MIDTRONICS

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CPX-950 EU

Battery & Electrical Diagnostic Analyzer

For 12-volt automotive batteries and 24V systems.

User Manual

Contents

1: Introduction

Personal Precautions

⚠ 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.

Inspect the battery for damage and check the electrolyte level. If the electrolyte level is too low, replenish it and fully charge the battery. Always use the necessary safety precautions when working with batteries to prevent severe injury or death. Follow all manufacturers' instructions and BCI (Battery Council International) safety recommendations, which include the following precautions:

- ✓ Battery acid is highly corrosive. If acid enters your eyes, immediately flush them thoroughly with cold running water for at least 15 minutes and seek medical attention. If battery acid gets on your skin or clothing, wash immediately with a mixture of 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.

Symbols Conventions

Symbol	Description
	The safety symbol indicates instructions for avoiding hazardous conditions and personal injury.
	The safety symbol with the words **CAUTION**, **WARNING, or DANGER** indicates instructions for avoiding hazardous conditions and personal injury.
	The wrench symbol indicates procedural notes and helpful information.

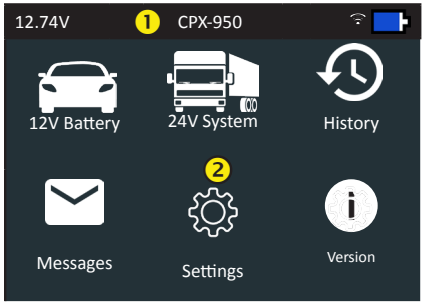
Description

The analyzer uses function-specific applications accessed through a series of menus and icons to guide users through the battery testing process for consistent testing implementation and accuracy. These are accessed using the tester's touch screen display. Test results can be displayed on the full-color screen, printed, or wirelessly emailed.

Controls & Connections

1. Display Screen
2. Cooling Vent
3. Arrow Keys & Power Button
4. Micro-USB Port
5. Temperature Sensor
6. VID Barcode Scanner (optional)
7. Clamp Tabs

Main Menu



1 Menu Bar

12.74V	Battery Voltage (if connected)		WiFi signal strength
			Controller internal battery status

2 Main Menu Selection Area

When displayed, the Screen Arrows show which **ARROW** key on the keypad to press to display other icons or screens. When displayed under a list of options, the Screen Arrows show which keypad arrow to press to highlight a character or item in a list.

Additional Screens

The dots at the bottom or side of a menu or results screen indicate additional screens are available.

Main Menu Icons

Icon	Description
 12V Battery	Automates battery testing for quickly testing in or outside of the vehicle using the fewest steps.
 24V System	Battery testing or generating a battery pair for 24V systems using the fewest steps.
 History	Access archived test histories or search test history by VIN or by technician.
 Messages	Displays alerts and notifications for upcoming tests and activities including scheduled tests, tool software updates and maintenance opportunities.
 Settings	Setup/adjust: WiFi, email settings, default language, display settings, information, shop information
 Version	Retrieve info of the current software version.

Initial Power Up

When powered up for the first time, the tester will take approximately 8 to 10 seconds to boot up while testing the integrity of the internal software.

The LANGUAGE screen is the first to appear. It enables you to set the language for the display and printed test results. You can disable this option in the Admin Menu.

1. Use ▲ or ▼ to select the default LANGUAGE and press **NEXT** to continue.
2. This product has a EULA (End User License Agreement), which you can find on www.midtronicseurope.com/eula. Before starting the use of your tool, read this EULA. By using the tool you agree to having read, understood and agreed to the contents of our EULA.
3. Next you are requested to add your preferred date setting (MMDDYYYY or DDMMYYYY) and the time setting (24-hour or AM/PM) and the actual time. The date can only be changed by Midtronics service centers.
4. Next up a WiFi connection can be made. Connect to a WiFi network of press SKIP to continue.
5. Your changes are saved and the Main Menu is displayed on the screen.

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 to ½ above the top of the plates 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-Vehicle (Battery Test)

The preferred battery test location is in the vehicle (Under Hood, Under Seat). However, if you plan to test out of the vehicle:

- 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.

⚠ CAUTION

Failure to properly install lead terminal adapters, or using adapters that are dirty or worn, may cause false test results.

When testing side-post or Group 31 batteries, always use lead terminal adapters provided with the tester—do not test at the battery's steel bolts. To avoid damage, never use a wrench to tighten the adapters more than ¼ turn.

Testing Under Hood or Under Seat

The preferred test position is at the battery posts. If you must test at a Jump (start) Post location, it should have both a positive and negative post.

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.

At the start of the test, place the vehicle transmission in PARK, make sure all vehicle accessory loads are off, the key is not in the ignition, and the doors are closed.

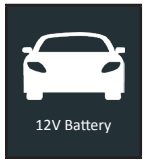
Connecting To The Battery

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

If you connect the clamps in the wrong polarity (red to negative or black to positive), the analyzer displays "CLAMPS REVERSED!" Reconnect the clamps.

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 analyzer displays the message CHECK CONNECTION. If the message reappears after you have correctly reconnected the clamps, clean the terminals and reconnect.

2 – 12V Battery



Use 12V Battery to perform Battery Tests on car batteries. Using test parameters the battery can be tested both in vehicle and out of vehicle. Press ▲◀▶▼ to return to the previous screen, select options and when necessary, ☐ to enter or continue to the next step. Use **BACK** to return to the Main Menu.

Battery Test

1. Connect to the battery.
2. Battery Test Setup - Edit the displayed vehicle and battery information.

Battery Location	Under Hood	Out of Vehicle	Under Seat
Test Location*1	Battery Post	Jump Start Post	Jump Start Post (BMS)
Predefined rating*2	A list of known Ford batteries, plus at the end of the list a possibility to enter a battery manually.		
Battery Type	EFB	AGM	SLI
Battery Units	EN SAE IEC	DIN JIS EN2	
Battery Rating	Hold down ▲ or ▼ to increase scrolling speed.		
VIN	Insert the last 5 number of the Vehicle ID number (VIN). This step is optional.		

*1 Test location is not shown in Setup menu when 'Out of Vehicle' was selected.

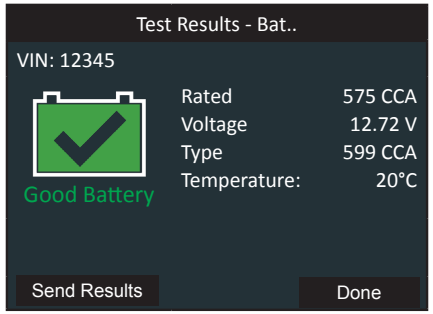
*2 When a predefined rating is selected, 'Type', 'Battery Units' and 'Rating' are not editable in the Setup menu.

Rating	Description	Range
EN	European Norms. The battery is required to meet a voltage of 7.5V after 10 seconds	100 to 3000
SAE	Society of Automotive Engineers norm. The test specifies that the battery at a temperature of –18°C will deliver a current equal to the Cold Cranking Amps for 30 seconds with the voltage staying above 7.2 volts	100 to 3000
IEC	International Electrotechnical Commission norm. The IEC test is performed at -18°C	100 to 1000
DIN	Deutsche Industrie-Norm	100 to 1000
EN2	European Norms 2. Performing a different second discharge than with EN.	100 to 3000
JIS	Japanese Industrial Standard test, carried out at -15°C.	A list is shown

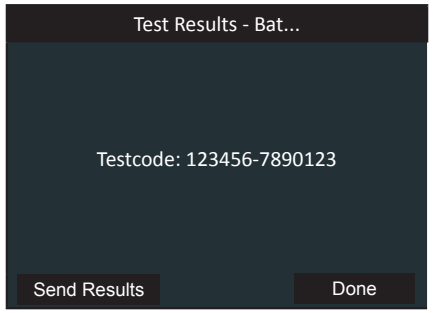
Select **Start** to advance to the battery test.

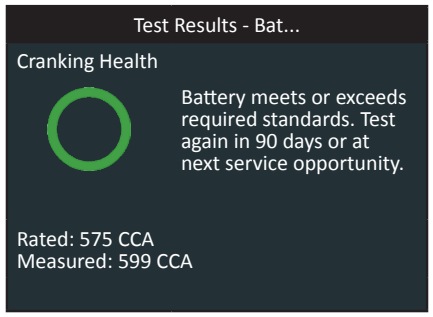
3. Temperature - you are requested to aim the temperature sensor at the battery. Then click 'Capture' The test is started.

Battery Test Results



Temperature is only shown when the temperature question was asked.





Test Results - Battery Test

To send the test results select **Send Results.** To return to the Home Screen, select **Done** to continue to the mainscreen.

Refer to Appendix B: Decision Tables for a complete explaination of the possible test results.

3 - 24V System

Use 24V System Test to test and verify the condition of customer batteries for possible return and/or warranty claim.
Press ▲◀▶▼ to return to the previous screen, select options and when necessary, **O** to enter or continue to the next step. Use **BACK** to return to the Main Menu.

Battery Test

1. First select whether you wish to perform a battery test or generate a battery pair. For generate pair test instructions, see next page.
2. Connect to the (first) battery.
3. Battery Test Setup - Edit the displayed battery information.

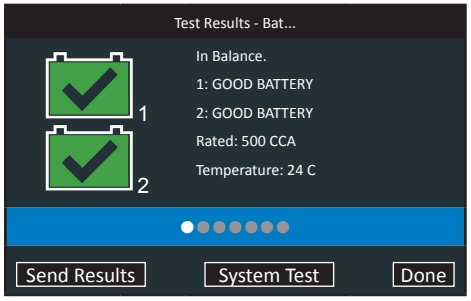
Battery Type	SLI	AGM
Number of Batteries	1	2
Battery Units	EN SAE IEC	DIN EN2 JIS
Battery Rating	Hold down ▲ or ▼ to increase scrolling speed.	
VIN	Insert the last 5 number of the Vehicle ID number (VIN). This step is optional.	

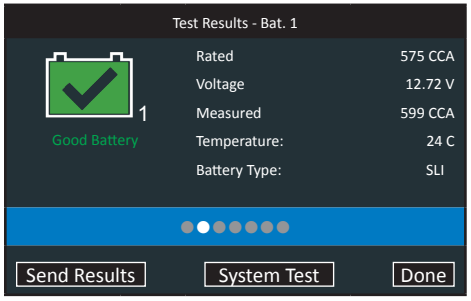
Rating	Description	Range
EN	European Norms. The battery is required to meet a voltage of 7.5V after 10 seconds	100 to 3000
SAE	Society of Automotive Engineers norm. The test specifies that the battery at a temperature of –18°C will deliver a current equal to the Cold Cranking Amps for 30 seconds with the voltage staying above 7.2 volts	100 to 3000
IEC	International Electrotechnical Commission norm. The IEC test is performed at -18°C	100 to 1000
DIN	Deutsche Industrie-Norm	100 to 1000
EN2	European Norms 2. Performing a different second discharge than with EN.	100 to 3000
JIS	Japanese Industrial Standard test, carried out at -15°C.	A list is shown

Select **Start** to advance to the test.

4. Temperature - you are requested to aim the temperature sensor at the battery. Then click 'Capture' The test is started.

5. You are requested to connect to the second battery. If there's only 1 battery, this step is automatically skipped.
6. Temperature - you are requested to aim the temperature sensor at the second battery. Then click 'Capture' The test is started.





Test Results - Battery Test

To send the test results select **Send Results.** To perform a System test, select **System Test.** To return to the Home Screen, select **Done** to return to the main screen.

Generate Pair

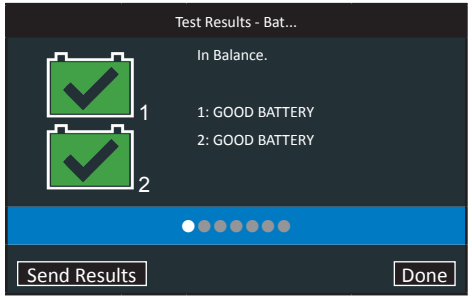
7. Connect to the first battery.
8. Battery Test Setup - Edit the displayed battery information.

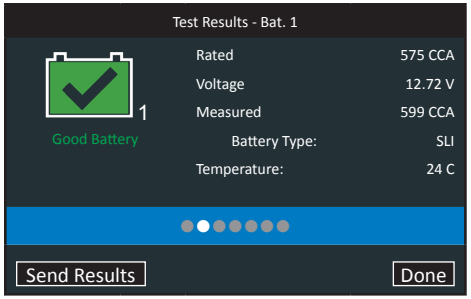
Battery Type	SLI	AGM
Battery Units	EN SAE IEC	DIN EN2 JIS
Battery Rating	Hold down ▲ or ▼ to increase scrolling speed.	
VIN	Insert the last 5 number of the Vehicle ID number (VIN).This step is optional.	

Rating	Description	Range
EN	European Norms. The battery is required to meet a voltage of 7.5V after 10 seconds	100 to 3000
SAE	Society of Automotive Engineers norm. The test specifies that the battery at a temperature of –18°C will deliver a current equal to the Cold Cranking Amps for 30 seconds with the voltage staying above 7.2 volts	100 to 3000
IEC	International Electrotechnical Commission norm. The IEC test is performed at -18°C	100 to 1000
DIN	Deutsche Industrie-Norm	100 to 1000
EN2	European Norms 2. Performing a different second discharge than with EN.	100 to 3000
JIS	Japanese Industrial Standard test, carried out at -15°C.	A list is shown

Select **Start** to advance to the test.

9. Temperature - you are requested to aim the temperature sensor at the battery. Then click 'Capture' The test is started.
10. If the battery is in a good state, you are requested to connect the CPX to the second battery. If the first battery needs a charge a warning is shown, asking the user to connect a different battery to test or charge the battery. A pair cannot be generated with discharged batteries.
11. Temperature - you are requested to aim the temperature sensor at the battery. Then click 'Capture' The test on the second battery is started.





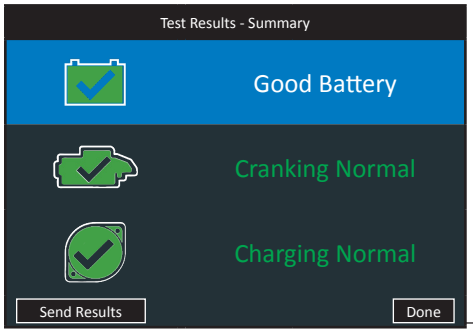
Test Results - Battery Test

To send the test results select **Send Results.** To continue to further testing the 24V batteries, select **System Test**. To return to the Home Screen, select **Done** to return to the main screen.

(In Vehicle test) - 24V System Test

1. Select External Amp Clamp or No Amp Clamp. Midtronics recommends to use the PDF40 external amp clamp.
2. Start the vehicle's engine and leave it running.
3. Ensure all accessories (High Beam headlights/ventilation blower etc.) are off and select **Next**. The analyzer tests the alternator output.
4. When prompted, rev and hold the engine to between 1000 to 1250 rpm. The analyzer tests the alternator output again.
5. When prompted Idle the engine and and select **Next**.
6. Turn on the high beam headlights and ventilation blower.
7. Select **Next**. The analyzer tests the alternator output.
8. When prompted, rev and hold the engine to between 1000 to 1250 rpm. The analyzer tests the alternator output again.
9. When prompted Idle the engine, turn off loads, then turn off ingition and select **Next**.
10. If an external amp clamp was used, the tester now asks the measured drain current. Insert the number, then select **Next**.
11. The results are shown.

System Test Results

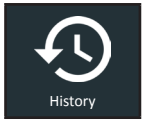


Test Results - Summary

The Test Results - Summary screen is displayed following a System Test. Select the Battery, Cranking, or Alternator Test to view detailed test results for each part of the test. Refer to Appendix B: Decision Tables for a complete explaination of the possible test results.

To send the test results to a configured printer or via email select **Send Results.** To return to the Home Screen, select **Done** to the Main Menu

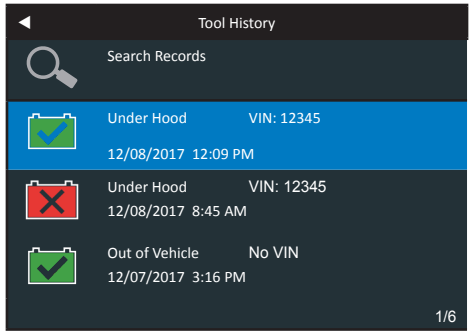
5 – History



Use History to access the tool usage history, a vehicle history based on VIN, and by test result decisions.

Press ▲◀▶▼ to return to the previous screen, select options and when necessary, **O** to enter or continue to the next step. Use **BACK** to return to the Main Menu.

1. At the Main Menu, select **History**. The Tool History screen is displayed.



For Out Of Vehicle tests, see Appendix B: Test Results Decision Tables for full screen descriptions.

To send the test results via email select **Send Results.** To return to the Home Screen, select **Done** to the Main Menu.

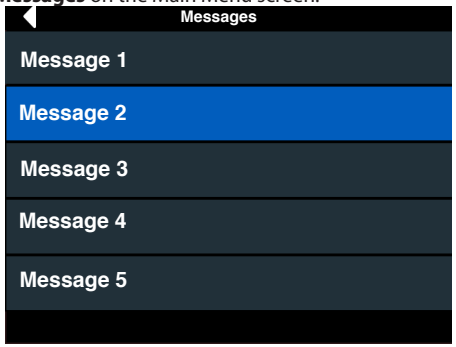
6 – Messages

The Messages function displays alerts and notifications for upcoming tests and activities. This includes scheduled testing as well as tool software updates.

Tap ◀ to return to the previous screen.

Accessing Messages

1. Tap **Messages** on the Main Menu screen.



2. Tap ✉ to read a message.
   Tap ⚙ to perform the message action item.
   Tap 🗑 to delete a message.
3. Tap ∧ to collapse a list of messages or ∨ to expand the list.

Message Types

Critical: An important action cannot be performed and may require user action.
Notifications: Indicates an action has been performed or data has been sent.

7 – Settings

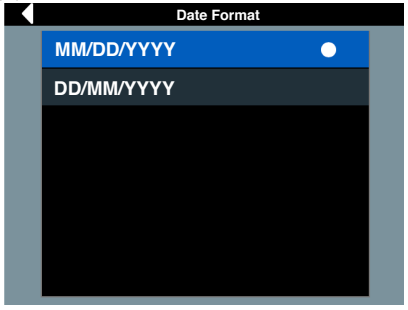
Use Setup to setup and adjust the tester display and time, shop and administrative settings, network connectivity.

Tool

Display

Language	Use ▲ or ▼ to select the analyzer default standard language. Use ◀ to return to the Display menu.
Temperature Units	Use ▲ or ▼ to select the default temperature units (Fahrenheit/Celsius) used when measuring battery temperature.
Number Separator	Use ▲ or ▼ to select the default number display using commas or periods separators.

Date & Time

Date Format	Use ▲ or ▼ to select Month/Day/Year, Day/Month/Year, or Year/Day/Month. 
Date	Date can be set at Midtronics Service Partners when the button cell battery was replaced. The button cell is designed for the same service life duration as EXP.
Time Format	Use ▲ or ▼ to select AM/PM or 24 Hour Format.
Time	Use ▲ or ▼ to advance the hours, minutes, and AM/PM setting. Use ◀ or ▶ to advance left or right and move to **Cancel** or **OK**. Select **OK** to save the time or **Cancel** to exit without saving.

Version

Use to confirm technical information for internal tester software and hardware.

Config:	192-111338A
Firmware:	192-121342A
SFlash:	192-151343A
PFlash	192-151343A
EEPROM:	192-151344A
Build Date:	10/24/2017
Build Number:	9
Serial Number:	111788888
Mac ID	-
FCC ID	1AB234-ABCDEFGH12

Check for Updates

Press the select button on the keypad to immediately check for software updates. It is possible to cancel an update during the first part of the update. A stable internet connection is needed to check for updates.

Email Format

The default email that is used for sending test results can be changed here. Press ESC to cancel the changes, press SAVE to save the changed email address.

Shop Settings

Shop Info

Use to enter information about the shop in which the tester will be used.

Shop Name	Country
Shop Address	Phone Number
Shop Address 2	Email Address
City	Website
State	(Blank)
Zipcode	(Blank)
Country	(Blank)
Phone Number	(Blank)
Email Address	(Blank)
Website	(Blank)

With the displayed alphanumeric keypad, use ▲▼◀▶ to highlight the desired alphanumeric character.
Select ↑ to access the lower case and symbol character maps.
Once all of the alphanumeric characters have been entered, select **Save** or **Esc** to exit without saving.

N*etwork settings*

WiFi

Not connected / Connected to:	If the tester is not connected to a network: "Not connected" If the tester is connected to a network: "Connected to: [networkname]"
Automatic	The tester searches for any detectable WiFi networks. A list of detected WiFi networks is then displayed on the tester screen.
Manual	Manually enter Security, SSID, Password, Encryption, and WEP Keys.

Problem: Tester does not detect/cannot access a wifi network:

- Confirm the selected WiFi network can be detected by a another device such as a phone or laptop.
- Perform network connection test using a mobile hotspot or temporary open network (may require IT assistance). If the tool connects to a mobile/temporary network, continue troubleshooting network. If the tool does not connect to temporary network, troubleshoot device with Midtronics.
- Confirm the selected WiFi network is enabled to support 802.11 b/g/n radios over a 2.4Ghz network. Many WiFi network connectivity issues can be resolved by cycling the router power, even if other wireless clients are still connected. Disconnect the router from its power source for 30 seconds, then reconnect. Refer to router documentation for specific instructions.
- Check the location of the router for obstructions like metal or concrete walls. Check the router antenna for damage or obstructions/interference.

IP addresses

Midtronics connectivity uses the following IP Addresses, which should be whitelisted if network access is otherwise blocked.

104.43.246.6	***40.69.172.106***	***52.173.199.181***
52.173.94.173	***52.173.194.249***	***52.173.19.232***

8 – Maintenance & Troubleshooting

Tester Cables

The test cables that come with your analyzer are consumable items. Cables are like tires in that the more you use them and the harder you drive them, the shorter their useful life. Here are a few things you can do to protect your test cables from damage and premature wear:

Cleaning Clamps

- The grease, dirt, and sulfation that build up on battery terminals are highly corrosive and can damage the clamps over time. Before connecting the clamps, ensure accurate test readings and protect the clamps by cleaning the battery case and terminals using a wire brush and a mixture of water and baking soda.
- Periodically clean the clamps using a mixture of baking soda and water, or a mild hand-soap, and a small bristle brush.
- To protect the clamps from oil and dirt, clip them to the back of the analyzer as shown.

Handling Test Cables

- Always connect and disconnect the clamps to the battery by opening and closing the clamps. Never pull on the test cables to remove the battery clamps. Pulling can damage the Y-junction, the cables, and the clamps to the extent that the analyzer may produce lower-than-expected conductance readings or fail completely.
- Never carry the analyzer by the cables. Carrying the analyzer or swinging it by the cables puts unnecessary strain on the cables and can result in premature failure. Handle the analyzer with care to get the maximum use from the product.

Storing Test Cables

- Never wrap the cables around the analyzer; this puts unnecessary strain on the test cables.

Because the test cables are the "tires" of the analyzer, they have a certain life expectancy and will wear out eventually. However, the abuse examples cited above are not covered under warranty. To ensure the best performance and longest life of the test cables, attach and remove them with care, and carry the analyzer and cables together.
If an inspection or a change in test results indicate that the test cables need to be replaced, contact a Midtronics Service Center near you..

Testing The Cable Set

If the analyzer frequently displays CLAMP ERROR! there may be an intermittent open circuit along one or both of the battery test cables. You can check the circuit with a simple test. The test requires an ohmmeter and a wire or paper clip if the ohmmeter probes are too large to insert into the pin holes. You will also need to a pencil or plastic marker to keep the clamp jaws apart.

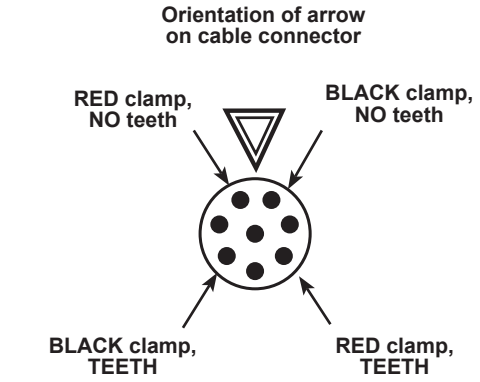
Test Procedure

You are testing the continuity of the following end points:

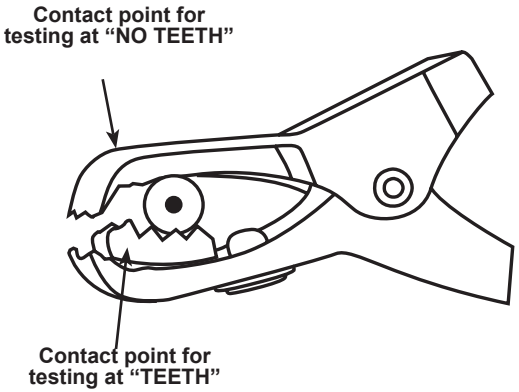
- The positive (RED clamp jaw without teeth and its corresponding pin hole.
- The positive (RED) clamp jaw with teeth and its corresponding pin hole.
- The negative (black) clamp jaw without teeth and its corresponding pin hole.
- The negative (black) clamp jaw with teeth and its corresponding pin hole.

1. Grip a pencil with the clamp as shown in the figure *Contacts for Clamp Jaws*. Do not grip the metal part of the pencil or any area that may conduct current.
2. Insert a probe tip into the hole designated "NO TEETH" for the color (BLACK or RED) of the clamp you are testing as shown in the figure "Contacts for Cable Connector."

3. Touch the toothless jaw of the clamp with the other probe tip. Wiggle the battery test cables. The resistance reading should be less than 1 Ω.
4. Repeat the test for the "TEETH" side of the circuit, this time touching the jaw with teeth. Insert the other probe tip into the "teeth" pin hole. Wiggle the battery test cables. The resistance reading should be less than 11 Ω.



Contacts for Cable Connector



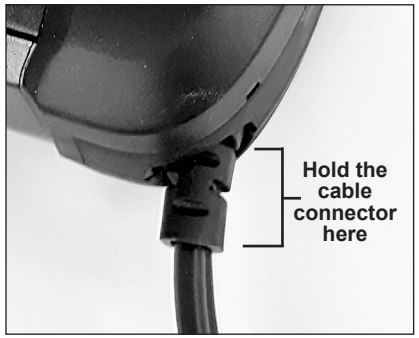
Contacts for Small Clamp

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 cable connector with the analyzer's housing. Hold the part of the cable connector as shown and firmly insert the connector into analyzer's 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.

Display Problems

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:

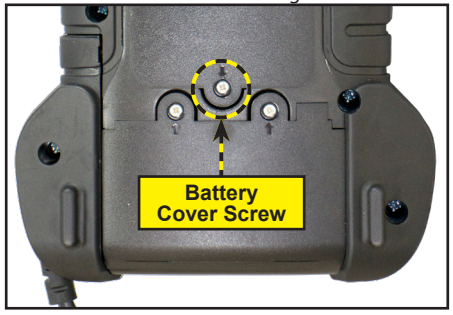
- The analyzer's internal batteries may need to be replaced.

Internal Batteries

The tester uses six AA, 1.5-volt batteries (alkaline recommended) to allow testing of batteries down to 1 volt and supply power while the menu is active. On the mainscreen you can see an internal battery charge indicator; this is purely an indicator to show when batteries are close to a necessary replacement.

Replacing The Internal Batteries

1. Turn the analyzer face down.
2. Use a Phillips 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.

Warning: Behind the AA batteries you find a sticker. Behind this a button cell is located, which once removed means a recallibration is needed at a Midtronics Service Center.

Appendix B: Test Results Decision Tables

Battery Test Results

Decision	Cranking Health	Reserve Capacity	SOH Message
Good Battery	Good	Good	The battery shows good cranking performance. Test the battery again at next service opportunity.
Good Recharge	Good Recharge		The battery shows good cranking performance but low charge. Fully charge the battery for optimal performance and life. Check the starting and charging systems for causes of low charge.
Charge & Retest	Charge and Retest		Charge the battery and retest to determine condition.
Replace Battery	Good	Warning	The battery shows good cranking performance but low reserve capacity performance. Low reserve capacity will compromise the battery's ability to provide power to the vehicle and hold a charge over time.
	Good Recharge		The battery shows good cranking performance but low charge and low reserve capacity performance. Low reserve capacity will compromise the battery's ability to provide power to the vehicle and hold a charge over time. Check the starting and charging systems for causes of low charge.
	Charge and Retest		The battery shows low charge and low reserve capacity performance. Low reserve capacity will compromise the battery's ability to provide power to the vehicle and hold a charge over time.
	Warning		The battery shows low cranking performance. Replace the battery to prevent a no-start situation in your vehicle.
	Warning		The battery shows low cranking performance. Replace the battery to prevent a no-start situation in your vehicle.
Frozen Battery			Thaw the battery and retest. Do NOT charge the battery!.

Decision	Cranking Health	Reserve Capacity	SOH Message
 Good Battery	Good	No Test	The battery shows good cranking performance. Test the battery again at next service opportunity.
 Good Recharge	Good Recharge		The battery shows good cranking performance but low charge. Fully charge the battery for optimal performance and life. Check the starting and charging systems for causes of low charge.
 Charge & Retest	Charge & Retest		Charge the battery and retest to determine condition.
 Replace Battery	Warning		The battery shows low cranking performance. Replace the battery to prevent a no-start situation in your vehicle.
	Warning		The battery shows low cranking performance. Replace the battery to prevent a no-start situation in your vehicle.
No Test	No Test	No Test	Conditions have prevented a test of the battery reserve capacity. Ensure that there are no loads on the battery before attempting any retest.

Generate Pair Results

Decision	Action
In balance	The batteries are working correctly and are balanced.
Pack replace	Replace the battery and retest. A REPLACE 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 vehicle test before replacing it.
Pack charge	Charge the battery pair and retest. Failure to fully charge the battery before retesting may cause false readings. If CHARGE appears again after you fully charge the battery, replace the battery.
Pack out of balance	The batteries are not balanced with each other and should not be used together.

Starter Test Results

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 repeat the starter system test.
 Replace Battery	If the battery test result was (REPLACE or BAD CELL.) The battery must be replaced before testing the starter.
 Low Cranking Amps	The starter voltage is high but the cranking amps are low.
 Cranking Skipped	The engine didn't start and the test was aborted or the vehicle's starting profile was not detected and the Starter Test was skipped.

Alternator Test Results

Decision	Action
 CHARGING NORMAL	The output from the alternator is normal.
 NO OUTPUT	No output detected. Check belts to ensure alternator is rotating when engine is running. √ Check all alternator connections including to the battery. Clean or replace if necessary and retest. √ If the belts and connections are in good working condition, replace alternator or external voltage regulator.
 LOW OUTPUT	Alternator not providing enough current to power electrical loads and charge the battery. √ Check belts to ensure the alternator is rotating with the engine running. √ Check alternator connections to and from the battery. If loose or heavily corroded, clean or replace the cable and retest.
 HIGH OUTPUT	Alternator voltage to the battery exceeds normal limits of a functioning regulator. √ Check for loose and normal ground connections. If no connection problems are found, replace the regulator. The normal high limit of a typical automotive regulator is 14.5 volts +/–0.5. Refer to the manufacturer specifications for the correct limit, which may vary by vehicle type.

Diode Test Results

Decision	Action
 EXCESSIVE RIPPLE	One or more diodes in the alternator are not functioning or there is 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.
 OPEN PHASE	Replace the alternator.
 OPEN DIODE	
 SHORTED DIODE	

Decision	Color	Example	500 Rated
 Good Battery			= 450 measured
 Good Recharge			= 250 measured
 Charge and Retest			N/A
 Replace Battery			= 150 measured
 Badcell, Replace			= 0 measured

The circle size is based on a (calculated) charged battery condition.

PATENTS

This product 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

Midtronics products are warranted to be free of defects in materials and workmanship for a period of two (2) years from date of purchase. Midtronics will, at our option, repair or replace the unit with a re-manufactured unit. This limited warranty applies only to Midtronics battery testers and does not cover any other equipment, static damage, water damage, overvoltage, 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.

Excluding cables.

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