ORP100 Sensor

Edition 1.01

User Manual

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Greenspan Customer Service

Technical Support When You Need It

The correct choice of sensor should be supported by professional advice to ensure long term success in the field. **Greenspan Technical Services** is dedicated to customer support and provides assistance in the selection, installation, deployment and commissioning of sensors with a full range of consulting services.

A full technical support and field advice service can be accessed by ringing **Customer Service** on +61 746 601888 between 8am - 6pm, 5 days a week.

All requests for information will be serviced within 24 hours.

All Greenspan products are designed, developed and manufactured in Australia, can be supplied at short notice and be customised to meet most requirements.

Warranty Details

All Greenspan products are covered by a 12-month warranty.

All warranty service will be turned around in 7 working days or less or contact will be made with customer to discuss delay.

The sensor should not be dismantled unless under instruction from Greenspan. Incorrect handling will void the warranty.

Contents

INTRODUCTION 1

Overview

Oxidation and reduction (redox) reactions govern the behaviour of many chemical constituents in drinking water, process and waste waters as well as most aquatic environments.

Reactions involving ions are both pH and Eh(mV) dependent, therefore chemical reactions in aqueous media can often be characterised by pH and Eh acting together with the activity of dissolved chemicals.

The output from the ORP100 sensor is standard 4 – 20mA current loop. The higher the redox reading, the greater the level of corrosion that can occur with non protected metals.

The Sensor

A standard commercial Platinum ORP sensor is utilised by the ORP100 to measure ionic absorption in solution.

The principle means of detection is by measuring the difference in potential between an inert indicator electrode and a reference electrode. At redox equilibrium, the potential difference between the ideal indicator electrode and the reference electrode equals the redox potential of the system.

Electrodes made of platinum are most commonly used for Eh measurements. The standard hydrogen reference electrode is fragile and impractical for routine field use. The Greenspan ORP100 uses a silver:silver-chloride electrode and these are commonly used.

HARDWARE 2

Sensor Design

The Greenspan ORP100 pressure sensor consists of the following primary elements:

- Platinum silver:silver-chloride electrode
- Signal conditioning and output circuit
- Data cable
- Stainless Steel or Delrin packaging

Signal Conditioning Circuit

This unit performs the following tasks:

- Provides a high impedance input circuit for the transducer.
- Monitors the output voltage from the platinum transducer.
- The signal path is optically isolated using balanced optical isolation techniques to ensure that there is no signal path from the electrode to a common power supply.
- A low DC-DC transformer isolated power supply ensures that there is no DC path between the electrodes and a common power supply.
- Provides 4-20mA output suitable for data acquisition or process control.
- Accepts any supply voltage between 8-15V and provides a stable operating voltage.

The sensor needs to be turned on for at least two seconds to ensure the full accuracy of the sensor. This assumes the sensor has reached equilibrium with the solution prior to reading.

Data Cable

The data cable consists of the following:

- Outer sheath of wall thickness 1.2 +/-0.3mm, Polyurethane.
- Eight inner cores of 7 strand x 0.2mm copper, PVC sheathed
- Aluminium earth shield and drain wire

The cable has a resistance of 9 ohms per 100m. Therefore, if 25m of cable is used with a 4-20mA sensor the total voltage drop across the cable at full scale is:

= (F/Scale + Quiescent I) x (25 x 0.09) ohms

= (20mA + 12mA) x 2.25 ohms = 34 millivolts

Therefore to ensure that the minimum voltage at the sensor is at least 8 volts, a supply voltage of 8 + 0.034 = 8.034V is required.

Protection

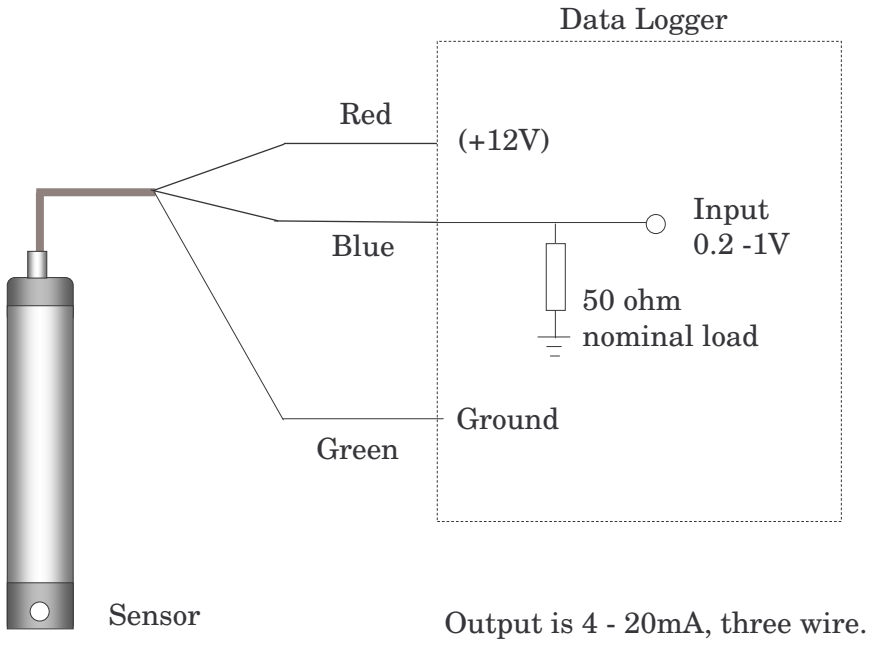
The sensors are protected against reverse voltage connection and transient voltages of 2KV such as may occur during lightning storms. However, if using in areas prone to lightning activity it is recommended that lightning arresters be fitted to all input cables.

INSTALLATION 3

Connection

The maximum load that may be applied to the sensor output is 400 ohms at 12V or 500 ohms at 14V. The typical loading is 50 - 100 ohms.

Diagram 1.



The red (+12V) and green (Gnd) wires provide power to the ORP100 sensor and the 4-20mA current loop output is available on the blue wire.

General Methods of Installation

There are many ways of positioning sensors in the field in order to ensure the continuous gathering of data and the safety of the device.

Consideration needs to be given to the possibility of vandalism, animal damage, theft and extreme weather conditions.

Some methods commonly in use are:

1. Installed in PVC conduit with sensor emerging from the immersed end.

2. Strapped to pylon or post in areas that become submersed, cabled to bank.

3. Hand operation for spot readings.

Typical Locations

1. Edge of river/stream/lake embankment.

3. Mounted within a stilling well, off stream from the main flow.

4. Sensor anchored to bed of lake/stream

5. Suspended from dam walls.

6. Mounted within drainage channels/pipes

CALIBRATION 4

It is not possible to calibrate Eh electrodes over a range of redox potentials (as is done with pH electrodes). Instead standard solutions that are stable with known redox potentials for specific indicator electrodes, are used to check response. There are two main solutions used for measuring redox potentials, Light's solution and Zo Bell's solution.
The table below shows the theoretical potential of platinum ORP electrodes using two different common reference electrodes in the ORP standard Light's solution and Zo Bell's solution. The actual potential of the Greenspan ORP electrode in Light's solution is specified as 465mV+/- 10mV.

Comparison Table

Reference	Standard Hydrogen Electrode (SHE)	Greenspan Ag/AgCl Electrode
Light's Solution	+675mV	+465mV, +/10mV
ZoBell's Solution	-	+229mV Saturated KCL

To determine the Eh of a sample relative to the hydrogen electrode, measure Eh of both sample and standard solution at the same temperature. Then calculate the Eh of the sample:

$$\mathbf{Eh_{system} = E_{observed} + Eh_{Light's\ vs\ SHE} - Eh_{Light's\ Observed}}$$

Where : $E_{observed}$ = measured potential of sample

$Eh_{Light's\ vs\ SHE}$ = Potential of Light's versus SHE (675mV),

$Eh_{Light's\ Observed}$ = measured potential of Light's solution, (465+/-10mV)

Reference

1. Standard Methods 19th ED. 1995, 2-76, Oxidation and Reduction Potential Measurement in Clean Water.

CLEANING AND MAINTENANCE 5

The sensor may be cleaned using a soft cloth and warm water, encrustation's or barnacle growth may have to be removed with a scraping action. Care is required when cleaning the head as the electrode must not be damaged.

Greenspan recommends calibration is checked every six to twelve months.

Greenspan offers a re-calibration service if required.

Maintenance

To restore electrodes after long periods of use, fill a small plastic cap that can be fitted over the sensor electrode with a solution of 6N HNO_3 (Nitric Acid) for 5 min after bringing to a boil, or fill with warm (70°C) aqua regia for 1-2 min. *

Alternatively treat with chromic acid solution followed by 6N HCl and rinse in water. Care is required handling any cleaning solutions.

(*Ref: 1 - Standard Methods)

TROUBLESHOOTING 6

1. If output readings appear incorrect, disconnect the ORP sensor from the logger and connect a milliammeter in series with the sensor output and ground. In Lights Solution it should read 19.44mA, ±0.2mA. If the readings are still incorrect and other causes have been eliminated contact Greenspan.

2. If there appears to be no output from the ORP sensor, check external connections are correct, (see connection diagram) and that power is 8 - 15V and turned on.

3. The platinum electrode may require replacement if readings are incorrect or the sensor has aged.

APPENDIX 7

SPECIFICATIONS

Specification	Model ORP100
Range	± 500mV
Temperature Range	0-40°C
Accuracy	± 10mV (or ± 0.2mA)
Supply Voltage	8-15VDC Reverse polarity protected Surge protected to 2kV
Quiescent Current	12 mA
Warm up time to stable reading	2 Seconds
Output	4-20mA
Dimensions	length 206 mm, S/S body 31.8 mm OD Delrin body 38 mm OD
Wetted Materials	316 Stainless steel, Delrin,
Output Load (min-max)	0-500 ohms at 14V 0-400 ohms at 12V
Storage Temperature	- 20 to +60°C

ORP (Redox) SENSOR

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CERTIFICATE of CONFORMANCE

Customer:

Model No. **ORP100**

Ref:

Product Information

Serial No.		**ORP1020**
Range		±500mV
Output	**FS**	20.00 mA
	Zero	4.00 mA
Accuracy		±10mV
Cable Length		20 metres

Supply Voltage		8- 15 VDC
Connection	**+ve**	Red
	o/p	Blue
	Gnd	Green
Connection Code		BW

For connection detail please refer to **Connector Chart** supplied.

User Notes

1. Do not attempt to dismantle the sensor as this will void the warranty. Contact your agent for technical advice.
2. The sensor is protected against reverse polarity connection.
3. The sensor is fitted with a lightning protector/surge device.

Inspected By : ..... / /