

The 9999 Cathodic Protection Reference Electrode (CPRE) Manual

- Measures Hull Potential
- Checks Sacrificial Anodes
- River and Marine Boats
- REDOX Potential of Water
- Survey Marinas for Stray DC
- Checks Metal Corrosion



QP999



9999

CL/5M/4MM/CROC



Introduction

This manual will not only give comprehensive instructions on how to use the 9999 Reference Electrode but will help explain and interpret the readings you get when testing your hull, anodes or other connected metal structures and components.

Equipment Required:

If you are using the 9999 Cathodic Protection Reference Electrode as part of the QP999 Boat Meter Kit you will already have everything you need to measure not only the Hull Potential but also the REDOX Potential of the water in your marina. This includes the ability to test for the presence of Stray DC and its source.

If you have just purchased the 9999 CPRE in isolation you will need the following:

- Digital Multimeter with a 2V scale
- Cable (Coax-Copper) with Crocodile clip 5 M
- Pen and paper to record results

Water potential can also be tested to help detect if there is any extra activity in the water that could accelerate hull corrosion such as stray DC current.

Preparation:

Familiarize yourself with your boat and the connections you are about to make. Read this booklet thoroughly before you begin taking measurements. You will need to identify the ideal metal contacts for the Crocodile Clip and Cable and familiarize yourself with the Isolators and the Shore Power Connection. You will also need to ensure the 9999 CPRE is secure before immersing it in the water. This means finding an appropriate point to affix or wrap the cable around a fixed point such as a rail or cleat so that the 9999 CPRE is submerged close to the hull in a stable location.

When taking readings you are not only looking for assurance that your anodes are working you are also looking to establish what a “good” Hull Potential result for your boat is and the “bad” value at which you will want to replace your anodes. You will therefore need to log all of your results as you make them.

The Boat Meter Kit has everything you need to make these measurements including a digital log function to store Hull and Water Potential results which are time and date stamped. These are downloadable to Excel.



Hull Potential Measurement Testing

Disconnect the shore power and switch off power to on board devices by turning off the isolators.

Remove the 9999 CPRE from its box and remove the black protective cap. This contains some Potassium Chloride Solution to keep it moist during storage. A 30ml bottle of this is supplied with the 9999 Electrode and the Boat Meter Kit.



Immerse the electrode into the water as close to the hull or metal components that you are measuring. When this is located correctly secure the probe by wrapping the cable around a secure object such as a rail or a cleat. For marine measurements the distance between the electrode and the metal should not be greater than 5 Metres to ensure good reading stability.

For freshwater measurements the 9999 CPRE should be as close as possible to the hull. Ideally within 1 Metre.

When the probe is secure connect the black plug from the 9999 CPRE to the negative terminal on the Multimeter.

Select the 2V mode on the Multimeter and find a connection to the hull or metalwork you wish to check. This will be a suitable earth which can often be identified by the attachment of earth wires from other components, devices or contacts.



Connect the Crocodile Clip from the 5 Metre Cable to the earth contact. The red connector from the Crocodile Clip Cable can then be plugged into the positive terminal of the Multimeter.

Switch on the Multimeter and make a note of the stable result.

What does your result mean?

The reading displayed is your Hull Potential of your boat. This is an average of all of the potentials of each metal component connected with each other and, directly or indirectly, to the water.

Each metal has its own particular “normal” potential which gets less negative over time as it becomes corroded. Corrosion is where the metal loses electrons to the water.

Whatever your result is, it will get less negative over time as the hull, drives, props and anodes etc. get depleted.

Typical Hull Potential Values

These should be taken as a guide only as the configuration and ratio of metals and anodes varies greatly.

The below values are typical for Marine vessels with Zinc Anodes:

Steel	-800 to -1100
Aluminium	-900 to -1100
Wood	-550 to -600
Fibre Glass (Inboard)	-500 to -1100
Fibre Glass (Outboard)	-800 to -1100

For river, canal or freshwater craft the configuration is a little more variable as anodes can be Magnesium, Zinc or Aluminium alloy.

Magnesium has the most negative potential (-1800 to -2000mV) when tested on its own. Zinc is closer to -1200mV and Aluminium alloy between -900 to -1200mV).

It stands to reason therefore that if two Steel hulled narrow boats have the same number and size of anodes but one has Magnesium and the other Zinc the potentials will be different. The boat with the Magnesium anodes will have a more negative reading usually by over 100mV.

This merely emphasises the need to test and record your own boat as it will be unique.

Below are typical values for Narrow and Inland Boats with Zinc anodes:

Steel	-700	to	-1100mV
Aluminium	-900	to	-1150mV
Fibreglass (inboard)	-550	to	-1100mV
Fibreglass (outboard)	-750	to	-1100mV

Degree of protection offered by your Anodes

If your result is less negative than the lowest value given your boat may be suffering excessive corrosion and is essentially under protected by the anodes in their current condition.

If however your result is in excess of -1100mv it is likely that it is overprotected.

Overprotection issues

It may sound good to have an overprotected hull. Unfortunately this is far from the case. If the reading is -1100 or more negative it means that the anodes will be readily giving up electrons. This means that in the area around the anode the pH may increase locally. It also can draw electrons from the connected part of the hull. Either of these scenarios is not good for the hull coating which can often become compromised exposing itself to rapid corrosion.

Galvanic Isolation & Stray DC

Whilst you are taking the hull measurements it is possible to make a series of measurements to check that all of your powered appliances are grounded and secure.

Moreover it is definitely worth checking to see if your boat is galvanically coupled to other vessels in the vicinity through the earthing system via the shore power connection.

In such cases the boats with the most negative Hull Potential will lose electrons first and essentially protect other less protected craft.

The first step to run this test is to connect the shore power whilst you are reading the Hull Potential.

There may be a small deflection in the result but the reading should typically be within 5-10mV of the unpowered reading. If this is the case there is no issue with Galvanic Isolation.

If however, the result becomes more negative or significantly different and variable - there may be an issue with galvanic isolation or with one of your devices on board e.g. Battery Charger, Refrigeration etc.

The first thing to do here is identify this source of discrepancy. You should take readings with the Shore Power connected. Then in turn switch off the isolators for each device until the issue is located. If all appliances are off and the shore power is connected and there is a different reading on the meter

Further Testing

If you wish to test the conditions in the marina for e.g. Stray DC and Corrosive Potential of the water you will need a 9999ORP REDOX Electrode to use in conjunction with the 9999 CPRE. This can also help you decide on the least corrosive mooring location or alert you to any local issues.

This is included in the QP999 Boat Meter Kit.

Visit our website and YouTube Channel for more information:



WEBSITE



YOUTUBE

