BUCKLEYS

MANUFACTURERS OF SPECIALIST TEST EQUIPMENT

# BathyCorrometer® Pro'

## Operating Instructions

English Version


**Please read carefully before use**

**BCMP/IM/ENG/V.05/23**

# Contents

# Description

The BathyCorrometer® Pro' (BCM) is an underwater corrosion voltmeter powered by an integral, rechargeable battery pack. The unit is fitted with a 3½ digit, high impedance (1MΩ) liquid crystal display (LCD) voltmeter.

The unit can read voltages from 0.000V to -1.999V DC. The structure to water potential is detected by an internal Ag/AgCl/seawater half-cell electrode of robust and proven construction. The reference electrode is mounted behind the red protective nose cone and sited 5cm from the probe tip.

**Probe Tips**

Six stainless steel probe tips are supplied with the instrument. They are provided with a standard point suitable for use on steel work with coatings of either paint or tape as used on piles, under sea pipelines and through thicker coatings, marine growth and similar.

The probe tip is fitted to the front of the instrument by screwing it onto the stainless-steel stud and tightened with the spanner provided. A definite 'bottoming' should be felt as the probe is screwed fully home. Silicone grease smeared on the outside of the probe will assist fitting.

**Shorting Plug**

The unit is activated by use of the shorting plug provided. This should be removed when the instrument is not in use to conserve battery power. Silicone grease smeared on the moulded pins of the plug will greatly ease its insertion. The plug MUST be inserted into the handle socket before the instrument is immersed in water, otherwise spurious readings and damage to the socket will occur.

**Battery**

Under normal usage a fully charged battery will provide in excess of 100 hours' operation. Low battery level is indicated by a battery symbol appearing in the top left of the LCD display. As the battery is nickel-metal hydride it has the advantage of no memory effect (unlike nickel-cadmium) and can be charged at any time.

The BCM should only be charged using the charger supplied. Use of an incorrect charger may damage the electronics and would not be covered by warranty.

# Technical data

| | |
|---|---|
| BCM unit operating depth: | Up to 300m<br>(pressure tested to 600psi/42bar) |
| Display: | 3½ digit LCD, 12.7mm digit height |
| Range: | 0.00 to -1.999V |
| DC accuracy: | 0.05% typical (±1 count) |
| Input impedance: | >1MΩ |
| Operating temperature range: | 0 to 30°C |
| Temperature stability: | ±100 ppm/°C |
| Storage temperature range: | 0 to 50°C |
| Operating time (fully charged): | 100hr + |
| Reference electrode: | Silver/Silver Chloride Seawater |
| Accuracy Ag/AgCl: | 250mV ±10mV vs SHE at 25°C |
| Temperature coefficient: | -0.6mV °C |
| Half-cell effective life: | 1-2 years |
| Contact with structure: | A4/316 stainless steel probe |
| Handle bulkhead socket for: | On/Off, charging, reference test,<br>remote readout |
| Weight in air: | 2.5Kg |
| Weight in water: | 0.85Kg negative buoyancy |
| Instrument size: | 100mm diameter x 275mm long |
| Carrying case size: | 505mm x 380mm x 200mm |
| Charger input voltage: | 100V-240V AC 50-60Hz |
| Charger input current: | 100mA |
| Maximum charger output voltage: | 4.8V DC @ 350mA<br>9.6V DC @ 150mA |
| Charge indicator: | Multi-function red/green LED |

# Unpacking

Please check that all items are present in the kit by referring to the relevant datasheet for your kit (Basic, Standard or Complete).

If any items are missing contact your supplier immediately.

The packaging should be kept for future use should the unit need to be returned for repair or put into storage.

# Operation

**BathyCorrometer® Pro' unit**

Fit a stainless steel pointed probe tip to the end of the instrument using a smear of silicone grease to prevent damage of the O-ring seal. Use the spanner provided to ensure the probe tip is tightened fully.

Smear the shorting plug pins with silicone grease and insert the plug into the bulkhead socket in the handle of the BathyCorrometer® Pro'; this switches the BathyCorrometer® Pro' on. Screw the shorting plug retaining ring into the handle to prevent the shorting plug from being accidentally removed.

**Note:** The shorting plug must NOT be removed from the BCM while immersed.

The BathyCorrometer® Pro' has been fully tested and calibrated during manufacture. However, some drying out of the Ag/AgCl/seawater half-cell electrode may occur, therefore, it is recommended that prior to initial use the unit is soaked in seawater for a minimum of 30 minutes.

**Note:** DO NOT immerse the unit in fresh/tap water.

The BathyCorrometer® Pro' is now ready for use. If required, the calibration can be checked prior to use, see section entitled 'Calibration'.

To take a reading under water, push the pointed probe onto the structure ensuring that a good electrical contact is made to the steel structure.

The structure to seawater potential at that point can now be seen on the display.

After use, wash the BathyCorrometer® Pro' in clean seawater to remove any debris from inside the red nose cone then recharge the unit using the battery charger supplied.

**BathyCorrometer® Pro' Charger**

The BathyCorrometer® Pro' battery charger is supplied with several mains plug options (European, UK, USA, Australia, Asia), select the correct configuration for your mains supply, clicking it into position on the charger input.

It is recommended that the BathyCorrometer® Pro' is charged for 8 hours before initial use. Connect the charger to the BathyCorrometer® Pro'. Connect the charger to the mains supply, the small indicator light on the charger should illuminate. If the indicator does not illuminate check the connection to the BathyCorrometer® Pro' and that the mains power is on.

The normal time to recharge the battery from fully discharged is 14 hours, but it can be left on charge for up to 48 hours without damage to the battery. The battery may be recharged after use. Allow a charge time of 12 minutes for each hour's use.

There is no indication on the charger or the BathyCorrometer® Pro' that the battery is charged. If the charger is turned off it will not discharge the BCM. When charging is complete, disconnect the charger from the mains supply and then from the BathyCorrometer® Pro'.

**Note:** The BathyCorrometer® Pro' is **NOT** compatible with older BathyCorrometer chargers and **MUST** only be charged with a BathyCorrometer® Pro' Charger.

Similarly, the charger provided with this unit is **NOT** compatible with earlier models, and should not be used to charge them.

# Calibration

**IMPORTANT**

BathyCorrometer® recalibration should only be undertaken by Buckleys trained and approved technicians with access to the appropriate electrical and pressure testing equipment.

Recalibration by unqualified technicians will invalidate the BathyCorrometer's warranty.

**Electronics Calibration Check**

1. The electronics in the BCM/BCM Pro' can be checked with the aid of the CalChecker Pro'. When connected to the BCM/BCM Pro', this produces a precision voltage of -1.900V DC which can be compared with the reading on the BCM/BCM Pro'. This is just a check as the electronics are contained inside the pressure housing and cannot be adjusted without breaking the seal.

**Note:** If checking the calibration of an older BCM, connect the short lead between the CalChecker Pro' and the BCM's stainless steel probe tip.

2. If the BCM/BCM Pro' is more than ± 2mV out from the -1.900V test voltage, firstly check the battery in the CalChecker Pro'. If necessary, replace with a CR1632 standard lithium primary button cell (1002-0026). Then ensure the CalChecker Pro' is not at fault. This can be carried out using a calibrated precision multimeter. If the CalChecker Pro' is within specification, it is advised that the BCM/BCM Pro' should be returned to the manufacturer or certified test house for repair.
3. The warranty will be void if repairs are undertaken by anyone other than the manufacturer or a certified test house.

**Test procedure using screw-on K-SAT Reference Electrode**

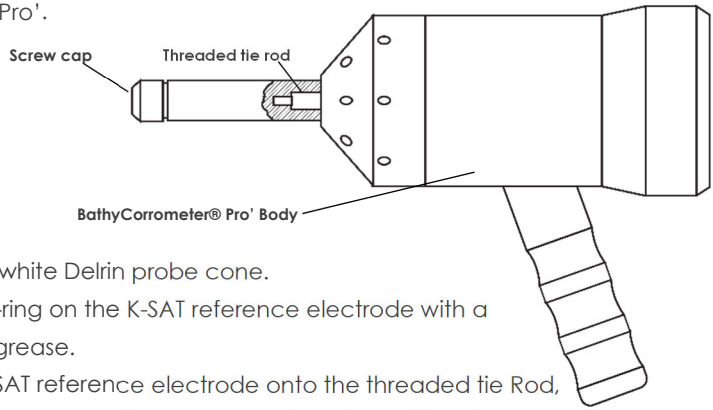
The BathyCorrometer® may be checked with the aid of verification tools either purchased with this kit or available separately.

The K-SAT electrode provides a stable, known voltage to calibrate the BathyCorrometer®. The reference electrodes are accurate external reference electrodes with an Ag/AgCl element contained in a potassium chloride solution of known chloride content. The reference voltage produced by the K-SAT cell is 196mV with respect to a Standard Hydrogen Electrode.

The effect of this is that the voltage reading obtained by a correctly-functioning silver-silver chloride (Ag-AgCl) half-cell in 3% sea water at 25C will be approximately -54mV for the K-SAT cell.

As with all Silver-Silver Chloride chemistry, the exact voltage obtained will depend on the conditions, particularly water temperature and salinity. A tolerance of +/- 10mV for the K-SAT cell indicates acceptable performance.

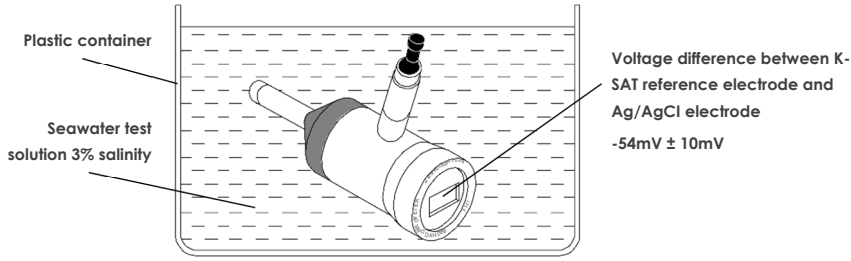
The following instructions should be used to check the calibration of the BathyCorrometer® Pro'.




1. Unscrew the white Delrin probe cone.
2. Smear the O-ring on the K-SAT reference electrode with a little silicone grease.
3. Screw the K-SAT reference electrode onto the threaded tie Rod, ensuring a tight connection and correct seating of the O-ring. Unscrew the K-SAT end cap to remove it.
4. Fit the shorting plug (6004-0019) and immerse the BCM/BCM Pro' in seawater test solution (3% salinity), ensuring that the level covers the red nose cone. The ideal temperature for the water is 20-25°C. Note for mixture 300 grams to 10 litres of de-ionised water.
5. Allow the electrode to reach a stable potential (10 to 15 minutes). The voltage difference between the K-SAT electrode and the internal silver/silver chloride electrode can be read directly off the digital display on the BCM/BCM Pro'.

6. The voltage difference between the K-SAT electrode and the internal silver/silver chloride electrode can be read directly off the digital display on the BCM/BCM Pro'.

The test should be repeated with another K-SAT to confirm the accuracy of the internal Ag/AgCl/seawater half-cell electrode.




Remove the K-SAT cells, refit their protective caps, wipe down and store in a cool dark place.

**Note:** The protective caps should **ALWAYS** be fitted whenever the K-SAT cells are not in use.

**Note:** The values recorded for the silver/silver chloride electrode are dependent upon the salinity and temperature of the seawater at the time of measurement.

**Note:** Mixture 300 grams to 10 litres of deionised water.

**Note:** The BCM Pro' displays results as a negative reading i.e. -54mV ± 10mV (K-Sat cell)

**Note:** Never allow water to enter the hole at the top of the K-SAT

# Using Zinc & Magnesium test blocks

Verification of the operation of the BCM Pro' can be carried out using Zinc and/ or Magnesium test blocks. Potential measurements taken should be noted to check if any significant variation occurs. Differences in the order of 10mV or so between readings are quite possible and will mainly be caused by variations in water salinity at different locations and/or changes in water temperature. As a guide, readings taken in a 3% salinity solution at ambient temperature of 25°C are as follows:

**Zinc (Zn) = -1.00 to -1.08V**

**Magnesium (Mg) = -1.40 to -1.70V**

Tarnished blocks will give a lower reading than clean ones. The test blocks should not be left in the seawater after use. Only one test block should be used at a time.

# Replacement of the Screw-In Reference Electrode

Remove the stainless steel probe tip - if fitted - using an 8mm spanner.

Using a 19mm spanner, remove the white delrin probe cone.

Remove the stainless steel slotted nut and washer from the tie rod, using the nose cone peg spanner (6005-0500).

Gently 'rock' and remove the red nose cone, which will expose the black plastic reference electrode.

Carefully unscrew the reference electrode.

Ensure that there are no foreign bodies in or around the seat of the reference electrode and the O-ring around the tie rod.

Smear the O-ring and the thread on the new reference electrode with silicone grease (4004-0017).

Screw in the new reference electrode until the O-ring just seats, then tighten half a turn and no more. Over tightening the reference electrode could damage the thread.

Replace the red nose cone, ensuring that there is no debris or foreign matter around its seat, and that the cut out is positioned to accommodate the reference electrode.

Replace the stainless steel washer and slotted nut and tighten so there is no gap between the red nose cone and the white body.

Check the O-rings on the inside and outside of the white delrin probe cone and replace if necessary. Smear the O-rings with a little silicone grease, and replace the white delrin probe cone onto the tie rod.

Replace the stainless steel probe tip.

# Maintenance

Very little maintenance is required apart from keeping the unit clean and ensuring that the holes in the red nose cone are kept clear of any obstructions such as dirt or marine growth etc.

The calibration of the BCM/BCM Pro' electronics and the reference electrode should be checked at regular intervals.

If the unit has been used in a dirty environment, the red nose cone should be flushed with clean seawater to remove any contamination as this could shorten the life of the reference cell. Clean the socket in the handle of the BCM/BCM Pro' and apply a smear of silicone grease to it and the plug to stop the contacts corroding.

Check the condition of the O-ring in the white delrin probe cone and replace it if necessary.

The battery charger must be maintained in accordance with local statutory requirements for maintenance of portable electronic equipment.

# Safety

All diving operations which involve the use of the BathyCorrometer® Pro' must be carried out in accordance with the current local statutory requirements for conducting Diving Operations at Work and International Guidance on Safe use of Electricity Underwater. If working within the vicinity of Impressed Current CP systems, it is essential that a full risk assessment is completed prior to commencement of the work and local safety requirements are followed as divers may be exposed to a hazard when working near energized impressed current anodes.

# Electromagnetic compatibility

**European Union Directive**

The BathyCorrometer® Pro' and its charger do not generate RF energy and therefore will not interfere with other electronic equipment. The BCM is a sensitive voltmeter which when used under water will be screened from electromagnetic interference by the sea. However, when on the surface during calibration, interference may cause the BathyCorrometer® Pro'

to give incorrect readings. If this is the case, investigate to see if any transmitting equipment is in operation ie. radio telephones, radar or if any arc welding is being carried out. Electrical storms can also have an effect.

# Long-term storage

**Laying-up**

Flush well in clean salt water (3% salt solution by weight) and allow to dry. If contamination is suspected within the red nose cone, it may be removed to facilitate cleaning of the nosecone, and the half cell. If the half cell is removed, do not permit water to enter the threaded hole into which it is installed, and do not wash the cell in fresh water – only use clean 3% salt solution.

Clean the shorting plug and the socket in the handle. Apply silicone grease to the plug and fit it into the handle, so that it is applied silicone grease into the socket. Re-apply if necessary, then remove the plug and re-grease ready for storage.

The BCM/BCM Pro' can be stored with the battery in any state of charge.

Place the BCM/BCM Pro', charger, probes, probe spanner, silicone grease and the instruction manual into the carrying case.

Store the BCM/BCM Pro' in an ambient temperature no less than 0°C or greater than 50°C. Storage outside these temperatures may cause damage.

**Re-Commissioning**

Remove the BCM/BCM Pro' from its case and check operation by fitting the shorting plug. Recharge the BCM/BCM Pro' fully before checking its operation.

It is recommended that you soak the BCM/BCM Pro' for a minimum of 8 hours in a seawater solution.

Carry out calibration checks, see Calibration (section 1).

# Disposal information

Producer registration number: WEE/HJ0051TQ

This Product must be disposed of in accordance with UK WEEE Producer Responsibility Regulations, or in accordance with your local WEEE guidance.

For further information on UK WEEE regulations click on:

http://www.gov.uk/government/collections/producer-responsibility-regulations

# EC Declaration of Conformity

We, Buckleys (UVRAL) Ltd., as manufacturer of the apparatus listed, declare that the product **BathyCorrometer® Pro'** is manufactured in conformity with the following directives:

**2014/30/EU**, **2014/35/EU, 2015/863/EU** and **2011/65/EU (RoHS)**.

Date: 01/07/2021

Authorised by:

J P Hoveman

CEO, Buckleys (UVRAL) Ltd.

CE

# UKCA Declaration of Conformity

We, Buckleys (UVRAL) Ltd., as manufacturer of the apparatus listed, declare that the product **BathyCorrometer® Pro'** is manufactured in conformity with the following UK legislation:

**Electronic Compatibility Regulations 2016**, **The Electrical Equipment (Safety) Regulations 2016** and **Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012**.

Date: 01/07/2021

Authorised by:

J P Hoveman

CEO, Buckleys (UVRAL) Ltd.

UK CA

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# Distributor details

# Product registration

Thank you for choosing a Buckleys product, we are sure it will provide you with many years of reliable service.

Please register this product via Buckleys' website and download the Warranty Registration Certificate.

Register your product in 5 minutes

Once your product is registered, you will receive the following benefits:

- **FREE** annual service & calibration reminders by email
- **Latest** industry news relating to your product
- Be the **first** to hear about our new products

We strive to improve the quality of our products and service.

Registering your product helps us monitor overall quality of our products, service and dealer network. Additionally, if we ever need to contact you regarding your product, we are able to do so immediately.

We will also send you annual service/calibration reminders by email to help ensure your product is always in perfect working order.

To register your product, simply visit:

www.buckleysinternational.com/registration

...Complete the online form and click on SUBMIT.