

USER MANUAL

SEAGUARD® DIGITAL CORROSION TESTER

Revision History

Revision	Description
A	Released

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This product complies with EU directives.



Danger

- Please do not use or store this product near explosive materials, strong magnetic fields, or a combustible gas environment, otherwise it may cause a fire or explosion.
- To avoid being shocked, do not use this product when the tested object has electrical power.



Warning

- Please do not repair, dismantle, or modify this product by yourself.
- If any abnormal situation occurs, such as smoke or abnormal noise, stop using this product immediately.



Note

- If do not use this product for a long period, take out the batteries.

Table of Contents

1. Introduction.....	3
2. Operation.....	4
2.1 Test Setup.....	4
2.2 Pro Model –Features.....	4
2.3 Pro Model – Operation Screens.....	5
2.3.1 Turning on the tester.....	5
2.3.2 Making selections in the tester screens.....	5
2.3.3 Using the Selection Window.....	5
2.3.4 Choosing the boat material.....	5
2.3.5 Change the potential limit.....	6
2.3.6 Taking measurements.....	6
2.3.7 Reviewing saved data.....	7
2.3.8 Clearing all the saved data.....	7
2.3.9 Resetting to factory settings.....	7
2.4 Standard Model – Features.....	7
2.5 Standard Model – Operation Screens.....	8
2.5.1 Turning on the tester.....	8
2.5.2 Making selections in the tester screens.....	8
2.5.3 Testing Screen.....	9
2.5.4 Main Menu Screen.....	9
2.5.5 Change the potential limit.....	9
2.5.6 Resetting to factory settings.....	10
3. How to Connect and Measure.....	10
3.1 General.....	10
3.2 Sterndrive.....	10
3.3 Inboard.....	10
3.4 Outboard.....	11
3.5 Others.....	11
4. Maintenance.....	11
5. Troubleshooting.....	12
6. Specifications.....	12
7. For more information.....	12

1. Introduction

This manual gives instructions for operating the Seaguard Digital Corrosion Tester to test boats and other marine structures in seawater. There are two models, Professional and Standard. The professional model is designed to be used by marina operators, shipyard workers and service technicians. This basic model is designed to be used by boat owners. Professional model uses silver / silver chloride reference cell (SSC). The basic version uses zinc reference cell (ZRE).

Measuring corrosion

Vessels in seawater produce galvanic reactions just like an electric battery does. Electrical current will flow through the hull when the hull contains different metals. This happens even in wooden hulls with motors attached. The most active metal discharges electrical current to the other metal, cycling the current back through the seawater. The most active metal becomes corroded.

If a metal part is greater than 0.2 volts negative to its natural potential, it will not corrode. If the part is positive to its natural potential then we know that it is connected to a different type of metal and it will cause corrosion.

One of the most effective protection methods is to add sacrificial electrodes called anodes to make the hull become a cathode, where the current flows from one to the other.

To measure the actual corrosion process we measure the electrical potential of the hull. If the voltage reading is too high, it means the hull is not protected. If the voltage is too low, we say it is "over-protected." Over-protection will cause the hull coating to lose its bond to the hull and peel off ("disbondment"). So checking the electrical potential is very important.

The Seaguard Digital Corrosion Tester is a high-impedance voltage meter with a reference cell. The tester is specially designed to check the electrical potential of the hull at different locations on the hull while the boat is in seawater. Each reading is color coded to indicate whether the boat is protected (PASS, green), under-protected (FAIL, red), or overprotected (OVER, yellow).

The following parts are included:

- Corrosion tester handheld device
- Zinc reference cell (ZRE) with 20 feet long cable (Basic version)
- Ag/AgCl reference cell (SSC) with 20 feet long cable (Pro version)
- Test probe with alligator clip and 6 feet long cable

2. Operation

WARNING! – The corrosion tester is a sensitive instrument used to measure the electrical potential of a boat hull or submerged structures. Please operate it according to these instructions.

2.1 Test Setup

Open the battery cover and install provided 3 AAA batteries. Note the orientation of the batteries.

Connect the reference cell.

Connect the alligator test probe. You are ready to use.

2.2 Pro Model - Features



1. Display screen
2. Power button
3. Key pad
4. Lanyard
5. Port for reference cell
6. Port for alligator clip
7. Alligator clip
8. Ag/AgCl reference cell
9. Selected material indicator
10. Number of stored reading
11. Type of reference cell
12. Power indicator
13. Upper limit
14. Corrosion protection value
15. Lower limit
16. Right function indicator
17. MENU/Save/Back/Update(Upd) indicator
18. Left function indicator

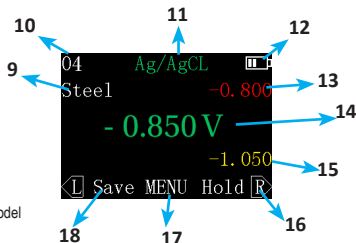


Figure 1 Pro Model

2.3 Pro Model – Operation Screens

2.3.1. Turning on the tester



Figure 2 Welcome screen

Press the power button. The tester will display the Welcome Screen (Figure 2) and then the Corrosion Measuring Screen (see Figure 6).

If the battery power is too low, the tester will not turn on.

2.3.2 Making selections in the tester screens



Figure 3 The keypad

Use the hand buttons to perform all functions of the tester.

Using the selection buttons

1. Power button
2. Move up, or increase number
3. Right “soft key” on the display
4. Go to the Selection Screen, or middle soft key on the display
5. Left “soft key” on the display
6. Move down, or decrease number

To make selections, press the buttons on the tester (Figure 3). The words displayed along the bottom of each screen are “soft keys” that represent the functions of the left key, the central menu key, and the right key. The functions will change depending on which screen you are viewing. For examples, see the screen images below.

2.3.3. Using the Selection Window

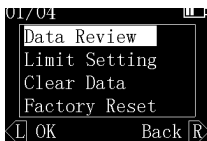



Figure 4 The Menu Screen

From the Potential Measuring Screen, press the  button to display the Main Menu Screen (Figure 4).

From the Menu Screen you can review stored measurement data, modify the potential limit settings for a material type, clear your stored data, and reset the tester to factory settings.

2.3.4. Choosing the boat material

Before measuring, first identify the material of the hull or fixture that you want to measure. From the Corrosion Measuring Screen, press Up/Down keys to select the right material. The material options are Steel alloy, Aluminum alloy, Copper alloy and others.

2.3.5. Change the potential limit



Figure 5 Limit Setting Screen

For advance user, you can customize all potential limits for different materials in Limit Setting Screen. To customize the Limit Settings for uncommon materials:

1. Choose “Others” material.
2. Select the Upper or Lower setting value for that material.
3. Press or to increase or decrease the value.

value.

4. Save the new Limit Settings. You will be taken back to the Measuring Screen.

In the same way, you may change the values for steel, aluminum, and bronze as well, based on your knowledge about corrosion.

For your reference, Table 1 lists the potential factory setting values for protected, under-protected, and over-protected conditions for each type of boat material.

Table 1 - Potential Limit Factory Settings for the Seaguard Digital Corrosion Tester (Ag/AgCl reference cell - SSC)

Hull Material	Under protection	Safe Protected	Over protection
Steel alloys	> -0.800V	-0.800V to -1.050V	< -1.050V
Aluminum alloys	> -0.900V	-0.900V to -1.100V	< -1.100V
Copper alloys	> -0.500V	-0.500V to -0.700V	< -0.700V
Others	> -0.500V	-0.500V to -0.700V	< -0.700V

The “<” symbol means “less than” the given limit, in the negative direction. The “>” symbol means “greater than” the given limit, in the positive direction. The default setting is steel.

2.3.6. Taking measurements



Figure 6 Corrosion Measuring Screen

Your Potential readings are displayed directly on the Corrosion Measuring Screen (Figure 6). To save the current measurement value, press the left button (Save). A window will appear for you to confirm that you do want to save, yes or no.

Important – For correct interpretation, note the polarity of the voltage reading (+ or -).

2.3.7. Reviewing saved data

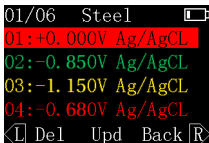


Figure 7 Saved Data

The example of the Data Review Screen (Figure 7) shows readings for over-protected steel (in yellow), measured relative to the corrosion tester's Ag/AgCL reference cell (SSC). To delete a saved measurement, select it using the Up/Down keys, then press the left key (Del).



Figure 8 Update Saved Data

To display a highlighted measurement in the Measuring Screen, press the Menu key "Upd". As shown in Figure 8, you can now view the static saved measurement along with the upper and lower limits, to compare them. To return to the Data Review Screen press the MENU key (Back).

2.3.8. Clearing all the saved data

From the Menu Screen (Figure 4), choose Clear Data. A window will pop up for you to confirm that you do want to save, yes or no.

2.3.9. Resetting to factory settings

From the Menu Screen (Figure 4), choose Factory Reset. A window will pop up for you to confirm that you do want to reset the data, yes or no.

2.4 Standard Model - Features



1. Display screen
2. Power button
3. Key pad
4. Lanyard
5. Port for reference cell
6. Port for alligator clip
7. Alligator clip
8. Zinc reference cell
9. Selected material indicator
10. Type of reference cell
11. Power indicator
12. Test result
13. Right function indicator
14. MENU/Save/Back indicator

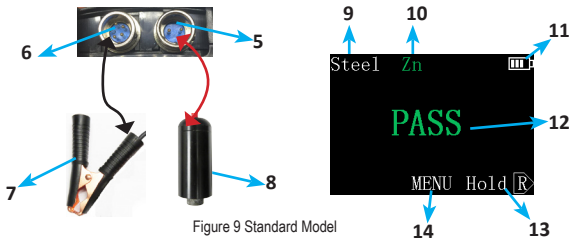


Figure 9 Standard Model

2.5 Standard Model – Operation Screens

2.5.1 Turning on the tester



Figure 10 Welcome screen

Press the power button. The tester will display the welcome Screen (Figure 10) and then the Corrosion Test Screen (see Figure 12).

If the battery power is too low, the tester will not turn on.

2.5.2 Making selections in the tester screens

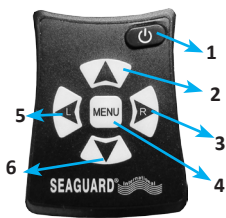


Figure 11 The keypad

Use the hand buttons to perform all functions of the tester.

Using the selection buttons

1. Power button
2. Move up, or increase number
3. Right “soft key” on the display
4. Go to the Selection Screen, or middle soft key on the display
5. Left “soft key” on the display
6. Move down, or decrease number

To make selections, press the buttons on the tester (Figure 11). The words displayed along the bottom of each screen are “soft keys” that

represent the functions of the left key, the central menu key, and the right key. The functions will change depending on which screen you are viewing. For examples, see the screen images below.

2.5.3 Testing Screen

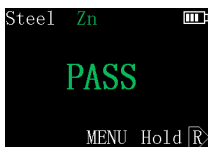


Figure 12 Corrosion Test Screen

Your Potential Test results are displayed directly on the main screen, the Corrosion Test Screen (Figure 12). Displays the test result in different color. PASS in green color, FAIL in red color and OVER in yellow color.

To change the material for testing, choose from Steel, Al, Bronze or Other,

Press or to select from the screen.

Press to stabilize the test result. Press to

the main menu screen.

2.5.4 Main Menu Screen

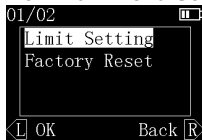


Figure 13 The Menu Screen

From the Corrosion Test Screen, press the button to display the Selection Window (Figure 13).

From the Menu Screen you can modify the potential limit settings for a material type, and reset the tester to factory settings.

2.5.5 Change the potential limit

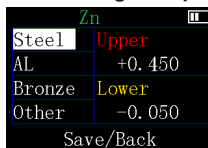


Figure 14 Limit Setting Screen

For advance user, you can customize all potential limits for different materials in Limit Setting Screen. To customize the Limit Settings for uncommon materials:

1. Choose "Others" material.
2. Select the Upper or Lower setting value for that material.
3. Press or to increase or decrease the value.

4. Save the new Limit Settings. You will be taken back to the Measuring Screen.

In the same way, you may change the values for steel, aluminum, and bronze as well, based on your knowledge about corrosion.

For your reference, Table 2 lists the potential factory setting values for protected, under-protected, and over-protected conditions for each type of boat material.

Table 2 - Potential Limit Factory Settings for the Seaguard Digital Corrosion Tester (Zn reference cell - ZRN)

Hull Material	FAIL	PASS	OVER
Steel alloys	> +0.250V	+0.250V to -0.050V	< -0.050V
Aluminum alloys	> +0.150V	+0.150V to -0.050V	< -0.050V
Copper alloys	> +0.600	+0.600V to -0.050V	< -0.050V

The “<” symbol means “less than” the given limit, in the negative direction. The “>” symbol means “greater than” the given limit, in the positive direction. The default setting is steel.

2.5.6 Resetting to factory settings

From the Selection Window, choose Factory Reset. A window will pop up for you to confirm that you do want to reset the data, yes or no.

3. How to Connect and Measure

WARNING! - Do not put the reference cell or test probe into water that is contaminated with oil, diesel, gas, or pollutants. This can cause contamination of the reference cell and erroneous readings.

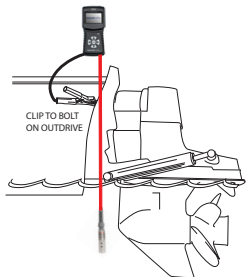
3.1 General

Lower the reference cell into the water so that it is at least a foot below the water surface, **near to the boat**. If there is wave action, lower the reference cell deeper.

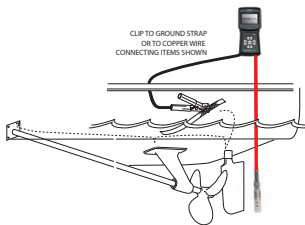
Secure the test lead using alligator clip to a point above water on the metal being tested.

Make an effective connection. The metal surface will often be covered by paint, dirt, oil, or rust. Make sure that the probe has effective electrical contact directly with the metal. Probe several times in different locations on the same material. If good contacts are made, the readings will be stable and very similar in the different locations. When taking measurements from a fixture attached to the hull, make sure that the fixture has been properly bonded. Search for a contact point until the measurement is stable.

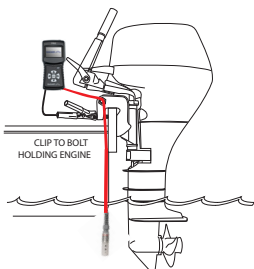
3.2 Sterndrive



3.3 Inboard



3.4 Outboard



3.5 Others

Any other structure that is steel, aluminum or copper which is in water can be measured.



4. Maintenance

Clean the Zinc reference cell regularly. This will remove any oxide film that has built up during exposure to air while being stored. This film can cause inaccurate readings. If necessary, scrape the Zn reference cell with a sharp edge or sand the reference cell to remove the film and expose the metallic zinc reference cell surface.

Ag/AgCl reference cell is maintenance free.

After using the tester:

1. Rinse the reference cell and test probe in fresh water.
2. Dry all parts after use and keep them in the box.
3. Store in a dry, safe place.

5. Troubleshooting

Problem	Possible solution
No display	Check that the test probe lead and reference cell are plugged into the correct place. The battery is dead. Replace the battery.
Reading is inaccurate	Check the wire of the reference cell. Replace it if there is any damage. Clean the surface of Zinc reference cell using fine sand paper.
Any damage	Contact Seaguard International for replacement.

6. Specifications

Measurement range	-2.500 to +2.500 volts
Measurement accuracy	0.5%
AD resolution	16 bits
Input impedance	$>10^8 \Omega$
Display	TFT LCD 1.8", 320x220
Power	3 AAA Batteries
Auto shutdown	No button action for 2.5 minutes
Manual shutdown	Press power button >2 seconds
Data stored (Pro Model)	Maximum 50 measurement values
Working temperature	-10°C to 50°C
Dimensions	142 mm x 63 mm x 32 mm

7. For more information

For more information, please check out our website seaguardinternational.com