

PH12 Series Analog and Smart Electrochemical Sensors and Accessories for pH and ORP Measurement



The Foxboro® brand PH12 Series Sensors are precision electrochemical sensors that are used with a popular set of mounting accessories to measure pH and ORP. These sensors provide a unique electrode technology in the widely used 12 mm form factor, and provide fast response, long life, and high accuracy and stability. They are rugged, easy-to-use devices particularly well suited for low and high temperature, sanitary, and biocompatibility installations. The low cost construction renders the sensor disposable, and therefore helps eliminate costly sensor maintenance. Both Analog and Smart versions are available.

FEATURES

- ▶ Proprietary electrode glass formulations.
- ▶ Double junction reference using Nafion ion barrier.
- ▶ Fast thermal response; <1 minute for 80% step.
- ▶ PEEK or Borosilicate Glass sensor bodies.
- ▶ Variopin or Smart connectors integral to sensor body.
- ▶ A selection of electrode types offered:
 - ▶ For pH measurement: Domed glass electrode to 125 or to 140°C (to 257 or to 284°F); or flat ruggedized glass electrode to 125°C (to 257°F).
 - ▶ For ORP measurement: Platinum electrode to 125°C (to 257°F).
 - ▶ For combination (simultaneous) pH and ORP measurement: glass and platinum electrodes to 125 or to 140°C (to 257 or to 284°F), depending

on glass electrode selected.

- ▶ Sensor length of 120, 225, 360, and 425 mm (4.7, 8.9, 14.2, and 16.7 in) available.
- ▶ Sanitary sensors comply with 3-A Standard 74-xx; also meet FDA food processing industry requirements. Sensors meet the biocompatibility requirements of EN ISO 10993-5 and USP 87.
- ▶ ATC with integral 100 or 1000 Ω platinum RTD.
- ▶ Steam sterilizable and autoclavable. Optional autoclave cap available help to protect the Variopin or Smart connections during the cleansing process.
- ▶ Integral solution ground.
- ▶ Standard Viton process seals; EPDM and Perfluoroelastomer are optional.

Equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising from the use of this material.

- ▶ Integral PG 13.5 connection directly threads into a flanged or NPT process connection accessory.
- ▶ Retraction/Insertion and Ball Valve Insertion assemblies offered to allow insertion and replacement of sensor without shutting down the process.
- ▶ 316L ss, CPVC, or Kynar protective sensor holder assembly with or without electrode guard.
- ▶ Mounting accessories include threaded and Tri-Clamp type sanitary process connections, and NPT, NPT pipe adapter, and flanged process connections. Retraction/Insertion and Ball Valve Insertion assemblies are also offered.
- ▶ The PH12-****S Smart sensor has internal, digital electronics, communicates digitally with a transmitter using low-cost, high-temperature cabling and carries sensor ID, calibration parameters and diagnostic history in its non-volatile memory. The PH12-****S Smart sensor with Sensor Termination code S, provides a means to store the calibration parameters, which include electrode slope and asymmetry potential, in the sensor.
- ▶ Cable strain relief housing accessory optional with Sensor Holder assembly; and provided as standard with the Retraction/Insertion assembly.
- ▶ Other accessories include junction boxes, patch cords, extension cables, raw cable, and flow chambers.

BENEFITS OF SMART SENSOR TECHNOLOGY

The largest source of measurement deviations in electrochemical systems comes from a flawed field system calibration. Field calibrations can be compromised for many reasons, such as not allowing the readings to stabilize; performing a single point calibration when a two point is called for; calibrating a sensor whose slope indicates it is approaching end of life; using calibration solutions whose temperatures are changing; etc.

Many of these common sources of calibration deviations are mitigated by performing a calibration under more controlled conditions, such as those found in an instrument shop or laboratory. However, it is not practical to move the field transmitter to the instrument shop to perform the calibration.

This is where the Smart sensors play an important role. A Smart sensor can be calibrated at any time against a “standard” or “reference” transmitter in the instrument shop, or by means of a personal computer (PC) using the Foxboro Smart Sensor PC Interface cable and the Smart Sensor Device Type Manager (DTM) software.

The Smart sensor stores its calibration parameters in an on-board memory chip. When the operator needs to perform a field calibration, he or she simply takes the pre-calibrated Smart sensor to the field, connects it to the transmitter, and allows the transmitter to upload the calibration parameters to the sensor. By managing the sensor calibrations in the instrument shop environment, the operator is more likely to perform a valid calibration. This process results in an easier, faster and more accurate field calibration.

SMART SENSOR MANAGEMENT USING A PC

The PH12-****S Smart sensor may also be connected directly to a PC for viewing measurements, performing calibrations, checking history and diagnostics, trending, and other functions. A Smart Sensor PC Interface Cable and a software package is offered for this function. The software is FDT (Field Device Tool) Group Certified. The software provides an easy to use operator interface, and is ideal for performing calibrations in the instrument shop environment. An enhanced history log is provided, which permits unlimited entries and allows for data export to a spreadsheet program. Sensor health is easily checked, assisting in sensor asset management.

TRANSMITTER/ANALYZER COMPATIBILITY

The PH12-****S sensor is compatible only with the 876PH-S Transmitter.

SELECTION OF THREE pH ELECTRODE TYPES FOR APPLICATION VERSATILITY

Foxboro by Schneider Electric has a long history of pH electrode research and development. Proprietary glass formulations are implemented, manufactured, and tested in its electrochemical sensor production facility. For the PH12 sensor family, three electrode choices are offered that provide the solution for your unique application requirements.

The pH electrodes offered are a flat membrane glass electrode, and a choice of two domed glass electrodes depending on the temperature application limits. See paragraphs below, and also the pH Electrode Selection Guide in Table 1 for a summary of electrode characteristics in varying application conditions.

High Performing Flat Membrane Electrode

Most flat membrane pH electrodes are not suitable for high temperature service. Though rugged and useful for abrasive applications, their application range has generally been limited to 80 to 85°C (176 to 185°F) due to the composition of glass employed. At Foxboro by Schneider Electric, extensive research and testing have resulted in a glass formulation capable of being formed into a ruggedized, flat membrane while maintaining excellent performance up to 125°C (257°F). When used with the PEEK body sensor, the flat, ruggedized glass electrode provides a sensor with exceptional durability in very harsh applications.

High Temperature Domed Glass Electrode for 140°C (284°F) Service

An enhanced domed glass formulation has been developed for high temperature service. This new formulation is the highest temperature electrode offered by Foxboro by Schneider Electric. It is recommended for very high temperature and/or temperature cycling applications. It is also an excellent choice for applications with high pH and high sodium content. With an upper temperature rating of 140°C (284°F), this electrode is the preferred choice for steam sterilizable applications.

Domed Glass Electrode with Very Wide Temperature Performance

Foxboro by Schneider Electric uses a proprietary glass formulation which capitalizes on a very low impedance characteristic. By starting with an electrode with low impedance, the electrode performs exceptionally well at very low temperatures. This particular glass formulation also performs well at high temperatures, up to 125°C (257°F). With a specified temperature range of -25 to +125°C (-13 to +257°F), this electrode provides one of the widest usable ranges of any pH electrode on the market.

pH, ORP, OR COMBINATION pH AND ORP MEASUREMENTS

A selection of electrode types is offered, as follows:

- ▶ pH Measurement, Flat Ruggedized Glass Electrode, 0 to 12 pH; -15 to +125°C (5 to 257°F).
- ▶ pH Measurement, Domed Glass Electrode, 0 to 14 pH; -25 to +125°C (-13 to +257°F) wide temperature range; or 0 to 140°C (32 to 284°F) high temperature rating.
- ▶ ORP Measurement, Platinum Electrode, -25 to +125°C (-13 to 257°F).
- ▶ pH and ORP Combination (and simultaneous) Measurement: 0 to 12 pH and ORP, or 0 to 14 pH and ORP; -15 to +125°C (5 to 257°F), -25 to +125°C (-13 to +257°F), or 0 to 140°C (32 to 284°F), depending on glass electrode selected.

NOTE

Many of the drawings in this document depict an Analog sensor for reference. For dimensions on the Smart sensor (PH12-****S) version, refer to the dimensions at the end of this document.

Table 1. pH Electrode Selection Guide

| Electrode Description | | | pH Electrode Application (a) | | | | | | |
|-----------------------|---------------------------|-----------------------|------------------------------|--------------------|---------------------|--------------------------------|---------------|---------------------|----------------------|
| Model Code (b) | pH Electrode Type | Process Temp. | Low Temp. Service | Low Ionic Strength | Fastest pH Response | Moderate to High Temp. Service | Temp. Cycling | High pH and High Na | Solids and Abrasives |
| -1 -A (c) | 0 to 14 pH Domed Glass | -25 to +125 °C (d) | A | A | A | B | B | B | NR |
| -2 -B (c) | 0 to 14 pH Domed Glass | 0 to +140 °C (e) | NR | B | B | A | A | A | NR |
| -3 -C (c) | 0 to 12 pH Flat Glass | -15 to +125 °C | B | NR | B | B | B | NR | A |

- a. Applications A, B, and NR are as follows, - A = Preferred: Generally considered the most suitable choice. - B = Acceptable: Reasonable life under most conditions. - NR = Not Recommended: Generally considered unsuitable for the application.
- b. Refer to Model Code for pH and ORP Sensor codes and descriptions.
- c. For Electrode Codes -A, -B, and -C (pH/ORP combinations), the electrode application is determined by the pH electrode selected. For example, electrode type -A combines a -1 (pH) electrode with a -4 (ORP) electrode, and therefore the recommended application is the same as that for the -1 (pH) electrode.
- d. Wide temperature range domed glass.
- e. High temperature domed glass.

SANITARY SENSORS

PH12 Sanitary Sensors and Sanitary Fittings comply with 3-A Standard 74-xx for use in dairy product processes. They also comply with FDA requirements for elastomers for use in the food processing industries. The 3-A test certificate can be specified as part of the model code structure of the PH12, and is included with the sensor in the shipment.

These sensors are offered with the following quick-disconnect sanitary process connections; a DN 25 threaded process connection, or a 1-, 1 1/2-, or 2-in Tri-Clamp type process connection. These connections are finished to RA15, or better. The crevice-free sensor construction facilitates CIP operations, and the DN25 and Tri-Clamp type process connections provide ease of sensor installation and removal for conventional applications.

BIOCOMPATIBILITY CERTIFICATION

Foxboro PH12 sensors have been engineered to perform in challenging applications found in biopharmaceutical processes. In addition to their ability to withstand multiple cycles of sterilization, they are designed to be biocompatible under worst case conditions. Sensors have been tested by an independent laboratory and are certified to be biocompatible according to United States Pharmacopeia & National Formulary (USP 87) and ANSI/AAMI/ISO 10993-5 criteria. The biocompatibility test certificate can be specified as part of the model code structure of the PH12, and is included with the sensor in the shipment. Sensors may be provided either with the biocompatibility certificate alone, or with a combination of certificates for biocompatibility and sanitary service according to 3-A.

LOW COST, BUILT-IN SOLUTION GROUND FOR SENSOR DIAGNOSTICS

Sensor diagnostics are an important part of the asset strategy for pH and ORP measurement systems. Increasingly, the diagnostics available from a pH or ORP sensor are used to predict when a sensor will need maintenance. Other diagnostics are used to identify conditions which must be addressed immediately.

Sensor diagnostics include aging glass electrode, fouled reference junction, failed temperature compensation element, and broken glass electrode. Using a unique, electrically conductive plastic solution ground, or in the case of sanitary models a stainless steel solution ground, the PH12 sensor incorporates the diagnostic signals as a standard feature in all PH12 models. Unlike competitive sensors which may require a separate, costly and cumbersome metallic solution ground contact, the PH12 design provides the functionality built-in as a standard component in a cost effective platform.

DURABLE PEEK SENSOR BODY

PEEK, a thermoplastic material, is selected because of its excellent strength and chemical resistance properties over a wide range of process temperatures and pressures. PEEK material displays excellent chemical resistance to most aqueous solutions of acids, bases, and salts. It is also excellent for most organic solvents. The Foxboro brand possesses over 20 years' experience in utilizing PEEK material in electrochemical sensors, the longest of any supplier. Many 12 mm sensors are designed as if they evolved from a laboratory environment, utilizing fragile glass bodies. The Foxboro brand with its reputation for delivering the most rugged sensors for process applications, has taken a different approach, one that results in longer service life and better resistance to the rigors of insertion, removal, and handling for cleaning and calibration.

NAFION ION BARRIER TO HELP PROTECT THE REFERENCE JUNCTION

PH12 sensors utilize a double junction reference electrode design to minimize the effects of contamination of the reference electrolyte with process solution.

The external, process wetted reference junction is ceramic material with ultra fine porosity and small surface area. The internal electrolyte is a high temperature gel that resists poisoning. The reference electrode is a silver/silver chloride half cell. The reference electrode is encased in a Nafion ion barrier which allows charge transfer while minimizing poisoning of the electrode and helping preventing silver ions from migrating to the external junction and causing clogging.

NONMETALLIC WETTED PARTS

For more than 20 years, Foxboro by Schneider Electric has pioneered the use of conductive plastic materials for solution ground contacts in process pH and ORP sensors. In the PH12 Series design, the solution ground is constructed of conductive Kynar, which has excellent chemical resistance. The sensor body is either borosilicate glass or PEEK, and the measuring electrode, reference junction, and process seals are nonmetallic and chemically inert. This results in a sensor design that is immune to attack from most process fluids.

SIMPLE ASSEMBLY WITH MANY PROCESS CONNECTIONS OFFERED

The PH12 sensor can be mounted directly to an ANSI Class 150 flange or NPT mounting accessory. The flange or NPT accessory is easily assembled to the sensor's PG 13.5 thread. An O-Ring process seal with a thrust washer is provided with this installation.

Each sensor can also be provided with a separate protective holder assembly which has integral Tri-Clamp type or DN 25 threaded sanitary connections, or ANSI Class 150 flange, NPT, or pipe adapter process connections. The protective holder assembly is also easily assembled to the sensor.

RETRACTION/INSERTION ASSEMBLY

A Retraction/Insertion assembly is used to install the PH12 sensor in a hot tap/retractable type housing. It permits the sensor to be inserted or removed, under rated pressure and temperature, without shutting down the process. See Mounting Accessories section for further details.

BALL VALVE INSERTION ASSEMBLY

A Ball Valve Insertion assembly together with a retraction chamber and insertion shaft also allows inserting and removing the sensor from the process under rated pressure and temperature. It also allows the operator to purge away hot, pressurized, or harmful chemicals before opening the assembly and servicing the sensor. Refer to Mounting Accessories section further in this document.

CABLE STRAIN RELIEF HOUSING

A cable strain relief housing is offered for users who require strain relief for the external patch cord connecting to the integral Variopin or Smart connectors on the sensor body. This strain relief housing is provided as standard with the Retraction/Insertion assembly, and optional with the Sensor Holder assembly. It is easily assembled to the Retraction/Insertion assembly or Holder assembly.

OPTIONAL AUTOCLAVE CAP

An autoclave cap screws on to the Variopin or Smart connectors to help protect the electrical connections during the sterilization and autoclaving process.

OPERATING, STORAGE, AND TRANSPORTATION CONDITION (A)

| Influence | Reference Operating Conditions | Normal Operating Condition Limits (a) (b) | Storage and Transportation Limits |
|--|--|--|--|
| Process Temperature with Electrodes below: <ul style="list-style-type: none"> ▶ Domed Glass (Wide Temp.) (pH) ▶ Domed Glass (High Temp.) (pH) ▶ Flat Ruggedized Glass (pH) ▶ Platinum (ORP) | <ul style="list-style-type: none"> ▶ 25 ± 3°C (77 ± 5°F) ▶ 25 ± 3°C (77 ± 5°F) ▶ 25 ± 3°C (77 ± 5°F) ▶ 25 ± 3°C (77 ± 5°F) | <ul style="list-style-type: none"> ▶ -25 and +125°C (-13 and +257°F) ▶ 0 and 140°C (32 and 284°F) ▶ -15 and +125°C (5 and 257°F) ▶ -25 and +125°C (-13 and +257°F) (c) | Not Applicable |
| Storage Temperature | Not Applicable | Not Applicable | -5 and +65°C (23 and 149°F) |
| Process Pressure | 0 kPag (0 psig) | -48 and +1034 kPag (-7 and +150 psig) | Not Applicable |
| Mounting Position | Vertical; with Electrode End Down | Vertical up to ±90°; with Electrode End Downward (d) | Not Applicable |
| Relative Humidity | 50 ±10% | 0 and 95% | 0 and 95% |
| Vibration | 0.1 “g” (1 m/s ²) Negligible Frequency | 1 “g” (10 m/s ²) from 5 to 500 Hz | 1.1 “g” (11 m/s ²) from 2.5 to 5 Hz; in a packaged container |

- a. The specifications listed in the table apply to all sensor configurations. High temperature limits are valid for intermittent service such as sterilization in a bioreactor. Continuous operation at the maximum temperatures, especially in aggressive solutions, may reduce sensor lifetime.
- b. The temperature limits for combination (pH and ORP) measurement is determined by the glass electrode selected.
- c. The ORP temperature limit is extended up to 140°C (284°F) when used with Electrode Type Code -B (pH/ORP combination measurement).
- d. Orientation of the sensor in any position up to 90° from vertical with the electrode end downward.

NOTE

The pressure-temperature limits of the sensor assembly are listed in the table above. When used with process connection accessories, the pressure-temperature limits are those listed above, or those of the process connection accessory used, whichever is less.

Table 2. Process Temperature Ratings

| Measuring Electrode Type | Smart Digital (a) |
|--------------------------|-----------------------------|
| Domed Glass - pH | 0 to 121°C (32 to 250°F) |
| Flat Glass - pH | 0 to 85°C (32 to 185°F) |
| ORP - pH | 0 to 121°C (32 to 250°F) |

- a. For Smart sensors (PH12-****S) in Intrinsically Safe or Non-Incendive hazardous locations, upper body must be in ambient temperature of 85°C (185°F) or lower.

PERFORMANCE SPECIFICATIONS

Electrometric Performance - pH Measurement

| Parameter | Electrode Type | | |
|-------------------------------------|--|---------------------------------------|--|
| | pH - Domed Glass Wide Temperature Range (a) | pH - Domed Glass High Temperature (b) | pH - Flat Ruggedized Glass |
| Measuring Range | 0 to 14 pH | | 0 to 12 pH |
| Electromotive Efficiency | 98.5% ±1.5% | | |
| Accuracy and Stability | ±0.02 pH/24 hrs | | |
| Electrode Resistance (c) | < 100 M Ω | < 500 M Ω | |
| Electrometric Response Time (c) (d) | < 15 s, 4 to 10 pH | | |
| Temperature Response Time (c) (e) | < 1 min for 80% | | |
| Sodium Ion Error (c) | < 0.2 pH in 0.5 M Na ⁺ at pH 12.4 | | < 0.2 pH in 0.5 M Na ⁺ at pH 12.0 |

- a. Wide temperature domed glass range: -25 to +125°C (-13 to +257°F).
- b. High temperature domed glass range: 0 to 140°C (32 to 284°F).
- c. Values listed are “as shipped”.
- d. Response time is the interval of time between the initiation of the input step, and the time at which the output signal first attains 90% of its final steady state value.
- e. The measurement is made from 25 to 100°C (77 to 212°F) in a pH 4 solution.

Electrometric Performance - ORP Measurement

| Parameter | Performance |
|-------------------|---|
| Measurement Range | ±2000 mV (Analog sensor) (a) ±1800 mV (Smart sensor) |

- a. The measurement range is limited only by the readout instrument.

Temperature Measurement Performance

| Parameter | Temperature Compensation Type RTD | |
|--|-----------------------------------|-------------------------------|
| | 100 Ω Platinum RTD; Class B | 1000 Ω Platinum RTD; Class B |
| Temperature Range | -25 to +140°C (-13 to +284°F) | -25 to +140°C (-13 to +284°F) |
| Accuracy at 25°C ±0.425°C (77°F ±0.77°F) | 109.73 Ω ±0.17 Ω | 1097.3 Ω ±1.7 Ω |
| Accuracy at Temperature T (a) | ±[(0.30°C) + (0.005) (T)] | |

- a. Where T = the measured temperature in °C; and [(°C)(9/5)] +32 = °F.

FUNCTIONAL SPECIFICATIONS

Measuring Electrode

- ▶ Domed glass or flat ruggedized glass electrode with silver/silver chloride internal electrode for pH measurement.
- ▶ Platinum electrode for ORP measurement.

Reference Electrode

The reference electrode is a silver/silver chloride half cell. This electrode is encased in a Nafion Ion barrier which allows charge transfer while also minimizing poisoning of the electrode and helping prevent silver ions from migrating to the external junction and causing clogging.

Measurement Range

DOMED GLASS ELECTRODE

0 to 14 pH

Flat RUGGEDIZED Glass ELECTRODE

0 to 12 pH

PLATINUM ELECTRODE

The measurement range (mV):
 +/-2000 mV for Analog sensor
 +/-1800 mV for Smart sensor

Automatic Temperature Compensation (ATC)

Integral temperature element provides temperature measurement for pH compensation over the full rated temperature range of the pH sensor. The integral temperature elements are:

- ▶ 100 Ω Platinum RTD, or
- ▶ 1000 Ω Platinum RTD

NOTE

In Analog sensors, both RTDs are 3-wire type to provide lead length compensation. They can be used with analyzers and transmitters that accept either 2- or 3-wire temperature elements.

Smart sensors (PH12-****S) use a 1000 Ω RTD.

Electromagnetic Compatibility

When properly installed per the applicable installation instructions with Foxboro Model 876PH Transmitters, the PH12 Series sensors comply with the electromagnetic compatibility requirements of European EMC Directive 2014/30/EU by conforming to the following EN and IEC Standards: EN 61326-1:2006, Electrical equipment for measurement, control and laboratory use - EMC requirements, Class A emission limits, and immunity requirements according to Table 2 for Industrial locations.

NOTE

Compliance with these standards requires that the sensor cable be enclosed in grounded conduit.

Solution Temperature Measurement

Solution temperature is measured by the RTD. The Resistance-Temperature response is per DIN EN 60751, or IEC 751, and is as follows:

| Solution Temperature | | Corresponding Resistance in ohms using the: | |
|----------------------|-----|---|-----------------------|
| °C | °F | 100 ohm Platinum RTD | 1000 ohm Platinum RTD |
| -30 | -22 | 88.222 | 882.22 |
| -20 | -4 | 92.160 | 921.60 |
| -10 | 14 | 96.086 | 960.86 |
| 0 | 32 | 100.00 | 1000.0 |
| 10 | 50 | 103.90 | 1039.0 |
| 20 | 68 | 107.79 | 1077.9 |
| 25 | 77 | 109.73 | 1097.3 |
| 30 | 86 | 111.67 | 1116.7 |
| 40 | 104 | 115.54 | 1155.4 |
| 50 | 122 | 119.40 | 1194.0 |
| 60 | 140 | 123.24 | 1232.4 |
| 70 | 158 | 127.07 | 1270.7 |
| 80 | 176 | 130.89 | 1308.9 |
| 90 | 194 | 134.70 | 1347.0 |
| 100 | 212 | 138.50 | 1385.0 |
| 110 | 230 | 142.28 | 1422.8 |
| 120 | 248 | 146.06 | 1460.6 |
| 130 | 266 | 149.82 | 1498.2 |
| 140 | 284 | 153.57 | 1535.7 |

ELECTRICAL SAFETY SPECIFICATIONS

The PH12 Analog sensor meets the requirements of a simple apparatus. A simple apparatus may be defined as an electrical component (or combination of components) of simple construction with well-defined electrical parameters which does not generate more than 1.5 V, 100 mA, and 25 mW, or a passive component which does not dissipate more than 1.3 W. Certification to the ATEX directive is not

required because of the low levels of energy which are added to the intrinsically safe circuit by this apparatus. When connected to an intrinsically safe pH/ORP transmitter, such as a Foxboro Model 870ITPH or 876PH, the PH12 sensor can be installed in a Division 1 or Zone 0 hazardous area. Table 3 details the Electrical Safety Specifications for the PH12****S.

Table 3. Electrical Safety Specifications (PH12-**S Only) (a)**

| Testing Laboratory, Types of Protection, and Area Classification | Application Conditions | Electrical Safety Design Code |
|--|-----------------------------|-------------------------------|
| ATEX, II 1 G Ex ia IIC, Intrinsic safe, Zone 0 | Temperature Class T3 to T6. | AA |
| CSA/CSAus, EX ia IIC, Intrinsically safe, Class I, Div 1, Zone 0 | Temperature Class T3 to T4. | CA |
| CSA/CSAus, Nonincendive, Class I, Div 2 | Temperature Class T3 to T6. | CN |
| FM/FMc, AEx ia IIC, Intrinsically safe, Class I, Div 1, Zone 0 | Temperature Class T3 to T6. | FA |
| FM/FMc, Nonincendive, Class I, Div 2 | Temperature Class T3 to T6. | FN |
| IECEX, Ex ia IIC, Intrinsic safe, Zone 0 | Temperature Class T3 to T6. | DA |

a. The sensors have been designed to meet the electrical safety descriptions listed in this table. Contact Global Customer Support for information or status of testing laboratory approvals or certifications.

PHYSICAL SPECIFICATIONS

Electrodes

MEASURING ELECTRODE

- ▶ pH Measurement: Domed or flat glass
- ▶ ORP Measurement: Platinum

Internal electrode is silver wire coated with silver chloride.

REFERENCE ELECTRODE

Internal electrode is silver wire coated with silver chloride (inside a Nafion ion barrier).

Sensor Parts

See Figure 1 and descriptions that follow.

Process Wetted Parts

Sensor Body

PEEK or Borosilicate Glass.

Sensitive Membrane

- ▶ pH Measurement: Glass
- ▶ ORP Measurement: Platinum

Reference Junction

Ceramic

Solution Ground

- ▶ pH or ORP Measurement: Conductive Kynar (nonmetallic), or stainless steel (option -S).
- ▶ pH/ORP Combination Measurement: Platinum

Process O-RING AND ELECTRODE Seal

Viton is standard; EPDM and Perfluoroelastomer are optional.

Reference Electrolyte

Gelled Electrolyte

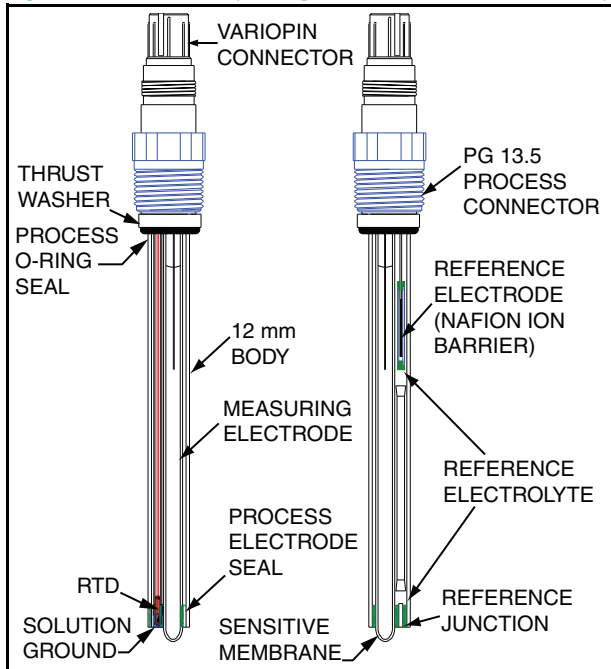
Process Connector

Valox

Thrust Washer

Glass filled (25%) ptfе

Figure 1. Sensor Parts (Analog Sensor Shown for Reference)



Variopin Connector

Integral to sensor. Contacts are 2 µm gold over nickel plate. Plug head is PEEK with a polyphenylene sulfide insert. Connector meets the ingress protection of IP66/68 per IEC 60529. IP68 immersion is at a depth of 2 m (6.6 ft) for 48 hours.

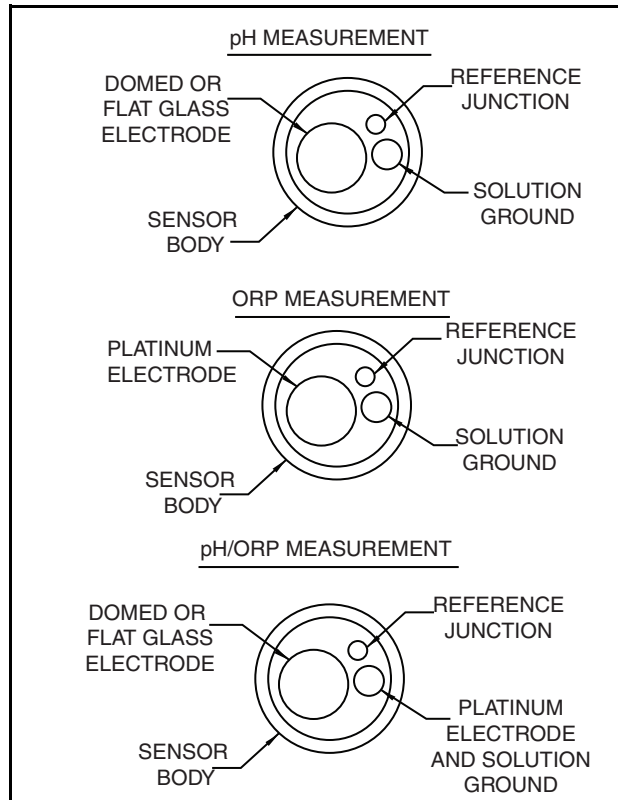
Smart Connector

Integral to sensor. Contacts are 10 µm gold over nickel plate. Smart Connector is constructed from Ultem plastic with fluorosilicon o-rings. Connector meets ingress protection of IP66/68 per IEC 60529. IP68 immersion is at a depth of 2 meters (6.6 ft) for 48 hours.

Measuring Electrodes Configuration

Figure 2 shows the location of the measuring electrode(s) at the bottom surface of the sensor. The configurations shown are for a pH measurement, an ORP measurement, and a pH/ORP combination measurement. Also shown is the location of the reference junction and solution ground.

Figure 2. Measuring Electrode Configuration at Bottom Surface of Sensor.



Sensor Mounting

SENSOR WITHOUT PROTECTIVE HOLDER ASSEMBLY

Sensor can be mounted to the process with NPT or ANSI Class 150 process connection accessories. These accessories are easily assembled to the sensor's PG13.5 threads. See Sensor Mounting Accessories Model Code Selection -3. Also see Figure 5 (A and C).

SENSOR WITH PROTECTIVE HOLDER ASSEMBLY

Sensor can be installed into a holder assembly that either has a guard or no guard. The selection of NPT, NPT pipe adapter, ANSI Class 150 flange, DN 25 thread, or Tri-Clamp type process connections are offered. These process connections are integral to the holder assembly, and the holder assembly is easily assembled to the sensor's PG13.5 threads. See Sensor Mounting Accessories Model Code Selections -1 and -2. Also see Figure 5 (B, D, F, G, and H).

Sensor Assembly Configurations

Refer to Figure 3, Figure 4, and Figure 5 for typical sensor assembly configurations. Also refer to MOUNTING ACCESSORIES section.

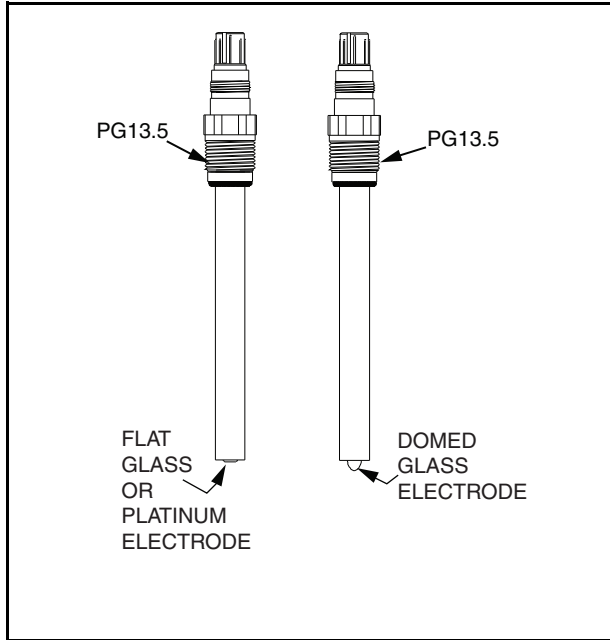
NOTE

The sensors shown in Figure 3, Figure 4, and Figure 5 show glass electrodes on the bottom surface for pH measurement. Refer to Figure 2 for electrode configurations on the bottom surface of the sensor for pH, ORP, or pH/ORP combination measurements.

Dimensions

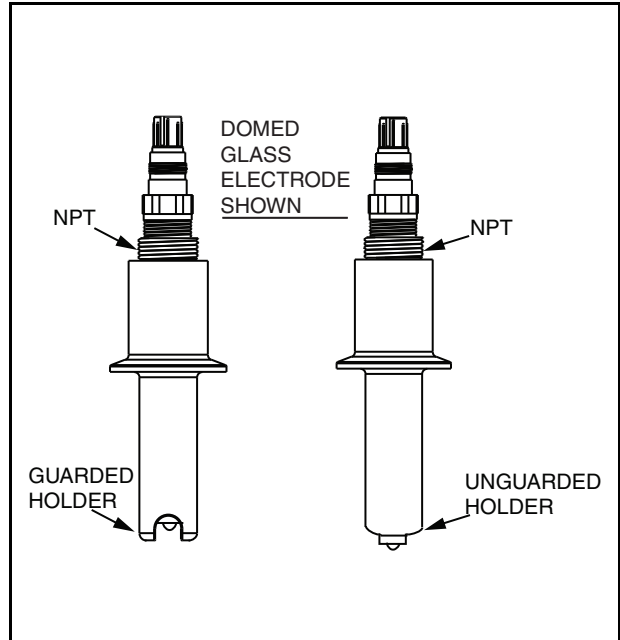
Refer to DIMENSIONS-NOMINAL section, and also to Dimensional Print DP 611-214 for additional dimensional information.

Figure 3. Sensor with Flat Glass or Platinum Electrode, and Domed Glass Electrode (No Protective Holder Assembly)



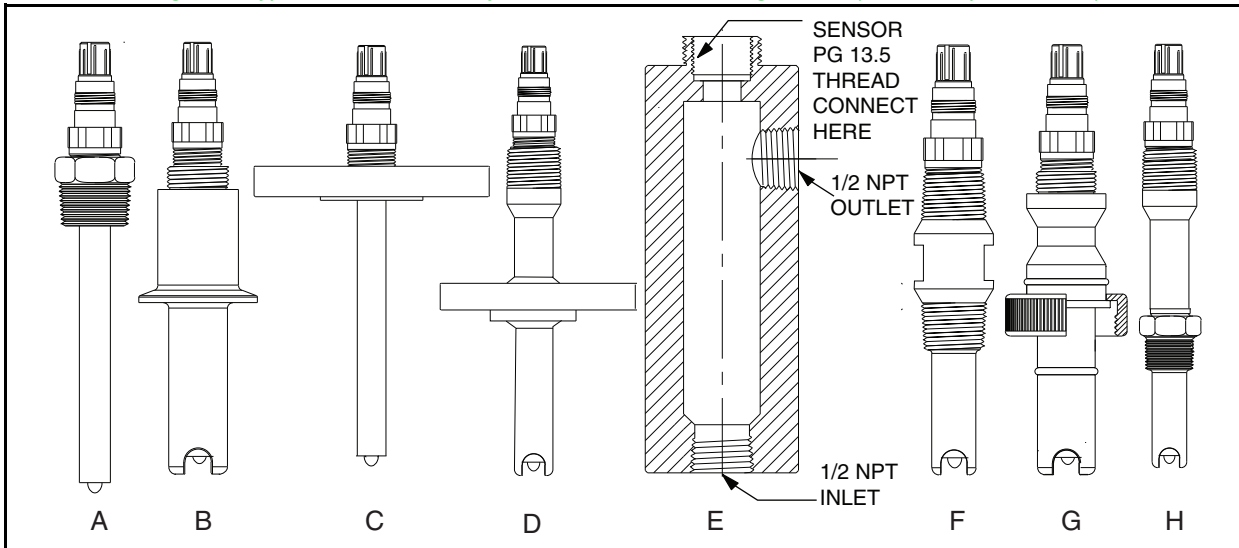
(Analog Sensor Shown for Reference)

Figure 4. Sensor with Guarded and Unguarded Protective Holder Assembly (shown with Tri-Clamp Type Process Connection)



(Analog Sensor Shown for Reference)

Figure 5. Typical Sensor Assembly and Flow Chamber Configurations (see Descriptions below)



(Analog Sensor Shown for Reference)

- A = No Holder; Domed Glass (pH); NPT Connection
- B = Guarded Holder; Domed Glass (pH); Tri-Clamp Type Sanitary Connection
- C = No Holder, Domed Glass (pH); Flanged Connection
- D = Guarded Holder, Domed Glass (pH); Flanged Connection
- E = Flow Chamber showing PG 13.5 Sensor Connection, and Inlet/Outlet Connections
- F = Guarded Holder, Domed Glass (pH); NPT Pipe Adapter Connection
- G = Guarded Holder, Domed Glass (pH); DN 25 Threaded Sanitary Connection
- H = Guarded Holder, Domed Glass (pH); NPT Connection

NOTE

The sensor assembly configurations shown in Figure 5 are with a domed glass electrode for pH measurement and a guarded protective holder, except configurations A, C, and E which are not offered with holder assemblies. These same configurations are also available with a flat glass electrode for pH measurement, a platinum electrode for ORP measurement, and a glass and platinum electrode for pH/ORP combination measurement. The sensor assembly configurations shown in Figure 5 are also offered with an unguarded protective holder (except configurations A, C, and E). Refer to the Model Codes section for sensor assembly configurations offered.

MOUNTING ACCESSORIES

(Selectable from Model FIT12 Mounting Accessories Model Code)

Sensor without Protective Holder Accessory Model FIT12-3

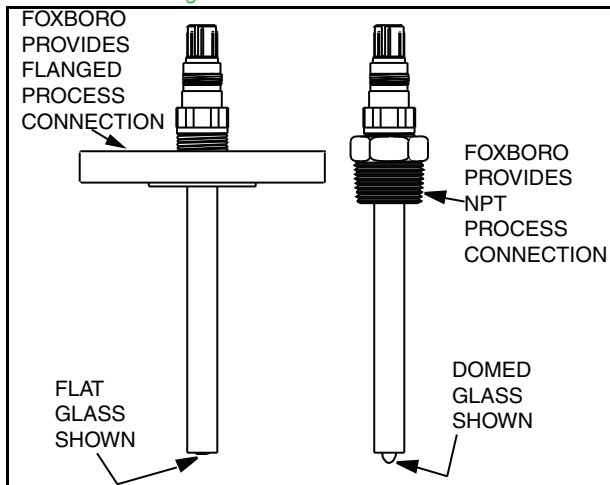
A Model PH12 sensor can be installed without a protective holder accessory, in which case it is connected directly to the process using an ANSI Class 150 flange or NPT process connection mounting accessory. The sensor attaches to the flange or NPT mounting accessory using the PG 13.5 external threads located at the nonimmersible end of the sensor. See Figure 6.

Another selection available with the no holder configuration is the process connection material of the flange or NPT accessory, either 316L ss, CPVC, or Kynar. See FIT12 Mounting Accessories Model Code.

NOTE

A Sensor Model (Model PH12) and Mounting Accessories Model (Model FIT12) must be specified separately. A sensor without a "Protective Holder Accessory" is shown in Figure 6 and is connected to the process with a flange or NPT process connection.

Figure 6. Sensor without Holder;
with Flanged and NPT Process Connection



(Analog Sensor Shown for Reference)

Sensor with Protective Holder Accessory Models FIT12-1 and FIT12-2

A Model PH12 sensor can also be provided with a protective holder. Numerous configurations are available when a protective holder is selected. See paragraphs below and Figure 7.

- ▶ Holder can either have a guard (generally selected with domed glass electrode), or have no guard (generally selected with flat glass or platinum electrode).
- ▶ The process connection can be as follows:
 - DN 25 Threaded Sanitary Connection
 - 3/4-, 1-, 1 1/2-, 2-, 3-, and 4-in Class 150 Flange
 - 3/4- or 1-in NPT
 - 3/4- or 1-in NPT Pipe Adapter
 - 1-, 1 1/2-, or 2-in Tri-Clamp Type Sanitary Connection
- ▶ The immersion length allowed can vary from 25 to 375 mm (1 to 14.8 in). See FIT12 Mounting Accessories Model Code.
- ▶ The holder material is 316L ss, CPVC, or Kynar.
- ▶ The holder to sensor O-Ring seal is Viton; or optionally EPDM, Chemraz, Kalrez, or Perfluoroelastomer (FFKM).
- ▶ And optionally, a cable strain relief housing can be attached to the holder itself. Refer to Figure 8 for a strain relief housing assembled to a sensor assembly with a holder. Also refer to DIMENSIONS-NOMINAL section.

Figure 7. Sensor with Various Holder Configurations (Analog Sensor Shown for Reference)

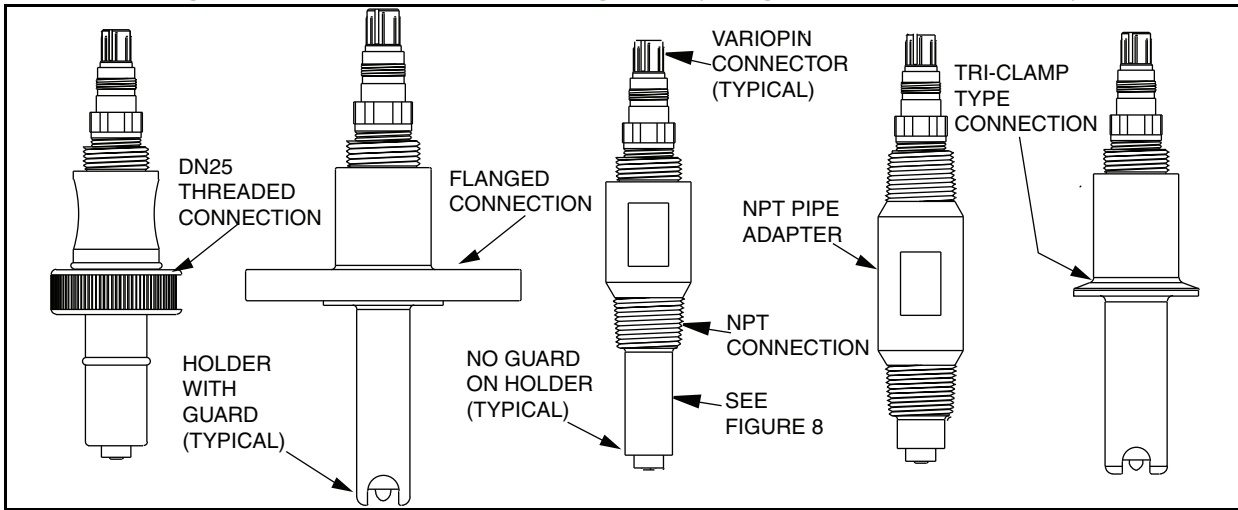
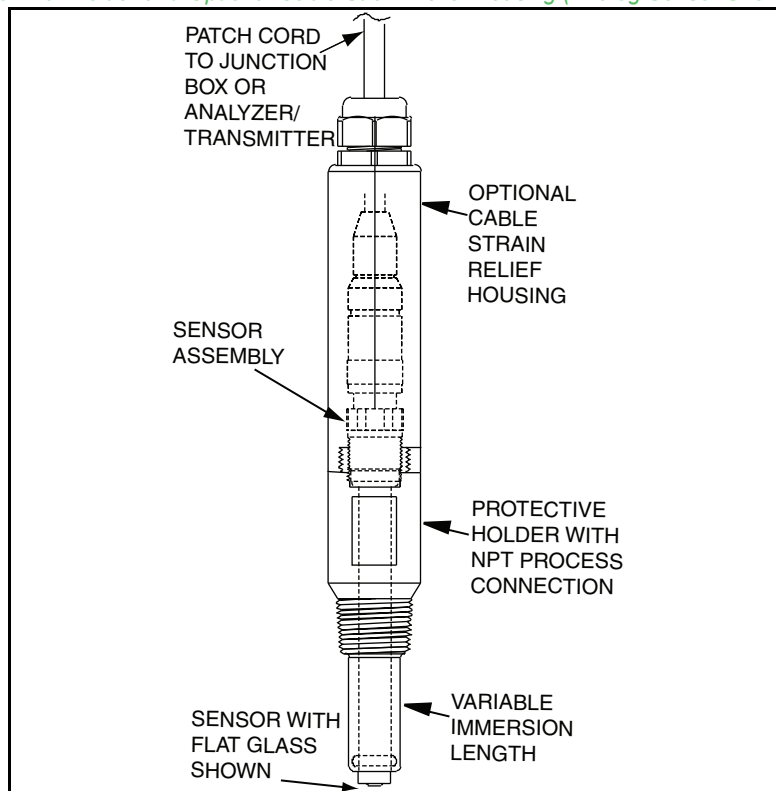


Figure 8. Sensor with Holder and Optional Cable Strain Relief Housing (Analog Sensor Shown for Reference)



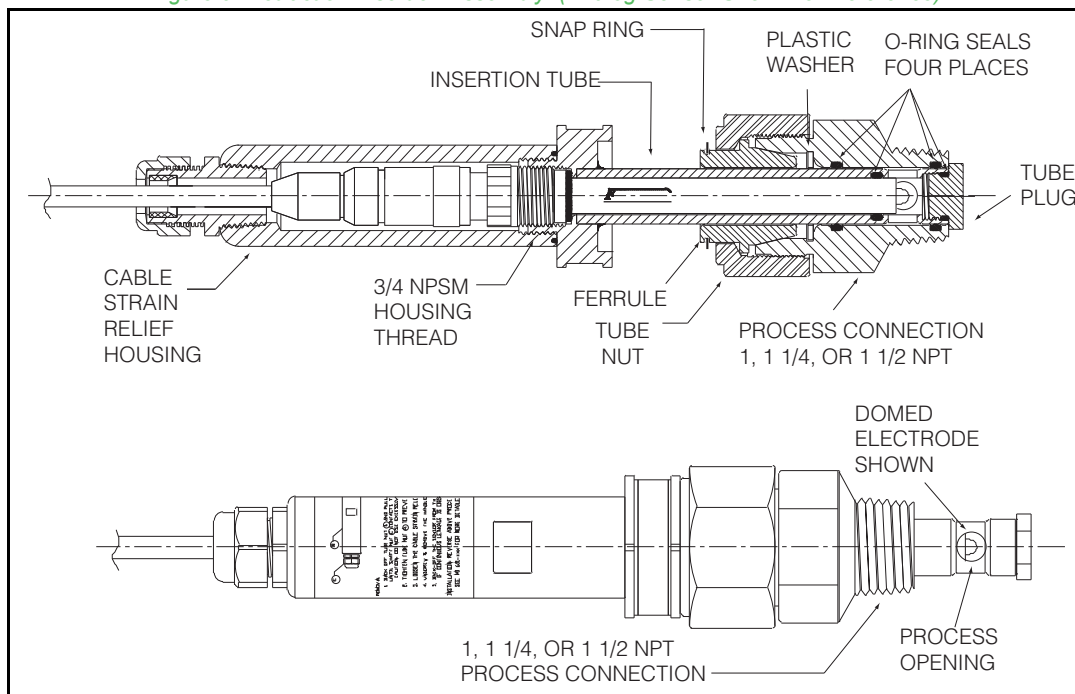
Retraction/Insertion Assembly

A Retraction/Insertion assembly is used to install the PH12 Sensor in a hot tap/retractable type mounting. It permits the sensor to be inserted into and removed from the installation, under rated pressure and temperature, without shutting down the process, draining the tank, or using a bypass system. A Retraction/Insertion assembly allows a continuously adjustable sensor immersion depth of 0 to 40, 0 to 145, 0 to 280, or 0 to 346 mm (0 to 1.6, 0 to 5.7, 0 to 11.0, or 0 to 13.6 in) depending on the sensor length and Retraction/Insertion assembly selected. This assembly uses a sensor compression seal fully tested to the rated pressure and temperature. The compression seal comprises a ferrule, process connector, O-rings, and a tube nut.

A tube plug is also provided to contain the sensor (blowout protection). A cable strain relief housing is also provided as standard with this assembly.

The Retraction/Insertion assembly is offered in 316L ss, Titanium, CPVC, or Kynar material. Process O-Ring seals (4) are Viton as standard, and optionally EPDM, Chemraz, Kalrez, or Perfluoroelastomer (FFKM). Process connections can be either 1, 1 1/4, or 1 1/2 NPT, and the threads for the cable strain relief housing are 3/4 NPSM. An alignment groove is provided to align the sensor into the insertion assembly. The alignment groove provides a visual reference as to the position of the sensor when inserted into the process. Refer to Figure 9 and to the Dimensions-Nominal section.

Figure 9. Retraction/Insertion Assembly (Analog Sensor Shown for Reference)



BALL VALVE INSERTION ASSEMBLY

The Ball Valve Insertion assembly is used to install a 120 mm (4.7 in) long PH12 sensor into a hot tap/retractable type mounting. It permits the sensor to be inserted and removed from the process under rated pressure and temperature without draining the tank, shutting down a line, or using a bypass system. It allows a continuously adjustable immersion depth up to the entire length of the Ball Valve Insertion shaft. It also allows the installer to locate the sensing end of the PH12 probe at the optimum location for the application, and allows adjustment of the immersion length in response to unexpected plumbing or hardware installation.

The Ball Valve Insertion assembly provides anti-blowout protection, and also provides purge ports on the retraction chamber as a feature. These ports allow the operator to purge away hot, pressurized or harmful chemicals prior to opening the assembly and servicing the sensor. A sealing feature also helps prevent the process fluid from migrating out through the shaft, and possibly out the cable conduit to the transmitter.

Other features include a push/pull plate for easy movement of the insertion shaft, and simple access to, and removal of the sensor without losing parts.

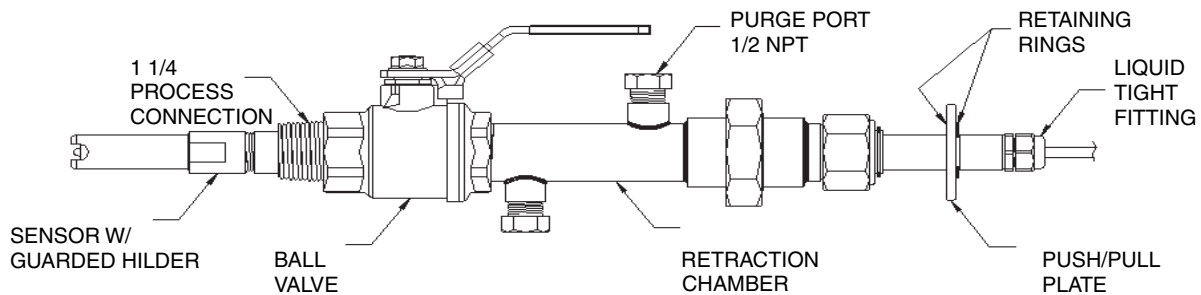
This Ball Valve Insertion assembly is one of the most effective and versatile means of installing and replacing a PH12 sensor. Refer to Table 4 and Figure 10.

Table 4. Ball Valve Insertion Assembly Description

| PH12 Sensor Length | Ball Valve Insertion Assembly Description | | | |
|--------------------|---|---------------------|---|--------------------|
| | Insertion Length | Ball Valve Material | O-Ring Material | Process Connection |
| 120 mm (4.7 in) | 0 to 20 cm (0 to 8 in) 0 to 40 cm (0 to 16 in) 0 to 60 cm (0 to 24 in) 0 to 80 cm (0 to 32 in) 0 to xx Length per Sales Order (a) | 316 ss, or Titanium | Viton, EPDM, Chemraz, Kalrez or Perfluoroelastomer (FFKM) | 1 1/4 NPT |
| | 0 to 40 cm (0 to 16 in) | | | |

a. Contact Global Customer Support.

Figure 10. Ball Valve Insertion Assembly (Analog Sensor Shown for Reference)



Temperature-Pressure Ratings of Mounting Accessories (Tables 5 to 8)

Table 5 shows the ratings of the Retraction/Insertion Assembly and Ball Valve Insertion assembly accessories with 316L ss and Titanium material.

Table 6 shows the ratings of the Retraction/Insertion assembly with CPVC and Kynar material.

Table 7 shows the ratings of the Flange, NPT, and NPT Pipe Adapter, and DN 25 accessories with 316L ss material.

Table 8 shows the ratings of the Flange, NPT, and NPT Pipe Adapter accessories with CPVC and Kynar material.

For the Tri-Clamp type Sanitary Connection (not shown), the temperature-pressure rating is determined by the user’s mating clamp and gasket used. Use the sensor’s rating or the Tri-Clamp/gasket rating, whichever is less. Also note that the ratings in Tables 5 to 8 may exceed the ratings of the sensor itself. However use the ratings in the tables or the sensor rating, whichever is less.

Table 5. Temperature-Pressure Ratings of Retraction/Insertion Assembly and Ball Valve Insertion Assembly with 316L ss and Titanium Material

| Process Temperature | | Maximum Working Pressure of Retraction/Insertion Assembly and Ball Valve Insertion Assembly | | | |
|---------------------|-------------|---|-----|------------------------|-----|
| | | with 316L ss Material | | with Titanium Material | |
| °C | °F | MPa | psi | MPa | psi |
| -29 to +66 | -20 to +150 | 1.59 | 230 | 1.90 | 275 |
| 93 | 200 | 1.35 | 195 | 1.72 | 250 |
| 121 | 250 | 1.28 | 185 | 1.65 | 240 |
| 149 | 300 | 1.21 | 175 | 1.59 | 230 |

Table 6. Temperature-Pressure Ratings of Retraction/Insertion Assembly with CPVC or Kynar Material

| Process Temperature | | Maximum Working Pressure of Retraction/Insertion Assembly | | | |
|---------------------|------------|---|-----|----------------|-----|
| | | CPVC Material | | Kynar Material | |
| °C | °F | KPa | psi | KPa | psi |
| -30 to +21 | -22 to +70 | 1034 | 150 | 1034 | 150 |
| 27 | 80 | 993 | 144 | 979 | 143 |
| 49 | 120 | 724 | 105 | 703 | 102 |
| 71 | 160 | 414 | 60 | 510 | 74 |
| 82 | 180 | 262 | 38 | 434 | 63 |
| 93 | 200 | 186 | 27 | 372 | 54 |
| 99 | 210 | 159 | 23 | 345 | 50 |
| 116 | 240 | - | - | 262 | 38 |

NOTE

See WARNING on Next Page.

Table 7. Temperature-Pressure Ratings of Flange, NPT, NPT Pipe Adapter, and DN 25 Accessories with 316L ss Material

| Process Temperature | | Maximum Working Pressure of Flange, NPT, NPT Pipe Adapter, and DN 25 Accessory | | | |
|---------------------|-------------|--|-----|--|------|
| | | 316L ss Flange Accessory (a) | | 316L ss, 3/4 and 1 NPT, NPT Pipe Adapter and DN 25 Accessory (b) | |
| °C | °F | MPa | psi | MPa | psi |
| -29 to +66 | -20 to +150 | 1.59 | 230 | 20.7 | 3000 |
| 93 | 200 | 1.35 | 195 | 20.7 | 3000 |
| 121 | 250 | 1.28 | 185 | 20.7 | 3000 |
| 149 | 300 | 1.21 | 175 | 20.7 | 3000 |

- a. Flange applies to Process Connection Accessory Code F* (ANSI Class 150 Flange).
- b. NPT applies to Process Connection Accessory Code N* (NPT), and NPT Pipe Adapter applies to Process Connection Code S* (NPT Pipe Adapter), and DN 25 applies to Process Connection Code DA (DN 25 Threaded Sanitary Connection).

Table 8. Temperature-Pressure Ratings of Flange, NPT, and NPT Pipe Adapter Accessories with CPVC or Kynar Material

| Process Temperature | | Maximum Working Pressure of Flange, NPT, or NPT Pipe Adapter Accessory | | | | | | | | | | | |
|---------------------|------------|--|-----|-------------|-----|-----------|-----|----------------|-----|-------------|-----|-----------|-----|
| | | CPVC Material | | | | | | Kynar Material | | | | | |
| | | Flange (a) | | 3/4 NPT (b) | | 1 NPT (b) | | Flange (a) | | 3/4 NPT (b) | | 1 NPT (b) | |
| °C | °F | kPa | psi | kPa | psi | kPa | psi | kPa | psi | kPa | psi | kPa | psi |
| -30 to +21 | -22 to +70 | 1034 | 150 | 2344 | 340 | 2206 | 320 | 1034 | 150 | 1586 | 230 | 1448 | 210 |
| 27 | 80 | 993 | 144 | 2277 | 326 | 2117 | 307 | 979 | 143 | 1510 | 219 | 1379 | 200 |
| 38 | 100 | 883 | 128 | 1993 | 289 | 1875 | 272 | 827 | 120 | 1269 | 184 | 1158 | 168 |
| 49 | 120 | 724 | 105 | 1641 | 238 | 1544 | 224 | 703 | 102 | 1076 | 156 | 979 | 143 |
| 60 | 140 | 572 | 83 | 1289 | 187 | 1214 | 176 | 600 | 87 | 917 | 133 | 841 | 122 |
| 71 | 160 | 414 | 60 | 938 | 136 | 883 | 128 | 510 | 74 | 779 | 113 | 703 | 103 |
| 82 | 180 | 262 | 38 | 586 | 85 | 552 | 80 | 434 | 63 | 669 | 97 | 607 | 88 |
| 93 | 200 | 186 | 27 | 421 | 61 | 400 | 58 | 372 | 54 | 572 | 83 | 524 | 76 |
| 99 | 210 | 159 | 23 | 352 | 51 | 331 | 48 | 345 | 50 | 524 | 76 | 476 | 69 |
| 116 | 240 | - | - | - | - | - | - | 262 | 38 | 400 | 58 | 365 | 53 |

- a. Flange applies to Process Connection Accessory Code F* (ANSI Class 150 Flange).
- b. NPT applies to both the Process Connection Accessory Code N* (NPT) and Process Connection Accessory Code S* (NPT Pipe Adapter).

| |
|---|
| ▲ WARNING |
| RISK OF EXPOSURE |
| For CPVC or Kynar accessories (Table 6 and Table 8), avoid pressure spikes, water hammer, and impact since these effects can be detrimental as the plastic becomes brittle at temperatures below -18°C (0°F). |
| Failure to follow these instructions can result in death or serious injury. |

WIRING ACCESSORIES

(Selectable by Part Number - see Tables 9 to 14)

Wiring

Analog Sensor

Patch cords are required for use with the sensor. The patch cord lengths offered are 10, 20, 30, 40, or 50 feet, and temperature limits are 80°C (176°F) for a standard temperature cord, or 125°C (257°F) for a high temperature cord. The patch cord has a Variopin connector on the sensor end and straight pin lugs on the other end which connect either directly to the analyzer or transmitter, a junction box with no amplifier, or a junction box with an amplifier. See Figures 11 and 12.

Extension cables with straight pin lugs on both ends are offered as follows:

- ▶ In lengths from 10 to 40 feet when no amplifier is used in the junction box. Temperature limits are 80 or 125°C. Refer to Figures 11 and 13.
- ▶ In lengths from 10 to 490 feet when an amplifier is used in the junction box. Temperature limits are 80°C. Refer to Figures 11 and 13.

Raw, unterminated cable is also offered in continuous lengths up to 1000 feet. The user must cut the cable to the required length, and add his own terminals. This cable has temperature limits of 80 or 125°C. See Figure 11.

For patch cord, extension cable and raw cable specifications and part numbers, see Tables 9 to 14.

Smart Sensors

Patch cords are used with the sensor. A standard length patch cord is 10 feet. Optional lengths are 20, 30, 40, or 50 feet, and lengths per sales orders, (with a maximum length of 328 feet.) The patch cord has a Smart female connector on the sensor end. See Figure 13. The Smart sensor cannot be used with an extension cable.

Junction Boxes

JUNCTION BOX WITH NO AMPLIFIER

This is a cast aluminum, surface-mounted enclosure with a neoprene gasket. It houses an encapsulated terminal block assembly with two blocks having seven terminals each.

One block is for the patch cord from the sensor assembly, and the second block is for the extension cable connecting to the transmitter or analyzer. Sufficient space is provided to allow for patch cord and extension cable terminations. The enclosure is 160 x 102 x 81 mm (6.3 x 4.0 x 3.2 in) in size, and protection of the equipment against corrosion, ingress of dust and water with NEMA 4X rating. Specify Part Number BS813XN. See Figures 11 and 15.

JUNCTION BOX WITH AN AMPLIFIER

This is the same enclosure as that for the junction box with no amplifier. The only two differences are as follows:

1. The encapsulated terminal block assembly incorporates an amplifier assembly.
2. One terminal block has seven terminals for the patch cord, and the second terminal block has terminals to accommodate the nine-conductor extension cable. Specify Part Number BS811MR. Refer to Figures 11 and 16.

Figure 11. Patch Cord and Extension Cable

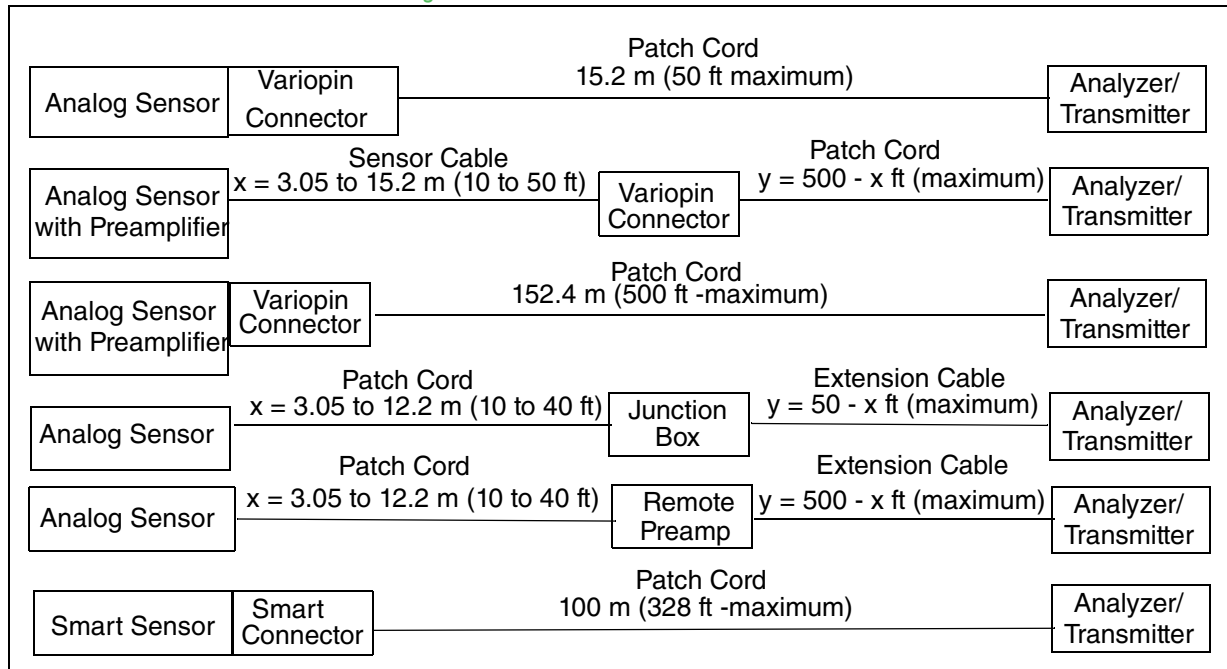


Figure 12. Patch Cord with Variopin Quick Connector and Straight Pin Lugs (see Table 9) - Analog

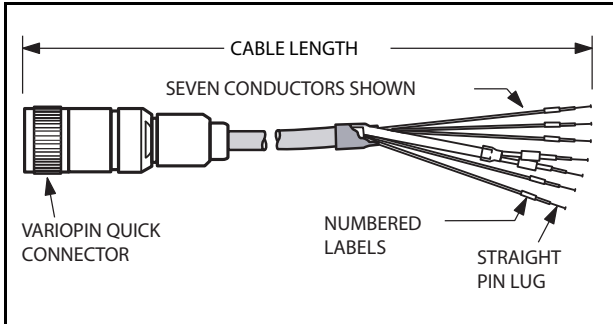


Figure 14. Raw, Unterminated Cable Shown (see Table 14) (Pin Lugs provided by User) - Analog

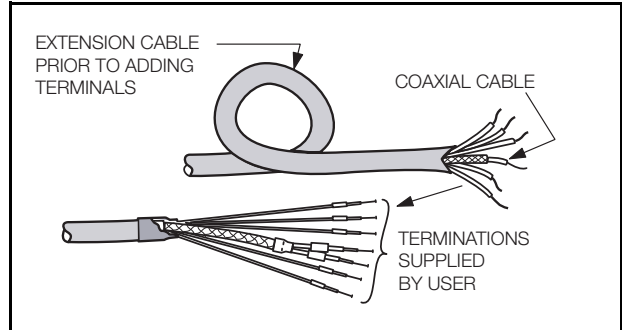


Figure 13. Extension Cable Assembly with Straight Pin Lugs on Both Ends (see Table 12 and Table 13) - Analog

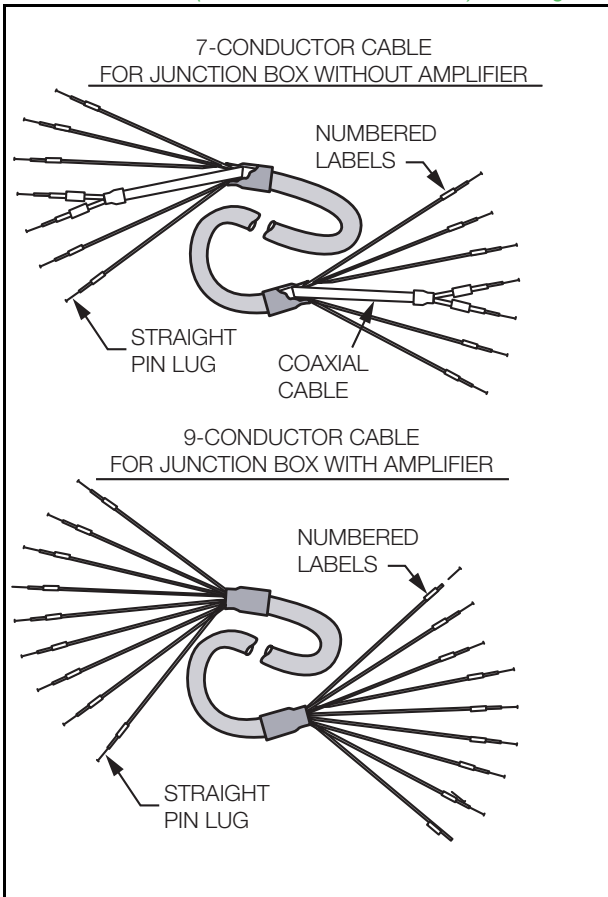


Figure 15. Junction Box with no Amplifier - Analog

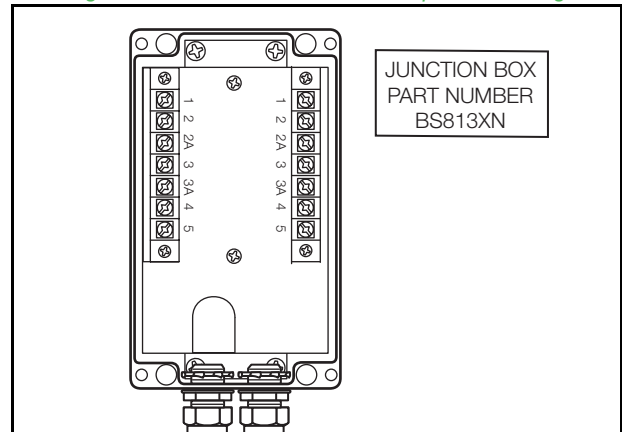


Figure 16. Junction Box with an Amplifier - Analog

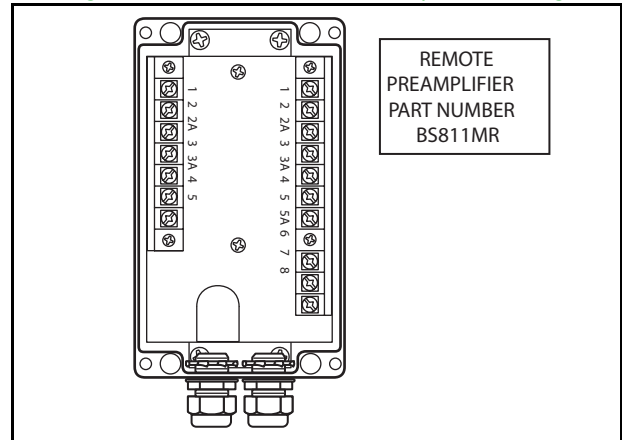


Figure 17. Patch Cord with Smart Connector and Straight Pin Lugs

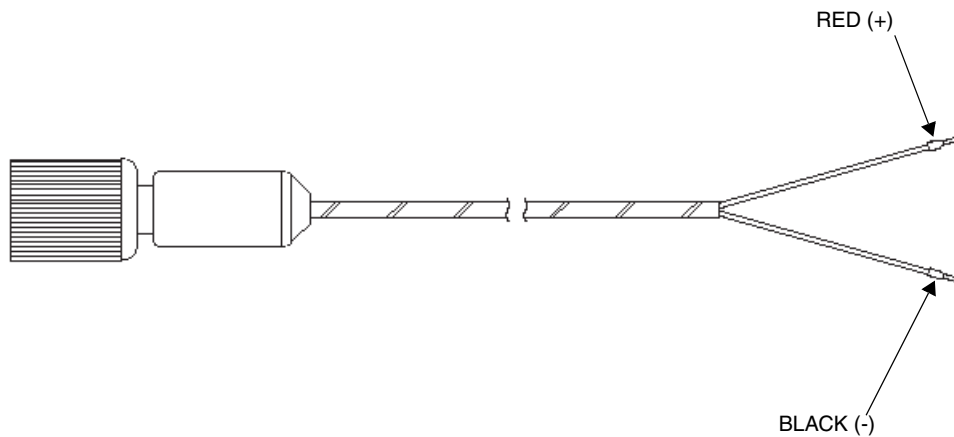


Table 9. Variopin Patch Cords

| Part No. | Temperature Range | Cable Terminations | Length (Feet) |
|----------|----------------------|----------------------|---------------|
| BS811GU | Standard (to 80°C) | Variopin to Pin Lugs | 10 |
| BS811GV | Standard (to 80°C) | Variopin to Pin Lugs | 20 |
| BS811GW | Standard (to 80°C) | Variopin to Pin Lugs | 30 |
| BS811GX | Standard (to 80°C) | Variopin to Pin Lugs | 40 |
| BS811GY | Standard (to 80°C) | Variopin to Pin Lugs | 50 |
| BS810QA | High Temp (to 125°C) | Variopin to Pin Lugs | 10 |
| BS810QB | High Temp (to 125°C) | Variopin to Pin Lugs | 20 |
| BS810QC | High Temp (to 125°C) | Variopin to Pin Lugs | 30 |
| BS810QD | High Temp (to 125°C) | Variopin to Pin Lugs | 40 |
| BS810QE | High Temp (to 125°C) | Variopin to Pin Lugs | 50 |

Table 10. Smart Patch Cords

| Part No. | Temperature Range | Cable Terminations | Length (Feet) |
|----------|------------------------------|-----------------------------|--------------------------|
| BS814KB | Temperature to 125°C (257°F) | Smart Connector to Pin Lugs | 10 ft (3.04 m) |
| BS814KC | Temperature to 125°C (257°F) | Smart Connector to Pin Lugs | 20 ft (6.09 m) |
| BS814KD | Temperature to 125°C (257°F) | Smart Connector to Pin Lugs | 30 ft (9.15 m) |
| BS814KH | Temperature to 125°C (257°F) | Smart Connector to Pin Lugs | 40 ft (12.19 m) |
| BS814KJ | Temperature to 125°C (257°F) | Smart Connector to Pin Lugs | 50 ft (15.24 m) |
| BS814KK | Temperature to 125°C (257°F) | Smart Connector to Pin Lugs | Variable per sales order |

Table 11. Foxboro Smart Sensor PC Interface Cable (a)

| Part No. | Temperature Range | Cable Terminations | Length |
|----------|-----------------------------|---------------------------------|-----------------|
| BS814ME | Temperature to 85°C (185°F) | Smart Connector to PC Interface | 5.5 ft (1.67 m) |

a. Requires Foxboro Smart Sensor Device Type Manager (DTM) software See MI 611-215 for the PH12 for details.

Table 12. Extension Cables for Junction Box without Amplifier (Analog Only)

| Part No. | Temperature Range | Cable Terminations | Length (Feet) |
|----------|----------------------|----------------------|---------------|
| BS811HE | Standard (to 80°C) | Pin Lugs to Pin Lugs | 10 |
| BS811HF | Standard (to 80°C) | Pin Lugs to Pin Lugs | 20 |
| BS811HG | Standard (to 80°C) | Pin Lugs to Pin Lugs | 30 |
| BS811HH | Standard (to 80°C) | Pin Lugs to Pin Lugs | 40 |
| BS810ZV | High Temp (to 125°C) | Pin Lugs to Pin Lugs | 10 |
| BS810ZW | High Temp (to 125°C) | Pin Lugs to Pin Lugs | 20 |
| BS810ZX | High Temp (to 125°C) | Pin Lugs to Pin Lugs | 30 |
| BS810ZY | High Temp (to 125°C) | Pin Lugs to Pin Lugs | 40 |

Table 13. Extension Cable for Junction Box with Amplifier (PH12***Q Only)

| Part No. | Temperature Range | Cable Terminations | Length (Feet) (a) |
|----------|--------------------|----------------------|-------------------|
| BS811HW | Standard (to 80°C) | Pin Lugs to Pin Lugs | 490 maximum |

a. Available to 490 ft maximum in 1 foot increments.

Table 14. Raw Cable, Unterminated, Maximum Continuous Length is 1000 ft

| Part No. | Temperature Range | Cable Terminations | Length (Feet) (a) |
|----------|--------------------------|-----------------------------|-------------------|
| P0170UU | Standard (to 80°C) (b) | None (Terminations by User) | 1000 maximum |
| P0170UA | High Temp (to 125°C) (b) | None (Terminations by User) | 1000 maximum |
| P0170UV | Standard (to 80°C) (c) | None (Terminations by User) | 1000 maximum |

a. Available in continuous lengths to 1000 feet in 1 foot increments.

b. Used with junction box not having an amplifier.

c. Used with junction box that has an amplifier.

Flow Chambers

Flow chambers are used with 120 mm (4.7 in) sensors for mounting in a system where a sample is provided by a small diameter sample line. The inlet and outlet ports of the chamber have 1/2 NPT threads, and connect to the system with user supplied fittings. The chamber is offered in 316L ss, Kynar, or CPVC. See Figure 18 and Table 15.

Figure 18. Flow Chamber and Optional Strain Relief Housing

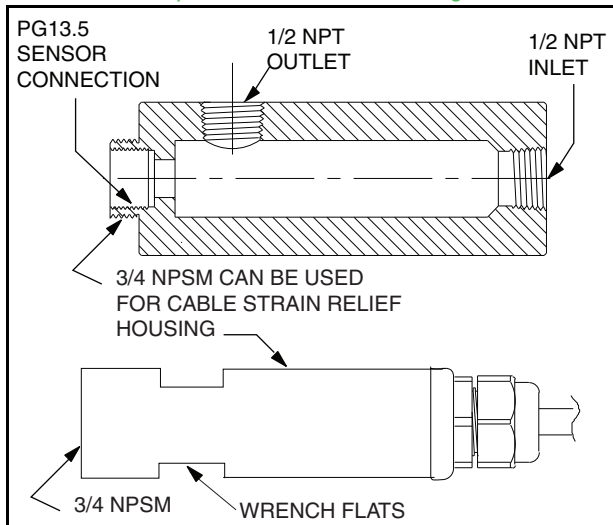


Table 15. Flow Chambers and Optional Strain Relief Housing

| Flow Chamber | | |
|--|---|----------|
| Material | Connection to Sensor | Part No. |
| 316L ss | PG 13.5 | BS813LA |
| Kynar | PG 13.5 | BS813LB |
| CPVC | PG 13.5 | BS813LC |
| Optional Strain Relief Housing | | |
| Material | Connection to Chamber | Part No. |
| Nylon (Analog) | 3/4 NPSM | BS812XU |
| Nylon (Smart) | 3/4 NPSM | BS814NM |
| Flow Chamber Pressure-Temperature Rating (a) | | |
| Material | Pressure-Temperature Rating | |
| 316L ss | 1.4 MPa at 140°C (200 psi at 284°F) | |
| Kynar | 0.7 MPa at 90°C (100 psi at 194°F) 0.35 MPa at 125°C (50 psi at 257°F) | |
| CPVC | 0.7 MPa at 70°C (100 psi at 158°F) 0.4 MPa at 85°C (60 psi at 185°F) | |

a. The pressure-temperature rating of the flow chamber is as listed. When the sensor is assembled to the chamber, the pressure-temperature limits of the assembled pair are as listed, or are the limits of the sensor itself, whichever is less.

Buffers for use with Model PH12 Sensors

Buffers are available as a solution, or in a salt packet. When provided in a salt packet, the buffer is mixed with 0.47 liters (16 fluid ounces) of distilled water to convert to a buffer solution. Refer to Table 16 for part numbers for Buffer Solutions and Salt Packets.

Table 16. Buffer Solutions and Salt Packets

| Type | Buffer Description | Part No. |
|-----------------|-----------------------------|----------|
| Buffer Solution | 4.00 pH, 0.47 L (16 fl oz) | Q0104KC |
| | 7.00 pH, 0.47 L (16 fl oz) | Q0104KB |
| | 10.00 pH, 0.47 L (16 fl oz) | Q0104KA |
| Salt Packet | 4.00 pH (a) | 1600100 |
| | 7.00 pH (a) | 1600101 |
| | 10.00 pH (a) | 1600102 |

a. Mix salt packet with 0.47 L (16 fl oz) of distilled water to convert to solution form.

MODEL CODE: PH12 PH AND ORP SENSOR

| Description | Model |
|--|-------|
| PH12 pH and ORP Sensor - 12 mm Diameter, PG 13.5 Process Connection | PH12 |
| Electrode Type | |
| pH, 0 to 14 pH, Wide Temperature Range Domed Glass, -25 to +125°C (-13 to +257°F) | -1 |
| pH, 0 to 14 pH, High-Temperature Domed Glass, 0 to 140°C (32 to 284°F) | -2 |
| pH, 0 to 12 pH, Flat Ruggedized Glass, -15 to +125°C (5 to 257°F) | -3 |
| ORP, Platinum, -25 to +125°C (-13 to +257°F) | -4 |
| pH/ORP Combination, 0 to 14 pH and ORP, Wide Temperature Range Domed Glass and Platinum, -25 to +125°C (-13 to +257°F) | -A |
| pH/ORP Combination, 0 to 14 pH and ORP, High-Temp Domed Glass and Platinum, 0 to 140°C (32 to 284°F) | -B |
| pH/ORP Combination, 0 to 12 pH and ORP, Flat Ruggedized Glass and Platinum, -15 to +125°C (5 to 257°F) | -C |
| Sensor Body Material | |
| Glass Body (a) | G |
| PEEK Body | P |
| Sensor Length | |
| 120 mm (4.7 in) | 1 |
| 225 mm (8.4 in) | 2 |
| 360 mm (14.2 in) | 3 |
| 425 mm (16.7 in) | 4 |
| Temperature Compensation | |
| 100 Ω Platinum RTD, 3-wire (b) | 1 |
| 1000 Ω Platinum RTD, 3-wire (b) | 2 |
| Sensor Termination | |
| Variopin Quick Connector Integral to Sensor Body (c) (d) | Q |
| Smart Connector with Digital Electronics Integral to Sensor Body (b) (c) (d) | S |
| Optional Selection | |
| Autoclave Cap (e) | -A |
| Biocompatibility Certificate | -B |
| Chemraz O-ring only | -C |
| EPDM Process O-Ring Seal and Process Electrode Seal (see Figure 1) (f) | -E |
| Kalrez O-ring only (f) | -K |
| Detailed Instruction Manual | -M |
| Electrical Certifications (g) | |
| ATEX, II 1 G Ex ia IIC, Intrinsic safe, Zone 0 | -AA |
| CSA/CSAus, Ex ia IIC, Intrinsically safe, Class I, Div 1, Zone 0 | -CA |
| CSA/CSAus, Nonincendive, Class I, Div 2 | -CN |
| FM/FMc AEx ia IIC, Intrinsically safe, Class I, Div 1, Zone 0 | -FA |
| FM/FMc Nonincendive, Class I, Div 2, | -FN |
| IECEX, Ex ia IIC, Intrinsic safe, Zone 0 | -DA |
| No Agency Certification | -ZZ |
| Example: PH12-3G12Q-E; PH12-2G21Q-MS | |

- a. Glass body available only with Sensor Length of 120 mm.
- b. Compatible with Analyzers and Transmitters that accept either 2-wire or 3-wire temperature elements.
- c. A mating Patch Cord is required with Sensor Termination selections Q and S. See footnote below for maximum length.
 - For Model Code PH12-****Q, use:
 - High Temp Patch Cords (-40°C to 125°C): BS810QA, BS810QB, BS810QC, BS810QD, BS810QE
 - Std Patch Cords (-40°C to 80°C): BS811GU, BS811GV, BS811GW, BS811GX, BS811GY
 - For Model Code PH12-****S, use: BS814KB, BS814KC, BS814KD, BS814KH, BS814KJ, BS814KK
- d. Maximum cable lengths as follows:
 - Model Code PH12-****Q without maximum length = 15m (50ft).
 - Model Code PH12****S with Smart Digital Technology maximum length = 100m (328 ft).
- e. Autoclave cap helps protect the Variopin and Smart connections during steam sterilization and autoclaving. The cap is shipped separate from the sensor.
- f. The standard process seals are Viton.

g. The sensors have been designed to meet the electrical safety descriptions listed in this table. Contact Global Customer Support for information or status of testing laboratory approvals or certifications.

MODEL CODE: FIT12 MOUNTING ACCESSORIES

| <u>Description</u> | <u>Model</u> |
|---|--------------|
| Mounting Accessories for PH12 Sensor | FIT12 |
| Sensor Holder/Protection | |
| Mounting Assembly for PH12 Sensor Holder - includes Protective Guarded Holder (a) | -1 |
| Mounting Assembly for PH12 Sensor Holder - includes Protective Unguarded Holder | -2 |
| Mounting Assembly for PH12 Sensor without Holder; For use with Process Connection Codes F* and N* only; cannot be configured with optional selections (cable strain relief housing or O-rings). | -3 |
| <u>Process Connection</u> | |
| DN 25 Threaded Type Sanitary Connection (b) (c) | DA |
| 3/4 in ANSI Class 150 Flange Connection | FA |
| 1 in ANSI Class 150 Flange Connection | FB |
| 1 1/2 in ANSI Class 150 Flange Connection | FC |
| 2 in ANSI Class 150 Flange Connection | FD |
| 3 in ANSI Class 150 Flange Connection | FF |
| 4 in ANSI Class 150 Flange Connection | FH |
| 3/4 NPT Connection | NA |
| 1 NPT Connection | NB |
| 1 NPT Adjustable Retraction/Insertion Assembly (a) | RB |
| 1 1/4 NPT Adjustable Retraction/Insertion Assembly (a) | RJ |
| 1 1/2 NPT Adjustable Retraction/Insertion Assembly (a) | RC |
| 1 NPT Adjustable Retraction/Insertion Assembly for Smart Assembly (a) | RM |
| 1 1/4 NPT Adjustable Retraction/Insertion Assembly for Smart Assembly (a) | RT |
| 1 1/2 NPT Adjustable Retraction/Insertion Assembly for Smart Assembly (a) | RN |
| 3/4 NPT Pipe Adapter (d) | SA |
| 1 NPT Pipe Adapter (d) | SB |
| 1 in Tri-Clamp Type Sanitary Connection (b) (c) | TB |
| 1 1/2 in Tri-Clamp Type Sanitary Connection (b) (c) | TC |
| 2 in Tri-Clamp Type Sanitary Connection (b) (c) | TD |
| <u>Immersion Length (e)</u> | |
| Immersion Length dictated by Electrode; select with Sensor Holder Code -3 only. | 000 |
| 25 mm (1 in) Immersion Length (f) | 025 |
| 33 mm (1.3 in) Immersion Length (f) | 033 |
| 40 mm (1.6 in) Immersion Length (g) | 040 |
| 70 mm (2.8 in) Immersion Length | 070 |
| 100 mm (4.0 in) Immersion Length | 100 |
| 150 mm (5.9 in) Immersion Length (g) | 150 |
| 175 mm (6.9 in) Immersion Length | 175 |
| 200 mm (7.9 in) Immersion Length | 200 |
| 275 mm (10.8 in) Immersion Length (g) | 275 |
| 375 mm (14.8 in) Immersion Length (g) | 375 |
| <u>Holder and/or Process Connection Material</u> | |
| 316L ss | L |
| CPVC | C |
| Kynar | K |
| Titanium (h) | T |

MODEL CODE: FIT12 MOUNTING ACCESSORIES (CONTINUED)

| Optional Selections | |
|--|----|
| Cable Strain Relief Housing for Variopin Connector (i) | -1 |
| Cable Strain Relief Housing for Smart Connector (j) | -2 |
| EPDM O-Rings (k) (l) (m) | -E |
| Chemraz O-Rings (k) (l) (m) | -C |
| Kalrez O-Rings (k) (l) (m) | -K |
| Perfluoroelastomer (FFKM) O-Rings (k) (l) (m) | -P |
| Examples: FIT12-1FB040L-1E; FIT12-3NA000L; FIT12-1RB150T-E | |

- a. Process Connection Codes RB, RJ, and RC are only available with Sensor Holder Code -1.
- b. Available with Holder Material Code L (316L ss) only.
- c. All Sanitary Process Connections are RA15, or better.
- d. Pipe adapters have NPT threads on both ends. Only available with Immersion Length Codes 040 and 070.
- e. See Table 17 for allowable combinations of Sensor Codes, Sensor Lengths, and Immersion Lengths.
- f. Immersion Length Codes 025 and 033 are not available with Process Connection Code -DA (DN 25 Connection).
- g. See Table 18 for allowable combination of Sensor Holder Code FIT12 -1R*, Sensor Length, and Immersion Lengths.
- h. Holder Material Code T (Titanium) is only available with Model Code Selections FIT12-1RB, FIT12-1RJ, and FIT12-1RC.
- i. Optional Cable strain relief housing is only offered with Sensor Holder Codes -1 and -2. It is provided as standard with Process Connection Codes RB, RJ, and RC.
- j. Optional Cable strain relief housing is only offered with Sensor Holder Codes -1 and -2. It is provided as standard with Process Connection Codes RB, RJ. Process Connection Codes RM, RT, and RN for Smart.
- k. Standard O-Ring material is Viton.
- l. Either -E, -C, -K or -P may be selected individually. However, only one of these choices may be selected.
- m. O-rings are only offered with Sensor Holder Codes -1 and -2.

Table 17. Allowable Combination of Sensor Codes, Sensor Lengths, and Immersion Lengths

| Sensor Code | Sensor Length | FIT12 Immersion Code and Length | |
|-------------|------------------|---------------------------------|------------------|
| | | Code | Immersion Length |
| PH12-**1 | 120 mm (4.7 in) | 025 | 25 mm (1 in) |
| | 120 mm (4.7 in) | 033 | 33 mm (1.3 in) |
| | 120 mm (4.7 in) | 040 | 40 mm (1.6 in) |
| | 120 mm (4.7 in) | 070 | 70 mm (2.8 in) |
| PH12-**2 | 225 mm (8.9 in) | 100 | 100 mm (4.0 in) |
| | 225 mm (8.9 in) | 150 | 150 mm (5.9 in) |
| | 225 mm (8.9 in) | 175 | 175 mm (6.9 in) |
| PH12-**3 | 360 mm (14.2 in) | 200 | 200 mm (7.9 in) |
| | 360 mm (14.2 in) | 275 | 275 mm (10.8 in) |
| PH12-**4 | 425 mm (16.7 in) | 375 | 375 mm (14.8 in) |

Table 18. Allowable Combination of Sensor Holder Code FIT12- 1R*, Sensor Length, and Immersion Length

| Sensor Holder Code | Sensor Code and Length | | Immersion Code and Immersion and Adjustable Length | | |
|--------------------|------------------------|------------------|--|------------------|----------------------------|
| | Code | Length | Code | Immersion Length | Adjustable Length |
| FIT12-1R* | PH12-**1 | 120 mm (4.7 in) | 040 | 40 mm (1.6 in) | 0 to 40 mm (0 to 1.6 in) |
| | PH12-**2 | 225 mm (8.9 in) | 150 | 150 mm (5.9 in) | 0 to 145 mm (0 to 5.7 in) |
| | PH12-**3 | 360 mm (14.2 in) | 275 | 275 mm (10.8 in) | 0 to 280 mm (0 to 11.0 in) |
| | PH12-**4 | 425 mm (16.7 in) | 375 | 375 mm (14.8 in) | 0 to 346 mm (0 to 13.6 in) |

MODEL CODE: BALL VALVE INSERTION ASSEMBLY

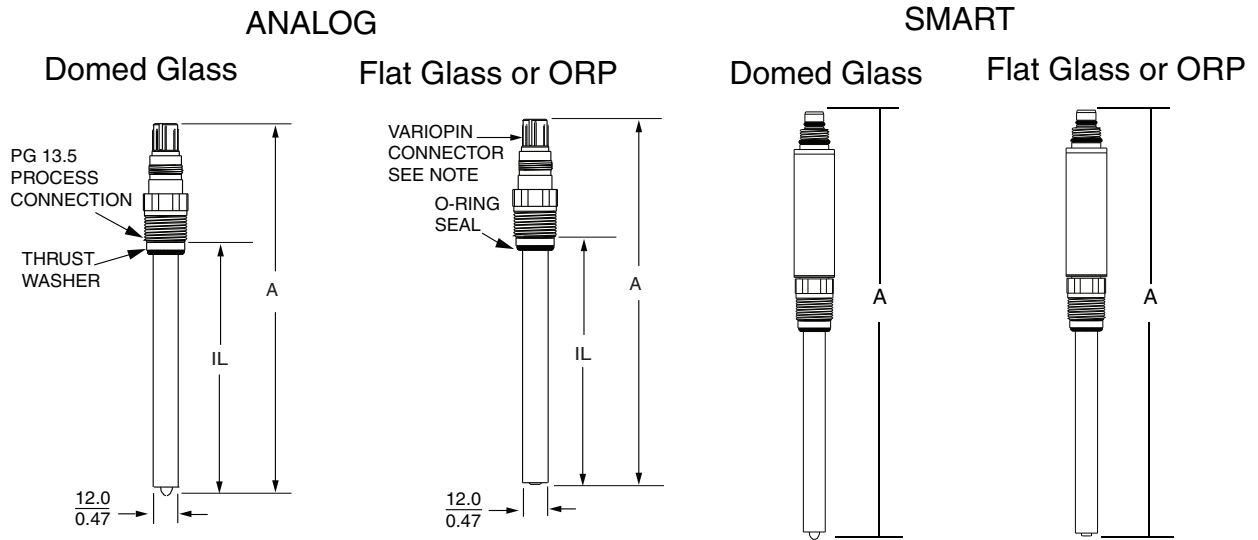
| Description | Model |
|--|-------|
| Ball Valve Insertion Assembly | BVA |
| Sensor Type | |
| For use with PH12 Sensor;120 mm (4.7 in) long only; 1 1/4 in Full Port Valve (a) | -PHD |
| For use with PH12 Smart Sensor;120 mm (4.7 in) long only; 1 1/4 in Full Port Valve | -PHF |
| <u>Process Wetted Material</u> | |
| Stainless Steel 316L | 1 |
| Titanium | 2 |
| <u>O-Ring Material</u> | |
| Chemraz O-Rings | C |
| EPDM O-Rings | E |
| Kalrez O-Rings | K |
| Perfluoroelastomer (FFKM) O-Rings | P |
| Viton O-Rings | V |
| <u>Insertion Length</u> | |
| 0 – 20 cm (0 to 8 in) includes ball valve and nipple | 08 |
| 0 – 40 cm (0 to 16 in) includes ball valve and nipple | 16 |
| 0 - 60 cm (0 to 24 in) includes ball valve and nipple | 24 |
| 0 - 80 cm (0 to 32 in) includes ball valve and nipple | 32 |
| Custom Insertion Length, includes ball valve and nipple 20cm (8 in) increments (b) | xx |
| <u>Optional Selections</u> | |
| Insertion Assembly (a) (c) | -A |
| 1½"ANSI 150# Flange | -C |
| 2" ANSI 150# Flange | -D |
| 3" ANSI 150# Flange | -F |
| 4" ANSI 150# Flange | -H |
| Safety Guard (d) | -S |
| Unguarded Holder (a) | -U |
| Example: BVA-PHD1V08-U | |

- a. Standard sensor mounting is Guarded for PH12 Ball Valve Insertion assemblies, Model codes BVA-PHD..., select -U for unguarded sensor mounting.
- b. Contact Global Customer Support, prior approval required.
- c. No valve or nipple supplied.
- d. Not available with Optional Selection -A.

DIMENSIONS - NOMINAL

mm
in

MODEL PH12 SENSOR WITH NO MOUNTING ACCESSORIES



DIMENSIONS

| Dimension (a) | Electrode Type | Sensor Length | | | |
|---------------|-------------------|-----------------|-----------------|-----------------|-----------------|
| | | 120 mm (4.7 in) | 225 mm (8.9 in) | 360mm (14.2 in) | 425mm (16.7 in) |
| IL | Domed Glass | 120 (4.7) | 225 (8.9) | 360 (14.2) | 425 (16.7) |
| | Flat Glass or ORP | 117 (4.6) | 222 (8.7) | 357 (14.1) | 422 (16.6) |
| A (Analog) | Domed Glass | 176 (6.9) | 281 (11.1) | 416 (16.4) | 481 (18.9) |
| | Flat Glass or ORP | 173 (6.8) | 278 (10.9) | 413 (16.3) | 478 (18.8) |
| A (Smart) | Domed Glass | 234 (9.2) | 340 (13.4) | 475 (18.7) | 539 (21.2) |
| | Flat Glass or ORP | 231 (9.1) | 335 (13.2) | 472 (18.6) | 536 (21.1) |

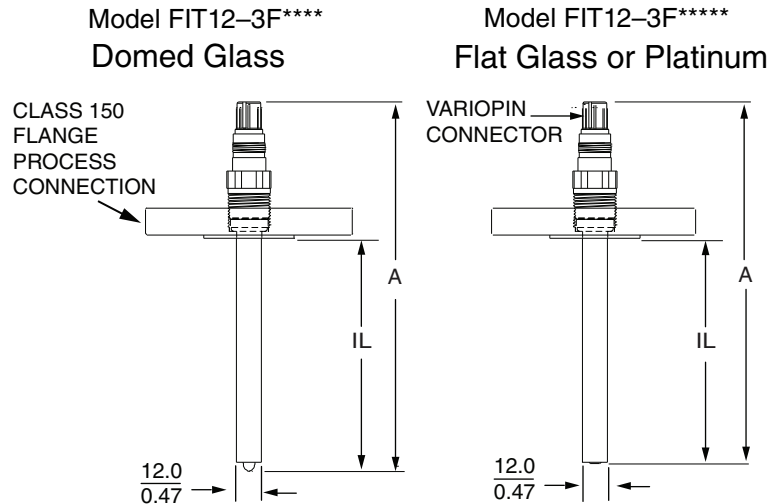
a. IL = Maximum Immersion Length.

NOTE

1. An optional Autoclave Cap (PH12 Sensor Option -A) screws on to the Variopin connector, and helps protect the Variopin or Smart connections during the steam sterilization and autoclaving process. See Optional Autoclave Cap further in this document.
2. Also refer to Dimensional Print DP 611-214.

mm
in

MODEL PH12 SENSOR WITH MODEL FIT12-3 MOUNTING ACCESSORIES
(ANALOG SHOWN FOR REFERENCE)



| Dimension (a) | Electrode Type | Immersion Length Code (b) | Flange Code | Sensor Length | | | |
|---------------|------------------------|---------------------------|------------------------|-----------------|-----------------|-----------------|-----------------|
| | | | | 120 mm (4.7 in) | 225 mm (8.9 in) | 360mm (14.2 in) | 425mm (16.7 in) |
| IL | Domed Glass | 000 | FA, FB, FC | 112 (4.4) | 217 (8.5) | 352 (13.9) | 417 (16.4) |
| | | 000 | FD | 109 (4.3) | 206 (8.1) | 341 (13.4) | 406 (16.0) |
| | | 000 | FF, FH | 104 (4.1) | 190 (7.5) | 325 (12.8) | 390 (15.4) |
| | Flat Glass or Platinum | 000 | FA, FB, FC | 109 (4.3) | 206 (8.1) | 341 (13.4) | 406 (16.0) |
| | | 000 | FD | 107 (4.2) | 201 (7.9) | 336 (13.2) | 401 (15.8) |
| | | 000 | FF, FH | 102 (4.0) | 183 (7.2) | 318 (12.5) | 383 (15.1) |
| A (Analog) | Domed Glass | 000 | FA, FB, FC, FD, FF, FH | 176 (6.9) | 281 (11.1) | 416 (16.4) | 481 (18.9) |
| | Flat Glass or Platinum | 000 | FA, FB, FC, FD, FF, FH | 173 (6.8) | 278 (10.9) | 413 (16.3) | 478 (18.8) |
| A (Smart) | Domed Glass | 000 | FA, FB, FC, FD, FF, FH | 234 (9.2) | 340 (13.4) | 475 (18.7) | 538 (21.2) |
| | Flat Glass or Platinum | 000 | FA, FB, FC, FD, FF, FH | 231 (9.1) | 335 (13.2) | 472 (18.6) | 536 (21.1) |

a. IL - Maximum Immersion Length.

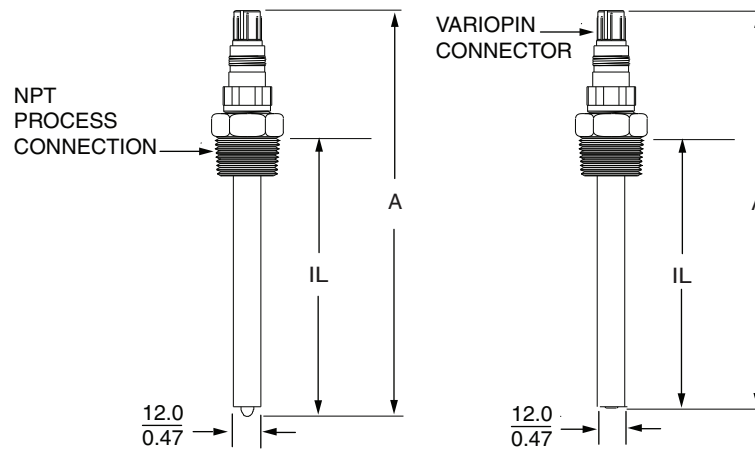
b. Immersion Length Code 000 must be selected when no holder assembly is used.

$\frac{\text{mm}}{\text{in}}$

MODEL PH12 SENSOR WITH MODEL FIT12-3 MOUNTING ACCESSORIES

Model FIT12-3N*****
Domed Glass

Model FIT12-3N*****
Flat Glass or Platinum



| Dimension (a) | Electrode Type | Immersion Length Code (b) | NPT Code | Sensor Length | | | |
|---------------|------------------------|---------------------------|----------|-----------------|-----------------|-----------------|-----------------|
| | | | | 120 mm (4.7 in) | 225 mm (8.9 in) | 360mm (14.2 in) | 425mm (16.7 in) |
| IL | Domed Glass | 000 | NA, NB | 122 (4.8) | 227 (8.9) | 362 (14.3) | 427 (16.8) |
| | Flat Glass or Platinum | 000 | NA, NB | 119 (4.7) | 224 (8.8) | 359 (14.1) | 424 (16.7) |
| A (Analog) | Domed Glass | 000 | NA, NB | 176 (6.9) | 281 (11.1) | 416 (16.4) | 481 (18.9) |
| | Flat Glass or Platinum | 000 | NA, NB | 173 (6.8) | 278 (10.9) | 413 (16.3) | 478 (18.8) |
| A (Smart) | Domed Glass | 000 | NA, NB | 234 (9.2) | 340 (13.4) | 475 (18.7) | 538 (21.2) |
| | Flat Glass or Platinum | 000 | NA, NB | 231 (9.1) | 335 (13.2) | 472 (18.6) | 536 (21.1) |

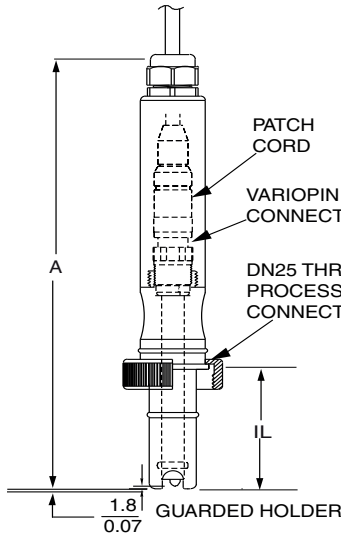
a. IL - Maximum Immersion Length.

b. Immersion Length Code 000 must be selected when no holder assembly is used.

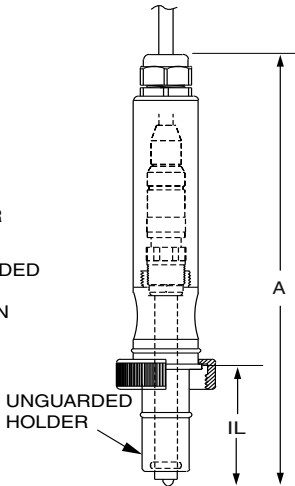
mm
in

MODEL PH12 SENSOR WITH MODELS FIT12-1/FIT12-2 MOUNTING ACCESSORIES

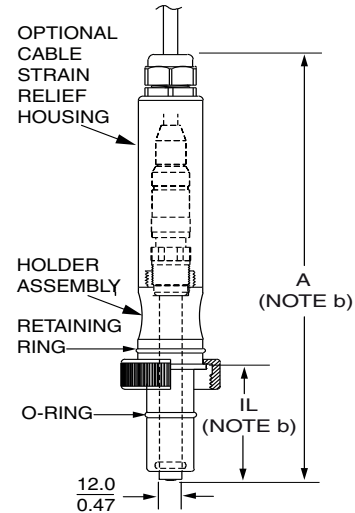
Model FIT12-1DA*** - 1
Domed Glass/Guarded



Model FIT12-2DA***L - 1
Domed Glass/Unguarded



Model FIT12-2DA***L - 1
Flat Electrode/Unguarded



| Dimension (a) | Electrode Type (b) | Immersion Length Code | Sensor Length | | | |
|----------------|--------------------|-----------------------|-----------------|-----------------|------------------|------------------|
| | | | 120 mm (4.7 in) | 225 mm (8.9 in) | 360 mm (14.2 in) | 425 mm (16.7 in) |
| IL (b) | Domed Glass | 040 | 40 (1.6) | - | - | - |
| | | 070 | 70 (2.8) | - | - | - |
| | | 100 | - | 100 (4.0) | - | - |
| | | 150 | - | 150 (5.9) | - | - |
| | | 175 | - | 175 (6.9) | - | - |
| | | 200 | - | - | 200 (7.9) | - |
| | | 275 | - | - | 275 (10.8) | - |
| | | 375 | - | - | - | 375 (14.8) |
| A (Analog) (b) | Domed | All | 259 (10.2) | 364 (14.3) | 499 (19.6) | 564 (22.2) |
| A (Smart) (b) | Domed | All | 345 (13.6) | 450 (17.7) | 584 (23) | 650 (25.6) |

a. IL - Maximum Immersion Length.

b. Dimensions IL and A are shown for the domed electrode configuration. For flat electrode (flat glass or platinum) dimensions, deduct 3.3 mm (0.13 in) from the dimensions in the table.

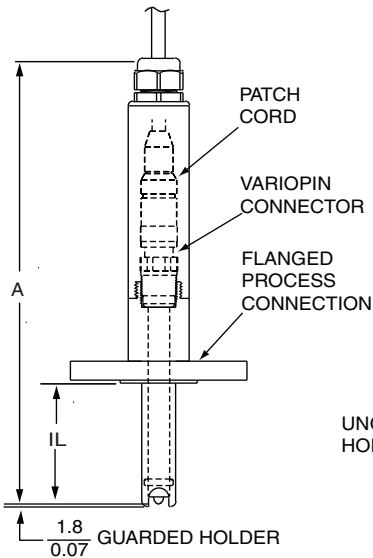
NOTE

1. For overall length without optional cable strain relief housing, refer to Model PH12 dimensions shown in the DIMENSIONS-NOMINAL section.
2. For dimensions of Optional Cable Strain Relief Housing (Option -1), refer to Dimensional Drawing of the housing in this document.
3. Refer to Dimensional Print, DP 611-214.

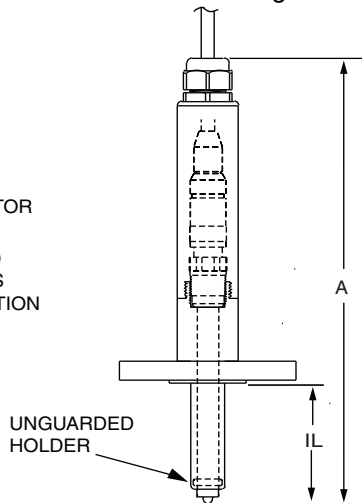
mm
in

MODEL PH12 SENSOR WITH MODELS FIT12-1/FIT12-2 MOUNTING ACCESSORIES

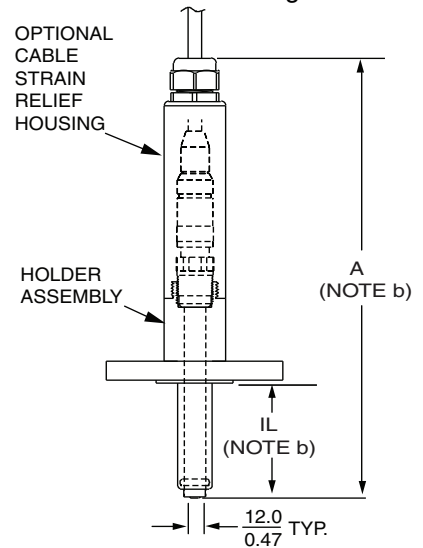
Model FIT12-1F**** - 1
Domed Glass/Guarded



Model FIT12-2F**** - 1
Domed Glass/Unguarded



Model FIT12-2F**** - 1
Flat Electrode/Unguarded

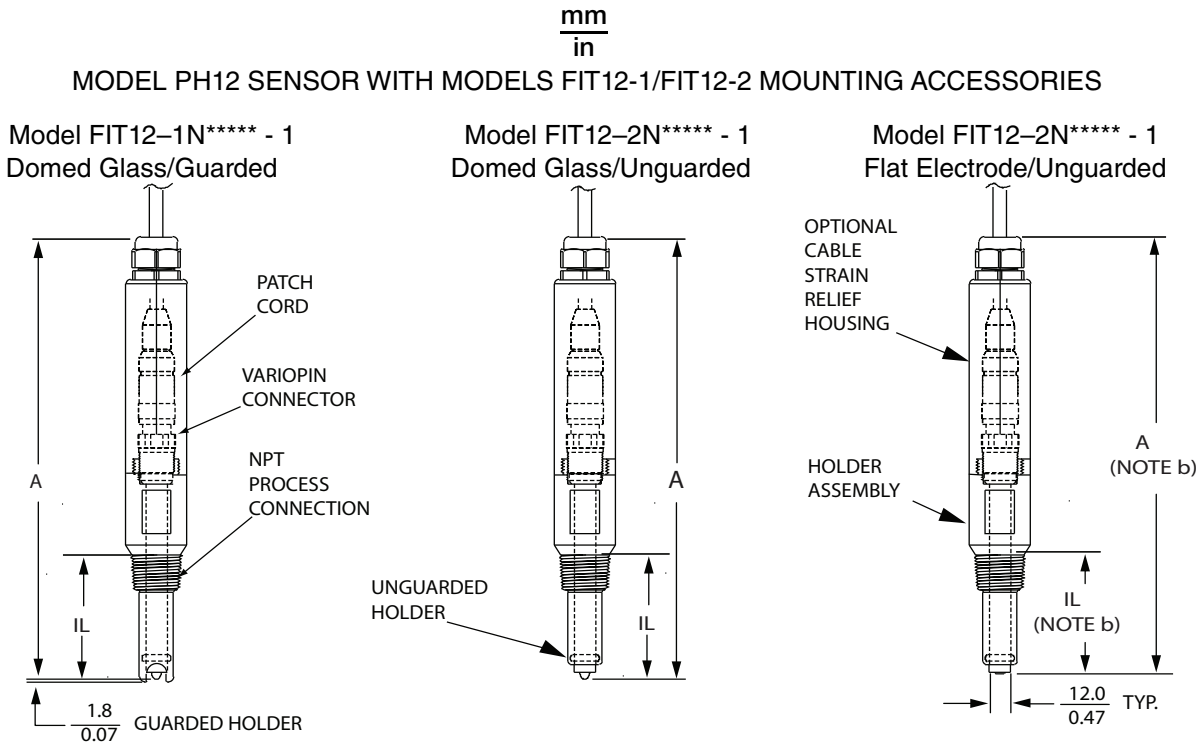


| Dimension (a) | Electrode Type (b) | Immersion Length Code | Sensor Length | | | |
|----------------|--------------------|-----------------------|-----------------|-----------------|-----------------|-----------------|
| | | | 120 mm (4.7 in) | 225 mm (8.9 in) | 360mm (14.2 in) | 425mm (16.7 in) |
| IL (b) | Domed Glass | 025 | 25 (1.0) | - | - | - |
| | | 033 | 33 (1.3) | - | - | - |
| | | 040 | 40 (1.6) | - | - | - |
| | | 070 | 70 (2.8) | - | - | - |
| | | 100 | - | 100 (4.0) | - | - |
| | | 150 | - | 150 (5.9) | - | - |
| | | 175 | - | 175 (6.9) | - | - |
| | | 200 | - | - | 200 (7.9) | - |
| | | 275 | - | - | 275 (10.8) | - |
| | | 375 | - | - | - | 375 (14.8) |
| A (Analog) (b) | Domed | ALL | 259 (10.2) | 364 (14.3) | 499 (19.6) | 564 (22.2) |
| A (Smart) (b) | Domed | ALL | 345 (13.6) | 450 (17.7) | 584 (23) | 650 (25.6) |

- a. IL - Maximum Immersion Length.
- b. Dimensions IL and A are shown for the domed electrode configuration. For flat electrode (flat glass or platinum) dimensions, deduct 3.3 mm (0.13 in) from the dimensions in the table.

NOTE

1. For overall length without optional cable strain relief housing, refer to Model PH12 dimensions shown in the DIMENSIONS-NOMINAL section.
2. For dimensions of Optional Cable Strain Relief Housing (Option -1), refer to Dimensional Drawing of the housing in this document.
3. Refer to Dimensional Print, DP 611-214.



| Dimension (a) | Electrode Type (b) | Immersion Length Code | Sensor Length | | | |
|---------------|--------------------|-----------------------|-----------------|-----------------|------------------|------------------|
| | | | 120 mm (4.7 in) | 225 mm (8.9 in) | 360 mm (14.2 in) | 425 mm (16.7 in) |
| IL (b) | Domed Glass | 025 | 25 (1.0) | - | - | - |
| | | 033 | 33 (1.3) | - | - | - |
| | | 040 | 40 (1.6) | - | - | - |
| | | 070 | 70 (2.8) | - | - | - |
| | | 100 | - | 100 (4.0) | - | - |
| | | 150 | - | 150 (5.9) | - | - |
| | | 175 | - | 175 (6.9) | - | - |
| | | 200 | - | - | 200 (7.9) | - |
| | | 275 | - | - | 275 (10.8) | - |
| | | 375 | - | - | - | 375 (14.8) |
| A (Analog) | Domed | ALL | 259 (10.2) | 364 (14.3) | 499 (19.6) | 564 (22.2) |
| A (Smart) | Domed | ALL | 345 (13.6) | 450 (17.7) | 584 (23) | 650 (25.6) |

a. IL - Maximum Immersion Length

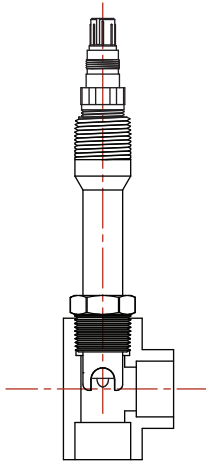
b. Dimensions IL and A are shown for the domed electrode configuration. For flat electrode (flat glass or platinum) dimensions, deduct 3.3 mm (0.13 in) from the dimensions in the table.

NOTE

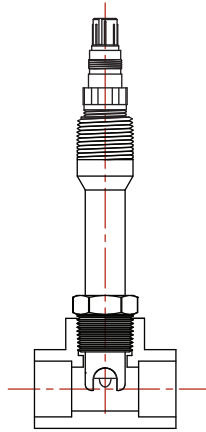
1. For overall length without optional cable strain relief housing, refer to Model PH12 dimensions shown in the DIMENSIONS-NOMINAL section.
2. For dimensions of Optional Cable Strain Relief Housing (Option -1), refer to Dimensional Drawing of housing in the document.
3. Refer to Dimensional Print, DP 611-214.

MODEL PH12 SENSORS WITH MODELS FIT12-1NA/FIT12-NB MOUNTING ACCESSORIES
USER-SUPPLIED TEE AND BUSHING INSTALLATION OPTIONS

FIT12-1NA033□
33 mm (1.3 in) IMMERSION

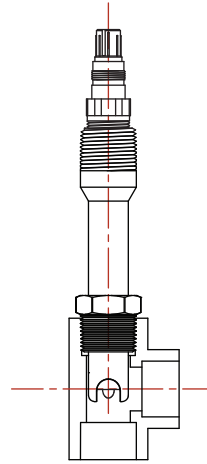


VERTICAL 1/4" NPT
TEE INSTALLATION

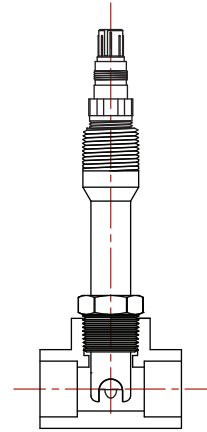


HORIZONTAL 1/4" NPT
TEE INSTALLATION

FIT12-1NA040□
40 mm (1.6 in) IMMERSION

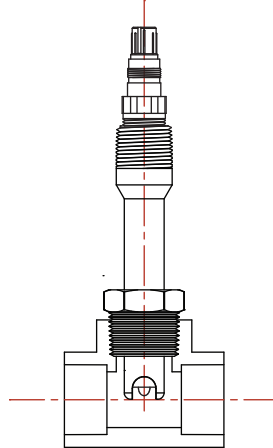


VERTICAL 1/4" NPT
TEE INSTALLATION



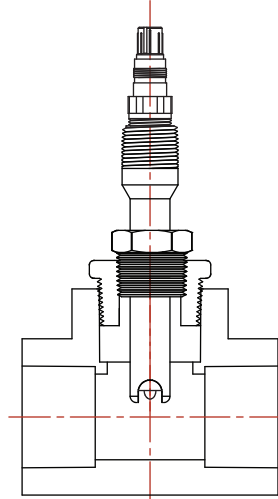
HORIZONTAL 1/4" NPT
TEE INSTALLATION

FIT12-1NB040□
40 mm (1.6 in) IMMERSION



HORIZONTAL 1" NPT
TEE INSTALLATION*

FIT12-1NB070□
70 mm (2.8 in) IMMERSION



HORIZONTAL 1 1/2" NPT
TEE INSTALLATION* WITH
USER-SUPPLIED TEE AND
BUSHING

* VERTICAL INSTALLATION NOT SHOWN

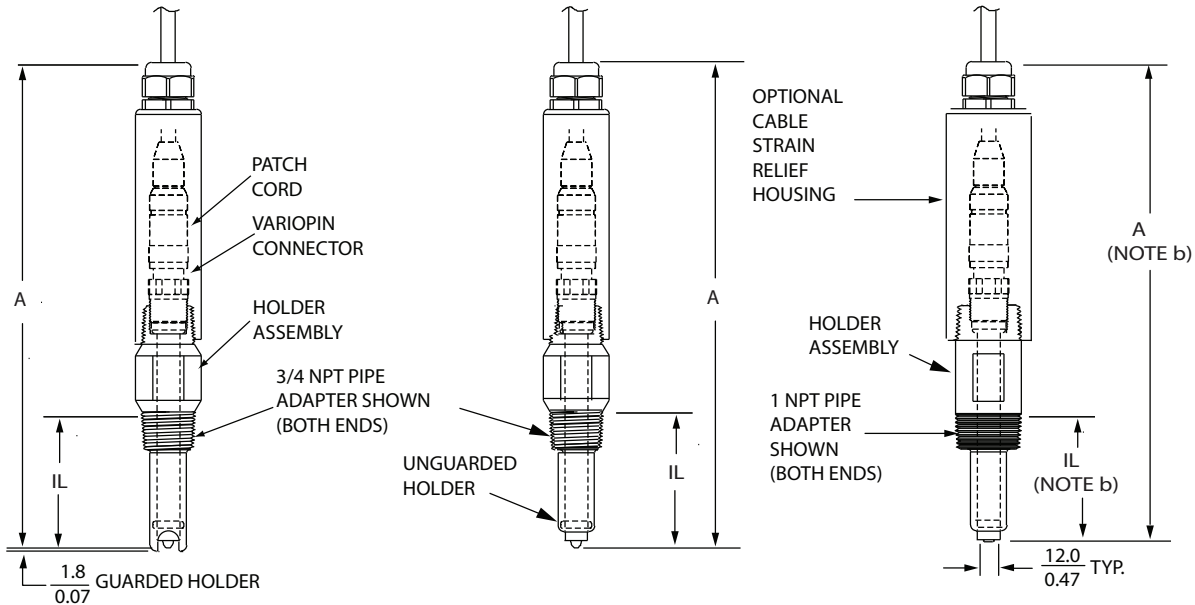
mm
in

MODEL PH12 SENSOR WITH MODELS FIT12-1/FIT12-2 MOUNTING ACCESSORIES

Model FIT12-1SA**** - 1
Domed Glass/Guarded

Model FIT12-2SA**** - 1
Domed Glass/Unguarded

Model FIT12-2SB**** - 1
Flat Electrode/Unguarded



| Dimension (a) | Electrode Type (b) | Immersion Length Code (c) | Pipe Adaptor Code | Sensor Length | |
|----------------|--------------------|---------------------------|-------------------|-----------------|--|
| | | | | 120 mm (4.7 in) | |
| IL (b) | Domed Glass | 040 | SA, SB | 40 (1.6) | |
| | | 070 | SA, SB | 70 (2.8) | |
| A (Analog) (b) | Domed Glass | 040 | SA, SB | 229 (9.0) | |
| | | 070 | SA, SB | 259 (10.2) | |
| A (Smart) (b) | Domed Glass | 040 | SA, SB | 315 (12.4) | |
| | | 070 | SA, SB | 354 (13.6) | |

- a. IL - Maximum Immersion Length.
- b. Dimensions IL and A are shown for the domed electrode configuration. For flat electrode (flat glass or platinum) dimensions, deduct 3.3 mm (0.13 in) from the dimensions in the table.
- c. Immersion Length Codes 000, 025, and 033 are not available with a holder assembly.

NOTE

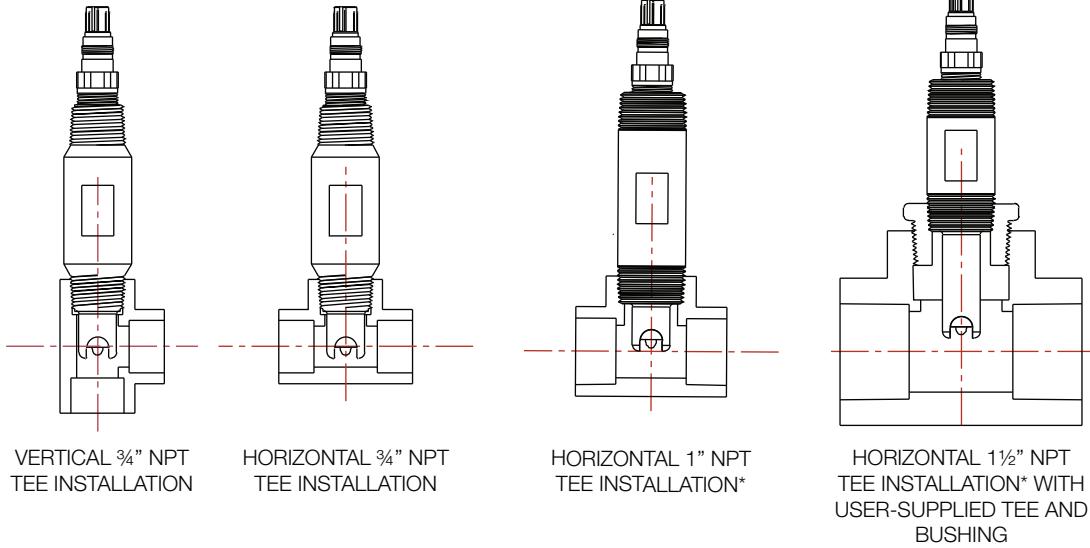
1. For overall length without optional cable strain relief housing, refer to Model PH12 dimensions shown in the DIMENSIONS-NOMINAL section.
2. For dimensions of Optional Cable Strain Relief Housing (Option-1), refer to Dimensional Drawing of housing in this document.
3. Refer Dimensional Print, DP 611-214.

MODEL PH12 SENSORS WITH MODELS FIT12-1SA/FIT12-SB MOUNTING ACCESSORIES
USER-SUPPLIED TEE AND BUSHING INSTALLATION OPTIONS

FIT12-1SA040□
40 mm (1.6 in) IMMERSION

FIT12-1SB040□
40 mm (1.6 in) IMMERSION

FIT12-1SB070□
70 mm (2.8 in) IMMERSION

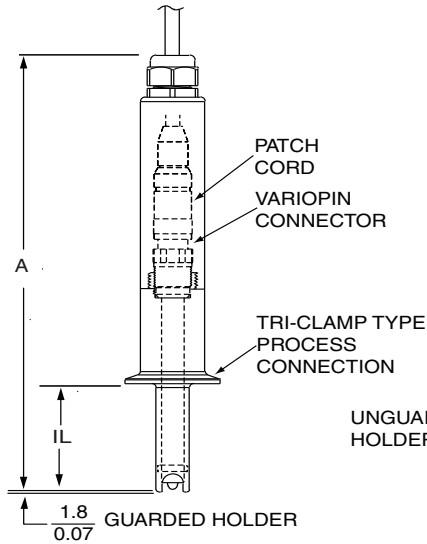


* VERTICAL INSTALLATION NOT SHOWN

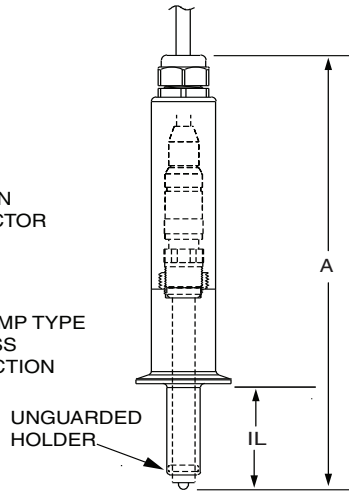
mm
in

MODEL PH12 SENSOR WITH MODELS FIT12-1/FIT12-2 MOUNTING ACCESSORIES

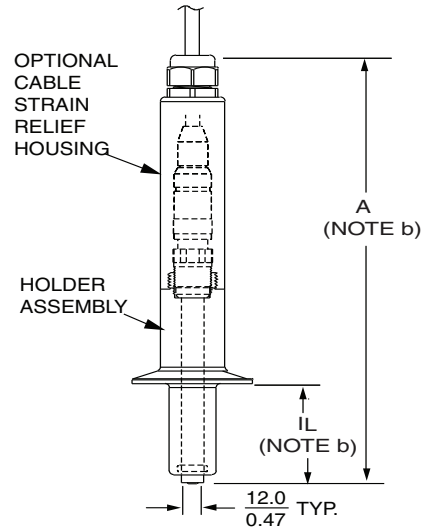
Model FIT12-1TB***L - 1
Domed Glass/Guarded



Model FIT12-2TC***L - 1
Domed Glass/Unguarded



Model FIT12-2TD***L - 1
Flat Electrode/Unguarded



| Dimension (a) | Electrode Type (b) | Immersion Length Code | Sensor Length | | | |
|---------------|--------------------|-----------------------|-----------------|-----------------|-----------------|-----------------|
| | | | 120 mm (4.7 in) | 225 mm (8.9 in) | 360mm (14.2 in) | 425mm (16.7 in) |
| IL (b) | Domed Glass | 040 | 40 (1.6) | - | - | - |
| | | 070 | 70 (2.8) | - | - | - |
| | | 100 | - | 100 (4.0) | - | - |
| | | 150 | - | 150 (5.9) | - | - |
| | | 175 | - | 175 (6.9) | - | - |
| | | 200 | - | - | 200 (7.9) | - |
| | | 275 | - | - | 275 (10.8) | - |
| | | 375 | - | - | - | 375 (14.8) |
| A (Analog) | Domed | ALL | 259 (10.2) | 364 (14.3) | 499 (19.6) | 564 (22.2) |
| A (Smart) | Domed | ALL | 345 (13.6) | 450 (17.7) | 584 (23) | 650 (25.6) |

a. IL - Maximum Immersion Length.

b. Dimensions IL and A are shown for the domed electrode configuration. For flat electrode (flat glass or platinum) dimensions, deduct 3.3 mm (0.13 in) from the dimensions in the table.

NOTE

1. For overall length without optional cable strain relief housing, refer to Model PH12 dimensions shown in the DIMENSIONS-NOMINAL section.
2. For dimensions of Optional Cable Strain Relief Housing (Option-1), refer to Dimensional Drawing of housing in this document.
3. Refer to Dimensional Print DP 611-214.

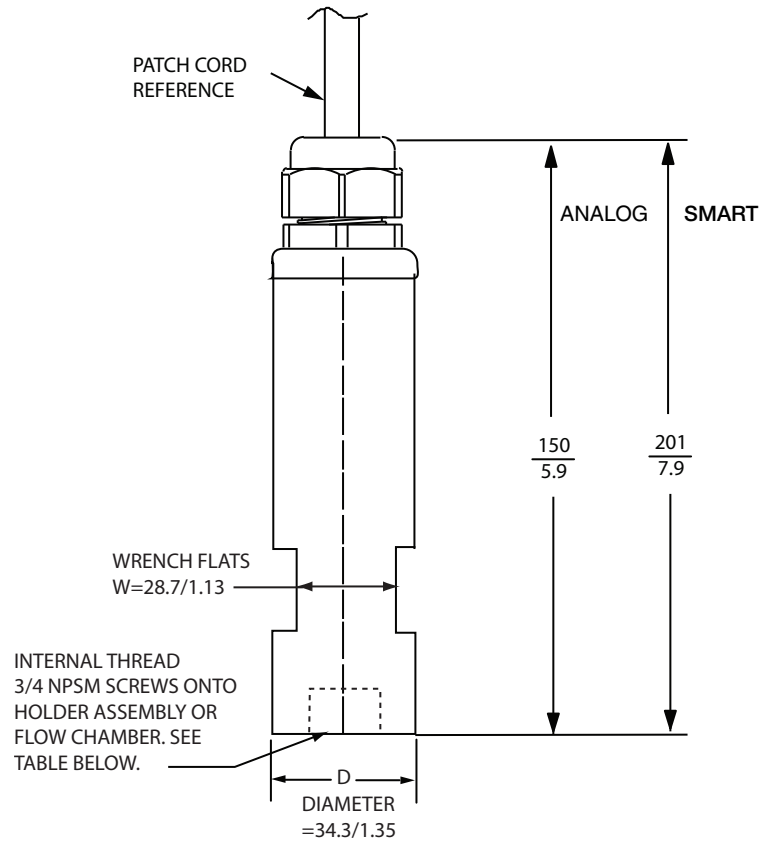
mm
in

OPTIONAL CABLE STRAIN RELIEF HOUSING
(ANALOG SHOWN FOR REFERENCE ONLY)

Model FIT-1***** - 1

and

Model FIT-2***** - 1

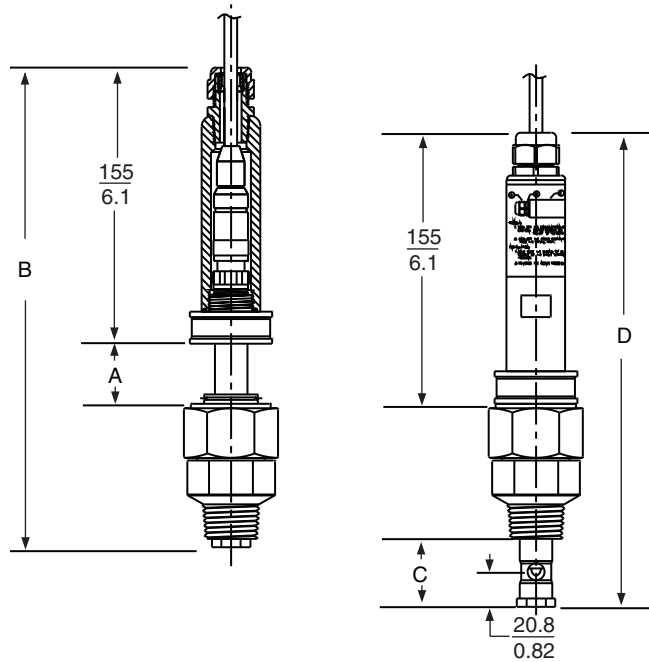


NOTE

Also refer to Dimensional Print DP 611-214.

$\frac{\text{mm}}{\text{in}}$

MODEL PH12 SENSOR WITH MODEL FIT12-1R*****
RETRACTION/INSERTION ACCESSORY

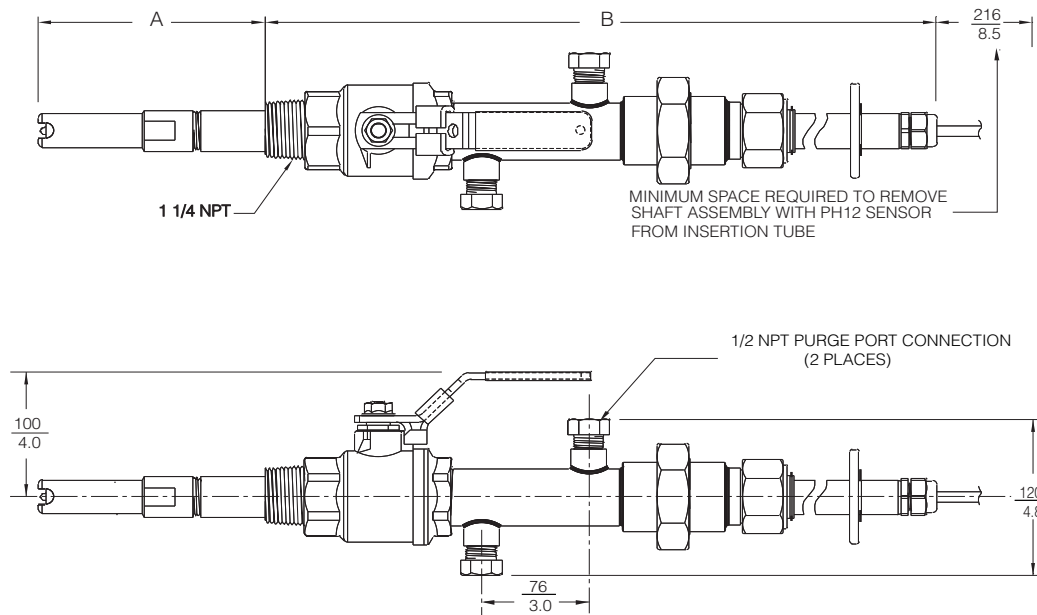


| Dimension | Sensor Lengths | | | |
|------------|-----------------------------|------------------------------|-------------------------------|-------------------------------|
| | 120 mm (4.7 in) | 225 mm (8.4 in) | 360 mm (14.2 in) | 425 mm (16.7 in) |
| A | 0 to 36 mm (0 to 1.4 in) | 0 to 141 mm (0 to 5.6 in) | 0 to 276 mm (0 to 10.9 in) | 0 to 342 mm (0 to 13.5 in) |
| B (Analog) | 280 mm (11.0 in) | 384 mm (15.1 in) | 521 mm (20.5 in) | 584 mm (23.0 in) |
| B (Smart) | 330 mm (13.0 in) | 434 mm (17.1 in) | 564 mm (22.2 in) | 635 mm (25 in) |
| C | 0 to 40 mm (0 to 1.6 in) | 0 to 145 mm (0 to 5.7 in) | 0 to 280 mm (0 to 11.1 in) | 0 to 346 mm (0 to 13.6 in) |
| D (Analog) | 280 mm (11.0 in) | 384 mm (15.1 in) | 521 mm (20.5 in) | 584 mm (23.0 in) |
| D (Smart) | 330 mm (13.0 in) | 434 mm (17.1 in) | 564 mm (22.2 in) | 635 mm (25 in) |

NOTE

Also refer to Dimensional Print DP 611-214.

BALL VALVE INSERTION ASSEMBLY

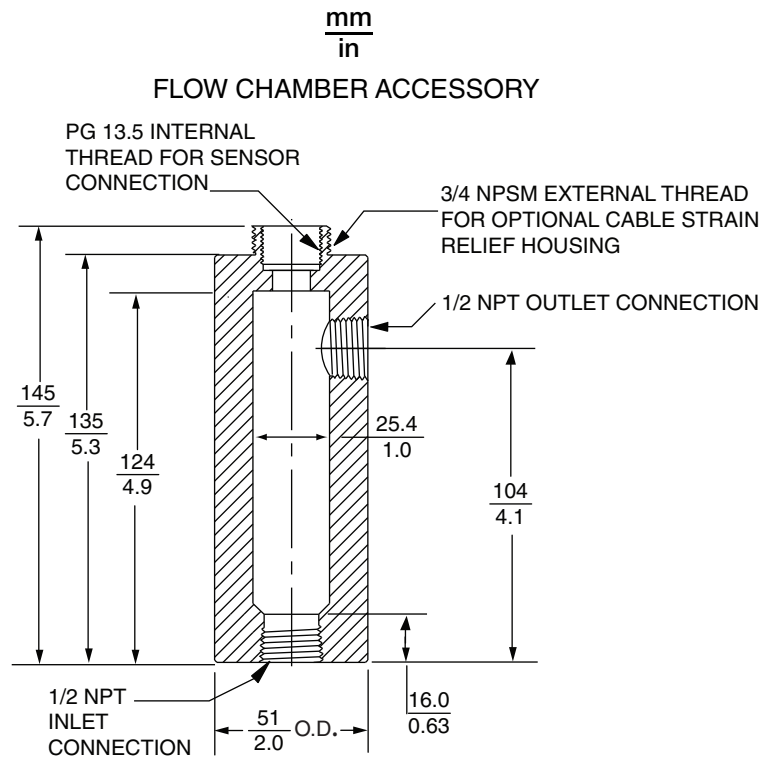


| Ball Valve Material | Dimension "A" Insertion Length | Dimension "B" (a) Overall Length for Analog Sensor | Dimension "B" (b) Overall Length for Smart Sensor |
|---------------------|--|--|---|
| 316 ss | 0 to 20 cm (0 to 8 in) | 75 cm (29.5 in) | 78 cm (30.6 in) |
| 316 ss | 0 to 40 cm (0 to 16 in) | 95 cm (37.5 in) | 90 cm (38.6 in) |
| 316 ss | 0 to 60 cm (0 to 24 in) | 115 cm (45.5 in) | 118 cm (46.6 in) |
| 316 ss | 0 to 80 cm (0 to 32 in) | 135 cm (53.5 in) | 139 cm (54.6 in) |
| 316 ss | 0 to xx cm (0 to length per Sales order) (c) | | |
| Titanium | 0 to 20 cm (0 to 8 in) | 77 cm (30.5 in) | 80 cm (31.6 in) |
| Titanium | 0 to 40 cm (0 to 16 in) | 98 cm (38.5 in) | 101 cm (39.6 in) |
| Titanium | 0 to 60 cm (0 to 24 in) | 117 cm (46.5 in) | 121 cm (47.6 in) |
| Titanium | 0 to 80 cm (0 to 32 in) | 132 cm (54.5 in) | 141 cm (55.6 in) |
| Titanium | 0 to xx cm (0 to length per Sales order) (b) | | |

- a. Overall length B dimension is at the fully retracted position (not shown).
- b. Smart sensor is model BVA-PHF.
- c. Contact Invensys, available in 20 cm (8 inch) increments.

NOTE

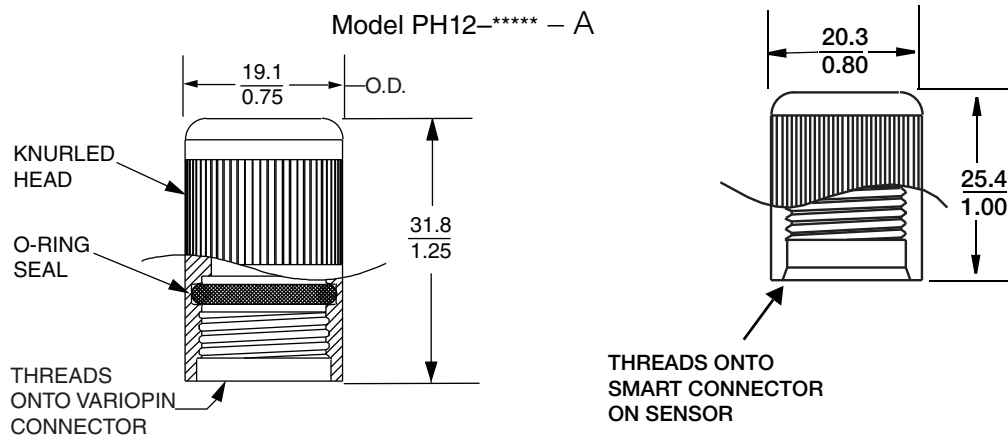
The ball valve assembly is for use with the 120 mm (4.7 in) PH12 Sensor only.



NOTE

The Flow Chamber accessory is for use with the 120 mm (4.7 in) PH12 Sensor only.

AUTOCLAVE CAP ACCESSORY



NOTES

ORDERING INSTRUCTIONS

- 1 Sensor Model Number - PH12
- 2 Mounting Accessories Model Number - FIT12
- 3 Ball Valve Insertion Assembly Accessory Model Number - BV
- 4 Wiring Accessories Part Number(s).
- 5 Other Accessories:
- 6 User Tag Information.

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