

RetroReader™

Clamp continuity tester

Operation manual



Designed for use
with Deepwater's
RetroClamp™

Confirms electrical
connection of clamp
and structure

Twin reference
elements for
online calibration

Includes Polatrak
Deep C Meter™
subsea readout

Table of contents

1. Overview	3
2. Scope	3
3. Health and safety	3
3.1 Heavy objects	3
4. Components	3
4.1 Holster	4
4.2 Deep C Meter 3000	5
4.3 Bulkhead connector	5
5. Operation	5
5.1 Topside installation	5
5.2 Deployment	6
5.3 Recovery	6
6. Reference documents	7
6.1 Drawings	7
6.2 MSDS documents	7
7. Calibration	7
8. Maintenance	7
8.1 Replace batteries	7
8.2 Reference electrode element replacement	8
9. Troubleshooting	8
9.1 Failure to power on	8
9.2 Readings are incorrect, or more than ± 5 mV from each other	8
9.3 Diagnosing a defective reference element electrode	9
9.4 Damage has occurred to the housing/lens/some other element	9
9.5 Other troubleshooting	9
10. Appendix	10

List of figures

Figure 1: RetroReader properly installed onto RetroClamp.....	3
Figure 2: RetroReader kit contents.....	4
Figure 3: Bulkhead connector and reference electrodes.....	5
Figure 4: RetroReader leads.....	6

List of tables

Table 1: Troubleshooting quick guide.....	9
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1. Overview

The RetroReader™ is a device attached to a RetroClamp™ that clearly indicates to the ROV operator when electrical contact with the target structure has been achieved. The RetroReader consists of an ultra-bright LED readout inside a pressure housing, a holster with two magnesium ribbon anodes, mounting hardware, grounding wires and breakaway zip ties.

2 Scope

The purpose of this document is to instruct the user on how to use and maintain the RetroReader in a safe and successful manner.

3 Health and safety

It is the intention of Deepwater Corrosion that all testing, inspection, installation, and recovery procedures are carried out in a safe manner in accordance with the Health and Safety at Work Act and any other relevant legislation. If required by the client, Deepwater personnel will attend any site safety induction courses before carrying out work on site.

3.1 Heavy objects

The RetroReader and the RetroClamp are both heavy, metal objects. Fingers, hands and feet caught between these objects or hit by a falling object can be subject to injury. Care should be taken when handling these items.

These items should not be stored, staged, or assembled in any location where they may fall and strike personnel or equipment. Such an incident could result in severe injury or death.

4. Components



Figure 1: RetroReader properly installed onto RetroClamp



Figure 2: RetroReader kit contents

4.1 Holster

The holster secures all of the RetroReader components onto the RetroClamp. The holster hangs on the side of the RetroClamp and has a spade connector attached to the floating plate of the clamp. The spade connector ensures electrical continuity between the RetroReader and RetroClamp and separates when the RetroReader is removed by the ROV. If installing multiple RetroClamps, a new spade connector should be attached for each clamp installation since half of the connector is left behind when the RetroReader is removed subsea. Two magnesium anode ribbons are attached to the

sides of the holster to give the RetroClamp assembly a much more electronegative value than the target structure: between -1300 mV and -1500 mV ref. Ag/AgCl. After the contact screw on the RetroClamp makes contact with the steel tubular, the LED readout should register a significant positive shift. The beaded cable ties secure the bottom end of the holster to the RetroClamp to prevent the RetroReader from detaching. The cable ties have a tensile strength of 18 pounds, which allows the ties to break upon ROV removal of the RetroReader. Spare beaded cable ties, magnesium anodes and spade connectors are provided in the kit.

4.2 Deep C Meter 3000

The Deep C Meter 3000 provides the voltage display for the system. The pressure housing, made of 316 SS, houses the electronics and LED readout, which is comprised of two display lines. There are two display lines because the voltage is measured against two separate Ag/AgCl reference electrodes for increased accuracy. There should be a ± 5 mV tolerance between the two readouts; if the LED readout displays voltages greater than ± 5 mV apart, refer to the troubleshooting section. The black lens cap should always be placed on the lens of the display when the unit is not in use. Spare lens screws, O-rings, an Allen key, Parker O-Lube, and Dow Corning Electrical Insulating Compound are provided in the kit.

4.3 Bulkhead connector

The three-pin bulkhead connector attaches directly to the Deep C Meter 3000. The bulkhead wires connect the two reference electrode cells and probe lead with the voltage display unit. The probe lead becomes the grounding wire from the Deep C Meter to the holster. Reference electrodes should never be touched by bare or greasy hands. The kit includes spare reference electrodes and black zip-ties for securing the electrodes to the bulkhead. See Section 5.1, Topside installation, for instructions on securing the electrodes and attaching the probe lead to the holster. Refer to Section 7, Calibration, for instructions on calibration of the reference electrodes.

5. Operation

5.1 Topside installation

- 1) Visually inspect the RetroReader and all components for damage.
- 2) Remove the dummy plug from the Deep C Meter and install the three-pin bulkhead connector. The dummy plug should always be in place when the Deep C Meter is unmated from the connector or not in use.
- 3) Apply an intense light source to the lens of the Deep C Meter to trigger the photocell and verify that the LED readout activates. If the unit fails to power on, see the troubleshooting section.
- 4) Secure the Deep C Meter assembly into the holster, as seen in Figure 1. Ensure that the fasteners on the Grinnell are secure.
- 5) Wrap the two reference electrodes and the probe lead up toward the Deep C Meter and secure onto the bulkhead with the provided black zip-tie. Do not touch the reference electrodes and always make sure that they are not touching the bulkhead or any

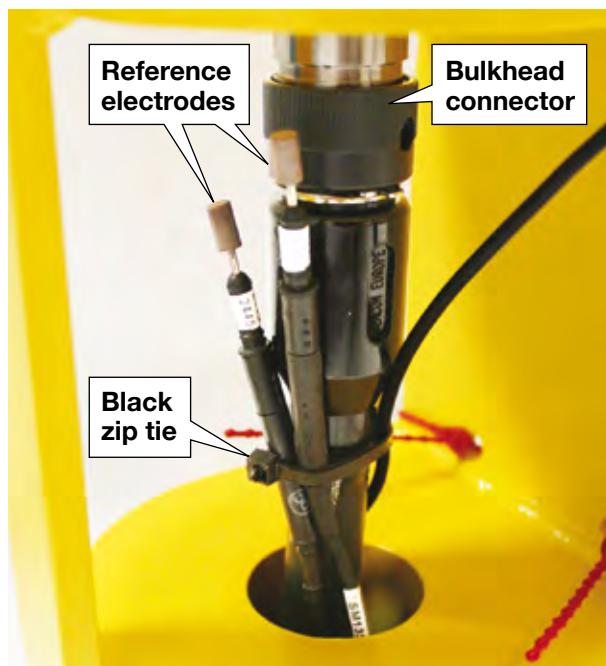


Figure 3: Bulkhead connector and reference electrodes

metal. Refer to Figure 3: Bulkhead connector and reference electrodes.

- 6) Fasten the probe lead and spade connector onto the holster stud as shown in Figure 4. The assembly starting from the bottom of the stud should be: nut, spade connector lug, star washer, nut, probe lead, star washer, and nut.
- 7) Calibrate the RetroReader assembly as per Section 7
- 8) Place the holster onto the clamp as shown in Figure 1 and Figure 4. The latch on the underside of the holster should fit over the round cross-member of the RetroClamp.
- 9) Fasten the other half of the spade connector to the floating plate of the RetroClamp and connect the two leads as shown in Figure 4.
- 10) Feed a beaded cable tie through each of the two holes on the lower end of the holster. Wrap them around the RetroClamp plate, pull until they fit snugly, and fasten the ties as shown in Figure 4.

11) Ensure electrical continuity from the magnesium anodes to the holster, and then from the holster to the RetroClamp. To do this, use a multimeter to measure the resistance between the two items. The resistance between them should not exceed 0.2Ω . For confirming continuity between the magnesium anodes and holster, apply one lead of the multimeter to the magnesium core and the other lead to a bare stud on the holster. To confirm continuity between the holster and RetroClamp, apply one lead of the multimeter to a stud on the RetroClamp and the other lead to a bare stud on the holster.

5.2 Deployment

- 12) Deploy the cathodic protection system as per appropriate system manual.
- 13) After moving the RetroClamp into position on the steel tubular, but before turning the contact screw, record the potential from the LED readout. The values may slowly become more negative due to the polarization of the RetroClamp by the anodes.
- 14) Continue installation of RetroClamp.
- 15) Expect a voltage potential shift of 200 to 400 mV in the electropositive direction once the contact screw makes contact with the steel pipe. This indicates that an electrical connection has been made. Stop turning the contact screw once a connection has been made.
- 16) Take another potential reading after RetroClamp installation is complete. This will be the pipeline "as-left" potential.

5.3 Recovery

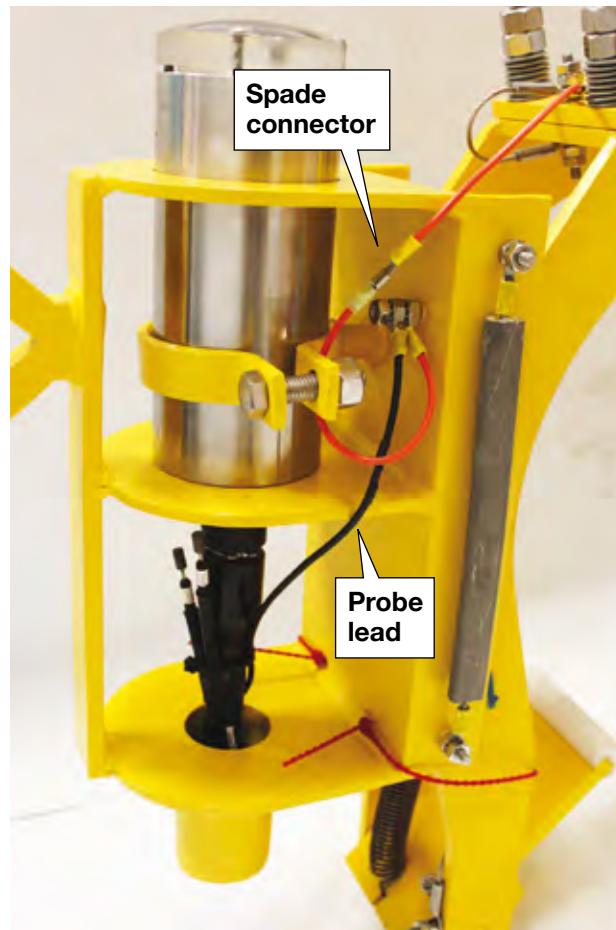


Figure 4: RetroReader leads

17) Recover the RetroReader. Grasp the D-Handle, lift straight up, and move away slowly. The beaded RetroReader cable ties will break first, followed by the spade connector between the holster and RetroClamp.

18) Wash all recovered equipment with fresh water before storing.

6 Reference documents

6.1 Drawings

RetroReader assembly drawing will be provided upon request by the client.

6.2 MSDS Documents

See the appendix for applicable MSDS documents, listed below.

1) Parker Seals – Parker O Lube MSDS

2) Dow Corning – 4 Electrical Insulating Compound MSDS

7 Calibration

1) Ensure the probe lead is firmly secured onto the grounding stud on the holster, and that the magnesium ribbon anodes are firmly secured onto the studs on the side of the holster.

2) Fill a non-metallic bucket or container with enough seawater (or simulated solution with a specific gravity between 1.021 and 1.028) to submerge the RetroReader. Place the RetroReader into the bucket. The reference electrodes, grounding stud, and anodes must be submerged. Never use a metallic container for storage or for performing calibrations.

3) Wait 30 minutes for the electrode elements to reach equilibrium. Both display lines of the LED readout should show between -1300 mV and -1500 mV and should be within ± 5 mV of each other.

4) If the readings are further apart than ± 5 mV, see section 9.2.

Note: If the RetroReader is deployed subsea and the lines of the LED readout are not within ± 5 mV of each other, this indicates that one reference electrode cell is defective. It is possible to complete the installation, but readings from the defective electrode should not be used. The defective reference electrode is normally the one that displays the most positive potential. To isolate the defective cell, note the potential reading from both display lines of the LED readout. The most negative reading indicates the properly functioning reference electrode; this is the reading that should be used for the completion of the installation. After recovering the RetroReader, replace the defective reference electrode. See Section 8 for instructions on replacing reference electrode elements.

8 Maintenance

This section covers general operational maintenance. Do not attempt any task not described in this section, as it may damage the system. Always wash the RetroReader and associated equipment with fresh water after equipment has been exposed to a saltwater environment.

8.1 Replace batteries

Batteries will need to be replaced after 48-60 hours of operation or when the LED readout begins to fade. This should be done someplace clean and dry.

1) Remove the Deep C Meter and bulkhead connector from the holster.

- 2) Remove all four stainless steel retaining screws from the lens.
- 3) Rotate the lens approximately 10 degrees in both directions to avoid damage to the threads in the housing.
- 4) Screw in the four stainless steel Allen screws evenly to draw out the lens.
- 5) Carefully pull out the lens.
- 6) Remove the stainless steel Allen screws from the lens.
- 7) Remove the voltmeter module from the housing. Remove and replace the two PP3 9-Volt batteries.

Note: O-rings and lube must be replaced every time the lens is removed.

8.2 Reference electrode element replacement

Spare plug-in electrode elements are available for the bulkhead connector. These are the same elements provided in the ROV-II probe and CP Gun. Follow this procedure for reference electrode replacement:

- 1) Remove the Deep C Meter and bulkhead connector from the holster. Completely dry the meter and bulkhead.
- 2) Remove the defective electrode and discard according to appropriate local environmental procedures. For steps on diagnosing the defective electrode, refer to section 9.3.
- 3) **DO NOT handle the electrode pellet with bare hands.** Take the new reference electrode and carefully place a small amount of Dow Corning Electrical Insulating Compound on the sealing section of the connector. Please refer to the MSDS in the Appendix before handling the compound. All appropriate Personal Protective Equipment (PPE) shall be worn, including safety glasses at the very least.
- 4) Plug the new electrode into the connector.
- 5) Check that all connectors are fully mated and reattach the bulkhead connector to the Deep C Meter.
- 6) Repeat calibration as described in Section 7. Note that a new dry element may take up to 30 minutes to reach equilibrium. NEVER immerse an electrode element in water with the connector pin exposed.

9 Troubleshooting

9.1 Failure to power on

- 1) Ensure that the light source is sufficient to trigger the photocell.
- 2) Change the batteries per section 8.1.
- 3) If these steps cannot resolve the issue, contact a Polatrak representative.

9.2 Readings are incorrect, or more than ± 5 mV from each other

Calibrate the unit. If the problem persists, one of the electrodes may have failed. Follow the steps below for diagnosing a defective electrode.

9.3 Diagnosing a defective reference element electrode

- 1) Wash the unit with fresh water and dry.
- 2) Do not handle the small electrode pellets with bare hands.
- 3) Determine how the electrodes are wired with respect to the display lines. Unplug one element at a time, without touching the electrode pellet, to see which display line turns off.
- 4) The defective electrode is the one which reads the most positive voltage. Replace the electrode following the steps in section 8.2.

If the problem persists, contact a Polatrak representative.

9.4 Damage has occurred to the housing/lens/some other element

- 1) Contact a Polatrak representative to ask if the system might be compromised.
- 2) If the system is compromised, order spare parts or a new unit through your Polatrak representative.

9.5. Other troubleshooting

Table 1 - Troubleshooting quick guide

Symptom	Possible problem	Action
Instrument will not calibrate	One electrode is bad	See section 9.3
	Magnesium is passivated	Remove magnesium and clean with rasp
	Electrodes are dry	Soak in seawater for 30 minutes and retry
Both electrodes reading low	Probe wire damaged	Inspect wire and repair with ScotchKote as a temporary measure. Order replacement bulkhead.
	LED readout batteries are low Poor structure contact	Replace batteries Ensure electrical continuity between all items.
One reading suddenly goes less negative	Connector is flooded Bulkhead wires are nicked.	Check connectors Inspect and repair / replace as necessary
	Not enough light to photo-cell Batteries are dead Pressure housing is flooded	Increase light intensity and re-direct to center of lens. Replace batteries Go to backup; return unit to Polatrak.

If a problem persists or is not listed, please call the hotline at (713) 983-7117 and ask for PolaTrak technical support.

10 Appendix

Please see the following pages for the pertinent MSDS documents:

1) Parker Seals – Parker O Lube MSDS

<http://www.parker.com/literature/O-Ring%20Division%20Literature/Static%20Files/lubricantusage.pdf>

2) Dow Corning – 4 Electrical Insulating Compound MSDS

<http://www.dowcorning.com/applications/search/products/Details.aspx?prod=01903128&type=PROD>