

## **HBD551 Durafet pH Electrodes and Accessories**

**70-82-25-146**

**Rev. 1**

**July 2013**

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Revision 1 – July 2013

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**Honeywell Process Solutions**

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# About This Document

## Abstract

This manual contains instructions for installation and use of the HBD551 pH electrodes.

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## Revision Notes

The following list provides notes concerning all revisions of this document.

Rev. ID	Date	Revision Details
1	July 2013	1 <sup>st</sup> Release

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## References

The following list identifies publications that may contain information relevant to the information in this document.

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## Support and Contact Information

For Europe, Asia Pacific, North and South America contact details, refer to the back page of this manual or the appropriate Honeywell Solution Support web site:

Honeywell Corporate                    [www.honeywellprocess.com](http://www.honeywellprocess.com)  
Honeywell Process Solutions        [www.honeywellprocess.com/hbd-series](http://www.honeywellprocess.com/hbd-series)  
Training Classes                        <http://www.automationcollege.com>

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## Telephone and Email Contacts

Area	Organization	Phone Number
United States and Canada	Honeywell Inc.	1-800-343-0228 Customer Service 1-800-423-9883 Global Technical Support
Global Email Support	Honeywell Process Solutions	<a href="mailto:ask-ssc@honeywell.com">ask-ssc@honeywell.com</a>

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## Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	This CAUTION symbol on the equipment refers the user to the Product Manual for additional information. This symbol appears next to required information in the manual.
	<b>WARNING</b> <b>PERSONAL INJURY:</b> Risk of electrical shock. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 Vdc may be accessible. <b>Failure to comply with these instructions could result in death or serious injury.</b>
	ATTENTION, Electrostatic Discharge (ESD) hazards. Observe precautions for handling electrostatic sensitive devices
	Protective Earth (PE) terminal. Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	Functional earth terminal. Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to protective earth at the source of supply in accordance with national local electrical code requirements.
	Earth Ground. Functional earth connection. NOTE: This connection shall be bonded to Protective earth at the source of supply in accordance with national and local electrical code requirements.
	Chassis Ground. Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

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# 1. Introduction

## 1.1 About This Manual

### Manual part of a set

This manual is part of a set documenting installation and use of the HBD551 pH Electrodes and associated accessories.

The set consists of the following manuals:

- this manual (70-82-25-146)
- Instruction manual for the pH instrument.

### What this manual contains

This manual contains instructions for the installation and use of the HBD551 pH electrodes and associated accessories.

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**CAUTION**

Read the electrode manual before installing and using the HBD Series electrodes. Failure to follow the installation instructions could result in damage to the equipment.

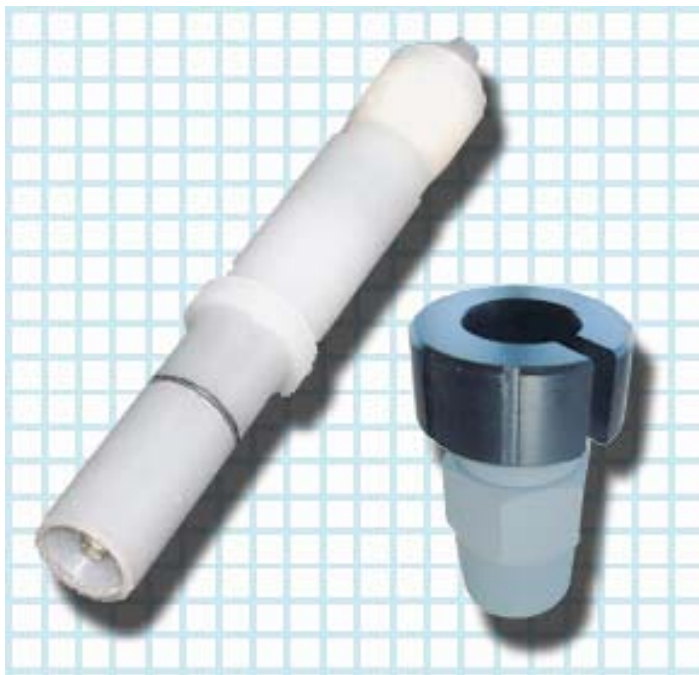
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## 1.2 Overview

Honeywell's HBD Series of pH electrodes are for applications with high pressure and temperature as well high and low pH ranges. They are intended for the harshest of applications where traditional glass sensors and reference electrode technology do not stand up. The HBD Series combines the superior stability and ruggedness of the Durafet sensor with a unique reference technology that resists poisoning and fouling.

The **HBD551** is:

- a quick change pH sensor
- a pH sensor with an external nut-loc that improves safety and makes replacement easy
- ideal for sample lines and valve side-streams
- rugged, versatile and simple to use
- compatible with most industrial transmitters and analyzers



### 1.3 Application Restrictions

Avoid using the Durafet series pH electrode with these chemicals and applications:

- Hydrofluoric acid
- High purity water (<10  $\mu\text{S}/\text{cm}$ )
- Hot caustic (see Figure 1-1 below)

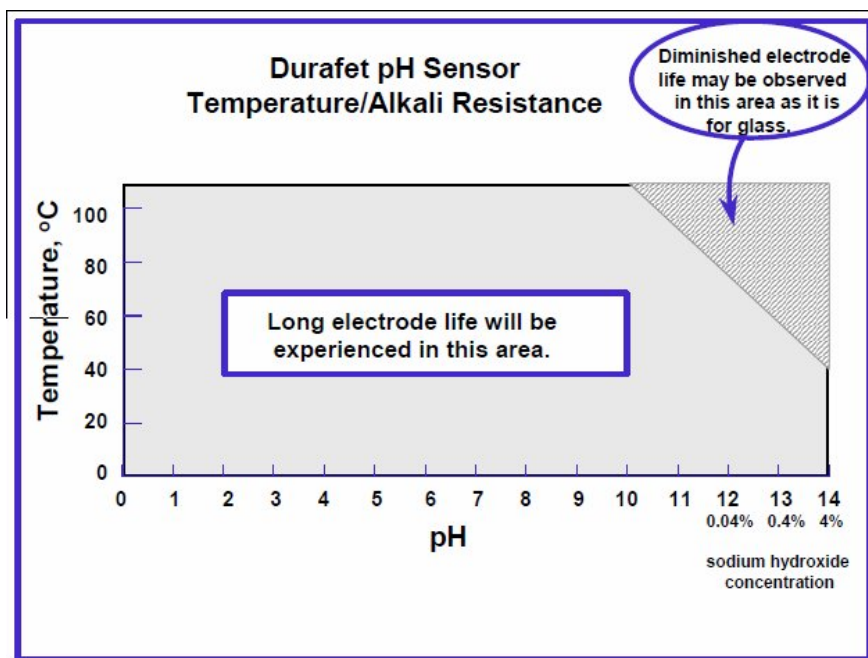


Figure 1-1 Temperature vs Alkali Resistance

## 2. Features & Specifications

### 2.1 Features

Table 2-1 Feature Summary

HBD551 Electrode	
<ul style="list-style-type: none"> <li>• Non-Glass Ion Sensitive Field Effect Transistor (ISFET) pH sensor</li> <li>• Rugged, virtually non-breakable</li> <li>• Long lasting stability in the harshest of application environments</li> <li>• <b><i>Ideal for sample lines and valve side-streams</i></b></li> <li>• Integral automatic temperature compensator</li> <li>• Chemically resistant Kynar body</li> <li>• Less cleaning lowers maintenance costs</li> <li>• Less frequent need for calibrations</li> </ul>	<ul style="list-style-type: none"> <li>• Great for high temperature and high pressure applications</li> <li>• Can be used in both low and high pH conditions</li> <li>• Utilizes an external nut-loc to improve safety</li> <li>• Quick Change, Quick Clean</li> <li>• Reduced replacement costs due to breakage and reference electrode failure</li> <li>• Faster response for better process control and lower reagent usage</li> </ul>

### 2.2 Specifications

Table 2-2 Specification Summary

Electrode	
<b>Pressure and Temperature Rating</b>	50 psig, 100°C 100 psig, 500°C
<b>Operating Range</b>	0-14 pH
<b>Mounting</b>	Quick-change in-line: 1" MNPT threaded adapter for installation into process, sample line or automatic cleaning system. Nut-loc retainer for quick removal and replacement.  Submerged: 3/4" MNPT threaded top for connection to 3/4" FNPT coupling and extension pipe.
<b>Wetted Materials</b>	Kynar, porous Teflon, Viton, Ryton, EPDM & Silicon
<b>Cable Options</b>	20 ft (6.1 m) and 50 ft (15.2 m) integral ferrule terminated leads or 10 inch integral Vario Pin connector
<b>Temperature Sensor</b>	8550 Ohm Thermistor, Pt1000 RTD
<b>Weight</b>	Approximately 0.23 kg (0.5 lb)

### 3. Accessories

Table 3-1 Accessory Summary

Description	Part Number
Adapter Nut-Loc	
CPVC 1" MNPT	50027407-001
Kynar 1" MNPT	50027407-002
316SS 1" MNPT	50027407-003
Kynar 1" MNPT with 316SS hex nut	50027407-004
316SS 1" MNPT with 316SS hex nut	50027407-005
Junction Box	50072803-501

## 4. Dimensions

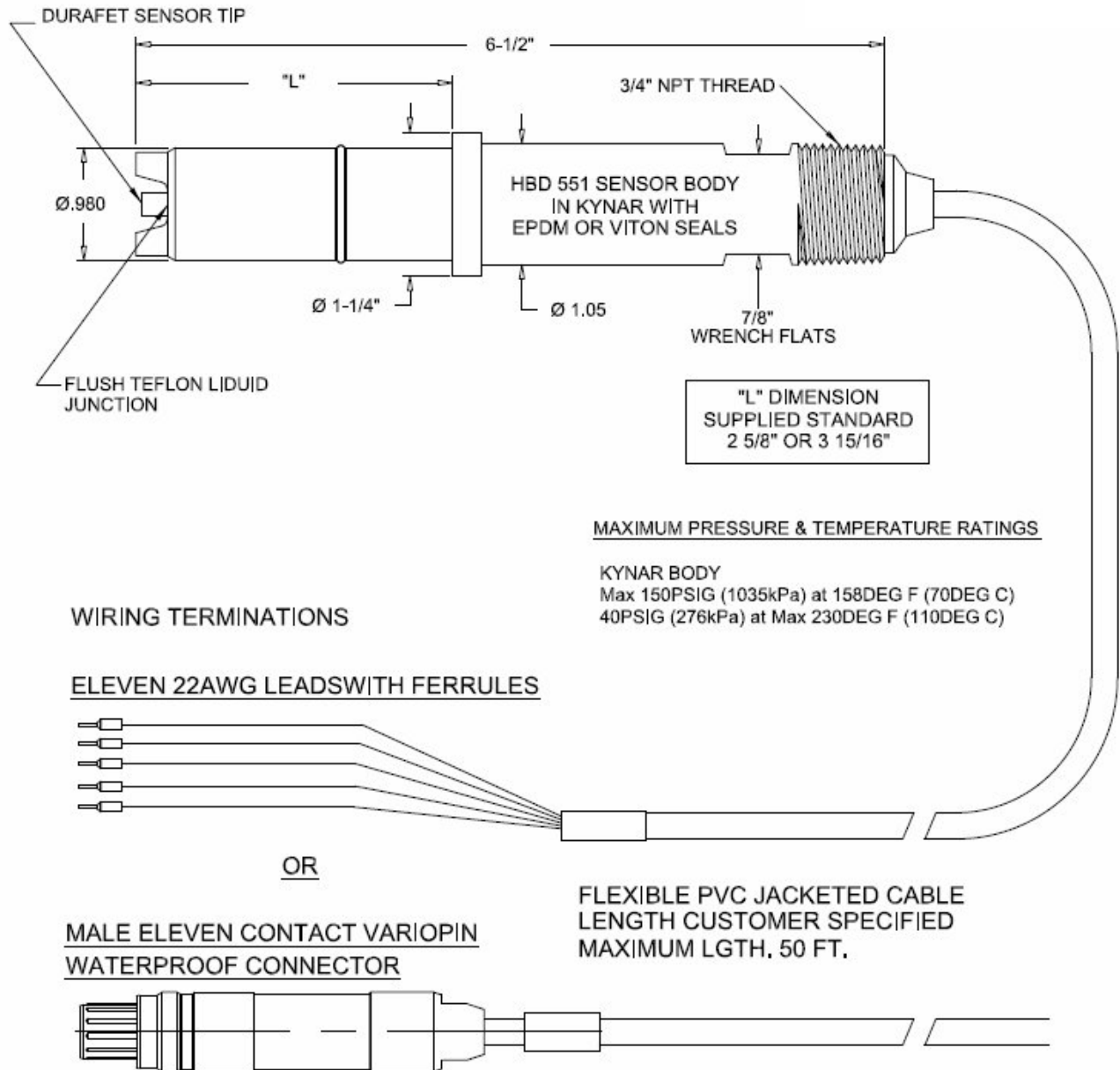


Figure 4-1 Dimension Drawing

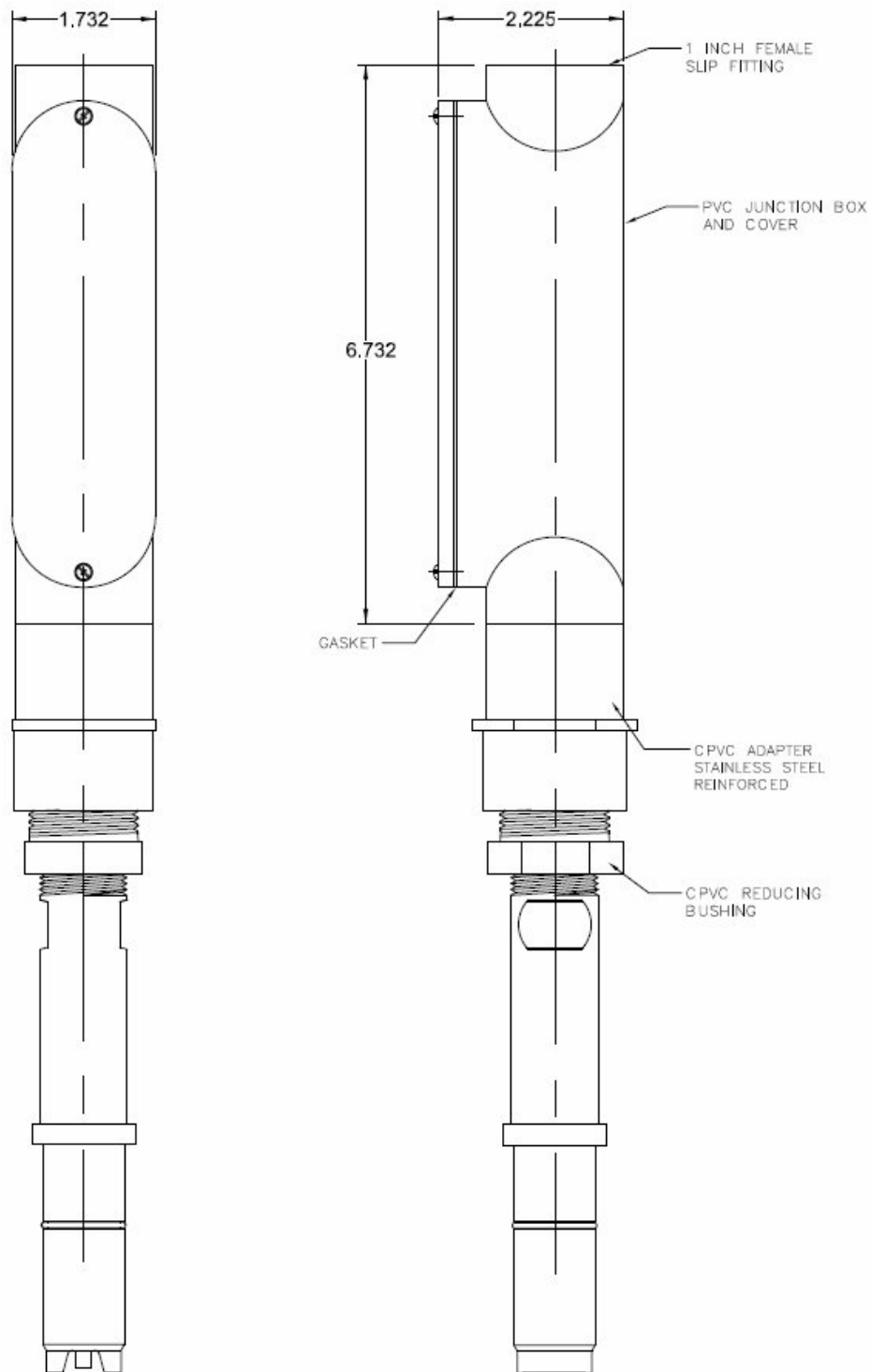


Figure 4-2 Dimension Drawing

## 5. General Assembly Instructions

### 5.1 Selecting Materials of Construction

#### Electrode

The materials used in the construction of the Durafet pH electrode are listed in the specifications. Materials of wetted parts must be compatible with the process temperature and corrosion conditions.

#### User-supplied components

Pipe couplings, and tees must be supplied by the user. Select materials that are compatible with the process temperature and corrosion conditions.

### 5.2 Sealing Pipe Joints

When making pipe joints apply Teflon tape pipe sealant to male threads. Wrap the threads with the tape overlapping by 50% on each wrap. Start the wrap at the end of the pipe and wrap in the direction of the thread at least two turns. When installing an electrode, apply Teflon tape to the threads, then hand-tighten the electrode in the fitting only until snug. If necessary to stop a leak, a wrench may be applied to the electrode's wrenching flats to further tighten the joint only until the leak has stopped. Always leave at least one thread on the electrode showing outside the fitting.

#### **CAUTION**

When tightening an electrode never exceed 15 ft-lb applied torque. Applying too much torque can result in damage to the electrode.

### 5.3 Durafet Electrode Preparation

#### 5.3.1 Unpacking

To safely unpack your Durafet Electrode, use the following procedure:

1. Carefully remove the electrode from the shipping carton.
2. Remove the plastic storage cap from the sensing end.
3. The fluid inside the cap is water. The water protects the porous reference junction from drying during shipment and storage.
4. Keep the black anti-static cap over the electrical connection end until you are ready to connect the electrode cable.
5. Save the black connector cap for ESD protection whenever the electrode cable is disconnected.
6. Any excess salt crystals on the sensor can be removed by placing the electrode under warm tap water until dissolved. If electrical connector end is wet, wipe dry before connecting to cable.



### 5.3.2 Precautions

- Do not allow liquids or other foreign matter to contact the cable connectors. Leave the protective cap in place on the electrode connector whenever the cable is not installed on an electrode.
- Avoid touching sensor area. Pressure applied to this area could damage the sensor.
- Avoid contaminating electrical connector contacts. Contamination can result in electrical leakage paths that affect the accuracy of pH measurements.
- Always replace the plastic storage cap over the sensor when the electrode is not in use. Be sure to reinstall the anti-static connector cap whenever the electrode is removed from service. Ensure that the plastic storage cap is filled with water.
- Do not expose the electrode to hydrofluoric acid.
- The sensor will have a reduced service life in processes that use high temperatures in combination with alkaline conditions. Do not install electrodes where temperatures go below  $-10\text{ }^{\circ}\text{C}$  ( $+14\text{ }^{\circ}\text{C}$ ) or freeze damage may result. Observe upper temperature limit specifications.
- In abrasive process streams, the electrode should be oriented so that the sensor surface faces downstream. In oily process streams, orient the sensor so that it faces  $90^{\circ}$  to the process flow.
- Promptly remove any water that might inadvertently come in contact with the electrode connector or cable connector. Blow drying with clean, low-pressure (15 psi) instrument air is a simple and effective means for drying the connector(s).

### 5.3.3 Cable Connection

Make sure electrode connector and cable connector are clean and dry. Align key way on VarioPin connector of electrode with tab inside mating connector on cable. Press cable connector onto electrode firmly. Tighten knurled bushing of cable connector by hand to ensure waterproof seal.

### 5.3.4 Shelf Life and Storage

#### Description

Periodic maintenance is required to ensure that the electrode does not dry out after prolonged shelf storage. Stored electrodes should be checked every 6 months to ensure that the water is still in the storage cap. The procedure below should be performed once per year for stored electrodes.

1. Remove the electrode from its storage box and remove the plastic cap from the sensing end.
2. Remove any excess crystals on sensor area by rinsing with warm tap water.
3. Refill the cap with distilled water.
4. Replace the cap on the electrode.
5. Place electrode in its storage box.
6. Mark the date on the box

#### **ATTENTION**

Do not store electrode at or below  $-10\text{ }^{\circ}\text{C}$  ( $+14\text{ }^{\circ}\text{F}$ ) or above  $50\text{ }^{\circ}\text{C}$  ( $122\text{ }^{\circ}\text{F}$ )

### 5.3.5 Cleaning

#### Overview

The frequency of cleaning is dependent on process conditions. Some process materials tend to adhere to the sensor and could interfere with the accuracy or time response of measurements. Note the following information before attempting to clean your electrode.

- Remove the electrode from service.
- Disconnect the cable from the electrode.
- Install anti-static electrode connector cap.
- Placing the electrode under flowing warm tap water will normally remove loose or lodged debris.
- Oil deposits can be removed using a household detergent (Joy or Windex) or a laboratory detergent (Micro or Sparkleen).
- The Kynar electrode body can be cleaned with almost any cleaning agent.
- Use dilute hydrochloric acid or other dilute acid to clean mineral scaling off the sensor. After cleaning, rinse thoroughly in distilled water. Allow it to soak for an hour in a neutral buffer (i.e. - 6.86 pH buffer, Honeywell Part Number 31103002).
- The sensor area can be wiped gently with a soft wet cotton swab.

### 5.4 Cap Adapter Option for Durafet Electrodes

The Cap Adapter cable option for Durafet electrodes eliminates the need to separately mount a preamplifier. The Cap Adapter cable contains a preamplifier electronics module that is integral with the electrode-to-instrument cable. The cable has tinned leads that are ready to be wired directly to UDA Analyzer or APT2000/4000 Transmitters and Analyzers. The knurled fitting should be hand-tightened onto the VarioPin connector of the electrode to seal an internal O-ring. When properly threaded onto the electrode the connection is waterproof.

## 6. Maintenance, Standardization, and Replacement Parts

### 6.1 Maintenance

#### Keeping electrode moist

When an electrode is removed from the process for any reason, assure that it does not become dry and remain dry for more than a short period of time. The electrode may require more frequent maintenance if used in a batch treatment installation which leaves the electrode dry between batches, or if it is exposed to process fluids that leave a deposit on the surface of the sensor chip (measuring electrode) and reference electrode. The manual supplied with the electrode contains instructions for cleaning the electrode. Thoroughly rinse the electrode with water after any type of cleaning. In addition to periodic cleaning, other electrode maintenance includes electrode performance checks, and treatment for a clogged junction or severely dry electrode.

### 6.2 Standardization

In addition to electrode maintenance, successful pH measurement relies on periodic standardizing of the measurement instrument and its electrode system. (This is required because all electrodes do not produce exactly the same potential in a solution of known pH. A periodic corrective adjustment eliminates any deviation from the standard value.) Establish regular intervals for standardizing according to conditions and experience. Procedures for standardizing are given in the measuring instrument instructions.

### 6.3 Accessories, Replacement Parts, Cables

Table 6-1 Accessories, Replacement Parts, Cables

Description	Part Number
<b>Accessories</b>	
NIST Buffer – 4.01 pH	31103001
NIST Buffer – 8.86 pH	31103002
NIST Buffer – 9.18 pH	31103003
<b>Replacement Parts</b>	
ESD Protective cap for VarioPin Connector	51500474-003
<b>Cables</b>	
Extension Cables - Only compatible with pH electrodes with lead terminations = VP (Direct Connect to UDA2182) Connection to instrument is ferrule terminated leads	
20'	50001391-501
50'	50001391-502
Extension Cables - Only compatible with pH electrodes with lead terminations = VP (Cap Adapter Cables) Connection to instrument is ferrule terminated leads	
20'	51453388-501
50'	51453388-502

## 7. Electrical Connections

### 7.1 Inputs and Outputs to the UDA2182

#### 7.1.1 Introduction

The analyzer can accept single or dual inputs from Honeywell Direct pH, pH Input from External Preamplifier, ORP, contacting conductivity and dissolved oxygen sensors.

- Two analog outputs standard
- One additional output optional
- Two electromechanical relays standard
- Two additional relays optional
- Two Digital Inputs

Wiring these inputs and outputs is described here.

#### 7.1.2 Accessing the terminals

The wiring is easily accessible through the front and the boards can be pulled out to facilitate the wiring of sensor input.

Open the case.

Loosen the four captive screws on the front of the bezel.

Grasp the bezel on the right side. Lift the bezel gently and swing the bezel open to the left.

Wiring terminals and board location

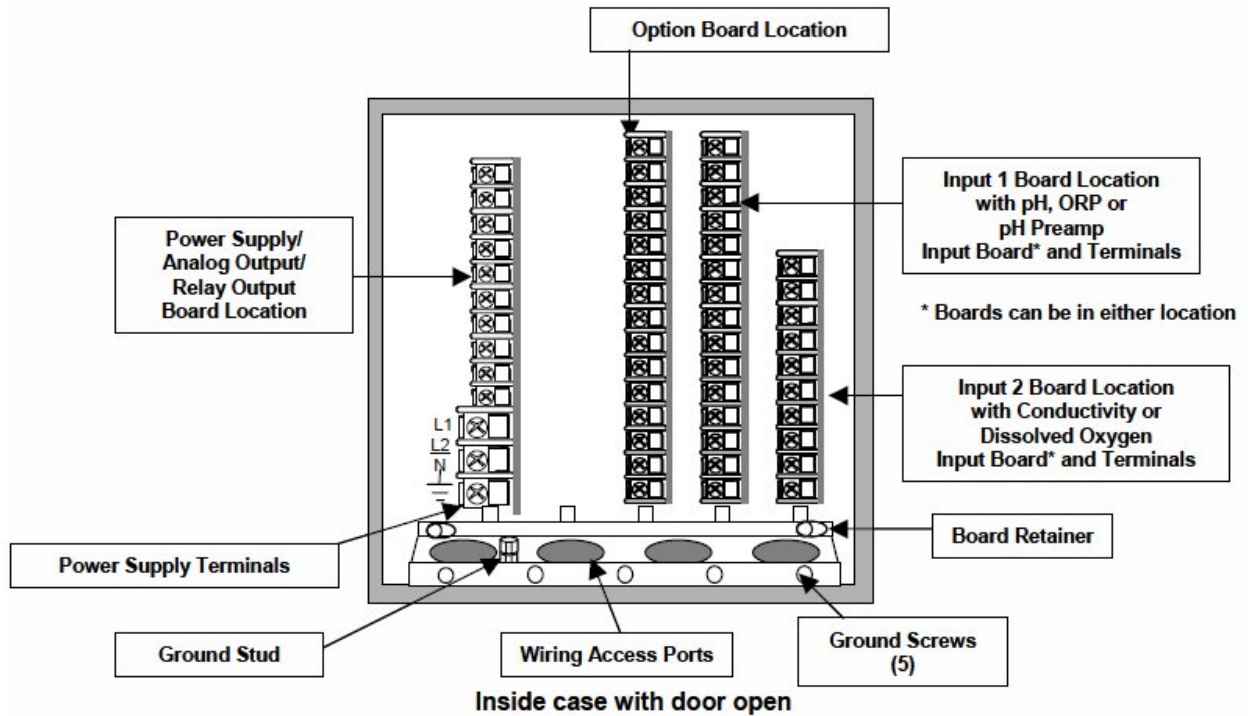





Figure 7-1 Wiring Terminals and Board Location



**WARNING**

While the unit is powered, a potentially lethal shock hazard exists inside the case. Do not open the case while the unit is powered.

Table 7-1 Procedure for installing Input and Output wiring

Step	Action
1	Go to Configuration setup to view the displays showing analog input, relay, and analog output use. Note the assignments shown. You must wire the unit to match these assignments in order for the analyzer to work as expected.
<b>ATTENTION</b>	
  Turn off the power to the analyzer. More than one switch may be required to remove power.	
2	With power off, open the case: <ul style="list-style-type: none"> <li>• Loosen the four captive screws on the front of the bezel.</li> <li>• Grasp the bezel on the right side. Lift the bezel gently and swing the bezel open to the left.</li> </ul>
3	Refer to UDA2182 manual for the location of the terminal board retainer. Loosen the screws that hold the retainer and slide the retainer left until the retainer tabs disengage from the terminal boards.
4	Insert a screwdriver into the tab in the terminal board to be wired and pull out gently. Slide the board half way out. There is a notch in the terminal board into which you can slide the retainer tabs and hold the boards in place while wiring.
5	Connect the inputs from the electrode or cells to the terminals in accordance with the configuration setup assignments. Refer to the wiring diagram provided (Section 7.2) with the electrode or cell.
6	Analog outputs (In addition to the standard outputs, one more is available as an option). See Option Board Wiring in manual for UDA2182). Connect the outputs from the Analyzer terminals in accordance with the configuration setup assignments. Refer to the wiring diagrams provided with the field devices receiving the signals.
7	<p>If the relay outputs are to be used, leave the unit open and powered down. The relays can be used for Time Proportioning Output, Pulse Frequency Output, and Digital Output control as well as alarm annunciation. (In addition to the standard relays, two more are available as an option. See Option Board Wiring –in manual for UDA2182). Connect the outputs from the Analyzer terminals in accordance with the configuration setup assignments. Refer to the wiring diagrams provided with the external device.</p> <p>These relays can be programmed to de-energize or energize on alarm. Use the Maintenance configuration setup to specify relay state. (NOTE 1)</p>
 <b>CAUTION: Alarm circuits are not internally fused in the analyzer. Provision for fuses in external circuits is recommended.</b>	
8	Slide the retainer to the left then slide the terminal board back into place. Slide retainer to engage the tabs and tighten the screws.
9	Close the Bezel and secure four captive screws to a torque value of .20Nm (1.5 Lb-in). Power up the unit. Do not apply power until the bezel is closed.

**Note 1:** If set to de-energize on alarm, this means that when an alarm occurs (or the discrete control point becomes active), the relay coil will be de-energized. The NC contacts will then be closed and the NO contacts will be open. Conversely, during normal non-alarm operation (or when the control point is not active) the NC contacts will be open, and the NO contacts will be closed.

If de-energize on alarm is selected, a power loss will force all relays to the same position as an alarm condition.

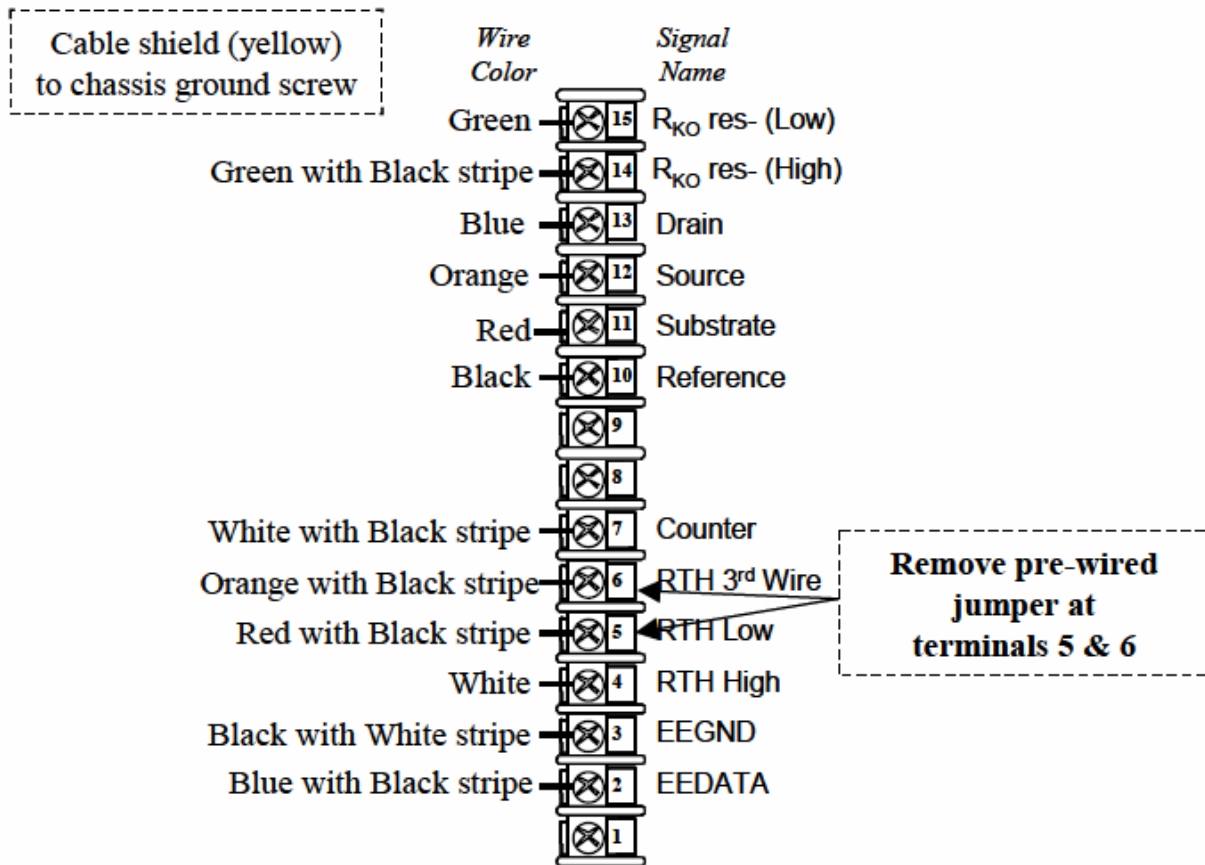
### Identify Your Wiring Requirements

To determine the appropriate diagrams for wiring your analyzer, refer to the model number interpretation in this section. The model number of the analyzer is on the outside of the case.

### Wiring the Analyzer

Using the information contained in the model number, refer to the individual diagrams listed to wire the analyzer according to your requirements.

## 7.2 HBD Series 551 pH Input Wiring Diagrams to UDA2182





### Durafet Cap Adapter

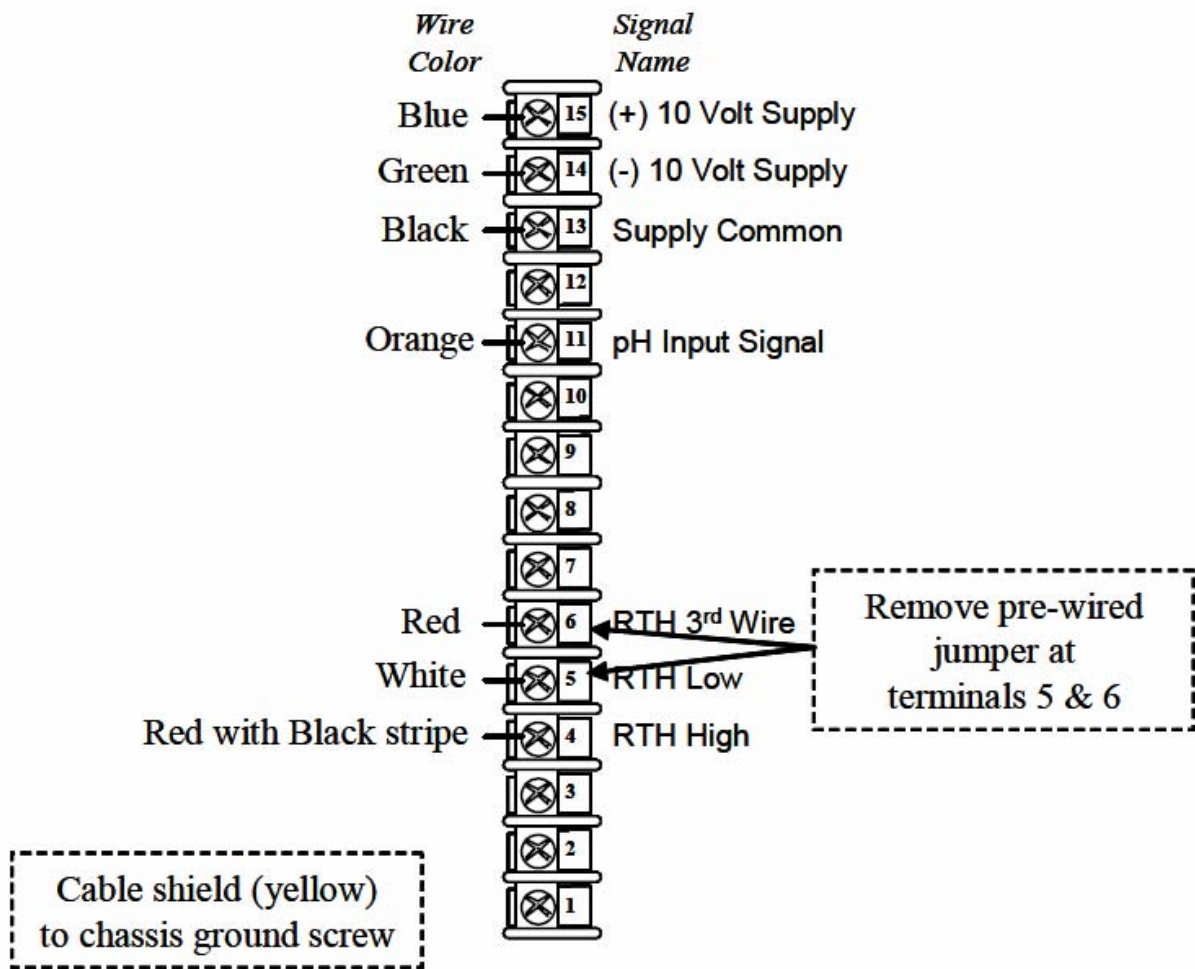


Figure 7-2 Terminal Designations for Durafet Electrode with Cap Adapter

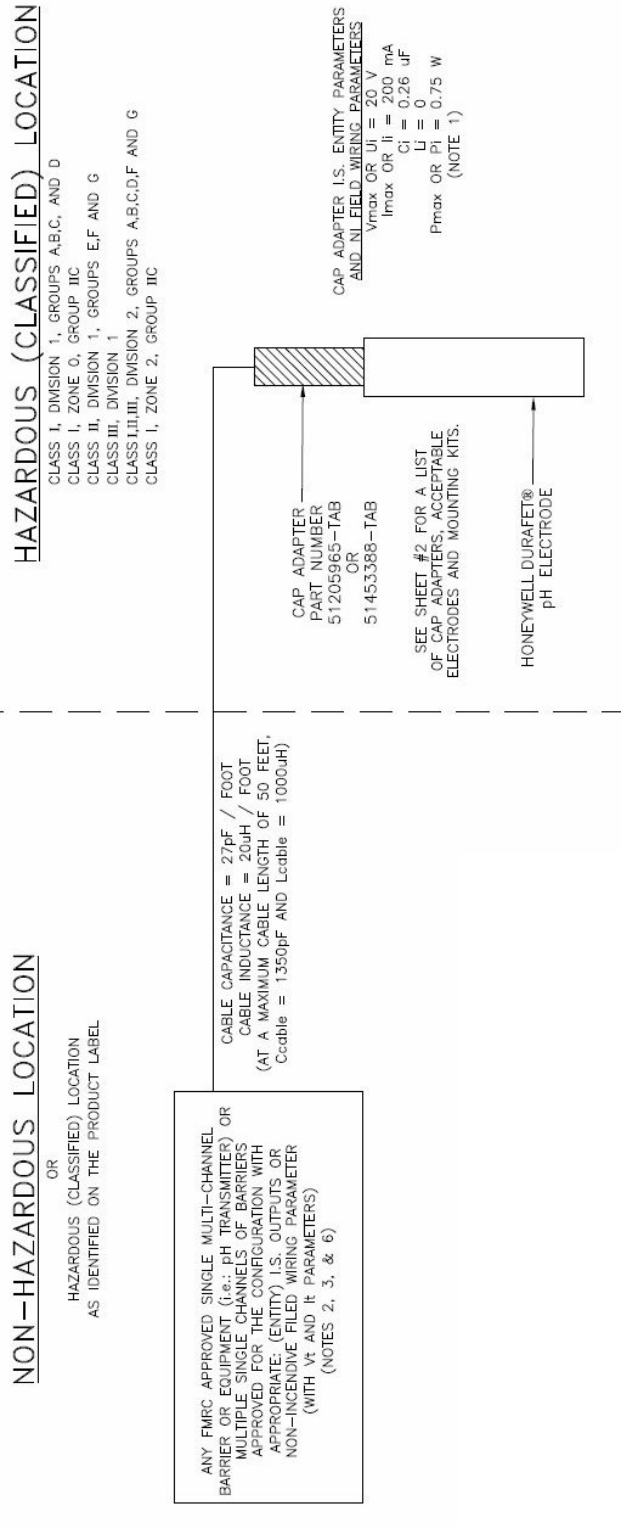


Figure 7-3 Cap Adaptor IS Control Drawing (page 1 of 3)

CAP ADAPTER PART NUMBERS

51205965-001, 12 FT. CABLE  
 51205965-002, 20 FT. CABLE  
 51205965-005, 50 FT. CABLE  
 51205965-006, 4 FT. CABLE  
 51205965-007, 8 FT. CABLE  
 51453388-001, 20 FT. CABLE  
 51453388-002, 50 FT. CABLE

DURAFET®pH ELECTRODES

51205554-001	51450948-001
51205554-002	51450948-002
51205554-008	51450948-003
51205554-009	51450948-004
51205554-010	51450948-005
51205554-011	51450948-006
51204976-001	51451346-001
51204976-006	51451346-002
51204976-007	51451346-003
51204976-008	51451346-007
51204976-009	51453535-001
51453503-001	51453535-002
51453503-005	51453535-003
	51453535-004
	51453535-005
	51453535-006
	50072804-001 THRU -036
	50072805-001 THRU -036
	50072806-001 THRU -036

ELECTRODE MOUNTING KITS

7773D  
 7774D  
 7758D  
 7777D  
 7794D  
 TL1000  
 7777DVP  
 7794DVP  
 HBD546  
 HBD547  
 HBD551

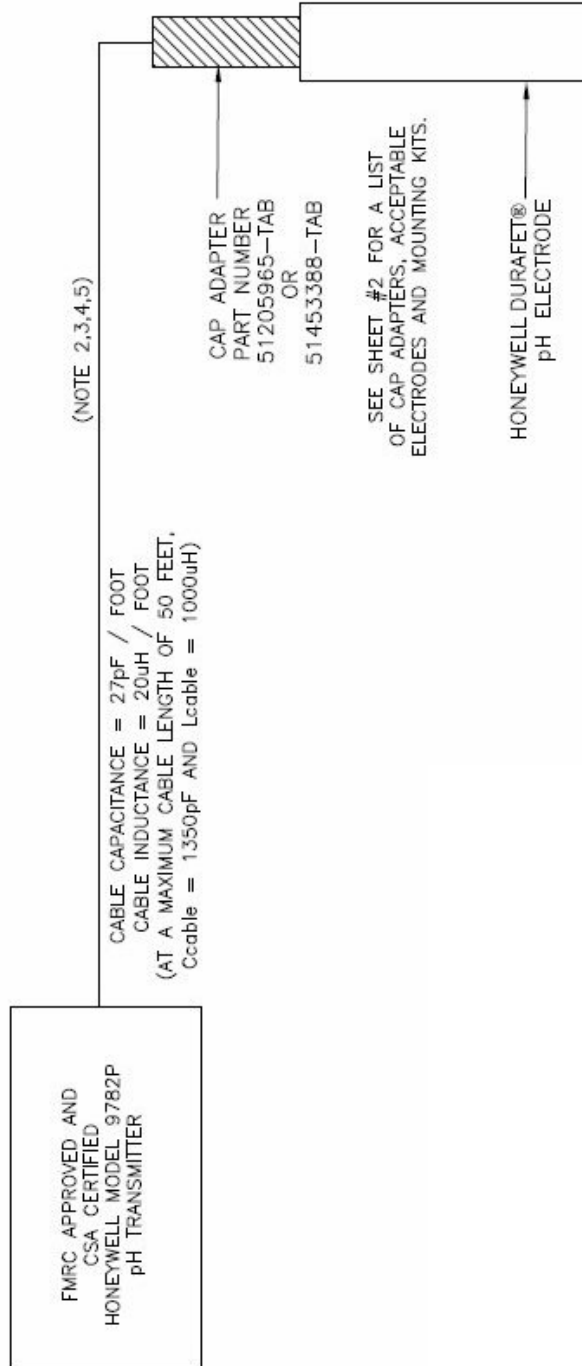
INSTALLATION INSTRUCTIONS

VOLTAGE RATING:  $\pm 3$  VDC TO  $\pm 16$  VDC  
 CURRENT RATING: 3.4mA MAX. AT 16 VDC  
 INSTALLATION CATEGORY: II  
 POLLUTION DEGREE: 2  
 MAX. AMBIENT TEMPERATURE: 70°C

**Cap Adaptor IS Control Drawing (page 2 or 3)**

NON-HAZARDOUS LOCATION

CLASS I, DIVISION 2, GROUPS A, B, C AND D



Cap Adaptor IS Control Drawing (page 3 of 3)

## HBD Series 546 pH Input Wiring Diagram to APT2000 and APT4000

The Cap Adapter can be connected to the APT2000 pH Transmitter. (See the APT2000 pH Transmitter Manual, part number 70-82-25-92, for more detailed description of the APT2000.)

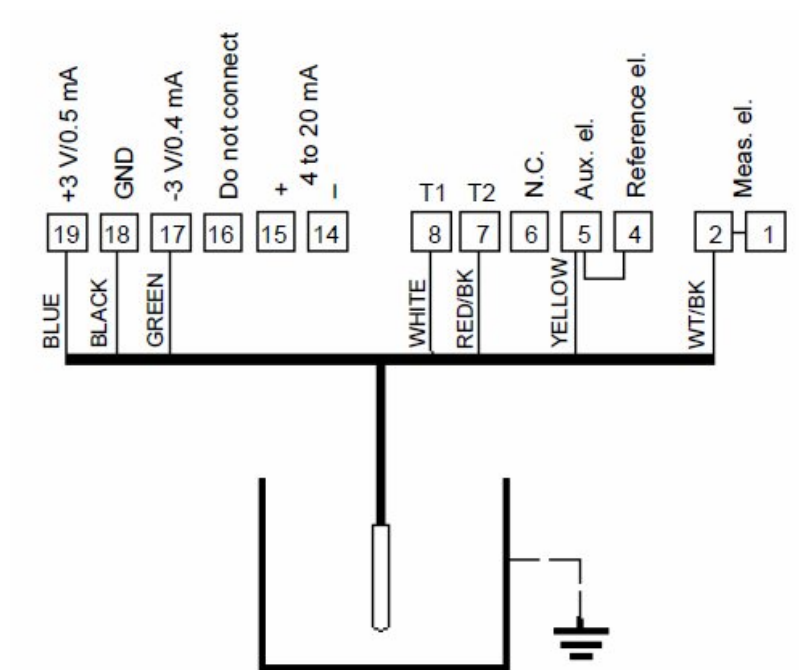


Figure 7-4 Connecting to an APT2000 pH Transmitter

NOTE: Orange and Red wires are not typically connected. These should be clipped and electrically sealed to avoid possible contact with other conductors.

### 7.3 Connection to an APT4000 pH Analyzer

The Cap Adapter can be connected to the APT4000 pH Analyzer. (See the APT4000 pH Analyzer Manual, part number 70-82-25-103, for more detailed description of the APT4000.)

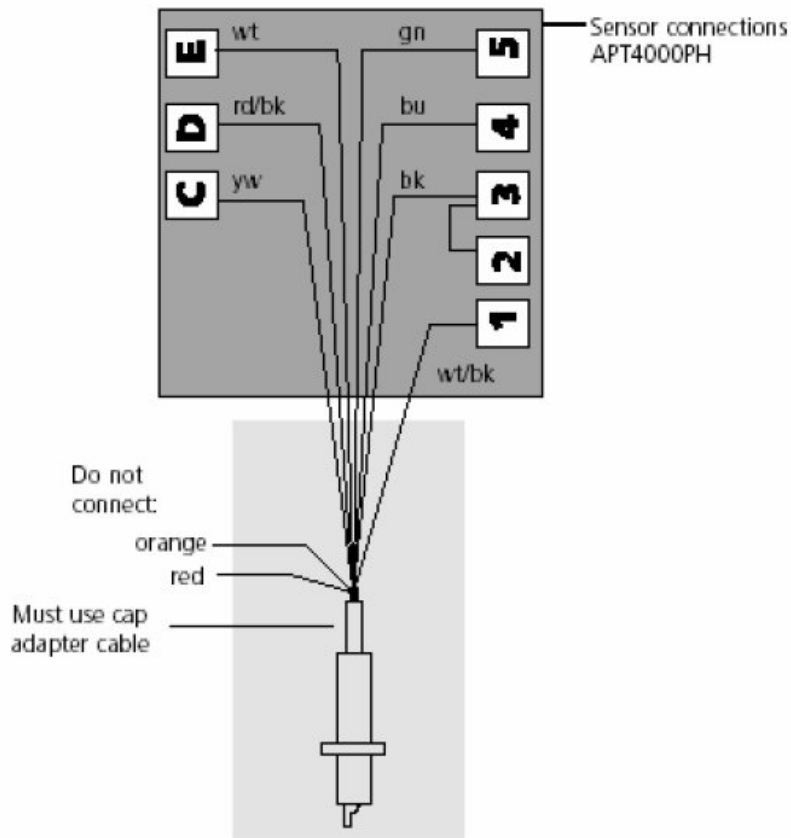


Figure 7-5 Connecting to an APT4000 pH Analyzer



## Sales and Service

### Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

#### ASIA PACIFIC

(TAC) [dfs-tac-support@honeywell.com](mailto:dfs-tac-support@honeywell.com)

##### Australia

Honeywell Limited  
Phone: +(61) 7-3846 1255  
FAX: +(61) 7-3840 6481  
Toll Free 1300-36-39-36  
Toll Free Fax:  
1300-36-04-70

##### China – PRC - Shanghai

Honeywell China Inc.  
Phone: (86-21) 5257-4568  
Fax: (86-21) 6237-2826

##### Singapore

Honeywell Pte Ltd.  
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Fax: +(65) 6445-3033

##### South Korea

Honeywell Korea Co Ltd  
Phone: +(822) 799 6114  
Fax: +(822) 792 9015

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Phone: + 80012026455 or +44  
(0)1202645583

FAX: +44 (0) 1344 655554

Email: (Sales) [sc-cp-apps-salespa62@honeywell.com](mailto:sc-cp-apps-salespa62@honeywell.com)  
or

(TAC) [dfs-tac-support@honeywell.com](mailto:dfs-tac-support@honeywell.com)

#### NORTH AMERICA

Honeywell Process Solutions,

Phone: 1-800-423-9883

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