Honeywell

4905 Style Conductivity Cells for 04905 Series and DL4-5xx DirectLine® Series Installation and Maintenance Manual

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6/04

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Revision 3 – 6/04

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About This Document

Abstract

This document is intended to support the installation, operation and maintenance of the 4905 Series of Conductivity Cells.

Revision Notes

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

Rev. ID	Date	Notes
0	12/96	This document is the initial Honeywell release of the L&N manual p/n 177667 Rev. M2. There has been no significant changes made to this manual. The format has been changed to reflect the Honeywell layout.
1	6/99	Edits done to add new Model Selection Guide information and to correct some errors in the text.
2	6/03	Removed obsolete info, added DL4000 details.

References

Honeywell Documents

The following list identifies all Honeywell documents that may be sources of reference for the material discussed in this publication.

Document Title	ID #
9782 Series Conductivity/Resistivity Analyzer/Controller Operator's Manual	70-82-25-74
APT2000CC Transmitter User Manual	70-82-25-95
APT4000CC Analyzer User Manual	70-82-25-104
DirectLine Module for Conductivity User Manual	70-82-25-112

Contacts

The following list identifies important contacts within Honeywell.

Organization	Telephone	Address
Honeywell Tech support	1-800-423-9883 Voice	1100 Virginia Drive Fort Washington, PA 19034

Contents

Figures

1. Introduction

1.1 Overview

These cells form the sensing network for industrial analyzers and transmitters designed to make continuous measurements of electrolytic conductivity. The cells are primarily suited to measurements in effluents of ion-exchangers and distillation columns; but appropriate constants are provided for many other applications, including measurements in micro-electronic component washing and plating-rinse effluents. Universal in mounting, any of the cells can be arranged for immersion (except DL4000 Series), insertion (1" NPT) or flow type sampling. The latter can be achieved by use of a CPVC flow housing, a 1" pipe tee (schedule 40), or 1-1/4" plastic tee (schedule 80) installed in a process line or bypass line as pictured in Figure 1-1.

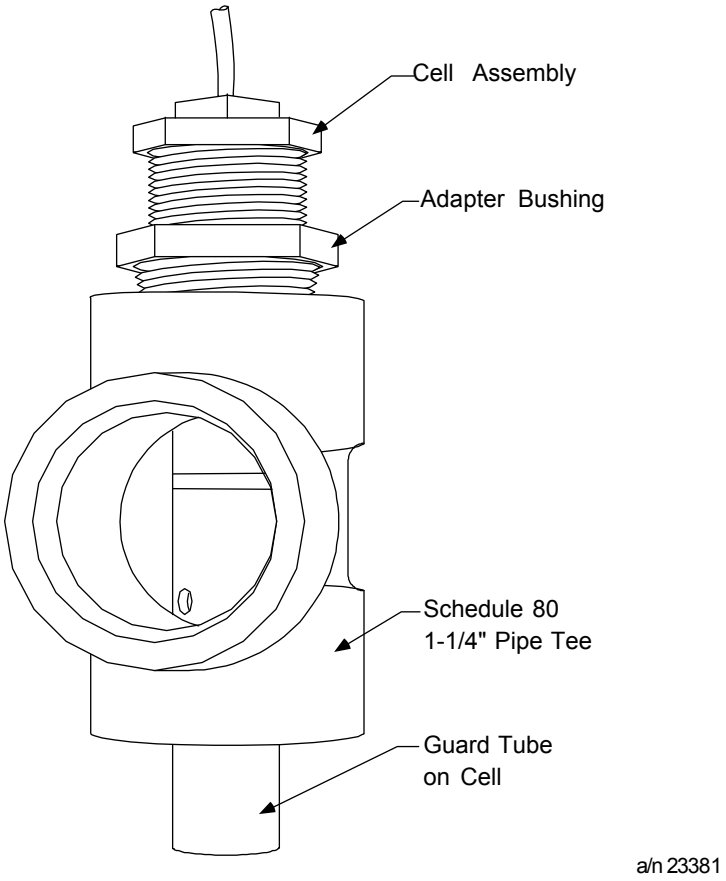


Figure 1-1 4905 Type Conductivity Cell Mounted in a 1-1/4" Schedule 80 Tee Using an Adapter Bushing

ATTENTION

Please note that specific parameters of your process may prohibit the use of nickel elements. For example, use a platinum-element cell if the cell will measure or be exposed to regeneration acids or bases.

The cell constant is selected according to the range of the measuring instrument used and the solution measured. In general, a high-constant cell is used for solutions having low electrical resistance (high conductivity) and a low-constant cell is used for solutions having high electrical resistance (low conductivity). The DL4-5xx Series of 4905 style cells used with the DirectLine Module (DL423 Series) can be specified for either integral or remote mounting of the module. The integral mount cell has a PC board connector so the DirectLine module mounts directly on the cell. Cells for remote mounting of the DirectLine module have a 20' cable that is an integral part (potted) of the cell. Automatic Temperature Compensation (ATC) during the measurement is provided by a built-in temperature sensing network located near the cross-channel or guard-tube holes.

The cells are molded from Polyethersulfone (PES) which is resistant to most corrosive chemicals over a wide range of temperatures. (A common exception is chlorinated hydrocarbons.) Sample solutions come into contact only with the above plastic and the platinum or nickel electrode surface. Any cell can be supplied with either electrode material.

2. Specifications and Model Selection Guide

2.1 Specifications

Cell Constant - 04905 Series: 0.01, 0.1, 1.0, 10, and 50 as specified.
DL4-5xx: 0.1, 10, 50 as specified

Electrode Material - Nickel or platinum as specified.

Maximum Pressure Limit - 250 psig (1724 kPa) @ 140°C (284°F).

Maximum Continuous Temperature Limit - 140°C (284°F)

Mounting

Insertion- 1" NPT male, Schedule 40.

Flow Chamber - Inlet - 3/4" NPT Male. Outlet: 3/4" NPT Female.

Insertion Depth - 5" to 7" (127 to 178 mm) depending on cell constant.

Overall Length - Approximately 6 to 8" (152 to 203 mm) or 10 to 12-1/4" (254 to 311 mm) if universal head is used.

Materials of Construction
(Wetted Parts) - Cell body: PES (Polyethersulfone).
Electrodes: nickel or platinum.

Leadwire- Tefzel-covered 18 gage cable, 0.177" (4.55 mm) OD at lengths listed.

Weight - Approximately 1 lb (0.45 kg) or 3 lb (1.35 kg) if universal head is used.

Specifications for 276127 Flow Chamber

Max. Flow - 2 gpm @ 40 psig and atmospheric discharge.

Max. Pressure - 200 psig at 25°C.

Max. Temperature - 140°C (284°F) at atmospheric pressure.

Dimensions - 1-1/2" (3.8 cm) octagon x 8-3/4" (22.2 cm) long. Sample inlet: 3/4" NPT male. Sample outlet: 3/4" NPT female. Cell inlet: 1" NPT female.

Material - Polyethersulfone (PES)

2.2 Model Selection Guides

4905 Series for use with 9782 Series or APT Series

Instructions

- **Consult Steps to Selecting Appropriate Conductivity Instrumentation and Cells before making selections below. (Section 2 INTRO)**
- Select the desired key number. The arrow to the right marks the selection available.
- Make one selection from each Table using the colum below the proper arrow. A dot denotes unrestricted availability.

Key Number	I	II	III	IV	V	VI
_ _ _ _ _	- _ _ _	- _ _	- _ _ _	- _ _	- _ _ _	- _ _ _

KEY NUMBER

Description	Selection	Availability
04905 Conductivity Cell	04905	↓

TABLE I - CELL CONSTANT

0.01	001	•
0.1	X01	•
1	XX1	•
10	X10	•
50	X50	•

TABLE II - ELECTRODE MATERIAL

Nickel **(Note 1)**	33	•
Platinum **(Note 1)**	44	•

TABLE III - AUTOMATIC TEMPERATURE COMPENSATION

For APT2000/4000CC, 9782C, or 7082 Only	333	c

TABLE IV - Leadwire Length

Leadwire Length	20 ft. (6,10 meters) Leadwire **(Note 2)**	20	•
	Universal Head (Aluminum)	X1	•

TABLE V - Special Insertion Lengths

Special Insertion Length	None	000	•
	4.4 in. (111,76 mm) extra	910	•
	8.8 in. (223,52 mm) extra	920	•

TABLE VI - OPTIONS

Tagging	None Linen Stainless Steel	0_ _ L_ _ S_ _	• • •
Certificate of Calibration & Conformance	No Yes	_0_ _ 1 _	• •
Future		_ _0	•

Note 1: Platinum is used in acid and base applications; Nickel is used in all others

Note 2: If shorter length is required, cut to length, skin and tin ends.

RESTRICTIONS

Restriction Letter	Table	Available Only With Selection	Table	Not Available With Selection
c	III	For 9782/7082 and APT2000/4000CC Analyzers Only		

DL4000 Series for use with DirectLine Sensor Modules

Instructions

- Select the desired key number. The arrow to the right marks the selection available.
- Make the desired selections from Table I using the column below the proper arrow. A dot (•) denotes availability. No ( ) dot denotes not available.

Key Number	I	II	III
_ _ _	- _ _ _	- _ _ _	- _ _ _ _

Key Number - Mounting/Electrode Only (Specify DL423 separately)	Selection	Availability
Contacting Conductivity Probes/Mountings for use with DL423	DL4	↓

TABLE I - Mounting Type, Construction, Cell Constant, DirectLine Connection

Cell/Mounting Type	Material of Construction	Cell Constant	DirectLine Connection	Internal EEPROM		
High Pu (4973	Titanium Graphite	0.1 10	Integral		301 302 311 312	• • • •

Not available for 4905 Style Conductivity Cells

TABLE I - Mounting Type, Construction, Cell Constant, DirectLine Connection (continued)

Cell/Mounting Type	Material of Construction - Note 2	Cell Constant	DirectLine Connection	Internal EEPROM	Selection	Availability
General Purpose (4905-style)	Nickel	0.1	Integral	Yes	501	•
	Platinum	0.1			502	•
	Nickel	10			503	•
	Platinum	10			504	•
	Nickel	50			505	•
	Platinum	50			506	•
	Nickel	0.1	Remote[1]	Yes	511	•
	Platinum	0.1			512	•
	Nickel	10			513	•
	Platinum	10			514	•
	Nickel	50			515	•
	Platinum	50			516	•
Stainless Steel Insertion/ Assembly (4909-style)	Nickel	0.1			911	•
	Platinum	0.1			912	•
	Nickel	10			913	•
	Platinum	10			914	•
	Nickel	50			915	•
	Platinum	50			916	•
Stainless Steel Insertion/ Replacem (4908-style)	Nickel	0.1			811	•
	Platinum	0.1			812	•
	Nickel	10			813	•
	Platinum	10			814	•
	Nickel	50			815	•
	Platinum	50			816	•

Not available for 4905 Style Conductivity Cells

Not available for 4905 Style Conductivity Cells

Notes:

1. Remote conductivity cells are supplied with a integral 6,1m (20 ft.) sensor cable which must be wired to the DL423 remote connector (supplied with DL423 Sensor Module).
2. Platinum is used in acid and base applications; Nickel in all others

TABLE II - Special Cell Constructions

Cell Type	Special Construction		
ALL	None	000	•
4905	Extra 4.4" of cell length	440	
4909/4908	316 SS Support Tube	316	

TABLE III - Options

Tagging	None	00 _ _	•
	Linen Customer I.D. Tag - 3 lines w/22 characters/line	LT _ _	•
	Stainless Steel Customer I.D. Tag -3 lines with 22 characters per line	SS _ _	•
Calibration Certificate	None	_ _ 00	•
	Calibration certificate to be supplied w/shipment	_ _ 10	•

3. Installation

3.1 Overview

The conductivity cell is secured permanently to the 1" N.P.T. bushing which is used for all types of mountings. The three different types of mountings are illustrated in Figure 3-1. Although the physical appearance of the various cells is the same (except for length), the cell construction differs according to the constant. On the 10, 25 and 50 constant cells, the electrodes are short tubes located midway inside the two parallel tubular channels that run lengthwise through the cell, and are open to the sample at both ends of the cell. The channels are larger on the 25 constant cell and they are elliptical on the 5 and 10 constant cell. The 1, 0.1, and 0.01 constant cells have a removable cell guard which is screwed onto the cell body to protect the electrode surfaces. Electrodes are three disks on the 1 constant cell, parallel plates on the 0.1 constant cell, and wire wound on the cell body on the 0.01 constant cell. Cells must be used with the guard in place or the cell constant may differ from that specified.

Most of the auxiliary parts which enable the user to achieve the various types of mounting are readily obtained from local suppliers. For an immersion mounting with 04905 Series cells, only the appropriate length of 1/2 inch pipe (e.g., CPCV) and if desired, a 1/2 inch end coupling is needed. For an in-line flow mounting, only a 1" schedule 40 tee is required. The basic cell can be converted to a flow cell for either bypass or in-line arrangements by use of the PES flow-cell housing (Honeywell Part 276127) shown in Figure 3-1 and Figure 3-3. However, the temperature and pressure specifications listed for this flow chamber under Specifications apply.

ATTENTION

The DL4-5xx Series DirectLine cells have a EEPROM device for automatic download of cell constant and cell calibration factor. During installation proper ESD protection is required so the memory device is not damaged.

3.2 Types of Mounting

The three types of mounting; Flow, Immersion and Insertion, are illustrated in Figure 3-1. Mounting dimensions for each type of cell assembly are given in Figure 3-3, Figure 3-4, and Figure 3-5.

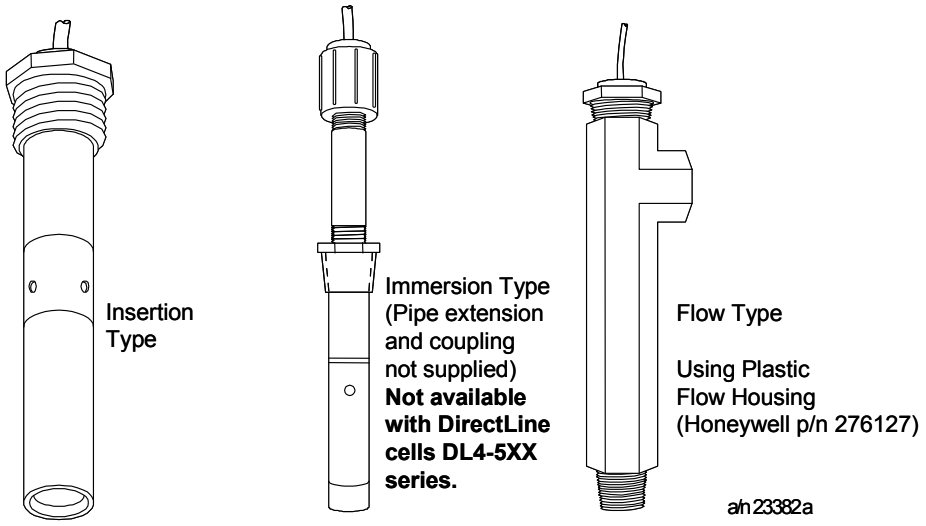


Figure 3-1 Types of Mountings for 4905 Type Conductivity Cells

3.3 Flow-Type Mounting

The cross-channel or guard-tube hole in the cell must always be covered by the solution and the solution level must be 1-1/2 inches above these holes. When mounting the cell in a pipe tee such as shown in Figure 3-2, have the solution enter the tee from below and exit to the side. As shown, the guard-tube hole is in line with the horizontal pipe run. However, if it is possible that the pipe line will not be full at all times, locate the hole just below the exit pipe to insure flooding of the cell under all conditions. As shown in Figure 3-2, always locate the cell on the pressure side, not the vacuum side of the pump. The flow-cell-housing, an accessory part having 3/4" male inlet and female outlet threads, can be used for an in-line measurement or in a bypass line as shown in Figure 3-2, depending upon the flow volume or pipe size. Adapter bushings are available to convert inlet and outlet fittings to 1/4" female threads. See Section 4.4 . The cell must be covered by the solution at all times. Therefore, make certain the lowest solution head is higher than the cell location. See that an air bubble does not prevent the cell from filling properly.

Flow-cell housing can be used "in-line" only if a maximum flow of 2 gallons per minute can be tolerated. To avoid cracking the 276127 flow-cell housing, use Teflon tape on cell threads and tighten cell only enough to prevent leakage.

To install, tighten the cell into a 1" schedule 40 pipe tee. If the flow-cell housing is used, assemble the cell and housing and install it in the process flow line or in a bypass line.

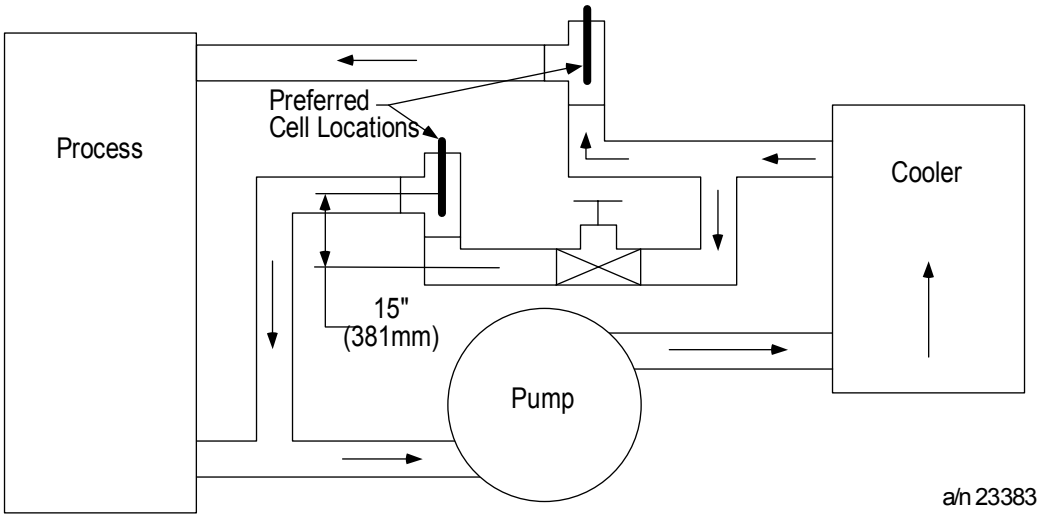


Figure 3-2 Typical Conductivity Measuring Installation

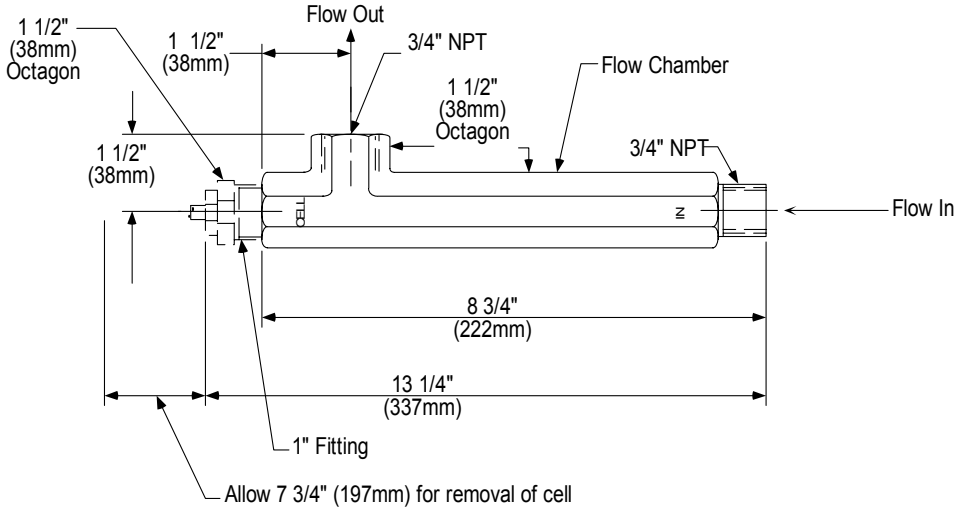
3.4 Immersion-Type Mounting for 04905 Series Cells

Does not apply to DL4-5xx Series Cells. The cell must be immersed to a level above the cross-channel or guard tube hole and must be immersed to 1-1/2 inches above this hole if an integral compensator is used. For most immersion applications, a 1/2" support pipe, preferably CPCV must be threaded into the cell bushing, using Teflon tape to seal the threads, thus permitting adequate immersion. Unless this pipe extension is used, do not immerse the top of the bushing. To insured that a representative sample is measured at all times, the solution must circulate through the channels. In quiescent solutions, provide sufficient agitation.

To install the cell, determine the length of 1/2" pipe required to give the immersion needed to keep the cell completely immersed at all times. Up to six feet of pipe can be used for the standard cell having seven feet of cable. Remove the small bushing at the top of the cell, slide it off the cable, and replace it with the 1/2-inch pipe. At the top of the pipe slide a pipe coupling and the small bushing back over the leadwire as shown in Fig. 3-1, or install a junction box to terminate the pipe.

3.5 Insertion-Type Mounting

The cell can be inserted into a 1" N.P.T. threaded opening, but it is imperative that the tank or chamber be full under all process conditions. Make certain the liquid head is above the cell location. A vertical insertion (from above) or a horizontal insertion can be used. To install, simply tighten the cell into a 1" N.P.T. threaded opening (using a Teflon thread compound such as Teflon tape) so that the entire electrode is immersed in the measured solution. Allow at least 1/2-inch clearance beyond the end of the cell. In applications where vertical mounting is required, avoid a position with the cell channels pointed up, as this will permit solution to flow down into the open end of the cell and may result in clogging by solids settling in the cell channels. See Figure 3-2.



NOTES:
1. Mount cell and flow chamber horizontally as shown above with flow exit "up to eliminate possible air gap around cell body.
2. If cell and flow chamber must be mounted vertically, attach a short length of tubing to flow exit as shown below and form a trap to ensure filling of flow chamber, especially at low flow.

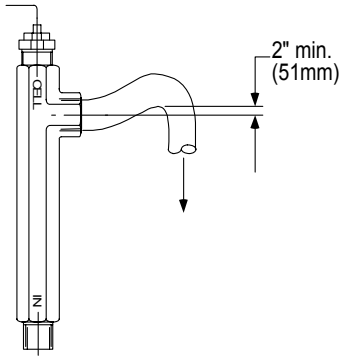
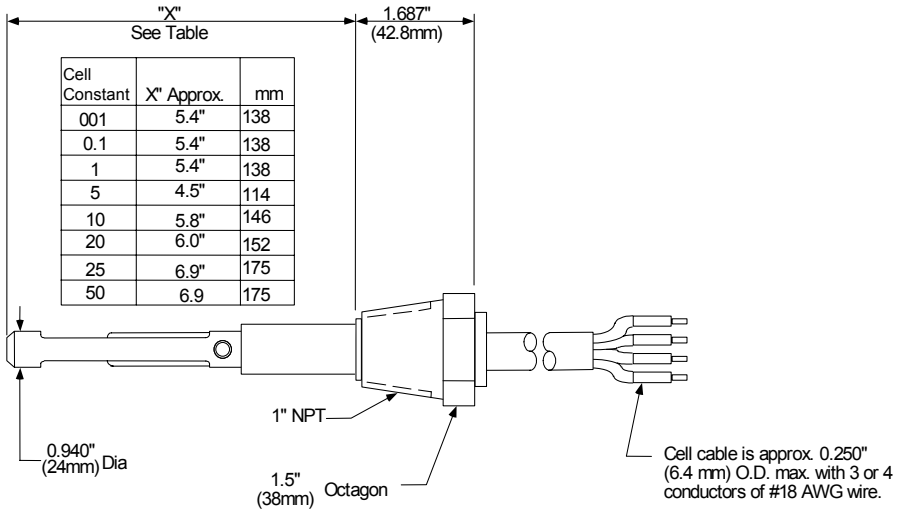
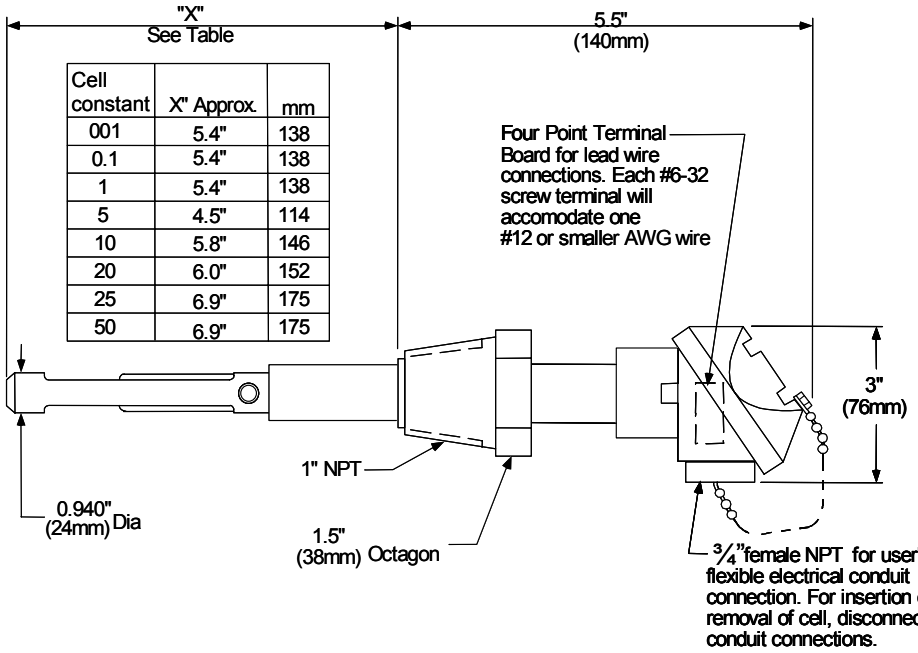


Figure 3-3 Dimension Drawing for 276127 Flow Housing



a/n 23385

Figure 3-4 Mounting Dimensions for 04905 Series and DL4-5xx Series Cells



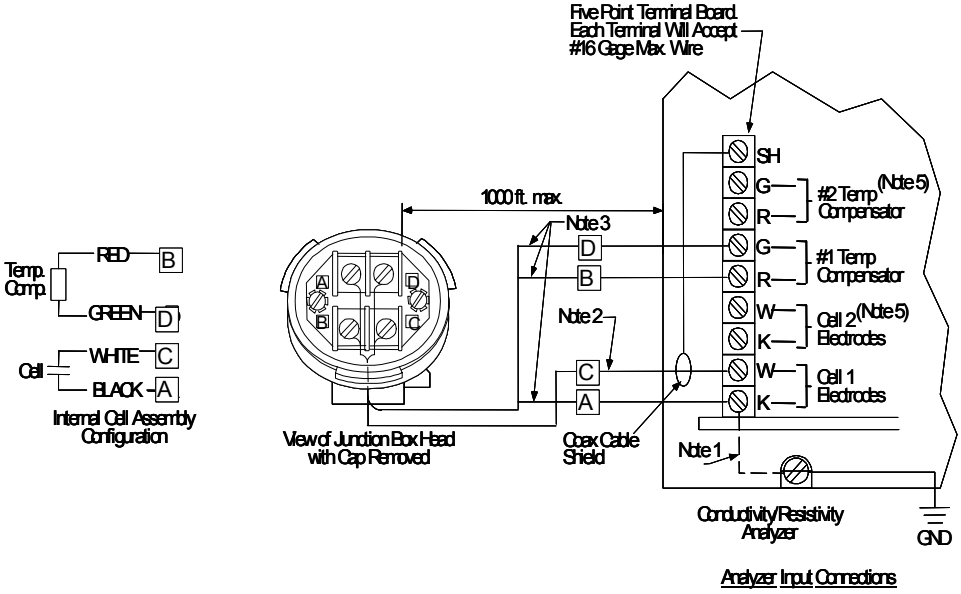
NOTE: For existing users with conduit, a ¾" x ½" adapter bushing will be required to use existing conduit.

Figure 3-5 Mounting Dimensions for 04905 Series with Junction Box Head (Not available on DL4-5XX DirectLine Cells)

3.6 Electrical Connections

The detailed terminal-board connections for the analyzer or transmitter are given in the appropriate directions furnished with the measuring instrument. See Figure 3-6 and Figure 3-7 for connections to the 9782 Analyzer. See Figure 3-8 and Figure 3-9 for connections to the APT Series. See Figure 3-10 and Figure 3-11 for connections to the DirectLine Modules.

To avoid the possibility of ac pickup in the cell leads, separate them from all ac line-voltage wiring or run them in a separate grounded conduit.



NOTES:

1. For pure water samples in non-conductive (plastic, glass, etc.) piping, ground the black cell electrode lead near the cell.
   Alternatively, connect to the 7082 ground screw as shown dotted. Do not ground 10, 25, or 50 constant cells.

2. 9782C – S0 – xx – Exxxx – BD (Standard Range Only)
   Use 18 gage minimum coaxial cable type RG6/U connecting shield to terminal "SH" only.

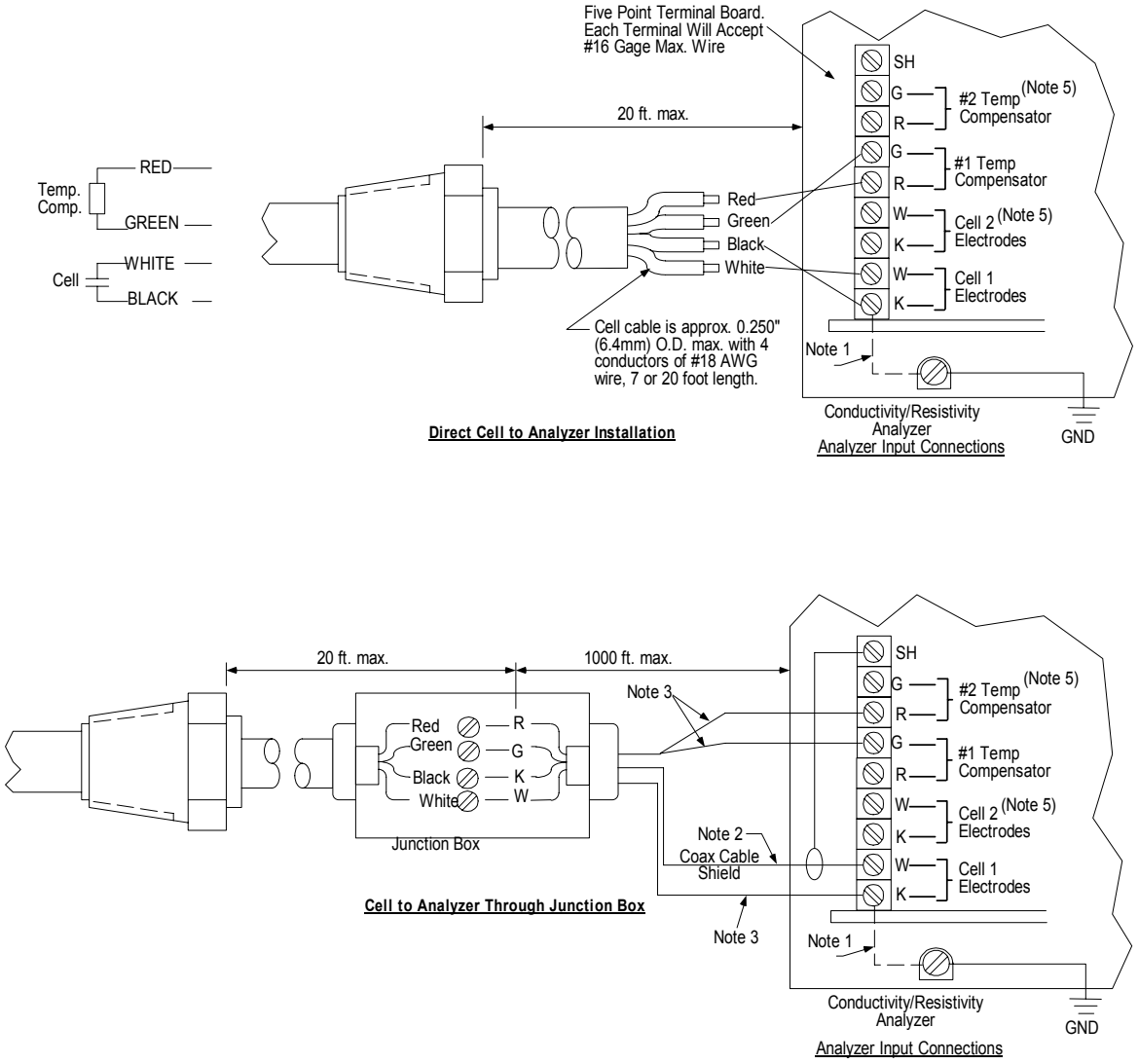
3. 9782C – S0 – xx – EOOOO – BD
   For cable runs of up to 500 ft., use 18 gage minimum, three conductor cable
   For cable runs of 500 - 1000ft., use 16 gage minimum, three conductor cable

   9782C – W0 – xx – EOOOO – BD [coax and shield (SH) not used]
   For cable runs of up to 500 ft., use 18 gage minimum, three conductor cable
   For cable runs of 500 - 1000ft., use 16 gage minimum, three conductor cable

4. Cell to analyzer cables are considered low level. Run separate from high level wiring.

5. If 2 cells are to be applied, the same wiring guidelines are applied to Cell 2 as are followed for Cell 1.

Figure 3-6 4905 Series Cell with Junction Box Head Connected to 9782 Conductivity/Resistivity Analyzer



NOTES:
1. For pure water samples in non-conductive (plastic, glass, etc.) piping, ground the black cell electrode lead near the cell. Alternatively, connect to the 7082 ground screw as shown dotted. Do not ground 10, 25, or 50 constant cells.
2. 9782C - S0 (only)
   Use 22 gage minimum coaxial cable type RG59/U connecting shield to terminal "SH" only.
3. 9782C - S0
   For cable runs of up to 500 ft., use: 18 gage minimum, three conductor cable.
   For cbale runs of 500 - 1000 ft., use: 16 gage minimum, three conductor cable.
   9782C - W0 [coax and shield (SH) not used]
   For cable runs of up to 500 ft., use: 18 gage minimum, four conductor cable.
   For cable runs of 500 - 1000 ft., use: 16 gage minimum, four conductor cable.
4. Cell to analyzer cables are considered low level. Run seperate from high level wiring.
5. If 2 Cells are to be applied, the same guidelines are applied to Cell 1 as wereused for Cell 1.

a/n 23346

Figure 3-7 04905 Series Cells with 7 or 20 Foot Leads Connected to 9782 Conductivity/Resistivity Analyzer or Connected to Junction Box

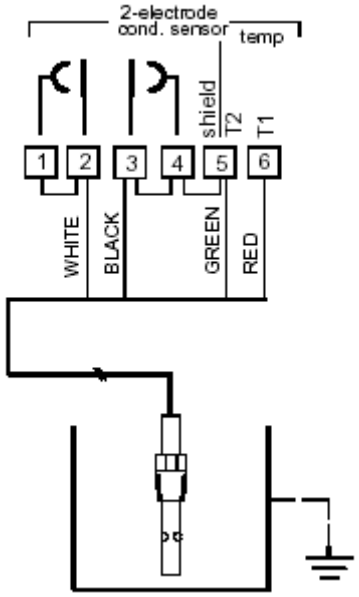


Figure 3-8 04905 series cells with 20' leads connected to an APT4000

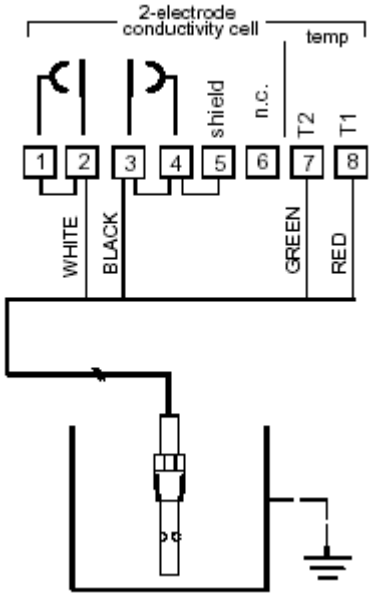


Figure 3-9 04905 series cells with or 20' leads connected to an APT2000

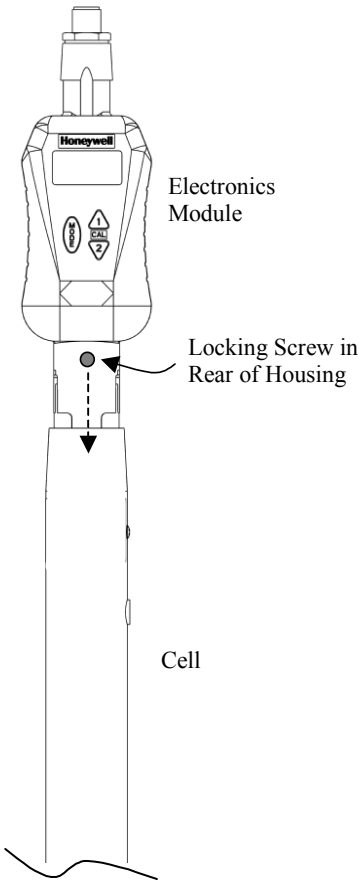


Figure 3-10 Integral DirectLine Mounting with DL4-5xx

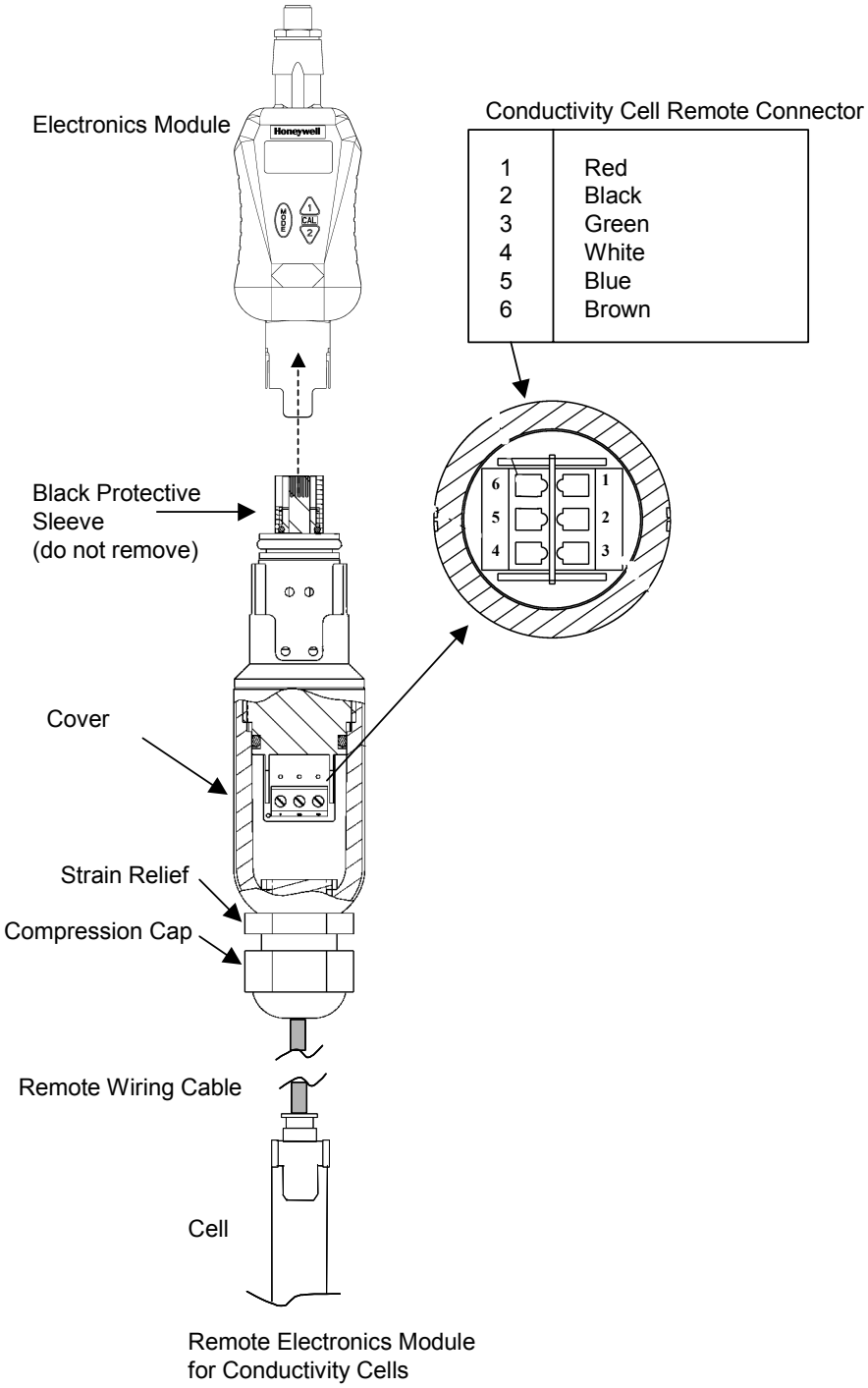


Figure 3-11 Remote DirectLine DL4-5xx series with 20' lead connected to a DL423 Modbule (through the use of the Remote Connector Assembly)

4. Maintenance

4.1 Introduction

If abnormal readings occur, this may indicate poor response because the cell is not filled with process solution. Check the cell installation. Note that a grayish dull surface on the cell plastic (normally glassy) can result from exposure to temperatures above 140°C.

The only maintenance which may be required is occasional cleaning in certain applications.

Cell constants 0.01, 0.1, and 1 cannot be used if solution resistance measures less than 1000 ohms unless the cell is platinized in accordance with Section 5.

4.2 To Clean The Cell

The cell will require cleaning if sludge, slime, etc., accumulates in the flow channels. Since the materials of construction are chemically inert, chemical agents may be used and are recommended for cleaning the cells. The particular cleaning agent used must be selected according to the type of contamination to which the cell is exposed.

CAUTION

The cell housing is PES (Polyethersulfone). DO NOT clean with acetone, chloroform, toluene, benzene, or any other chlorinated hydrocarbon.

In general, soap and hot water are effective and adequate. If necessary, a soft bristle brush of about 1/4" diameter may be used to clean out the tubular channels of the 10, 25, and 50 constant cells. Do not scratch the electrode surfaces. Be especially careful not to bend the electrode plates of the 0.1 constant cell. Rinse the cell thoroughly in tap water and then in distilled water if available.

4.3 To Check Conductivity System

To check the conductivity system comprising conductivity cell, leadwire, and measuring instrument, the user may desire to make a measurement in a reference solution of known conductivity. Control the temperature only within limits consistent with the desired accuracy. The 25°C temperature value is suggested. The solutions may be prepared in the presence of air. The solution must fill the cell during measurement.

For optimum accuracy in acid measurements above 5% concentration, use the "Calibration Trim" function available in the conductivity instrument. See the 9782, APT 2000/4000 or DirectLine Model DL423 manuals for details on the trim function.

To check the constant of a cell, use a second cell having the same constant and compare the reading of one against the other.

If the 04905 Series conductivity cell model number contains '333', the normal resistance of the temperature sensor as measured across the red (B) and green (D) leads is 8550 ohms at 25°C.

To check the electrode insullation, connect an ohmmeter across the black (A) and white (C) leads. With a dry and clean cell, the resistance should be greater than 50 megohms.

4.4 Replacement Parts and Accessories

Description	Part Number
Cell Guard Tube (1, 0.1, and 0.01 constants only)	065632
Leadwire bushing for 04905 Series Cells	050366
Flow Cell Housing, PES	276127
1 1/4” to 1” Bushing to adapt cell to 1 1/4” Schedule 80 pipe tee, PVDC	276142
Cell Extension Leadwire Table III other than 333	
Three conductor PVC 18 gage (105°C max, Belden 9493)	834059
Three conductor Tefzel 18 gage (140°C max)	834086
Junction Box	316260
9782 Standard Ranges **Up to 500 ft.**	
Three conductor, 18 gage cable (Belden 9494)	834059
Coax Cable (Belden 9259) – 22 AWG Coax Cable (Belden 9290) – 18 AWG	835024 - - - - - -
Up to 1000 ft.	
Four conductor (3 used), 16 gage cable (Belden 9494)	834055
Coax Cable (Belden 9259) – 22 AWG Coax Cable (Belden 9290) – 18 AWG	835024 - - - - - -
9782 Wide Ranges	
Up to 500 ft. - Four conductor, 18 gage	834052
Up to 1000 ft. - Four conductor, 16 gage	834055
DirectLine DL423	
Remote Connector	51500768-004

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