

DirectLine® DL422 Sensor Module *for Meredian® II ORP Electrodes* **User Manual**

70-82-25-107

Rev. 2

1/03

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Insert 70-82-10-02 should accompany this document.

About This Document

Abstract

This manual contains all the information that is needed to install, configure, calibrate, operate, and troubleshoot the DirectLine® Sensor. Insert 70-82-10-02, a quick reference guide for configuring and calibrating the DL422, should accompany this document.

Contacts

World Wide Web

The following lists Honeywell's World Wide Web sites that will be of interest to our customers.

Honeywell Organization	WWW Address (URL)
Corporate	http://www.honeywell.com
Industrial Measurement and Control	http://www.honeywell.com/imc
International	http://www.honeywell.com/Business/global.asp


Telephone

Contact us by telephone at the numbers listed below.

Organization		Phone Number	
United States and Canada	Honeywell	1-800-423-9883	
		(215) 641-3610	<i>Tech. Support</i>
		1-888-423-9883	<i>Q&A Faxback (TACFACS)</i>
		1-800-525-7439	<i>Service</i>

Symbol Definitions

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

Symbol	Definition
	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.

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1. Introduction

1.1 Overview

The DirectLine® Sensor consists of an electronics module connected to a Meridian II ORP electrode that eliminates the need for pre-amps, transmitters, and analyzers in ORP applications.

The modular electronics design can be separated from the electrode, allowing the electrode to be easily removed or replaced while retaining power to the electronics module.

The DL422 **electronics module** is contained in a Nema Type 4x polysulfone housing. The Module can be mounted as an integral unit directly connected to the electrode or remotely using an electrode with a cable. The sealed polysulfone housing has plug-in connections for the Meridian II ORP probe and 4-20 mA output connection.

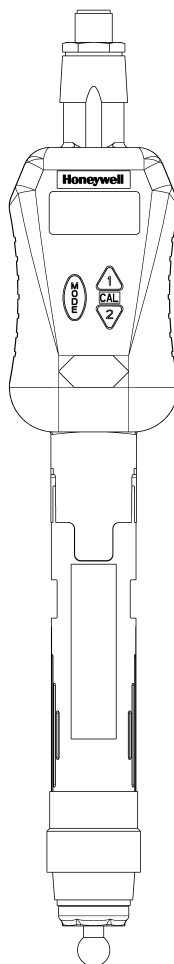


Figure 1-1 DirectLine® Sensor

1.2 Electronics Module

The electronics module is loop-powered by 16-42 Vdc and will modulate its supply current from 4 mA to 20 mA, depending upon the ORP value that is measured by the Meridian II electrode.

A 4-20 mA output connection is provided via a 6m cordset or a customer supplied cable used in combination with a field wiring connector.

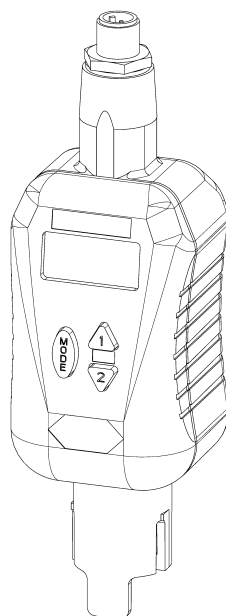


Figure 1-2 Electronics Module

1.3 Operator Interface

The DirectLine® Sensor operator interface consists of three pushbuttons and one 4-digit, 7-segment LCD display with 3 decimal points, plus (+), and minus (–) signs. It is responsible for the display of measured values and configuration of parameter values.

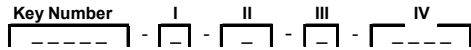
1.4 Specifications

Displayed ORP	–1600 mV to +1600 mV
Meridian Sensor Survivable Temperature Range	–10 °C to +130 °C (14 °F to 266 °F)
Electronics Module Ambient Temperature	–20 °C to +85 °C (–4 °F to +185 °F)
Output Type	4-20 mA (2-wire loop powered)
Output Scale	–1600 mV to +1600 mV
Output Calibration	4-20 mA
Output Cordset	Shielded twisted pair, length 6 m (19.7')
User Termination	Tinned leads
Sensor Cable Length	3.65 m (12') or 6.096 m (20')
Power	16-42 Vdc <i>Maximum load resistance:</i> 250 ohms at 16 Vdc 600 ohms at 24 Vdc 1400 ohms at 42 Vdc
Local Display and Buttons	LCD 4-digit, 7-segment
Engineering Units	mV
Calibration Options	1 point Sample
Diagnostics	Sensor and electronics
Case	Weatherproof, corrosion-resistant plastic housing
Approvals	CE Mark for Industrial Applications UL – General Purpose for Process Control CSA – General Purpose FM – CLI, DIV1, Groups C & D and CLI, Zone 0 AEx ia IIB (IS) FM – CLI, DIV2, Groups C & D and CLI, Zone 2, Groups IIB (N.I. Field Wiring)
Remote Mounting	Pipe, Wall, or DIN Rail
Dimensions	H 123 mm (4.84") x W 48 mm (1.89") x D 46 mm (1.81")
Weight	Approximately 142 g (5.0 oz.)

1.5 Model Selection Guide

Instructions

- Select the desired key number. The arrow to the right marks the selection available.
- Make the desired selections from Tables I through IV using the column below the proper arrow. A dot (•) denotes availability.



Key Number - DirectLine® Sensor Electronics Module

(Specify electrodes/cells/probes separately)

pH	For use with Durafet II, Meredian II & HPW7000 pH electrodes
ORP	For use with ORP electrode.
Conductivity	For use with Contacting Conductivity Cells
DO - PPM	For use with Dissolved Oxygen ppm Probes
DO - PPB	For use with Dissolved Oxygen ppb Probes

Selection	Availability				
DL421	↓				
DL422		↓			
DL423			↓		
DL424				↓	
DL425					↓

TABLE I - OUTPUT CABLE

Output Cable for Integral or Remote Mounting	None (replacement module or customer supplied output cable)- Note 1
	Cordset - 6m (19.7 ft.) - includes connector and cable - Note 2
	Field Wiring Connector only - customer supplies cable only- Note 2

D	•	•	•	•	•
E	•	•	•	•	•
F	•	•	•	•	•

TABLE II - SENSOR CABLE/REMOTE CONNECTOR (between electronic module and electrode, sensor or probe)

Integral Mounting	No cable or connector required
Remote Mounting Cable - Durafet only	6,096m (20 ft.) of sensor cable - Durafet II Remote Mounting
	15,24m (50 ft.) of sensor cable - Durafet II Remote Mounting
Remote Mounting Connector (Cable is supplied with sensor or probe)	Remote Mounting Connector - Meredian II pH
	Remote Mounting Connector - Meredian II ORP
	Remote Mounting Connector - HPW7000
	Remote Mounting Connector - Conductivity
	Remote Mounting Connector - Dissolved Oxygen

0	d	d	d	d	d
1	e				
2	e				
3	e				
3		e			
4	e				
5			e		
6				e	e

TABLE III - REMOTE MOUNTING OPTIONS

Mounting Kit for Remote Mounting	None Integral unit - mounting not required
	2" (5,08 cm) Pipe mtg. bracket, wall mtg. & DIN Rail clip

A	•	•	•	•	•
B	•	•	•	•	•

TABLE IV - OPTIONS

Tagging	None
	Linen Customer ID Tag - 3 lines w/22 characters/line
	SS Customer ID Tag - 3 lines w/22 character/line
Certificates	None
	Calibration & Conformance

00__	•	•	•	•	•
LT__	•	•	•	•	•
SS__	•	•	•	•	•
__00	•	•	•	•	•
__CC	•	•	•	•	•

Notes:

- Customer supplies cordset or cable with M12 connector. Suppliers & P/Ns include:

	Phoenix Contact	Turck
Cord--set	SAC-3P-5.0-PUR/M12FSSH Stainless	RKV4T-6/S618
M12 Field Wiring Connector	SACC-M12FS-4CON-PG7	B8141-0
Cable	2-wire twisted shielded pair	

- Recommended cable is 2-wire twisted shielded pair

RESTRICTIONS

Restriction Letters	Available Only With		Not Available With	
	Table	Selection	Table	Selection
d	III	A		
e	III	B		

ORDERING INSTRUCTIONS:

- Part numbers are provided to facilitate Distributor Stock.
- Orders may be placed either by model selection or by part number.
- Part numbers are shown within the model selection tables to assist with compatibility information.
- Orders placed by model selection are systematically protected against incompatibility.
- Compatibility assessment is the responsibility of the purchaser for orders placed by part number.
- Items labeled as N/A are not available via the stocking program and must be ordered by model selection.

2. Installation

2.1 Assembly and Wiring

Depending on the customer selected output cable options, the DirectLine can be wired to an appropriate 16-42 Vdc source using 2 different methods:

- 1) Cordset. See Figure 2-1.
- 2) Field wiring connector with customer supplied cable. See page 6.

2.1.1 Cordset

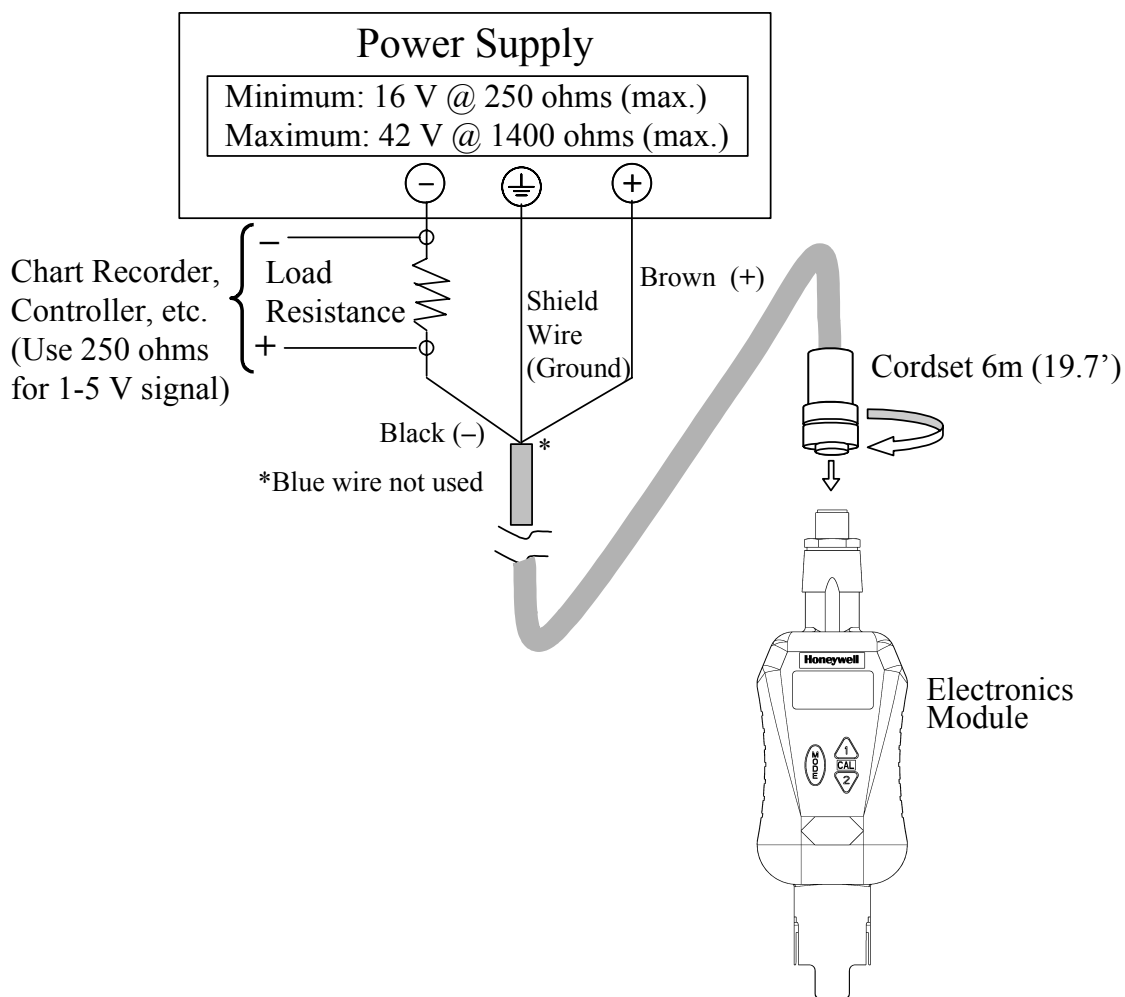


Figure 2-1 Cordset Connection and Wiring

2.1.2 Field Wiring Connector with customer supplied cable

Refer to Figure 2-2. The field wiring connector supports customer supplied cable with an outer diameter of 4-6mm, 2-wire twisted shielded pair.

Table 2-1 Assembly and Wiring Procedure for Field Wiring Connector

Step	Procedure
1	Disassemble field wiring connector a) Unscrew parts to separate pressure screw, clamp type cage, gasket, housing and female insert.
2	Insert customer supplied cable through connector parts a) Slide pressure screw over skin and tinned customer cable (note orientation). b) Slide clamp type cage over cable (note orientation). c) Slide gasket over cable. d) Slide housing over cable (note orientation).
3	Connect wires to pins Look closely at end of female insert to locate pin numbers. Connect positive wire to pin 1 and negative wire to pin 4. Remaining wires and female insert pins 2 and 3 are unused.
4	Assemble field wiring connector a) Screw female insert to housing until female insert's o-ring is compressed. b) Slide clamp type cage/gasket into housing. c) Thread pressure screw into housing until ¼ turn past finger tight.
5	Connect cable to power supply Wire the other end of the Output cable to a 16-42 Vdc source as indicated in Figure 2-1. Note: your wire colors may be different.

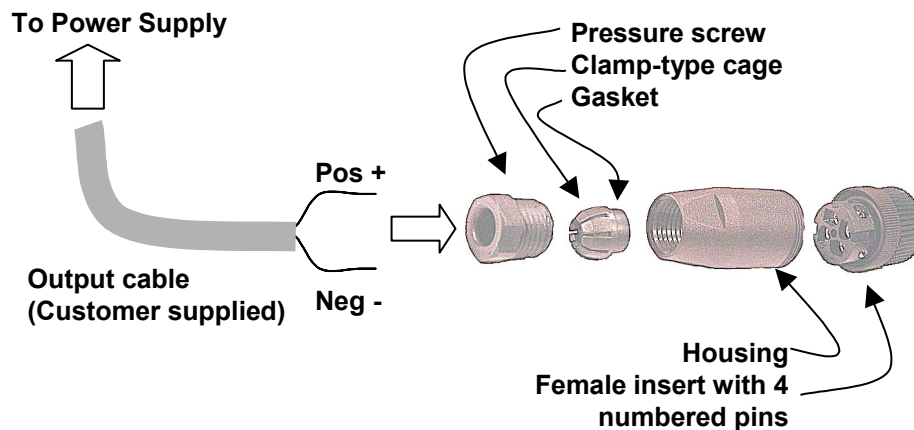


Figure 2-2 Field Wiring Connector

2.2 Integral Mounting

Table 2-2 Integral Mounting Procedure for ORP Electrodes

Step	Procedure
Connect Electrode to Pipe and Electronics Assembly (Figure 2-3)	
1	Screw the electrode into the pipe tee (3/4 " NPT thread). Make sure that the final position of the installed electronics module allows the display to be easily viewed by plant personnel.
2	Align the slots in the electronics module with those in the electrode and press down to connect the electronics to the electrode.
3	Tighten the locking screw on the bottom rear of the electronics module.

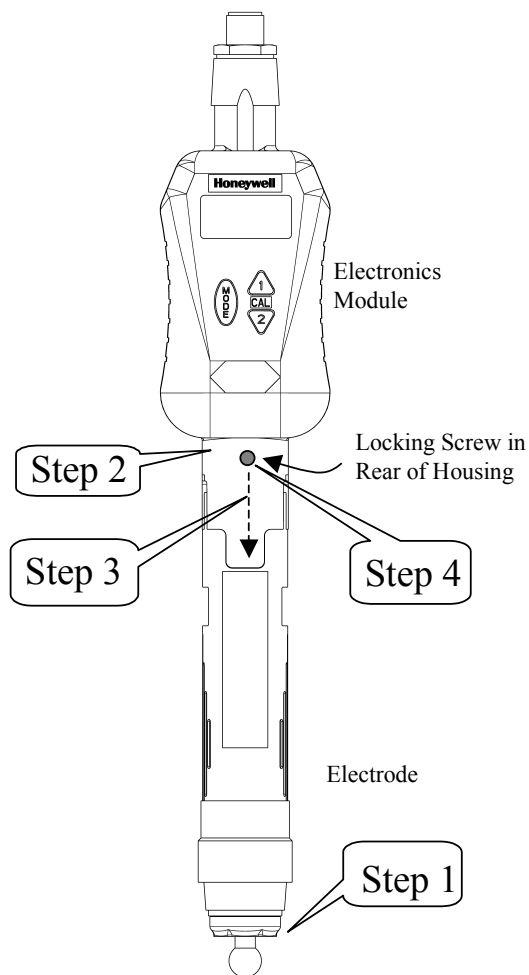


Figure 2-3 Integral Mounting

2.3 Remote Mounting

When the DL422 is specified with Table II = 3, the Remote Connector Assembly (part number 51500768-002) is supplied loose for connection of the Meredian II ORP electrode cable to the DL422 module. Table 2-3 gives the mounting procedure.

Table 2-3 Remote Mounting Procedure for ORP Electrodes

Step	Procedure (Refer to Figure 2-4 and Figure 2-5)
1	Turning counterclockwise, remove strain relief/cover combination from the remote connector assembly.
2	Loosen and remove compression cap from strain relief fitting. Carefully push cable end through cap and strain relief fitting so that these parts are strung back along cable jacket.
3	Connect cable leads as follows: Terminal 1 = Black Reference Lead Terminal 2 = 100K ohm resistor (pre-installed by Honeywell) Terminal 3 = 100K ohm resistor (pre-installed by Honeywell) Terminal 4 = Shield Terminal 5 = 1 Megohm resistor (pre-installed by Honeywell) Terminal 6 = Red Measuring Lead and 1 Megohm resistor (pre-installed by Honeywell)
4	Slide cover along cable and tighten by hand onto the remote connector assembly.
5	Slide cap along cable and tighten onto cable jacket with small wrench until cable cannot slide within strain relief rubber bushing.
6	Remove red protective vinyl boot from opposite end of connector assembly.
7	Apply a thin film of silicon grease on the ID of the electronics module's electrode mounting cavity.
8	Plug remote connector assembly into DL422 module aligning polarity tab of module housing and mating groove on connector.

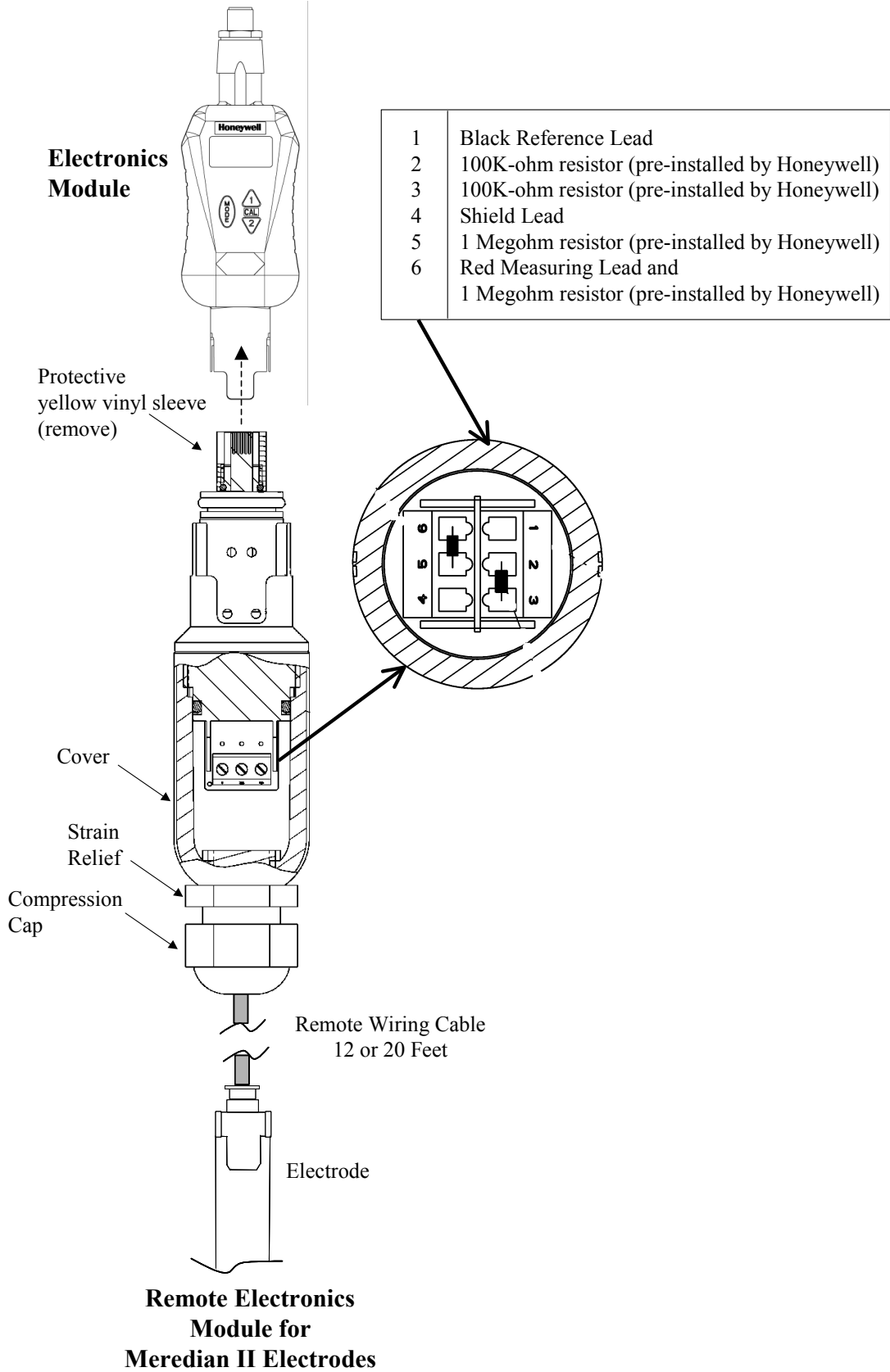
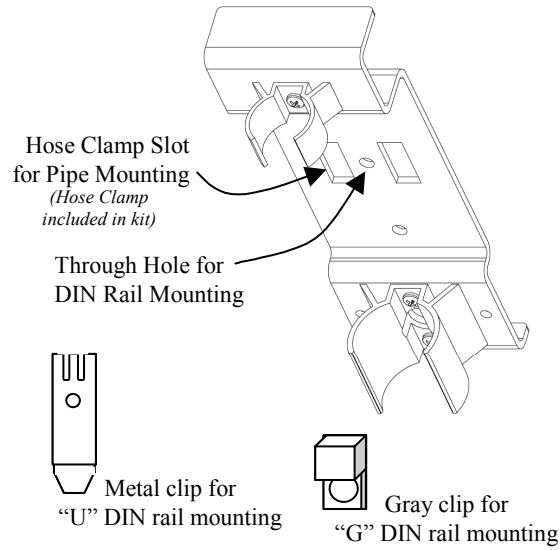


Figure 2-4 Remote Mounting



Mounting Kit

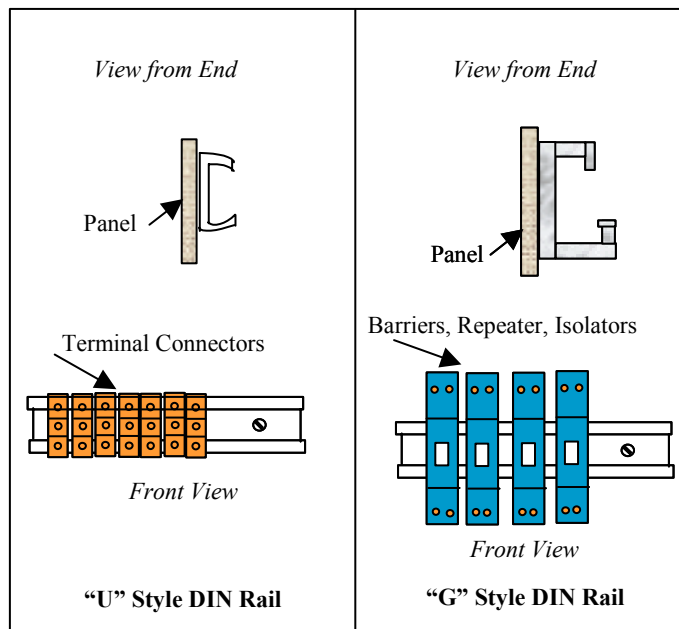


Figure 2-5 Remote Mounting Hardware

2.4 Conduit connections

The DirectLine provides a male $\frac{1}{2}$ " NPT thread to accommodate a customer conduit connection. Use $\frac{1}{2}$ " conduit coupling (min. 38.1mm (1.5") long) on DL conduit connection to clear cordset connector. Conduit can not be used with field wiring connector due to size restriction.

Do not exceed 200in-lb. torque when attaching fixed piping.

Use wrench flats provided under the $\frac{1}{2}$ " NPT threads to support the DirectLine during installation.

3. Configuration

3.1 Overview

Configuration Parameters

Set Up consists of configuring the following functions:

- **Noise Suppression Frequency Selection** – Selection of 50 Hz or 60 Hz. Defaults to 60 Hz at unit reset.
- **Output Configuration** – The following Output Configuration functions can be selected:
 - **0 % Range** 0 % Range values can be adjusted within a range of –1600 mV to +1600 mV in 10 mV increments.
 - **100 % Range** 100 % Range values can be adjusted within a range of –1600 mV to +1600 mV in 10 mV increments.
 - **0 % Calibration** Output current can be typically adjusted to within a range of 3.80 mA to 4.40 mA.
 - **100 % Calibration** Output current can be typically adjusted to within a range of 19.60 mA to 20.40 mA.

Table 3-1 provides steps and entry information for the complete configuration sequence.

3.2 Configuration Set Up Procedure

ATTENTION:

In Table 3-1, under the **Press** column:




- **Hold** means to hold the button down until the display changes.
- **Momentarily** means to press and release the indicated button.







From the Online ORP display, follow this procedure.

ATTENTION:

If no key is pressed for 60 seconds, the display will abort the entry mode and default to Online Display.

Table 3-1 Configuration Set Up Procedure

Step	Operation	Press	Display
1	Enter Noise Suppression Frequency	MODE Hold	nSUP (for 1 second) then, (Noise Suppression Frequency Selection)
	Edit Noise Suppression Frequency	MODE Hold	Flashing Display – You are now in EDIT mode (Value of current Frequency selection)
	Select desired Frequency	 Momentarily	To select 50 Hz or 60 Hz (default)
	Save the Noise Suppression Frequency	MODE Momentarily	Selection for frequency
2	Enter Output Configuration	MODE Momentarily	OutC Enter Output Calibration
	0 % Range Value Selection	 Momentarily	rnGL (for 1 second) then, (value of current 0 % Range Value Selection)
	Edit 0 % Range Value Selection	MODE Hold	Flashing Display – You are now in EDIT mode Value of current 0 % selection)
	Select desired 0 % ORP Value	 Momentarily	Selected 0 % ORP Value in 10 mV increments Range: –1600 to +1600 mV (default –1600 mV)
	Save the New 0 % Range Value	MODE Momentarily	(New Value)

Step	Operation	Press	Display
3	100 % Range Value Selection	 Momentarily	rnGH (for 1 second) then, (value of current 100 % Range Value Selection)
	Edit 100 % Range Value Selection	MODE Hold	Flashing Display – You are now in EDIT mode (value of current 100 % selection)
	Select 100 % ORP Value	 Momentarily	Selected 100 % ORP Value in 10 mV increments Range: –1600 to +1600 mV (default 1600 mV)
	Save the New 100 % Range Value	MODE Momentarily	(New Value)
4	0 % Calibration	 Momentarily	AdJL
	Adjust 0 % Calibration	MODE Hold	AdJL (flashes) – You are now in EDIT mode Range: 3.80 to 4.40 mA typically (default 4.00 mA)
		 Momentarily	+AdJL (increments value) –AdJL (decrements value)
	Save 0 % Calibration	MODE Momentarily	AdJL
5	100 % Calibration	 Momentarily	AdJH
	Adjust 100 % Calibration	MODE Hold	AdJH (flashes) – You are now in EDIT mode Range: 19.60 to 20.40 mA typically (default 20.00 mA)
		 Momentarily	+AdJH (increments value) –AdJH (decrements value)
	Save 100 % Calibration	MODE Momentarily	AdJH
6	Return to Online Display	MODE Momentarily	Returns to Online Display

4. Calibration

4.1 Calibration Diagnostics

Introduction

The manual standardization adjustment changes the zero offset diagnostics used by this system. This value is viewed as read-only information. It is good practice to observe this value after calibration. Monitoring the value over time will help you predict when the electrode will need to be replaced.

Zero Offset Value

When Online ORP value is displayed, **PRESS** ▲ button momentarily to display the current **Zero Offset value**.

Zero Offset is non-volatile and is initialized to 0 mV at unit reset.

It has a range of ± 120 mV and it is updated after each calibration.

60 Second Timeout

If no key is pressed for 60 seconds, the display will abort the entry mode and default to Online Display.

4.2 Calibration Diagnostic Reset

Introduction

When a new electrode is installed, the indicated ORP will use the zero offset value from the previous calibration. Depending on the condition of the replaced electrode, the difference between the known and indicated ORP of the new electrode may vary as much as several millivolts. A calibration on the new electrode will correct this difference.

Zero Offset ORP Value

- a) Momentarily press ▲ to view the Zero Offset value. From this display press and hold the ▲ button until the Zero Offset ORP value resets to factory default "0".
- b) Press MODE button, or wait 60 seconds, to return to Online ORP.

4.3 Calibration

Overview

Calibration consists of the following function:

- **Calibrating the Zero (Standardization)** – Manual ORP calibration. In manual calibration, you can select a new ORP value above or below the recognized live ORP value.

ORP Calibration Using Reference Solution

Recommended to adjust for changes in electrode potential over time

An ORP measuring system can be checked by measuring a solution having a known oxidation-reduction potential, then adjusting the sensor to match. Although a reference solution provides only an approximation of ORP potential, the system can be adjusted periodically to compensate for changes in electrode potential over time.

Materials

The materials required to use the ORP standardization method are:

- A solution with a known oxidation-reduction potential. (See “Instructions for preparing solution” below.)
- A container for the solution, large enough to immerse the electrode to measuring depth.
- Distilled or de-ionized water to rinse the electrode.

Instructions for preparing solution

To prepare an ORP standardization solution, dissolve 0.1 g of quinhydrone powder (available as Honeywell part number 31103015 for a 2 oz. bottle) in 5 cc of acetone or methyl alcohol (methanol). Add this to not more than 500 cc of a standard pH reference solution (buffer), about 1 part saturated quinhydrone to 100 parts buffer solution. The oxidation potential of this solution is listed below for several temperatures. The polarity sign shown is that of the measuring element with respect to the reference element.

These solutions are unstable and should be used within eight hours of preparation.

All mV values in Table 4-1 have a ± 30 mV tolerance.

Table 4-1 Oxidation-Reduction Potential of Reference Solutions at Specified Temperature

pH Buffer Solution (Honeywell Part Number)	Temperature		
	20 °C	25 °C	30 °C
4.01 @ 25 °C (31103001)	267 mV	263 mV	259 mV
6.86 @ 25 °C (31103002)	100 mV	94 mV	88 mV
7.00 @ 25 °C (not available from Honeywell)	92 mV	86 mV	80 mV
9.00 @ 25 °C (not available from Honeywell)	-26 mV	-32 mV	-39 mV
9.18 @ 25 °C (31103003)	-36 mV	-43 mV	-49 mV





Calibration Procedures

ATTENTION:

In Table 4-2, under the **Press** column:

- **Hold** means to hold the button down until the display changes.
- **Momentarily** means to press and release the indicated button.

Table 4-2 Zero (Standardization) Calibration Procedure

Step	Operation	Press	Display
1	Enter Zero (Standardization) Calibration	 Hold	CAL1
2	Do Sample (Manual) Calibration	 Momentarily	SCAL for one second, then displays Live ORP Value.
	Edit ORP Value	 or  Momentarily	To edit ORP Value (<i>Flashing Display</i>)
	Save New ORP Value	MODE Momentarily	ORP Value is saved and goes to Online Display .

5. Operation

5.1 Displays

Overview

The DirectLine® DL422 displays the ORP value and Zero Offset ORP value. The table below describes these parameters.

Table 5-1 Online Parameter Descriptions

Parameter	Description
Online ORP	Measured ORP expressed with fixed whole number precision. Range: –1600 mV to +1600 mV
Zero Offset ORP Value	Zero Offset ORP value expressed with whole number precision. Range: –120 mV to +120 mV

The default display and home position is the **Online ORP** display. It appears when:

- *The unit is powered up*
- *No button presses for 60 seconds*
- *The Mode button has been pressed during Zero (Standardization) calibration (**Sample Calibration**)*
- *The Mode button has been pressed during a configuration edit*


The measurement and display of ORP is updated at a rate of 500 ms.

ATTENTION:

In Table 5-2, under the **Press** column:

- **Momentarily** means to press and release the indicated button.

Table 5-2 Display Navigation Procedure

Step	Operation	Press	Display
1	View Online ORP value	MODE Momentarily	<i>(measured ORP)</i>
2	View Zero Offset ORP value	 Momentarily	<i>(Zero Offset ORP)</i>
3	Return to home position	MODE Momentarily	<i>(measured ORP)</i>

5.2 Diagnostic Error Messages

When a diagnostic error or status condition occurs, the Online Display alternates between measured ORP and a text message.

Table 5-3 Online Diagnostic Errors

What you see	What it is	What to do
CNFG	Data error detected.	Reset unit or cycle power. Second occurrence will show FALT.
FALT	Unit electronics are defective.	Replace electronics module.
<i>These errors may occur when online ORP is displayed.</i>		
O HI	Measured ORP is > 1600 mV	Bring process within limits
O LO	Measured ORP is < -1600 mV	Bring process within limits
PRBE	Probe is defective, removed from process, or not connected. Forces the output to burnout level (approximately 21.8 mA).	Check probe, connection and presence of sample. When the source of the error is removed, the error will clear and the output will return to normal operation.
<i>This error may occur during probe calibration and abort the calibration process.</i>		
FAIL	This error message is preceded by the message "FAIL" ZRNG The Zero (Standardization) calibration failed due to a calculated Zero Offset value outside the range of -120 mV to +120 mV.	Press Mode to return to online display.

5.3 Unit Reset

Overview

Unit Reset initializes all of the DirectLine® Sensor’s calibration and configuration data to factory default values.

Procedure

- From the Online ORP display, press and hold the ▲ and ▼ buttons simultaneously until the “rSEt” appears on the display (**minimum of 10 seconds**).
- “rSEt” will remain on the display until reset is complete. Next, the firmware version number appears briefly and the unit then returns to the Online ORP display.

Table 5-4 Factory Default Values

Data	Default Values
Zero Offset	0 mV
Noise Suppression Frequency Selection	60 Hz
Output Configuration – 0 % Range Value	–1600 mV
Output Configuration – 100 % Range Value	1600 mV
Output Configuration – 0 % Calibration	4.00 mA typically
Output Configuration – 100 % Calibration	20.00 mA typically

6. Spare Parts

Part Number	Description
51452682-001	DirectLine® Sensor Module (Replacement Module)
51452683-001	6m cordset
51452684-001	Field Wiring Connector supports customer supplied cable (4-6 mm OD)
51500768-002	Remote Electrode Cable Connector Assembly– Includes O-rings, strain relief, and pre-installed resistors
51451371-001	Cable Strain Relief
51198302-006	Internal O-ring for Remote Electrode Cable Connector
31086221	External O-ring for Integral Meredian Electrode or Remote Electrode Cable Connector
51452655-001	Remote Mounting Kit for Wall, Pipe, or DIN Mounting
51452706-001	Locking screw (locks sensor module to electrode)

Cordset

The cordset connection is an M12 female type that can be purchased directly from Honeywell or from multiple vendors including:

Turck Industries

Part Number RKV4T-6/S618 for a 6 m cordset with a stainless coupling nut

Part Number RK4T-6/S618 for a 6 m cordset with a nickel plated coupling nut

Phoenix Contact

Part Number SAC-3P-5.0-PUR/M12FSSH Stainless for a 5m cordset with a stainless coupling nut

Part Number SAC-3P-5.0-PUR/M12FSSH for a 5m cordset with a nickel plated coupling nut

Field Wiring connector

The Field Wiring Connector is an all-plastic screw terminal M12 female type that can be purchased directly from Honeywell or from multiple vendors including:

Turck Industries

Part Number B8141-0 for a M12 field wiring connector that accommodates customer supplied cable.

Phoenix Contact

Part Number SACC-M12FS-4CON-PG7 for a M12 field wiring connector that accommodates customer supplied cable.

7. Sales and Service

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

ARGENTINA

HONEYWELL S.A.I.C.
BELGRANO 1156
BUENOS AIRES
ARGENTINA
Tel.: 54 1 383 9290

ASIA PACIFIC

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