

# BioProcess Technologies®

pH | Dissolved Oxygen

Bioprocess Analytical  
Measurements Catalog

2014

Broadley  
James®

Sensors, Instrumentation,  
Equipment and Supplies  
for Analytical Bioprocess  
Applications



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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 quick 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-James sells over 2,000 different items and offers many custom options for your specific application.

## Introducing New and Useful BioProcess Products

Broadley-James Corporation 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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# FermProbe<sup>®</sup> pH Electrodes

Steam Sterilizable and Autoclavable

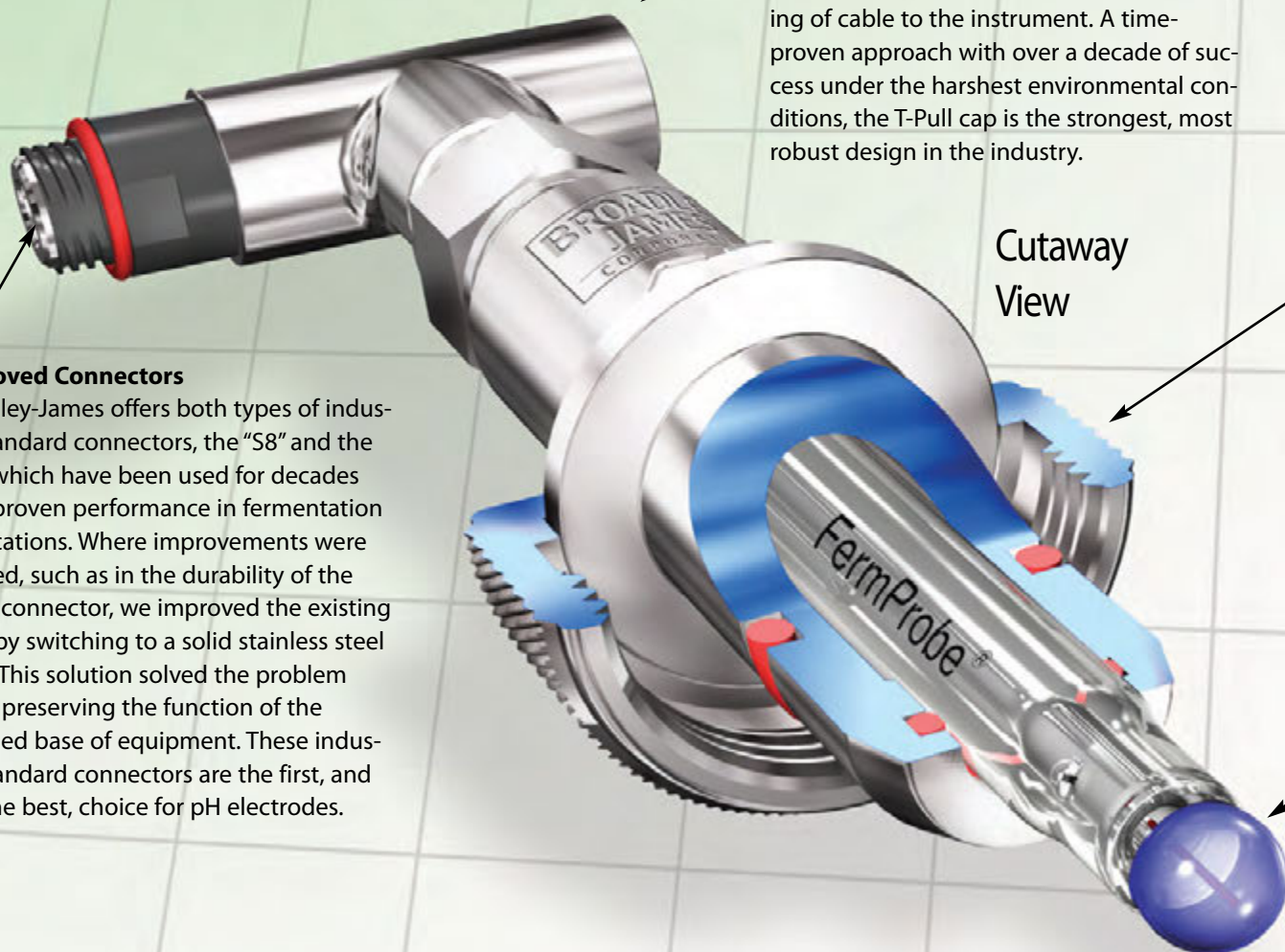
## Original T-Pull<sup>®</sup> Cap

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.

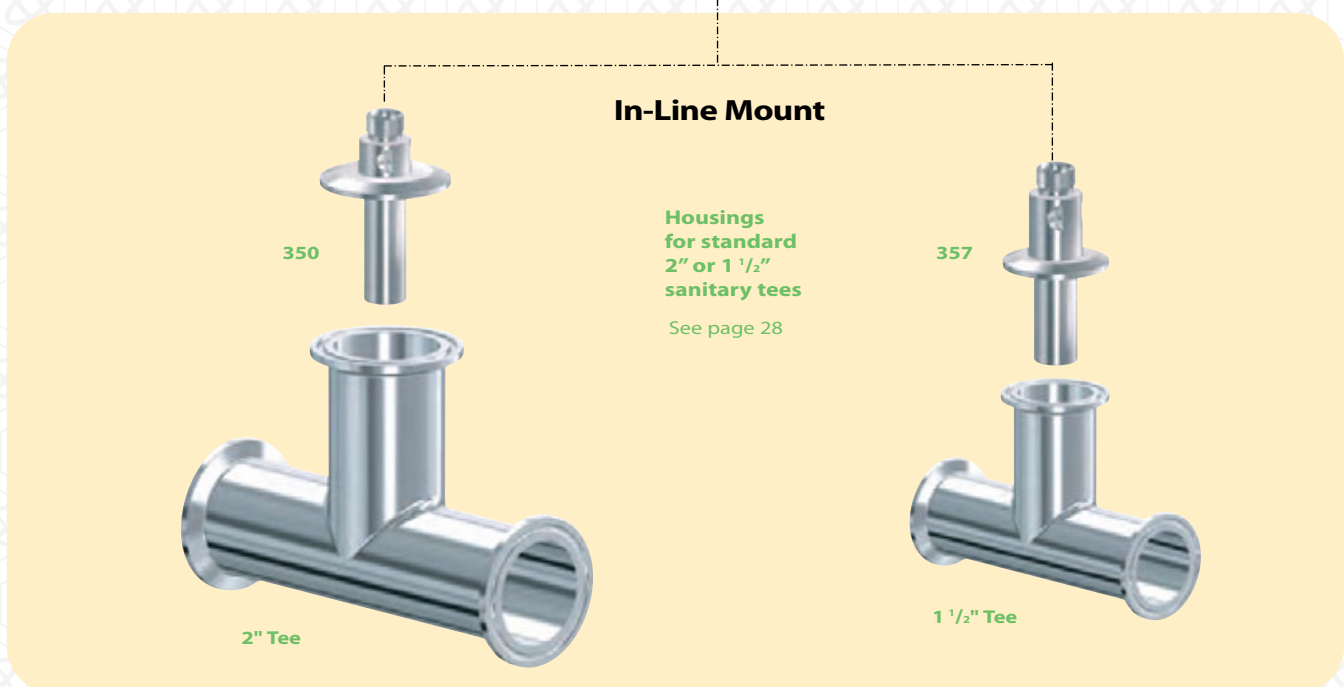
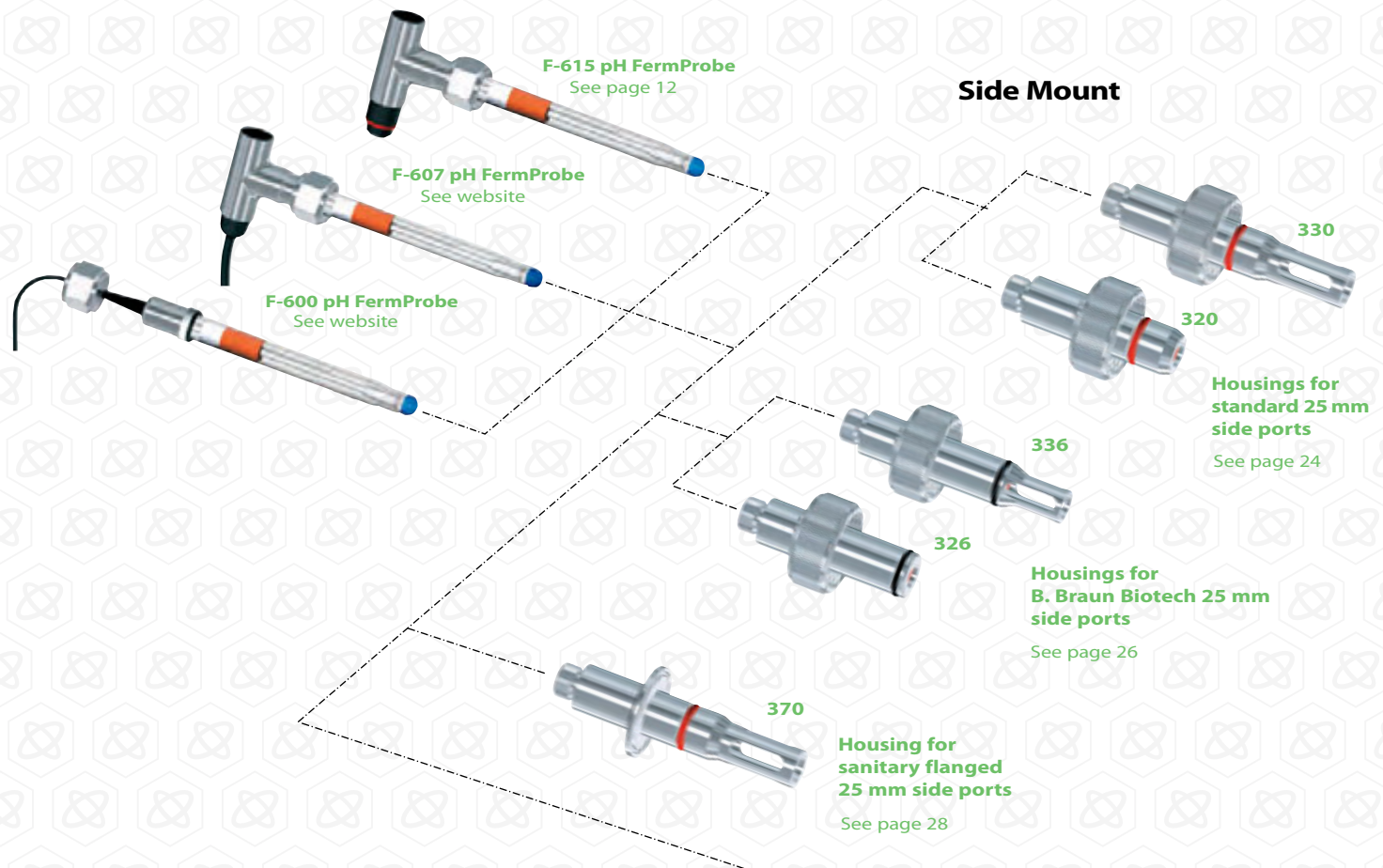
**Universally Compatible**

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.

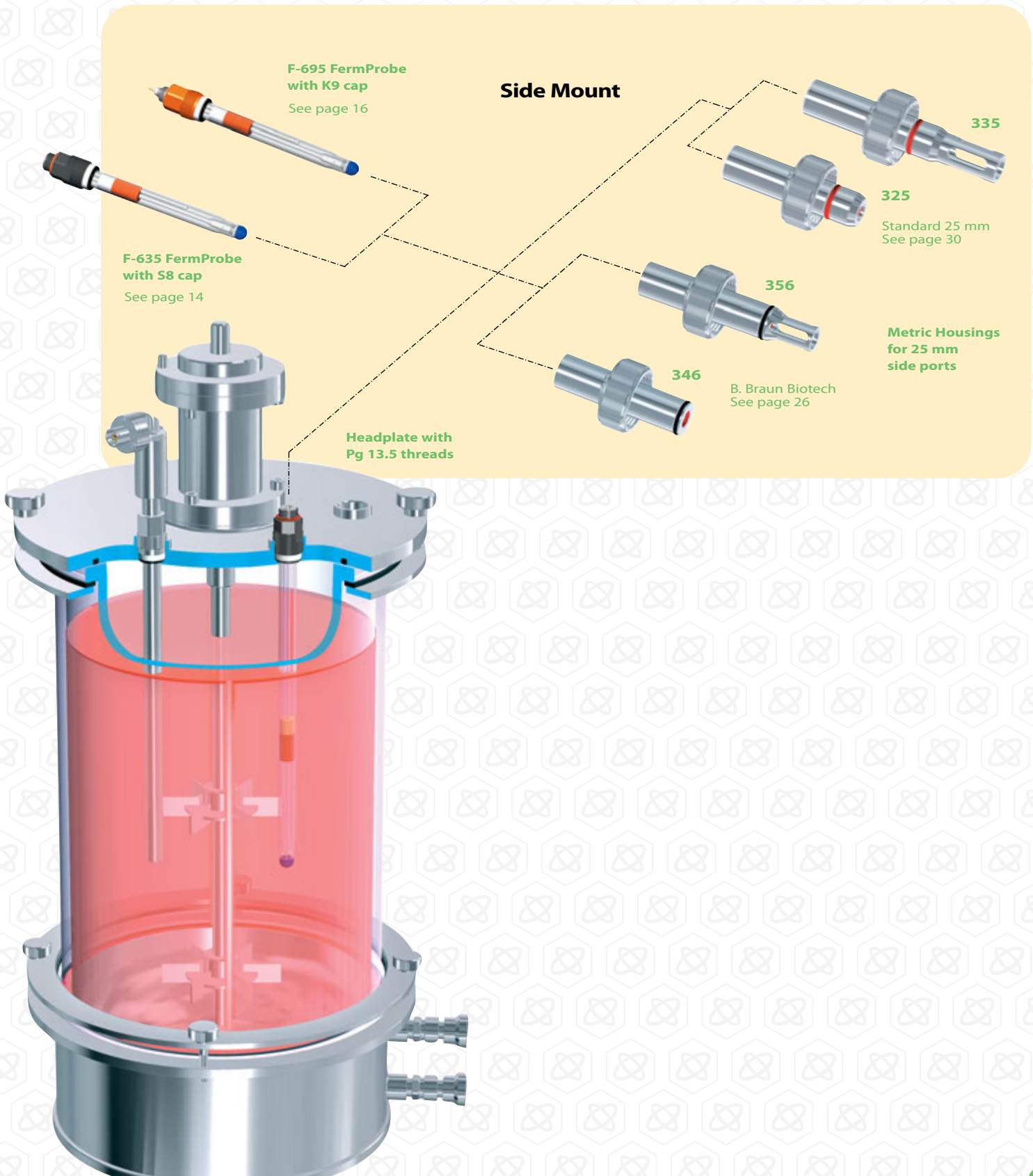
**The Market Leader in pH Electrode Design**

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. 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



## pH Electrodes pH Electrodes pH Electrodes pH Electrodes pH Elec





# How to Select a FermProbe® pH Electrode

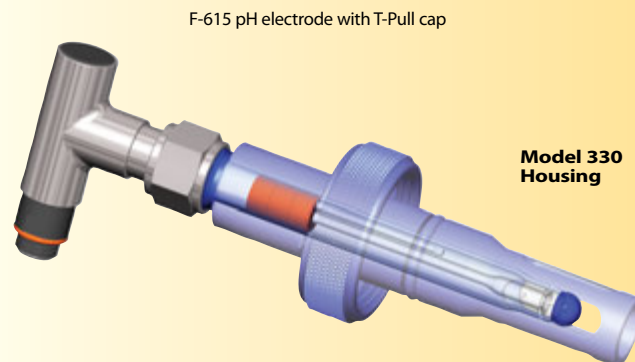
## STYLE 1 (see page 12)

### 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

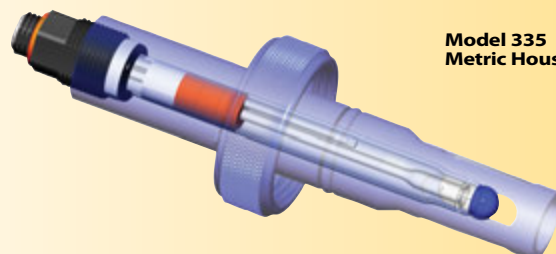
## STYLE 2 (see page 14)

### 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

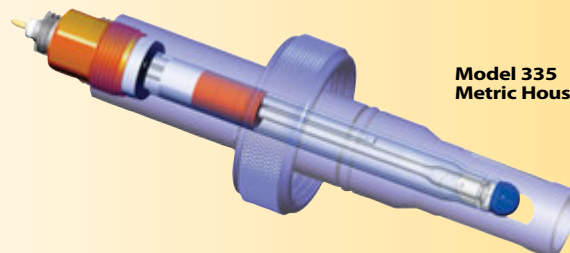
## STYLE 3 (see page 16)

### 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.

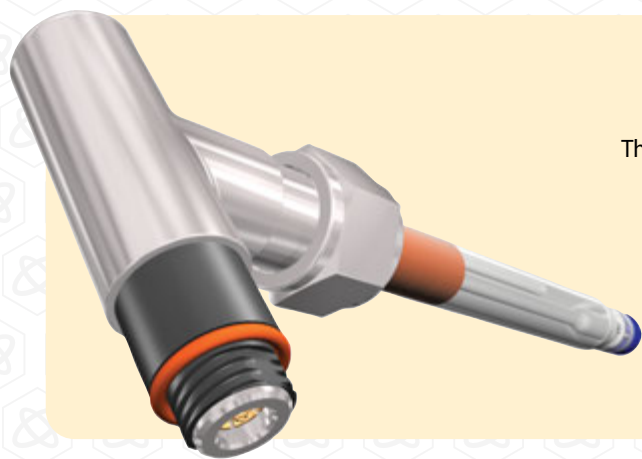
## SEE EXAMPLE BELOW



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

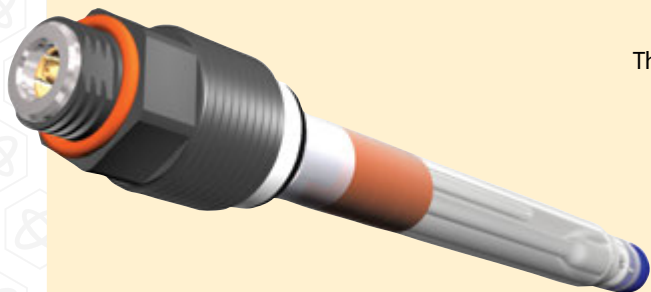
| ordering information  |       |                                   |                  |                       |
|---|-------|-----------------------------------|------------------|-----------------------|
| Electrode Model   | Class | Use With These Housing Models     | Electrode Length | Electrode Part Number |
| <b>Model F-615 pH FermProbe with T-Pull Handle &amp; Disconnect Cap</b> |       |                                   |                  |                       |
| 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?



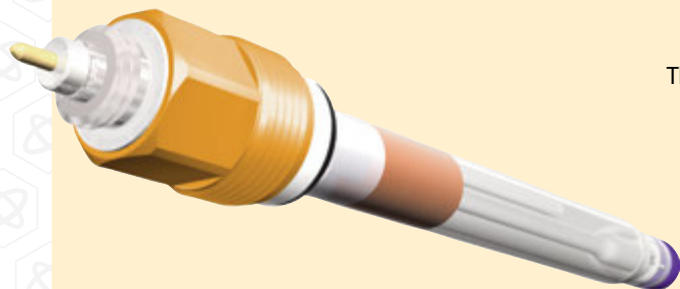
### T-Pull® Cap

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

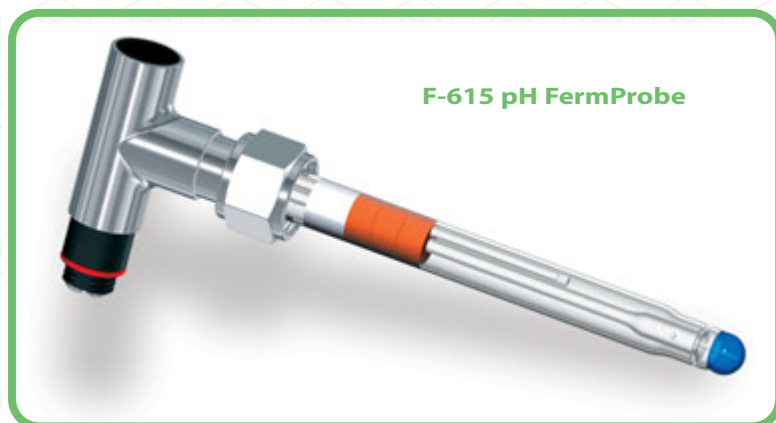
This FermProbe® style features a standard S8 detachable cable connection on a metric threaded polymer cap that allows the electrode to be used with European style electrode housings. The standard metric cap is a newer autoclavable design that protects the connector pin from breakage. The design requires 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.

# H Electrodes pH Electrodes pH Electrodes pH Electrodes pH Elect



**T-Pull®**  
cap style

**For electrode**  
see page 12

**For cable**  
see page 70



**Standard S8 Metric**  
cap style

**For electrode**  
see page 14

**For cable**  
see page 70



**K9 Metric**  
cap style

**For electrode**  
see page 16

**For cable**  
see page 72



## T-Pull<sup>®</sup> pH FermProbe<sup>®</sup> — 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

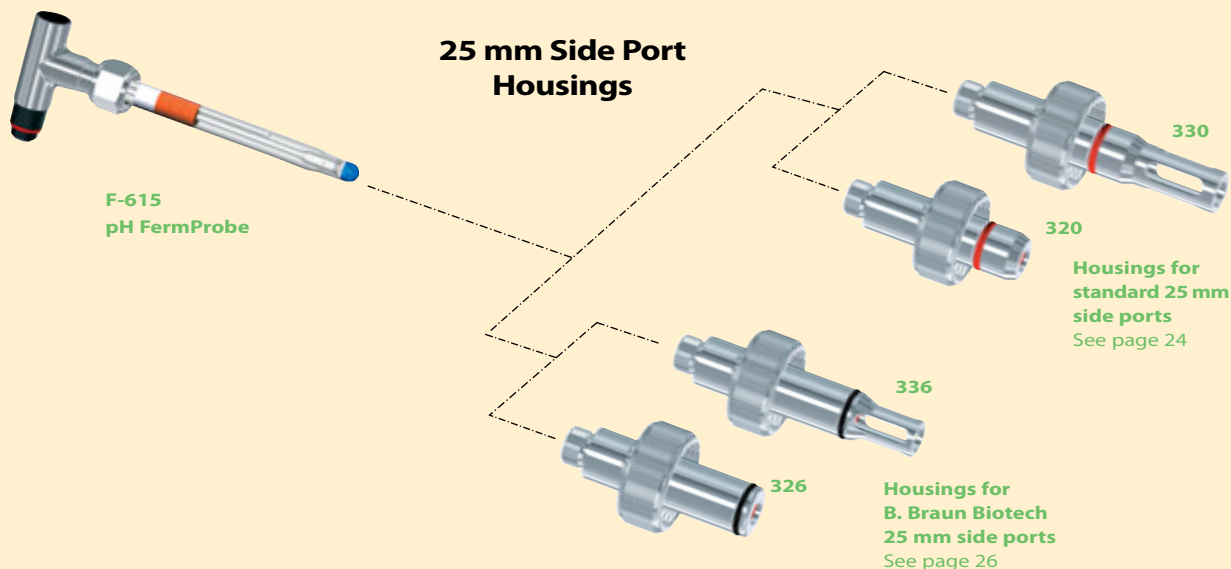
### FermProbe pH Electrodes with T-Pull Cap

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.

# H Electrodes pH Electrodes pH Electrodes pH Electrodes pH Elect



## 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 18–20. 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 70 and 71

## ordering information

| Electrode Model   | Class | Use With These Housing Models     | Electrode Length | Electrode Part Number |
|---|-------|-----------------------------------|------------------|-----------------------|
| <b>Model F-615 pH FermProbe with T-Pull Cap &amp; S8 Disconnect Connector</b> |       |                                   |                  |                       |
| 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<sup>®</sup> 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

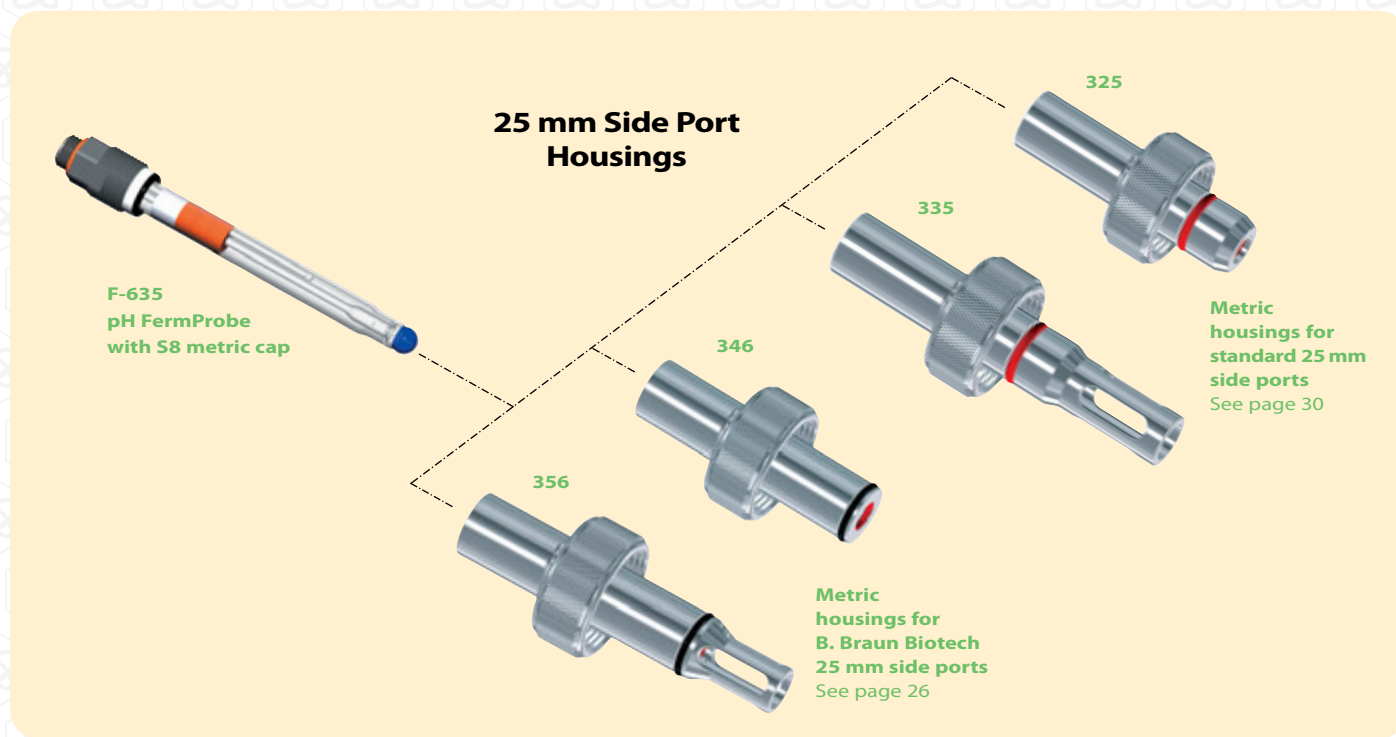
This FermProbe style features a standard S8 detachable cable connector on a metric Pg13.5 threaded polymer cap, which allows it to be used with European style electrode housings. Autoclavable as well as steam sterilizable, this style of pH FermProbe is the first choice for use with small autoclavable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



# H Electrodes pH Electrodes pH Electrodes pH Electrodes pH Elect



## 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 18–20. 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 70 and 71.

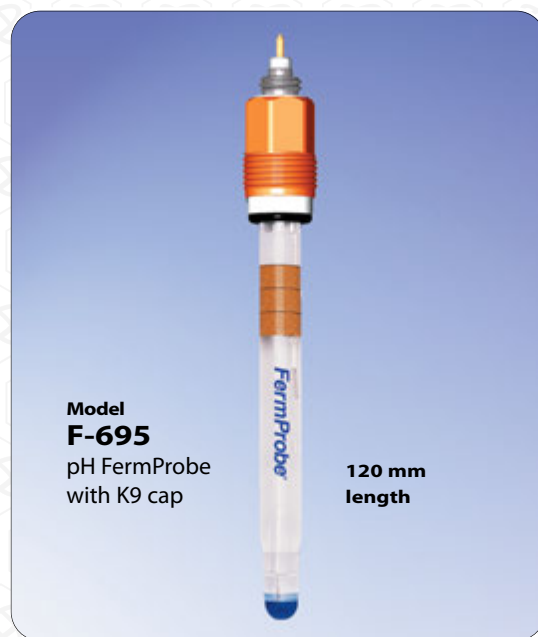
## ordering information

| Electrode Model   | Class | Use With These Housing Models  | Electrode Length | Electrode Part Number |
|---|-------|--|------------------|-----------------------|
| <b>Model F-635 pH FermProbe with Standard S8 Metric Cap</b> |       |  |                  |                       |
| 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:<br>compression fittings, short guide<br>tube versions of Models 380 and 382<br>or thread directly into<br>vessel's headplates | 420 mm           | F-635-B420-DH         |
| F-635   | X     |  | 480 mm           | F-635-B480-DH         |

## pH FermProbe<sup>®</sup> 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.



### 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

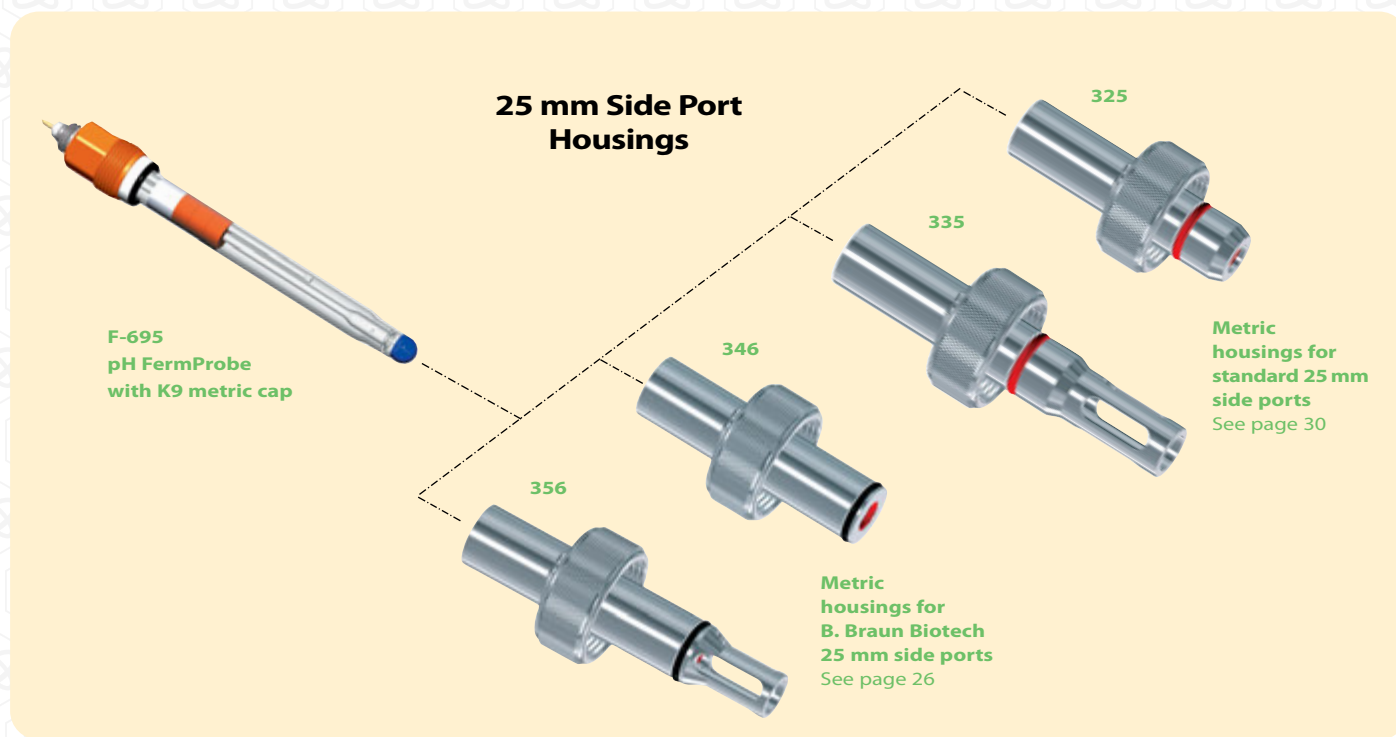
### FermProbe pH Electrodes with K9 Metric Cap

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.

# H Electrodes pH Electrodes pH Electrodes pH Electrodes pH Elect



## 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 18–20. 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 72 and 73.

## ordering information

| Electrode Model                                    | Class | Use With These Housing Models  | Electrode Length | Electrode Part Number |
|--|-------|--|------------------|-----------------------|
| <b>Model F-695 pH FermProbe with K9 Metric Cap</b> |       |  |                  |                       |
| 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:<br>compression fittings, short guide<br>tube versions of models 380 and 382<br>or thread directly into<br>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

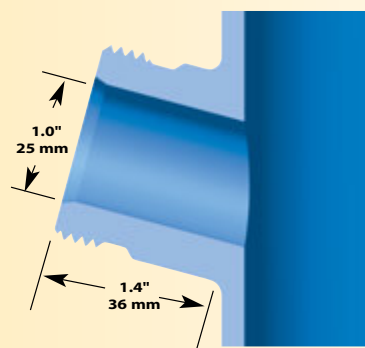
The electrode housing is designed to hold and protect the pH electrode while inserting it into the bioprocess vessel. There are various types of side entry ports and different

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

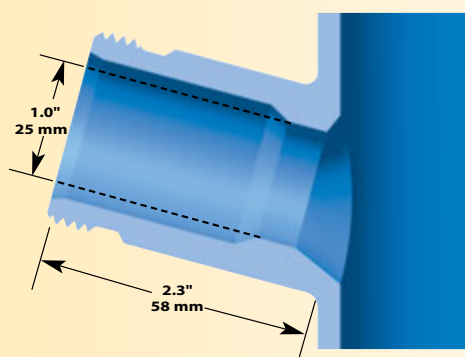
## STANDARD 25 mm SIDE PORT

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.



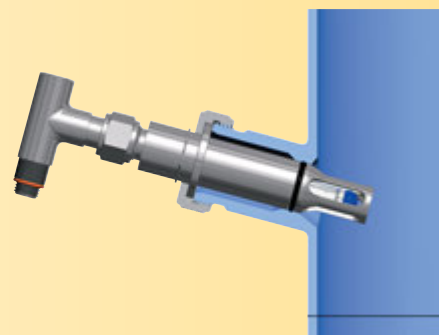
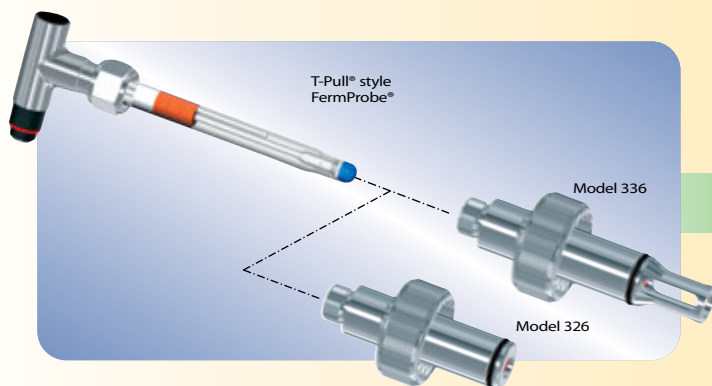
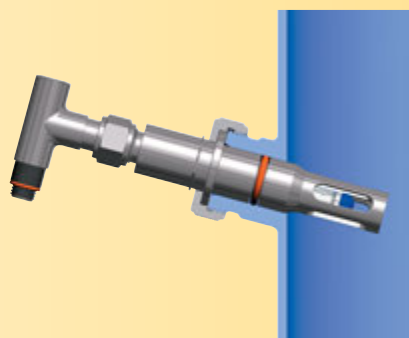
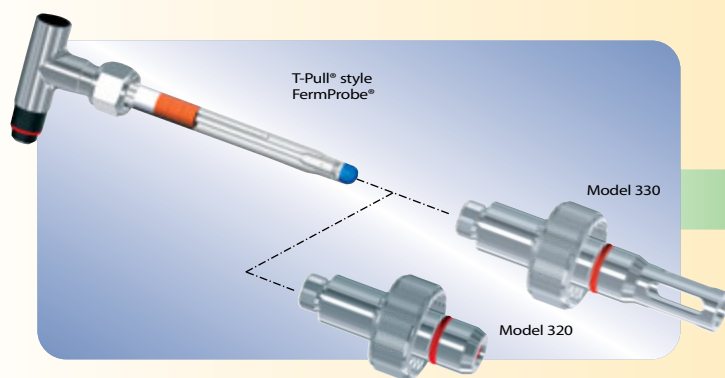
# Housings pH Housings pH Housings pH Housings pH Housings

*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.**



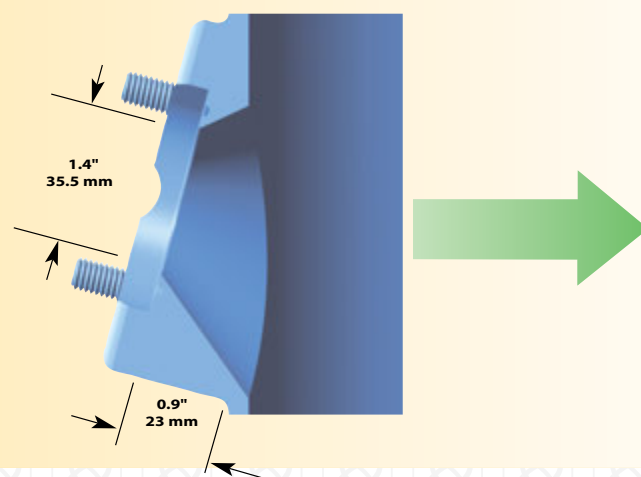
# How to Choose a Housing Style: Additional Sanitary Installations

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.

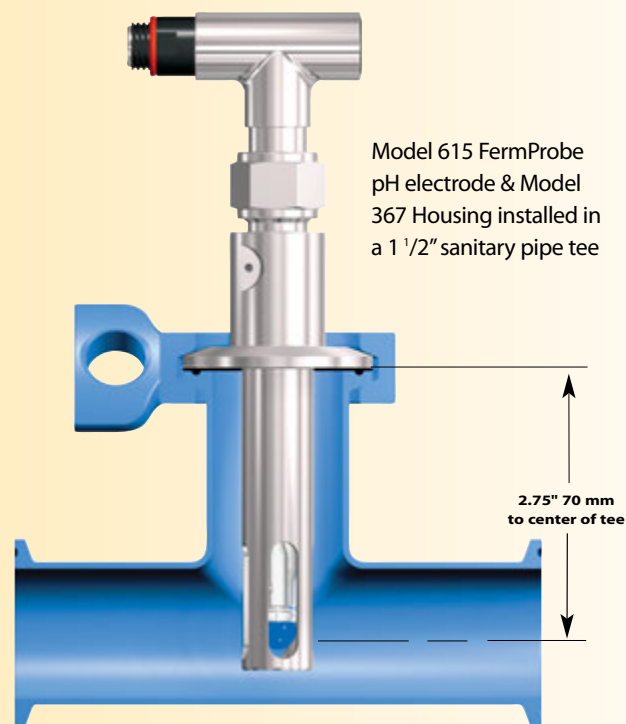


## SANITARY PIPE TEE

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.

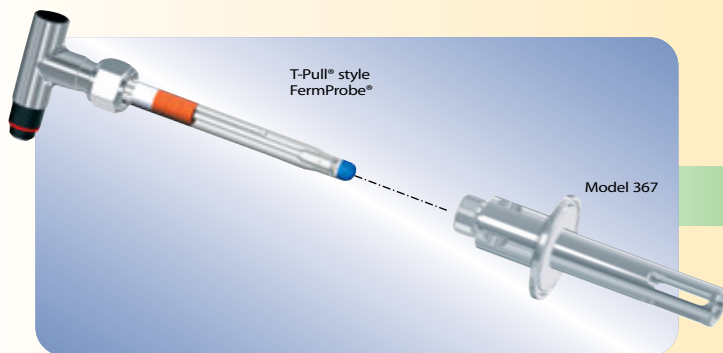
Commonly used in both the food and pharmaceutical industries, the Model 357 and 367 housings are suitable for sanitary pipe systems with CIP requirements. These housings are most often found in downstream processes such as purification.

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.

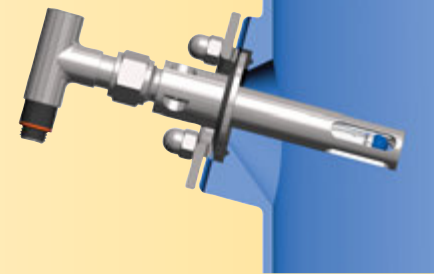




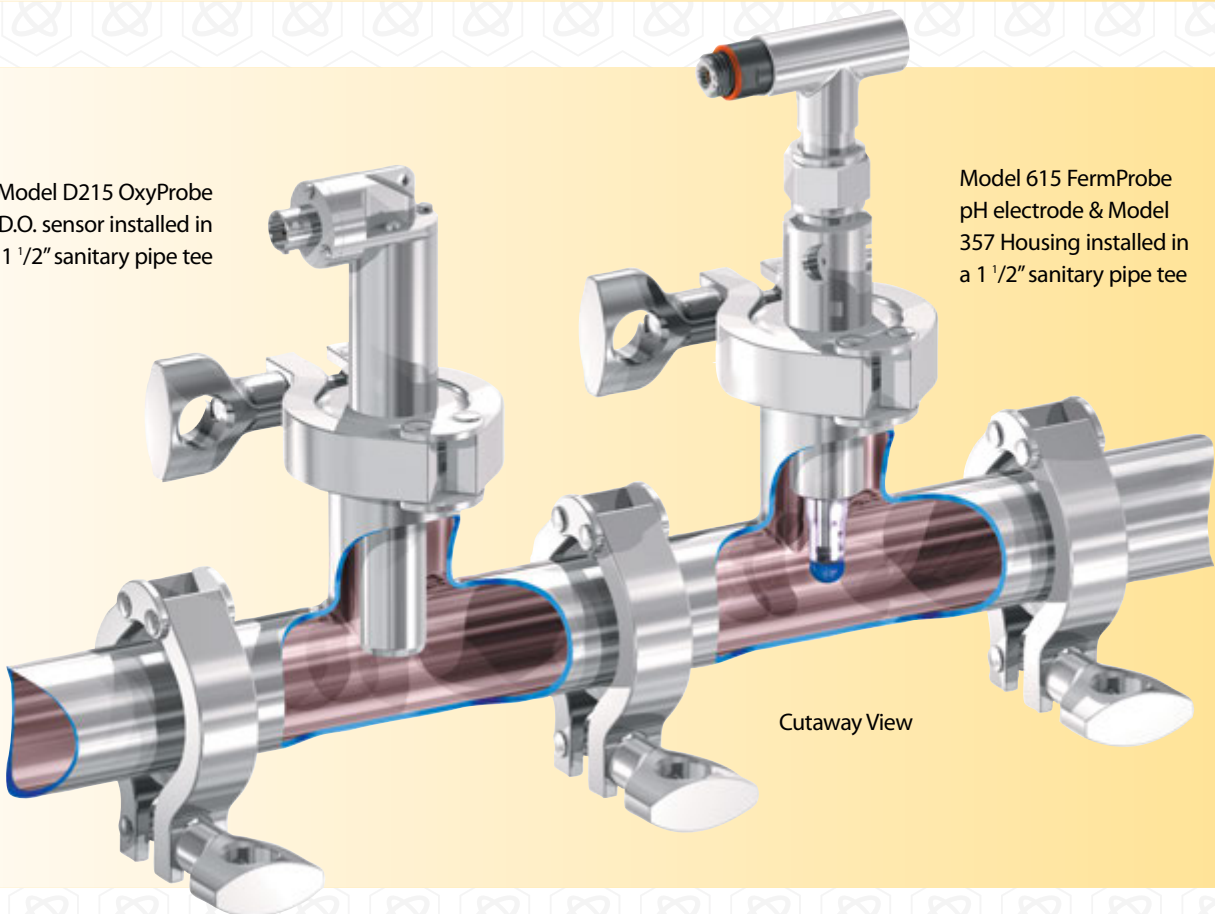
# Housings pH Housings pH Housings pH Housings pH Housings pH



Cutaway of vessel wall with housing and pH electrode installed



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

## 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.*



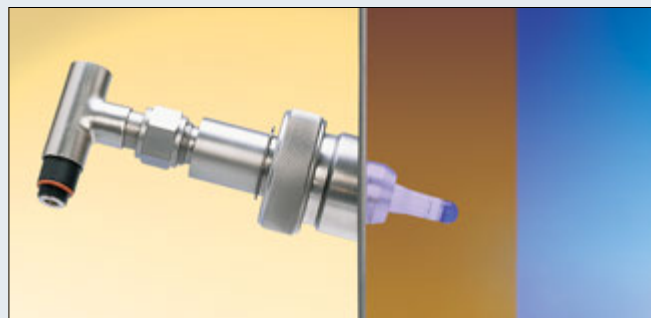
*The F-615/336 assembly with guarded housing to protect the pH glass bulb of the electrode during installation.*



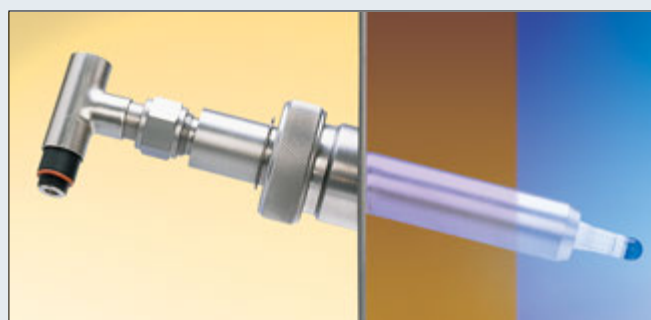
### 2. When do I Choose a Longer Housing Length?

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.*

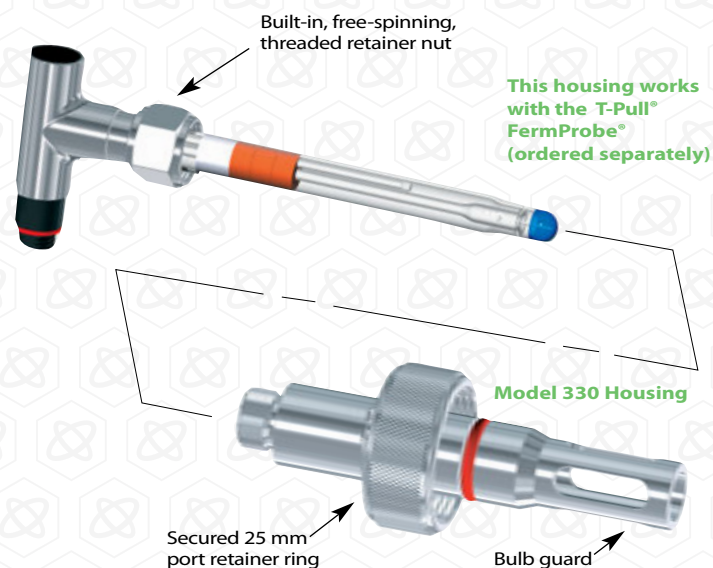
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## Housings for Standard 25 mm Side Ports

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.**



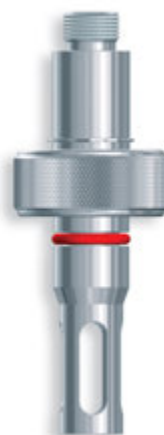
CLASS **A**



CLASS **B**

### Model 320

Unguarded housings  
preferable in viscous media



CLASS **A**



CLASS **B**

### Model 330

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 silicone o-rings. (EPDM available upon request.)
- Permanently secured port retainer ring for additional operator safety.

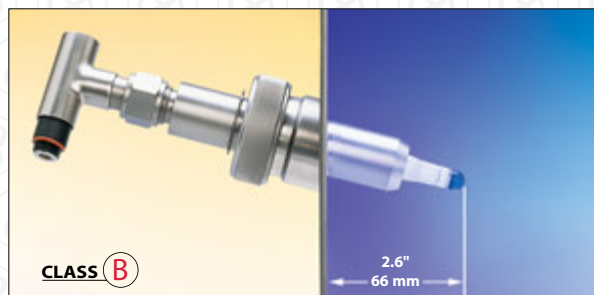
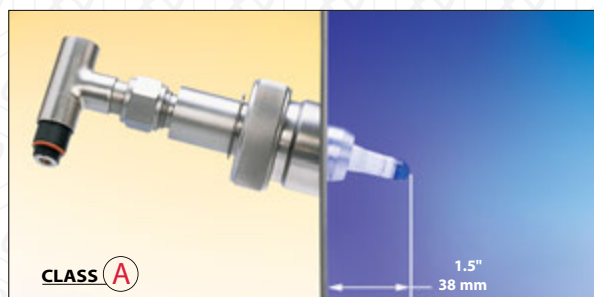
### Additional Features Include:

- 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.

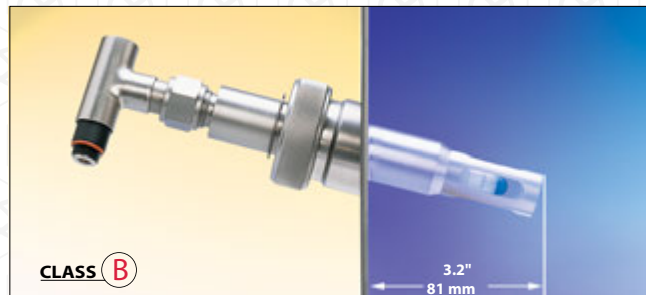
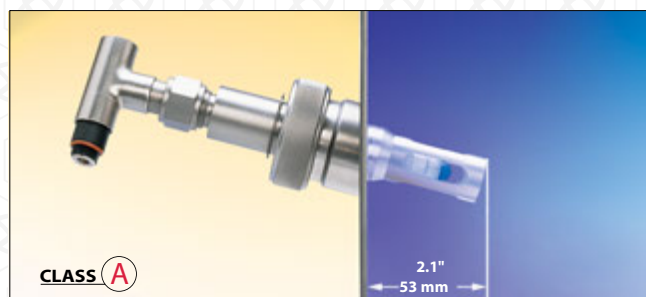


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## Model 320 Insertion Lengths



## Model 330 Insertion Lengths



## How to Order a Housing

- (1) Confirm that the vessel has a standard 25 mm side port. Cutaway views and dimensions are shown on pages 18 and 19.
- (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 applications except where the media is highly viscous. Highly viscous media is prone to clog the guard area of the housing which can cause erroneous measurements.
- (3) Determine how far the housing and electrode should extend for best performance (see illustration above). For most process media the minimum length is optimum. However, if the media is viscous and tends to thickly coat the inner vessel wall, then a longer length that protrudes farther into the vessel may provide better pH electrode performance.
- (4) Choose a pH electrode from among those listed on page 12. These rugged process pH electrodes secure to the housing with a free-spinning threaded retainer nut. The pH electrodes must be ordered separately.

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

| Housing Model                        | Class | Typical Vessel Insertion Length |      | Used With pH Electrode Models | Used With Electrode Length | Housing Part Number |  |
|--------------------------------------|-------|---------------------------------|------|-------------------------------|----------------------------|---------------------|--|
| Unguarded Housings                   |       |                                 |      |                               |                            |                     |  |
| 320                                  | A     | 38 mm                           | 1.5" | F-615                         | 130 mm                     | 320-61-H070         |  |
| 320                                  | B     | 66 mm                           | 2.6" | F-615                         | 160 mm                     | 320-61-H100         |  |
| Housings With Protective Bulb Guards |       |                                 |      |                               |                            |                     |  |
| 330                                  | A     | 53 mm                           | 2.1" | F-615                         | 130 mm                     | 330-61-H070         |  |
| 330                                  | B     | 81 mm                           | 3.2" | F-615                         | 160 mm                     | 330-61-H100         |  |



# 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

**Proper 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



### Housings for Metric FermProbes



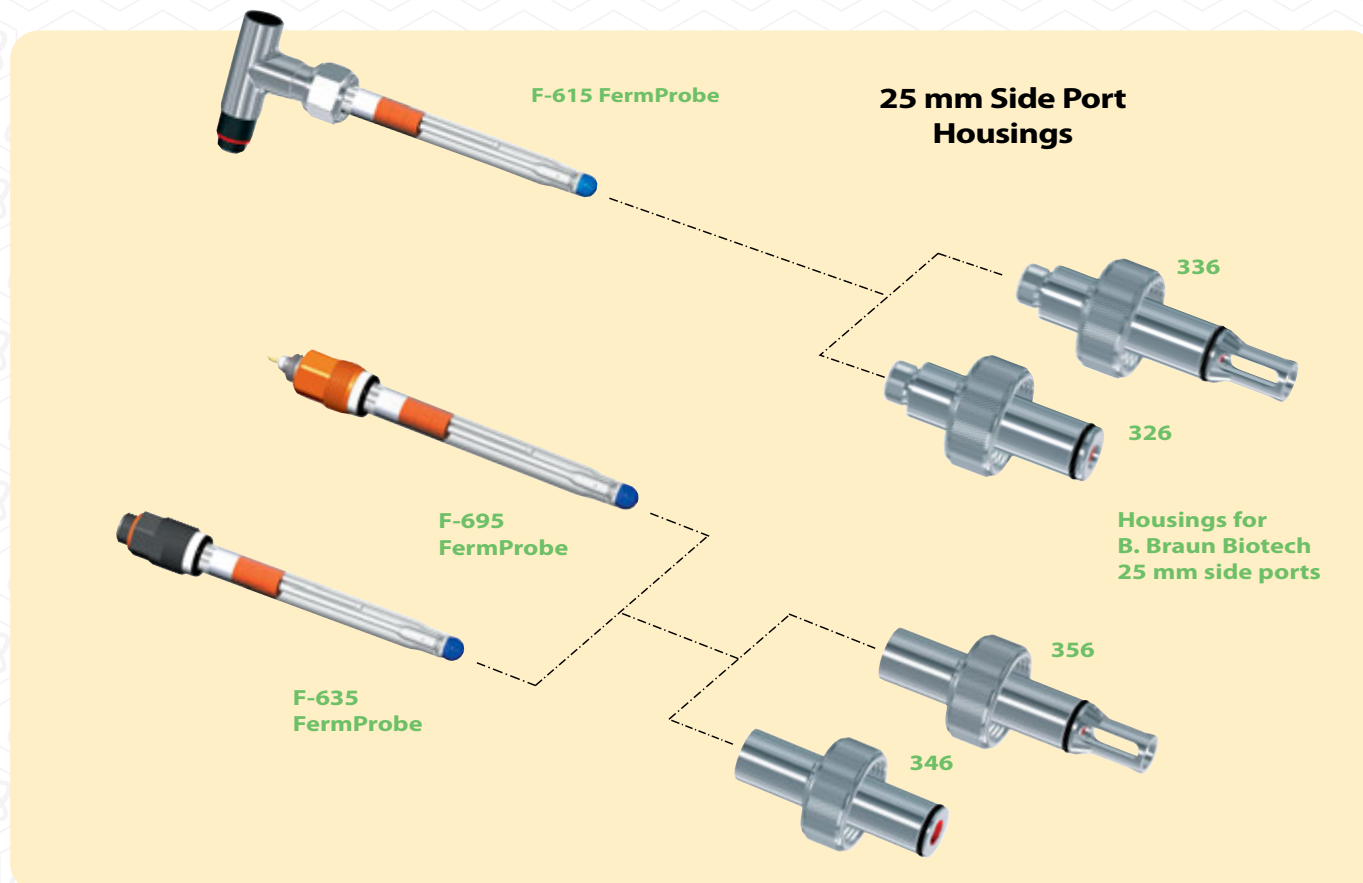
### Specifications:

- 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.

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## 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 18 and 19.
- (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 12 and 13 for T-Pull FermProbes.
  - See pages 14–17 for Metric FermProbes.

### ordering information

| Ordering Information               |       |                         |      |                               |                            |                     |  |
|------------------------------------|-------|-------------------------|------|-------------------------------|----------------------------|---------------------|--|
| Housing Model                      | Class | Vessel Insertion Length |      | Used With pH Electrode Models | Used With Electrode Length | Housing Part Number |  |
| 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 Sanitary Tees and Novasaptic Side Ports



#### Model 357

Unguarded,  
for 1 1/2"  
Sanitary Tee

CLASS **A**



#### Model 367

Guarded,  
for 1 1/2"  
Sanitary Tee

CLASS **A**

### 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-

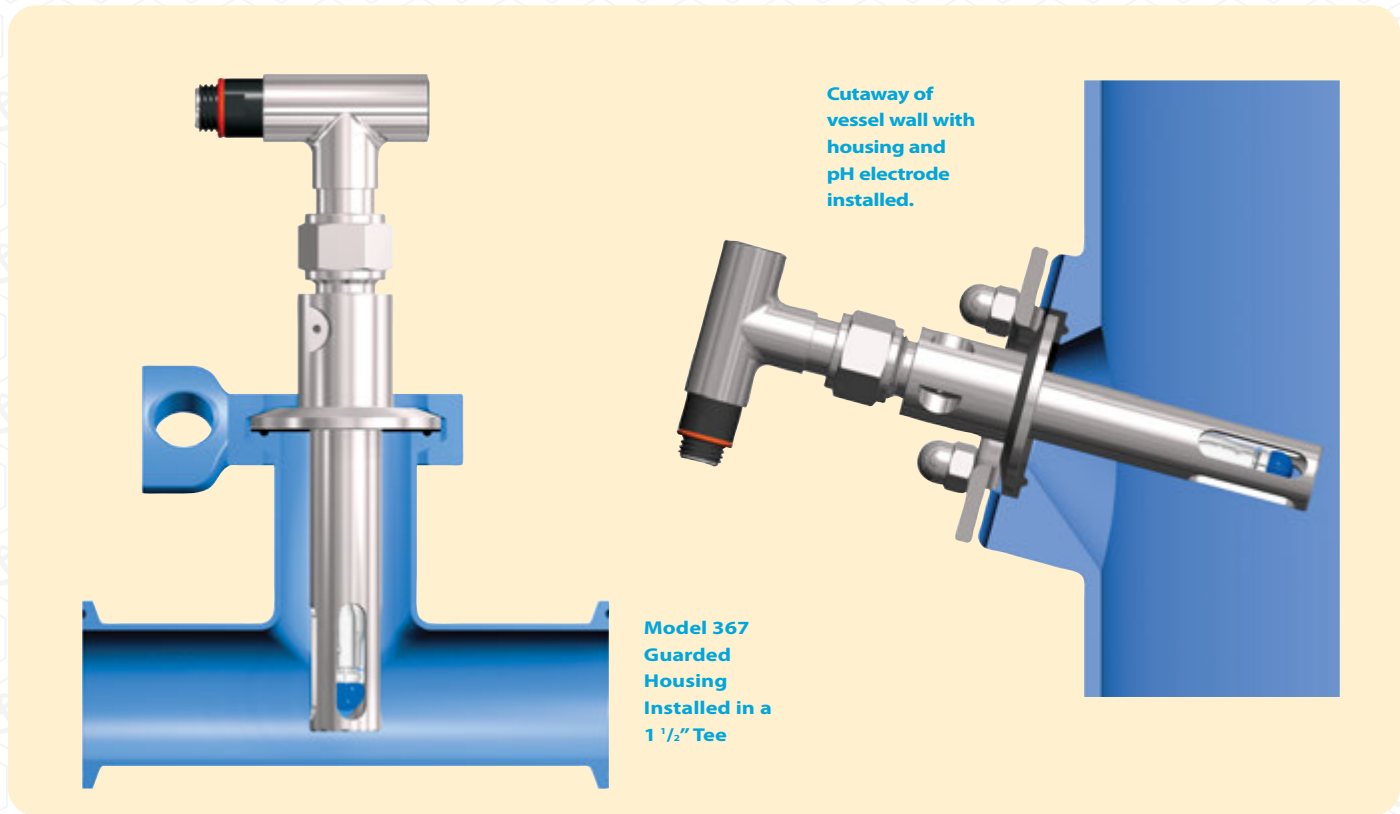
urements. When using a standard sanitary tee, the sensor will be positioned such that the tip of the sensor is in the middle of the process flow. T-Pull® FermProbes® are compatible with these housings.

These housing are also compatible with Novaseptic side ports.

### ordering information

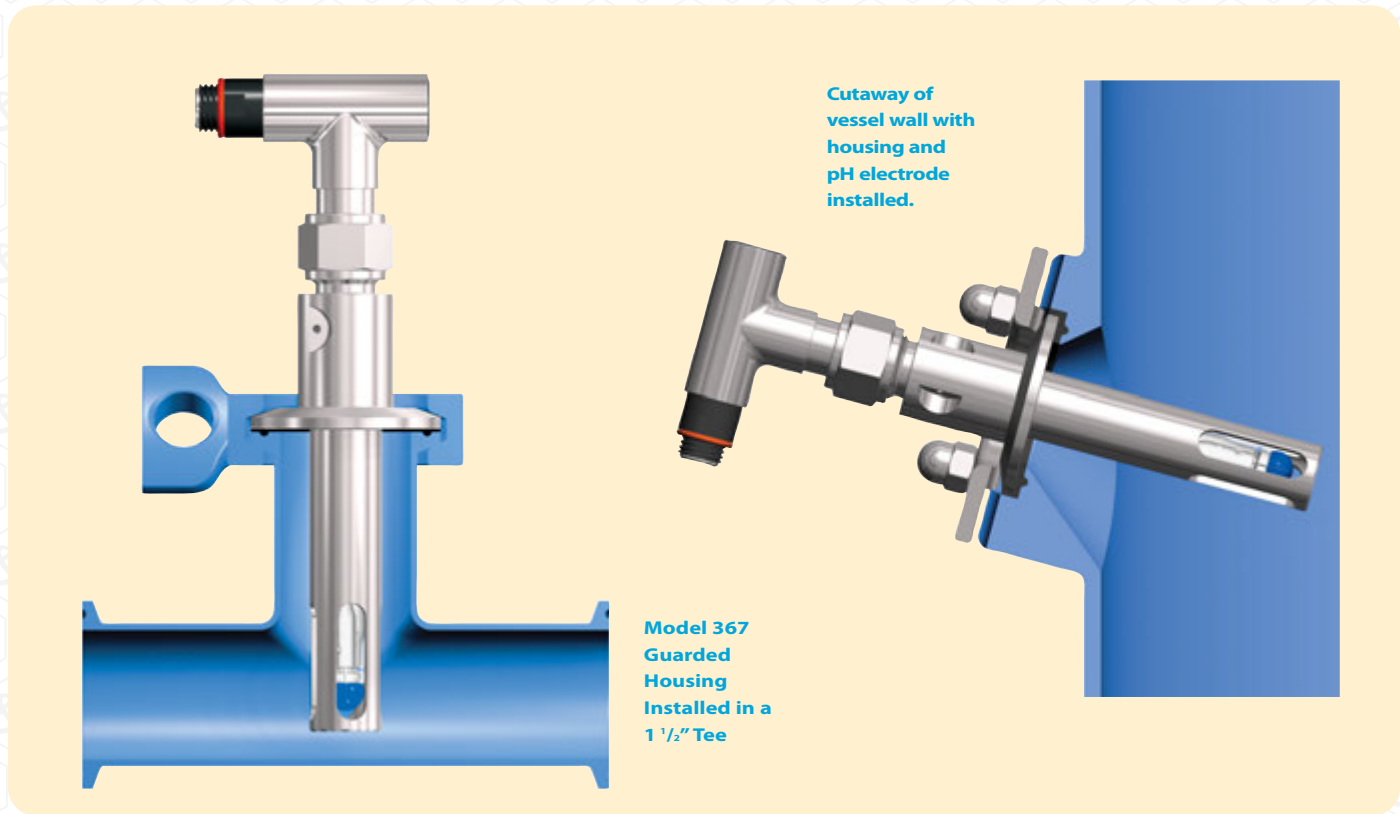
| Housing Model  | Class | Typical Insertion Length |      | Used With pH Electrode Model | Used With Electrode Length | Housing Part Number |
|--|-------|--------------------------|------|------------------------------|----------------------------|---------------------|
| Model 357 for 1.5" Sanitary 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         |

## Exploded and Inserted Views



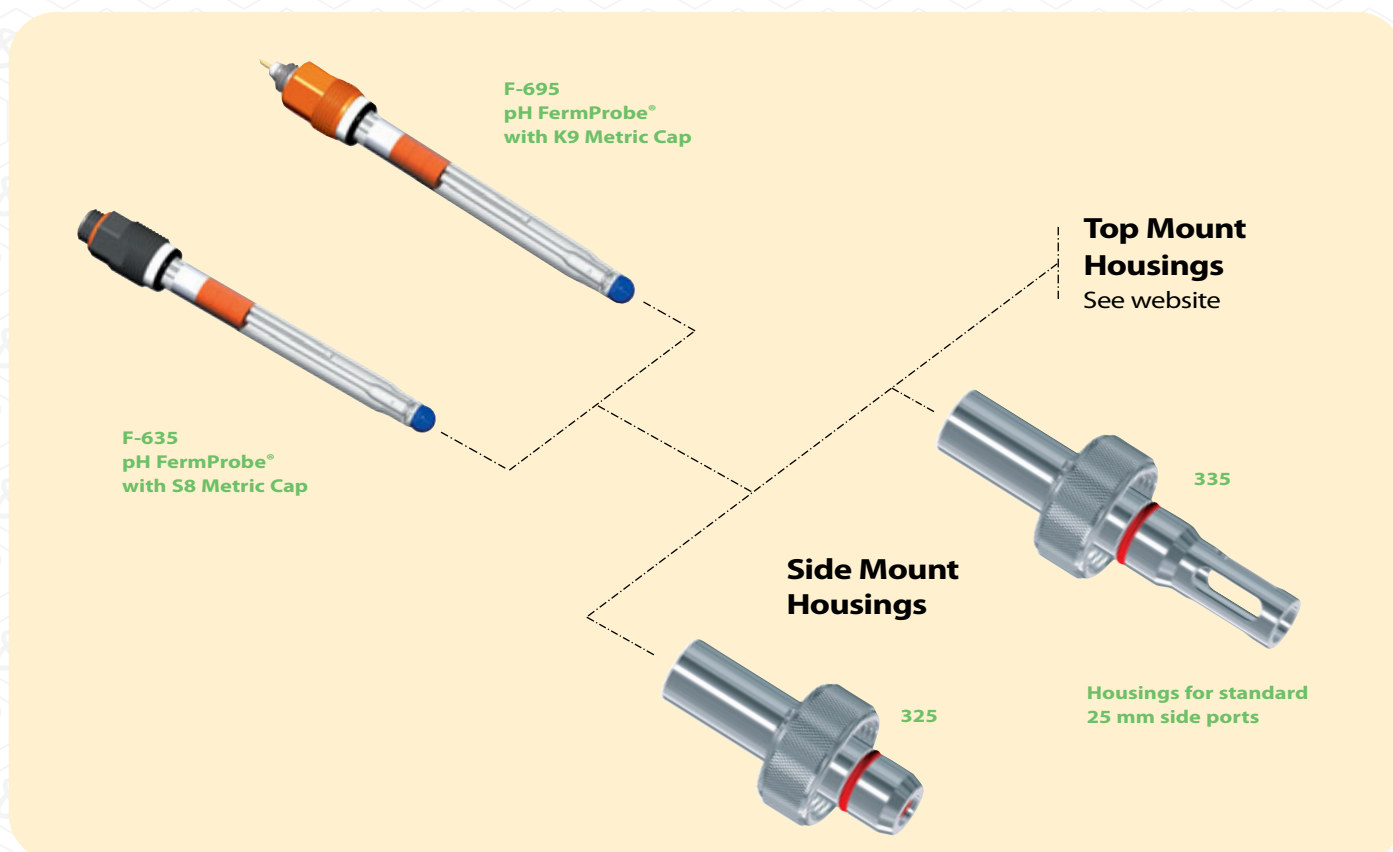


## Exploded and Inserted Views





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## How to select the correct housing

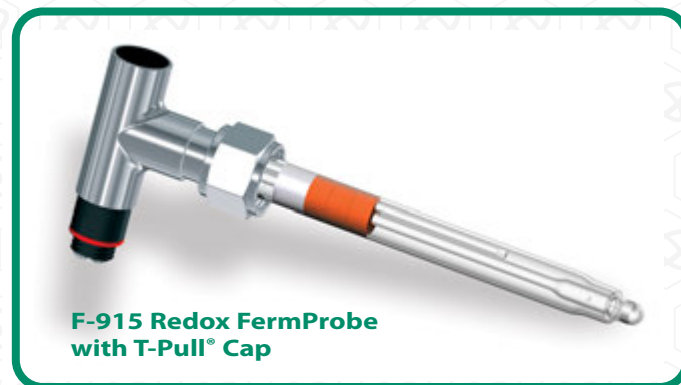
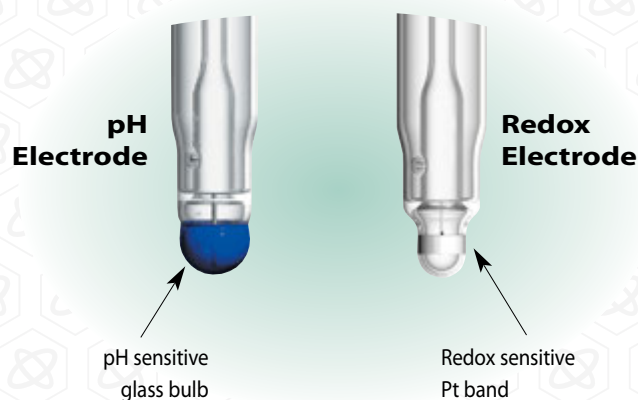
- (1) Confirm that the opening is a standard 25 mm side port. Cutaway views and dimensions are shown on pages 18 and 19.
- (2) Determine whether the application will permit the use of a bulb guard on the housing. The bulb guard is highly recommended for all applications except when the media is very 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 14–17 for more information on metric FermProbe electrodes and electrode selection.
  - \* See page 44 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 |
|------------------------------------|-------|---------------------------------|------|---|------------------------------------|---------------------|
| Unguarded Housing                  |       |                                 |      |   |                                    |                     |
| 325                                | D     | 38 mm                           | 1.5" | F-695, F-635, D140, D145                      | 120 mm                             | 325-61-H070         |
| Housing with Protective Bulb Guard |       |                                 |      |   |                                    |                     |
| 335                                | D     | 53 mm                           | 2.1" | F-695, F-635                                  | 120 mm                             | 335-61-H070         |

# Redox Electrodes Redox Electrodes Redox Electrodes Redox Electrodes Redox Electrodes

## Redox Electrodes



### Redox FermProbes®

- Fits all suitable FermProbe housings
- Works with standard FermProbe cables
- Compatible with pH transmitters that have a millivolt display mode.

### 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:

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



# Redox Electrodes Redox Electrodes Redox Electrodes Redox Electrodes



**F-935 Redox FermProbe  
with S8 Metric Cap**



**F-995 Redox FermProbe  
with K9 Metric 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 18-21. 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 70-73.

## 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.

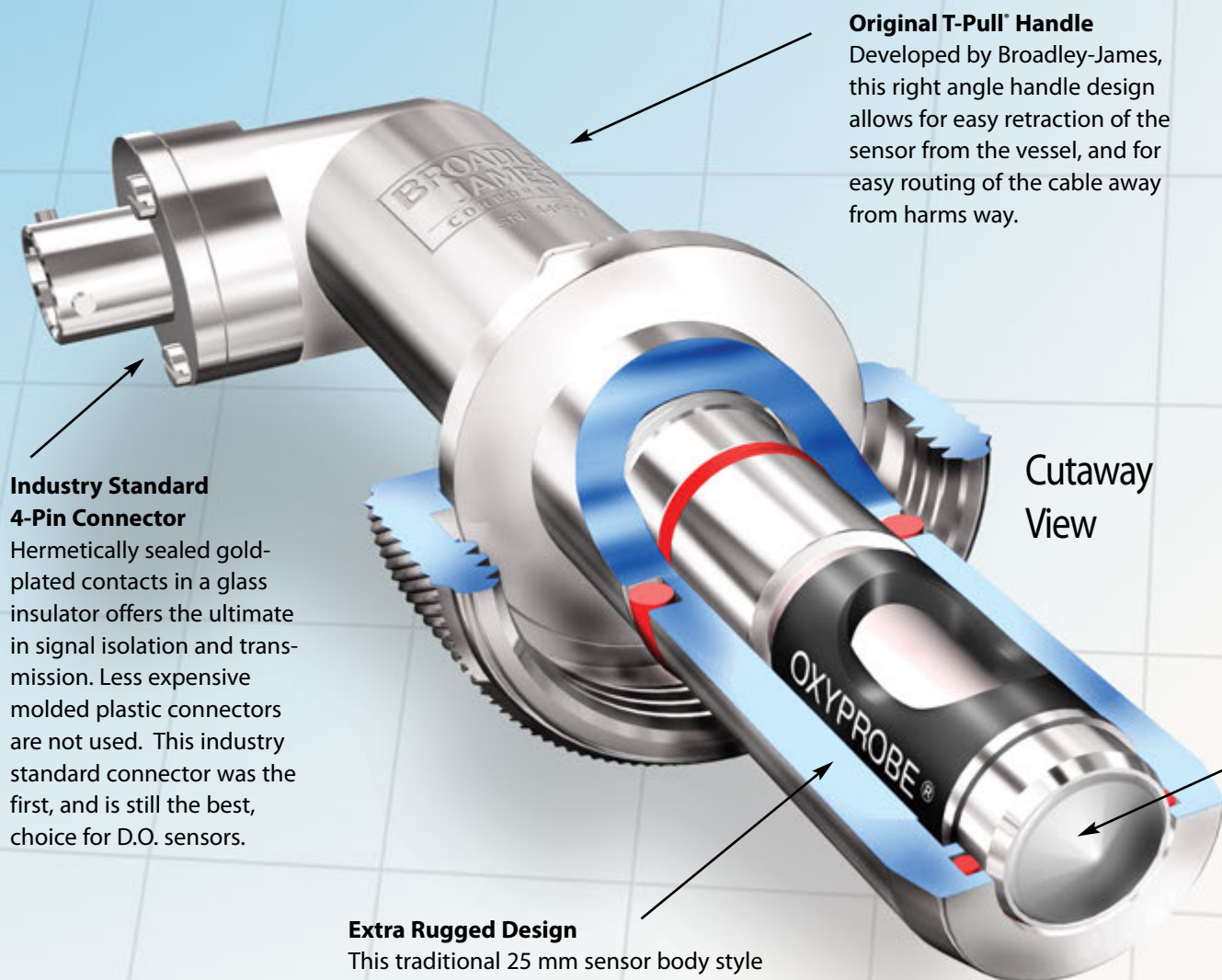
## o r d e r i n g   i n f o r m a t i o n

| Electrode Model                      | Class | Use With These Housing Models     | Electrode Length* | Electrode Part Number |  |
|--------------------------------------|-------|-----------------------------------|-------------------|-----------------------|--|
| <b>Series F-900 Redox FermProbes</b> |       |                                   |                   |                       |  |
| 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.

# OxyProbe<sup>®</sup> D.O. Sensors

Steam Sterilizable and Autoclavable



# Dissolved Oxygen Sensors Dissolved Oxygen Sensors Dissolved Oxygen

## Performance Specifications

|                               |   |
|-------------------------------|---|
| <b>Measurement principal:</b> | Amperometric –<br>Polarographic   |
| <b>Output signal in air:</b>  | Approx. 67 nA at 25°C   |
| <b>Temperature range:</b>     | Operation: 0 to 80°C<br>Sterilization: Max. 135°C                                 |
| <b>Stability:</b>             | Better than 2% of<br>readout per week at<br>constant pressure<br>and temp. (30°C) |
| <b>Maximum Pressure:</b>      | 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 3.1 certificates and mill certificates are available upon request. Every sensor is serialized with paperwork on file in our database.

### Universally Compatible

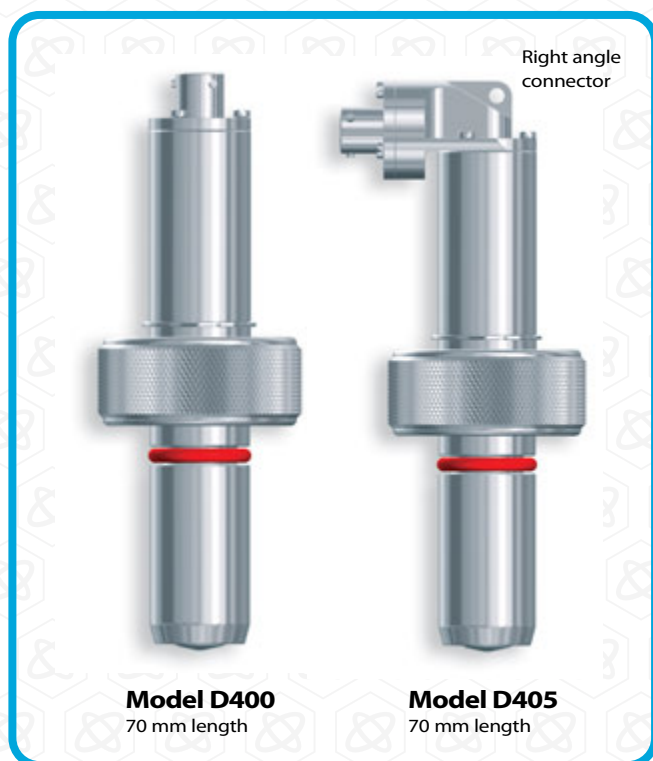
All Broadley-James D.O. sensors work with existing biotech equipment. No proprietary electronics or cables are required. All designs are intended to fit both existing and future requirements, without introducing any unnecessary changes in hardware or cabling. Reduces inventory and confusion, increases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

# Sensors Dissolved Oxygen Sensors Dissolved Oxygen Sensors Dissolved Oxygen Sensors

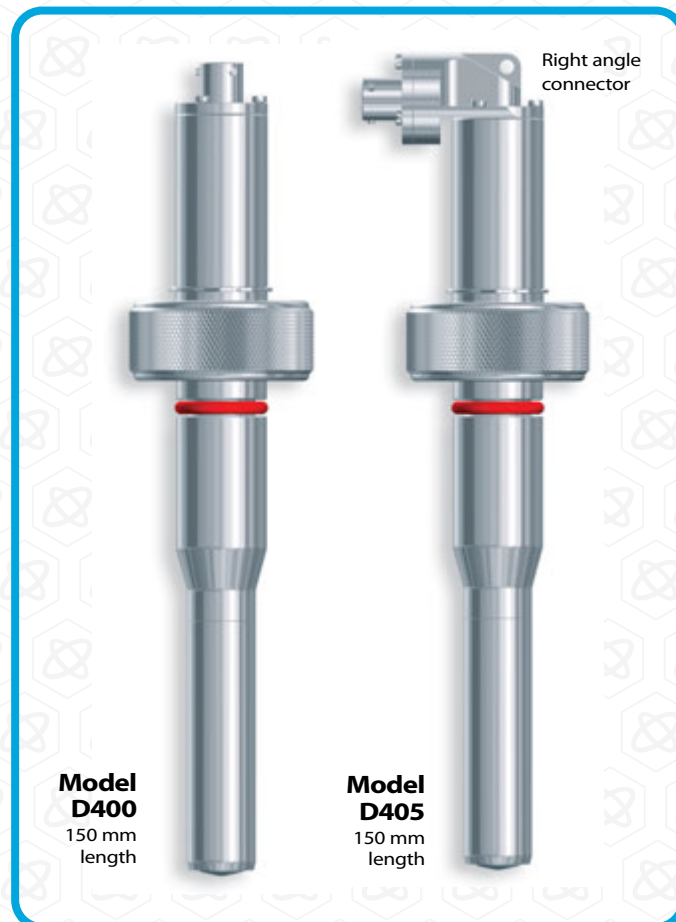
## OxyProbe® D.O. Sensors for Standard 25 mm Side Ports



### 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 1-year warranty.

For performance specifications see page 35.



### 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 |       |
|---|---------------|--------------------------|-------|
| <b>Model D400 Series 25 mm OxyProbe with Straight Connector</b> |               |                          |       |
| • 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 |       |
|--|---------------|--------------------------|-------|
| <b>Model D405 Series 25 mm OxyProbe with Right Angle Connector</b> |               |                          |       |
| • 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" |



# Dissolved Oxygen Sensors Dissolved Oxygen Sensors Dissolved Oxygen

## 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 48 and 49 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.

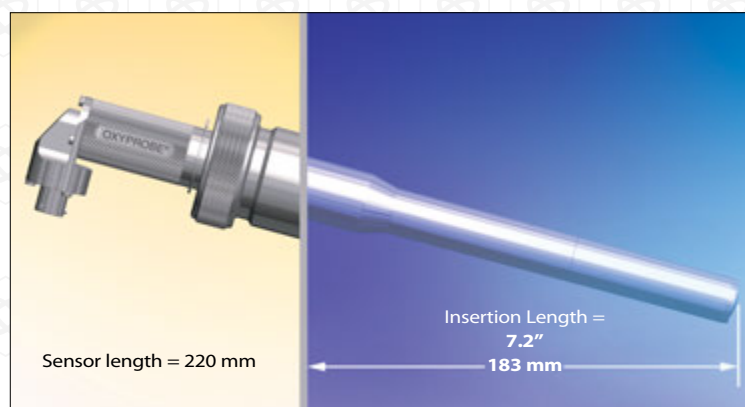
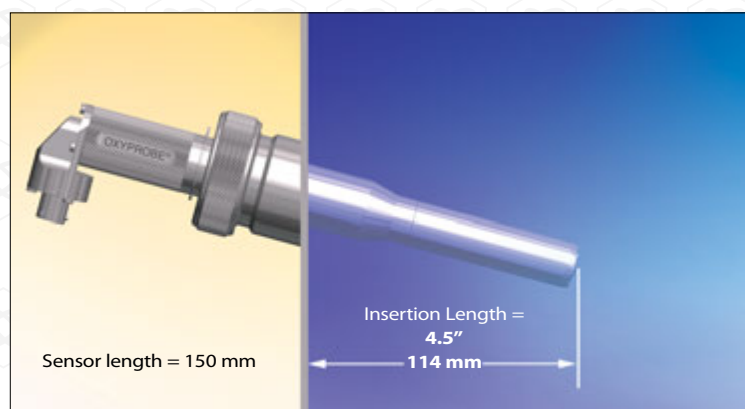
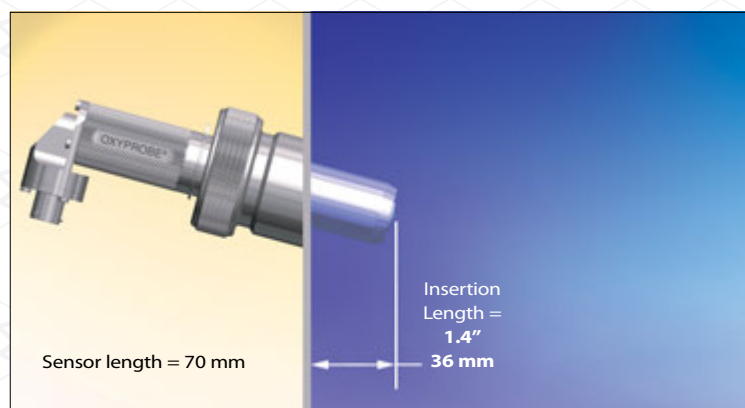
**All Broadley-James dissolved oxygen sensors are available with an optional right angle connector. This low profile design provides:**

- 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 18 and 19.
- (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 74 and 75.

## Model D400/D405 Insertion Lengths



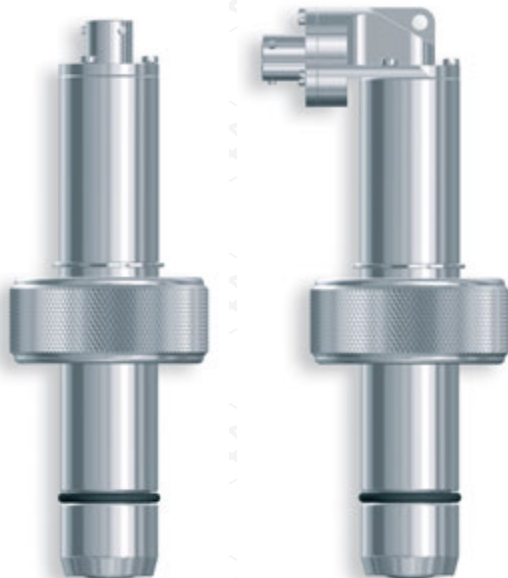
## TIPS & HINTS

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.

# sensors Dissolved Oxygen Sensors Dissolved Oxygen Sensors Disso

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

### Standard Insertion Length



**Model D430**

70 mm length

**Model D435**

70 mm length

### Model D430 Series OxyProbe® D.O. Sensors

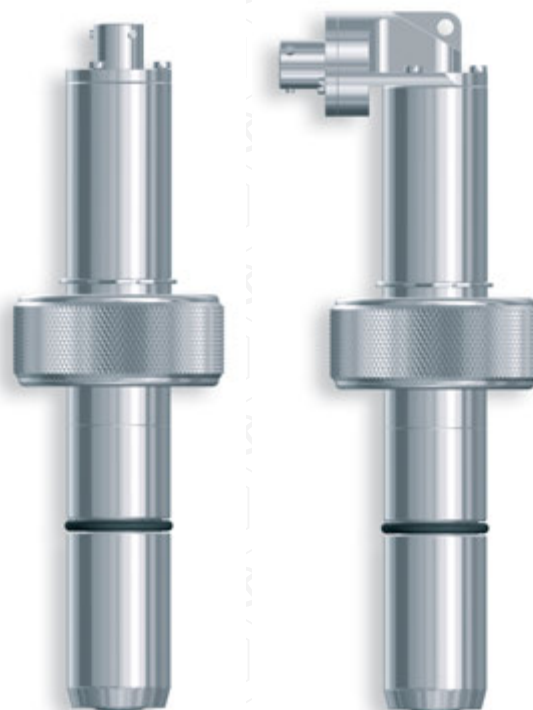
The ports of B. Braun Biotech fermentation vessels are longer and have a slightly different internal design. In order to seal properly, the o-ring on these sensors has been moved closer to the tip of the sensor.

### 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 1-year warranty.

### Extended Insertion Length



**Model D430**

95 mm length

**Model D435**

95 mm length

For performance specifications see page 35.

### Features:

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

### ordering information

| Part Number   | Sensor Length | Typical Insertion Length |      |
|---|---------------|--------------------------|------|
| <b>Model D430 Series 25 mm OxyProbe with Straight Connector</b>   |               |                          |      |
| <ul style="list-style-type: none"> <li>• Unique o-ring placement for better seal</li> <li>• Fits B. Braun Biotech Fermentors</li> </ul> |               |                          |      |
| D430-B070-PT-D9   | 70 mm         | 13 mm                    | 0.5" |
| D430-B095-PT-D9   | 95 mm         | 36 mm                    | 1.4" |

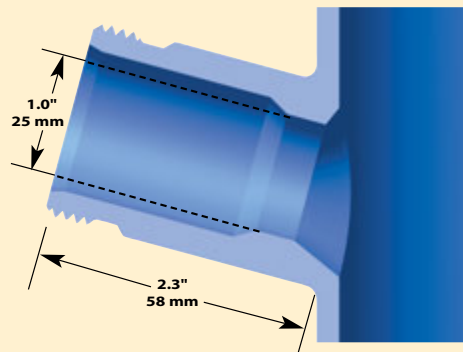
### ordering information

| Part Number   | Sensor Length | Typical Insertion Length |      |
|---|---------------|--------------------------|------|
| <b>Model D435 Series 25 mm OxyProbe with Right Angle Connector</b>  |               |                          |      |
| <ul style="list-style-type: none"> <li>• Unique o-ring placement for better seal</li> <li>• Fits B. Braun Biotech Fermentors</li> </ul> |               |                          |      |
| D435-B070-PT-D9   | 70 mm         | 13 mm                    | 0.5" |
| D435-B095-PT-D9   | 95 mm         | 36 mm                    | 1.4" |

# Dissolved Oxygen Sensors Dissolved Oxygen Sensors Dissolved Oxygen

## 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 74 and 75.

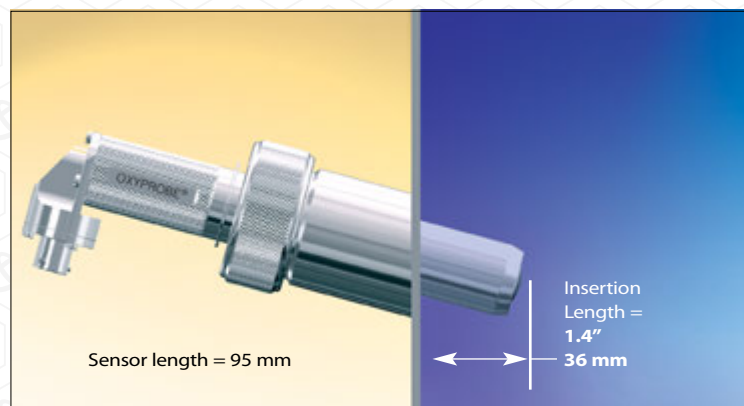
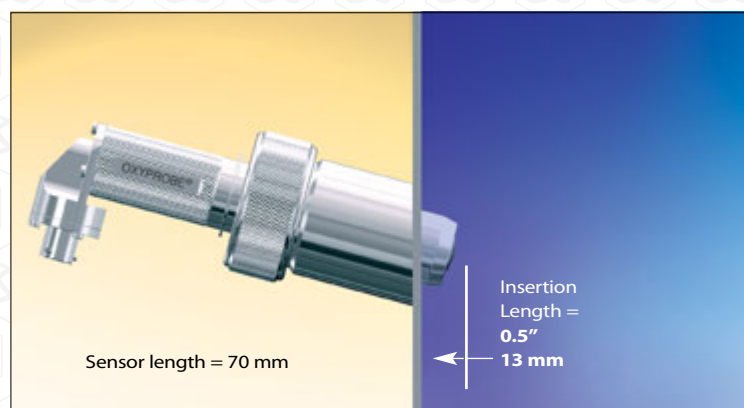
## TIPS & HINTS

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. |
|-------------|------|
| 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



# Sensors Dissolved Oxygen Sensors Dissolved Oxygen Sensors Disso

## Broadley-James® Smart Polarizer

### Conditions a Polarographic D.O. Sensor

# AM-9660

NEW!!



#### BENEFITS:

- Full zero and air test to verify the dissolved oxygen sensor is fit for purpose.
- Prevents a faulty sensor being fitted to a vessel.
- Simplifies testing procedures.
- Reduces operational costs.

#### FEATURES:

- Convenient: One unit to test and polarize.
- Universal: Can be used with all popular makes of polarographic sensors.
- Battery Powered: Can be used in the lab or production areas.
- Portable: Small pocket size.



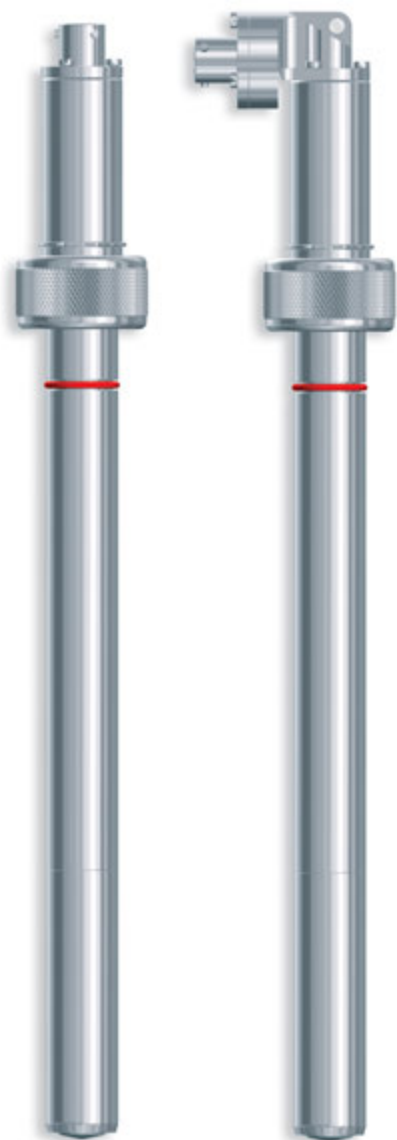
**Broadley  
James**®

Manufacturers of Sensors, Bioreactors and Process Control Automation

For Details See:  
[www.broadleyjames.com](http://www.broadleyjames.com)



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



**Model D200**  
220 mm length

**Model D205**  
220 mm length

## 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 1-year warranty.

For performance specifications see page 35.

## 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 74 and 75.

## ordering information

| Sensor Model                                       | Sensor Length | Typical Insertion Length | Sensor Part Number |                 |
|--|---------------|--------------------------|--------------------|-----------------|
| 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

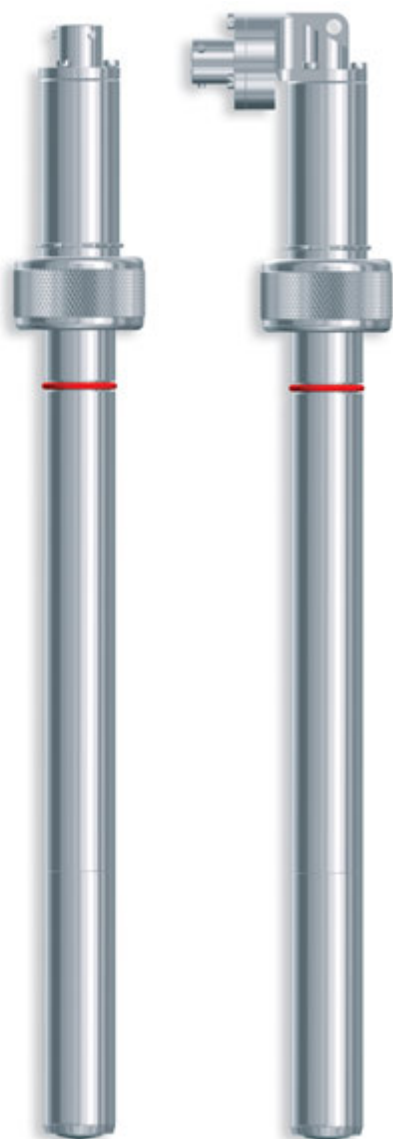
| Sensor Model  | Sensor Length | Typical Insertion Length | Sensor Part Number |                 |
|---|---------------|--------------------------|--------------------|-----------------|
| D205 Series 19 mm OxyProbe with Right Angle Connector |               |                          |                    |                 |
| 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

# Dissolved Oxygen Sensors Dissolved Oxygen Sensors Dissolved Oxygen

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



**Model D200**  
220 mm length

**Model D205**  
220 mm length

### 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 1-year warranty.

For performance specifications see page 35.

### 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 74 and 75.

### ordering information

| Sensor Model  | Sensor Length | Typical Insertion Length | Sensor Part Number |                 |
|---|---------------|--------------------------|--------------------|-----------------|
| <b>D200 Series 19 mm Oxyprobe with Straight Connector</b> |               |                          |                    |                 |
| 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 |                 |
|--|---------------|--------------------------|--------------------|-----------------|
| <b>D205 Series 19 mm OxyProbe with Right Angle Connector</b> |               |                          |                    |                 |
| 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

# Sensors Dissolved Oxygen Sensors Dissolved Oxygen Sensors Dissolved Oxygen Sensors

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



**Model D210**  
70 mm length

**Model D215**  
70 mm length

### 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 74 and 75.

### 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 18. However, they can be used with the NovAseptic ports shown on page 43.

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 1-year warranty.

For performance specifications see page 35.

### 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.*

### ordering information

| Sensor Part Number                               | Sensor Length | Typical Insertion Length |      |
|--|---------------|--------------------------|------|
| <b>19 mm OxyProbe® with 1.5" Sanitary Flange</b> |               |                          |      |
| Straight Connector:<br>D210-B070-PT-D9           | 70 mm         | 70 mm                    | 2.8" |
| Right Angle Connector:<br>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)

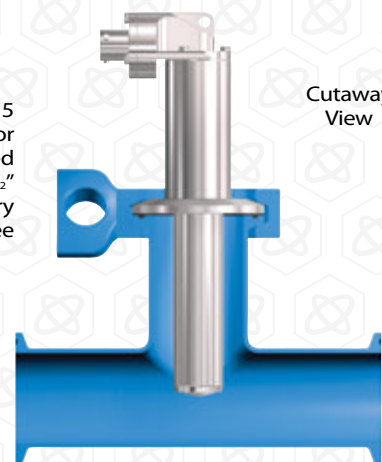
# Dissolved Oxygen Sensors Dissolved Oxygen Sensors Dissolved Oxygen

## 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

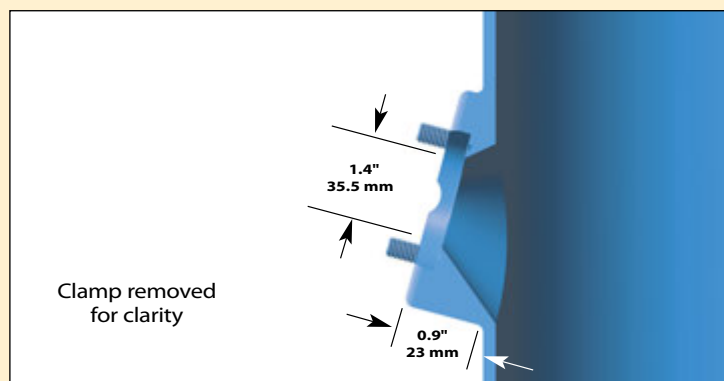
Cutaway View



## TIPS & HINTS

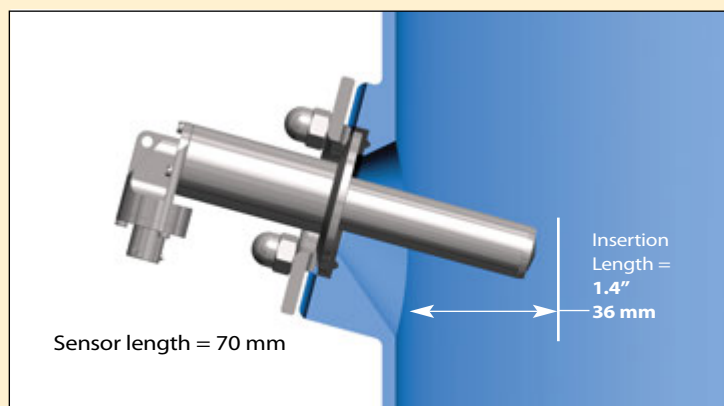
### NovAseptic Sanitary Port

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

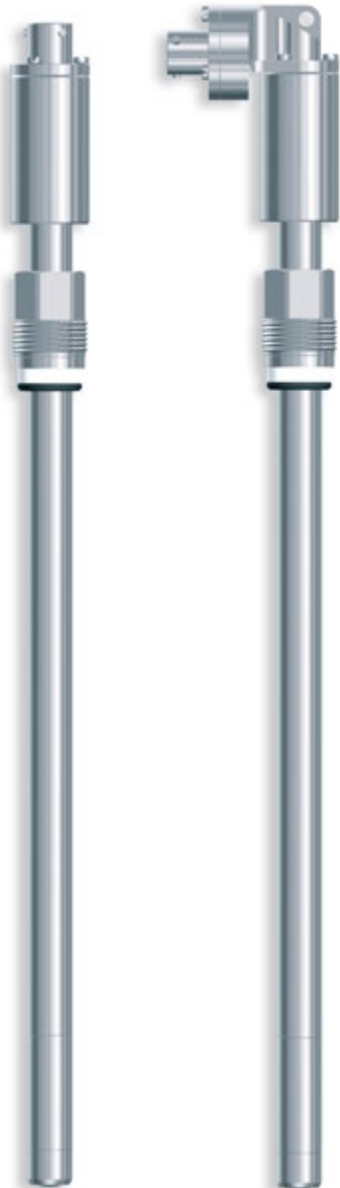
The Model D210 or D215 sensor installed in a NA-connect® port offers potential benefits in biotech applications. The unique design of the port offers increased drainage around the port and most effective Clean-In-Place (CIP). The flush port allows the use of a 19 mm sensor front end, since there is no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





# Sensors Dissolved Oxygen Sensors Dissolved Oxygen Sensors Dissolved Oxygen Sensors

## 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 35.

**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 74 and 75.

### ordering information

| Sensor Model  | Sensor Length | Typical Insertion Length | Sensor Part Number |                 |
|---|---------------|--------------------------|--------------------|-----------------|
| <b>D140 Series 12 mm OxyProbe with Straight Connector</b> |               |                          |                    |                 |
| 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

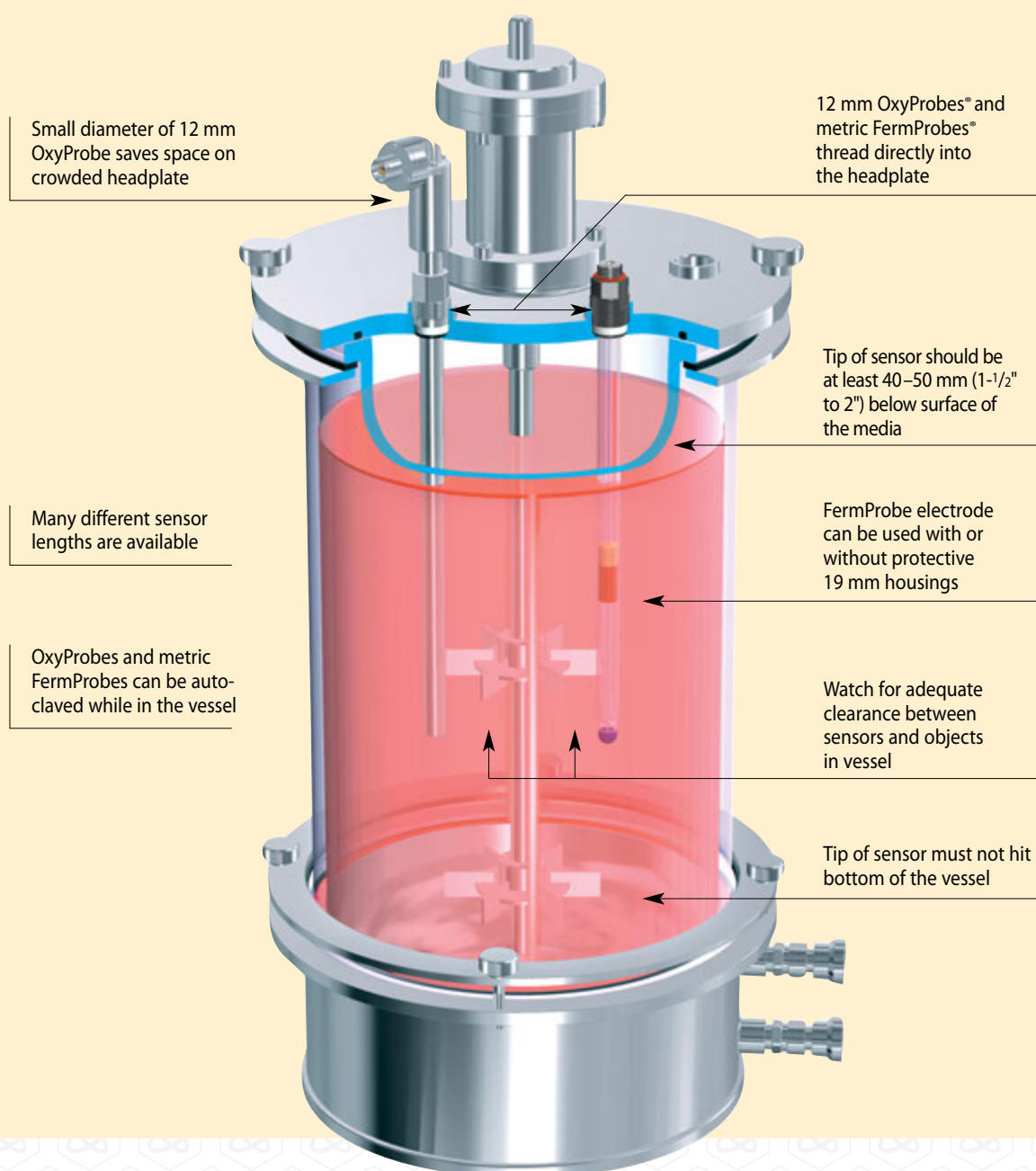
| Sensor Model   | Sensor Length | Typical Insertion Length | Sensor Part Number |                 |
|--|---------------|--------------------------|--------------------|-----------------|
| <b>D145 Series 12 mm OxyProbe with Right Angle Connector</b> |               |                          |                    |                 |
| 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.



# Maintenance

Service and Supplies



## Improved Sensor Performance & Longevity

### **Broadley-James® 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" condition. 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-James may have the item in stock or be able to direct you to where it can be found.

### **25 mm Membrane Cartridges**

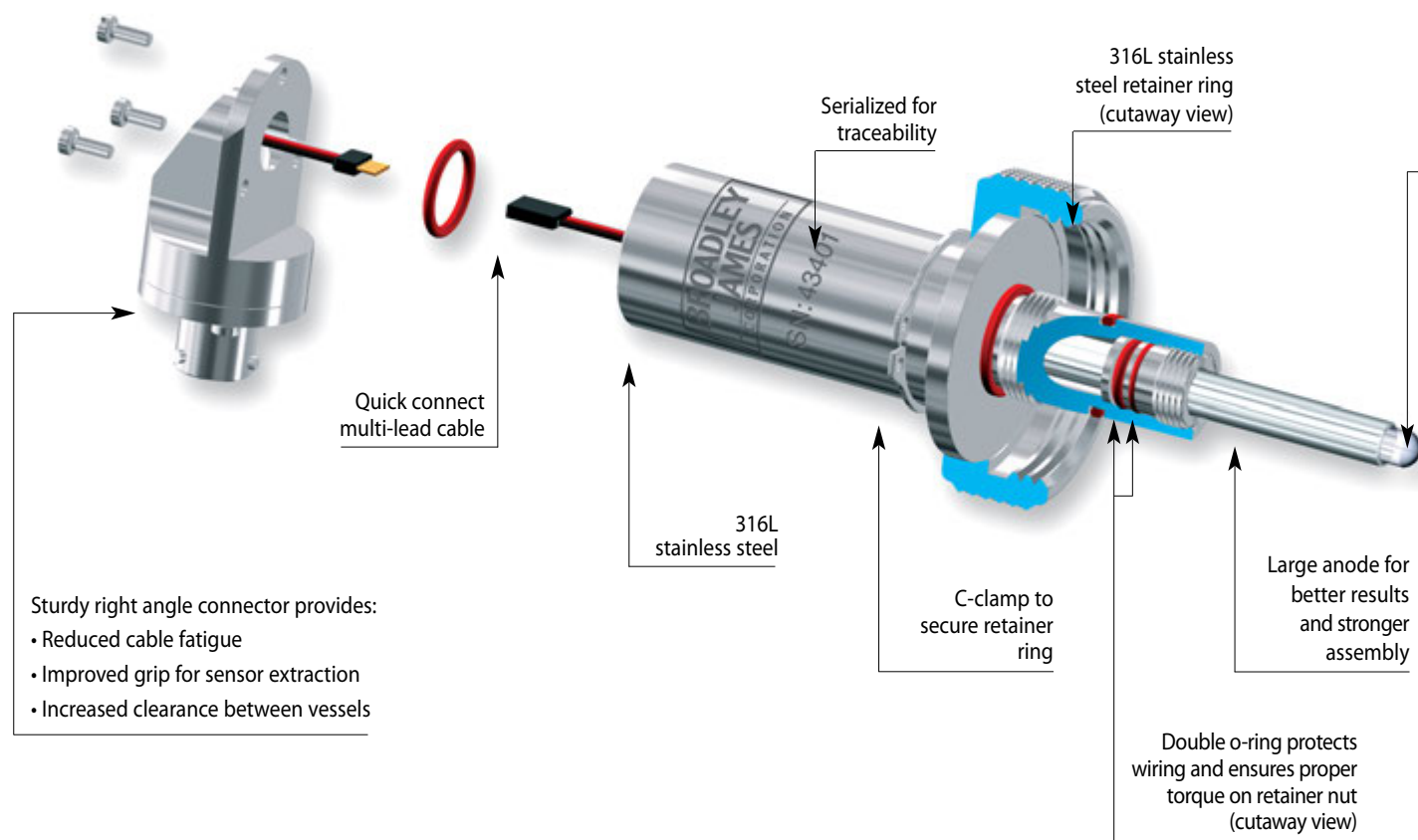
The OxyProbe® 25 mm membrane cartridges are a rather complex item. The body is composed of a chemical resistant polymer with a unique silicone internal bladder which contains the internal electrolyte. The shape of this bladder, combined with the shape of the polymer body, allows for the expansion of 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



**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.

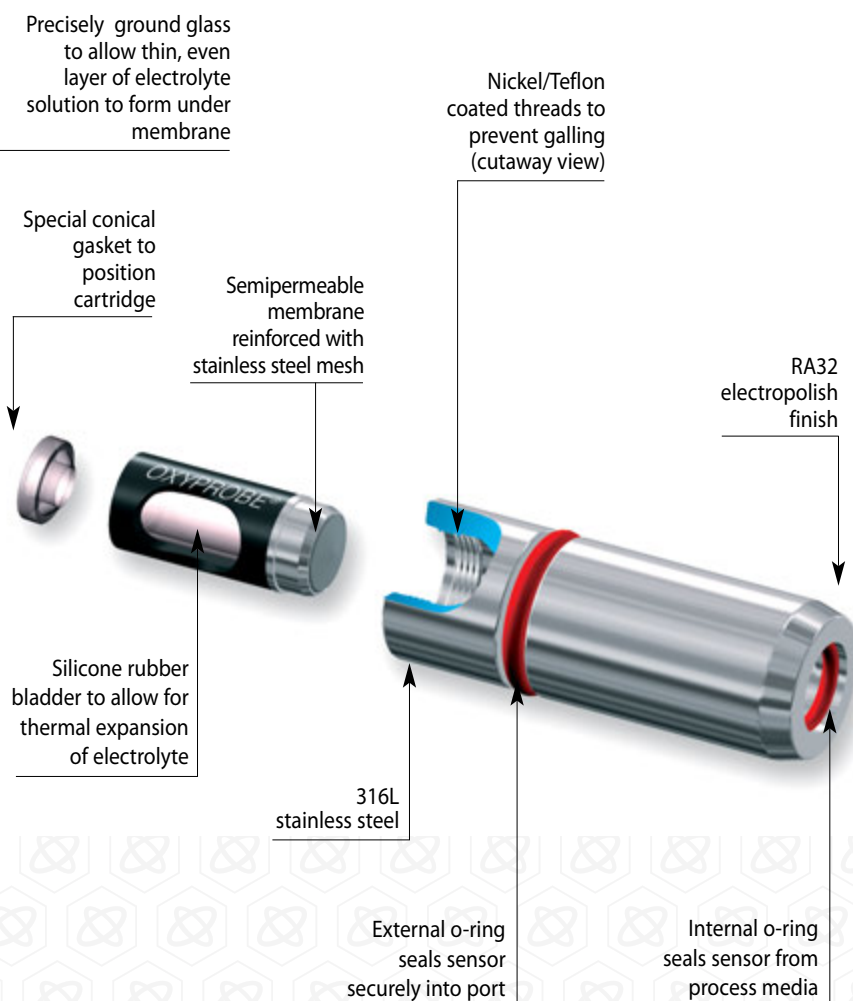
### 2. Replace Cathode Assembly

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.

# Maintenance Maintenance Maintenance Maintenance Maintenance M



## 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 1 -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

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

AM-9213

Cathode  
Retainer  
Nut

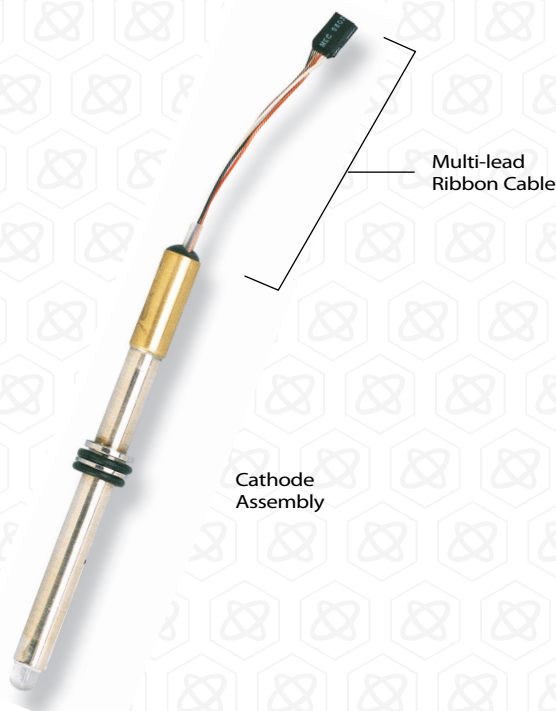


### Cathode Retainer Nut

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

AM-9210



### 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 |
|---------------|---------------|
| 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

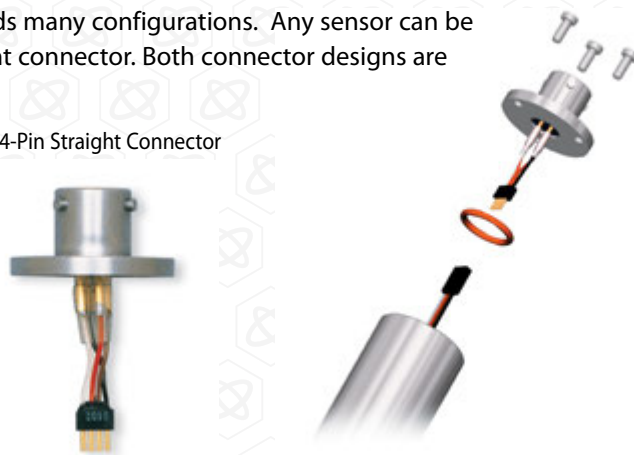
## Sensor Connectors

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                     |
|-------------|---------------------------------|
| AM-9202     | 25 mm Sensor                    |
| AM-9203     | 19 mm Sensor<br>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          |
|-------------|----------------------|
| AM-9349     | 4-pin connector      |
| AM-9387     | Adapter              |
| AM-9386     | Right angle assembly |

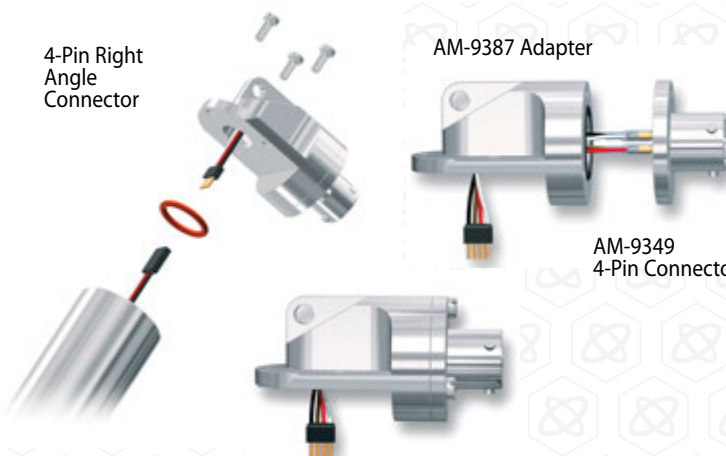
### 19 mm or 12 mm Sensors

| Part Number | Descriptions         |
|-------------|----------------------|
| 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

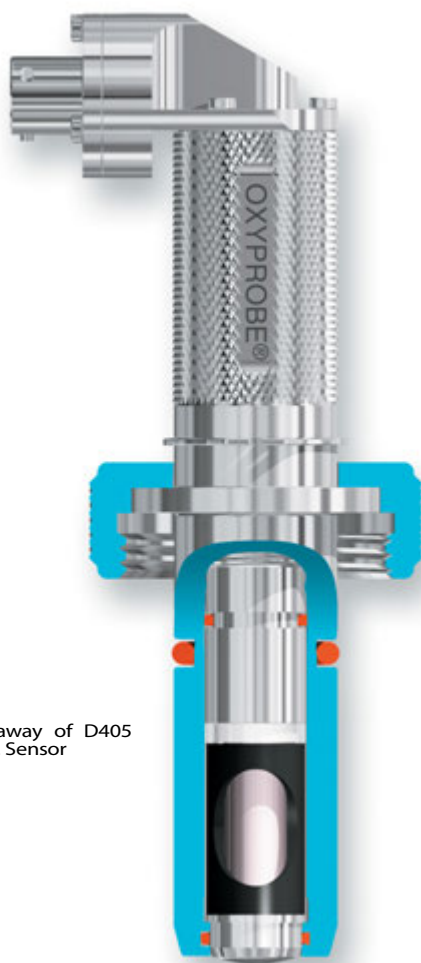
## TIPS & HINTS

### Right Angle 4-Pin Connector Assembly

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

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

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

KA2525



# 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

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

KA1204

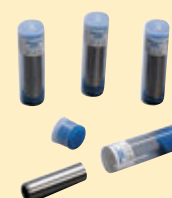
## 25 Piece Cartridge Kit

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

KA1225

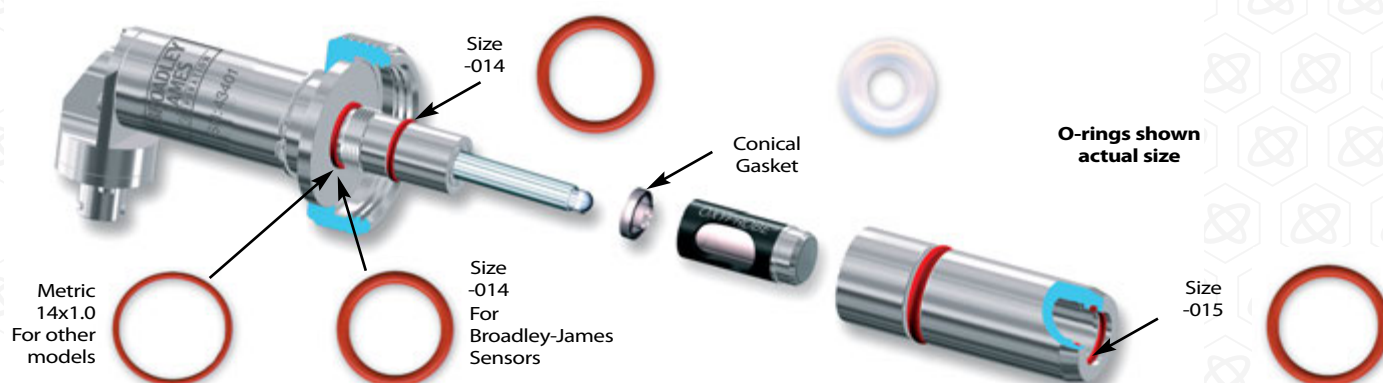


## O-rings for D.O. Sensors

### 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 |
|-------------|------------------------------|----------|
| AG-9206-10  | 4 internal o-rings, 1 gasket | 10 sets  |



## TIPS & HINTS

### O-ring kits

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.

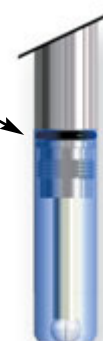
| Part Number | Description                     | Quantity |
|-------------|---------------------------------|----------|
| AG-E011-25  | Internal o-rings for 12 mm D.O. | 25       |

Shown  
actual size

Size -011  
EPDM



12 mm D.O.  
Sensor and  
Cartridge



# O-rings for D.O. Sensors

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

## 19 mm External O-rings

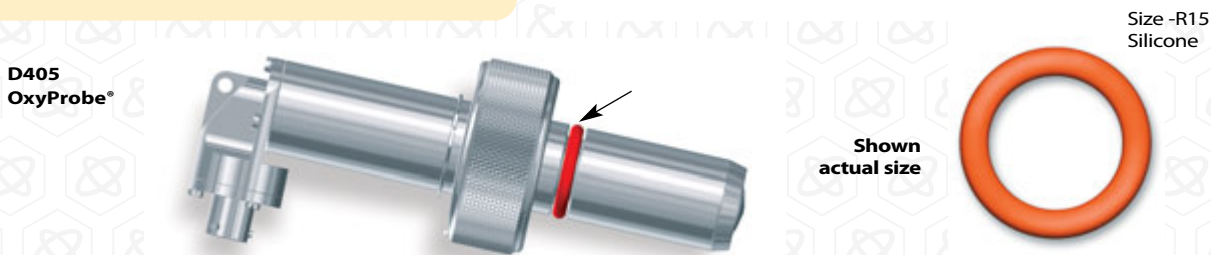
This silicone o-ring will fit the external groove of any 19 mm D.O. sensor or housing. It should be replaced regularly to ensure that the housing or sensor fits securely into the port.



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

## Standard 25 mm External O-rings

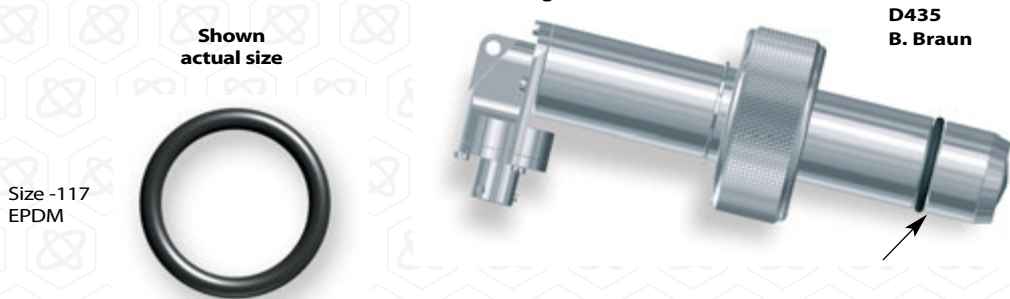
The external silicone o-ring on a 25 mm D.O. sensor is the same as the one found on a 25 mm housing. It should be replaced regularly to ensure that the sensor fits securely into the port.



| Part Number | Quantity |
|-------------|----------|
| 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 |
|-------------|---|----------|
| 300-P101    | F-600, F-607 and F-615 FermProbes                       | 3 sets   |
| 300-P102    | F-695 and F-635 Fermprobes<br>and 12 mm D.O. OxyProbes® | 3 sets   |

Replacement Set Shown Actual Size



Size  
-111 Viton



Teflon  
Washer



F-635  
FermProbe



F-600  
FermProbe



D145  
OxyProbe

## TIPS & HINTS

### FermProbe O-ring Sets

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 |
|-------------|----------------------------|----------|
| 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

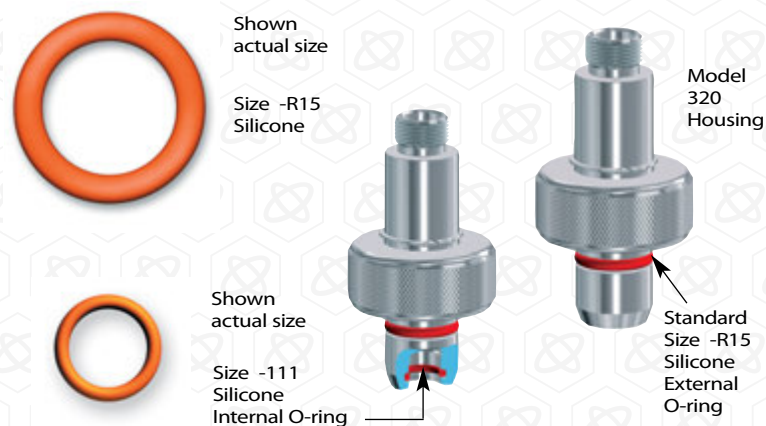
Broadley-James Models 320, 330, 370 housings use the same set of o-rings. O-rings should be inspected regularly and replaced at the first sign of wear.

## External O-rings

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

## Internal O-rings

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



## B. Braun Biotech Housing O-rings

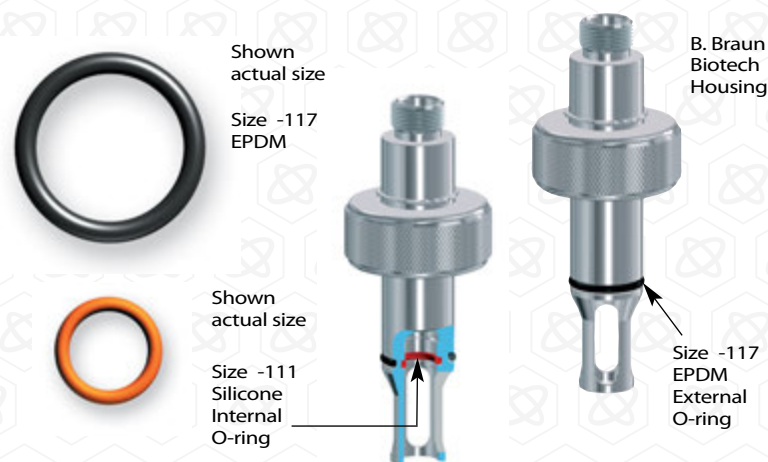
The external EPDM o-ring on the B. Braun Biotech housings, Models 322, 326 and 336, has a slightly smaller cross section than those found on other Broadley-James housings. The internal silicone o-ring is the same on all Broadley-James housings. Regular inspection and replacement is recommended. Do not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

## External O-rings

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

## Internal O-rings

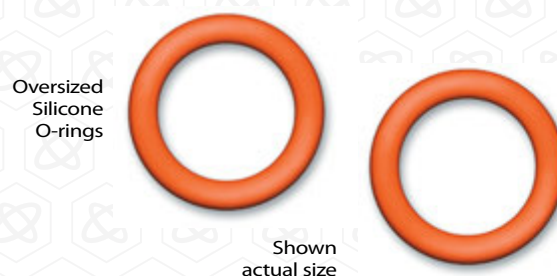
| Part Number | Quantity |
|-------------|----------|
| AG-S111-50  | 50       |
| AG-S111-25  | 25       |
| AG-S111-10  | 10       |



## 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 |
|-------------|----------|
| AG-SF25-10  | 10       |



# 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-James 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 attach 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.

### Dust Caps, Ports, Plugs, Cleaning Kits

Broadley-James 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



Stanchion Mount  
Storage Containers  
for Pipe or Vessel  
Mounting

Benchtop  
Free Standing  
Storage  
Containers



Mounting  
Hardware Kits for  
Stanchion Mount

### 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 |
|---------------|----------------|
| 301-P109-H070 | ≤ 70 mm        |
| 301-P109-H150 | ≤ 150 mm       |

*Stanchion mount storage containers for pipe or vessel mounting.*

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

*Mounting hardware kit for stanchion mount.*

|               |                              |
|---------------|------------------------------|
| 300-P111-0200 | For 50 mm (2") Pipe Diameter |
|---------------|------------------------------|



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

AM-1090-12

## pH Accessories

### Buffer Solution

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   |
|------------------|---------------|--------|
| 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 |



Buffer Solution  
pH 4



Buffer Solution  
pH 7



Buffer Solution  
pH 10

### pH 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   |
|------------------|-------------------------------------|--------|
| AS-3120-C20-0500 | Electrode Storage<br>Solution (KCl) | 500 ml |



Electrode  
Storage  
Solution

### 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 |
|-------------|-------------|----------|
| 300-P103-05 | S8 Cap      | 5        |
| 300-P203-05 | K9 Cap      | 5        |

S8  
Autoclave Cap



K9  
Autoclave Cap



### 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   |
|---------------|
| E-1245-AAD-DZ |

Cable  
Adapter



# 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   |
|-------------|---------------|---------------|
| 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.



## 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 |
|-------------|
| 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

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

|                  |                                      |
|------------------|--------------------------------------|
| 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

AM-9212

AM-9219



AM-9219 Cable Connector Dust Cap



AM-9212 Sensor Connector Dust Cap

### D.O. Sensor Cleaning Kit

Periodic cleaning of the cathode surface with a toothbrush and toothpaste, 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

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 |
|-------|----------------|----------------------|
| 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 18 and 19.

| Part Number    | Description   |
|----------------|---|
| AF-305-62-L055 | Straight plug<br>For use with 25 mm B. Braun<br>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           |
|-------|----------------|-----------------------|
| 100   | AF-100-60-L040 | 25 mm port            |
| 105   | AF-105-60-L040 | Undersized 25 mm port |

## ies Accessories Accessories Accessories Accessories Accessories Accessories

**TIPS & HINTS**

**Ports & Plugs** 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   |
|----------------|---|
| 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                |
|----------------|----------------------------|
| AF-310-61-L040 | Chamfered plug, 25 mm o.d. |



Chamfered  
Plug

# 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

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

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

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 N<sub>2</sub>. 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

|         |              |
|---------|--------------|
| 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

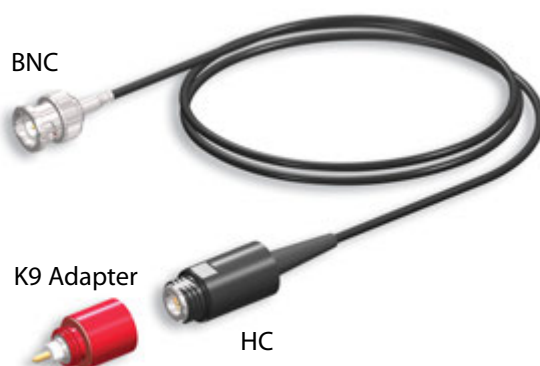
When a pH meter is reading incorrectly the simulator helps determine if the problem is related to the electrode or to the transmitter. It simulates pH and mV values: from 0-14 pH units in 1 pH unit increments ( $\pm 414$  mV). The simulator operates on a 9-volt battery and has a BNC connector, which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

### 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.



## FEATURES AND APPLICATIONS

### Troubleshooting Device Isolates Transmitter

The Broadley-James 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 pH cables to accommodate the most common transmitter connections

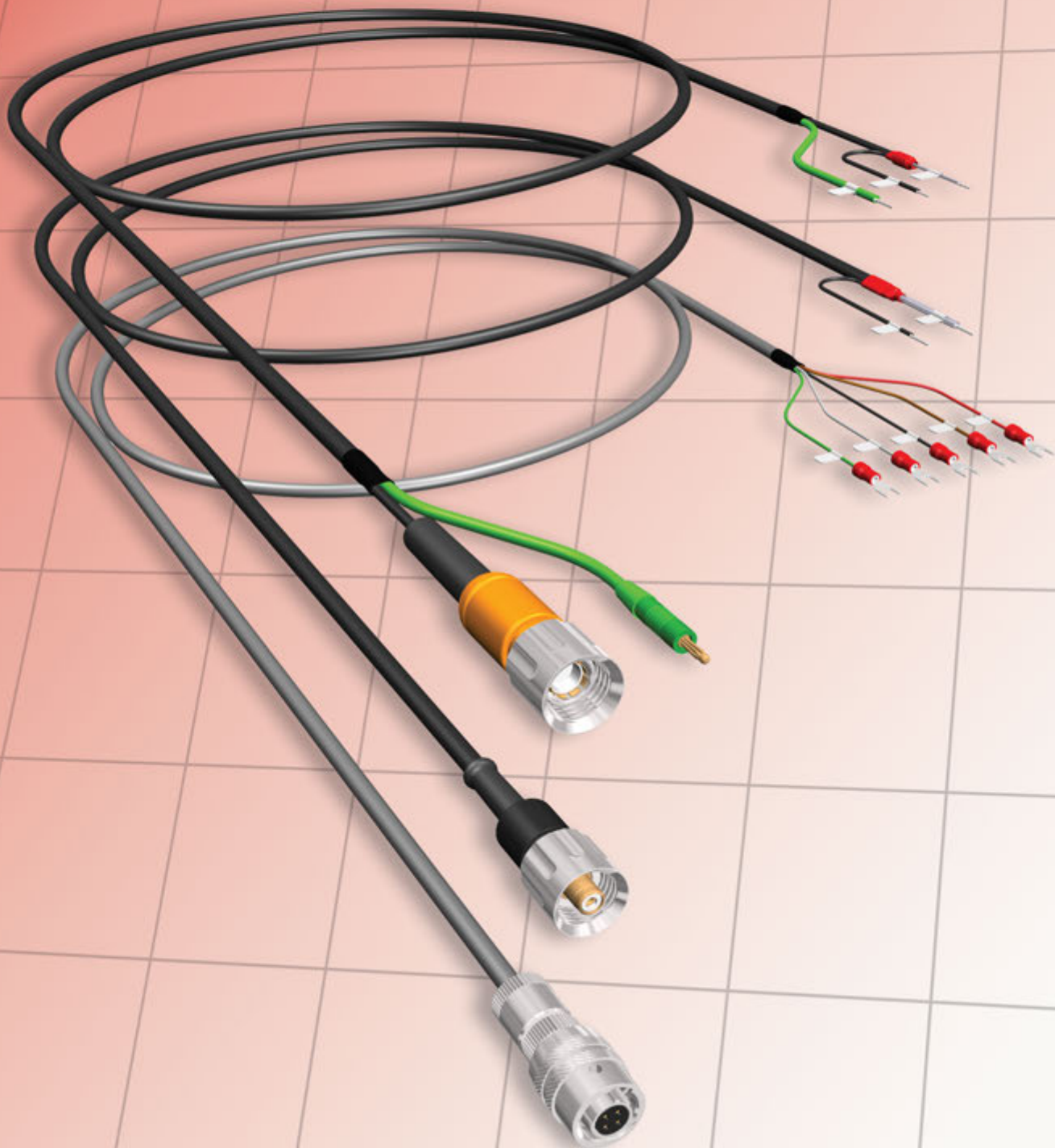
## ordering information

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



**Cables Cables Cables Cables Cables Cables Cables Cables Cables Cables**

# 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.

### 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 |  |
|--|-------------|------------|--------------|-------------|--|
| <b>HP Electrode Plug to BNC Plug</b>                   |             |            |              |             |  |
| • Lightweight and highly flexible 3 mm cable           |             |            |              |             |  |
| • Connects to most NBS and Applikon vessel controllers |             |            |              |             |  |
| 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 |  |
|--|-------------|------------|--------------|-------------|--|
| <b>HP Electrode Plug to BNC Plug</b>                   |             |            |              |             |  |
| • Rugged 5 mm cable                                    |             |            |              |             |  |
| • Connects to most NBS and Applikon vessel controllers |             |            |              |             |  |
| 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 |  |
|--|-------------|------------|--------------|-------------|--|
| <b>HP Electrode Plug to DIN 19262 Plug</b> |             |            |              |             |  |
| • Rugged 5 mm cable                        |             |            |              |             |  |
| 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    |  |



# Cables Cables Cables Cables Cables Cables Cables Cables Cables

## ordering information

| Cable Part Number  | Connector A | Cable Type | Cable Length | Connector B |  |
|--|-------------|------------|--------------|-------------|--|
| <b>HP Electrode Plug to Spade Lugs</b>   |             |            |              |             |  |
| <ul style="list-style-type: none"> <li>• Rugged 5 mm cable</li> <li>• Typically connects to terminal strips found in junction boxes</li> </ul> |             |            |              |             |  |
| 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      |  |
|--|-------------|------------|--------------|------------------|--|
| <b>HP Electrode Plug to Crimped Ferrules</b>   |             |            |              |                  |  |
| <ul style="list-style-type: none"> <li>• Rugged 5 mm cable</li> <li>• Connects to either terminal blocks or terminal strips</li> </ul> |             |            |              |                  |  |
| 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      |  |
|--|----------------------|------------|--------------|------------------|--|
| <b>HP Electrode Plug with Solution Ground to Crimped Ferrules</b>  |                      |            |              |                  |  |
| <ul style="list-style-type: none"> <li>• Rugged 5 mm cable</li> <li>• Connects to either terminal blocks or terminal strips</li> </ul> |                      |            |              |                  |  |
| AX-1000-H5-N03FF   | HP plug <sup>1</sup> | N          | 3 ft (1 m)   | Crimped Ferrules |  |
| AX-1000-H5-N06FF   | HP plug <sup>1</sup> | N          | 6 ft (2 m)   | Crimped Ferrules |  |
| AX-1000-H5-N10FF   | HP plug <sup>1</sup> | N          | 10 ft (3 m)  | Crimped Ferrules |  |

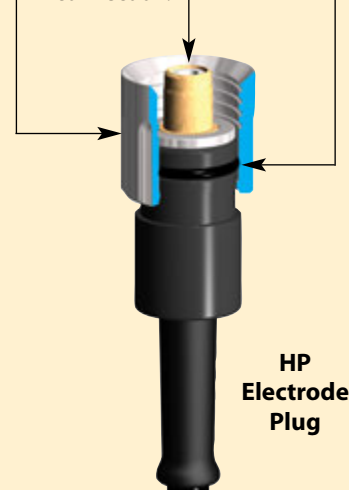
Note 1: This HP plug has additional 7" (18 cm) solution ground lead to plug into electrode housing.



## TIPS & HINTS

### New & Improved Standard 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.



HP Electrode Plug



# 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

### How to Convert Cables with a KP Electrode Plug to Work with the F-635 FermProbe® pH Electrodes

E-1245 Adapter

#### 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

## 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 |  |
|--|-------------|------------|--------------|-------------|--|
| <b>KP Electrode Plug to BNC Plug</b>                   |             |            |              |             |  |
| • Rugged 5 mm cable                                    |             |            |              |             |  |
| • Connects to most NBS and Applikon vessel controllers |             |            |              |             |  |
| 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 |  |
|--|-------------|------------|--------------|-------------|--|
| <b>KP Electrode Plug to DIN 19262 Plug</b> |             |            |              |             |  |
| • Rugged 5 mm cable                        |             |            |              |             |  |
| 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.**

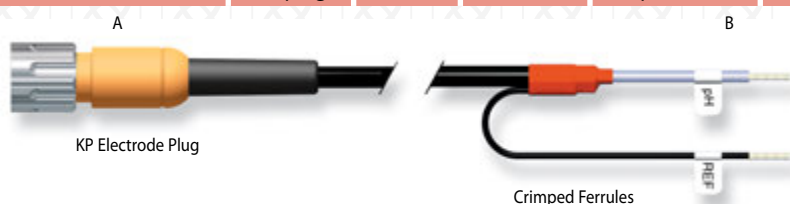
# Cables Cables Cables Cables Cables Cables Cables Cables Cables

## ordering information

| Cable Part Number  | Connector A | Cable Type | Cable Length | Connector B |  |
|--|-------------|------------|--------------|-------------|--|
| <b>KP Electrode Plug to Spade Lugs</b>   |             |            |              |             |  |
| <ul style="list-style-type: none"> <li>Rugged 5 mm cable</li> <li>Typically connects to terminal strips found in junction boxes</li> </ul> |             |            |              |             |  |
| 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      |  |
|--|-------------|------------|--------------|------------------|--|
| <b>KP Electrode Plug to Crimped Ferrules</b>   |             |            |              |                  |  |
| <ul style="list-style-type: none"> <li>Rugged 5 mm cable</li> <li>Connects to either terminal blocks or terminal strips</li> </ul> |             |            |              |                  |  |
| 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      |  |
|--|----------------------|------------|--------------|------------------|--|
| <b>KP Electrode Plug with Solution Ground to Crimped Ferrules</b>  |                      |            |              |                  |  |
| <ul style="list-style-type: none"> <li>Rugged 6 mm cable</li> <li>Connects to either terminal blocks or terminal strips</li> </ul> |                      |            |              |                  |  |
| AX-1000-K5-N03FF   | KP plug <sup>1</sup> | B          | 3 ft (1 m)   | Crimped Ferrules |  |
| AX-1000-K5-N06FF   | KP plug <sup>1</sup> | B          | 6 ft (2 m)   | Crimped Ferrules |  |
| AX-1000-K5-N10FF   | KP plug <sup>1</sup> | B          | 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

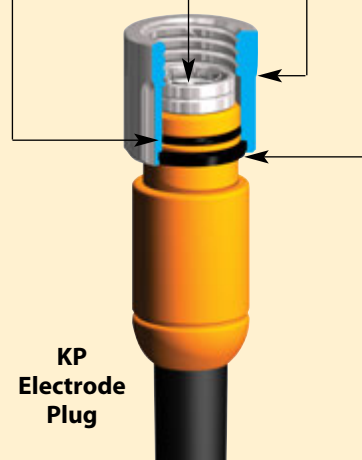
### New Connector Offers Improved Seals

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

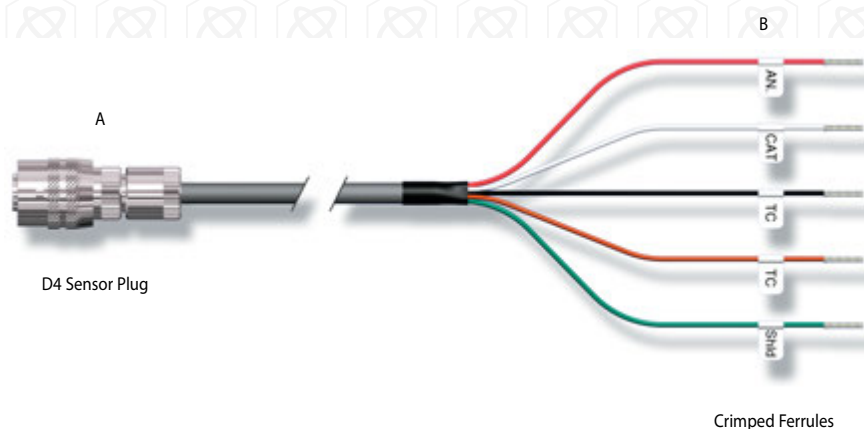
### Stock Cable Assemblies for All OxyProbe® Sensors

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

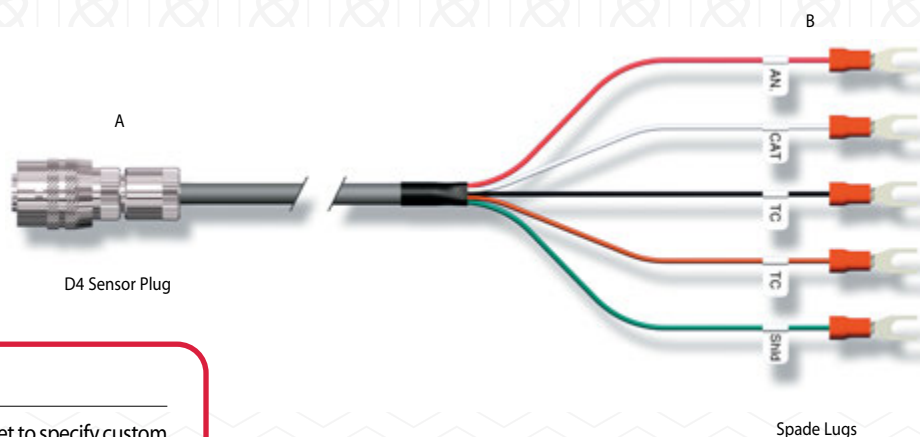
- Stock cable assemblies feature the most commonly requested cable lengths and connector schemes.
- Cables are shielded to decrease signal noise and other interferences.
- Cables are tagged with part numbers for easy replacement.
- Cables have a D4 twist-lock coaxial cable plug to connect to the sensor.
- 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.

#### 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      |  |
|---|-------------|------------|--------------|------------------|--|
| <b>D4 Sensor Plug to Crimped Ferrules</b>               |             |            |              |                  |  |
| • Connects to either terminal blocks or terminal strips |             |            |              |                  |  |
| 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 |  |
|---|-------------|------------|--------------|-------------|--|
| <b>D4 Sensor Plug to Spade Lugs</b>                     |             |            |              |             |  |
| • Connects to either terminal blocks or terminal strips |             |            |              |             |  |
| 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  |  |



### 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.

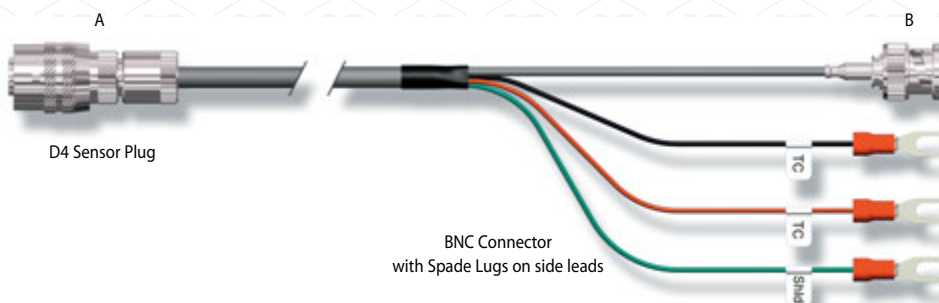
# Cables Cables Cables Cables Cables Cables Cables Cables Cables

## 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 |  |
|---|-------------|------------|--------------|-------------|--|
| <b>D4 Sensor Plug to Lemo 6 Connector</b>                           |             |            |              |             |  |
| • 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      |  |



| Cable Part Number                                     | Connector A | Cable Type | Cable Length | Connector B              |  |
|---|-------------|------------|--------------|--------------------------|--|
| <b>D4 Sensor Plug to BNC Connector and Spade Lugs</b> |             |            |              |                          |  |
| • 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 |  |



\* 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

## TIPS & HINTS

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

**Sensor Connector Dust Cap**

Part Number: AM-9212



Sensors Sensors Sensors Sensors Sensors Sensors Sensors

# Broadley-James OxyProbe® II Dissolved Oxygen Sensors

**NEW!!**

**Autoclavable  
& Sterilizable  
Styles & Lengths  
For All Applications  
Fermentation  
& Cell Culture**



**D545-VP**

**D545-D9**

**D540-D9**

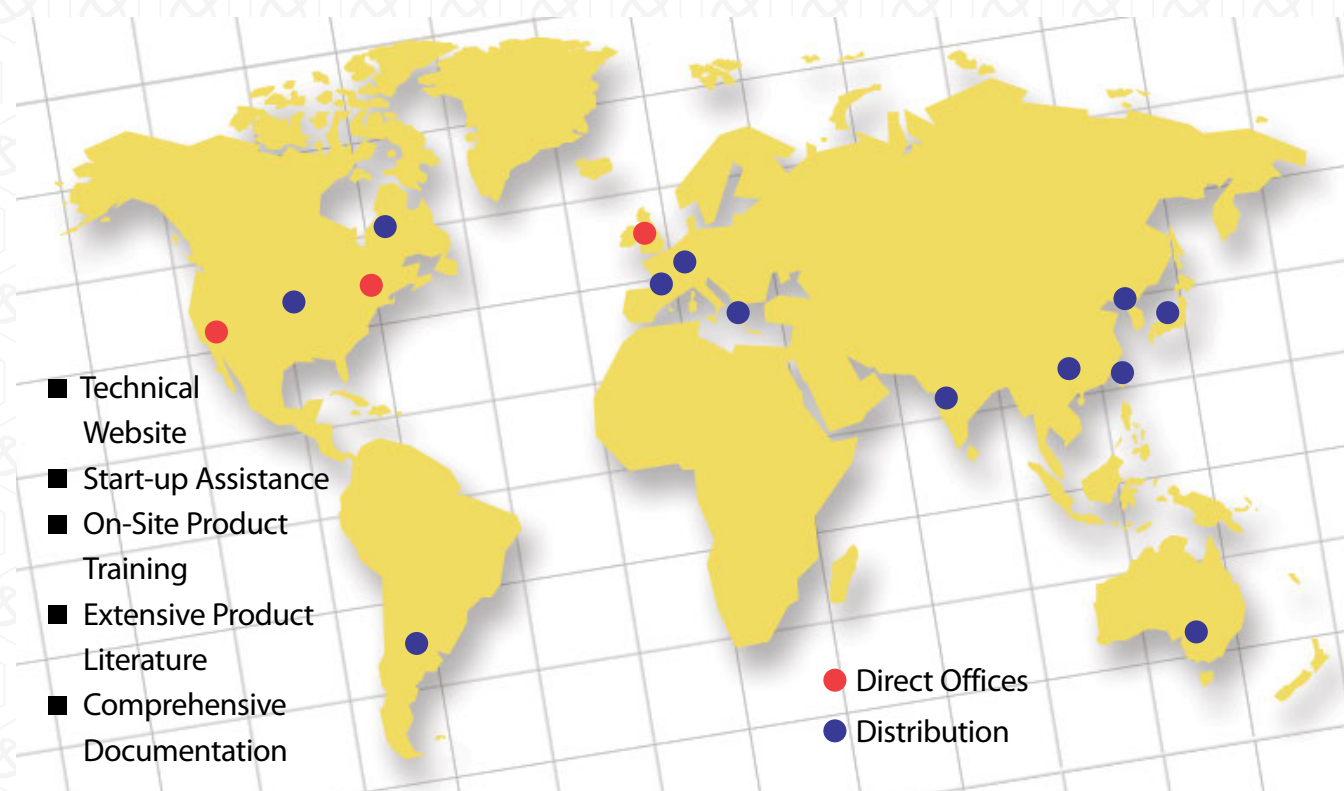
**D635-D9**

**Broadley  
James®**

Manufacturers of Sensors, Bioreactors and Process Control Automation

**For Details See:**  
[www.broadleyjames.com](http://www.broadleyjames.com)

## Global Support



### If you don't see what you're looking for in this catalog

#### We have Over 2000 Items

Broadley-James makes and stocks thousands of items that are not shown in this catalog. With each updated catalog, we show the most popular items currently used in the bioprocess industry. If you don't see what you're looking for, call us. We probably have what you need.

#### Custom Options are Available

We show the most popular connector combinations, cable lengths, and sensor, electrode and housing lengths in the BioProcess Technologies® Catalog. However, there are many different variations that are available. We make custom assemblies to meet unique requirements.

#### Call Us

Call Broadley-James toll-free at 1-800-288-2833 to speak to one of our friendly and knowledgeable sales representatives. Our trained staff is an excellent source of information for you. We're here to help you make the best choices to meet your needs.

#### Search Our Web Site

Do you need more information than we provide in the BioProcess Technologies® Catalog? Our website contains a wealth of information on the items we stock and their applications in the various industries we support. For more information, please visit our website.

**[www.broadleyjames.com](http://www.broadleyjames.com)**

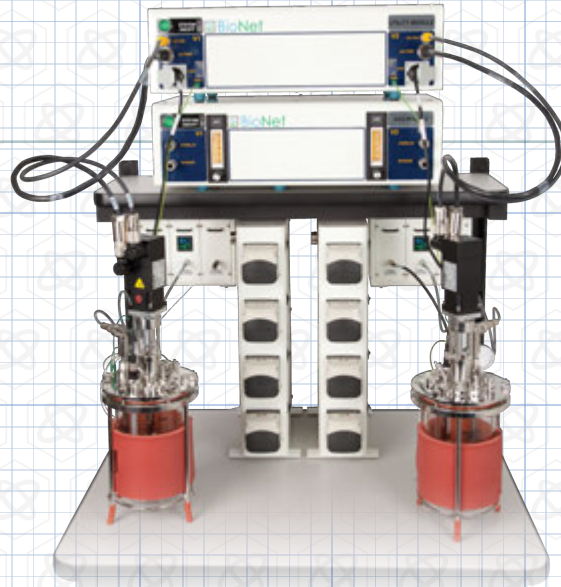


# Broadley James<sup>®</sup>



## M3 Bioreactor Control System

- Designed for Cell Culture Or Microbial Applications
- Built-In Continuous Historian To Securely Archive All Process Data
- Various Control Strategies For Fed-Batch And Perfusion Applications
- Sensor Calibration And Sensor Diagnostics Data Stored For Better Experimental Management
- User Definable Substrate Feed Control Strategies Based Upon On-Line BGA Measurements



## FEATURES & BENEFITS

**The BioNet Modular System offers a number of options for the networked HMI user interface:**

**Traditional Benchtop Workstations**

**Locally Mounted Touch Screens**

**Secure Wireless PC Tablets**

The new Modular BioNet system was designed to completely clear the bench-top of control components allowing all control equipment to be mounted underneath or above the bench-top on a shelf. This space saving design frees up the entire bench-top to be used for more vessels or analytical instruments and significantly reduces the traditional wiring clutter associated with multi vessel installations.

This system design breaks the Bioreactor Control System into three smaller subcomponents:

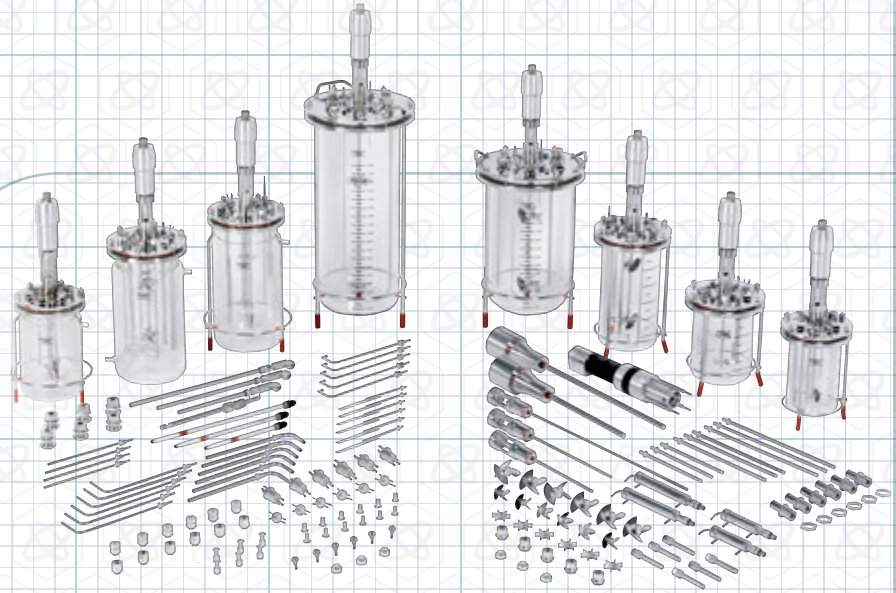
1. Pump Module
2. Gas MFC Module
3. Dual Vessel Utility Module

Dimensional and Data Sheets available at [www.broadleyjames.com](http://www.broadleyjames.com)  
For information about our Bioreactor Control System, please contact us at: **800.288.2833**

# Broadley James®



## Bioreactors



■ Suitable for Cell Culture & Microbial Applications

■ Like-for-Like Replacement of the Other Leading Manufacturer

■ Single-Walled & Jacketed

■ pH, DO, Temperature & Optical Density Sensors Available

■ Direct Drive & Magnetically Coupled Agitation Assemblies

■ Individual Bioreactor Components, Complete Assemblies, Rebuild Kits & O-Ring Packs Available

■ Large Inventory Available for Immediate Delivery

## FEATURES & BENEFITS

**Complete Bioreactor Systems in a variety of volumes:  
3L, 5L, 7L, 15L & 20L.**

### Single-Walled & Jacketed Styles

The BioNet® Bioreactor is the latest in autoclavable benchtop glass vessels. Available in a range of sizes: 3, 5, 7, 15 and 20 liters total volume. All metal components are manufactured from 316L stainless steel with electropolish.

Integral scaling, improved component designs and extensive product inventory makes this the most user-friendly bioreactor available.

Special configurations are available upon request.

Agitation motors, sensors, cables and control systems are available.

Dimensional and Data Sheets available at [www.broadleyjames.com](http://www.broadleyjames.com)

For information about our Bioreactor Control System:

Please contact us at: **800.288.2833**





Manufacturers of Sensors, and  
Process Control Automation

## BioProcess Technologies® Catalog of Supplies

- pH Electrodes
- Dissolved Oxygen  
Sensors
- Redox Electrodes
- Stainless Steel  
Housings
- Sensor Rebuild  
Service
- Cable Assemblies
- O-rings
- Solutions
- Simulators
- Accessories

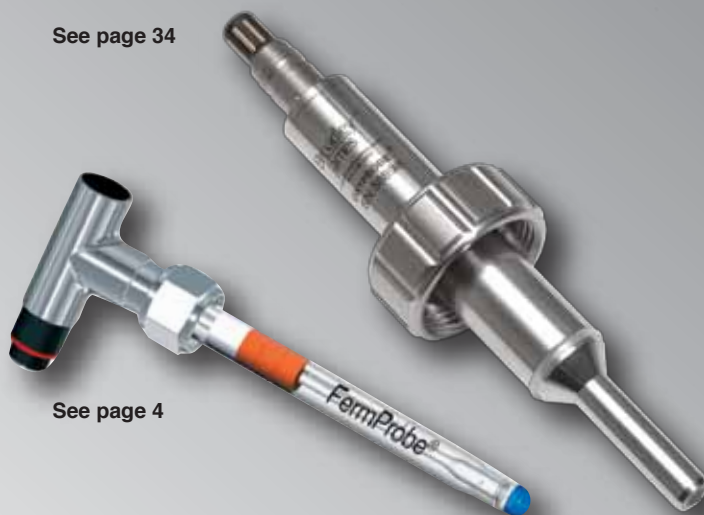
## A broad range of products for the biotech industry including:

pH and D.O. sensor simulator for  
instrument diagnostics

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