable, further reducing cable fatigue.

Features:

- Rugged T-Pull cap design eases removal of electrode from housing. No tools required.
- Greatly reduces cable fatigue.
- Electrode retainer nut is part of the handle. Cannot be lost or misplaced.
- Available with integral cable.



How to Order an Electrode

(1) Choose Electrode Model.

If the electrode needs to fit an existing cable, check the cable connector and note its color. If the cable connector is black and has an S8 connector, use the F-615 or F-635 FermProbe. If the cable connector is red or orange and has a K9 connector, use the F-695 FermProbe.

(2) Choose Electrode Length.

If you have already chosen a housing, select an electrode length

with the same Class designation as the housing. For more information on selection of housings, see pages 44–47. The housing *ordering information* box also lists the correct electrode length to order. If you have not already chosen the housing, please review the recommendations next to each electrode model below.

(3) Confirm Cable Length and Connector.

Model F-615 pH electrodes require an S8 disconnect cable and connector assembly. See pages 98 and 99.

ordering information

Electrode Model	Class	Use With These Housing Models	Electrode Length	Electrode Part Number	Electrode Price
Model F-615 pH FermProbe with T-Pull Cap & S8 Disconnect Connector					
F-615	A	320, 330, 326, 336, 350, 357, 370	130 mm	F-615-B130-DH	
F-615	B	320, 330	160 mm	F-615-B160-DH	
F-615	C	320, 330	210 mm	F-615-B210-DH	

pH FermProbe® with S8 Metric Cap — Style 2

This FermProbe pH electrode has the standard Broadley-James S8 connector. Additionally, it features a metric threaded, polymer cap which allows it to be used with European style electrode housings.

All FermProbe pH electrodes are designed to be used in bioprocess applications where CIP/SIP procedures are used. Built to withstand repeated steam sterilization cycles, the FermProbe quickly stabilizes after steam exposure to be back on-line in half the time of other electrodes. This rugged, low impedance, process pH electrode continues to provide fast and precise pH measurements even after harsh use and prolonged steam exposure.



FermProbe pH Electrode Specifications:

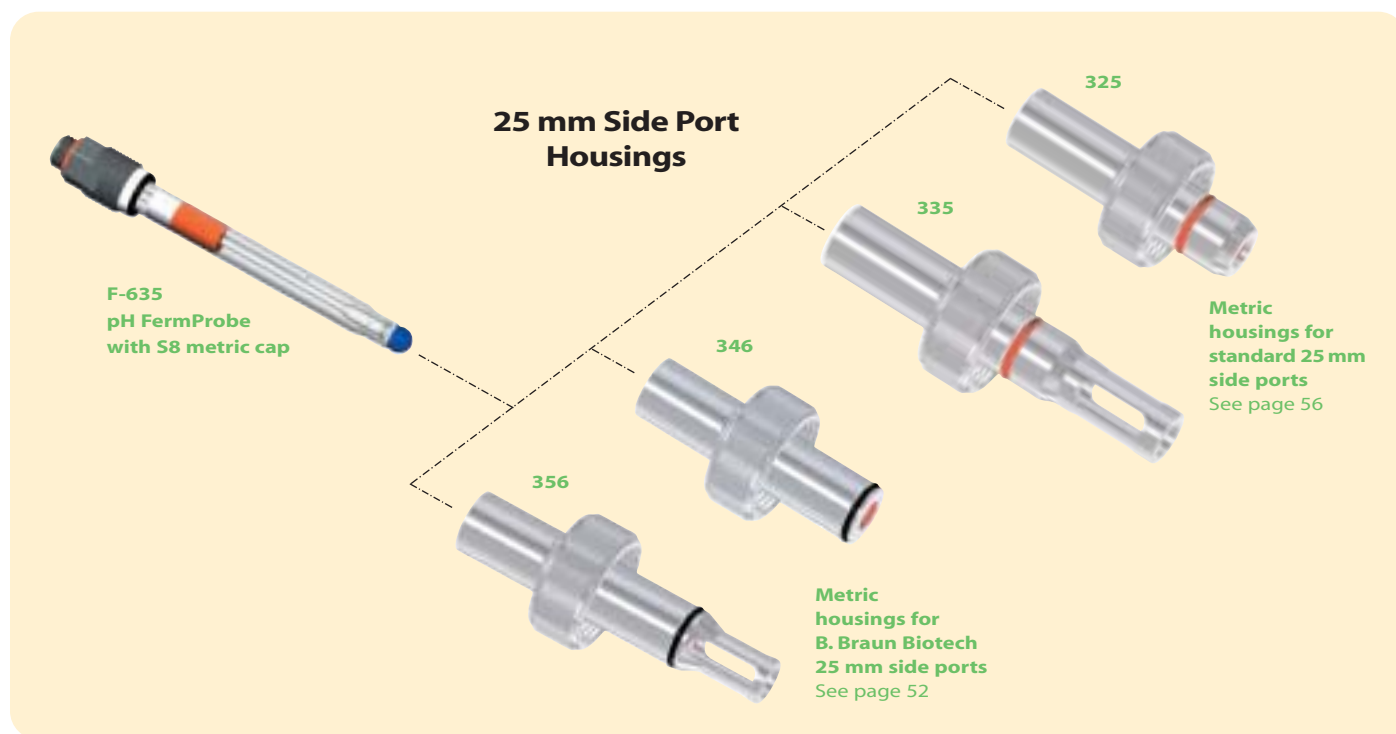
- 0–14 pH range
- Steam sterilizable to 135° C
- 150 psig maximum pressure
- Double junction, Ag-AgCl reference system
- Electrode secures to housing with threaded retainer nut
- S8 disconnect connector in a metric PG 13.5 threaded cap

FermProbe pH Electrodes with S8 Metric Cap

This FermProbe style features a standard S8 detachable cable connector on a metric Pg13.5 threaded polymer cap, which allows it to be used with European style electrode housings. Autoclavable as well as steam sterilizable, this style of pH FermProbe is the first choice for use with small autoclavable benchtop vessels.

Features:

- Metric threaded cap is compatible with nearly all European designed bioprocess electrode housings.
- Steam sterilizable and autoclavable.
- First choice for use with small autoclavable vessels.
- Available in a variety of lengths for different insertion length requirements and applications.



How to Order an Electrode

(1) Choose Electrode Model.

If the electrode needs to fit an existing cable, check the cable connector and note its color. If the cable connector is black and has an S8 connector, use the F-615 or F-635 FermProbe. If the cable connector is red or orange and has a K9 connector, use the F-695 FermProbe.

(2) Choose Electrode Length.

If you have already chosen a housing, select an electrode length

with the same Class designation as the housing. For more information on selection of housings, see pages 44–47. The housing *ordering information* box also lists the correct electrode length to order. If you have not already chosen the housing, please review the recommendations next to each electrode model below.

(3) Confirm Cable Length and Connector.

Model F-635 pH electrodes require an S8 disconnect cable and connector assembly. See pages 98 and 99.

ordering information

Electrode Model	Class	Use With These Housing Models	Electrode Length	Electrode Part Number	Electrode Price
Model F-635 pH FermProbe with Standard S8 Metric Cap					
F-635	D	325, 335	120 mm	F-635-B120-DH	
F-635	F	325, 335	200 mm	F-635-B200-DH	
F-635	G	380, 381, 382, 383	225 mm	F-635-B225-DH	
F-635	H	380, 381, 382, 383	325 mm	F-635-B325-DH	
F-635	X	Extended lengths for use with: compression fittings, short guide tube versions of Models 380 and 382 or thread directly into vessel's headplates	420 mm	F-635-B420-DH	
F-635	X		480 mm	F-635-B480-DH	

pH FermProbe with K9 Metric Cap — Style 3

The FermProbe pH electrode is available with the K9 metric cap style. This K9 connector cap expands the Broadley-James offering to make it completely compatible with any existing system, regardless of the installed cable type.

All FermProbe pH electrodes are designed to be used in bioprocess applications where CIP/SIP procedures are used. Built to withstand repeated steam sterilization cycles, the FermProbe quickly stabilizes after steam exposure to be back on-line in half the time of other electrodes. This rugged, low impedance, process pH electrode continues to provide fast and precise pH measurements even after harsh use and prolonged steam exposure.



Model F-695
pH FermProbe
with K9 cap
120 mm length

FermProbe pH Electrode Specifications:

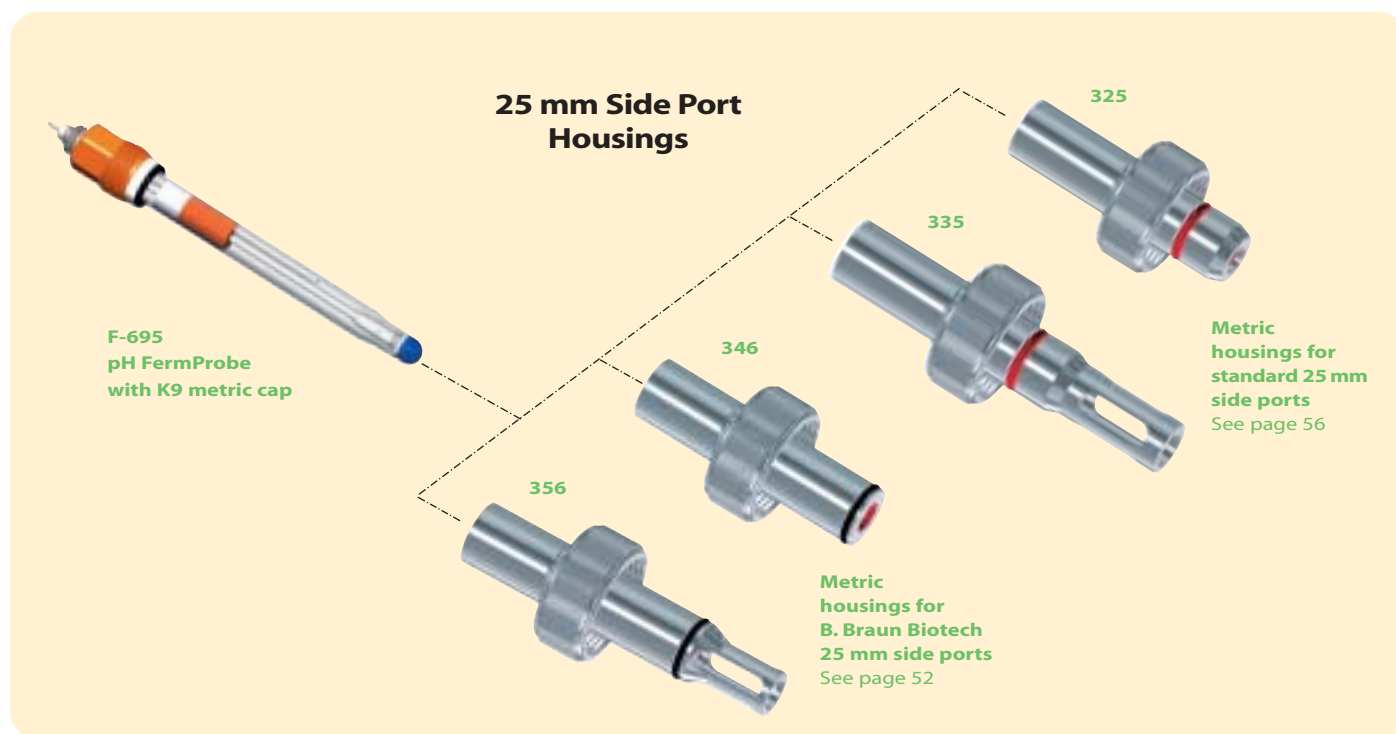
- 0–14 pH range
- Steam sterilizable to 135° C
- 150 psig maximum pressure
- Double junction, Ag-AgCl reference system
- Electrode secures to housing with threaded retainer nut
- K9 disconnect connector in a metric PG 13.5 threaded cap

FermProbe pH Electrodes with K9 Metric Cap

This FermProbe style features a K9 detachable cable connector on a metric Pg13.5 threaded polymer cap that allows it to be used with European style electrode housings. Autoclavable as well as steam sterilizable, this style of pH FermProbe is the first choice for use with small autoclavable benchtop vessels.

Features:

- Metric threaded cap is compatible with nearly all European designed bioprocess electrode housings.
- Steam sterilizable and autoclavable.
- First choice for use with small autoclavable vessels.
- Available in a variety of lengths for different insertion length requirements and applications.



How to Order an Electrode

(1) Choose Electrode Model.

If the electrode needs to fit an existing cable, check the cable connector and note its color. If the cable connector is black and has an S8 connector, use the F-615 or F-635 FermProbe. If the cable connector is red or orange and has a K9 connector, use the F-695 FermProbe.

(2) Choose Electrode Length.

If you have already chosen a housing, select an electrode length with

the same Class designation as the housing. For more information on selection of housings, see pages 44–47. The housing *ordering information* box also lists the correct electrode length to order. If you have not already chosen the housing, please review the recommendations next to each electrode model below.

(3) Confirm Cable Length and Connector.

Model F-695 pH electrodes require disconnect cable and connector assemblies. See the cable assemblies for pH electrodes with the K9 cap on pages 100 and 101.

ordering information

Electrode Model	Class	Use With These Housing Models	Electrode Length	Electrode Part Number	Electrode Price
Model F-695 pH FermProbe with K9 Metric Cap					
F-695	D	325, 335	120 mm	F-695-B120-DK	
F-695	F	325, 335	200 mm	F-695-B200-DK	
F-695	G	380, 381, 382, 383	225 mm	F-695-B225-DK	
F-695	H	380, 381, 382, 383	325 mm	F-695-B325-DK	
F-695	X	Extended lengths for use with: compression fittings, short guide tube versions of models 380 and 382 or thread directly into vessel's headplates	420 mm	F-695-B420-DK	
F-695	X		480 mm	F-695-B480-DK	

How to Choose a Housing Style: Identifying the Vessel Port Style

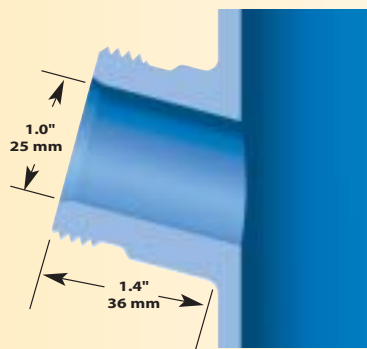
The electrode housing is designed to hold and protect the pH electrode while inserting it into the bioprocess vessel. There are various types of side entry ports and different

groups of housings to fit each port type. The size and make of the port must first be identified in order to narrow the selection process.

The three most common types of entry ports found on pilot and production scale vessels are as follows:

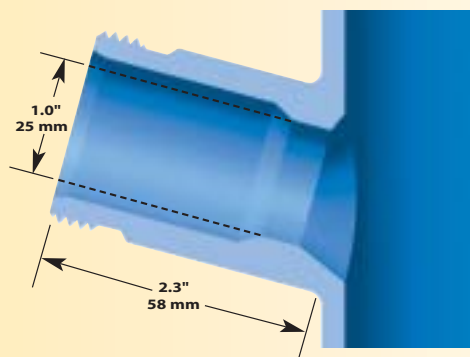
STANDARD 25 mm SIDE PORT

Found on nearly all vessels other than those manufactured by B. Braun Biotech. The port bore is 25 mm i.d. and the housing o-ring seals to the inside of the port. The housing is then secured to the port by a threaded retainer ring. The port is installed at a 15° angle for better electrode performance. See the cutaway drawing to the right for typical installation dimensions.



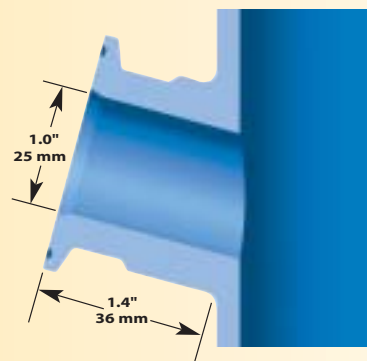
B. BRAUN BIOTECH 25 mm SAFETY SIDE PORT

Found exclusively on vessels manufactured by B. Braun Biotech. This style of port is longer than the standard port and needs a special housing to fit correctly. (Note: The port opening on newer tanks is 30 mm i.d. and the port narrows down to 25 mm i.d. at the critical point where the housing o-ring seals to the inside wall of the port.) Again, the port is installed at a 15° angle for better electrode performance. See the cutaway drawing to the right for typical installation dimensions.



SANITARY FLANGED 25 mm SIDE PORTS

This hybrid port uses the familiar 1.5" sanitary flange and clamp to secure the housing into a 25 mm i.d. port. The electrode housing o-ring still seals to the inside of the port. The sanitary flange seal is a backup seal in case of housing o-ring failure. The port is installed at a 15° angle for better electrode performance. See the cutaway drawing to the right for typical installation dimensions.

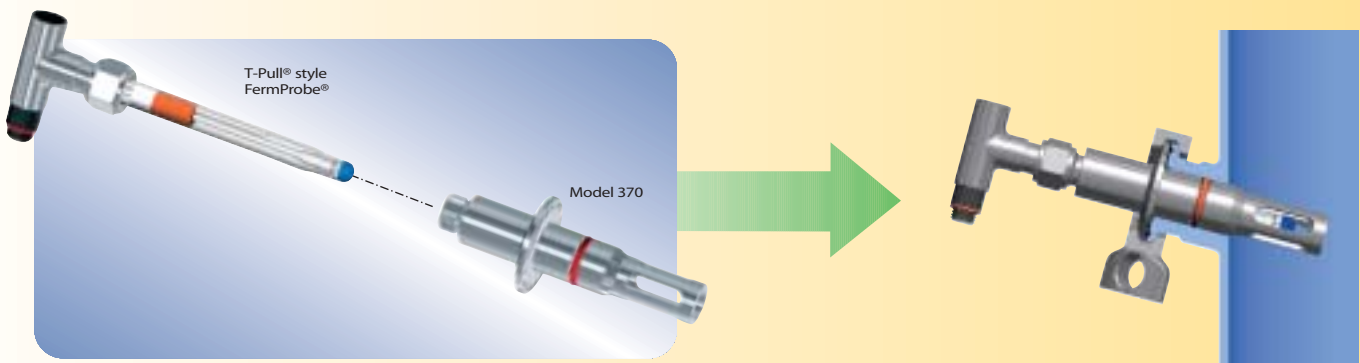
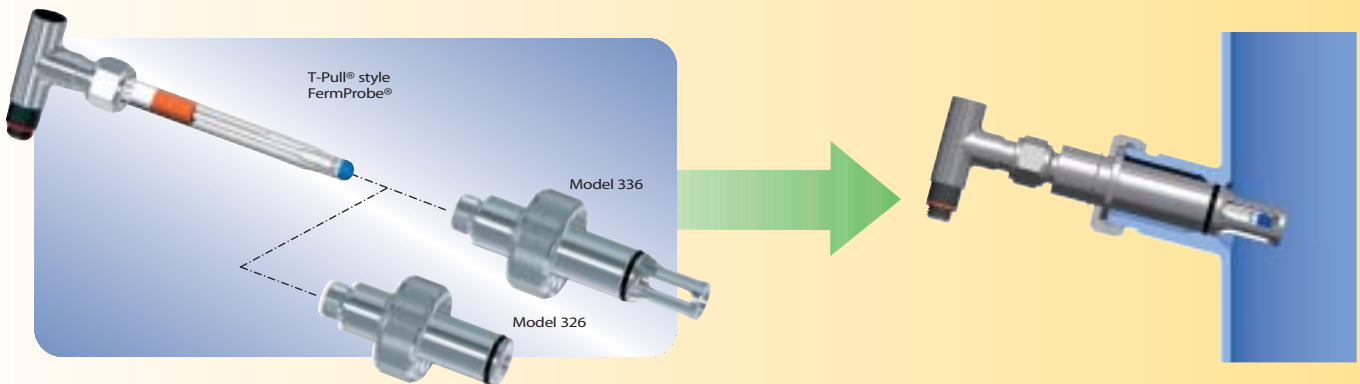
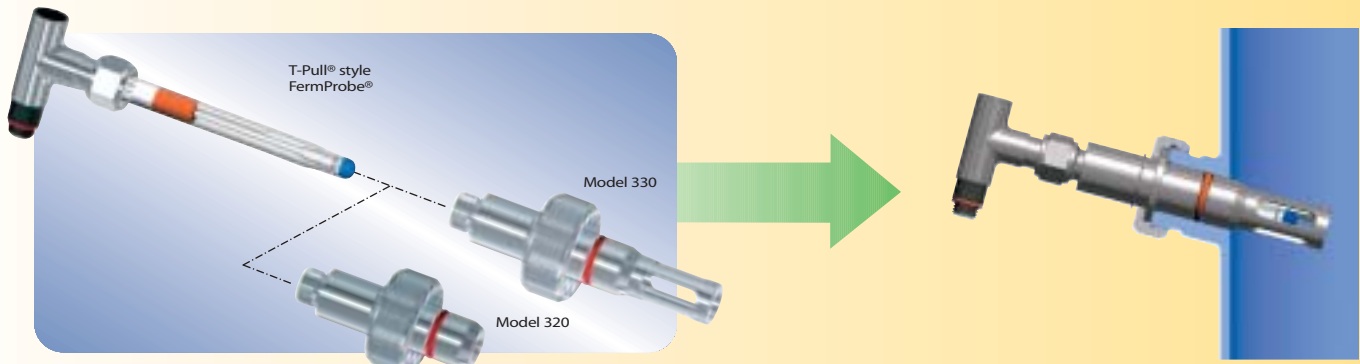




Dual pH electrode and D.O. sensor side ports on a B. Braun Biotech 400 liter bioreactor.

pH electrodes and housings available for this port.

Cutaway of vessel wall with housing and electrode installed.



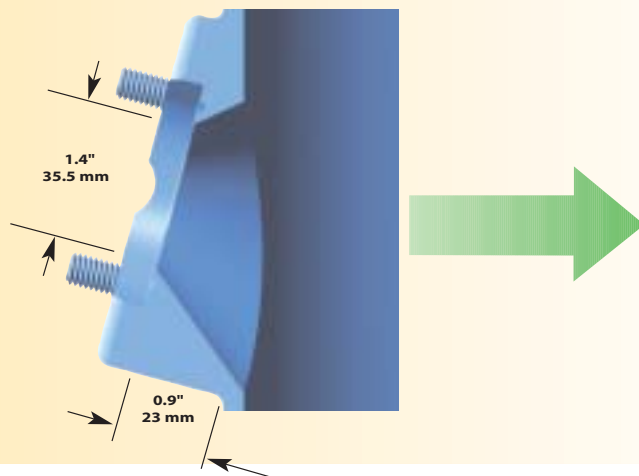
How to Choose a Housing Style: Additional Sanitary Installations

In addition to the standard types of entry ports found on the previous pages, there are other options for sanitary ports. These electrode housings are designed to hold and protect the pH electrode while insertion into sanitary pipe

tees and NovAseptic's sanitary side ports. Both entry ports require a unique housing with a narrow front end. Specifically housing models 357 and 367.

NOVASEPTIC SANITARY SIDE PORT

Sometimes found on vessels in biotech facilities, this style of port is flush to the vessel wall to minimize crevices. The unique design of the port offers increased drainage around the port and more effective Clean-In-Place (CIP). The NA-connect® port from NovAseptic is compatible with a special sanitary housing, which is secured to the port by a clamp. The port is installed at a 15° angle to allow for proper electrode performance. See the cutaway drawing to the right for typical installation dimensions.

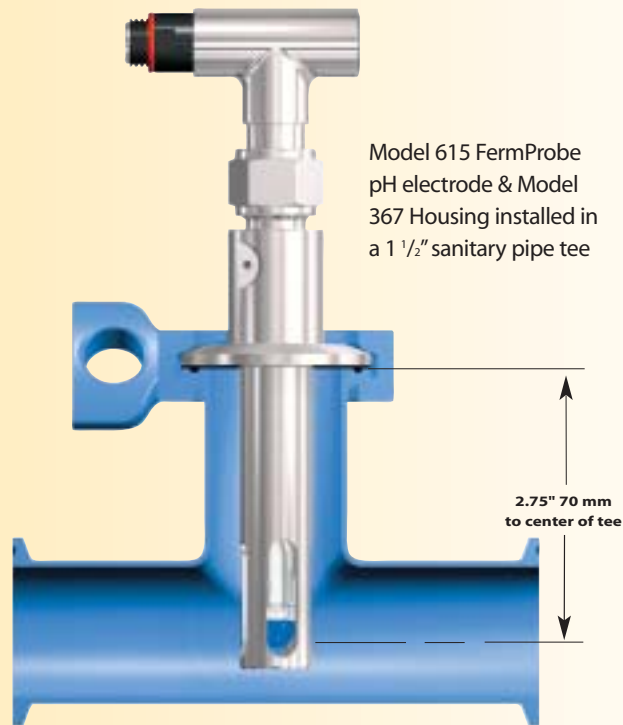


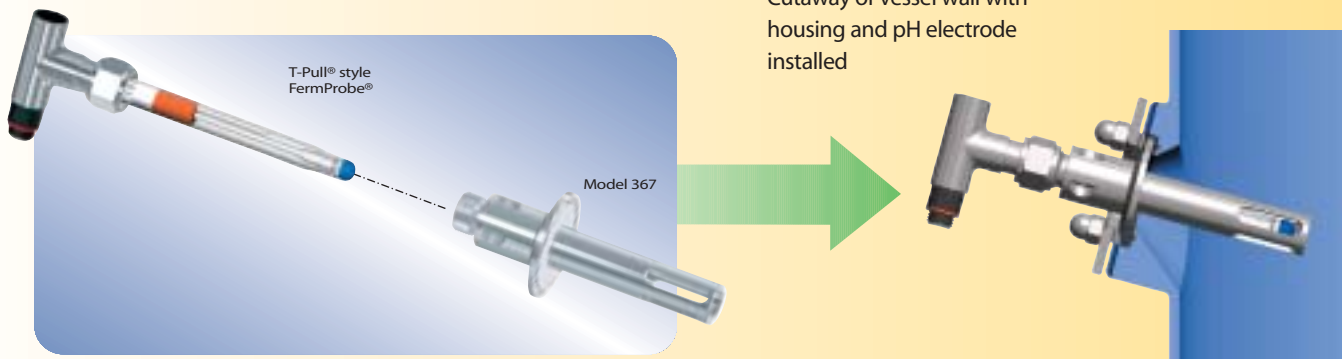
SANITARY PIPE TEE

In-line measurements in a sanitary pipe tee require sanitary flange housings. Since the sanitary gasket is the primary seal, no o-ring is required on the outer portion of the housing.

Commonly used in both the food and pharmaceutical industries, the Model 357 and 367 housings are suitable for sanitary pipe systems with CIP requirements. These housings are most often found in downstream processes such as purification.

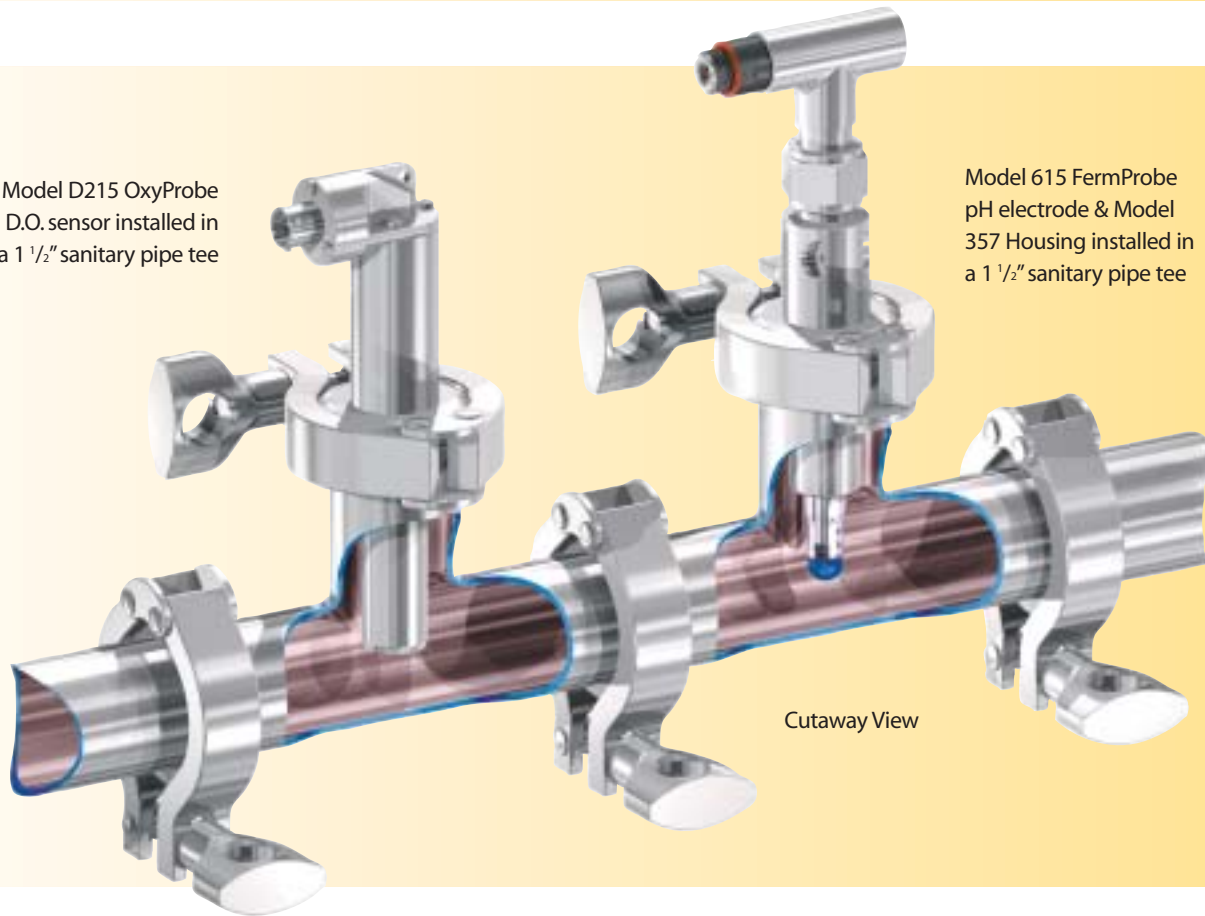
The housings are secured into a sanitary pipe tee with a standard flange clamp sealed with a flange gasket. The pH electrode is then inserted into the housing for on-line measurements. When using a standard sanitary tee, the sensor is positioned such that the tip of the sensor is in the middle of the process flow.





Model D215 OxyProbe
D.O. sensor installed in
a 1 1/2" sanitary pipe tee

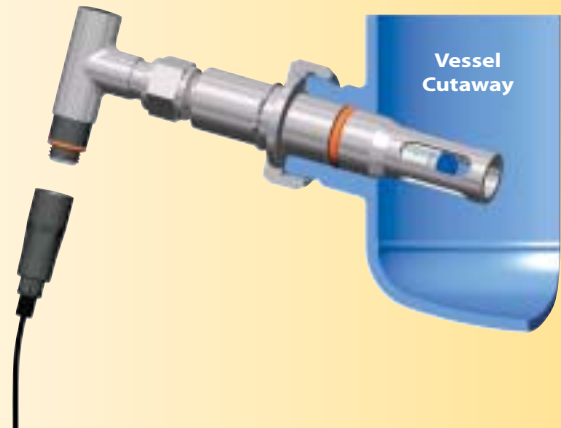
Model 615 FermProbe
pH electrode & Model
357 Housing installed in
a 1 1/2" sanitary pipe tee



Three Common pH Configurations

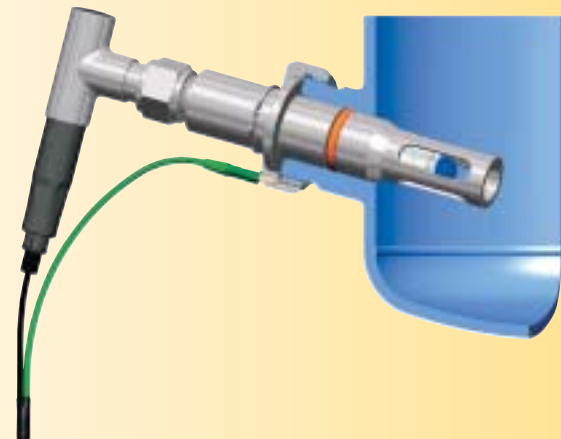
(1) F-615/330 Assembly with Guarded Bulb

This is our most popular combination of pH FermProbe and electrode housing for pilot and production scale vessels. The electrode of choice is the F-615-B130-DH with the rugged T-Pull® handle. The electrode is secured to the housing with a hex nut that can be tightened without twisting the electrode or the cable. The housing is the Model 330-61-H070 with a bulb guard to protect the glass electrode bulb from accidental impact as the housing and electrode are inserted into a 25 mm side port of a tank or vessel. This electrode and housing combination has long been the first choice of engineers needing rugged sensor equipment suited for the industrial environment.



(2) F-615/330 Assembly with Solution Ground Connection

All Broadley-James electrode housings have a built-in slot for a solution ground pin connection. The solution ground lead can be built into the cable assembly for quick and easy connection between the transmitter and the housing. No connection to the tank is necessary. See the pH cable assembly pages to select a cable with a solution ground lead.



(3) F-607 pH Electrode with Integral Cable

The Model F-607 pH FermProbe with integral cable is sometimes found in dairy applications. In areas of constant wash down, a cable that disconnects from the electrode may be prone to moisture contamination and failure. This can be a problem if the electrode/housing assembly is located near the very bottom of a tank or vessel. In such cases, the operators may prefer the F-607 pH electrode. The cable then routes from the electrode/housing assembly to a panel or J-box located in a drier area, away from the bottom of the tank. The same hex nut design described in (1) above allows for easy removal of the electrode from the housing without twisting the cable. See website for more details.



Two Most Frequently asked Questions

1. Do I want a Guarded or Unguarded Housing?

The electrode/housing assembly can accidentally “bump” into the 25 mm port when being installed. If the pH sensing glass bulb of the electrode is not protected by a housing bulb guard, the electrode can easily be shattered. A guarded housing design is often the engineer’s first choice when choosing an electrode housing.

However, sometimes the media is so viscous that it will clog the housing guard and effectively smother the pH sensing glass bulb. In this case, an unguarded housing must be used to ensure that the pH sensing glass bulb is always in contact with fresh media.

The F-615/326 assembly with unguarded housing. Recommended for viscous media to ensure that the pH sensing bulb of the electrode is always in contact with fresh media.



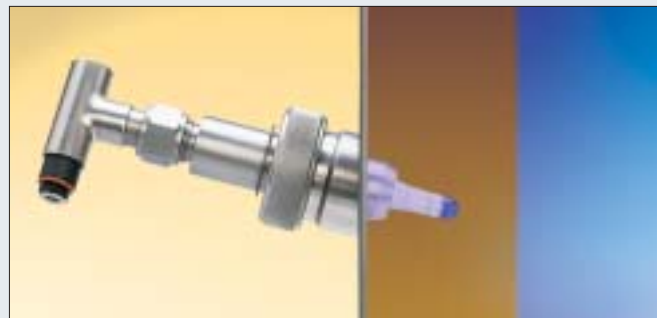
The F-615/336 assembly with guarded housing to protect the pH glass bulb of the electrode during installation.



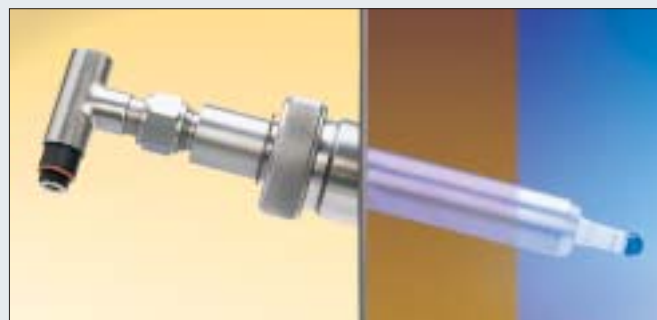
2. When do I Choose a Longer Housing Length?

Sometimes the tank wall can become coated with a thick layer of viscous material that does not mix well with the rest of the media. If the pH sensing bulb of the electrode is located just a couple of inches inside the tank wall, the bulb might be smothered by this viscous layer. Subsequent pH readings may not be representative of the bulk of the media circulating in the rest of the tank. In the illustration at the right, the pH electrode’s bulb is trapped in this slow moving viscous layer near the tank wall. The electrode is only measuring the pH of this layer.

A solution to the problem described above is to choose an electrode and a matching housing that extends further into the tank. This will position the pH sensing bulb away from the tank wall and place it closer to the circulating media further inside the tank. The subsequent pH measurements will be much more representative of the circulating media. In the illustration to the right, the electrode and the housing protrude past the viscous zone and into the area of well stirred and circulated media within the production tank.



Bulb of electrode is trapped in thick viscous layer near the wall of the tank.



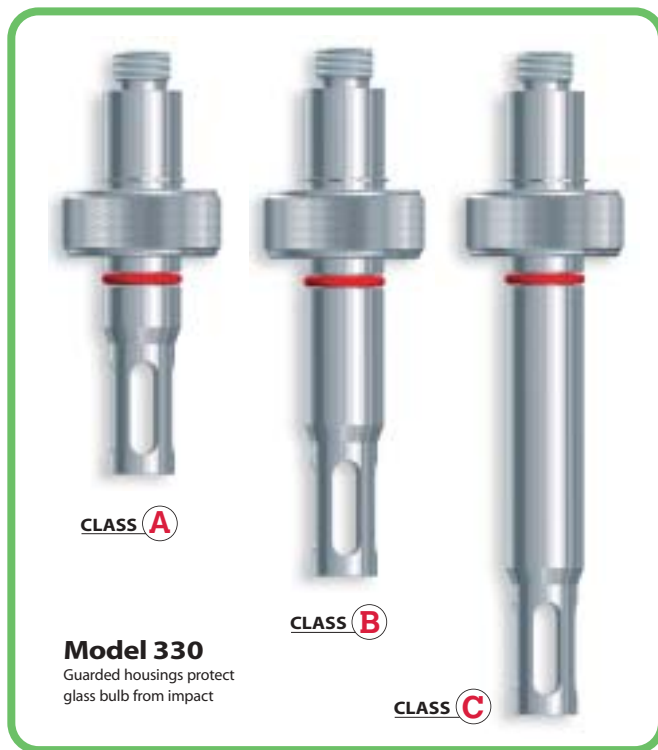
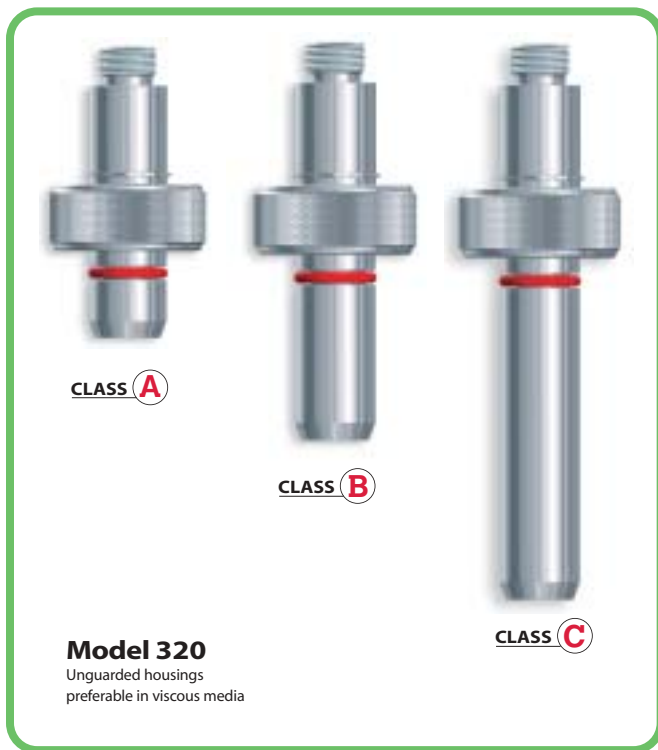
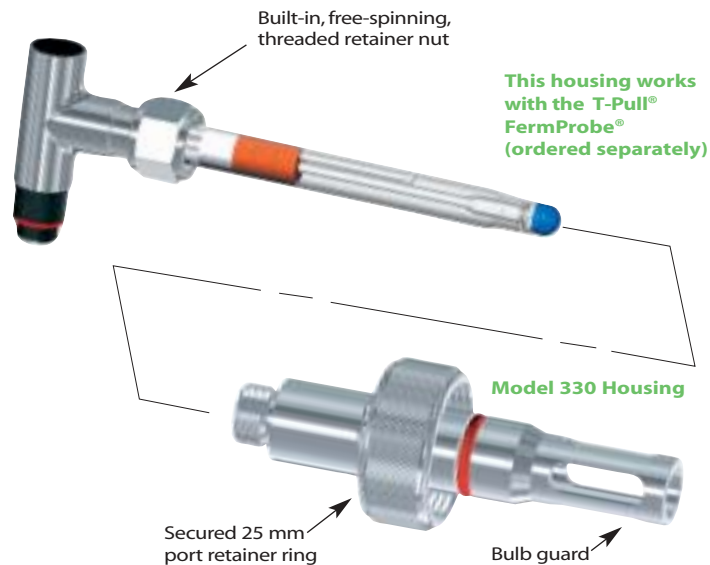
A longer electrode and housing extend further into the tank. The sensing bulb of the pH electrode is past the viscous zone.

Housings for Standard 25 mm Side Ports

The 320 and 330 style electrode housings are designed to be used with the Model F-615 style FermProbe® pH electrode. These housings fit nearly all standard 25 mm side ports found in production and pilot plant vessels and are available in a variety of different lengths to suit your application.

This design requires that the pH electrode be secured to the housing by a free-spinning threaded retainer nut. This allows the electrode to be installed into or removed from the housing without twisting or disconnecting the electrode cable. This feature is very helpful when calibrating the pH electrode tank side in a production environment.

These housings are also designed to be used with Model F-607 and F-600 style FermProbe pH electrodes found on our website.



Specifications:

- 316L stainless steel construction.
- Serialized for traceability to mill steel specifications.
- RA32 finish with electropolish on all wetted parts.
- FDA compliant silicone o-rings. (EPDM available upon request.)
- Permanently secured port retainer ring for additional operator safety.

Additional Features Include:

- Guarded versions for rugged handling while protecting the pH glass bulb in a production environment.
- Unguarded versions for viscous media.
- Available in a variety of lengths for different insertion length requirements.
- Custom designs and modifications promptly quoted.

Housings for B. Braun Biotech 25 mm Safety Side Ports

There are two FermProbe® electrode housing designs, standard and metric, for B. Braun Biotech 25 mm side ports. These housings incorporate the latest B. Braun Biotech design requirements and are compatible with both the new 25 mm safety ports and the older 25 mm port designs.

When these housings are used with the new B. Braun Biotech safety port, the port will release internal steam pressure in the vessel before the housing is completely disengaged from the port.

The standard FermProbe pH electrode is secured to the Models 326 and 336 style housings by a free-spinning threaded retainer nut. This allows the electrode to be installed and removed from the housing without twisting or disconnecting the electrode cable. This feature is very helpful when calibrating the pH electrode tank side in a production environment.

The metric FermProbe pH electrodes thread directly into the Models 346 and 356 style housings, eliminating the need for the threaded retainer nut. In order to prevent twisting the cable, the metric FermProbes have a detachable cable.

Guarded and unguarded versions are available. Using a guarded housing is highly recommended for pH electrodes to provide maximum protection against damage to the sensing bulb. However, highly viscous media is prone to clog the guard.

The model 326 and 336 housings are also designed to be used with Model F-607 and F-600 style FermProbe pH electrodes found on our website.

TIPS & HINTS

Storage of pH Electrodes

The first choice for storing FermProbe® electrodes is 2M KCl. If this is not available, buffer solution can be used, preferably pH 4 buffer. Deionized (DI) water should never be used to store pH electrodes. If an electrode has been stored in DI water the resistance of the junction will change, causing instability and noise in the reading. Soaking the electrode in 2M KCl overnight, prior to use, will usually reverse most of this effect.

Housings for Standard FermProbes



Model 326
Unguarded housings
preferable in viscous media

Model 336
Guarded housings protect
glass bulb from impact

Housings for Metric FermProbes



Model 346
Unguarded housings
preferable in viscous media

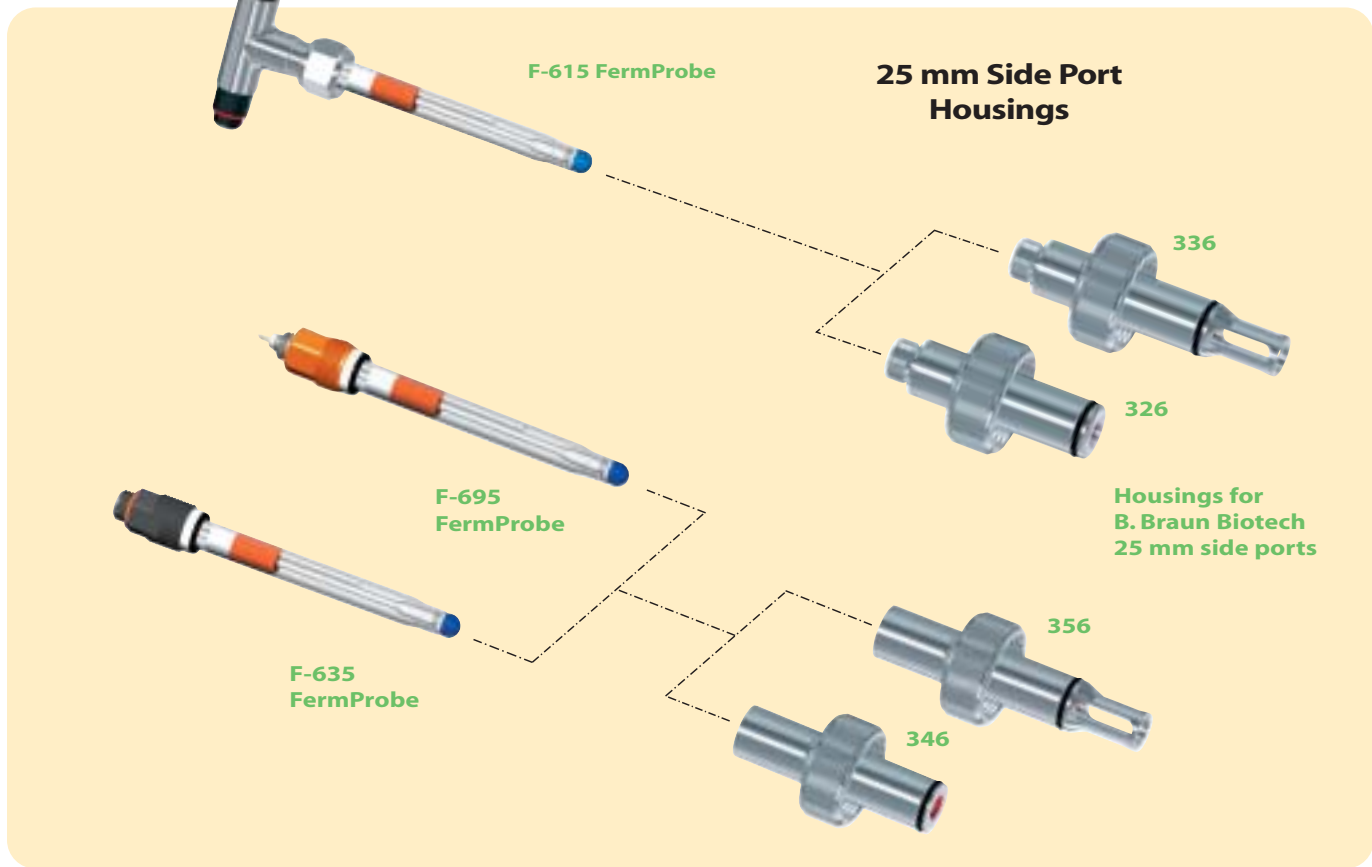
Model 356
Guarded housings protect
glass bulb from impact

Specifications:

- 316L stainless steel construction.
- Serialized for traceability to mill steel specifications.
- RA32 finish with electropolish on all wetted parts.
- FDA compliant external EPDM o-rings.
- Permanently secured port retainer ring for additional operator safety.

Additional Features Include:

- Guarded versions for rugged handling while protecting the pH glass bulb. in a production environment.
- Unguarded versions for viscous media.
- Custom designs and custom modifications promptly quoted.



How to Order a Housing

- (1) Confirm that the vessel has a B. Braun Biotech 25 mm side port. Cutaway views and dimensions are shown on pages 44 and 45.
- (2) Determine whether the application will permit the use of a bulb guard on the housing. The bulb guard design is highly recommended for all types of process applications except when media is highly viscous. Highly viscous media is prone to clog the guard area of the housing. See bulb guard area in pictures on opposite page.
- (3) Choose the correct steam sterilizable FermProbe pH electrode.
 - See pages 38 and 39 for T-Pull FermProbes.
 - See pages 40–43 for Metric FermProbes.

ordering information

Housing Model	Class	Vessel Insertion Length	Used With pH Electrode Models	Used With Electrode Length	Housing Part Number	Housing Price
Unguarded Housing						
326	(A)	25 mm	1"	F-615	130 mm	326-62-H085
Housing With Protective Bulb Guard						
336	(A)	40 mm	1.6"	F-615	130 mm	336-62-H085
Unguarded Housing						
346	(D)	25 mm	1"	F-635, F-695	120 mm	346-62-H085
Housing With Protective Bulb Guard						
356	(D)	40 mm	1.6"	F-635, F-695	120 mm	356-62-H085

Housings with Sanitary Flanges



Housings for Vessels with Sanitary Flanged 25 mm Side Ports

The Model 370 housing is designed to fit into vessels with sanitary flanged 25 mm side ports. Vessels with these ports are sometimes found in food and pharmaceutical processes that utilize CIP. This housing has two seals to secure it into the vessel. In addition to the gasket seal at the flange, it has a 25 mm o-ring that seals it in the port near the point where the housing enters the vessel. This forward seal minimizes any crevice space when the housing is installed.

Flanged Housings for Sanitary Pipe Systems

Commonly used in both the food and pharmaceutical industries, the 350 series and 360 series housings are suitable for sanitary pipe systems with CIP requirements. These housings are most often found in downstream processes such as purification.

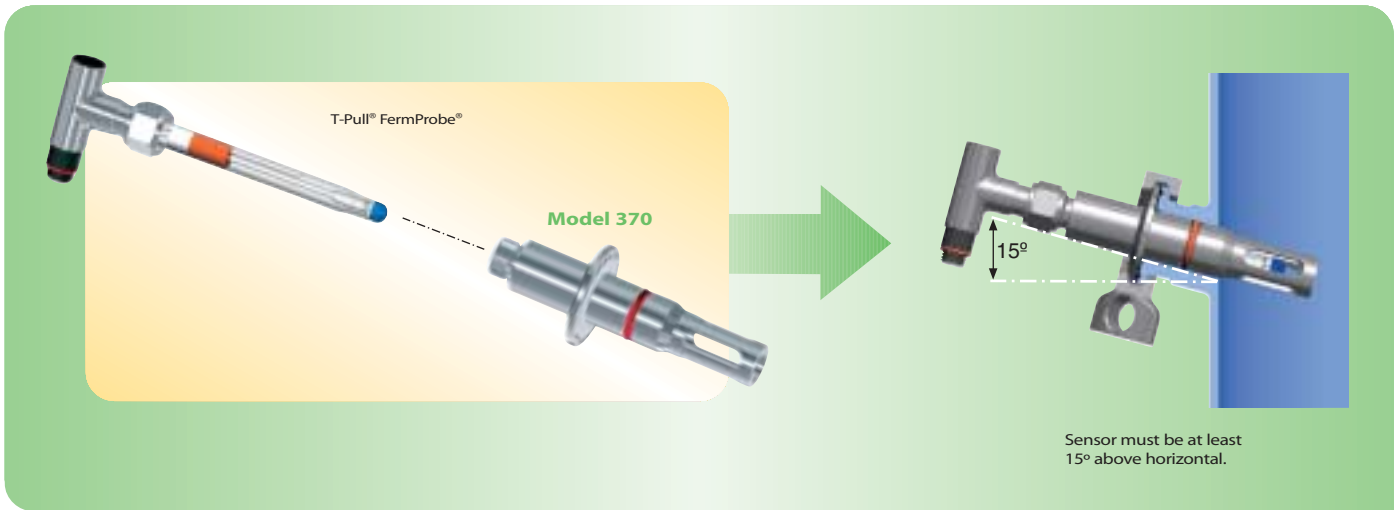
These housings are secured into a sanitary pipe tee with a standard flange clamp sealed with a flange gasket. The pH electrode is then inserted into the housing for on-line meas-

urements. When using a standard sanitary tee, the sensor will be positioned such that the tip of the sensor is in the middle of the process flow. T-Pull® FermProbes® are compatible with these housings.

These housing are also compatible with Novaseptic side ports.

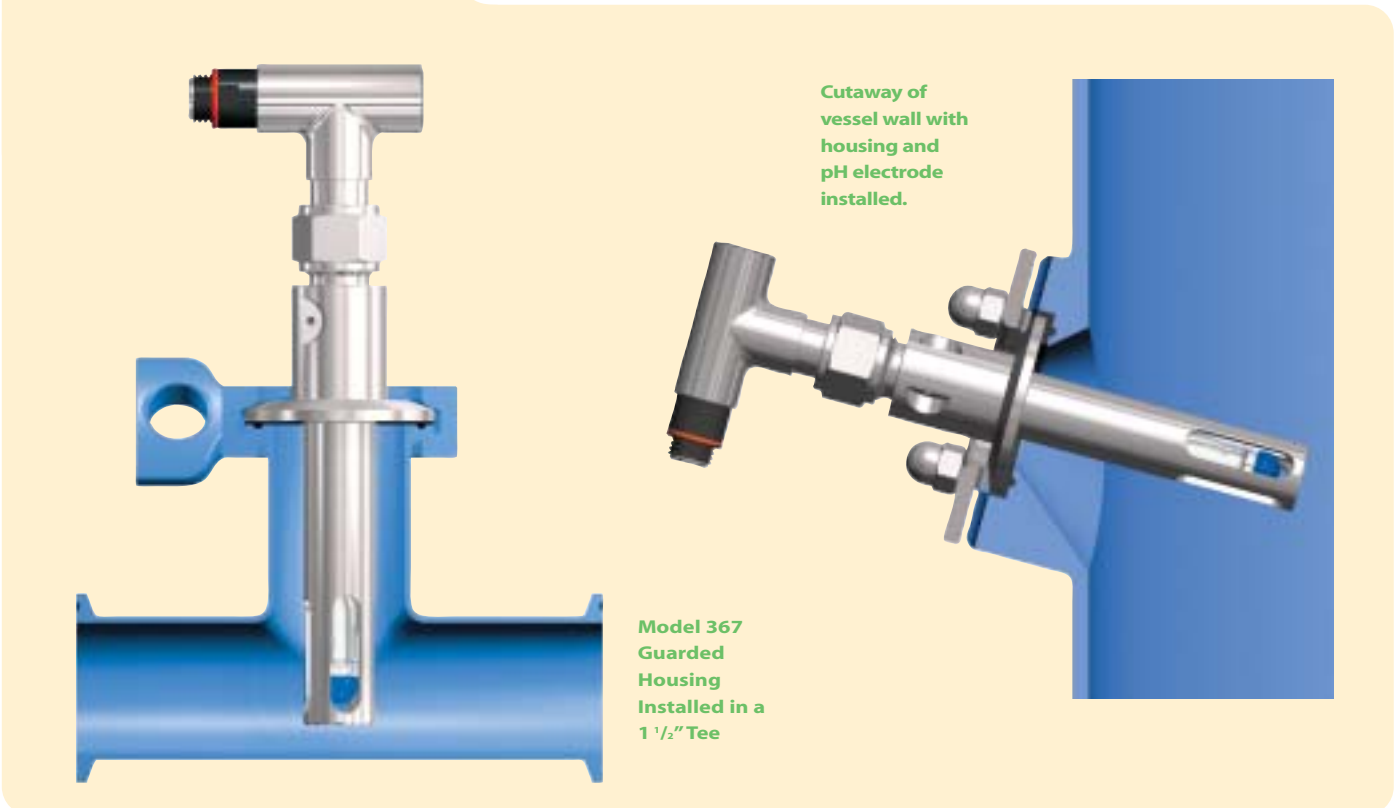
ordering information

Housing Model	Class	Typical Insertion Length		Used With pH Electrode Model	Used With Electrode Length	Housing Part Number	Housing Price
Model 370 for Vessel with Flanged 25 mm Side Port, Guarded							
370	A	70 mm	2.8"	F-615	130 mm	370-61-H070	
Model 357 for 1.5" Sanitary Tee Fitting, Unguarded							
357	A	75 mm	3.0"	F-615	130 mm	357-61-H075	
Model 367 for 1.5" Sanitary Tee Fitting, Guarded							
367	A	90 mm	3.6"	F-615	130 mm	367-61-H075	
Model 350 for 2" Sanitary Tee Fitting, Unguarded (not shown)							
350	A	100 mm	3.9"	F-615	130 mm	350-61-H090	
Model 360 for 2" Sanitary Tee Fitting, Guarded (not shown)							
360	A	115 mm	4.5"	F-615	130 mm	360-61-H090	

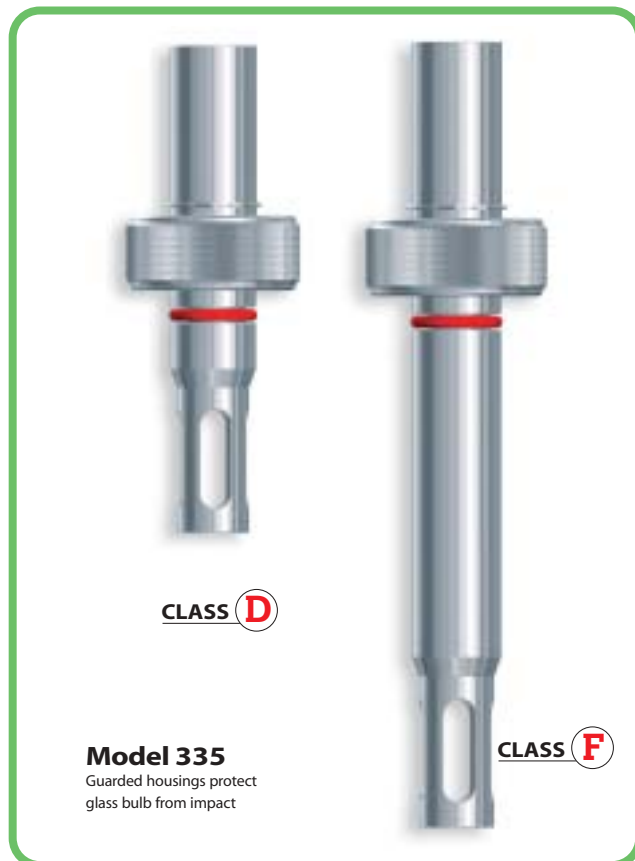
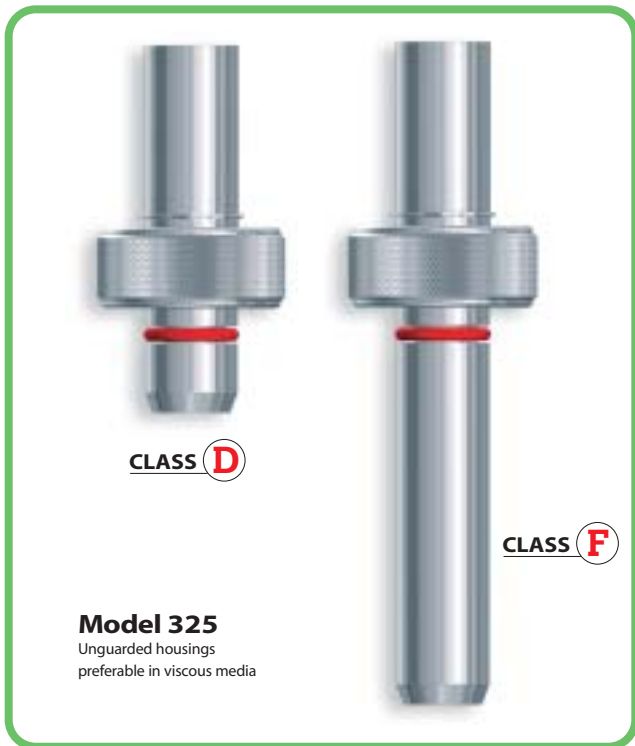


It is recommended to NOT use Model 370 in a horizontal port. pH electrodes should be at a 15° angle minimum with the bulb pointing downward (see above).

Exploded and Inserted Views



Metric Housings for Standard 25 mm Side Ports



These housings are designed to be used with models F-635 and F-695 Metric FermProbe® electrodes and models D140 and D145 12 mm OxyProbe® sensors. They are also compatible with any sensor that has Pg13.5 threads. These housings fit nearly all standard 25 mm ports found on production and pilot plant vessels. Different housing lengths are available to accommodate various application or vessel requirements.

The pH electrode or D.O. sensor threads directly into this metric housing, eliminating the need for a threaded retainer nut. In order to prevent twisting the cable, the metric FermProbes have a detachable cable.

Guarded and unguarded versions are also available. Using a guarded housing is highly recommended for pH electrodes to provide maximum protection against damage to the sensing bulb. However, highly viscous media is prone to clog the guard.

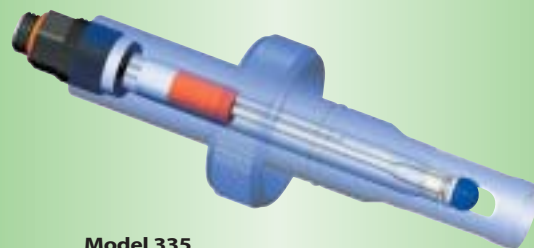
Specifications:

- 316L stainless steel construction.
- Serialized for traceability to mill steel specifications.
- RA32 finish with electropolish on all wetted parts.
- FDA compliant silicone o-rings.
- Permanently secured retainer ring for additional safety.

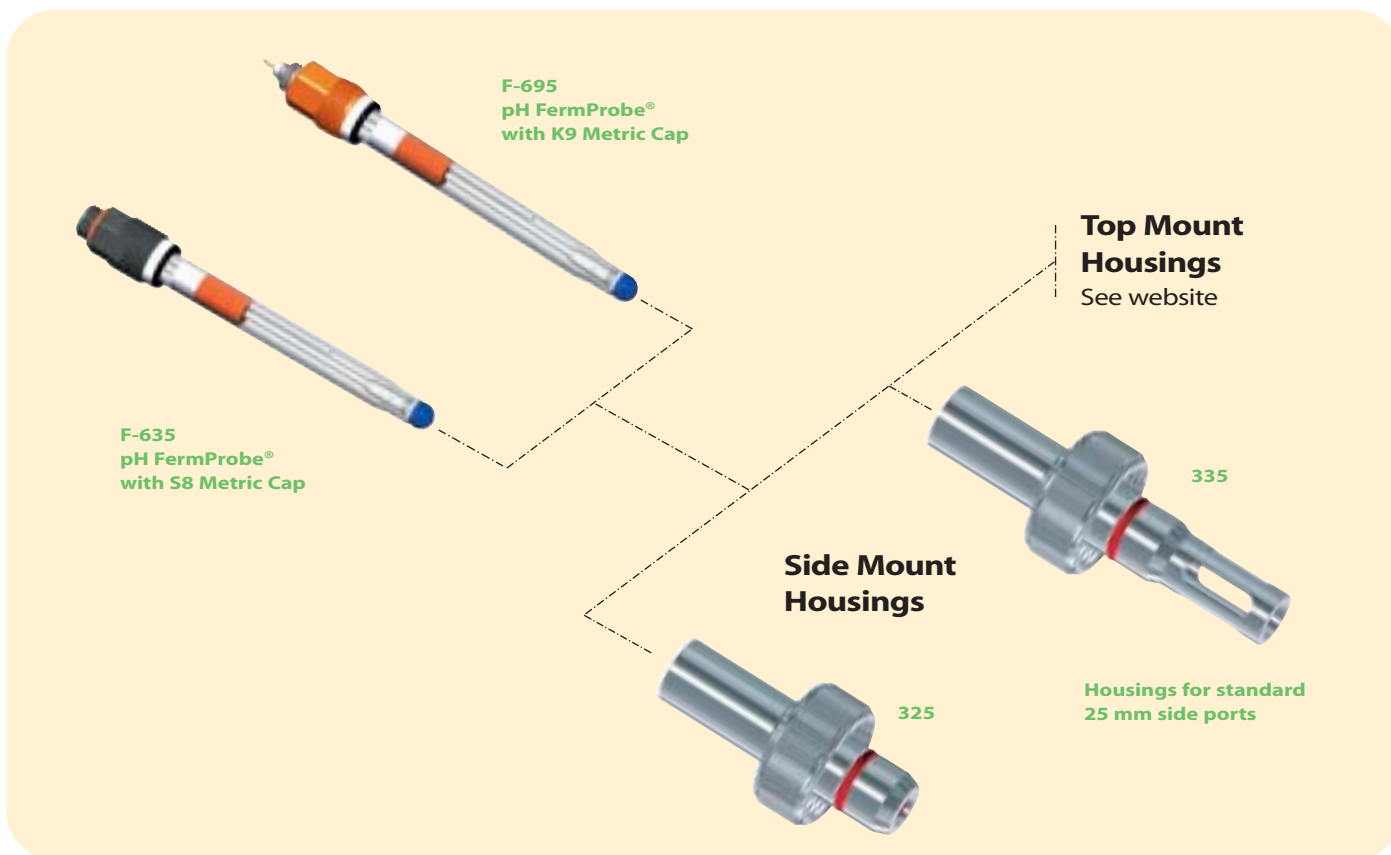
Additional Features:

- Guarded version for rugged handling while protecting the pH glass bulb in a production environment.
- Unguarded version for viscous media.
- Available in two lengths for different requirements.
- Custom designs and modifications promptly quoted.

F-635 electrode with S8 metric cap and detachable cable



Model 335
Metric Housing



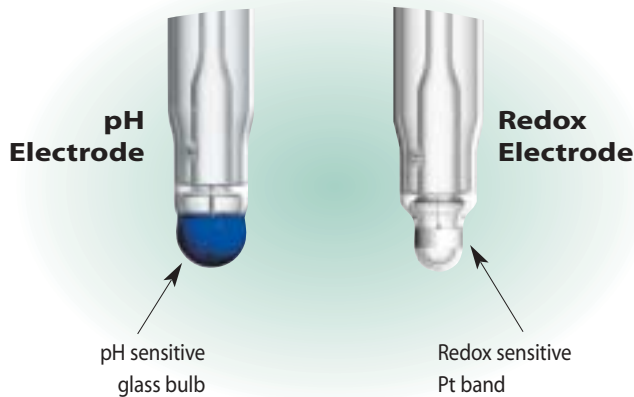
How to select the correct housing

- (1) Confirm that the opening is a standard 25 mm side port. Cutaway views and dimensions are shown on pages 44 and 45.
- (2) Determine whether the application will permit the use of a bulb guard on the housing. The bulb guard is highly recommended for all applications except when the media is very viscous. Highly viscous media is prone to clog the guard.
- (3) Determine how far the housing and pH electrode or D.O. sensor should extend into the vessel.
- (4) Confirm the electrode or sensor is a metric FermProbe®, 12 mm OxyProbe®, or European sensor with Pg13.5 threads.
 - * See pages 40–43 for more information on metric FermProbe electrodes and electrode selection.
 - * See page 70 for more information on 12 mm OxyProbe sensors and sensor selection.

ordering information

Housing Model	Class	Typical Vessel Insertion Length		Used With pH Electrode and D.O. Sensor Models	Used With Sensor/Electrode Length	Housing Part Number	Housing Price
Unguarded Housing							
325	D	38 mm	1.5"	F-695, F-635, D140, D145	120 mm	325-61-H070	
325	F	114 mm	4.5"	F-695, F-635, D140, D145	200 mm	325-61-H150	
Housing with Protective Bulb Guard							
335	D	53 mm	2.1"	F-695, F-635	120 mm	335-61-H070	
335	F	127 mm	5.0"	F-695, F-635	200 mm	335-61-H150	

Redox Electrodes



Redox FermProbes®

- Fits all suitable FermProbe housings
- Works with standard FermProbe cables
- Compatible with pH transmitters that have a millivolt display mode, such as the Models 30, 40, and 50

Reasons to Measure Redox in Fermentation Media

The metabolic activity of microorganisms depends on many factors, including the redox potential of the culture environment. Measuring the redox potential allows the vessel operator to monitor the addition of reducing agents while ensuring that the potential is in the proper range for initiation of growth. It is also important to monitor the redox potential just before inoculation.

- ANAEROBIC FERMENTATION
Redox sensors are most commonly used to maintain anaerobic conditions in a culture media. They can be used to measure trace amounts (<1 ppm) of dissolved oxygen, at levels that are too low for D.O. sensors.

- DOWNSTREAM PROCESSING
Sometimes used in steps performed downstream of the fermentation process, redox sensors can monitor changes in concentration or the absence or presence of specific chemicals. Monitoring the redox potential is an effective way of tracking chemical conversions in the process.

- PROTEIN FOLDING
The close regulation of redox potential is crucial to allow efficient formation of disulfide bonds, which facilitate folding and the stability of the folded protein. Overly oxidizing conditions can result in misfolding due to the formation of incorrect bonds.

- METABOLIC PATHWAYS
Measuring the redox potential is an effective way to determine its influence on the metabolic pathways of microorganisms. This is useful for substrate utilization or the production of specific metabolites.

Specifications:

- ± 5000 mV range
- Steam sterilizable to 135°C
- 150 psig maximum pressure
- Double junction, Ag-AgCl reference system
- Metric Pg13.5 threaded disconnect cap



How to Order a Redox Electrode

(1) Choose Electrode Model.

If the electrode needs to fit an existing cable, check the cable connector and note its color. If the cable connector is black and has an S8 connector, use the F-915 or F-935 Redox FermProbes. If the cable connector is red or orange and has a K9 connector, use the F-995 Redox FermProbe.

(2) Choose Electrode Length.

If you have already chosen a housing, select an electrode length with the same Class designation as the housing. For more information on selection of housings, see pages 44–47. The housing *ordering information* box also lists the correct electrode length to order. If you have not already chosen the housing, please review the recommendations next to each electrode model below.

(3) Confirm Cable Length and Connector.

Model F-915, F-935, and F-995 Redox electrodes require disconnect cable and connector assemblies. See pages 98–101.

TIPS & HINTS

What is Redox (ORP)?

- The terms are interchangeable in meaning: Redox = Oxidation-Reduction Potential (ORP)
- The term Redox is more commonly used for bioprocess applications in Europe and the U.S.
- The term ORP is more commonly used for industrial chemical process applications in the U.S.
- The redox potential of a media is related to the overall availability of electrons in the media, specifically the ratio of positive and negative ions in the solution. Note that redox measurements vary significantly with changing pH.

ordering information

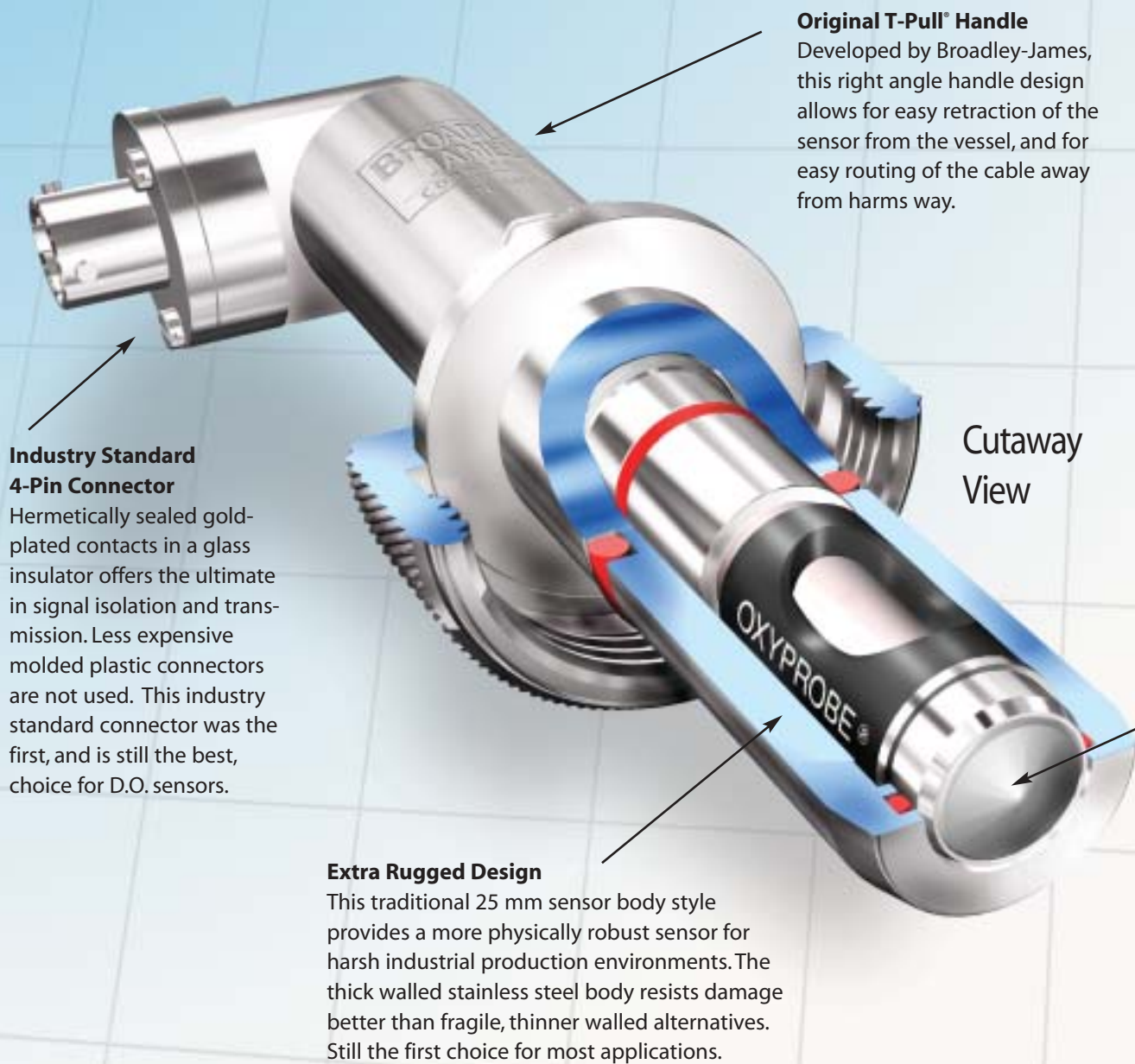
Electrode Model	Class	Use With These Housing Models	Electrode Length*	Electrode Part Number	Electrode Price
Series F-900 Redox FermProbes					
F-915	(A)	320, 330, 326, 336, 350, 357, 370	130 mm	F-915-B130-DH	
F-935	(D)	325, 335	120 mm	F-935-B120-DH	
F-995	(D)	325, 335	120 mm	F-995-B120-DK	

*Other lengths are available upon request.

Section Three

OxyProbe® D.O. Sensors

Steam Sterilizable and Autoclavable



Industry Standard 4-Pin Connector

Hermetically sealed gold-plated contacts in a glass insulator offers the ultimate in signal isolation and transmission. Less expensive molded plastic connectors are not used. This industry standard connector was the first, and is still the best, choice for D.O. sensors.

Original T-Pull® Handle

Developed by Broadley-James, this right angle handle design allows for easy retraction of the sensor from the vessel, and for easy routing of the cable away from harms way.

Cutaway
View

Extra Rugged Design

This traditional 25 mm sensor body style provides a more physically robust sensor for harsh industrial production environments. The thick walled stainless steel body resists damage better than fragile, thinner walled alternatives. Still the first choice for most applications.

Performance Specifications

Measurement principal:	Amperometric – Polarographic
Output signal in air:	Approx. 67 nA at 25°C
Temperature range:	Operation: 0 to 80°C Sterilization: Max. 135°C
Stability:	Better than 2% of readout per week at constant pressure and temp. (30°C)
Maximum Pressure:	4 bar (atm.), 58 psig

Suitable for Hygienic Applications

The OxyProbe withstands Steam in Place (SIP) and caustic Clean in Place (CIP) applications. FDA compliant o-rings on all product contact surfaces.

Easy to Replace Membrane Body

The outer silicone layer protects the inner teflon layer, and an added stainless steel mesh provides the mechanical strength required to withstand repeated autoclaving or steam sterilization. The strongest, most robust membrane in the industry, it is an improvement of the industry standard design. Compatible with existing sensors, there is no need to change sensors or electronics to get improved performance!

D.O. Sensor Design

Replaceable Anode/Cathode Assembly

A concept pioneered by Broadley-James, this unique assembly permits the sensor to be repaired quickly, easily, and reliably in just a few minutes. A time-proven approach with years of success under the harshest environmental conditions.

FDA Positive Listed Materials of Construction

Electropolished stainless steel surfaces provide better surface cleanability than mechanically polished 16RA alternatives. Copies of 3.1B certificates and mill certificates are available upon request. Every sensor is serialized with paperwork on file in our database.

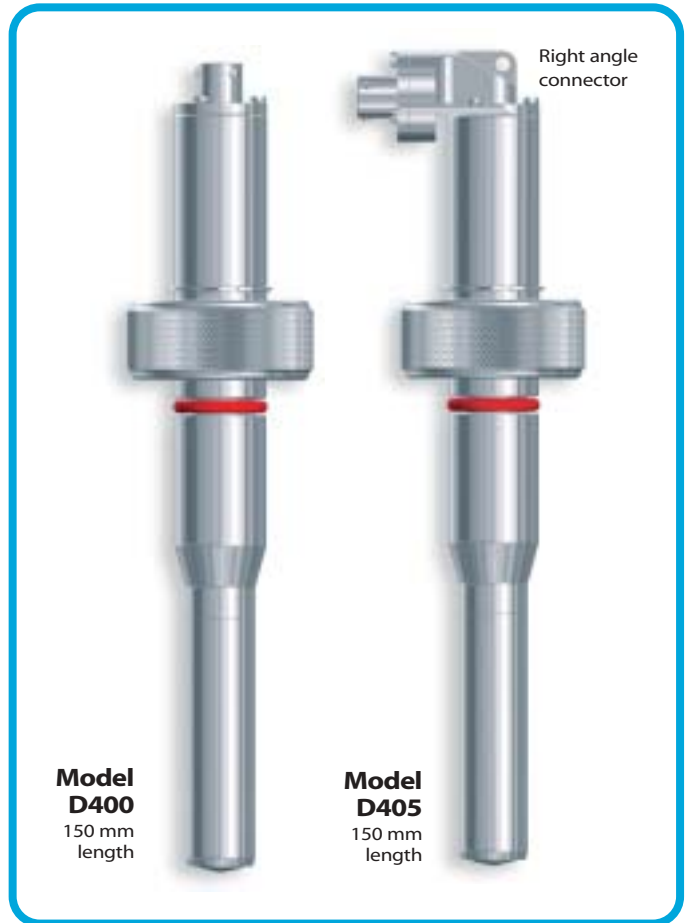
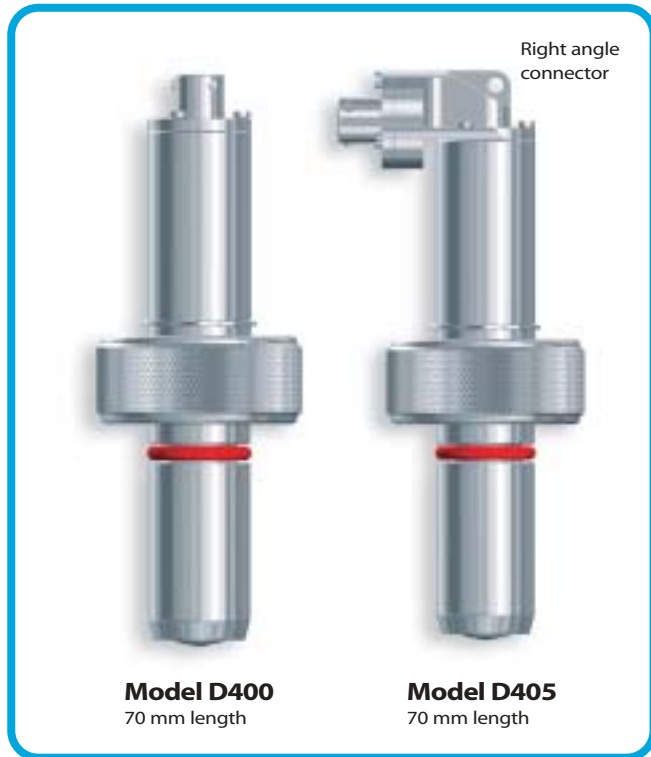
Universally Compatible

All Broadley-James D.O. sensors work with existing biotech equipment. No proprietary electronics or cables are required. All designs are intended to fit both existing and future requirements, without introducing any unnecessary changes in hardware or cabling. Reduces inventory and confusion, increases flexibility and cost savings.

The Market Leader in D.O. Sensor Design

Unlike other manufacturers, Broadley-James does not believe in changing the basic design every few years forcing customers into buying new equipment to keep current. Instead, Broadley-James strives to make improvements "backwards compatible" so they can be used with new electronics as well as the old. No changing of connector which would require new cabling to be run throughout the suite, no special RTD's that would require new transmitters, no changing of cartridge design that forces the customer to obsolete perfectly good, but no longer supported, sensor designs. Instead, Broadley-James strives to protect investments, and help leverage them into the future.

OxyProbe® D.O. Sensors for Standard 25 mm Side Ports



Model D400 OxyProbe® D.O. Sensor Series

The OxyProbe® D400 series dissolved oxygen sensor offers the most rugged design for 25 mm side ports. It fits directly into the vessel, eliminating the need for a housing, reducing contamination risks. The modular design allows quick replacement of any part, making it easy to maintain and repair the sensor. OxyProbe dissolved oxygen sensors carry a 2-year warranty.

For performance specifications see page 61.

Features:

- 316L Stainless Steel
- Serialized for traceability
- RA32 finish with electropolish on wetted parts
- FDA compliant silicone o-rings
- Secured retainer ring

ordering information

Part Number	Sensor Length	Typical Insertion Length	Sensor Price
Model D400 Series 25 mm OxyProbe with Straight Connector			
• Fits standard 25 mm ports			
• Secured retainer ring			
• Custom lengths available			
D400-B070-PT-D9	70 mm	36 mm	1.4"
D400-B150-PT-D9	150 mm	114 mm	4.5"
D400-B220-PT-D9	220 mm	183 mm	7.2"
D400-B320-PT-D9	320 mm	277 mm	10.9"
D400-B420-PT-D9	420 mm	373 mm	14.7"

ordering information

Part Number	Sensor Length	Typical Insertion Length	Sensor Price
Model D405 Series 25 mm OxyProbe with Right Angle Connector			
• Fits standard 25 mm ports			
• Secured retainer ring			
• Custom lengths available			
D405-B070-PT-D9	70 mm	36 mm	1.4"
D405-B150-PT-D9	150 mm	114 mm	4.5"
D405-B220-PT-D9	220 mm	183 mm	7.2"
D405-B320-PT-D9	320 mm	277 mm	10.9"
D405-B420-PT-D9	420 mm	373 mm	14.7"

What makes OxyProbe® sensors unique?

The internal seals of an OxyProbe are all mechanical seals using o-rings. There are no adhesives to leak or fail in process, making this a more rugged and reliable sensor. Replacing the cathode is also much easier and faster since there is no sealant to clean from the integral threads. Additionally, no sealant makes the job of replacing the cathode much easier and cleaner. See pages 74 and 75 for an exploded view of a Dissolved Oxygen sensor.

It is important to properly maintain the sensors by inspecting and calibrating them regularly. The membrane cartridge should be checked and refilled prior to every use.

All Bradley-James dissolved oxygen sensors are available with an optional right angle connector.

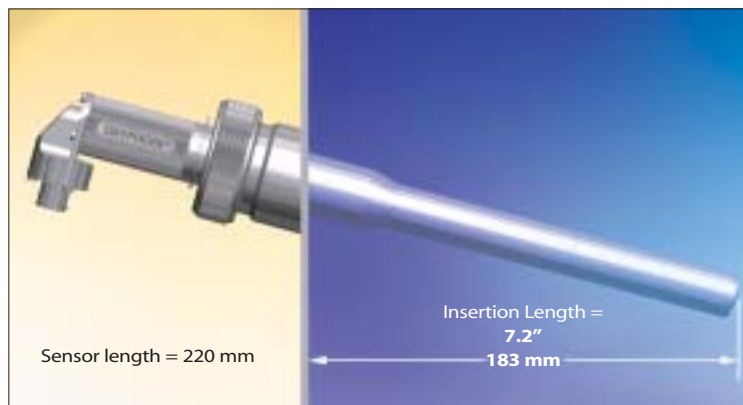
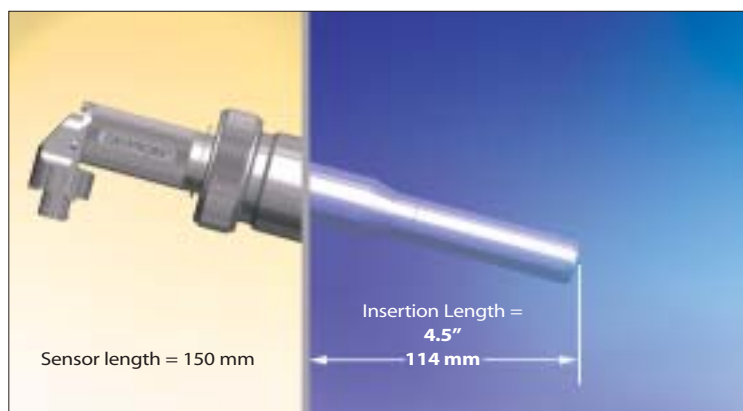
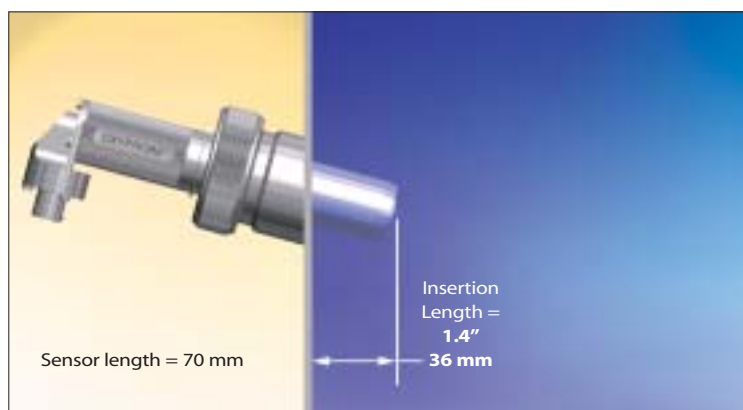
This low profile design provides:

- Protection against cable fatigue
- Improved grip for sensor extraction
- Increased clearance between vessels

How to choose a sensor:

- (1) Confirm that the entry site is a standard 25 mm port. Cutaway views and dimensions are shown on pages 44 and 45.
- (2) Determine how far the sensor should extend into the vessel. (See illustration to the right.) For most process media, the minimum length is optimal. However, if the media is viscous and tends to coat the inner wall of the vessel, a longer length may provide better performance.
- (3) Decide whether a right angle connector is preferred over a straight connector.
- (4) Choose cable length and a connector. All D.O. sensors require cable and connector assemblies. See pages 102 and 103.

Model D400/D405 Insertion Lengths



TIPS & HINTS

Angle of Insertion

A D.O. sensor or a pH electrode must be at least 15° above horizontal to consistently function properly. DO NOT install pH electrodes or D.O. sensors in a port perpendicular to the vessel wall. The liquid inside the sensor contains small air bubbles. If not inclined slightly above horizontal, a bubble can adhere to the cathode or pH bulb where it will affect the sensor's performance.

OxyProbe® D.O. Sensors for B. Braun Biotech 25 mm Safety Side Ports



Model D430 Series OxyProbe® D.O. Sensors

The ports of B. Braun Biotech fermentation vessels are longer and have a slightly different internal design. In order to seal properly, the o-ring on these sensors has been moved closer to the tip of the sensor.

What makes OxyProbe sensors unique?

The internal seals of an OxyProbe are all mechanical seals using o-rings. There are no adhesives to leak or fail in process, making this a more rugged and reliable sensor. Replacing the cathode is also much easier and faster since there is no sealant to clean from the threads.

The sensor fits directly into the vessel, eliminating the need for a housing, reducing contamination risks. Few accessories are required. The modular design allows quick replacement of any part, making it easy to maintain and repair the sensor. OxyProbe dissolved oxygen sensors carry a 2-year warranty.

For performance specifications see page 61.

Features:

- 316L Stainless Steel
- Serialized for traceability
- RA32 finish with electropolish on wetted parts
- FDA compliant external EPDM o-ring
- Secured retainer ring

o r d e r i n g i n f o r m a t i o n

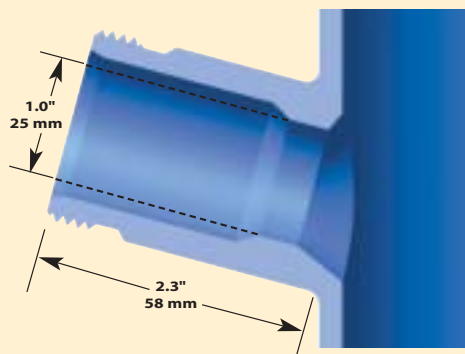
Part Number	Sensor Length	Typical Insertion Length		Sensor Price
Model D430 Series 25 mm OxyProbe with Straight Connector				
• Unique o-ring placement for better seal				
• Fits B. Braun Biotech Fermentors				
D430-B070-PT-D9	70 mm	13 mm	0.5"	
D430-B095-PT-D9	95 mm	36 mm	1.4"	

o r d e r i n g i n f o r m a t i o n

Part Number	Sensor Length	Typical Insertion Length		Sensor Price
Model D435 Series 25 mm OxyProbe with Right Angle Connector				
• Unique o-ring placement for better seal				
• Fits B. Braun Biotech Fermentors				
D435-B070-PT-D9	70 mm	13 mm	0.5"	
D435-B095-PT-D9	95 mm	36 mm	1.4"	

B. BRAUN BIOTECH 25 mm SAFETY PORT.

Found exclusively on vessels manufactured by B. Braun Biotech. This style of port is longer than the standard port and needs a special housing to fit correctly. (Note: The port opening on newer tanks is 30 mm i.d. and narrows to 25 mm i.d. at the critical point where the housing o-ring seals to the inside wall of the port.) The port is installed at a 15° angle for better electrode performance. See the cutaway drawing to the right for typical installation dimensions.



How to choose a sensor:

- (1) Confirm that the vessel has a 25 mm B. Braun Biotech side port, as in the drawing above.
- (2) Determine how far the sensor should extend into the vessel. (See illustration to the right.) For most process media, the minimum length is optimal. However, if the media is viscous or tends to coat the inner wall of the vessel, a longer length may provide better performance.
- (3) Decide whether a right angle connector is preferred over a straight connector.
- (4) Choose cable length and connector. All D.O. sensors require a separate cable connector assembly. See pages 102 and 103.

TIPS & HINTS

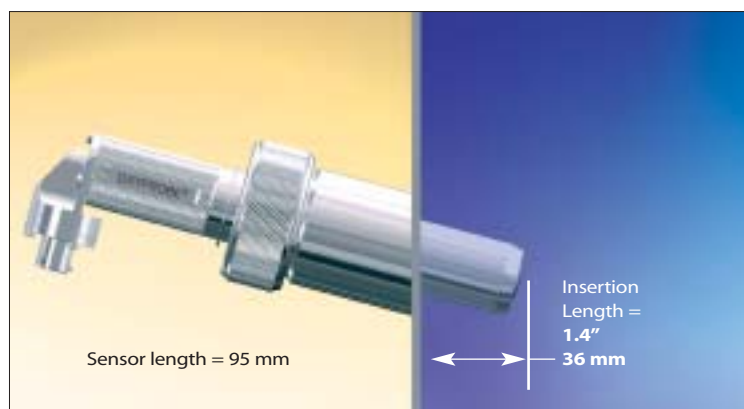
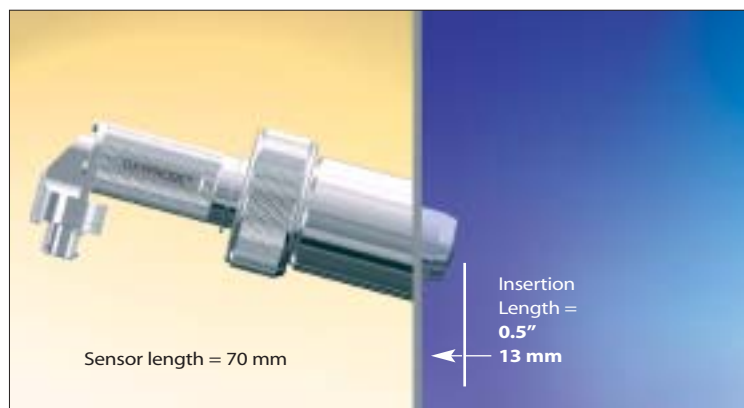
External Seals on D.O. Sensors

The external seal on the Models D430 and D435 D.O. sensors is slightly different from other 25 mm OxyProbes. The o-ring is EPDM and the groove is more shallow. Therefore, the external o-ring for these sensors has a slightly smaller cross-section.

External o-rings for 25 mm OxyProbes® for B. Braun Biotech side ports

Part Number	Qty.	Price
AG-E117-04	4	
AG-E117-25	25	

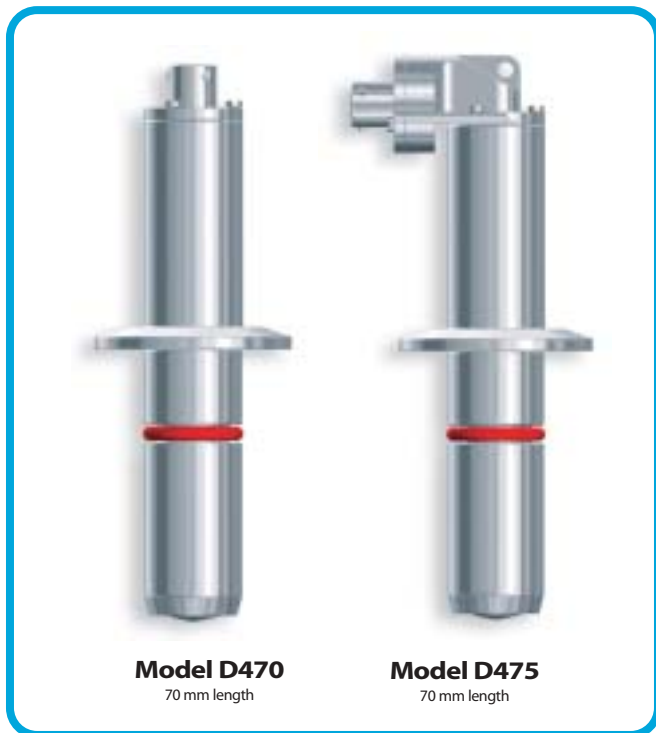
Model D430/D435 Insertion Lengths



All OxyProbe dissolved oxygen sensors are available with the right angle connector. This low profile design provides:

- Protection against cable fatigue
- Improved grip for sensor extraction
- Increased clearance between vessels

OxyProbe® D.O. Sensors for 1.5" Flanged 25 mm Side Ports



Model D470 Series OxyProbe® D.O. Sensors

The sensor fits directly into a 25 mm side port with a 1.5" sanitary flange, eliminating the need for a housing, and reducing contamination risks. Designed with an integral 1.5" sanitary flange, this sensor has two seals to secure it into the vessel. A gasket seal at the flange holds the sensor securely in place, while the 25 mm o-ring seal minimizes crevices when the sensor is installed.

It is important to note, the port should be at least 15° above horizontal in order to be used for any pH electrode or D.O. sensor. Vessels with these ports are often found in food and pharmaceutical processes that utilize CIP.

The interior design and replacement parts of this sensor are the same as other 25 mm OxyProbes. The modular design allows quick replacement of any part, making it easy to maintain and repair the sensor. OxyProbe dissolved oxygen sensors carry a 2-year warranty.

For performance specifications see page 61.

How to choose a sensor:

- (1) Confirm that the vessel has a 1.5" sanitary flange port with an internal diameter of 25 mm. Cutaway views and dimensions are shown on pages 44 and 45.
- (2) Decide whether a right angle connector is preferred over a straight connector.
- (3) Choose the optimum length cable and a connector. All D.O. sensors require a separate cable connector assembly. See pages 102 and 103.

Features:

- 316L Stainless Steel
- Serialized for traceability
- FDA compliant silicone o-rings
- RA32 finish with electropolish on wetted parts

TIPS & HINTS

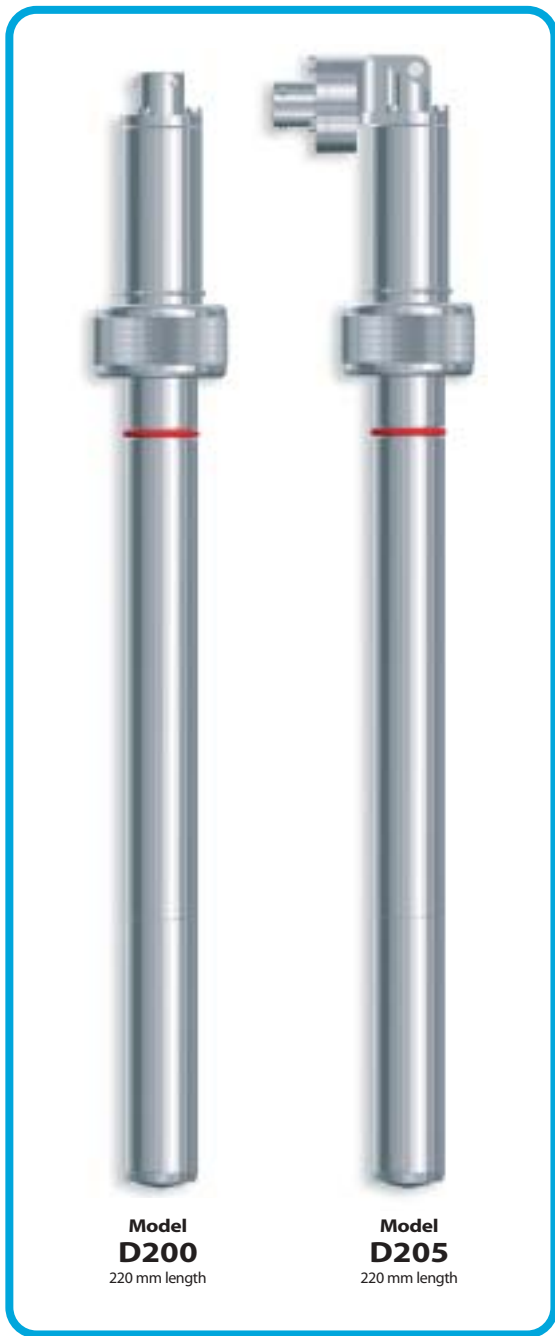
Partial Pressure of Oxygen

Polarographic D.O. sensors measure the partial pressure of oxygen. The partial pressure of oxygen is dependent on both the mixture of the gases and the pressure inside the vessel. Variations in pressure will lead to a significant change in measurement. When reading % saturation, the operating pressure of the vessel should be taken into consideration if the process pressure is not the same as the calibration pressure. Changes in headspace pressure and changes in media level will both change the pressure at the sensor.

ordering information

Sensor Part Number	Sensor Length	Typical Insertion Length	Sensor Price
25 mm OxyProbe® with 1.5" Sanitary Flange			
Straight Connector:			
D470-B070-PT-D9	70 mm	36 mm	1.4"
Right Angle Connector:			
D475-B070-PT-D9	70 mm	36 mm	1.4"

OxyProbe® 19 mm D.O. Sensors for 19 mm Top Ports



Model D200 Series

The OxyProbe® 19 mm dissolved oxygen sensor features the same rugged and versatile design as the 25 mm OxyProbe. Although the 19 mm OxyProbe sensor has a slightly smaller diameter than the 25 mm sensor, it utilizes the same anode/cathode assembly and membrane cartridges. The 19 mm OxyProbe is often used in both process and benchtop applications, which are equipped with special 19 mm top ports

The Model D200 series dissolved oxygen sensors are made of 316L stainless steel to withstand the bioprocess environment. Each sensor is serialized for traceability, and the port retainer ring is secured to the sensor to prevent loss. All Broadley-James dissolved oxygen sensors carry a 2-year warranty.

For performance specifications see page 61.

How to choose a sensor:

- (1) Determine that the port has a 19 mm diameter.
- (2) Decide whether a right angle connector is preferred over a straight connector.
- (3) Choose a sensor length appropriate for the application. The sensor tip should be at least 40–50 mm (1-1/2" to 2") below the surface of the media without hitting an obstruction, such as the impeller, within the vessel.
- (4) Choose the correct cable length and connector. All D.O. sensors require cable and connector assemblies. See pages 102 and 103.

ordering information

Sensor Model	Sensor Length	Typical Insertion Length		Sensor Part Number	Sensor Price
D200 Series 19 mm Oxyprobe with Straight Connector					
D200	150 mm	140 mm	5.5"	D200-B150-PT-D9	
D200	220 mm	210 mm	8.3"	D200-B220-PT-D9	
D200	320 mm	310 mm	12.2"	D200-B320-PT-D9	
D200	420 mm	410 mm	16.1"	D200-B420-PT-D9	

ordering information

Sensor Model	Sensor Length	Typical Insertion Length		Sensor Part Number	Sensor Price
D205 Series 19 mm OxyProbe with Right Angle Connector					
D205	150 mm	140 mm	5.5"	D205-B150-PT-D9	
D205	220 mm	210 mm	8.3"	D205-B220-PT-D9	
D205	320 mm	310 mm	12.2"	D205-B320-PT-D9	
D205	420 mm	410 mm	16.1"	D205-B420-PT-D9	

All OxyProbes are available with a right angle connector. This low profile design offers:

- Protection against cable fatigue
- Improved grip for sensor extraction
- Increased clearance between vessels

OxyProbe® D.O. Sensor with 1.5" Sanitary Flange for Sanitary Pipe Tee and Novaseptic Side Ports



Model D210 Series OxyProbe® D.O. Sensors

These sensors are unique in their construction. The front end of the sensor is the same as the 19 mm sensor, with the smaller diameter and no crevices or o-rings. It fits directly into a 1.5" sanitary pipe tee, eliminating the need for a housing, reducing contamination risks. Designed with an integral 1.5" sanitary flange, a gasket seal at the flange holds the sensor securely in place.

It is important to note, these sensors are not intended for use with the standard 25 mm sanitary flange ports found on page 44. However, they can be used with the NovAseptic ports shown on page 69.

The interior design and replacement parts of this sensor are the same as other 25 mm OxyProbes. The modular design allows quick replacement of any part, making it easy to maintain and repair the sensor. OxyProbe dissolved oxygen sensors carry a 2-year warranty.

For performance specifications see page 61.

Features:

- 316L Stainless Steel
- Serialized for traceability
- RA32 finish with electropolish on wetted parts

Additional Features Include:

- Fits in both sanitary flange ports and NovAseptic ports.
- Can also be used in-line in a sanitary pipe tee.

It is important to maintain the sensors by inspecting and calibrating them regularly. The membrane cartridge should be checked and refilled prior to every use.

How to choose a sensor:

- (1) Confirm that the pipe tee has the proper clearance.
- (2) Decide whether a right angle connector is preferred over a straight connector.
- (3) Choose the optimum length cable and a connector. All D.O. sensors require a separate cable connector assembly. See pages 102 and 103.

Ordering Information

Sensor Part Number	Sensor Length	Typical Insertion Length	Sensor Price
19 mm OxyProbe® with 1.5" Sanitary Flange			
Straight Connector: D210-B070-PT-D9	70 mm	70 mm	2.8"
Right Angle Connector: D215-B070-PT-D9	70 mm	70 mm	2.8"

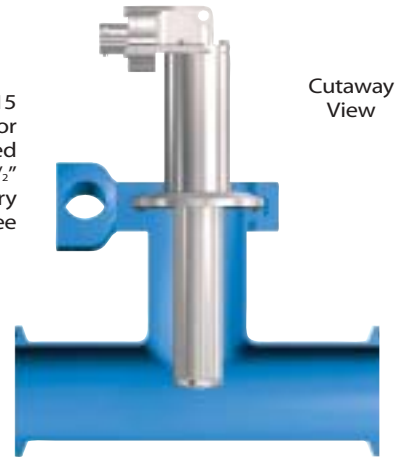
All OxyProbe dissolved oxygen sensors are available with a right angle connector. This low profile design provides:

- Protection against cable fatigue
- Improved grip for sensor extraction
- Reduced random sensor mobility on flat surfaces (won't roll off the table)

Standard Mounting for Model D210 Series D.O. Sensors

The Models D210 Series D.O. OxyProbe sensors are intended for use in a 1 1/2" sanitary pipe tee. The sensor is secured into the tee with a standard flange clamp sealed with a flange gasket. The tip of the sensor is positioned in the middle of the process flow when it is placed in a standard size tee. These sensors can also be used in NovAseptic ports. See the Tip and Hint below for more information.

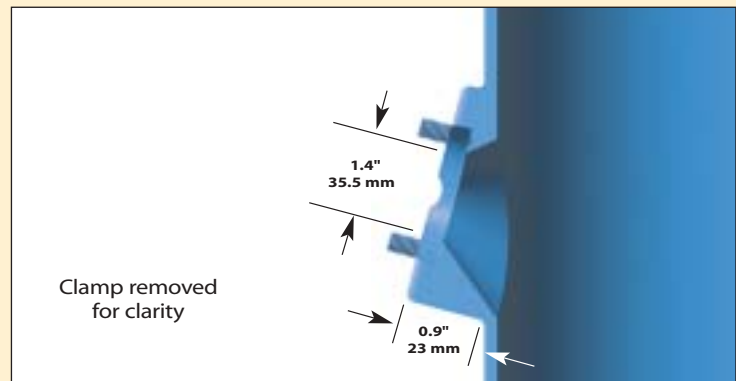
Model 215 D.O. sensor installed in a 1 1/2" sanitary pipe tee



TIPS & HINTS

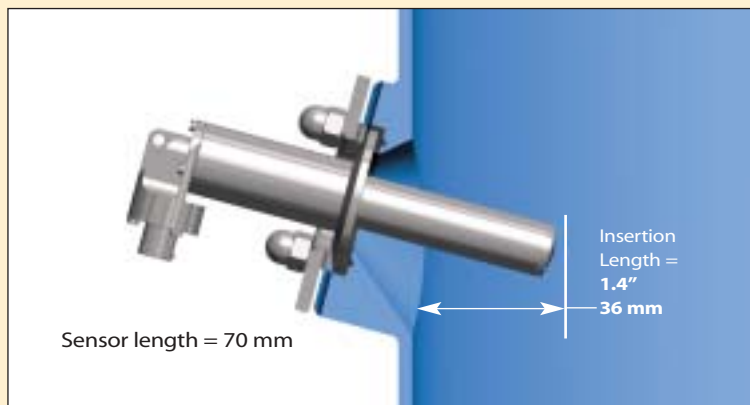
NovAseptic Sanitary Port

A novel approach to vessel port design, this NA-connect® port from NovAseptic is sometimes found on vessels in biotech facilities. This style of port is flush to the vessel wall to minimize crevices. The port is installed at a 15° angle to allow for proper sensor performance. See the cutaway drawing to the right for typical installation dimensions.

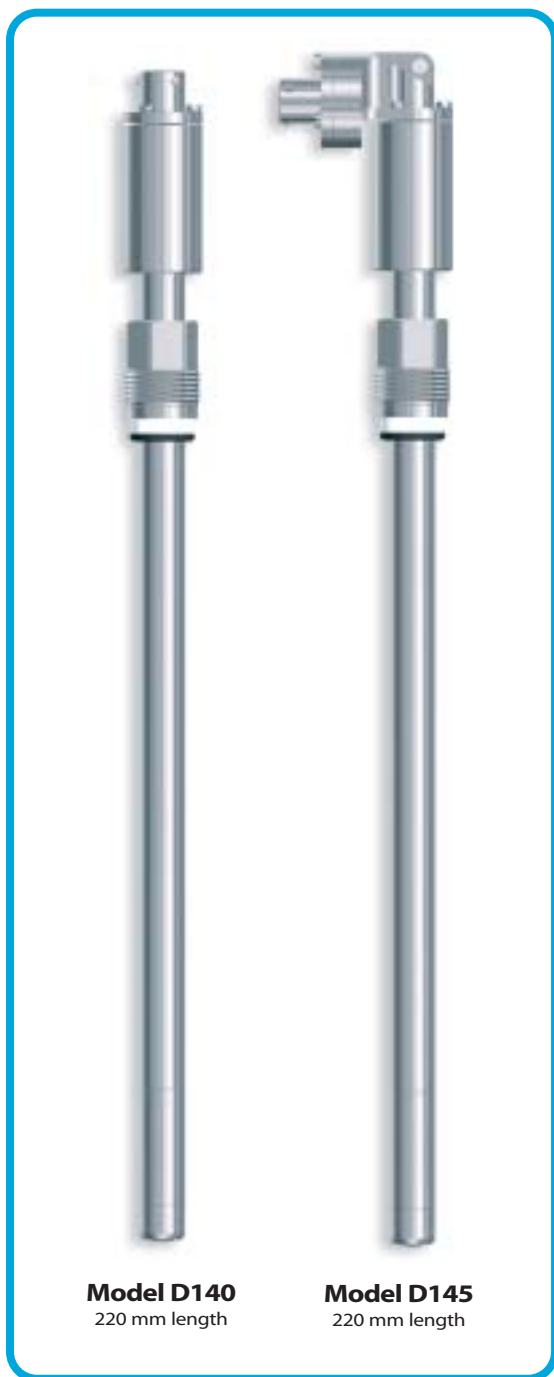


D215 Installed in NovAseptic Port

The Model D210 or D215 sensor installed in a NA-connect® port offers potential benefits in biotech applications. The unique design of the port offers increased drainage around the port and most effective Clean-In-Place (CIP). The flush port allows the use of a 19 mm sensor front end, since there is no need for a forward o-ring to seal the sensor into the vessel. Minimizing or eliminating the cracks or crevices improves cleanability.



OxyProbe® 12 mm D.O. Sensors for Benchtop Vessels



Model D140
220 mm length

Model D145
220 mm length

It is important to regularly maintain the sensors by inspecting and calibrating them. The membrane cartridge should be checked and refilled prior to every use.

Model D140 Series OxyProbe® D.O. Sensors

The OxyProbe 12 mm dissolved oxygen sensor offers the most rugged and versatile design for benchtop vessels. The compact profile saves space on a crowded headplate. It will fit directly into any 12 mm multipurpose port with standard compression fittings or Pg13.5 threads. The small diameter facilitates D.O. measurement in small volumes, especially bottles and spinner flasks.

The OxyProbe 12 mm D.O. sensor has the same rugged performance as the 19 mm and 25 mm sensors. This polarographic sensor utilizes the longer silver anode and small cathode which has become the industry standard. It also uses the same gas-permeable, silicon/teflon composite membrane, reinforced with stainless steel mesh.

For performance specifications see page 61.

All OxyProbe dissolved oxygen sensors are available with a right angle connector. This low profile design provides:

- Protection against cable fatigue
- Improved grip for sensor extraction
- Increased clearance between vessels
- Reduced random sensor mobility on flat surfaces (won't roll off the table)

How to choose a sensor:

- (1) Determine how far the sensor should project into the vessel.
- (2) Decide whether a right angle connector is preferred over a straight connector.
- (3) Choose the correct cable length and a connector. All D.O. sensors require cable and connector assemblies. See pages 102 and 103.

ordering information					
Sensor Model	Sensor Length	Typical Insertion Length		Sensor Part Number	Sensor Price
D140 Series 12 mm OxyProbe with Straight Connector					
D140	120 mm	110 mm	4.3"	D140-B120-PT-D9	
D140	150 mm	140 mm	5.5"	D140-B150-PT-D9	
D140	220 mm	210 mm	8.3"	D140-B220-PT-D9	
D140	320 mm	310 mm	12.2"	D140-B320-PT-D9	
D140	420 mm	410 mm	16.1"	D140-B420-PT-D9	

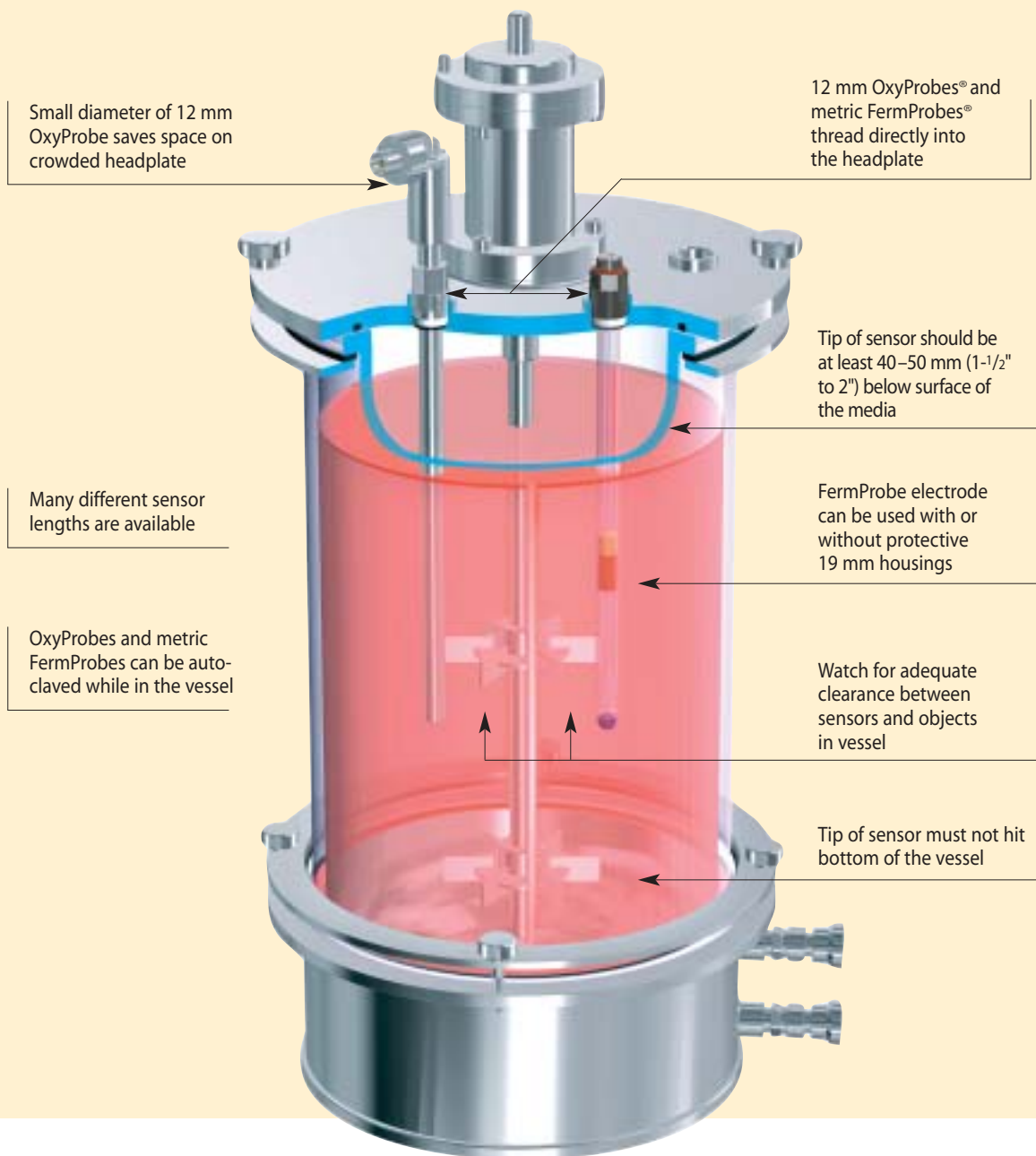
ordering information					
Sensor Model	Sensor Length	Typical Insertion Length		Sensor Part Number	Sensor Price
D145 Series 12 mm OxyProbe with Right Angle Connector					
D145	120 mm	110 mm	4.3"	D145-B120-PT-D9	
D145	150 mm	140 mm	5.5"	D145-B150-PT-D9	
D145	220 mm	210 mm	8.3"	D145-B220-PT-D9	
D145	320 mm	310 mm	12.2"	D145-B320-PT-D9	
D145	420 mm	410 mm	16.1"	D145-B420-PT-D9	

TIPS & HINTS

How to Select Sensors for Benchtop Vessels

Typically a benchtop application is less than 5 L, and uses a glass vessel or flask. Usually the entire vessel can be placed or wheeled into an autoclave for sterilization prior to a run. Not only is there a wide range of different vessel sizes used in benchtop bioprocess applications, but also the volume of the media in the vessel will often change during the process. Accordingly, the sensors for benchtop vessels are available in

a wide variety of lengths. The operator must choose a sensor length that ensures that the sensor tip is submerged at all times during operation. Some sensor models have been configured to thread directly into the headplate and various access ports found on small vessels. Detachable cables and other design features allow these products to withstand the demands of autoclaving requirements.



Section Four

Maintenance

Service and Supplies



Improved Sensor Performance & Longevity

Broadley Technologies® Maintenance Supplies, Designed to make your job easier.

The primary components of a Dissolved Oxygen or pH measurement loop are the sensors and the transmitters. The sensors are designed to be as robust as possible, but still require regular inspection and maintenance. Some items, such as membrane cartridges, are consumables and need to be replaced on a frequent basis. Others, such as 4-pin connectors, provide a safe and repeatable method of restoring a damaged sensor back to “as new” conditions. Still others, such as o-rings and gaskets, ensure that the effects of normal wear and tear are eliminated and optimum performance is restored. On the following pages you will find a wide variety of supplies to keep your sensors in optimum condition. If you need something not shown, just call. Broadley Technologies may have the item in stock or be able to direct you to where it can be found.

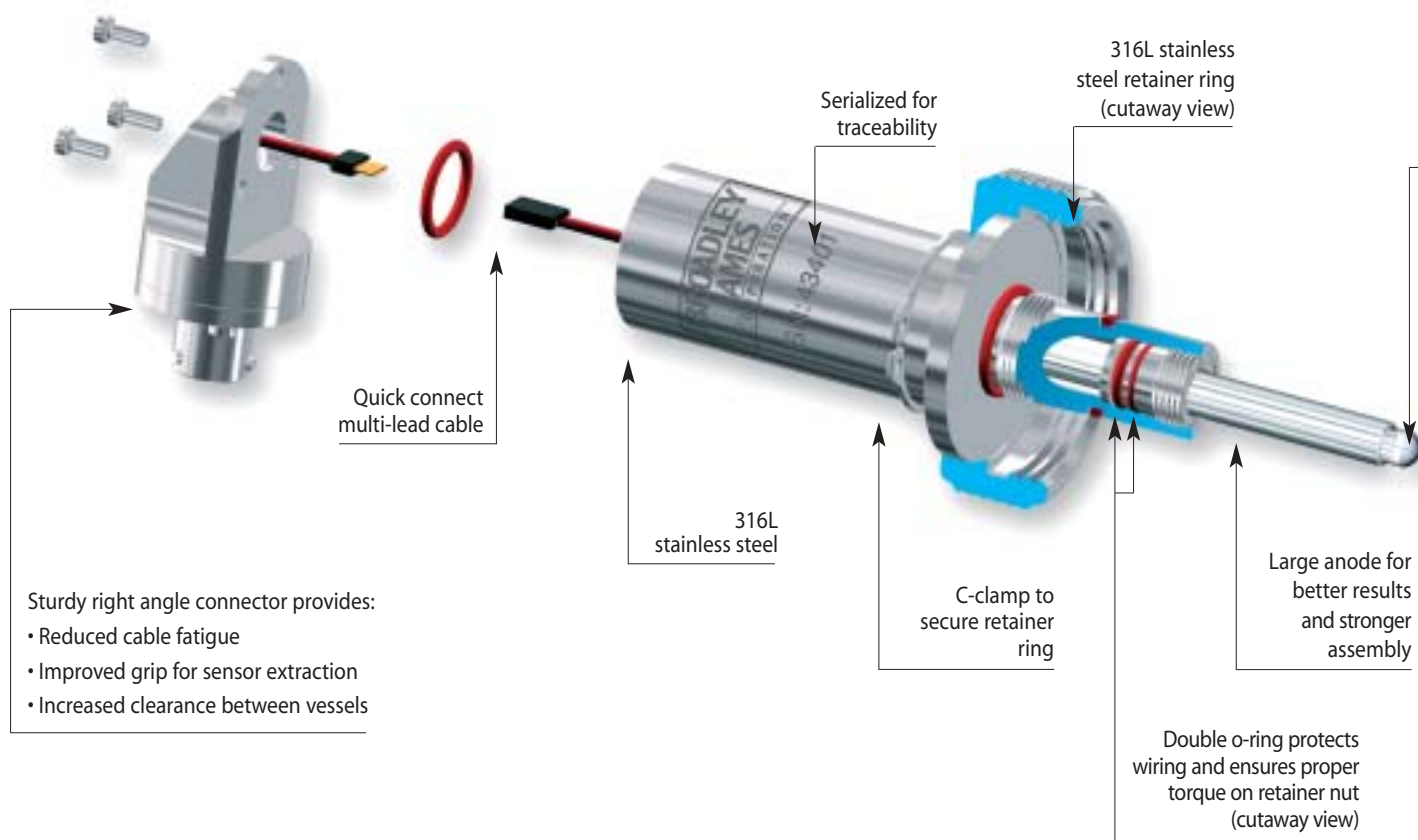
25 mm Membrane Cartridges

The OxyProbe® 25 mm membrane cartridges are a rather complex item. The body is composed of a chemical resistant polymer with a unique silicone internal bladder which contains the internal electrolyte. The shape of this bladder, combined with the shape of the polymer body, allows for the expansion of the electrolyte during the sterilization cycle without distortion of the actual sensing membrane. The sensing membrane is reinforced with an internal stainless steel mesh. Rather than use a nickel-plated brass membrane retainer ring, Broadley-James uses a 316L stainless steel retainer. The combined effect of these improvements is a durable, yet precise and repeatable, membrane cartridge assembly. Each membrane is individually leak tested and visually inspected under high magnification prior to packaging in its own protective vial.

O-rings

One of the smallest parts plays one of the biggest roles. O-rings are the first and only defense against contamination. To properly perform their intended function o-rings must have the proper fit, compression, elasticity, chemical resistance, and durability. All of our o-rings are compatible with steam sterilization and are highly chemical resistant. The sealing materials are all in accordance with FDA guidelines. Documentation of the o-ring compliance is available upon request. Over two pages of this catalog are devoted to just o-rings — every size, material, and quantity that you might need to regularly service your pH housings and D.O. sensors. An interesting and perhaps little known fact about our o-ring catalog pages is that the items are shown actual size! If you have an o-ring and are not sure of the type, just place it on top of the image in the catalog. If it matches then you have found your part.

Complete Rebuild Service for 25 mm, 19 mm and 12 mm D.O. Sensors



Sturdy right angle connector provides:

- Reduced cable fatigue
- Improved grip for sensor extraction
- Increased clearance between vessels

Broadley-James provides complete D.O. sensor rebuild service. This service includes rebuilding, testing, polishing and certifying any of the D.O. sensor designs for the cost of 1 hour of labor plus parts. While the modular design of the 25 mm and 19 mm OxyProbe D.O. sensors facilitates rapid rebuilding of the sensor by the customer, it is recommended that 12 mm D.O. sensors always be rebuilt by Broadley-James due to the difficulty in removing the anode/cathode assembly.

The Rebuild Service Consists of These 7 Steps:

1. Inspect the Connector Plug and Wiring

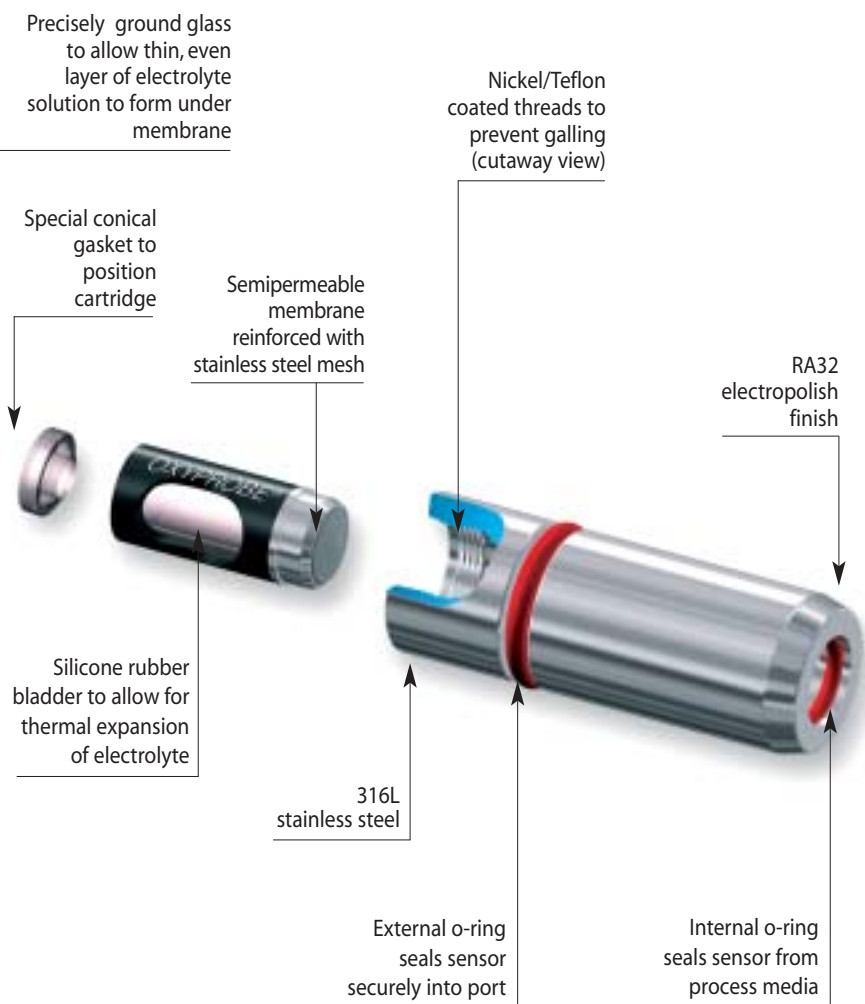
Occasionally the connector pins become bent or broken during use, so the connector will be replaced if necessary. The optional right angle connector minimizes cable fatigue and makes it easier to remove the sensor. Its low profile will also provide additional clearance between vessels. Any D.O. sensor with a straight connector can easily be converted to this right angle style.

2. Replace Cathode Assembly

This is the heart of the sensor. The glass tip should never be bumped or hit. Imperfections in the polish or curve of the tip will affect sensor readings and calibration. For example, nicks in the glass allow pools of electrolyte to form. During the process, oxygen will collect in these same spots and interfere with the reading. If a pool of electrolyte is near the platinum wire of the cathode, the sensor will not zero.

3. Replace all O-rings

All o-rings are replaced during rebuild. The unique feature of the Broadley-James D.O. sensor is that all seals are mechanical seals. There are no adhesive sealants to leak or fail while the sensor is in process.



5. Replace Membrane Cartridge

The silicone membrane is reinforced with stainless steel mesh and can easily be damaged. Just a bump on a hard surface can ruin its integrity. Eventually it will become clogged, stretched or damaged, so it should be changed regularly. Inspection and calibration of the sensor will determine when to change the cartridge. Broadley-James has designed a membrane testing kit to confirm that the membrane has not been compromised prior to use. The membrane cartridge is replaced during rebuild service.

6. Refill Electrolyte Solution

It is recommended that the electrolyte be changed after every run for the sensor to work at optimum reliability. The surface of the cathode assembly is ground to allow a thin layer of electrolyte to be trapped between the membrane and the glass. It is this solution which completes the circuit of the sensor. The electrolyte, along with the membrane, is replaced during rebuild.

7. Provide Quality Assurance Certificate and 2-Year Warranty

As a final step, Broadley-James Corporation will heat sterilize the sensor and test it to ensure it is working correctly. A QA certificate is provided which includes the date of rebuild and calibration results. The serial numbers of the sensor and cathode are kept on file. This documentation will serve as the new warranty against manufacturer's defects in parts and workmanship.

It is much easier to replace o-ring seals rather than sealant. With sealant, it is necessary to eliminate all residue before re-applying another seal. Always inspect o-rings for wear prior to use. Good o-ring seals are critical to sensor performance for the following reasons:

- To keep moisture out of the wiring pocket allowing the sensor to withstand washdowns and autoclaving.
- To prevent the process from contaminating the sensor and wiring.
- To seal the sensor securely into the port to prevent leakage.

4. Polish the Outer Body

The sensor is polished down to the base metal. Dirt, tarnish and steam scorch marks are removed from the surface. The body of the sensor is fabricated from 316L stainless steel to withstand repeated exposure to both CIP and SIP conditions. Anything less would allow pitting and corrosion of the metal over time. The extra polishing step ensures the sensor is as clean as possible before returning it to service after the rebuild.

Replacement Parts for 25 mm and 19 mm D.O. Sensors

AM-9213
Cathode
Tool



Cathode Removal Tool

The two notches in the bottom of this stainless steel tool fit into the grooves of the cathode retainer nut to quickly remove the nut and the cathode assembly. The knurled handle provides sufficient grip to tighten the retainer nut to the proper torque eliminating the need for additional tools.

Part Number **Price**

AM-9213

AM-9210
Cathode
Retainer
Nut

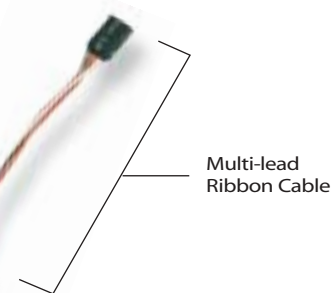


Cathode Retainer Nut

This retainer nut secures the cathode assembly into the sensor body. The mechanical seals on the Broadley-James electrode keep this retainer nut clean and dry. It is reusable and unlikely to need replacing unless accidentally lost during rebuild.

Part Number **Price**

AM-9210



CT25-PT-
Cathode
Assembly

Cathode Assembly for 25 mm and 19 mm Sensors

This part number includes the cathode assembly and both o-rings required to seal it into the sensor body. The only difference between each of the models listed below is the length of the multi-lead ribbon cable. The ribbon cable connects the assembly to the sensor's 4-pin connector.

Part Number **Sensor Length** **Price**

CT25-PT-050MP	70 mm	
CT25-PT-130MP	150 mm	
CT25-PT-200MP	220 mm	
CT25-PT-300MP	320 mm	
CT25-PT-400MP	420 mm	

Connectors for 25 mm, 19 mm and 12 mm D.O. Sensors

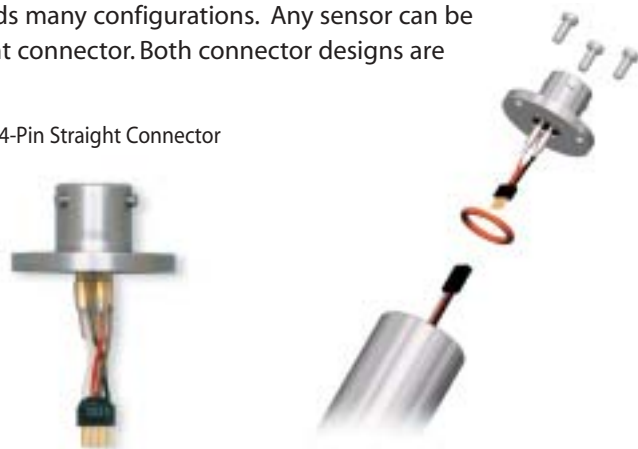
Sensor Connectors

The modular design of Broadley-James OxyProbe® sensors affords many configurations. Any sensor can be quickly converted to or from a right angle connector or a straight connector. Both connector designs are useful; choose whichever one works best for the application.

Straight 4-Pin Connector

Part Number	Description	Price
AM-9202	25 mm Sensor	
AM-9203	19 mm Sensor or 12 mm Sensor	

4-Pin Straight Connector



Right Angle 4-Pin Connector Assembly

The 4-pin right angle connector assembly is comprised of 2 components, the straight connector and the right angle adapter. These parts can be purchased individually or as a set. To convert from a straight connector to a right angle connector, the 4-pin straight connector listed above needs to be replaced. The 4-pin connector used with the right angle adapter has longer connector wires to accommodate the bend in the right angle adapter. The opening in the extended elbow is a great place to easily attach a dust cap or permanent identification tag to the sensor.

25 mm Sensors

Part Number	Description	Price
AM-9349	4-pin connector	
AM-9387	Adapter	
AM-9386	Right angle assembly	

19 mm or 12 mm Sensors

Part Number	Descriptions	Price
AM-9349	4-pin connector	
AM-9392	Adapter	
AM-9393	Right angle assembly	

4-Pin Right Angle Connector

AM-9387 Adapter



AM-9349 4-Pin Connector

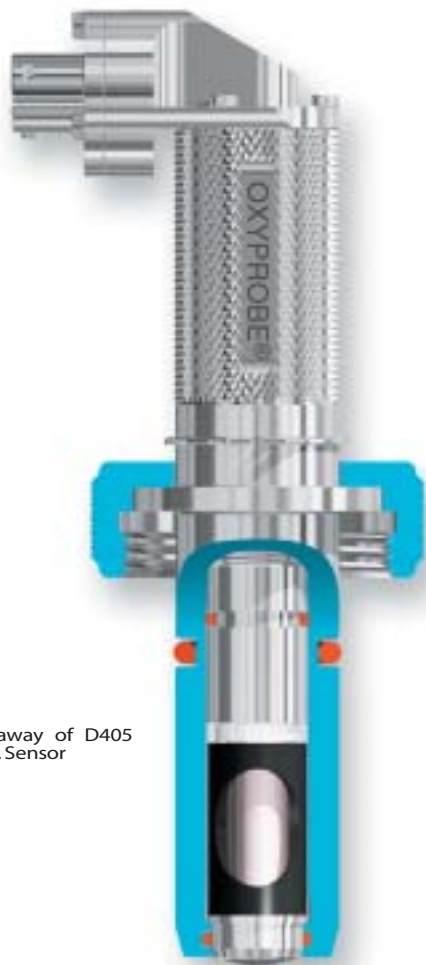
AM-9386 Complete Assembly

TIPS & HINTS

Right Angle Connector Benefits

The right angle connector keeps the sensor from rolling off of the table or laboratory bench and prevents cable stress caused by tight bends as the cable exits the sensor. A sensor with the old style straight connector can be easily retrofitted to use the new right angle connector, which also has a place to attach the connector dust cap and an identification tag. The right angle connector combines form and function to help make the sensors more useful and extend their life.

Membrane Cartridges for 25 mm and 19 mm D.O. Sensors



Cutaway of D405 D.O. Sensor



Membrane Cartridge for 25 mm and 19 mm D.O. Sensors

Single Cartridge Kit

This kit includes everything required to replace the membrane cartridge and internal o-rings on one 25 mm or 19 mm OxyProbe®.

This kit includes:

- One 25 ml bottle of electrolyte
- One membrane cartridge
- One set of internal o-rings



Part Number **Price**

KA2501

Four Cartridge Kit

This kit contains everything required to replace four membrane cartridges on any combination of 25 mm or 19 mm OxyProbes. Everything is conveniently packed in one box for easy storage.

This kit includes:

- One 25 ml bottle of electrolyte
- Four membrane cartridges
- Four sets of internal o-rings



Part Number **Price**

KA2504

25 Piece Cartridge Kit

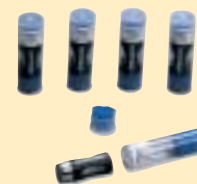
This convenient bulk pack is the most popular among large volume users. It contains 25 membrane cartridges in one easy-to-store box. **Internal o-rings, gaskets and electrolyte must be ordered separately.**



Part Number **Price**

KA2525

Cartridges only



Membrane Cartridges for 12 mm D.O. Sensors



Model D145
D.O. Sensor

Cartridge threads
directly onto
12 mm D.O.
Sensor



Membrane Cartridge
for 12 mm D. O. Sensor

Single Cartridge Kit

This kit includes everything required to replace the membrane cartridge and internal o-rings on one 12 mm OxyProbe®.

This kit includes:

- One 25 ml bottle of electrolyte
- One membrane cartridge
- One set of internal o-rings



Part Number	Price
KA1201	

Four Cartridge Kit

This kit contains everything required to replace four membrane cartridges on a 12 mm OxyProbe. Everything is conveniently packaged in one box for easy storage.

This kit includes:

- One 25 ml bottle of electrolyte
- Four membrane cartridges
- Four sets of internal o-rings



Part Number	Price
KA1204	

25 Piece Cartridge Kit

This convenient bulk pack is the most popular among large volume users. It contains 25 membrane cartridges in one easy-to-store box. **Internal o-rings, gaskets and electrolyte must be ordered separately.**



Part Number	Price
KA1225	

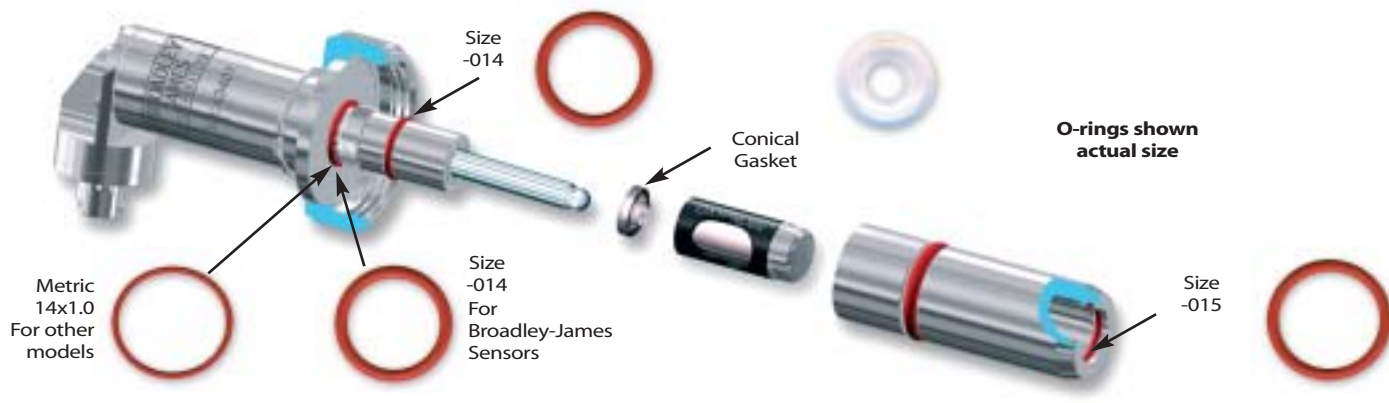
Cartridges only

O-rings for D.O. Sensors

Internal O-rings for 19 mm and 25 mm D.O. Sensors

O-rings need to be replaced over time. Internal o-rings for 19 mm and 25 mm D.O. sensors are included with each membrane kit. However, bulk packs are also available.

Part Number	Description	Quantity	Price
AG-9206-10	4 internal o-rings, 1 gasket	10 sets	



TIPS & HINTS

Beveled Sealing Points of D.O. Sensors

The Broadley-James D.O. o-ring kit contains five o-rings, but the sensor only has four sealing points. The difference is at the first sealing point (see above). There is a bevel at the very end of the inside threads of a Broadley-

James endcap. This bevel creates a pocket into which the o-ring seats securely. Some manufacturers do not have such a pocket, therefore, only a very small, thin o-ring will fit. An extra, thin o-ring is provided to fit these sensors.

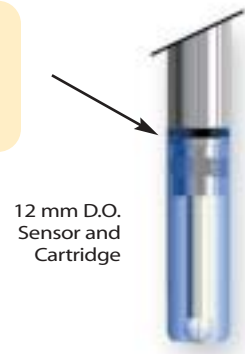
Internal O-rings for 12 mm D.O. Sensors

O-rings should be on hand when changing the membrane cartridge of a D.O. sensor. These internal o-rings are included in membrane cartridge kits. However, membrane cartridge bulk packs do not include o-rings or electrolyte solution. These items must be purchased separately.

Part Number	Description	Quantity	Price
AG-E011-25	Internal o-rings for 12 mm D.O.	25	

Shown actual size

Size -011 EPDM



12 mm D.O. Sensor and Cartridge

O-rings for D.O. Sensors

Part Number	Quantity	Price
AG-S016-50	50	
AG-S016-25	25	
AG-S016-10	10	

19 mm External O-rings

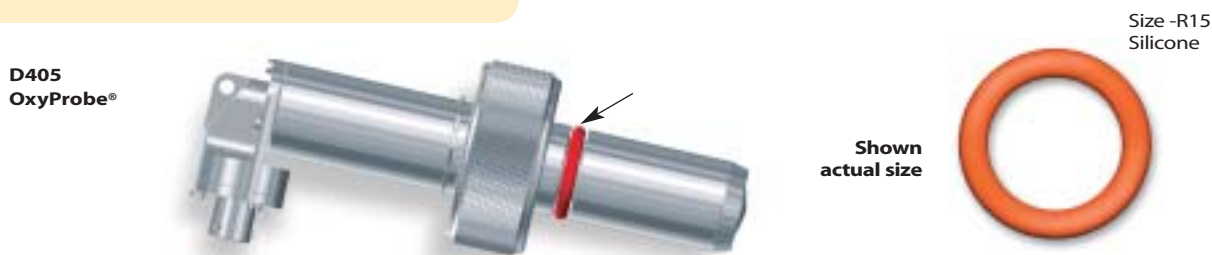
This silicone o-ring will fit the external groove of any 19 mm D.O. sensor or housing. It should be replaced regularly to ensure that the housing or sensor fits securely into the port.



Part Number	Quantity	Price
AG-SR15-50	50	
AG-SR15-25	25	
AG-SR15-10	10	

Standard 25 mm External O-rings

The external silicone o-ring on a 25 mm D.O. sensor is the same as the one found on a 25 mm housing. It should be replaced regularly to ensure that the sensor fits securely into the port.



Part Number	Quantity	Price
AG-E117-50	50	
AG-E117-25	25	
AG-E117-04	4	

25 mm B. Braun Biotech External O-rings

The B. Braun Biotech D.O. sensors and housings have an EPDM o-ring seal. The internal diameter is slightly larger and the cross-section is slightly smaller than the external silicone o-rings found on other Broadley-James 25 mm housings and D.O. sensors.



O-rings for D.O. Sensors and pH Electrodes

External O-rings for 12 mm D.O. Sensors and FermProbe® pH Electrodes

The Viton o-ring and Teflon washer found on 12 mm D.O. sensors is the same as those found on FermProbes with metric threads. These seals should last the lifetime of the sensor or electrode, but replacements can be purchased in sets of three.

Part Number	Compatible Probes	Quantity	Price
300-P101	F-600, F-607 and F-615 FermProbes	3 sets	
300-P102	F-695 and F-635 Fermprobes and 12 mm D.O. OxyProbes®	3 sets	

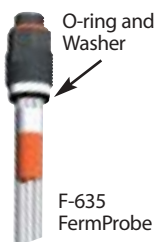
Replacement Set Shown Actual Size



Size -111 Viton



Teflon Washer



F-635 FermProbe



F-600 FermProbe

O-ring and Washer



O-ring and Washer

F-695 FermProbe



D145 OxyProbe

O-ring and Washer

TIPS & HINTS

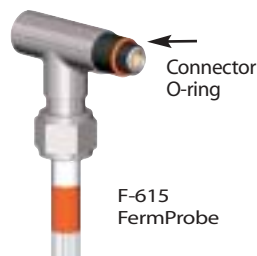
Beveled Teflon Washer for Pg13.5 Metric Threads

The difference between the above two sets of o-rings is the Teflon washer. Electrodes with the Pg13.5 metric threads require a beveled Teflon washer, which allows the o-ring and electrode to seat better when threaded into a metric threaded port or headplate. A bevel is not required for a FermProbe to seal correctly in a standard housing.

O-rings for FermProbe Connectors

In order to keep moisture out of the connector during autoclaving, FermProbes have a small o-ring gasket at the base of the connector. These o-rings should last the lifetime of the electrode. However, they may need to be replaced on occasion due to loss during handling.

Part Number	Description	Quantity	Price
AG-S013-04	FermProbe connector o-ring	4	
AG-S013-25	FermProbe connector o-ring	25	



F-615 FermProbe



F-635 FermProbe



Size -013 Silicone

Actual Size O-ring

O-rings for 25mm Housings

Standard 25 mm Housing O-rings

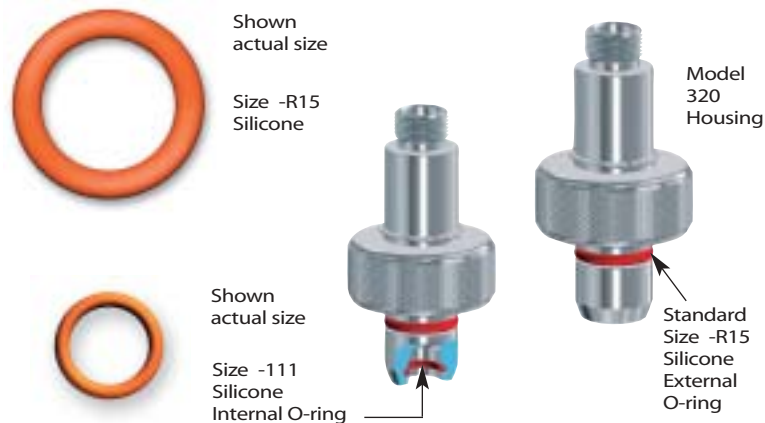
Broadley-James Models 320, 330, 370 housings use the same set of o-rings. O-rings should be inspected regularly and replaced at the first sign of wear.

External O-rings

Part Number	Quantity	Price
AG-SR15-50	50	
AG-SR15-25	25	
AG-SR15-10	10	

Internal O-rings

Part Number	Quantity	Price
AG-S111-50	50	
AG-S111-25	25	
AG-S111-10	10	



B. Braun Biotech Housing O-rings

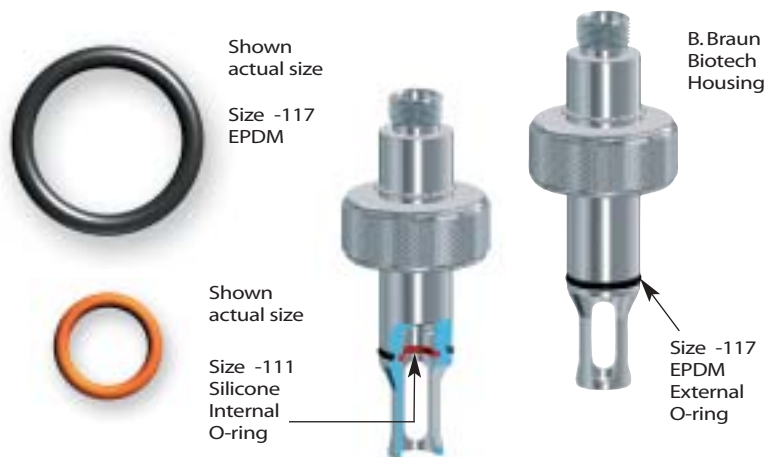
The external EPDM o-ring on the B. Braun Biotech housings, Models 322, 326 and 336, has a slightly smaller cross section than those found on other Broadley-James housings. The internal silicone o-ring is the same on all Broadley-James housings. Regular inspection and replacement is recommended. Do not use grease on any housing o-ring.

External O-rings

Part Number	Quantity	Price
AG-E117-50	50	
AG-E117-25	25	
AG-E117-04	4	

Internal O-rings

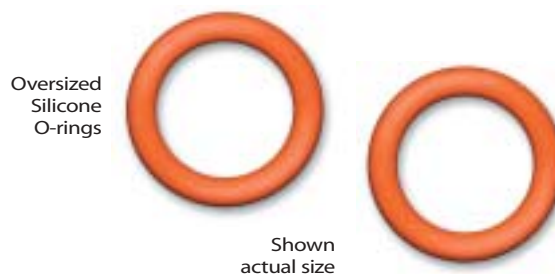
Part Number	Quantity	Price
AG-S111-50	50	
AG-S111-25	25	
AG-S111-10	10	



Oversized 25 mm O-rings

Broadley-James also offers a thicker, more pliable o-ring for certain applications. It has a larger o.d., but is more compressible than other silicone o-rings. It can be used on any standard 25 mm housing or D.O. sensor. This unique o-ring was designed to compensate for port imperfections such as a port that is out-of-round or has an i.d. slightly greater than 25 mm.

Part Number	Quantity	Price
AG-SF25-10	10	



Section Five

Accessories



Line-Powered Four-Station
D.O. Sensor Polarizer

pH & D.O. Sensor Simulator
for Troubleshooting
Instrumentation and
Cable Assemblies



Calibration, Diagnostics and Storage Accessories

The primary components of a measurement loop are the sensors and transmitters. However, when readings are suspect or if noise and interference are a problem, it can be hard to find the source of the problem without having the proper equipment. Many of the accessories are designed with troubleshooting in mind, allowing the metrology department or even the operator to diagnose equipment quickly and efficiently.

pH & D.O. Sensor Simulator

It is difficult to tell whether a problem with a measurement is due to a faulty sensor, or to a faulty cable or instrument. By substituting the pH & D.O. simulator in place of the sensor, a technician can verify if the cable and transmitter are configured correctly. While not intended to “calibrate” a loop, this high precision device mimics the sensor electronically. Problems with the transmitter or cable will become evident when testing, which can save hours trying to examine and diagnose a functioning sensor. Conversely, if the simulator works well on the system, then the technician knows to focus on the sensor for possible difficulties.

Four-Station Polarizer

Polarization plays an important role in the calibration of a D.O. sensor. A sensor which has not been completely polarized can be calibrated to 100%, but any attempt to do a zero calibration may result in an elevated zero value. Initially, D.O. sensors take a minimum of several hours to reach a completely polarized condition. If time is short and a few percent error is not critical, it should be noted that about 98% of the polarization occurs in the first 30 minutes. Another way to save time is to store the sensor attached to a Broadley Technologies OxyProbe® sensor polarizer. This four-station, line-operated device keeps four sensors polarized and ready for use. As an added feature, it contains a testing station for the battery operated single-station polarizer. Simply attached the battery polarizer to the connector and check the status lights. Two green lights indicate the correct millivolt output and enough battery left to perform the job.

Single-Station Polarizer

A standard in the industry, this battery powered device keeps D.O. sensors polarized as they wait for service. Note that these polarizers should not be autoclaved, since the batteries cannot survive the high temperature involved. As part of our awareness of the continuing need for documentation, we have individually serialized each polarizer and added a hole for attachment of a tag. As a result, the last time the unit was tested can be recorded and stored by serial number or noted directly on a tag attached to the device. No more wondering if the polarizer is functional or not.

Dust Caps, Ports, Plugs, Cleaning Kits

Broadley Technologies offers a wide variety of spare parts and accessories to make routine maintenance and upkeep of the sensor a simple process. Purchased in small quantities or large, there are no minimum orders or other penalties should you need a little something to make your system perfect.

pH and D.O. Storage



Benchtop Free Standing Storage Containers



Stanchion Mount Storage Containers for Pipe or Vessel Mounting



Mounting Hardware Kits for Stanchion Mount



Stainless Steel Stanchion Mount Storage Containers

Storage Containers

These strong storage containers were designed for industrial applications requiring an easily accessible, short-term, remote storage location for pH electrodes during tank maintenance to prevent the electrodes from dehydrating.

Free standing storage containers for benchtop use.

Part Number	Housing Length	Price
301-P109-H070	≤ 70 mm	
301-P109-H150	≤ 150 mm	

Stanchion mount storage containers for pipe or vessel mounting.

Part Number	Housing Length	Price
301-P110-H070	≤ 70 mm	
301-P110-H150	≤ 150 mm	

Mounting hardware kit for stanchion mount.

Part Number	Description	Price
300-P111-0200	For 50 mm (2") Pipe Diameter	

Stainless Steel storage containers for pipe or vessel mounting. Stanchion mount or tack-weld directly to vertical surface such as side of vessel or support.

Part Number	Housing Length	Price
AM-9364	70 mm	



4-Pack of Soaker Bottles

Soaker Bottle

Soaker bottles provide protection for any 12 mm pH electrode or D.O. sensor during transportation or storage. The o-ring fits securely against the sensor body, sealing the solution from the atmosphere to minimize evaporation, prevent spillage and increase solution life. Soaker bottles should be filled with buffer for D.O. sensor storage or KCl solution for pH electrode storage. Soaker bottles are available in a convenient 4-pack.

Part Number	Price
AM-1090-12	

pH Accessories

Buffer Solution

Broadley Technologies now carries buffer solutions from Ricca Chemical. Precision reference buffers of pH values 4, 7 and 10 are available in 500 ml size bottles. Certificates of Analysis will be included with each bottle. The pH temperature chart is on the label.

Part Number	Description	Size	Price
AS-3220-C30-0500	Buffer, pH 4	500 ml	
AS-3221-C30-0500	Buffer, pH 7	500 ml	
AS-3222-C30-0500	Buffer, pH 10	500 ml	



pH Electrode Storage Solution

The BioProcess Technologies Catalog™ now offers an electrode storage solution. Potassium Chloride (KCl) solution is the first choice for storing FermProbes®. If this is not available, buffer solution can be used. NEVER store pH electrodes in deionized (DI) water.

Part Number	Description	Size	Price
AS-3120-C20-0500	Electrode Storage Solution (KCl)	500 ml	



Standard Replacement Autoclave Cap

Every FermProbe with a detachable cable is shipped with an autoclave cap and a sealing o-ring. This cap should be used every time the electrode is autoclaved, to prevent moisture from resting in crevices of the connector.

Part Number	Description	Quantity	Price
300-P103-05	S8 Cap	5	
300-P203-05	K9 Cap	5	



Cable Adapter

This cable adapter converts any pH cable with an AK9 connector to a standard FermProbe connector. This rugged adapter can remain on the cable when not in use.

Part Number	Price
E-1245-AAD-DZ	



Retainer Rings for pH & D.O. Sensors & Housings



Retainer Ring for 25 mm Port

All port retainer rings from Broadley-James Corporation are 316L stainless steel. Housings and D.O. sensors come with an attached retainer ring, however, the ring may need to be replaced due to loss or damage.

Part Number	Height	Description	Price
AM-9200	0.87" (22 mm)	Current Style	
AM-9363	0.70" (18 mm)	Old Style	

Since 1999, Broadley-James Corporation has been supplying housings and D.O. sensors with a slightly taller retainer ring than in the past. The taller ring and additional threads were necessary to be compatible with the new safety ports offered by B. Braun Biotech and other vessel manufacturers. These taller rings will fit most old and new ports.



Smooth 25 mm Port Retainer Ring

25 mm Ergonomic Port Retainer Ring

This new port retainer ring has a smoother design to provide a more ergonomic grip, which is an advantage for individuals with smaller hands. The rounded edges are cleaner and will not catch or tear a glove or hand. It utilizes the same threads as the standard retainer ring to fit any 25 mm port, and has nickel-tylon coated threads to prevent galling. This beveled retainer ring can be ordered separately or as an upgrade on any 25 mm housing or D.O. sensor.

Part Number	Description	Price
AM-9388	Ergo-ring and C-clamp	



19 mm Port Retainer Ring

19 mm Port Retainer Ring

This port retainer ring will fit most 19 mm ports. The threads on the 19 mm port are finer than those on a 25 mm port. The ring is made of 316L stainless steel.

Part Number	Price
AM-9201	

Accessories for All D.O. Sensors

Membrane Cartridge Test Kit

Although the membrane is reinforced with stainless steel mesh, it is easy to damage the surface. A slight impact on a hard surface can damage the membrane and affect sensor performance. If cartridges are to withstand multiple cycles, it is critical to confirm that the membrane has not been compromised from the prior run. A quick test with this device assures that the membrane is in good condition.

Part Number	Price
AM-9425	



Membrane Tester

D.O. Electrolyte Solution

In critical biotech applications, the electrolyte should be changed after every run to yield the best results. The shelf life of this solution is approximately 2 years. Lot numbers and expiration dates are clearly marked on each bottle for tracking.

Part Number	Description	Price
AS-3140-C30-0025	25 ml—Approx. 10 cartridge refills	
AS-3140-C30-0250	250 ml—Approx. 100 cartridge refills	



D.O. Electrolyte Solution

Cable and Sensor Connector Dust Caps

Two different dust caps are available from Broadley-James. One to protect the D4 cable connectors and the other to protect the 4-pin D.O. sensor connection. The dust caps protect the connectors from damage and moisture when not in use.

Part Number	Price
AM-9212	
AM-9219	AM-9212 Sensor



AM-9219 Cable Connector Dust Cap

Connector Dust Cap

D.O. Sensor Cleaning Kit

Periodic cleaning of the cathode surface with a soft brush and cleaning paste, followed by a D.I. water rinse, has proven to be an effective and simple method for the removal of contamination on the cathode and anode surfaces. The kit includes a bottle of cleaning paste, a soft brush, and two pieces of micron polishing paper.

Part Number	Price
AM-9389	



D.O. Sensor Cleaning Kit

Ports and Plugs



25 mm Port Plugs

There are three styles of plugs available from Broadley-James Corporation for straight threaded ports. All are designed to accommodate 25 mm ports and are made from 316L stainless steel. The primary difference in each design is the placement of the o-rings.



Straight Port Plug for Standard 25 mm Port

While these two plugs have the same body dimensions, the o-ring on the Model 303 is further forward, providing a better fit in precision honed ports. The o-rings are silicone, and the distance listed is measured from the inside flange to the top of the o-ring groove.

Model	Part Number	Distance from flange	Price
300	AF-300-61-L040	0.43" (11 mm)	
303	AF-303-61-L040	1.17" (30 mm)	



B. Braun Biotech Plug

Straight Plug for B. Braun Biotech 25 mm Port

The longer body and forward o-ring are necessary for this plug to properly seal in a B. Braun Biotech port. The unique design of these ports makes the position of the o-ring critical for an effective seal. The o-ring is EPDM to conform with B. Braun Biotech's specifications. For more information regarding port identification, see pages 44 and 45.

Part Number	Description	Price
AF-305-62-L055	Straight plug For use with 25 mm B. Braun Biotech ports	

Straight 25 mm Threaded Port

Broadley-James offers two 25 mm straight threaded ports, both made of 316L stainless steel. Their i.d. varies to accommodate two different approaches to welding a port to a vessel. The Model 100 has an inner diameter of 25 mm to allow immediate use after welding. The Model 105 has a slightly smaller i.d. to allow the port to be honed out to the proper diameter after it has been attached to the vessel. This second approach is more forgiving of different welding techniques.



Straight Port

Model	Part Number	Description	Price
100	AF-100-60-L040	25 mm port	
105	AF-105-60-L040	Undersized 25 mm port	

TIPS & HINTS

Port Variations

Although the 25 mm threaded port is a standard within the biotech industry, the term "standard port" is no guarantee that two ports will be exactly the same. The overall length of a 25 mm port may vary from tank to tank. This

variation is often due to the wall thickness of the tank and the manufacturer's specifications. If a particular sensor or plug is not sealing properly in a port, measure the length of the port and compare it to the position of the o-ring. Perhaps a different plug or sensor will work better.

Chamfered 25 mm Threaded Port

This port style is the one most commonly found in the biotech industry. Proper installation will yield a side mounted port at 15° above horizontal. This angle is ideal for D.O. or pH measurement. The measured length is 40 mm from the top of the port to the bottom of the longer side.

Chamfered 25 mm Threaded Port

Part Number	Description	Price
AF-110-60-L040	Standard threaded port, chamfered (15° angle), 25 mm i.d.	



Chamfered Threaded Port

Chamfered 25 mm Plug

When properly installed, the bottom of this plug should be flush with the tank wall. The length is 40 mm from the inside flange to the end of the longer side of the plug.

Chamfered 25 mm Plug

Part Number	Description	Price
AF-310-61-L040	Chamfered plug, 25 mm o.d.	



Chamfered Plug

Chamfered 25 mm Port with 1.5" Sanitary Flange

This port is designed to be mounted on the side of a tank or vessel. When properly installed, the sensor will be 15° above horizontal. Ports with sanitary flanges are starting to appear more frequently in the biotech industry. These ports are usually sealed with a blind plate instead of a plug.

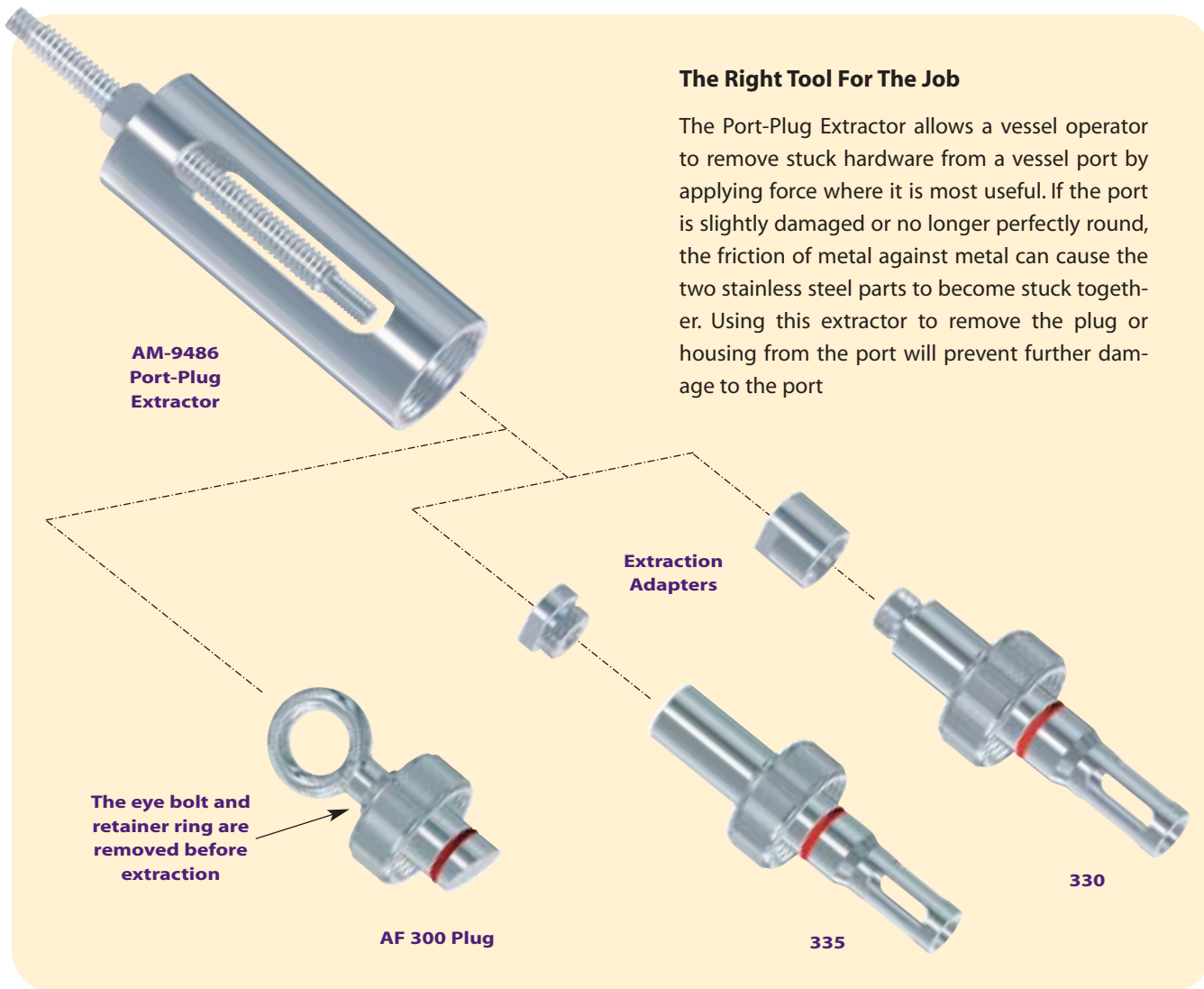
25 mm Port with 1.5" Sanitary Flange

Part Number	Description	Price
AF-210-60-L040	Port with 1.5" sanitary flange, chamfered (15° angle), 25 mm i.d.	



25 mm Port with 1.5" Sanitary Flange

Port-Plug Extractor



The Right Tool For The Job

The Port-Plug Extractor allows a vessel operator to remove stuck hardware from a vessel port by applying force where it is most useful. If the port is slightly damaged or no longer perfectly round, the friction of metal against metal can cause the two stainless steel parts to become stuck together. Using this extractor to remove the plug or housing from the port will prevent further damage to the port

Save the Day with the New 316L Stainless Steel Port-Plug Extractor:

On the rare occasion that a plug or housing becomes stuck in a 25 mm threaded port, Broadley Technologies now offers a port-plug extractor to solve this problem.

The extractor may be used with both standard and B.Braun Biotech vessels and is made of 316L stainless steel. The port will need to be cleaned and polished afterward to make sure future plugs and housings don't get stuck.

Housing Adapters:

The Port-Plug Extractor can remove a 25 mm threaded plug without any additional hardware. With the addition of the extraction adapters, the functionality of the Port-Plug Extractor has been expanded to include removal of two models of pH electrode housings.

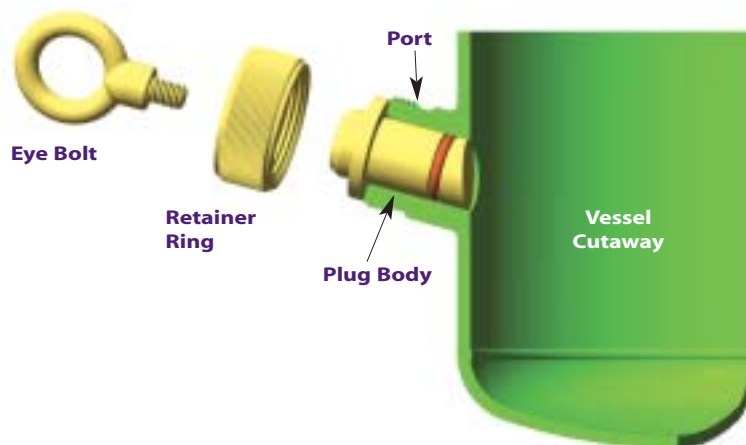
o r d e r i n g i n f o r m a t i o n

Part Number	Description	Price
AM-9486	Port-Plug Extractor with Adapters	

Step 1

If the 25 mm threaded port plug is stuck in the 25 mm threaded port...

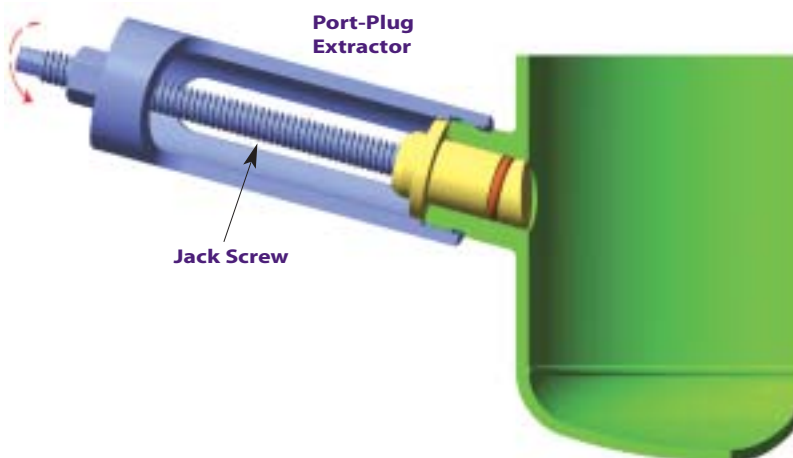
1. Unscrew the eye bolt from the plug body.
2. Unscrew the retainer ring from the port.



Step 2

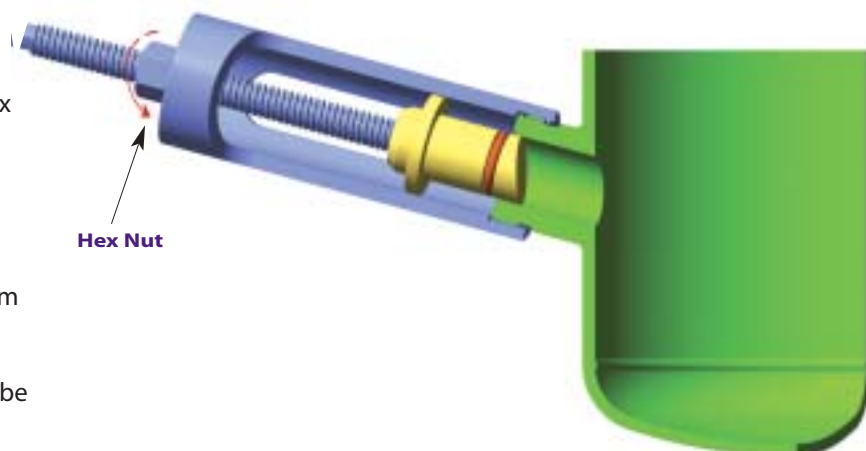
Gather together all of the parts of the port-plug extractor, and a wrench...

1. Screw the body of the port-plug extractor onto the port.
2. Screw the jack screw of the port-plug extractor into the eye-bolt hole of the plug, using your fingers or a wrench.



Step 3

1. Using a wrench, tighten the hex nut against the body of the extractor to pull the plug from the port.
2. When the plug is free from the port, unscrew the extractor from the threaded port.
3. The body of the plug can now be unscrewed from the port-plug extractor.



Calibration Accessories for All D.O. Sensors



D.O. Signal Simulator

D.O. Signal Simulator

The simulator isolates the transmitter by mimicking the load of a D.O. sensor. In doing so, the simulator can help confirm whether fluctuations in the display are caused by the sensor or by EMF interferences. A two position switch allows simulation of either 0% or 100% saturation.

Part Number Price

AM-9222



Single Station Module
(Battery Powered)

Polarization Modules

D.O. sensors may need to be polarized for several hours prior to calibration and use. Polarization modules allow the sensor to be polarized without tying up a transmitter.

Battery Powered Polarizer

The single station, battery operated module attaches directly to any OxyProbe®. It uses a lithium battery, with a five year life span, which should be checked annually. This polarization module allows maximum portability of a polarized sensor.

Part Number Price

AM-9221

Four Station Module
(Line Powered)



115 VAC Powered Polarizer

The four-station module plugs into any 115 VAC outlet to continuously polarize up to four sensors at 675 mV. The included cables connect the sensors to the polarizer. This polarization module has an additional terminal to check the battery of a single station polarization module.

Part Number Price

E-1807-AAM-DZ



Calibration Caps

Calibration Caps

Calibration caps slide onto the sensing end of a sensor providing an easy way to flush with N₂. This makes it easier to zero the sensor and check its responsiveness and calibration. Any tubing with a 6 mm (1/4") i.d. attaches easily to the barbed end of the cap. The conical shape of the cap helps prevent the tip of the sensor from accidentally bumping the bottom of the cap, which would damage the membrane.

Part Number Sensor Length Price

AM-9351 12 mm sensor

AM-9293 19 mm sensor

AM-9292 25 mm sensor

pH & D.O. Sensor Simulator

- NEW, REDESIGNED SIMULATOR WITH DIGITAL DISPLAY
- A TROUBLESHOOTING DEVICE for both pH and D.O.
- USED FOR TESTING CABLES AND TRANSMITTERS
- NEW, RUGGED ENCLOSURE

HOW IT WORKS

pH

When a pH meter is reading incorrectly the simulator helps determine if the problem is related to the electrode or to the transmitter. It simulates pH and mV values: from 0-14 pH units in 1 pH unit increments (± 414 mV). The simulator operates on a 9-volt battery and has a BNC connector, which attaches to the pH cable adapter.

Dissolved Oxygen

The simulator isolates the transmitter by mimicking the load of a D.O. sensor. The 4-pin connector attaches directly to the D.O. cable, in place of the sensor. In doing so, the simulator can help confirm whether fluctuations in the transmitter display are caused by the sensor, or caused by problems with the instrument or cable.



FEATURES AND APPLICATIONS

Troubleshooting Device Isolates Transmitter

The Broadley Technologies pH & D.O. Simulator allows the operator to troubleshoot a questionable pH or D.O. measurement by isolating the transmitter and cables from the actual pH and D.O. sensor inputs.

Diagnostic Tool Simulates Sensor Input

It simulates an ideal pH electrode or D.O. sensor. Simply attach the simulator in place of the pH electrode or D.O. sensor, and check for the appropriate responses from the transmitter.

Technical Specifications

- pH Output: 0-14 pH in 1 pH increments
- D.O. Output: 0% sat (0 nA)
100% sat (~67 nA)
300% sat (~200 nA)
- Auto Off Feature
- Tactile Membrane Keypad
- Includes 3 different 2-foot long pH cables to accommodate the most common transmitter connections

pH SIMULATOR CABLE & ADAPTER

One of the accessory pH cables, included with the simulator, allows the HP or K9 plug on the instrument pH cable to be attached to the BNC jack on the simulator.

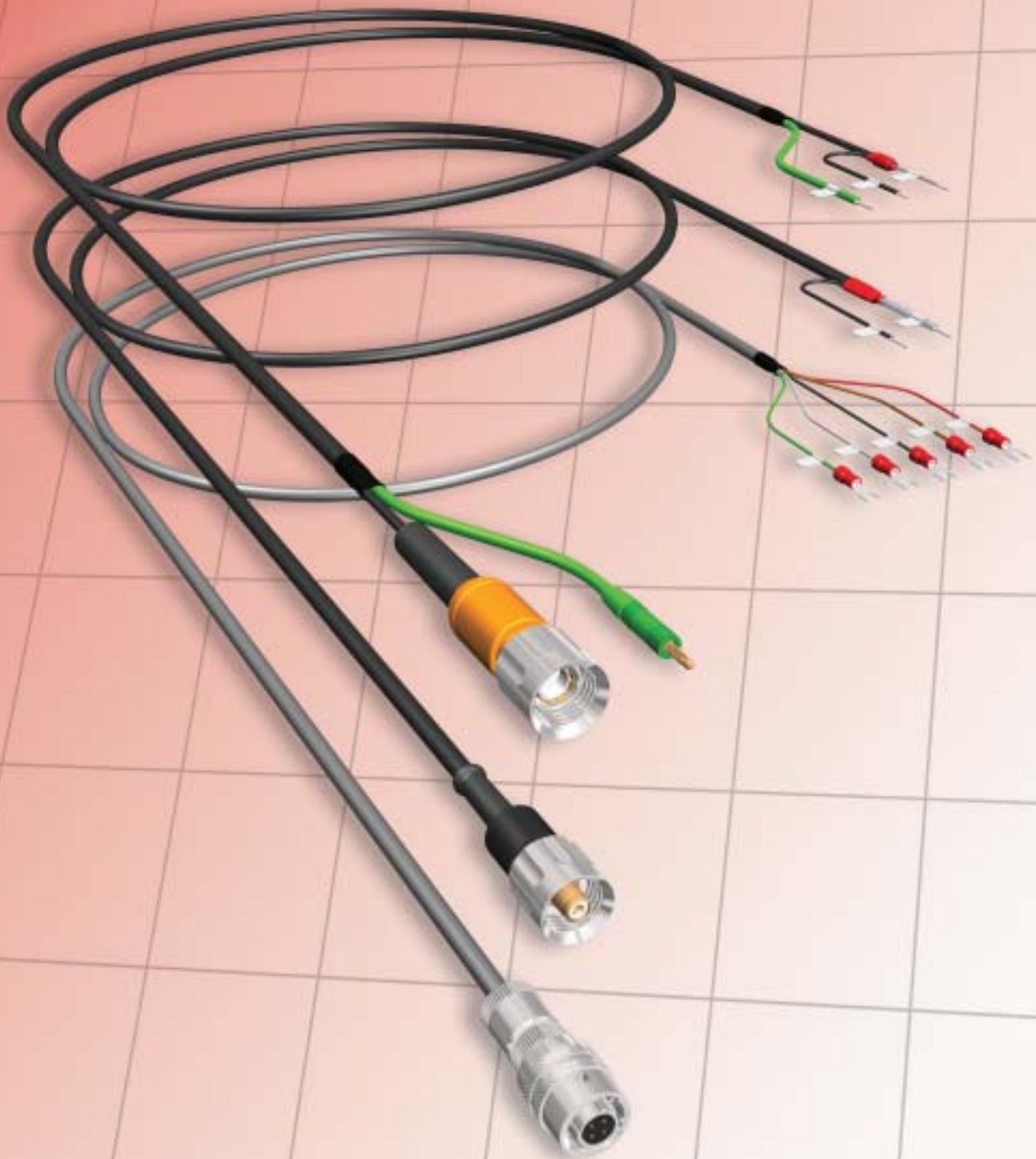


ordering information

Part Number	Description	Price
AM-9504	pH & D.O. Sensor Simulator Kit	

Section Six

Cables



New & Improved Cable & Connector Designs

Improved Stainless Steel pH Connectors

Broadley-James offers both types of industry standard connectors, the "S8" and the "K9", which have been used for decades with proven performance in fermentation applications. Where improvements were needed, such as in the durability of the cable connector, the existing style was improved by switching to a solid 316L stainless steel shell. This approach solved the problem while preserving the function of the installed base of equipment. These industry standard connectors are the first, and still the best, choice for pH sensors.

Special Low-Noise Coaxial Cable

Some suppliers use standard coaxial cables for pH and D.O. sensors, and while functional, they are not optimal. If such cables are pinched or sharply bent the inner shielding is compromised and the sensor is subject to interference from electromagnetic noise. Broadley-James has found that the environments around a fermentation tank or bioreactor are full of such sources, including agitators, solenoids, electronic valves, and pumps, and use a different style cable instead. These cables have an extra layer of shielding, lying just below the traditional outer braid. It is composed of an electrically conductive polymer and provides for 100% shielding, even when the cable is tightly bent or stressed. This cable is custom made for Broadley-James and is standard on all cables, at no extra charge.

Improved D.O. Sensor Connector

The "D9" connector used on Broadley-James D.O. cables has been used for decades in the industry. However, while the same connectors are used, other companies construction methods are not used. Instead, not only are the leads soldered to the internal gold contacts, they are then coated with epoxy. This seals them in place and acts as a second barrier should any moisture penetrate. The added step, combined with an improvement in the cable compression fitting, prevents the cable from pulling loose from the contacts after extensive service. The end result is a longer lasting installation. The D.O. cable assemblies are made with the same custom fabricated low-noise coaxial cable that is used for the pH cables.

The Market Leader in pH and D.O. Cable and Connector Design

Broadley-James Corporation does not believe in changing the basic design of connectors every few years, forcing customers into buying new equipment to keep current. Instead, Broadley-James strives to make improvements "backwards compatible" so they can be used with new equipment as well as the old. Broadley-James strives to protect investments, and help leverage them into the future. Improvements are made with the customer process in mind.

New & Improved pH Cable Assemblies for T-Pull and S8 Metric Caps

Stock Cable Assemblies for All F-615 and F-635 FermProbe® pH Electrodes

The BioProcess Technologies™ Catalog offers a wide range of cable assemblies to connect FermProbe pH electrodes with all of today's pH transmitters and benchtop controllers.

- The cables and electrodes are color coordinated so that the black HP electrode plug will connect to the standard S8 black cap on the pH electrode.
- Stock cable assemblies feature the most commonly requested cable lengths and connector schemes.
- Choice of flexible, lightweight 3 mm or rugged 5 mm low noise coaxial cable.
- Cables are tagged with replacement part numbers to enhance field serviceability.
- Cable assemblies are 100% tested for continuity, polarity, and the absence of short circuits.

Cable Type:

Type A 3 mm, low noise, shielded coaxial cable, lightweight and very flexible. 3 mm cable is frequently chosen for benchtop installations where space is at a premium and cables are required to make many sharp turns and twists.

Type M 5 mm, low noise, shielded coaxial cable. Thicker and more rugged, the 5 mm cable is often specified for pilot and process installations.

Type N 5 mm, low noise, shielded coaxial cable, jacketed with an extra lead for connecting solution ground to differential input style transmitters.

A wide selection of connectors is available upon request.

Custom assemblies to meet unique cabling requirements

How to Order Custom Cables

Ask for the Custom Cable Worksheet to specify custom cable assembly requirements. Return it by fax or mail to receive a quotation within 24 hours.

Ordering Information

Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
HP Electrode Plug to BNC Plug					
• Lightweight and highly flexible 3 mm cable					
• Connects to most NBS, Corning Costar and Applikon vessel controllers					
• Connects to BJC Model 10 and Uniloc 1054B pH transmitters					
AX-1000-HP-A03BC	HP plug	A	3 ft (1 m)	BNC plug	
AX-1000-HP-A06BC	HP plug	A	6 ft (2 m)	BNC plug	
AX-1000-HP-A10BC	HP plug	A	10 ft (3 m)	BNC plug	



Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
HP Electrode Plug to BNC Plug					
• Rugged 5 mm cable					
• Connects to most NBS, Corning Costar and Applikon vessel controllers					
• Connects to BJC Model 10 and Uniloc 1054B pH transmitters					
AX-1000-HP-M03BC	HP plug	M	3 ft (1 m)	BNC plug	
AX-1000-HP-M06BC	HP plug	M	6 ft (2 m)	BNC plug	
AX-1000-HP-M10BC	HP plug	M	10 ft (3 m)	BNC plug	



Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
HP Electrode Plug to DIN 19262 Plug					
• Rugged 5 mm cable					
• Connects to most B. Braun Biotech and Chemap vessel controllers					
AX-1000-HP-M03DN	HP plug	M	3 ft (1 m)	DIN plug	
AX-1000-HP-M06DN	HP plug	M	6 ft (2 m)	DIN plug	
AX-1000-HP-M10DN	HP plug	M	10 ft (3 m)	DIN plug	



ordering information

Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
HP Electrode Plug to Spade Lugs					
<ul style="list-style-type: none"> • Rugged 5 mm cable • Typically connects to terminal strips found in junction boxes 					
AX-1000-HP-M03SL	HP plug	M	3 ft (1 m)	Spade Lugs	
AX-1000-HP-M06SL	HP plug	M	6 ft (2 m)	Spade Lugs	
AX-1000-HP-M10SL	HP plug	M	10 ft (3 m)	Spade Lugs	



Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
HP Electrode Plug to Crimped Ferrules					
<ul style="list-style-type: none"> • Rugged 5 mm cable • Connects to either terminal blocks or terminal strips • Use with BTC Models 30, 40 and 50 and Yokogawa Models PH402, PH202 pH transmitters 					
AX-1000-HP-M03FF	HP plug	M	3 ft (1 m)	Crimped Ferrules	
AX-1000-HP-M06FF	HP plug	M	6 ft (2 m)	Crimped Ferrules	
AX-1000-HP-M10FF	HP plug	M	10 ft (3 m)	Crimped Ferrules	



Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
HP Electrode Plug with Solution Ground to Crimped Ferrules					
<ul style="list-style-type: none"> • Rugged 5 mm cable • Connects to either terminal blocks or terminal strips • Use for solution ground connection with the BTC Models 30, 40 and 40, and Yokogawa Models 402, PH202 pH transmitters 					
AX-1000-H1-N03FF	HP plug ¹	N	3 ft (1 m)	Crimped Ferrules	
AX-1000-H1-N06FF	HP plug ¹	N	6 ft (2 m)	Crimped Ferrules	
AX-1000-H1-N10FF	HP plug ¹	N	10 ft (3 m)	Crimped Ferrules	

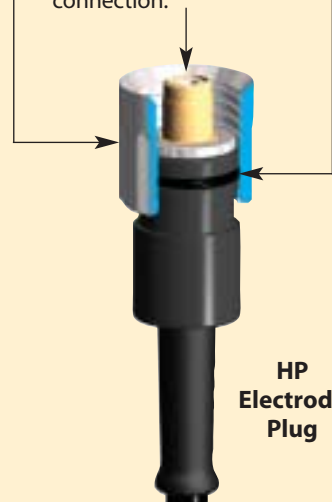
Note 1: This HP plug has additional 7" (18 cm) solution ground lead to plug into electrode housing.



TIPS & HINTS

New & Improved Sanitary HP Plug

1. Thick walled 316 stainless steel shell is free spinning to reduce cable twisting.
2. O-ring is seated in a precisely machined groove, which provides a better seal to keep the connector moisture-free.
3. Gold plated pH connection.



New & Improved pH Cable Assemblies for K9 Metric Caps

Stock Cable Assemblies for All F-695 FermProbe® pH Electrodes

The BioProcess Technologies™ Catalog offers a wide range of cable assemblies to connect FermProbe pH electrodes with all of today's pH transmitters and benchtop controllers.

- Cables with the KP electrode plug fit on all brands of pH electrodes that use the K9 cap.
- The cables and electrodes are color coordinated so that the orange KP electrode plug will connect to the orange K9 cap on the pH electrode.
- Choice of rugged 5 mm or 6 mm low noise coaxial cable.

TIPS & HINTS

Conversion of Other Cables for use with FermProbe® Electrodes

Step 1:

Thread the adapter into an AK9 cable plug.

Step 2:

Adapter and cable are now converted to work with the FermProbe pH electrode disconnect cap.

E-1245 Adapter
Part Number:
E-1245-AAD-DZ
Price: \$16.00



o r d e r i n g i n f o r m a t i o n

Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
KP Electrode Plug to BNC Plug					
• Rugged 5 mm cable					
• Connects to most NBS, Corning Costar and Applikon vessel controllers					
• Connects to BJC Model 10, Uniloc 1054B pH transmitters					
AX-1000-KP-M03BC	KP plug	M	3 ft (1 m)	BNC plug	
AX-1000-KP-M06BC	KP plug	M	6 ft (2 m)	BNC plug	
AX-1000-KP-M10BC	KP plug	M	10 ft (3 m)	BNC plug	



Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
KP Electrode Plug to DIN 19262 Plug					
• Rugged 5 mm cable					
• Connects to most B. Braun Biotech and Chemap vessel controllers					
AX-1000-KP-M03DN	KP plug	M	3 ft (1 m)	DIN plug	
AX-1000-KP-M06DN	KP plug	M	6 ft (2 m)	DIN plug	
AX-1000-KP-M10DN	KP plug	M	10 ft (3 m)	DIN plug	



Cable Type:

Type M 5 mm, low noise, shielded coaxial cable is thicker and more rugged. The 5 mm cable is often specified for pilot and process installations.

Type Z 6 mm, low noise, shielded triaxial cable is jacketed with an extra lead for connecting solution ground to differential input style transmitters.

How to Order Custom Cables

Ask for the Custom Cable Worksheet to specify custom cable assembly requirements. Return it by fax or mail to receive a quotation within 24 hours.

Cables are tagged with replacement part numbers to enhance field serviceability.

Cable assemblies are 100% tested for continuity, polarity, and the absence of short circuits.

Stock cable assemblies feature the most commonly requested cable lengths and connector schemes.

ordering information

Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
KP Electrode Plug to Spade Lugs					
<ul style="list-style-type: none"> • Rugged 5 mm cable • Typically connects to terminal strips found in junction boxes 					
AX-1000-KP-M03SL	KP plug	M	3 ft (1 m)	Spade Lugs	
AX-1000-KP-M06SL	KP plug	M	6 ft (2 m)	Spade Lugs	
AX-1000-KP-M10SL	KP plug	M	10 ft (3 m)	Spade Lugs	



Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
KP Electrode Plug to Crimped Ferrules					
<ul style="list-style-type: none"> • Rugged 5 mm cable • Connects to either terminal blocks or terminal strips • Use with BTC Models 30, 40, and 50, and Yokogawa Models PH402, PH202 pH transmitters 					
AX-1000-KP-M03FF	KP plug	M	3 ft (1 m)	Crimped Ferrules	
AX-1000-KP-M06FF	KP plug	M	6 ft (2 m)	Crimped Ferrules	
AX-1000-KP-M10FF	KP plug	M	10 ft (3 m)	Crimped Ferrules	



Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
KP Electrode Plug with Solution Ground to Crimped Ferrules					
<ul style="list-style-type: none"> • Rugged 6 mm cable • Connects to either terminal blocks or terminal strips • Use for solution ground connection with the BTC Models 30, 40, and 50, and Yokogawa Models PH402, PH202 pH transmitters 					
AX-1000-K5-Z03FF	KP plug ¹	Z	3 ft (1 m)	Crimped Ferrules	
AX-1000-K5-Z06FF	KP plug ¹	Z	6 ft (2 m)	Crimped Ferrules	
AX-1000-K5-Z10FF	KP plug ¹	Z	10 ft (3 m)	Crimped Ferrules	

Note 1: This KP plug has an additional 7" (18 cm) solution ground lead to plug into the electrode housing.

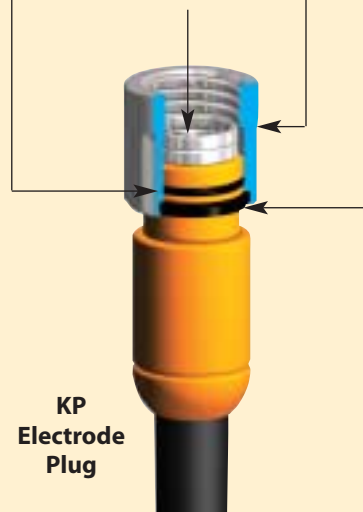


TIPS & HINTS

Improved Seals of KP Electrode Plug

1) The o-ring is seated in a precisely machined groove. This provides a better seal to keep the connector moisture-free.

- 2) Gasket to secure threaded cap.
- 3) Free-spinning steel nut to reduce cable twisting.
- 4) Gold plated pH connection.



Cable Assemblies for Dissolved Oxygen Sensors

Stock Cable Assemblies for All OxyProbe® Sensors

The BioProcess Technologies™ Catalog offers a variety of cable assemblies to connect OxyProbe D.O. sensors with today's D.O. transmitters and controllers.

- Stock cable assemblies feature the most commonly requested cable lengths and connector schemes.
- Cables are shielded to decrease signal noise and other interferences.
- Cables are tagged with part numbers for easy replacement.
- Cables have a D4 twist-lock coaxial cable plug to connect to the sensor.
- Cable assemblies are 100% tested for continuity and the absence of short circuits.
- D-type cables are 6 mm diameter, low noise, multi-conductor cables.

TIPS & HINTS

Splash Guard for Connectors

All cables in the catalog are available with an optional protector cap. This cap protects the plug from direct exposure to water or moisture in the working environment. To order, change the middle series of numbers in the cable order number from 5000 to 5100. The protective cap costs an additional price.

For example:

Change part number AX-5000-D4-D03S5 to AX-5100-D4-D03S5



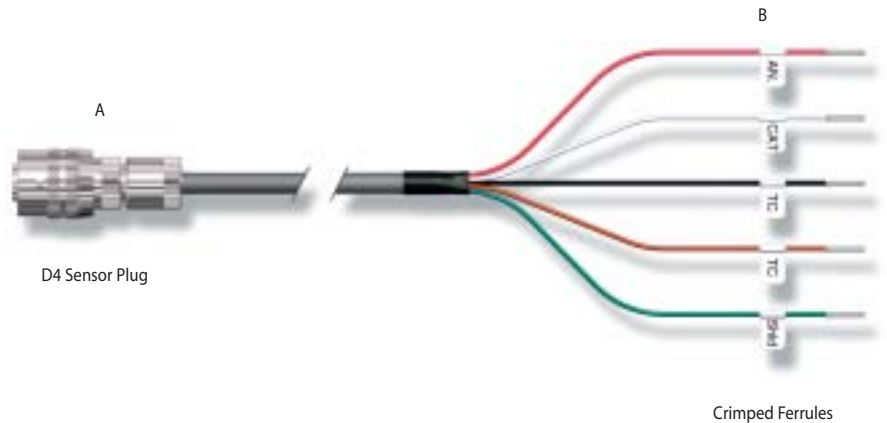
Custom assemblies to meet unique cabling requirements

How to Order Custom Cables

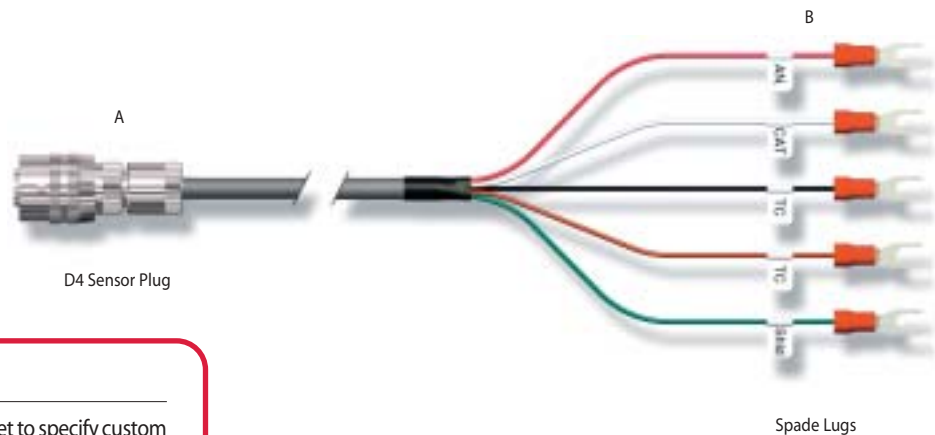
Ask for the Custom Cable Worksheet. Use this worksheet to specify custom cable assembly requirements. Return it by fax or mail to receive a quotation within 24 hours.

Ordering Information

Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
D4 Sensor Plug to Crimped Ferrules					
• Connects to either terminal blocks or terminal strips					
• Connects to several transmitters including BTC Models 30, 40, and 50					
AX-5000-D4-D03FF	D4	D	3 ft (1 m)	Crimped Ferrules	
AX-5000-D4-D06FF	D4	D	6 ft (2 m)	Crimped Ferrules	
AX-5000-D4-D10FF	D4	D	10 ft (3 m)	Crimped Ferrules	



Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
D4 Sensor Plug to Spade Lugs					
• Connects to either terminal blocks or terminal strips					
• Connects to BTC Models 30, 40, and 50					
AX-5000-D4-D03S5	D4	D	3 ft (1 m)	Spade Lugs	
AX-5000-D4-D06S5	D4	D	6 ft (2 m)	Spade Lugs	
AX-5000-D4-D10S5	D4	D	10 ft (3 m)	Spade Lugs	



ordering information

Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
D4 Sensor Plug to Lemo 6 Connector					
• Connects to B. Braun Biotech and some European vessel controllers					
AX-5000-D4-D03L6	D4	D	3 ft (1 m)	Lemo 6	
AX-5000-D4-D06L6	D4	D	6 ft (2 m)	Lemo 6	
AX-5000-D4-D10L6	D4	D	10 ft (3 m)	Lemo 6	

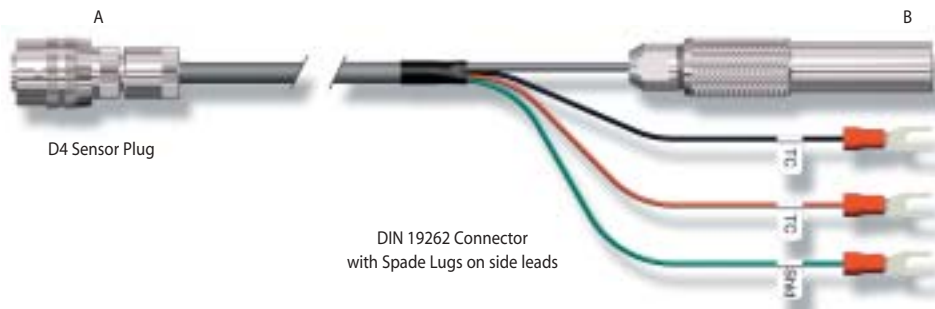


ordering information

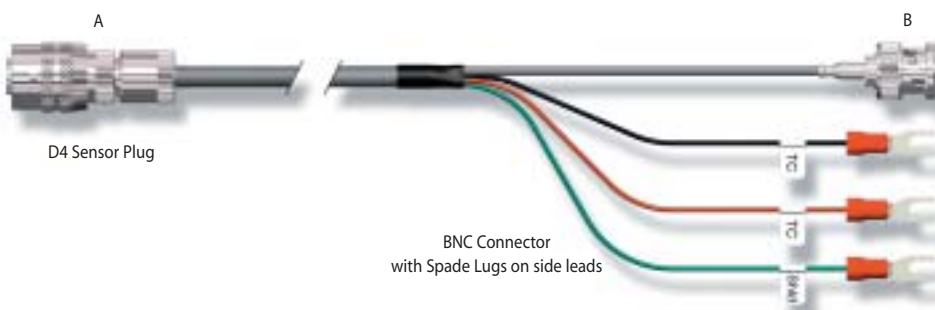
Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
D4 Sensor Plug to Lemo 3 Connector					
• Connects to Chemap and some older B. Braun Biotech fermentors					
• It is larger than the Lemo 6 connector and wired differently					
AX-5000-D4-D03L3	D4	D	3 ft (1 m)	Lemo 3	
AX-5000-D4-D06L3	D4	D	6 ft (2 m)	Lemo 3	
AX-5000-D4-D10L3	D4	D	10 ft (3 m)	Lemo 3	



Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
D4 Sensor Plug to DIN Connector and Spade Lugs					
• Also connects to some older B. Braun Biotech and Chemap vessel controllers					
AX-5000-D4-D03DT	D4	D	3 ft (1 m)	DIN with TC & Spade Lugs	
AX-5000-D4-D06DT	D4	D	6 ft (2 m)	DIN with TC & Spade Lugs	
AX-5000-D4-D10DT	D4	D	10 ft (3 m)	DIN with TC & Spade Lugs	



Cable Part Number	Connector A	Cable Type	Cable Length	Connector B	Price
D4 Sensor Plug to BNC Connector and Spade Lugs					
• Connects to Applikon vessel controllers*					
AX-5000-D4-D03G3	D4	D	3 ft (1 m)	BNC with TC & Spade Lugs	
AX-5000-D4-D06G3	D4	D	6 ft (2 m)	BNC with TC & Spade Lugs	
AX-5000-D4-D10G3	D4	D	10 ft (3 m)	BNC with TC & Spade Lugs	



TIPS & HINTS

Dust Caps Protect Connectors

Two different dust caps are available from Broadley-James. One to protect the cable and the other to protect the sensor connection. When the sensor is disconnected from the transmitter, attach the cap to the connector to protect it from damage and moisture. When the sensor is connected the cap can hang from the sensor or cable, ready for the next use.

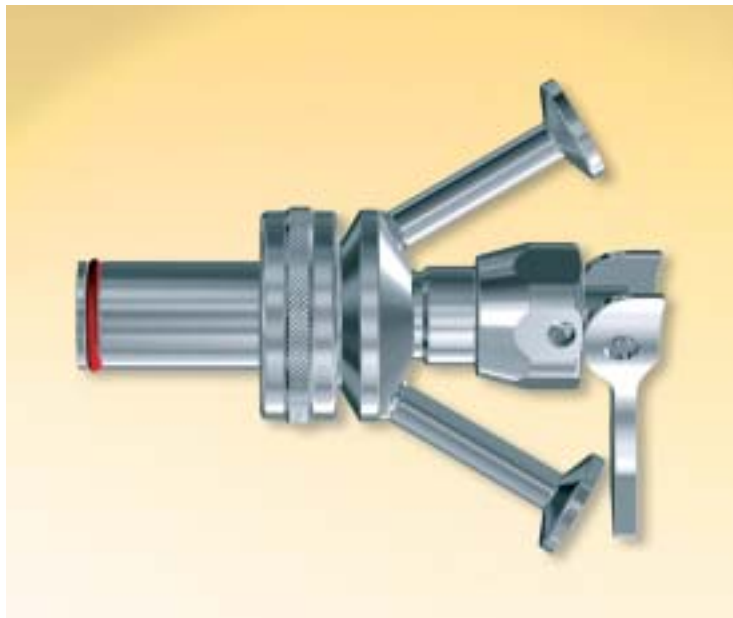


Cable Connector Dust Cap
Part Number: AM-9219
Price:

Sensor Connector Dust Cap
Part Number: AM-9212
Price:

* Note: On many Applikon controllers the T.C. leads and shield are not utilized. Simply cut off or tape them back out of the way

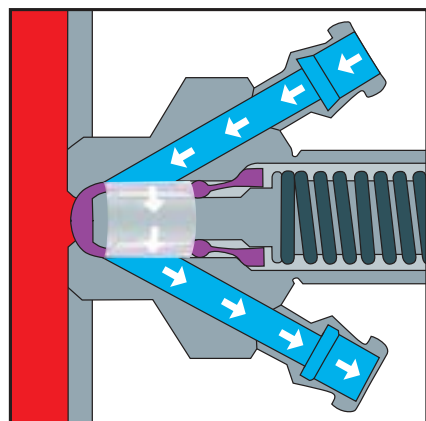
Keofitt® Membrane Sampling Valves



Keofitt valves allow sterile and non-sterile sampling without compromising tank integrity

Keofitt sampling valves allow quick sampling from any vessel. They have very few moving parts and are quickly cleaned or sterilized between samplings to prevent residual accumulation. The inner membrane can be changed to prevent any cross-contamination. Sterile samples can also be taken with a sample bottle assembly.

These valves were first designed to be used in fermentation vessels. Due to their simple operation and solid performance, Keofitt valves can now be found in all phases of the process stream.

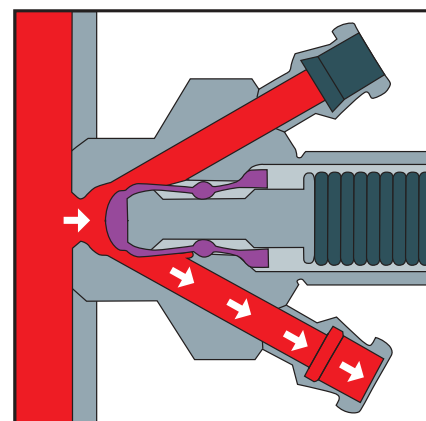


Close valve to steam sterilize

Simple Operation

When the valve is closed, the body seals within 1/8" of the vessel wall. This reduces the dead volume and ensures that samples are taken directly from the vessel, not from the neck of the fitting. The entire internal chamber and outlets can be steam sterilized to remove any sample residue and eliminate potential cross-sample contamination.

The Keofitt Sterile Sampling Valve consists of a valve body and a valve head. The stretchable membrane is mounted on the stem of the valve head and has two functions: It forms a static and cleanable seal between valve body and valve head and it serves as the sealing part when the valve is closed. The in- and outlet connection pieces of the valve body allow the user to steam sterilize the sampling valve in its closed position. These connection pieces are welded to the valve body using a unique method that avoids any crevices or pores and thus ensures full sterilizability of the valve. All Valves are 3A-authorized and tested for steam sterilizability. Documentation is available.



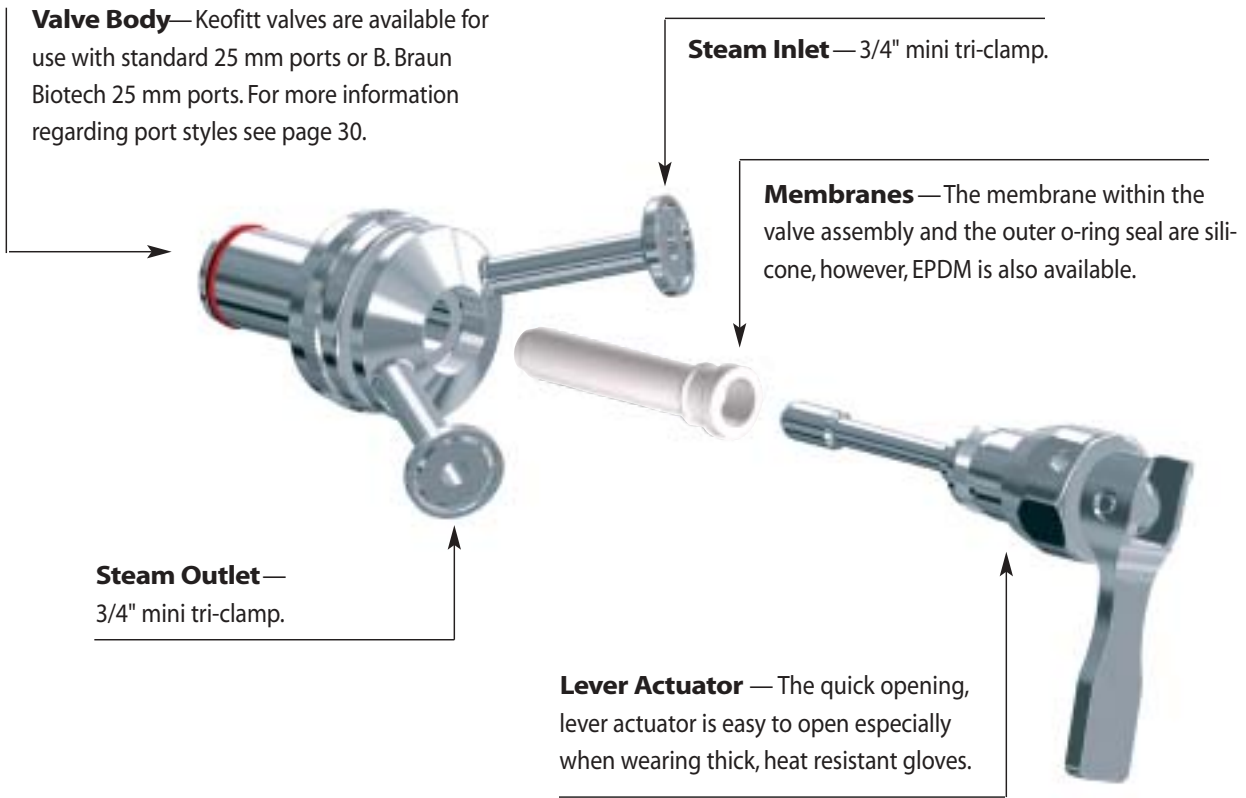
Open valve to sample

The lever orientation accommodates right- or left-handed operation.



Cutaway View

There are five elements to any Keofitt® valve:



- Membranes are made of FDA approved compounds
- Valve is certifiable/traceable 316L stainless steel
- Interior of the valve is Ra 0.5 µm (20 µin)
- More than 40,000 valves in use

Silicone EPDM



EPDM and Silicone membranes are easy to replace

o r d e r i n g i n f o r m a t i o n

Part Number	Description	Price
Complete Valves		
10-1011-12	Valve with Silicone membrane, for use on Braun ports	
10-1012-13	Valve with Silicone membrane, for use on Standard ports	
Replacement Membranes, B. Braun Biotech		
10-1013-14	Membranes, 52 mm, Silicone, pack of 4	
10-1014-15	Membranes, 52 mm, EPDM, pack of 4	
Replacement Membranes, Standard		
10-1015-16	Membranes, 40 mm, Silicone, pack of 4	
10-1016-17	Membranes, 40 mm, EPDM, pack of 4	

Burns Engineering Temperature Sensor



Burns Engineering Precision Wire Wound Temperature Sensor

Designed for Reliability and Performance

This sensor utilizes Burns proven performance technology. Its unique design and construction features improve the durability of the sensor without compromising its accuracy.

Element Construction



Each element is constructed with a high purity platinum wire that is coil wound to minimize stress and assure accurate readings over long periods of time. Each coil is fully suspended in a high purity ceramic insulator and surrounded by a ceramic powder with a new binder additive. This "Burns Coil Suspension (CS) Element" enhances vibration and shock resistance without interfering with the coils ability to expand or contract. High strength platinum alloy leads have been increased in size to improve durability and insure that the RTD does not open circuit during rugged applications.

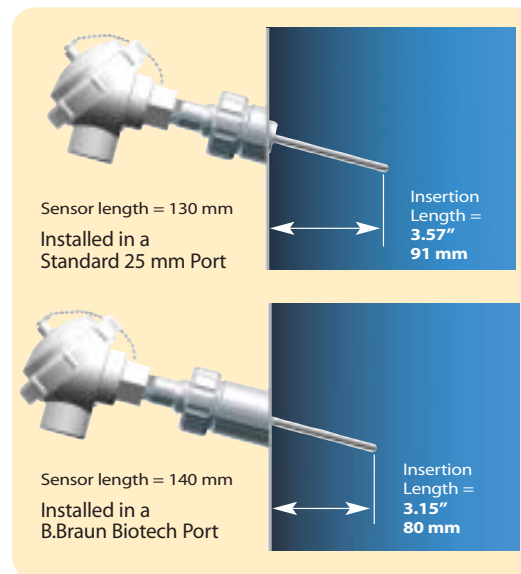


Sheath Design & Construction

A proprietary manufacturing technique that forms the metallurgical bond between the element leads and the internal sheath leads virtually eliminates lead wire short out. And when encapsulated with compacted ceramics, assures durability and fast time response over the life of the sensor.

Specifications

- Element resistance is 100 ohms $\pm 0.1 \Omega$ at 0°C
- 0.00385 $\Omega/\Omega/^\circ\text{C}$ temperature coefficient
- Sensor operating range is 0 to 160°C
- 3.5 inch stem length
- 316L stainless steel construction
- RA20 finish with electropolish on wetted parts
- Polypropylene weather proof connection head



Temperature Transmitter



Burns Engineering – Two-Wire Temperature Transmitter for Platinum RTD Input

Function:

Two-wire temperature transmitters are signal conditioning devices that convert the RTD signal and transmit it via a standard 4-20 mA current loop to a recorder or controller. The transmitter is usually installed in the connection head.

Purpose:

A head-mounted transmitter greatly reduces the effects of electrical noise from degrading the RTD signal on its way to the control room or readout location. Some of the

common causes of this accuracy-degrading electrical noise are walkie-talkies, large electronic motors, and a/c power lines.

Operation:

By drawing current from a standard 24 VDC power supply (in proportion to the resistance signal from the temperature sensor), the transmitter converts the highly sensitive measurement signal into simple process current. This current loop will transfer temperature information over a long distance, minimizing the problem of wire resistance or outside accuracy-degrading noise. The power source and the signal share the same pair of wires.

Specifications:

- Accuracy: $\pm 0.1\%$ of span.
- Linearity: $\pm 0.1\%$ of span.
- Adjustability: $\pm 50^\circ\text{C}$.
- Ambient temperature range: -20 to 70°C .
- Measurement temperature range: -50 to 550°C .

TIPS & HINTS

Temperature Transmitter FAQ

Q: What does RTD and PRT mean?

A: An RTD is a resistance temperature detector. It may use platinum, nickel or copper for its element. A PRT (platinum resistance thermometer) is a type of RTD that uses platinum for its element. The sensors shown on this page are all PRTs.

Q: What is the maximum distance that a PRT can be from a recorder or controller without using a transmitter?

A: There is no definitive distance. Burns Engineering recommends no more than 250 feet of at least 18 AWG leadwire without a transmitter. Further information may be available from the manufacturer of the controller/recorder. When a 3-wire connection is made to the PRT, there is a maximum error of $+1.16^\circ\text{F}$ per 100 feet of 18 AWG leadwire. This error is caused by the manufacturing tolerances of the leadwire. If the resistance of each of the three leads is exactly the same, there is no error.

Q: If I use a Burns transmitter, how far can I run the signal from the transmitter to a controller?

A: The transmitter requires a minimum of 12 VDC at the terminals and this is the only limiting factor. A power supply will have to be capable of overcoming the leadwire resistance. Remember that a long leadwire can act as an antennae causing radio frequency and electromagnetic interference with the transmitter. Twisted shielded wire should be used for long runs or if the wires run next to other wires or electric motors.

Ordering Information

Part Number	Description	Price
Standard		
AM-9508	Burns Pt 100, for Standard port, with 4-20 mA Transmitter	
AM-9507	Burns Pt 100, for Standard port, without 4-20 mA Transmitter	
B. Braun		
AM-9510	Burns Pt 100, for B.Braun port, with 4-20 mA Transmitter	
AM-9509	Burns Pt 100, for B.Braun port, without 4-20 mA Transmitter	



optek® Cell Density Probe

Bioprocess Cell Density Probe

The new optek bioprocess photometric probe is a near infrared absorption-based probe designed for use in sanitary fermentation and cell culture applications.

By measuring cell growth / biomass as a function of NIR absorption, the process operator can gain real time knowledge to optimize the control of the bio-process cycle.

Designed to increase yields and maximize the use of nutrients and other process additions, this in-process sensor not only provides valuable growth cycle information, it does it without extensive sampling and bench analysis, thereby greatly reducing operator labor.

Optimized for ultra-sanitary bioprocess environments, and to withstand the rigors of sanitization and sterilization, the optek photometric probe can be Cleaned In Place (CIP) and Sterilized In Place (SIP) to maintain sterility in the bioreactor or fermentation tank.



Coupled with the optek photometric analyzer, the user is offered a new level of capabilities for precision monitoring, datalogging, and control.

- Superior sapphire measuring windows, with no seals, are impervious to all CIP chemicals for long life
- All wetted parts are certified and traceable

- One-piece probe body, with no gaps or crevices, is made of special low ferrite 316L stainless steel and electropolished to $R_a < 0.4 \mu m$

- 3-5 year lamp life – Located in the head to eliminate heat damage from SIP, and replaced without removing probe from fermenter

System Benefits

AS16N Probe Coupled with the C4000 Analyzer Offers:

- HIGH PERFORMANCE – Highest level of performance, accuracy, function, and repeatability.
- TIME SAVINGS – In-Process analysis minimizes the time and losses incurred by sampling and off-line lab analysis.
- REMOTE CONTROL – Remote control features allow plant PLCs and DCSs to control the C4000.
- COMPATIBLE – Conformity to standard 25 mm ports and B. Braun Biotech reactor ports.
- MULTIPLE INPUTS – Connect two probes to one C4000 Analyzer to trend, control, and display multiple fermentation points simultaneously.
- RUGGED – Designed for ultra-sanitary processes, sapphire optics with no seals, gaps, or crevices, withstands both CIP and SIP.
- REAL-TIME MONITORING – Enables powerful real-time records of cell growth cycles to adjust for the effects of nutrient feed, gas addition, agitation, pH, and temperature.

optek® Cell Density Analyzer



The optek Control 4000 photometric analyzer is the latest in a generation of powerful microprocessor-based converters with integrated modularity that offers a new level of photometric functions and capabilities for precision process monitoring and control.

The user-friendly menu-based software provides easy configuration for superior accuracy, resolution, and performance. The photometric analyzer integrates valuable functionality such as remote ranging, zero and hold, PC-downloadable datalogging, adjustable signal damping, multiple linearization and calibration tables, ad-



TIPS & HINTS

Bioprocess Applications for Cell Density Systems:

optek's sanitary photometric probes, coupled with their advanced photometric analyzer, have been used for:

- Biomass Concentration
- Yeast Cultures
- Mammalian Cell Growth
- Bacterial Cell Culture
- Growth Cycle Optimization
- Fermentation Characterization

NIST-Traceable Validation Filter:

The addition of the NIST-traceable validation filter allows the process operator to validate the measurement "span" while the probe is in-process. The filter may be installed without removing the probe from the vessel.

vanced math capabilities providing real-time measurement, trending in absorbance, transmittance, and concentration in any unit of measure, and many other unique system functions to optimize nearly all cell culture operations.

The C4000 analyzer provides multiple analog and relay outputs for direct measurement and control as well as the unique capability to be controlled remotely.

Specifications:

- Analog Outputs: Two 0/4-20 mA outputs.
- Display Modes: Numeric with bar graph, continuous trend line, and others configurable in any combination.
- Auto Zero: Local or remote activated zero to set measurement baseline.

o r d e r i n g i n f o r m a t i o n

Part Number	Description	Price
C4121-115/230	optek Advanced Photometric Analyzer, Control 4000	
AS16NVI-10S	optek Photometric Probe with Validation, 10 mm OPL*	
3000-3015-00	NIST-Traceable Span Validation Filter	

* A wide selection of optical path lengths, insertion lengths, and other options are available upon request.

Part Number Index

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10-1013-14	Keofitt Membrane, B.Braun, 52 mm, Silicone, 4-pack	105	AG-S013-04	FermProbe connector o-ring, 4-pack	82
10-1014-15	Keofitt Membrane, B.Braun, 52 mm, EPDM, 4-pack	105	AG-S013-25	FermProbe connector o-ring, 25-pack	82
10-1015-16	Keofitt Membrane, Standard, 40 mm, Silicone, 4-pack	105	AG-S016-10	O-ring kit, 19 mm, external, 10-pack	81
10-1016-17	Keofitt Membrane, Standard, 40 mm, EPDM, 4-pack	105	AG-S016-25	O-ring kit, 19 mm, external, 25-pack	81
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30-B-PH/DO	Model 30 Dual pH & D.O. Transmitter, Pipe Mount	15	AG-S111-25	O-rings, 25 mm housing, internal, 25-pack	83
30-A-PH	Model 30 Single pH Transmitter, Panel Mount	15	AG-S111-50	O-rings, 25 mm housing, internal, 50-pack	83
30-A-DO	Model 30 Single DO Transmitter, Panel Mount	15	AG-SF25-10	O-rings, 25 mm housings, oversized, 10-pack	83
40-A-PH	Model 40 pH Transmitter, Panel Mount	19	AG-SR15-10	O-rings, 25 mm, external, 10-pack	81, 83
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300 - 3000			AM-9201	D.O., Port retainer ring, 19 mm sensor	88
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300-P203-05	pH Replacement Autoclave Cap, K9, 5-pack	87	AM-9213	D.O. Cathode removal tool	76
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325-61-H150	Housing, 25 mm Side Port, Pg13.5, Unguarded	57	AM-9364	Stainless Steel Storage Container, 70 mm Housing	86
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AF-303-61-L040	Plug, Standard 25 mm Straight, Forward O-ring	90	AS-3220-C30-0500	Buffer, pH 4, 500 ml bottle	87
AF-305-62-L055	Plug, B.Braun 25 mm, Straight	90	AS-3221-C30-0500	Buffer, pH 7, 500 ml bottle	87
AF-310-61-L040	Plug, Standard 25 mm, Chamfered	91	AS-3222-C30-0500	Buffer, pH 10, 500 ml bottle	87
AG			AX		
AG-9206-10	O-ring Kit, 25 mm, internal set of 4, pack of 10	80	AX-1000-H1-N03FF	Cable, pH, Type N, soln grd, HP plug - ferrules, 3ft(1m)	99
AG-E011-25	O-ring Kit, 12 mm, internal, pack of 25	80	AX-1000-H1-N06FF	Cable, pH, Type N, soln grd, HP plug - ferrules, 6ft(2m)	99
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Part Number	Description	Page	Part Number	Description	Page
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AX-1000-HP-M06BC	Cable, pH, Type M, HP plug to BNC, 6ft (2m)	98	D200-B320-PT-D9	OxyProbe, 19 mm, 320 mm length	67
AX-1000-HP-M06DN	Cable, pH, Type M, HP plug to DIN, 6ft (2m)	98	D200-B420-PT-D9	OxyProbe, 19 mm, 420 mm length	67
AX-1000-HP-M06FF	Cable, pH, Type M, HP plug to ferrules, 6ft (2m)	99	D205-B150-PT-D9	OxyProbe, 19 mm, Right angle, 150 mm length	67
AX-1000-HP-M06SL	Cable, pH, Type M, HP plug to Spade Lugs, 6ft (2m)	99	D205-B220-PT-D9	OxyProbe, 19 mm, Right angle, 220 mm length	67
AX-1000-HP-M10BC	Cable, pH, Type M, HP plug to BNC, 10ft (3m)	98	D205-B320-PT-D9	OxyProbe, 19 mm, Right angle, 320 mm length	67
AX-1000-HP-M10DN	Cable, pH, Type M, HP plug to DIN, 10ft (3m)	98	D205-B420-PT-D9	OxyProbe, 19 mm, Right angle, 420 mm length	67
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AX-1000-K5-Z06FF	Cable, pH, Type Z, soln grd, KP plug - ferrules, 6ft(2m)	101	D400-B150-PT-D9	OxyProbe, 25 mm, 150 mm length	62
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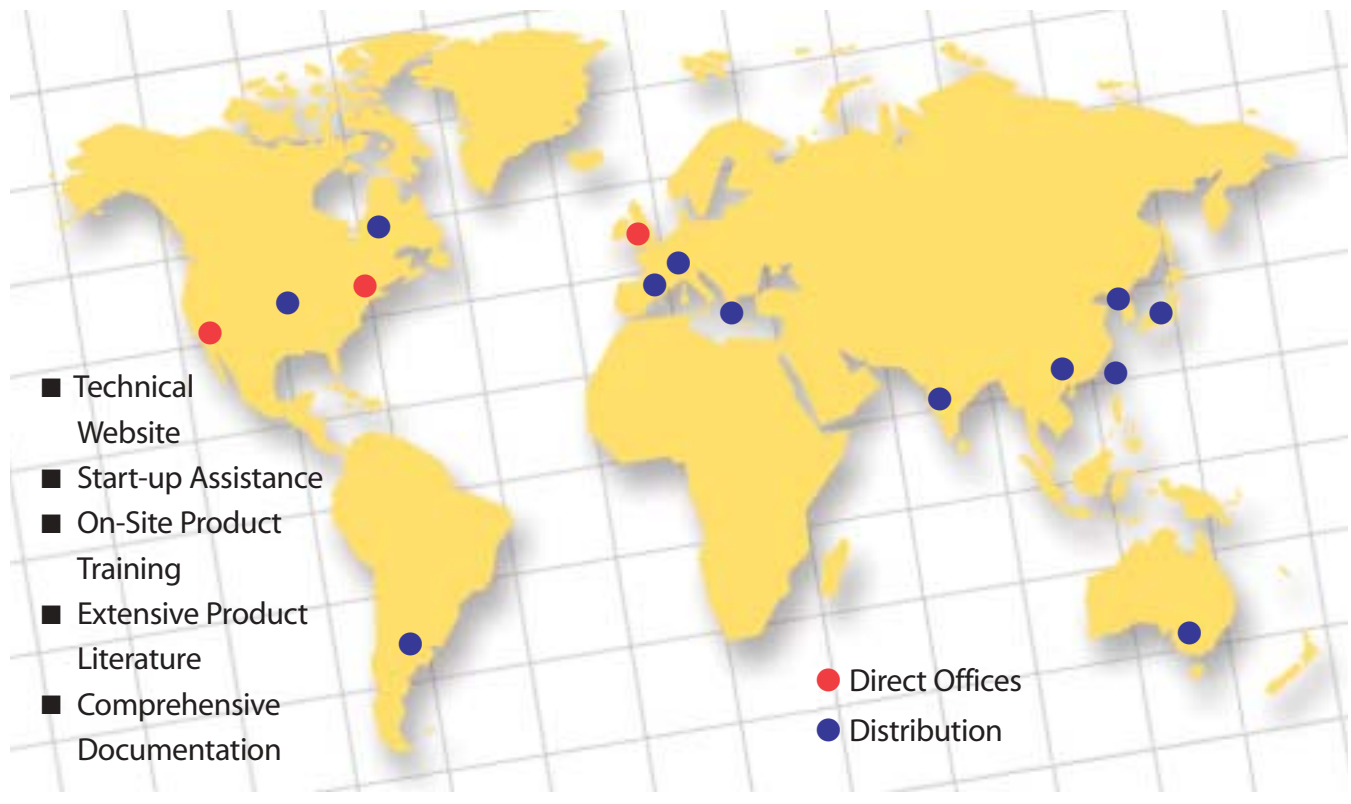
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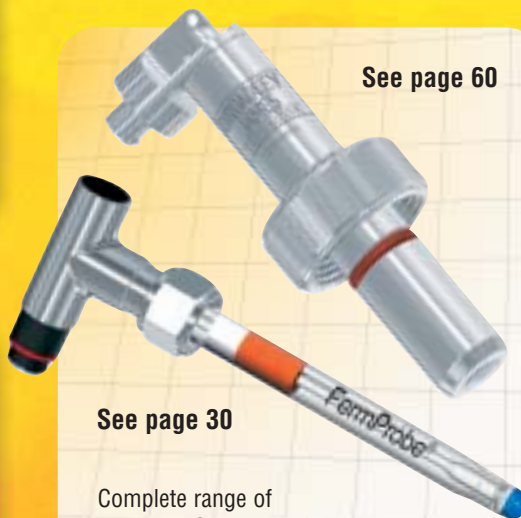
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