MIDTRONICS

Advancing
Battery Management

MAR-800P

Marine Battery
& Electrical Diagnostic Analyzer

INSTRUCTION MANUAL

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Contents

Chapter 1: Before You Begin

Starting the tester for the first time

When the tester is first used the operator is asked to enter a couple of items such as language, date and time. Changes can be made afterwards by going in to the Utility Menu and selecting CONFIG TESTER.

Safety

Because of the possibility of personal injury, always use extreme caution when working with batteries. Follow all manufacturers' instructions and BCI (Battery Council International) safety recommendations.

General Precautions

- ⇨ Battery acid is highly corrosive. If acid enters your eyes, immediately flush them thoroughly with running cold water for at least 15 minutes and seek medical attention. If battery acid gets on your skin or clothing, wash immediately with water and baking soda.
- ⇨ Always wear proper safety glasses or face shield when working with or around batteries.
- ⇨ Keep hair, hands, and clothing as well as the analyzer cords and cables away from moving engine parts.
- ⇨ Remove any jewelry or watches before you start servicing the battery.
- ⇨ Use caution when working with metallic tools to prevent sparks or short circuits.
- ⇨ Never lean over a battery when testing, charging or jump starting it.

⚠ DANGER

Risk of explosive gases.
Never smoke or allow a spark or flame in the vicinity of a battery.

Batteries can produce a highly explosive mix of hydrogen gas and oxygen, even when the battery is not in operation. Always work in a well-ventilated area.

⚠ WARNING

Wash hands after handling.

REQUIRED BY CALIFORNIA PROP. 65: Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer and birth defects or other reproductive harm.

The tester is manufactured in line with the latest state of the art and according to recognised safety standards. If used incorrectly or misused, however, it can cause

- injury or death to the user or a third party,
- damage to the tester and other material assets belonging to the operator,
- inefficient operation of the tester.

All persons involved in commissioning, operating, maintaining and servicing the tester must

- be suitably qualified,
- have knowledge of and experience in dealing with testers and batteries and
- read and follow these operating instructions carefully.

Conventions Used in This Manual

To help you learn how to use your analyzer, the manual uses these symbols and typographical conventions:

Convention	Description
⚠	The safety symbol followed by the word **WARNING** or **CAUTION** indicates instructions for avoiding hazardous conditions and personal injury.
CAUTION	The word **CAUTION** indicates instructions for avoiding equipment damage.
	The wrench symbol indicates procedural notes and helpful information.
UP ARROW	The text for keypad buttons and soft-key functions are in bold capital letters.
CAPITAL LETTERS	The text for screen options are in regular capital letters.

Chapter 2: Overview

Connections and Data Ports

① Integrated thermal printer

② Release lever for the paper compartment door

③ Paper slot

④ LCD screen with Main Menu

⑤ Control Panel: keypad and power button

⑥ 6-pin connector for the battery test cable (see the next page for detail)

⑦ Spring-loaded data card slot for test data storage and software upgrades.

⑧ Infrared temperature sensor with a range of -28 °C to +93 °C (-20 °F to +200 °F)

⑨ Data transmitter: sends test results to a PC using an optional hardware and software kit

Connecting the Battery Test Cable

⚠ WARNING

To prevent damage to the analyzer's circuitry, do not connect the analyzer to a voltage source greater than 30 Vdc.

To connect the battery test cable to the analyzer align the arrow on the cable connector with the arrows on the analyzer's housing. Hold the part of the cable connector as shown and firmly insert the connector into analyzer's six-pin receptacle. **Do not twist.**

To avoid damaging the battery test cable, always hold the ridged part of the cable connector (as shown in the photo) when inserting and removing the cable.

Removing and Inserting the Data Card

The analyzer ships with a plastic insert in the data card slot to protect it from dust and debris. To remove the plastic insert or a data card, push briefly on its edge to release it and pull it from the slot.

When inserting a card, push it into the slot until it locks. The card is correctly inserted when it is not protruding from the slot. To protect the card slot and enable the analyzer to read and write to the card, leave the card in the slot.

Data Entry Methods

To perform a particular test or function, the tester will ask for different types of information. This means that the methods you use to enter information will change depending on the type of information requested. The four types of entry methods are described below.

Typically, the soft key below the right half of the screen confirms your choice, although the word above it may vary. In a similar fashion, the soft key below the left half of the screen cancels your choice or returns you to the previous screen, although the word above it may also vary.

Menu icons

A menu icon is a graphical representation of a function you can select. To select an icon, use the **LEFT** or **RIGHT ARROW** key to highlight it. Highlighting changes the icon to a white picture on a black background. To confirm your selection, press the appropriate soft key.

Option Buttons

Some lists have option buttons before each item. To select an item, use the **UP/DOWN ARROW** keys to move the dot into the button next to the item you want. You can also use the alphanumeric keypad to enter the number preceding the option button. To confirm your selection, press the appropriate soft key.

Scrolling Lists

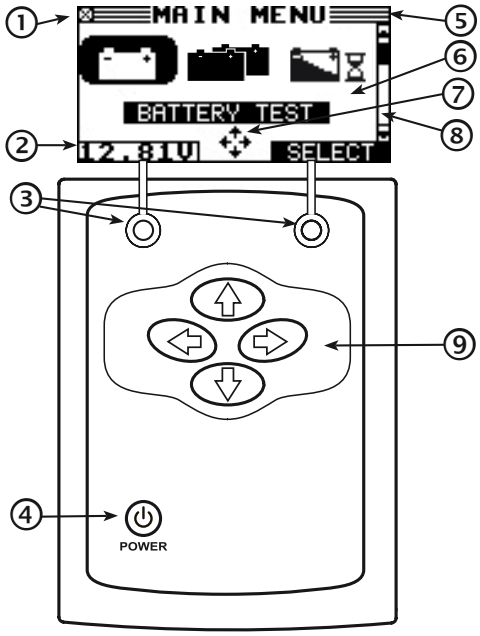
Scrolling lists contain items that extend above and below the screen or the selection box that contains them. To indicate that there are more items, the symbols ▲▼ appear to the right of the first visible or highlighted item on the list.

Alphanumeric Entries

Even though the tester does not use an alphanumeric keypad it is possible to enter alphanumeric values. When applicable the alphanumeric values appear on the display. Use the **UP/DOWN or LEFT/RIGHT ARROW** keys to scroll and confirm this with the > key. To return one or more steps use the < key.

Display and Keypad

The keypad and display work together to help you quickly find and use the right tools at the right time. The display also keeps you on track with on-screen navigation aids, directions and messages.



❶ Internal Batteries Status Indicator

This indicator appears in the screen's top left corner, lets you know the status and charge level of the analyzer's six 1.5-volt batteries. The **X** in the top left corner of the screen shows that the analyzer is powered by the battery you're testing to conserve the analyzer's internal batteries.

❷ Voltmeter

When you first connect the analyzer to a battery it functions as a voltmeter. The voltage reading appears above the left soft key until you move to other menus or functions.

❸ Soft Keys

Press the two **Soft Keys** linked to the bottom of the screen to perform the functions displayed above them. The functions change depending on the menu or test process. So it may be helpful to think of the words appearing above them as part of the keys. Some of the more common soft-key functions are **SELECT**, **BACK,** and **END**.

❹ POWER Key

Press the **POWER** button to turn the analyzer on and off. The analyzer also turns on automatically when you connect its test leads to a battery.

❺ Title Bar

The title bar shows you the name of the current menu, test tool, utility, or function.

❻ Selection Area

The selection area below the Title Bar contains selectable items or dialog boxes that display information or require a response.

❼ Menu Screen Arrows

When displayed in menu screens, the menu screen arrows show you which **ARROW** key on the keypad to press to display other icons or screens. The Up and Down Menu Screen Arrows, for example, indicate when to press the **UP** (▲) and **DOWN** (▼) **ARROW** keys to display the screens above and below the current screen.

The Left and Right Menu Screen Arrows tell you when to use the **LEFT** (◀) or **RIGHT** (▶) **ARROW** keys to select an icon.

When displayed under a list of options, the menu screen arrows show you which keypad arrow to press to highlight a character or item in a list.

❽ Scroll Bar

Another navigational aid is the scroll bar on the right side of the screen. The position of its scroll box shows you whether the screen is the top (or only screen), middle, or last in a series.

❾ ARROW keys

Press the **UP ARROW** key to move up to the next selectable item or row. When entering text, use the **UP ARROW** key to move to the previous character.

To select from this type of list, use the **UP/DOWN ARROW** keys to scroll to the item, or use the keypad to enter your choice, and press the appropriate soft key.

Menu Structure

This section will help you get to your destination while letting you know what test leads you may need when you arrive. The test leads are represented by symbols for their connectors.

Main Menu

The Main Menu is the starting point for all tools and utilities, which are depicted as icons. Some icons lead directly to the function they represent, while others are menu icons that lead to two or more functions. Menu icons are marked here with an asterisk (*) and are mapped on the following pages.

Icon	Description
	The **BATTERY TEST** tests a starter or auxiliary battery using the battery information you select in a series of screens.
	The **GENERATE PAIR** modus allows you to check whether two batteries can be used together.
	The **DRAIN TEST** allows you to test the battery with taking the drain current in account.
	**QC MODE** is used for testing stock or compound batteries.
	**PRINT/VIEW** for the test results of the last performed tests, and totals by battery test decision.
	**VERSION INFO** contains information on the built, version, serial number, a test counter, and more.
	**UTILITY MENU** includes functionality to setup the tester.

Print/View Menu

Icon	Description
	**BATTERY RESULTS** displays the results of the last battery test performed and the totals by battery test decision.
	**PAIR RESULTS** displays the results of the last battery test performed and the totals by battery test decision.
	**PACK RESULTS** displays the results of the last battery test performed and the totals by battery test decision.

Utility Menu

The Utility Menu lets you customize your analyzer for your needs.

Icon	Description
	The **CONFIG TESTER** menu allows you to set the following parameters: TIME, MODE, DATE, FORMAT, TEMPERATURE UNITS, and WRITE FAIL.
	The **DISPLAY** allows you to set the contrast of the LCD.
	With the **LANGUAGE** menu you can select one of the 23 available languages.
	Create your own address details for printouts with the **SHOP INFO** icon.
	If you have created a coupon in the **COUPON** utility, use coupon to enable or disable.
	**EDIT COUPON** allows you to create and store up to three separate coupons to be printed on test results.
	With **FORMAT CARD** you erase all information on the data card
	With **CLEAR COUNTERS** you can reset statistical data like the battery test decision totals.
	With **UPDATE** you can install new software on the tester
	**QC MODE** allows you to add and delete batteries, and import and export battery lists.

Chapter 3: Test Preparation

Inspecting the Battery

Before starting the test visually inspect the battery for:

- Cracked, buckled, or leaking case. If you see any of these defects, replace the battery.
- Corroded, loose, or damaged cables and connections. Repair or replace them as needed.
- Corrosion on the battery terminals, and dirt or acid on the case top. Clean the case and terminals using a wire brush and a mixture of water and baking soda.
- Low electrolyte level. If the electrolyte level is too low, add distilled water to fill up and fully charge the battery. Do not overfill.
- Corroded or loose battery tray and hold-down fixture. Tighten or replace as needed.

Testing Out-of-Vessel (Battery Test)

The preferred battery test location is in the vessel. However, if you plan to test out of the vessel:

- Always disconnect the negative cable from the battery first and reconnect it last.
- Always use a carry tool or strap to lift and transport the battery.

Testing In-Vessel (System Test)

The preferred test position is at the battery posts.

At the start of the test, make sure **all vessel accessory loads are off**. If systems in the vessel are still active it might lead to a **SYSTEM NOISE** message, the tester will automatically continue to test the battery until the noise is gone.

Connecting to the Battery

CAUTION: Do not connect the tester to a voltage source greater than 30 Vdc.

Connect the clamps to the battery: the red clamp to the positive (+) terminal and the black clamp to the negative (–) terminal.

If you connect the clamps in the wrong polarity (positive to negative or negative to positive), the tester displays **CLAMPS REVERSED!** Reconnect the clamps correctly.

To make sure both sides of the clamps are gripping the terminals, rock the each clamp back and forth. A poor connection will prevent testing, and the tester will display the message **CHECK CONNECTION**. If the message reappears after you have correctly reconnected the clamps, clean the terminals and reconnect.

Setting User Preferences

Before starting your test you may want to customize the use of your analyzer by setting preferences in the Utility Menu. The menu has settings for the display's date and time, the contrast and backlight time, a utility to customize printouts, among others.

To conserve the analyzer's internal batteries, the tester will turn off after 30 seconds of inactivity.

Chapter 4: Battery Test

The tester guides you through the steps of selecting your battery test parameters and interpreting the results. Before you start the test, review the instructions in *Chapter 3: Test Preparation*.

1. In the Main Menu select the BATTERY TEST icon.

   Press the **SELECT** soft key to continue.

2. Select the purpose of the battery at test.

   1 ⦿ STARTER
   2 ○ AUXILIARY

   Press the **NEXT** soft key to continue. In case of STARTER please continue with step 4.

3. In case of AUXILIARY please press the **UP (▲)** or **DOWN (▼) ARROW** key and select the capacity of the battery.

   Press **ENTER**.

4. Select the age of the battery.

   1 ⦿ IN SERVICE
   2 ○ NEW BATTERY

   Press the **NEXT** soft key to continue. In case of NEW BATTERY please continue with step 6.

5. Select the location of the battery.

   1 ⦿ OUT OF VESSEL
   2 ○ IN VESSEL

   Press the **NEXT** soft key to continue. In case of IN VESSEL please follow the steps of the sub chapter *In Vessel*.

6. Select the battery type.

   1 ⦿ FLOODED LEAD ACID
   2 ○ AGM FLAT
   3 ○ AGM SPIRAL
   4 ○ GEL

   Press the **NEXT** soft key to continue. The **BACK** soft key returns you to the Main Menu at the start of the test and to the previous screen as you progress.

7. Select the rating units.

   1 ⦿ MCA
   2 ○ EN
   3 ○ CCA
   4 ○ JIS
   5 ○ DIN
   6 ○ SAE
   7 ○ IEC
   8 ○ NONE (AUXILIARY)

Battery Standards

Rating System	Description	Range
MCA	Marine Cranking Amps	100 to 2000
EN (A)	European Norm	100 to 2000
CCA	Cold Cranking Amps (specified by SAE): The amount of current a battery can provide at 0 ºF (–17.8 ºC).	100 to 2000
JIS	Japanese Industrial Standard: (shown on a battery as a combination of numbers and letters)	73 numbers from 26A17 to 245H52
DIN (A)	Deutsche Industrie-Norm	100 to 1250
SAE (A)	European labeling of CCA	100 to 2000
IEC (A)	International Electrotechnical Commission	100 to 1250

   If you select JIS, the analyzer asks for the JIS part number. Scroll to the part number. To increase your scrolling speed, hold the **UP (▲)** or **DOWN (▼) ARROW** key, or use the **LEFT (◀)** or **RIGHT (▶) ARROW** key to move up or down four part numbers at a time.

   Press the **NEXT** soft key to continue.

8. Press an **UP (▲)** or **DOWN (▼) ARROW** key to select the BATTERY RATING.

   Press **ENTER**.

9. Hold the bottom of the tester five centimeters above the battery case so that the IR temperature sensor on its underside can approximate the battery temperature.

   Press **NEXT** to lock in the battery temperature.

10. In some cases the tester needs to know if the battery has been charged before the test. Select BEFORE CHARGING when the battery has not been charged. Select AFTER CHARGE when the battery has been fully charged with an external charger.

    1 ⦿ BEFORE CHARGE
    2 ○ AFTER CHARGE

    Press **NEXT** to start the test. The results will be shown.

    Press **NEXT** to proceed with the system test. For instructions please see *Chapter 5: System Test*.

In Vessel

The tester prompts you to isolate the battery. This means ensuring there is no interference when you perform the test. If possible, turn off the main electric switch.

6. Please enter the vessel ID and press **NEXT**.
7. Select the battery configuration.

   1 ⦿ 12V SINGLE

   2 ◯ 12V PARALLEL

   3 ◯ 24V SERIES

   4 ◯ 24V SERIES PARALLEL

   Press **SELECT**.

8. Select the number of batteries in the pack (for parallel connections only).

   Press the **NEXT**.

9. Select the battery type.

   1 ⦿ FLOODED LEAD ACID

   2 ◯ AGM FLAT

   3 ◯ AGM SPIRAL

   4 ◯ GEL

   Press the **NEXT** soft key to continue. The **BACK** soft key returns you to the Main Menu at the start of the test and to the previous screen as you progress.

10. Select the rating units.

    1 ⦿ MCA 5 ◯ DIN

    2 ◯ EN 6 ◯ SAE

    3 ◯ CCA 7 ◯ IEC

    4 ◯ JIS 8 ◯ NONE (AUXILIARY)

Battery Standards

Rating System	Description	Range
MCA	Marine Cranking Amps	100 to 2000
EN (A)	European Norm	100 to 2000
CCA	Cold Cranking Amps (specified by SAE): The amount of current a battery can provide at 0 ºF (–17.8 ºC).	100 to 2000
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If you select JIS, the analyzer asks for the JIS part number.

Scroll to the part number. To increase your scrolling speed, hold the **UP (▲)** or **DOWN (▼) ARROW** key, or use the **LEFT (◀)** or **RIGHT (▶) ARROW** key to move up or down four part numbers at a time.

Press the **NEXT** soft key to continue.

11. Press an **UP (▲)** or **DOWN (▼) ARROW** key to select the BATTERY RATING.

    Press **ENTER**.

12. Hold the bottom of the tester five centimeters above the battery case so that the IR temperature sensor on its underside can approximate the battery temperature.

    Press **NEXT** to lock in the battery temperature and begin the battery test.

    In case of multiple batteries the tester will prompt you to connect to the next battery.

    When the battery test is finished, the tester will save the data to the SD card.

Additional Test Requirements and Messages

For a more decisive result the tester may ask for additional information or probe deeper into the battery's condition. The following messages and instructions may appear before the analyzer displays the results of your test.

System Noise

To perform a correct measurement the tester requires the vessel to be in rest. After the boat has sailed, some vessel specific systems might still be active in the background. The tester will detect this and displays the message **SYSTEM NOISE**. When this message appears switch off all consumers(radio, airconditioning) and remove the key from the ignition. As soon as there is no more activity in the vessel, the tester will continue testing and display the test result.

Unstable Battery Detected

A battery that is weak or that has just been charged may retain enough electrical activity to be detected by the analyzer and will adversely affect the test results. A fully charged battery should stabilize quickly, after which the analyzer will automatically retest. Weak batteries should be charged and retested. If the battery is fully charged, check the clamp connections.

Surface Charge

The battery can hold a surface charge if the engine has been running or after the battery has been charged. The tester may prompt you to remove the surface charge before it displays a test result.

1. Follow the instructions indicating when to turn the headlights on and off (IN-VESSEL)
2. The tester will resume testing after it detects that the surface charge is removed.

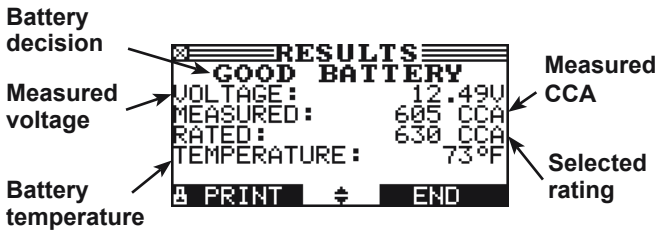
Deep Scan Test

In some cases the tester may need to further analyze the battery to determine whether the battery should be replaced or it has a significant chance to be recovered. It will then conduct a Deep Scan Test of the battery for a few seconds. This test will typically be performed on batteries that are in a low state of charge.

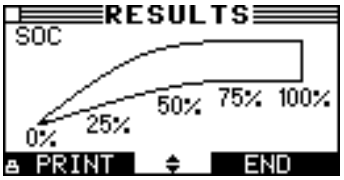
Battery Test Results

After the test the tester will display the battery decisions with the complete results in a series of screens. Use the **UP/DOWN ARROW** keys to scroll through each result. To print the results press the **PRINT** soft key. To return to the Main Menu, press the **END** soft key.

Screen 1 of 2



Screen 2 of 2



Battery Decisions and Recommendations

Decision	Recommended Action
GOOD BATTERY	Return the battery to service.
GOOD–RECHARGE	Fully charge the battery and return it to service.
CHARGE & RETEST	Fully charge the battery and retest. ***Failure to fully charge the battery before retesting may cause false readings.*** If CHARGE REQUIRED appears again after you fully charge the battery, replace the battery.
REPLACE BATTERY	A REPLACE BATTERY result may also mean a poor connection between the battery and the vessel. If you tested the battery using the IN-VESSEL test, disconnect the battery cables and retest using the OUT-OF-VESSEL test before replacing it.
BAD CELL-REPLACE	Replace the battery and retest.
FROZEN BATTERY	Thaw the battery and retest
24 VOLT SYSTEM	24-volt system detected. Connect to 12V battery instead of the system.

New Battery Test Result

Decision	Recommended Action
GOOD BATTERY	Return the battery to service
CYCLING REQUIRED	Battery needs to be cycled for optimal performance.
REST & RETEST	Battery could have a surface charge, because it has recently been charged.
CHARGE & RETEST	Fully charge the battery and retest. Failure to fully charge the battery before retesting may cause inaccurate results. If CHARGE & RETEST appears again after you fully charge the battery, replace the battery.
REPLACE BATTERY	Replace the battery and retest. A REPLACE BATTERY result may also mean a poor connection between the battery cables and the battery. After disconnecting the battery cables, retest the battery using the OUT OF VESSEL test before replacing it.
BAD CELL-REPLACE	Replace the battery and retest.
FROZEN BATTERY	Defrost the battery and retest.
24 VOLT SYSTEM	24-volt system detected. Connect to 12V battery instead of the system.
LOW VOLT REPLACE	Battery voltage is too low.

Pair Test Result

Decision	Recommended Action
GOOD PAIR	Return the pair to service
CHARGE PAIR	Fully charge the pair and return it to service.
REPLACE PAIR	Replace the pair. A REPLACE PAIR result may also mean a poor connection between the battery cables and the battery. After taking the battery out, retest the battery using the OUT OF VESSEL test before replacing it.
OUT OF BALANCE	The batteries used in the pack do not have the same state of charge and/or the same state of health. This means the testers are not in balance and this can result in a non properly functioning battery pair. Follow the tester's instructions.

Pack Test Result

Decision	Recommended Action
GOOD PACK	Return the pack to service
CHECK PACK	Follow the tester's advise and check the battery indicated. Disconnect the battery and perform a single battery test.
CHARGE PACK	Disconnect the batteries and charge them individually according to the test result.

Chapter 5: System Test

Before starting the test, inspect the alternator drive belt. A belt that is glazed or worn, or lacks the proper tension, will prevent the engine from achieving the rpm levels needed for the test.

The System Test includes 4 tests that provide a complete diagnosis of the vehicle's electrical system:

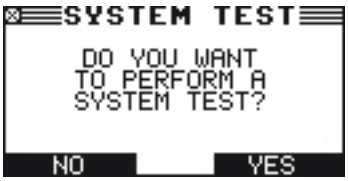
- BATTERY TEST
- STARTER TEST
- ALTERNATOR TEST
- DRAIN TEST

Battery Test

The System Test includes a test of the battery to eliminate it as the cause of starting or charging problems. See Chapter 4 for the Battery Test procedure.

Starter Test

1. Press the **YES** soft key to proceed.

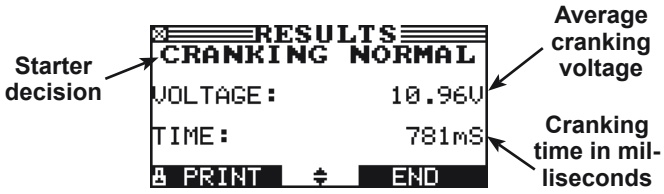


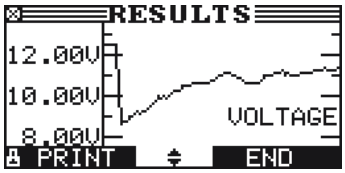
2. Start the vessel's engine when prompted. If after the vessel started and the results do not appear after approximately 25 seconds, press the **NO START** soft key.
3. The analyzer displays one of the decisions and the results in a series of screens.

NOTE: In some cases, the tester may not detect the vessel's starting profile. It will display the soft key options **STARTED** and **NO START**. If you select **STARTED**, the analyzer skips to the Alternator Test. If you select **NO START**, the test process ends.

Starter System Test Results

The results include the battery analysis. Use the **UP (▲)** or **DOWN (▼) ARROW** key to scroll to each screen. See the Starter System Decision table for an explanation of the starter system decisions. To continue testing, press the **NEXT** soft key.





X axis = time

Starter System Test Decisions

Decision	Action
CRANKING NORMAL	The starter voltage is normal and the battery is fully charged.
LOW VOLTAGE	The starter voltage is low and the battery is fully charged.
CHARGE BATTERY	The starter voltage is low and the battery is discharged. Fully charge the battery and retest the starter system.
REPLACE BATTERY	Replace the battery and retest before testing the alternator test..
NO START	The engine did not start and the test was aborted.
CRANKING SKIPPED	The tester didn't detect the vessel's starting profile and skipped the Starter Test.

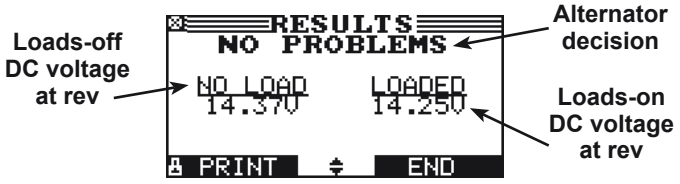
Alternator Test

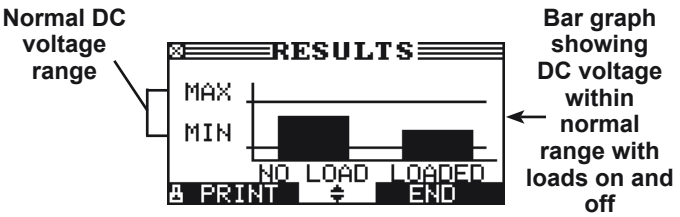
1. The tester starts checking for alternator output.
2. TESTING ALTERNATOR WITH LOADS OFF: The analyzer will next test the engine at idle for comparison to other readings, and then test the diode ripple. Excessive ripple usually means one or more diodes have failed in the alternator or there is stator damage.
3. APPLY LOADS: BOW THRUSTERS, LIGHTS, HEATERS, ETC.: After a few seconds, the tester will ask you to turn on the accessory loads. It will determine if the charging system is able to provide enough current for the demands of the electrical system.

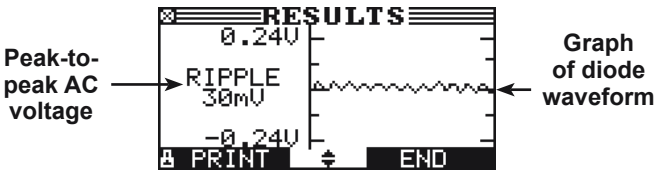
> **IMPORTANT:** Turn on the bow thrusters, lights, heaters. Do not use cyclical loads such as air conditioning.

4. TESTING ALTERNATOR WITH LOADS ON: The analyzer will determine if the charging system is able to provide sufficient current for the demands of the vehicle's electrical system.
5. ANALYZING CHARGING SYSTEM DATA: The tester is completing its final analysis of the charging system data.
6. TURN OFF LOADS AND ENGINE: Press the NEXT soft key to display the results.

Alternator Test Results







Drain Test

1. Press the **NEXT** soft key to initiate the drain test.
2. Press **NEXT** and measure the drain current with the external amp-meter.
3. Enter the drain current and press **NEXT** to start the drain test.

The result will be shown after a few seconds.

Alternator Decisions

Decision	Action
NO PROBLEMS	The system is showing normal output from the alternator. No problem detected.
NO VOLTAGE	The alternator is not providing charging current to the battery. √ Check the belts to ensure the alternator is rotating with the engine running. Replace broken or slipping belts and retest. √ Check all connections to and from the alternator, especially the connection to the battery. If the connection is loose or heavily corroded, clean or replace the cable and retest. √ If the belts and connections are in good working condition, replace the alternator. (Older vessels use external voltage regulators, which may require only replacement of the voltage regulator.)
LOW VOLTAGE	The alternator is not providing enough current to power the system's electrical loads and charge the battery. √ Check the belts to ensure the alternator is rotating with the engine running. Replace broken or slipping belts and retest. √ Check the connections from the alternator to the battery. If the connection is loose or heavily corroded, clean or replace the cable and retest.
HIGH VOLTAGE	The voltage output from the alternator to the battery exceeds the normal limits of a functioning regulator. √ Check to ensure there are no loose connections and that the ground connection is normal. If there are no connection problems, replace the regulator. (Most alternators have a built-in regulator requiring you to replace the alternator. In older vessels that use external voltage regulators, you may need to replace only the voltage regulator.)

Diode Decisions

Decision	Action
EXCESSIVE RIPPLE	One or more diodes in the alternator aren't functioning or there's stator damage, which is shown by an excessive amount of AC ripple current supplied to the battery. √ Make sure the alternator mounting is sturdy and that the belts are in good shape and functioning properly. If the mounting and belts are good, replace the alternator.
PHASE OPEN	The Tester has detected an open phase within the alternator. Replace the alternator.
DIODE OPEN	The Tester has detected a open diode within the alternator. Replace the alternator.
DIODE SHORT	The Tester has detected an shorted diode within the alternator. Replace the alternator.

Chapter 6: Generate Pair

With generate pair you can test whether two batteries can be used together.

1. Select the battery type.

   1 ◉ FLOODED LEAD ACID

   2 ○ AGM FLAT

   3 ○ AGM SPIRAL

   4 ○ GEL

   Press the **NEXT** soft key to continue. The **BACK** soft key returns you to the Main Menu at the start of the test and to the previous screen as you progress.

2. Select the rating units.

   1 ◉ MCA 5 ○ DIN

   2 ○ EN 6 ○ SAE

   3 ○ CCA 7 ○ IEC

   4 ○ JIS

Battery Standards

Rating System	Description	Range
MCA	Marine Cranking Amps	100 to 2000
EN (A)	European Norm	100 to 2000
CCA	Cold Cranking Amps (specified by SAE): The amount of current a battery can provide at 0 ºF (–17.8 ºC).	100 to 2000
JIS	Japanese Industrial Standard: (shown on a battery as a combination of numbers and letters)	73 numbers from 26A17 to 245H52
DIN (A)	Deutsche Industrie-Norm	100 to 1250
SAE (A)	European labeling of CCA	100 to 2000
IEC (A)	International Electrotechnical Commission	100 to 1250

   If you select JIS, the analyzer asks for the JIS part number. Scroll to the part number. To increase your scrolling speed, hold the **UP (▲)** or **DOWN (▼) ARROW** key, or use the **LEFT (◀)** or **RIGHT (▶) ARROW** key to move up or down four part numbers at a time.

   Press the **NEXT** soft key to continue.

3. Press an **UP (▲)** or **DOWN (▼) ARROW** key to select the BATTERY RATING.

   Press **ENTER**.

4. Hold the bottom of the tester five centimeters above the battery case so that the IR temperature sensor on its underside can approximate the battery temperature.

   Press **NEXT** to lock in the battery temperature.

5. Connect to the reference battery and press **NEXT**.

6. When the tester detects an insufficient charged or bad battery the tester asks you to connect another battery. Press **NEXT**.

7. In case of a good battery, connect to battery 2 of 2 and press **NEXT**.

Pair Test Result

Decision	Recommended Action and Information
GOOD PAIR	Return the pair to service
CHARGE PAIR	Fully charge the pair and return it to service.
REPLACE PAIR	Replace the pair. A REPLACE PAIR result may also mean a poor connection between the battery cables and the battery. After taking the battery out, retest the battery using the OUT OF VESSEL test before replacing it.
OUT OF BALANCE	The batteries used in the pack do not have the same state of charge and/or the same state of health. This means the testers are not in balance and this can result in a non properly functioning battery pair. Follow the tester's instructions.

Chapter 7: Drain Test

With the drain test you can check the amount of current that is lost as a result of leakage.

1. Measure the drain current with the external amp-meter.
2. Enter the drain current and press **NEXT** to start the drain test.

The result will be shown after a few seconds.

Chapter 8: QC Mode

The tester has the ability to test multiple batteries one after the other without having to input the battery rating / settings.

There are two types of QC tests: the **STOCK CONTROL** or **COMPOUND TEST**.

STOCK CONTROL is meant for batteries standing in a warehouse or on a pallet where as **COMPOUND TEST** is done when the battery is in the vessel.

Stock Control

1. The first screen shows you the amount of tests performed. Once you press both the arrow keys you reset the test counter. Press **NEXT** if you want to continue without clearing the tests.

2. Select the battery type.

   1 ⦿ FLOODED LEAD ACID

   2 ◯ AGM FLAT

   3 ◯ AGM SPIRAL

   4 ◯ GEL

   Press the **NEXT** soft key to continue. The **BACK** soft key returns you to the Main Menu at the start of the test and to the previous screen as you progress.

3. Select the rating units.

   1 ⦿ MCA
   2 ◯ EN
   3 ◯ CCA
   4 ◯ JIS
   5 ◯ DIN
   6 ◯ SAE
   7 ◯ IEC
   8 ◯ NONE

   Press the **NEXT** soft key to continue. The **BACK** soft key returns you to the previous screen.

4. Select the battery rating.

   Press the **UP** (▲) and **DOWN** (▼) **ARROW** keys to select the rating. In case of a JIS battery type the part number.

5. Enter the voltage.

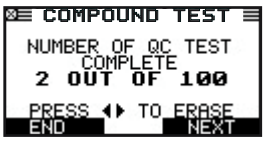
6. select the temperature.

   Aim the tester 5 cm from the sides or top of the battery case. As soon as the temperature reading is stable the operator can press **NEXT.**

   The tester will now test the battery.

Compound Test

1. The first screen shows you the amount of tests performed. Once you press both the arrow keys you reset the test counter. Press **NEXT** if you want to continue without clearing the tests.



2. Select the battery menu.

   1 ⦿ MANUAL

   2 ◯ PRE-SELECTION

   MANUAL input is selecting the different battery parameters that can be found on the battery. The **PRE-SELECTION** is what is entered in the tester memory. This is initially empty but can be filled in from the **UTILITY** menu.

   Press the **NEXT** soft key to continue. The **BACK** soft key returns you to the previous screen.

   For selection of the **MANUAL** input see the previous explanations and screens.

Chapter 9: Print/View

From the MAIN MENU select the Print/View Menu using the **UP**, **DOWN**, **LEFT** and **RIGHT ARROW** keys.

The Print/View Menu enables you to view and print the results of the last test performed. Print/View also allows you to view and print test decision totals.

To return to the MAIN MENU, press the **END** key. To print the results press the **PRINT** key.

The results can be viewed per test type:

- BATTERY RESULTS
- PAIR RESULTS
- PACK RESULTS
- QC MODE

Chapter 10: Version Info

From the MAIN MENU select Version Info using the **UP**, **DOWN**, **LEFT** and **RIGHT ARROW** keys.

Version info displays the build, the software version, the database version, the serial number and the total tests performed.

The utility keeps a permanent count of the number of battery tests performed since the analyzer was first used. Please note that whenever you load new firmware the counter will be reset.

Chapter 11: Utility Menu

The Utility Menu allows you to easily set up your analyzer:

Config tester

TIME :	**9:07**
MODE :	**24 HOUR**
DATE :	**01/10/2014**
FORMAT :	**MM/DD/YYYY**
TEMP. UNITS :	**°C**
WRITE FAIL :	**ASK**

Time

1. Use the **LEFT/RIGHT ARROW** keys to highlight the hour or minutes. To rapidly scroll, hold down an **ARROW** key.

2. Press the **SAVE** soft key to save your setting or **BACK** to return to the ADJUST screen.

Mode

Use the **LEFT/RIGHT ARROWS** to select the option of your choice.

1. Select the 24-hour or AM/PM mode
2. Press the **OK** soft key to save your setting

Date

Date cannot be changed.

Format

Use the **UP/DOWN ARROWS** to select the desired option.

1. MM/DD/YYYY (month/day/year) or DD/MM/YYYY (day/month/year)
2. Press the **OK** soft key to save your setting.

Temperature Units

Use the **LEFT/RIGHT ARROWS** to select either Celsius or Fahrenheit as temperature indication.

Write Fail

After each measurement the test results are stored on the data card. In case the data cannot be stored on to the card you can select the way this is notified to the operator.

ASK (operator is asked if it is ok to continue even when results are not stored)

FORCE (measurements can only continue when data card is entered)

IGNORE (measurement is not stored and operator not notified)

Display

The LCD OPTIONS utility enables you to adjust the contrast of the text on the display and the backlight time.

Contrast Level

The contrast level is 0 (lightest) to 10 (darkest). To change it:

1. Press the **UP** or **DOWN ARROW** to highlight the option.

2. Press the **LEFT/RIGHT ARROW** key to display the option's numerical scroll box.

3. Press the **UP/DOWN ARROW** keys to select your preference.
4. Press the **SAVE** soft key to save your setting or the **BACK** soft key to return to the CONTRAST LEVEL screen without saving the changes.

Backlight Time

Backlight time is from 0 to 60 seconds. To change it:

1. Press the **UP** or **DOWN ARROW** to highlight the option.

2. Press the **LEFT/RIGHT ARROW** key to display the option's numerical scroll box.

3. Press the **UP/DOWN ARROW** keys to select your preference.
4. Press the **SAVE** soft key to save your setting or the **BACK** soft key to return to the BACKLIGHT screen without saving the changes.

Language

The LANGUAGE utility enables you to select a language for the display and printouts. To set your preference:

1. Use the **UP/DOWN ARROWS** to move the dot to the option button of your choice. There is a selection of 23 languages.
2. Press the **NEXT** soft key to save your setting.

Shop Info

The SHOP INFO utility enables you to create a header for your printed test results showing your business location information. Its two information screens contain eight lines of text with up to 16 characters on each line.

Screen 1

1–WORKSHOP NAME
2–STREET NAME
3–CITY
4–ZIP CODE

Screen 2

5–COUNTRY
6–PHONE NUMBER
7–FAX NUMBER
8–WEBSITE.COM

To create or overwrite a header:

1. Press the **UP** or **DOWN ARROW** to highlight the line you want to change.
2. Press SELECT to activate the line for editing, move the cursor backward to erase a character, press the **LEFT ARROW** key; to move the cursor forward, press the **RIGHT ARROW** key.
3. Insert a character by pressing the key associated with the character as many times as needed.
4. You can center text by selecting blank spaces before and after lines of text or insert spaces between words.
5. Press the **SAVE** soft key to save your setting or the **BACK** soft key to return to the SHOP INFO screen without saving the changes.

Coupon

The COUPON SELECT utility enables and disables the printing of the custom coupon you've created in the EDIT COUPON utility.

1. Use the **UP/DOWN ARROWS** to move the dot to the option button of your choice.
2. Press the **NEXT** soft key to save your setting or the **BACK** soft key to return to the COUPON SELECT screen without saving the changes.

Edit Coupon

The EDIT COUPON utility enables you to create a promotional coupon for your customers that prints at the bottom of every test result. Its two information screens contain eight lines of text with up to 16 characters each. The editing process is the same as when you create a header for your test results printouts. See the SHOP utility for more information.

Format Card

Select this utility to format a data card to receive data or erase all data on the card. The Tester will warn you before formatting the card and ask you if you want to continue. When a new blank data card is used you always have to use this function before the tester can write to the card.

Clear Counters

The counters can be seen as some statistics or test history. Use Clear Counters to reset the battery test decision totals.

Update

As software updates become available you'll be able to use this utility to update the Tester software using files on an SD card. The use of a special formatted card is required for this action.

FIRMWARE (use this option when new software becomes available from Midtronics)

SAVE CONFIG (the tester will store the workshop address to the data card, file name is CONFIG.CSV)

LOAD CONFIG (after new software is uploaded you can reload the workshop details to the tester)

1. Connect the tester to a 12V battery to ensure the tester does not switch off during the proces
2. Insert the disc in the tester
3. Select one of the options and follow the instructions on the screen
4. When finished the tester will prompt you to remove the card and reboot the tester

QC Mode

In this function you can add, delete battery information that is used for the various battery tests.

ADD BATTERY
From this menu you can add batteries that you can select in the QC mode. When you add a battery you must have the BATTERY TYPE, BATTERY RATING, BATTERY CCA, BATTERY CAPACITY.

DELETE BATTERY
From this menu you can delete batteries that you can select in the QC mode.

IMPORT LIST
When VW delivers new battery information it can be uploaded with this function. It will have the same effect as the above mentioned steps but than in a more simple way.

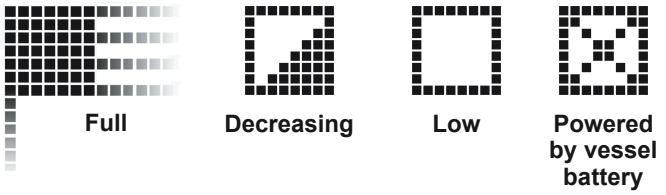
EXPORT LIST
To view the current battery and partnumber information use the EXPORT function to send the information to the data card.

Chapter 12: Tester Internal Batteries

The Tester uses 6 AA, 1.5-volt batteries (alkaline recommended) to allow testing of batteries down to 1 volt and supply power while the menu is active. The analyzer can test batteries down to 5.5 volts when the internal batteries are not functioning.

Battery Power Indicator

The square in the upper left corner of the display indicates the charge level of the battery pack. The square is black when the battery pack is fully charged. It gradually changes to white as the charge level declines. The Tester will display a warning message when the batteries need replacing.



Power Level Indicator for AA Batteries

Replacing the Tester Batteries

1. Turn the Tester face down.
2. Use a Philips screwdriver to remove the screw securing the door to the battery compartment.
3. Lift the door at the tab and place it aside.
4. Remove the discharged batteries.
5. Insert new batteries as shown, make sure the positive and negative terminals are positioned correctly.
6. Reposition the door on the battery compartment.
7. Reinsert and tighten the screw.

Troubleshooting

If you have problems with the display or printer try these troubleshooting suggestions:

Problems with the display

The display does not turn on:

- Check the connection to the battery.
- The analyzer's internal batteries may need to be replaced.

The display flickers or is dim:

- The contrast may need to be adjusted in the Utility menu.
- The analyzer's internal batteries may need to be replaced.

Data Will Not Print

The internal printer will not print

- The analyzer must be connected to the vessel battery to print to the internal printer.
- The vessel battery may be too low to power the printer. (Battery with at least 11.5 volts)
- Verify that the paper is properly installed
- Verify that the paper sensor is clean and undamaged

Patents

The EXP series is made by Midtronics, Inc., and is protected by one or more U.S. and foreign patents. For specific patent information, contact Midtronics, Inc. at +1 630 323-2800.

Limited Warranty

This analyzer is warranted to be free of defects in materials and workmanship for a period of two years from date of purchase. Midtronics will, at our option, repair or replace the unit with a remanufactured unit. This limited warranty applies only to the analyzer, and does not cover any other equipment, static damage, water damage, overvoltage damage, dropping the unit, or damage resulting from extraneous causes including owner misuse. Midtronics is not liable for any incidental or consequential damages for breach of this warranty. The warranty is void if owner attempts to disassemble the unit or to modify the cable assembly.

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