

MODIS™ Edge

User Manual



ZEEMSAU341A Rev. A

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IMPORTANT:

Before operating or maintaining this unit, please read this manual carefully paying extra attention to the safety warnings and precautions.

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Safety Information

READ ALL INSTRUCTIONS

For your own safety and the safety of others, and to prevent damage to the equipment and vehicles upon which it is used, it is important that the accompanying *Important Safety Instructions* be read and understood by all persons operating, or coming into contact with, the equipment. We suggest you store a copy near the unit in sight of the operator.

This product is intended for use by properly trained and skilled professional automotive technicians. The safety messages presented throughout this manual are reminders to the operator to exercise extreme care when using this test instrument.

There are many variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. Because of the vast number of test applications and variations in the products that can be tested with this instrument, we cannot possibly anticipate or provide advice or safety messages to cover every situation. It is the responsibility of the automotive technician to be knowledgeable of the system being tested. It is essential to use proper service methods and test procedures. It is important to perform tests in an appropriate and acceptable manner that does not endanger your safety, the safety of others in the work area, the equipment being used, or the vehicle being tested.

It is assumed that the operator has a thorough understanding of vehicle systems before using this product. Understanding of these system principles and operating theories is necessary for competent, safe and accurate use of this instrument.

Before using the equipment, always refer to and follow the safety messages and applicable test procedures provided by the manufacturer of the vehicle or equipment being tested. Use the equipment only as described in this manual.

Read, understand and follow all safety messages and instructions in this manual, the accompanying *Important Safety Instructions*, and on the test equipment.

Safety Signal Words

Safety messages are provided to help prevent personal injury and equipment damage. All safety messages are introduced by a signal word indicating the hazard level.

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury to the operator or to bystanders.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to the operator or to bystanders.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury to the operator or to bystanders.

Safety Message Conventions

Safety messages are provided to help prevent personal injury and equipment damage. All safety messages are introduced by a signal word indicating the hazard level.

Safety messages communicate the hazard, hazard avoidance and possible consequences using three different type styles:

- Normal type states the hazard.
- **Bold type states how to avoid the hazard.**
- *Italic type states the possible consequences of not avoiding the hazard.*

An icon, when present, gives a graphical description of the potential hazard.

Example:

WARNING



Risk of unexpected vehicle movement.

- **Block drive wheels before performing a test with engine running.**

A moving vehicle can cause injury.

Important Safety Instructions

For a complete list of safety messages, refer to the accompanying *Important Safety Instructions*.

SAVE THESE INSTRUCTIONS

Using This Manual

Content

This manual contains basic operating instructions and is structured in a manner to help you become familiar with your diagnostic tool features and perform basic operations.

The illustrations in this manual are intended as reference only and may not depict actual screen results, information, functions or standard equipment. Contact your sales representative for availability of other functions and optional equipment.

Conventions

The following conventions are used.

Terminology

The terms “Scanner” and “Scanner function” are used to describe the Scanner Function(s) of the diagnostic tool.

Examples:

- Select **Scanner** from the Home screen.
- From the Scanner main menu select **Continue**.
- The Scanner function provides many diagnostic tests.

The term “select” describes tapping/touching an icon on the touch screen, or highlighting an icon or menu choice and then selecting the confirmation menu choice such as **Continue, Accept, OK, Yes, or other similar** choice.

Abbreviated example for the following procedure: “Select **Brightness**”

1. Navigate to and highlight the **Brightness** selection.
2. Select **OK, or similar**, button.

Symbols

Different types of arrows are used. The “greater than” arrow (>) indicates an abbreviated set of selection (navigation) instructions.

Abbreviated example for the following procedure: “Select **Tools > Connect-to-PC**”

1. Select **Tools** from the home screen.
2. Highlight **Connect-to-PC** on the Tools menu.
3. Select **Connect-to-PC**.

The solid arrows (◀, ▶, ▼, ▲) are navigational instructions for the four directions of the directional buttons.

Example: Press the down ▼ arrow.

Bold Text

Bold emphasis is used in procedures to highlight selectable items such as control buttons, icons and menu options.

Example: Press the **OK** button

Notes and Important Messages

The following messages are used.

Notes

A NOTE provides helpful information such as additional explanations, tips, and comments.

Example:



NOTE:

For additional information refer to...

Important

IMPORTANT indicates a situation which, if not avoided, may result in damage to the test equipment or vehicle.

Example:

IMPORTANT:

Do not disconnect the data cable while the diagnostic tool is communicating with the ECM.

IMPORTANT:

Read all applicable [Safety Information](#) before using this diagnostic tool!

Procedures

An arrow icon in the left-margin area indicates a procedure.

Example:



To change screen views:

1. Select the **Graph** icon.
The dropdown menu displays.
2. Select an option from the menu.
The screen layout changes to the format selected.

The MODIS™ Edge is a multi-function tool that combines a diagnostic scan Tool with a two-channel lab scope, graphing multimeter, and the exclusive Snap-on® Guided Component Tests database into a single hand-held unit.



This chapter introduces the basic features of the diagnostic tool, including the control buttons, data ports, battery pack, and power sources. Technical Specifications are provided at the end of this chapter.

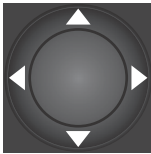


1.1 Control Buttons

There are four “push type” control buttons and one “thumb pad rocker type” multi-directional button located on the right side of the diagnostic tool. All other diagnostic tool operations are controlled through the touch screen.



Figure 1-1 Front view

Item	Button	Description	
1		N/X or Cancel - Push type button	<ul style="list-style-type: none"> To exit a menu or program. To close an open list and return to the previous menu or screen. To answer “No” when a yes/no choice is given.
2		Y/✓ or Accept - Push type button	<ul style="list-style-type: none"> To confirm a selection from a menu or program. To select an item that was highlighted using the direction arrows. To advance to the next screen in a series. To answer “Yes” when a yes or no choice is given.

Item	Button	Description	
3		Directional - Thumb pad rocker type buttons	Buttons move the cursor or highlight in their respective direction: <ul style="list-style-type: none"> • Up (▲) • Down (▼) • Left (◀) • Right (▶)
4		S (Shortcut) - Push type button	Programmable function button that can provide a shortcut for performing a variety of routine tasks. Refer to Configure Shortcut Button , on page 117 for additional information.
5		Power (On/Off) - Push type button	Turns the diagnostic tool on and off. Also, press and hold for 5 seconds for emergency shutdown.

1.2 Data and Power Connections

Connectors and jacks for the scope multimeter, data communication cables and the AC/DC power supply are located on the top of the diagnostic tool.

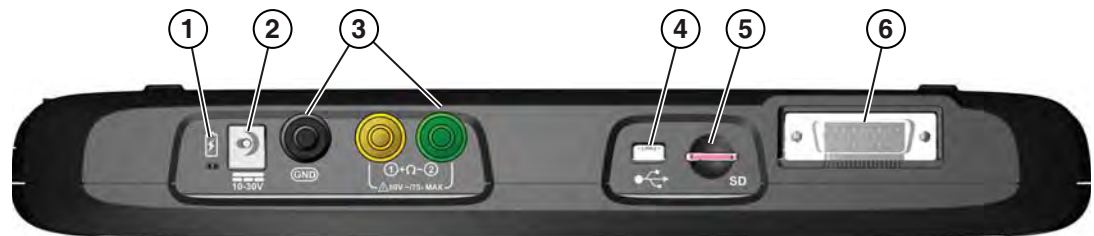


Figure 1-2 Top view

Item	Description
1	Battery Status Indicator LED <ul style="list-style-type: none"> • Green - battery is fully charged • Red - battery is charging • Amber - indicates there is a battery issue (correct before operating)
2	DC Power Supply Jack - AC/DC power supply connection
3	Scope/Multimeter Jacks - Scope and multimeter lead connections
4	Mini USB Jack - USB cable connection used to connect the diagnostic tool to a personal computer
5	Micro secure digital (uSD) Card - contains operating system programming. IMPORTANT The uSD card must be installed for the diagnostic tool to operate. Do not remove the uSD card while the diagnostic tool is powered on.
6	Data Cable Connector - Data cable connection used to connect the diagnostic tool to a vehicle data link connector

1.3 Battery Pack and Stand



Figure 1-3 Rear view

Item	Description
1	Built in-Stand (shown closed) - The built-in stand extends from the back of the diagnostic tool and clips into the diagnostic tool for storage.
2	Battery Cover

1.4 Power Sources

Your diagnostic tool can receive power from any of the following sources:

- [Internal Battery Pack](#)
- [AC/DC Power Supply](#)
- [Vehicle Power](#)

1.4.1 Internal Battery Pack

The diagnostic tool can be powered from the internal rechargeable battery pack. A fully charged battery provides sufficient power for about 3 hours of continuous operation.

Battery charging occurs when the diagnostic tool is connected to the AC/DC Power Supply and to a live AC power source.

The Battery Status Indicator LED (located next to the DC power supply jack) indicates battery status ([Figure 1-3](#)).

- **Green** - indicates battery is fully charged
- **Red** - indicates battery is charging
- **Amber** - indicates a battery issue. This is usually caused by excessive battery temperature (above 104°F/40°C), which disables charging. Allow the diagnostic tool to cool down before continuing operation.

1.4.2 AC/DC Power Supply

The diagnostic tool can be powered from a standard AC outlet using the AC/DC power supply. The connector on the end of the output cable of the AC/DC power supply attaches to the DC power supply input jack on top of the diagnostic tool. Use only the AC/DC power supply provided.

IMPORTANT:

Never connect the AC/DC power supply to the DC power supply input on the diagnostic tool when the diagnostic tool is communicating with a vehicle.

1.4.3 Vehicle Power

All OBD-II/EOBD vehicles have vehicle battery power (B+) available on the DLC. The diagnostic tool is powered through the Data Cable when connected to the vehicle DLC. A green LED indicator on the DLC end of the data cable, illuminates when power is being supplied to the cable. If the LED fails to illuminate, check that the data cable is properly connected and then check the DLC power circuit. See [Data Cable Connection](#), on page 17 for additional data cable information.

An optional power cable is required when testing non-OBD-II/EOBD models that do not have vehicle battery power (B+) available on the DLC. Contact your sales representative for availability.

IMPORTANT:

Never connect the optional power cable to the DC power supply input on the diagnostic tool when the diagnostic tool is communicating with a vehicle.

1.5 Technical Specifications

Item	Description / Specification
Touch Screen	Resistive Touch Panel
Display	8.0 inch diagonal, Colour LCD
	800 x 480 resolution SWVGA
Meter	Category 1
Battery	Rechargeable lithium-ion battery pack
	Approximately 3 hour run time
	Approximately 5 hour charge time
Power Supply	Supply Rating; 15VDC, 2A
DC Operating Voltage	10 to 30VDC
Width	11.06 in. (281.0 mm)
Height	6.29 in. (160 mm)
Depth	1.58 in. (40.3 mm)
Weight (including battery):	2.65 lb (1.20 kg)
Operating Temperature Range (ambient)	At 0 to 90% relative humidity (non-condensing) 32 to 113°F (0 to 45°C)
Storage Temperature (ambient)	At 0 to 70% relative humidity (non-condensing) -4 to 140°F (-20 to 60°C)
Operating Altitude	Maximum 2000 m
Environmental Conditions	This product is intended for indoor use only
	This product is rated for Pollution Degree 2 (normal conditions)

Basic Operation and Navigation

This chapter describes basic diagnostic tool operation, navigation, screen layout, icon functions, and screen messages. Before you operate the diagnostic tool, make sure the battery pack is fully charged or the diagnostic tool is powered by the AC power supply.

2.1 Turning On/Off and Emergency Shutdown

The following sections describe how to turn the diagnostic tool on and off and how to perform an emergency shutdown.

2.1.1 Turning On

The diagnostic tool will automatically turn on and open the Home screen ([Figure 2-1](#)) when power is supplied through the Data Cable or by the AC/DC Power Supply. If the diagnostic tool does not automatically turn on, press and release the Power button on the front of the diagnostic tool to turn the diagnostic tool on.

2.1.2 Turning Off

IMPORTANT:

All vehicle communication must be terminated **BEFORE** turning off the diagnostic tool. A warning message displays if you attempt to turn the diagnostic tool off while communicating with the vehicle. Forcing a shut down while communicating may lead to ECM problems on some vehicles. Never disconnect the Data Cable when the diagnostic tool is communicating with the vehicle ECM.

**To turn off the diagnostic tool:**

1. Press the **N/X** button or select the **Back** or **Home** icon to navigate to the Home screen.
The “stopping communication” message appears briefly before the Home screen displays.
2. Disconnect the diagnostic tool Data Cable from the vehicle.
3. Press and release the **Power** button.
A confirmation screen displays.
4. Press the **Y/✓** button or select **OK** from the menu to turn the diagnostic tool off. To continue operating, press the **N/X** button or select **Cancel** from the menu.

2.1.3 Emergency Shutdown

IMPORTANT:

Using the emergency shutdown procedure while communicating with the vehicle ECM may lead to ECM problems on some vehicles.

During normal operation turn the diagnostic tool off using the *Turning Off* procedure above. The emergency shutdown procedure should only be used If the diagnostic tool does not respond to navigation or the control buttons, or exhibits erratic or abnormal operation. To force an emergency shutdown, press and hold the **Power** button for five seconds until the diagnostic tool turns off.

2.2 Basic Navigation

2.2.1 Home Screen Layout

The Home screen includes a title bar and main body. The Home screen contains icons, one for each of the primary diagnostic tool functions.



Figure 2-1 Home screen

2.2.2 Title Bar

The title bar at the top of the screen provides basic information about current diagnostic tool operating conditions. Title bar options vary depending upon vehicle make and model, what function is active, what test is being performed, or what menu is selected. The title bar contains information only, there are no selectable items.

Elements of the title bar let you know at a glance:

- What diagnostic tool function is currently active.
- The current time.
- The source and status of the power being supplied to the diagnostic tool.





An active function icon is always displayed along the left-hand edge of the title bar. These icons resemble their Home screen icon counterparts in appearance and colour. The name of the function displays to the right of the icon on some screens.

A real time clock displays to the left of the power supply icon. The clock is powered by a dedicated internal battery, so the correct time is maintained even when the main battery pack is discharged. Use the Tools function to set the clock and format how time is displayed. See [Clock Settings](#), on page 123 for additional information.

The title bar displays other information that varies depending upon what functions are being performed. Other information may include:

- The identification (ID) of the test vehicle
- The name of the active menu or function
- The name of the test being performed

Table 2-1 Title Bar Icons







Icon	Function	Icon	Function
	Full Battery Charge Level - Indicates power is being supplied by the internal battery pack. Horizontal bars diminish as the battery discharges.		External Power Connected - Indicates power is being supplied through the data cable connection to a vehicle or by the AC/DC Power Supply.
	Low Battery Charge Level - Indicates the internal battery pack is low and needs to be recharged immediately. A warning message will also display on the screen when the battery gets low.		Active Vehicle Communication - Indicates the diagnostic tool is actively communicating with a vehicle.

2.2.3 Home Screen Icons

Each available diagnostic tool function is represented by an icon on the home screen. The table below provides descriptions of the icon functions.






Select an icon from the Home screen to start a function. You can also use the control buttons to activate a function, a yellow border around the icon indicates it is highlighted, or in focus. Use the Directional buttons (◀, ▶, ▲, ▼) to highlight the desired function and then press the **Y/✓** button to select it. A “please wait” message may display briefly, then automatically clear once the function is loaded and ready for use.

Table 2-2 Home screen icons





Function Name	Function Icon	Description
Scanner		Used to communicate with the electronic control systems of a vehicle. This function allows you to retrieve diagnostic trouble codes (DTCs), view PID data and perform diagnostic tests. See Scanner , on page 18 for details.
OBD-II/EOBD		Allows you to access generic OBD-II/EOBD data and tests without identifying the vehicle being tested. See OBD-II/EOBD , on page 42 for details.
Guided Component Tests		Allows you to perform diagnostic tests for the identified vehicle. See Guided Component Tests , on page 101.
Scope Multimeter		Allows you to perform lab scope, graphing multimeter and digital multimeter tests and measurements. See Scope Multimeter , on page 52.
Previous Vehicles & Data		Allows you to quickly reconfigure the diagnostic tool to a recently tested vehicle and to access saved data files. See Previous Vehicles and Data , on page 113 for details.
Tools		Allows you to adjust diagnostic tool settings to your personal preferences and perform other special functions. See Tools , on page 116 for details.

2.2.4 Common Toolbar Control Icons

Common control icon functions are described in the following table. Specific function control icons are described in their applicable chapters. Displayed control icons vary depending on the active function or test. Select a control icon on a screen to activate a control function. You can also use the control buttons to activate a function, a yellow border around the icon indicates it is highlighted, or in focus. Use the Directional buttons (◀, ▶, ▲, ▼) to highlight the desired function and then press the Y/✓ button to select it.

Icon	Function	Icon	Function
	Back - Returns to the previously viewed screen. Icon is located on the left-hand edge of the toolbar.		Record - Indicates the data being displayed is paused and not being updated. Selecting resumes data collection.
	Home - Returns to the Home screen. Icon is located next to the Back icon on the left side of the toolbar.		Tools - Opens the tools menu.
	Save - Writes data from buffer memory to a file. The saved "movie" file can be accessed for future reference by selecting Previous Vehicles and Data > View Saved Data .		

The icons below are used to navigate through paused or saved data ("movie") files during playback.

Icon	Function	Icon	Function
	Step Forward - allows forward movement in singular steps. To quickly step forward, select this icon (yellow frame appears) then press and hold the Y/✓ button. (Note: To quickly step forward during Scanner data playback, press and hold the icon down until a red frame appears around the icon.)		Step Back - allows backward movement in singular steps. To quickly step backward, select this icon (yellow frame appears) then press and hold the Y/✓ button. (Note: To quickly step backward during Scanner data playback, press and hold the icon down until a red frame appears around the icon.)
	Skip Forward - allows forward movement in multiple steps. To quickly skip forward, select this icon (yellow frame appears around icon) then press and hold the Y/✓ button		Skip Back - allows backward movement in multiple steps. To quickly skip backward, select this icon (yellow frame appears around icon) then press and hold the Y/✓ button.

2.2.5 Scroll Bar

A vertical scroll bar appears along the right-hand edge of the screen when additional data expands above or below what is currently on the screen (Figure 2-2).

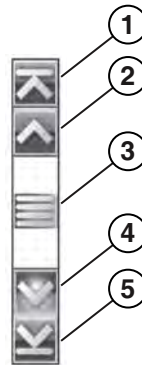


Figure 2-2 Scroll bar

- 1— **Beginning** - Moves to beginning of data displayed.
- 2— **Step up** - Moves up one increment of the data displayed.
- 3— **Slider (position indicator)** - Select and drag the **Slider** to scroll through data. The slider indicates the relative position of the current screen to the total available data.
- 4— **Step down** - Moves down one increment of the data displayed.
- 5— **End** - Moves to end of data displayed.

The Up (▲) and Down (▼) directional buttons can also be used to move through the data one line at a time. Press and hold a directional button to rapidly scroll through data.

2.3 Screen Messages

2.3.1 System Messages

There are four types of system messages that may be displayed:

Message Type	Description
Loading and Connecting	Loading and connecting messages display when the diagnostic tool is performing an internal operation, such as loading a database, establishing communications with the vehicle, or initiating a test. The message automatically clears once the internal operation is complete.
Confirmation	Confirmation messages inform you when you are about to perform an action that cannot be reversed or when an action has been initiated that requires a confirmation to continue. When a response is not required, the message displays briefly, then disappears.
Warning	Warning messages inform you when completing the selected action may result in an irreversible change or in the loss of data. A confirmation is required to continue.
Error	Error messages inform you when a system or procedural error has occurred, for example if the data cable becomes disconnected during operation.

2.3.2 Communication Messages

When “no communication” messages are displayed, it indicates the diagnostic tool and the vehicle electronic control module are not communicating.

The following conditions cause “no communication” messages to display:

- The diagnostic tool is unable to establish a communication link with the vehicle.
- The vehicle is not equipped with the system that was selected.
- There is a loose connection.
- There is a blown vehicle fuse.
- There is a wiring fault on the vehicle.
- There is a circuit fault in the data cable or adaptor.
- Incorrect vehicle identification was entered.

Refer to the Vehicle Communication Software manuals for manufacturer-specific problems.

2.4 Data Cable Connection

Connection of the data cable to the diagnostic tool and vehicle DLC is required for Scanner and OBD-II/EOBD testing.

Depending on the vehicle, the supplied DA-4 data cable may be used alone or may require optional adaptors.

- **All OBD-II/EOBD compliant vehicles** - Use the supplied DA-4 data cable. The 26-pin end of the cable attaches to the data cable connector on the top of the diagnostic tool. The 16-pin end connects to the vehicle DLC. The cable connectors are secured with captive screws.
- **All non-OBD-II/EOBD (OBD-I) compliant vehicles** - Use the supplied DA-4 data cable with the optional DA-5 adaptor and a manufacturer specific adaptor. The 26-pin end of the cable attaches to the data cable connector on the top of the diagnostic tool. The 16-pin end connects to the DA-5 adaptor, the DA-5 adaptor connects to the manufacturer specific adaptor and then connects to the vehicle DLC. The cable connectors are secured with captive screws.

On-screen cable and adaptor connection instructions are provided while using the Scanner and OBD-II/EOBD functions. The instructions may also include the location of the vehicle DLC ([Figure 2-3](#)). If required, additional connection information can be found in the appropriate vehicle communication software manual for the vehicle. Vehicle communication software manuals are available online, see the website information at the front of this manual



Figure 2-3 Vehicle connection data cable message

For data cable vehicle power connection information, see [Vehicle Power](#), on page 8.



To connect the data cable to the vehicle:

1. Follow the on-screen instructions for connecting to the vehicle ([Figure 2-3](#)).
2. Select **Continue** once the data cable is connected.
The diagnostic tool establishes communication then displays a list of available tests. If the diagnostic tool is unable to establish a communications link, a "no communications" message displays.
3. Select from the available tests to open a submenu of test options.

This chapter describes the basic operation of the Scanner function.

The **Scanner** icon is located on the Home screen.

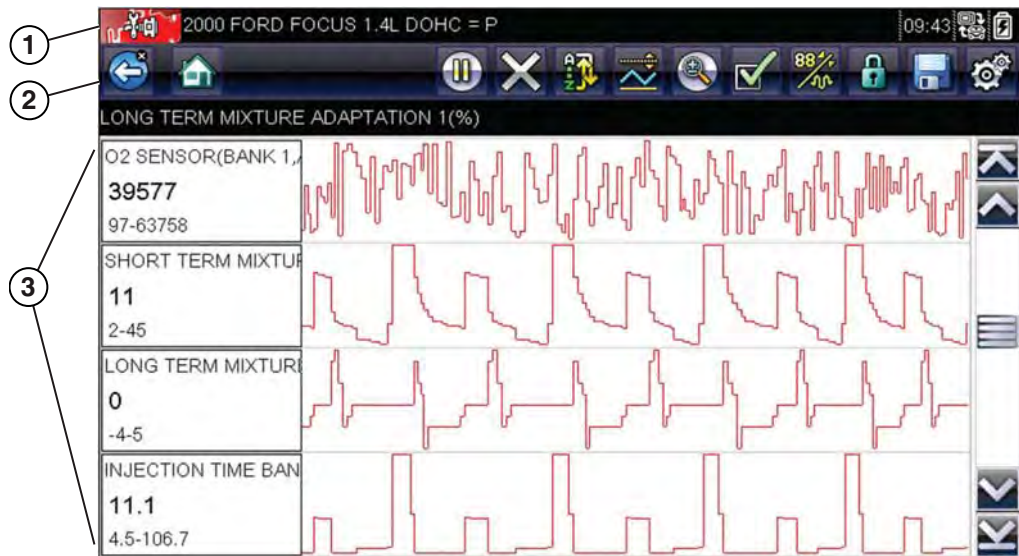


The Scanner function allows your diagnostic tool to communicate with the electronic control systems of a vehicle. This allows you to retrieve diagnostic trouble codes (DTCs), view PID data and perform diagnostic tests.

3.1 Screen Layout and Toolbar Icons

The following screen layout and toolbar controls apply to both the Scanner and the OBD-II/EOBD functions.

3.1.1 Screen Layout











- 1— **Title bar**—shows active test, vehicle and diagnostic tool status
- 2— **Toolbar**—contains control icons
- 3— **Main Body**—displays menus, PID and test data

Figure 3-1 Screen layout

The Title bar appears for all functions and displays information only, there are no selectable items. Refer to [Title Bar](#), on page 12 for details.

3.1.2 Scanner Control Icons

The scanner toolbar contains control icons. Control icons may vary depending on the active function or test. A yellow frame surrounding an icon (highlighted), indicates it is selected. Other control icons (not shown) are described in [Common Toolbar Control Icons](#), on page 14.

Icon	Function	Icon	Function
	Pause - Indicates PID data from the vehicle is being displayed. Selecting pauses data collection.		Custom Data List - Opens a menu for selecting which PIDs display in the list.
	Clear - Erases all the PID data in the buffer and begins a new recording. Selecting opens a confirmation message.		Change View - Changes display options between PID list or graph displays.
	Trigger - Opens a menu that allows you to set, arm, and clear threshold values that automatically trigger PID data to be saved from buffer memory to a file.		Lock/Unlock - Locks or unlocks the highlighted parameter. Locked PIDs move to the top of the list and do not scroll as you move through the data.
	Zoom - Incrementally increases and decreases the scale of the data being displayed.		Sort - Determines the order in which PIDs are listed on the screen.

3.2 Scanner Demonstration Program

The Scanner demonstration program contains actual ECM PID data that allows you to navigate and become familiar with the many capabilities of the Scanner function without actually connecting to a vehicle. The following sections in this chapter provide detailed information on navigating through the Scanner function and various menus. As you navigate through the Demonstration program, refer to the applicable section for additional information.



To start the demonstration program:

1. From the Home screen, select the **Scanner** icon.
The manufacturer menu displays.
2. Select the **Demonstration** icon.

IMPORTANT:

Do not connect a vehicle to the diagnostic tool while using the Demonstration program.

3. Follow the on-screen instructions and make the selection as needed until the confirmation screen displays.
4. Select **OK** on the confirmation screen to load the demonstration database.
A message displays "Demo mode: Do not connect to vehicle."
5. Select **Continue**.
A systems menu, which shows all of the systems available for testing, displays.
6. Select a system from the menu, then select submenus as applicable to display the desired demonstration information.

3.3 Scanner Operation

Launching Scanner opens a menu list of vehicle manufacturers and begins the process by identifying the vehicle being tested. After the vehicle is identified, a vehicle system is selected and then a specific test or function is selected to allow you to retrieve diagnostic trouble codes (DTCs), view and save PID data, or perform diagnostic tests.



Scanner Operation (Quick Reference)

1. Connect the data cable to the vehicle, and diagnostic tool.
Note: If the diagnostic tool is turned off, when the OBD-II data cable is connected to the vehicle DLC, the diagnostic tool will automatically turn on.
2. Turn the diagnostic tool on (if required).
3. Turn the vehicle ignition switch on.
4. Select **Scanner** from the Home screen.
5. Select the vehicle year and make
6. Select **Auto** or **Manual ID** and enter the vehicle information at the screen prompts to continue.
7. Select a **System** to test.
8. Select a **Test** to be performed.



NOTE:

The above information applies to most OBD-II vehicles.

3.3.1 Vehicle Identification

The vehicle must be correctly identified for the diagnostic tool to communicate and display data correctly. Menus and navigation will vary by vehicle.



Identifying a vehicle:

**NOTE:**

Menus and navigation will vary by vehicle.

1. Select **Scanner** from the Home screen.
A list of vehicle manufacturers (make) displays ([Figure 3-2](#)).
The list includes Demonstration, which opens the Demonstration program (see [Scanner Demonstration Program](#), on page 19).
2. Select a **vehicle manufacturer** ([Figure 3-2](#)).

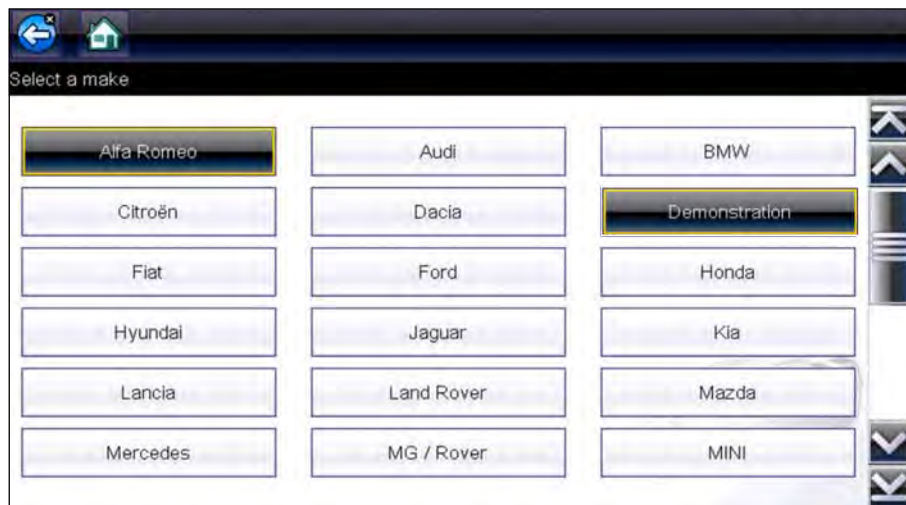


Figure 3-2 Manufacturer list

A model year menu displays.

3. Select the **vehicle year**.
4. If the vehicle supports automatic identification, a menu choice will display providing the option to either “Auto ID the vehicle” or “Manual ID the vehicle”.
 - Selecting Auto ID will automatically enter the vehicle’s information, and then display the vehicle confirmation screen, see step 7.
 - Selecting Manual ID will display a list of vehicle models, see step 5.
5. Select the **vehicle model**.
6. Several selections may be required to get to the vehicle confirmation screen. If applicable, make any other additional menu sections that may be required to select the vehicle.
7. The vehicle confirmation screen displays (Figure 3-3).
8. Select **OK** to confirm the vehicle (Figure 3-3).

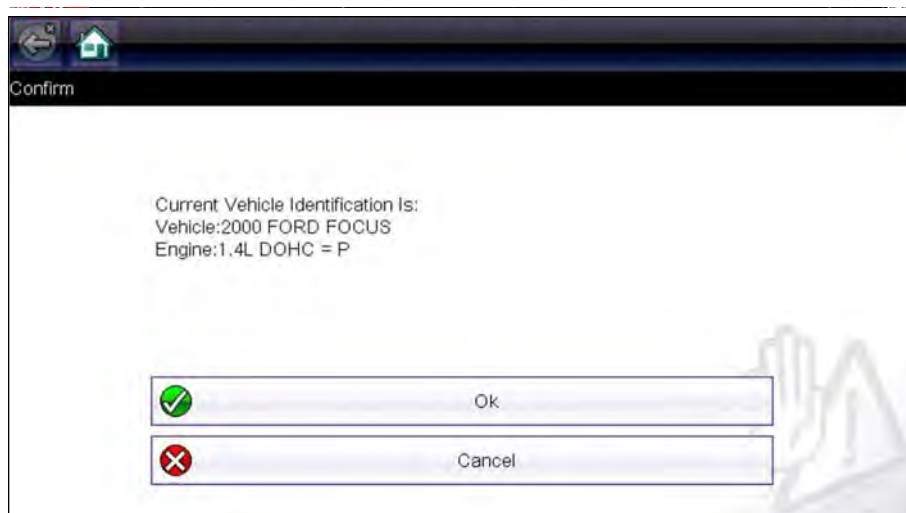


Figure 3-3 Vehicle confirmation screen

3.3.2 Connecting the Data Cable

Connection of the data cable to the diagnostic tool and vehicle DLC is required for Scanner testing, see [Data Cable Connection](#), on page 17.

3.3.3 System Selection

After a vehicle is identified, a menu of available systems, and options are displayed ([Figure 3-4](#)).

**NOTE:**

Only the systems and options available for the vehicle are included in the menu list.

Select a system or option ([Figure 3-4](#)).

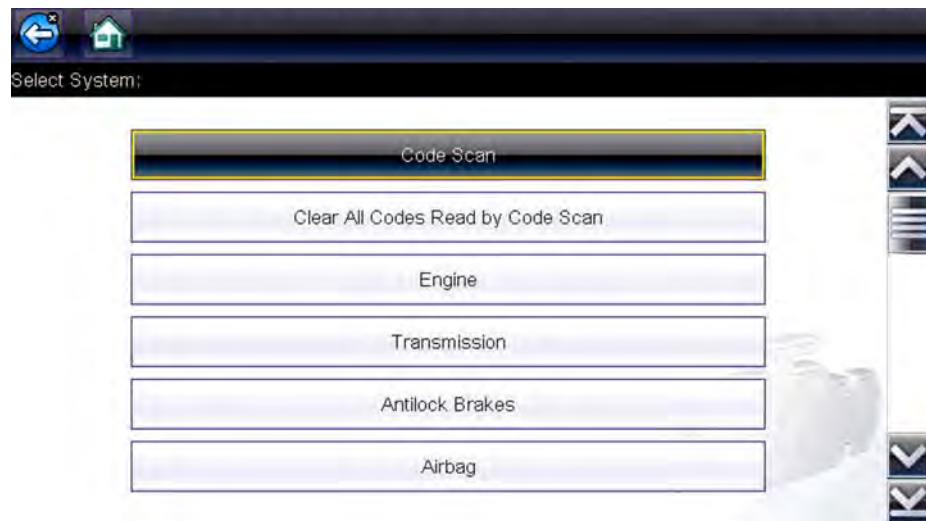


Figure 3-4 Typical systems menu

If a system (e.g. Engine, Transmission, Antilock Brakes, etc) is selected, the diagnostic tool may establish communication with the vehicle, then display the system main menu (available tests) ([Figure 3-5](#)). For sub-menu option information, see [System Main Menu Options](#), on page 26.





Figure 3-5 System main menu

Code Scan

Depending on the vehicle, the Code Scan option (if supported) may be available from the menu. Selecting **Code Scan** starts an active scan of vehicle control modules, and opens the Code Scan results screen (Figure 3-6). A green progress bar is shown at the top indicating the active scanning progress. Once completed, the results are displayed by system category.

The following Code Scan related control icons are used:

Icon	Function
	Refresh - Refreshes the code scan data (restarts the code scan)
	System - Opens the main menu of the system selected

The following results are displayed progressively as the modules are scanned:

- **The total number of systems (modules) detected** (Figure 3-6).

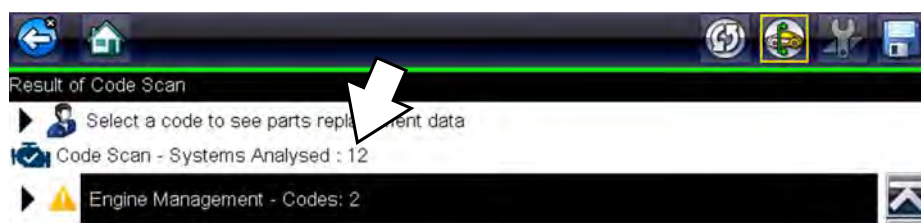


Figure 3-6 Code Scan systems analyzed result total

Quick reference indicators are used to show system code status (Figure 3-6):

- **Green icon “✓” mark** - No Codes
- **Yellow Triangle icon “!” mark** - Codes are present

- **A list of all the systems analyzed with DTCs totals.** A categorized system list with DTC totals is displayed in the order they are scanned. To view the main menu for a system in the list, select the system, then select the **System** icon (Figure 3-7).

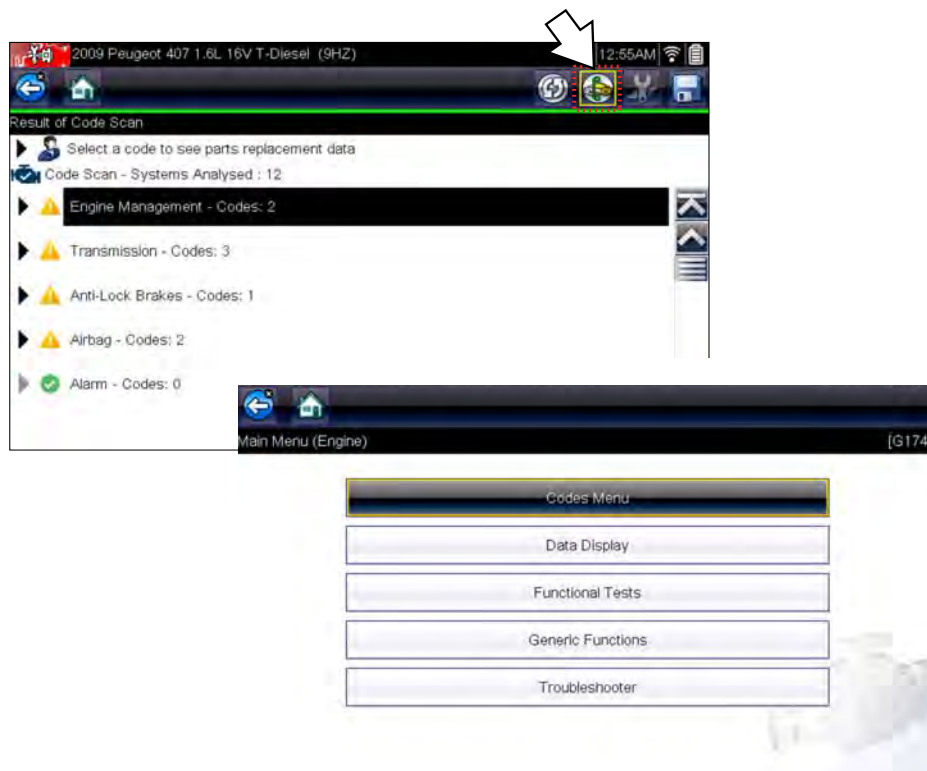


Figure 3-7 System icon (opens Main Menu)

Select the **expand/collapse** icon (Figure 3-8) on the left side of a system category title to expand or collapse a systems' DTC list.

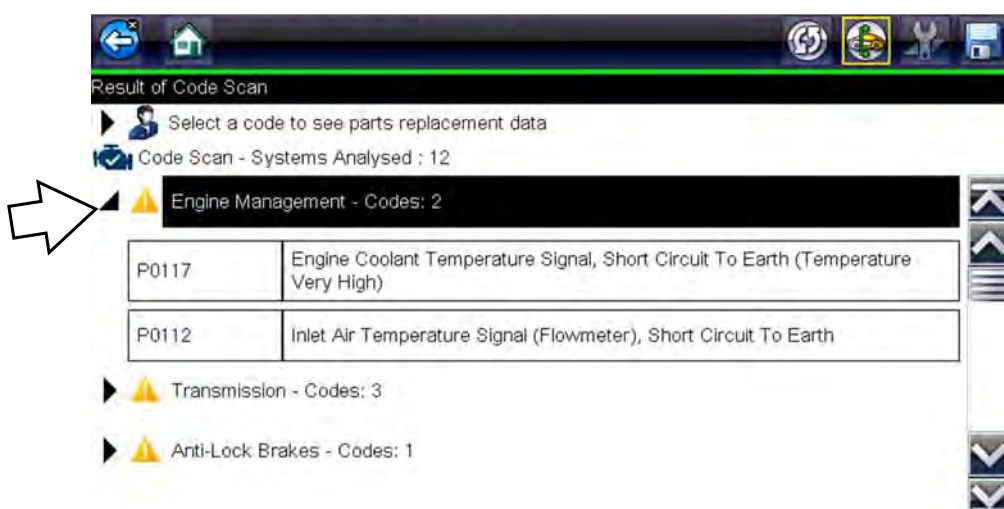


Figure 3-8 Expand/Collapse Icon (expanded result)

- **Global OBDII DTCs.** Towards the end of the Code Scan list Global OBDII DTCs are displayed.

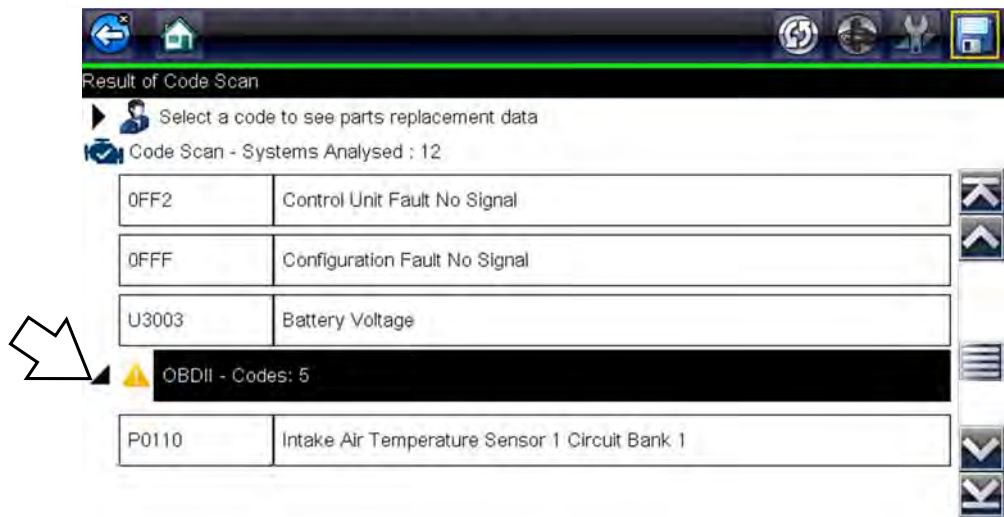


Figure 3-9

NOTE: Some vehicles may not display global OBD-II information in the Code Scan list. A message will be displayed to inform you the OBD-II - codes and monitors for this vehicle may be accessed using the global OBD-II function. See [OBD-II/EOBD](#), on page 42.

- **Readiness Monitor Test Status.** At the end of the Code Scan list, readiness monitor test results are displayed as “Tests Complete” or “Not Complete”.

Quick reference indicators are used to show monitor status.

- **Green icon “✓” mark** - Monitor test is complete
- **Grey icon “—” mark** - Monitor test is not complete

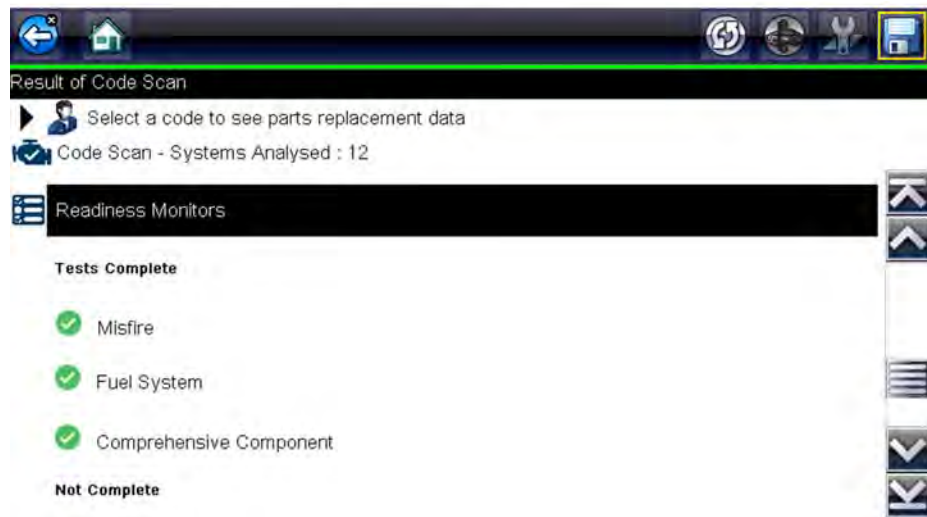


Figure 3-10

NOTE: Monitors that are not supported by the vehicle are not displayed in Code Scan.

Saving Code Scan Data

Selecting the **Save** icon from the Code Scan toolbar saves the Code Scan results as an (.XML) file. The (.XML) file can be reviewed, by selecting **Previous Vehicles and Data > View Saved Data** and then selecting the (.XML) file from your saved file list. When opened, the (.XML) file displays basic vehicle information, a list of DTCs with a brief description, global OBD codes, and readiness monitor status. The (.XML) file can also be transferred to a personal computer (PC) using ShopStream Connect. For additional information, on using ShopStream Connect to view (.XML) files, see [Saving and Reviewing Codes](#), on page 28.

Clear All Codes Read by Code Scan

Selecting **Clear All Codes Read by Code Scan** erases all DTCs from all vehicle system modules that were read by Code Scan.

**NOTE:**

The **Clear All Codes Read by Code Scan** function may not clear OBD-II generic codes on some vehicles.

3.3.4 System Main Menu Options

Once a System is selected (e.g. Engine, Transmission, Antilock Brakes, etc) is selected, the diagnostic tool may establish communication with the vehicle, then display the System Main Menu (available tests).

**NOTE:**

Menus and navigation will vary by vehicle.

The System Main Menu may include:

- **Codes Menu**—displays diagnostic trouble code (DTC) records from the vehicle electronic control module. Selecting may open a submenu of viewing options.
- **Clear Codes**—erases DTC records and other data from the ECM. This selection is found on a Codes submenu for some models.
- **Data Display**— displays PID data from the vehicle electronic control module. Selecting may open a submenu of viewing options.
- **Functional Tests**—provides specific subsystem tests. The tests vary depending on the manufacturer and model.
- **Actuator Tests**—similar to functional tests, checks the operation of certain actuators, such as solenoid valves and relays.
- **Memory Resets**—allows you to reprogram adaptive values for certain components after making repairs. Selecting opens a submenu. These options are found on the Functional Tests Menu for some models.
- **System Tests**—provides specific subsystem testing. Performing these tests is similar to functional tests.
- **Generic Functions**—lets you access certain available Generic OBD II functions from a proprietary menu (1996 and newer vehicles only).
- **Troubleshooter**—provides step-by-step procedures, integrating PIDs and retrieving trouble codes when appropriate, for specific symptoms of the identified vehicle.

The following sections, describe some of the System Main Menu items listed above.

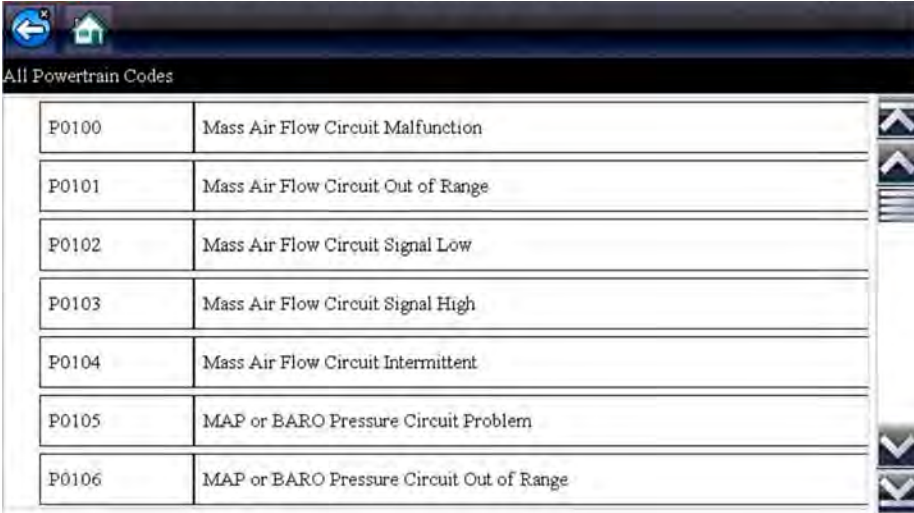
Codes Menu

This selection may appear as Codes, Codes Menu, Codes Only, Codes (No Data), Service Codes or something similar on the menu. Selecting opens a list of viewing options that includes:

- [Display Codes](#)
- [Clear Codes](#), on page 30
- [Freeze Frame/Failure Records](#), on page 30
- [DTC Status](#), on page 30

Display Codes

This function opens either a list of diagnostic trouble codes (DTCs) stored in the selected vehicle electronic control module (ECM), or a submenu of DTC viewing options. The code list includes the DTC and a brief description ([Figure 3-11](#)).



All Powertrain Codes	
P0100	Mass Air Flow Circuit Malfunction
P0101	Mass Air Flow Circuit Out of Range
P0102	Mass Air Flow Circuit Signal Low
P0103	Mass Air Flow Circuit Signal High
P0104	Mass Air Flow Circuit Intermittent
P0105	MAP or BARO Pressure Circuit Problem
P0106	MAP or BARO Pressure Circuit Out of Range

Figure 3-11 DTC results

Submenu options may include:

- **Trouble Code Information**—opens a list of codes in ECM memory
- **History Codes**—opens a list of codes whose symptoms are not currently present. History codes indicate an intermittently occurring problem.
- **Failed This Ignition**—opens a list of codes that set during the current ignition cycle.
- **MIL SVS or Message Requested**—displays ECM requests to turn on the malfunction indicator lamp (MIL) or service vehicle soon (SVS) lamp, or display a driver information alert.
- **Last Test Failed**—displays a complete list of failed tests.
- **Test Failed Since Code Cleared**—displays a list of tests that failed since the last time codes were cleared from ECM memory.

Saving and Reviewing Codes

Selecting the **Save icon** saves the displayed DTC results list as an (.XML) file.

The (.XML) file can be reviewed, by selecting **Previous Vehicles and Data > View Saved Data** and then selecting the (.XML) file from your saved file list (Figure 3-12). When opened, the (.XML) file displays basic vehicle information and a list of DTCs with a brief description of each.



Figure 3-12 Typical - DTC (.XML) files in the **View Saved Data** list

Viewing Saved DTC Files in ShopStream Connect (Vehicle System Report)

Saved DTC (.XML) files can also be transferred to a personal computer (PC) using ShopStream Connect (Figure 3-13). Once the diagnostic tool is connected to the PC, (.XML) files can be printed, transferred, and copied.

ShopStream Connect is a companion program that is available online, at no charge. See the ShopStream Connect website information at the front of this manual to visit the website and download the application.

(.XML) files transferred with ShopStream Connect are text files containing vehicle information, and the DTC list. The files can be viewed and printed from ShopStream Connect (Figure 3-13).

Vehicle System Report

VEHICLE INFORMATION

MAKE	Peugeot
YEAR	2009
MODEL	407
ENGINE	1.6L 16V T-Diesel (94Z)
SYSTEM	Engine Management

CODE SCAN RESULTS

Systems Analyzed: 12

- ▲ Engine Management - Codes: 2
- ▲ Transmission - Codes: 3
- ▲ Anti-Lock Brakes - Codes: 1
- ▲ Airbag - Codes: 2
- Alarm - Codes: 0
- ▲ Battery Charge Status Unit (If Fitted) - Codes: 3
- ▲ Climate Control - Codes: 3
- ▲ Electric Steering - Codes: 3
- ▲ Tire Pressure Monitoring - Codes: 2
- ▲ Xenon/ Directional Lights Left - Codes: 3
- ▲ Xenon/ Directional Lights Right - Codes: 3
- ▲ OBDII - Codes: 5

Engine Management

P0117	Engine Coolant Temperature Signal, Short Circuit To Earth (Temperature Very High)
P0112	Inlet Air Temperature Signal (Flowmeter), Short Circuit To Earth

Transmission

0FF2	Control Unit Fault No Signal
0FF6	Configuration Fault No Signal
U3003	Battery Voltage

Figure 3-13 Typical - Vehicle System Report (viewed in ShopStream Connect)

Clear Codes

The diagnostic tool clears codes from the vehicle electronic control module memory on most vehicles. If this function is not available on the test vehicle, Clear Codes does not appear as a menu option.

**NOTE:**

Clear Codes is also available from OBD-II Health Check (see [OBD Health Check](#), on page 43).

**To clear codes:**

1. Select **Clear Codes** from the Codes Menu.
A confirmation message displays.
2. Make sure any conditions shown on the confirmation message are met, then select **Yes**.
A “codes cleared” message displays once the operation is complete.
3. Select **Continue** to return to the Codes Menu.

IMPORTANT:

Clearing codes erases all temporary ECM information, including Freeze Frame/Failure Records. Make sure no vital diagnostic information will be lost before clearing codes.

Freeze Frame/Failure Records

This selection displays the DTC that was set, along with corresponding data, when the ECM commanded the malfunction indicator lamp (MIL) to turn on.

DTC Status

This selection allows you to view the records of a particular DTC.

**To check DTC status**

1. Select **DTC Status** from the Codes Menu.
The DTC Status entry field displays ([Figure 3-14](#)).
2. Use the touch keypad on the screen to enter the characters of the DTC.
3. Select the **Check Mark** icon on the toolbar once all the code characters are entered.
The DTC status report displays ([Figure 3-14](#)).
4. Select **Back** to return to the DTC status entry screen.
5. Select **Back** again to return to the Codes menu.



Figure 3-14 DTC Status entry field

Data Display

Select **Data** to view PID data from the vehicle ECM. In data display mode the screen has a toolbar and a main body (Figure 3-15).

ENGINE DATA 1 - RPM		245 / 2000
ENGINE SPEED(rpm)	876	↑
CONTINUOUS DTC COUNTER	0	↑
THROTTLE POSITION SENSOR(V)	0.94	↑
TP MODE	C/T	↑
COOLANT TEMPERATURE(°F)	118	↑
BAROMETRIC PRESSURE("Hg)	65.9	↓
INTAKE AIR TEMPERATURE(°F)	108	↓

Figure 3-15 Data display screen

The toolbar control icons are described in [Scanner Control Icons](#), on page 19 and [Common Toolbar Control Icons](#), on page 14.

During data display the main body of the screen is divided into two columns; the left-hand column has a description of the parameter and the right-hand column shows the parameter value or state. Parameters are listed in the order in which they are transmitted by the ECM, so expect variations between years, makes, and models.

Up to three parameters can be locked, or fixed, at the top of the list. Locked parameters do not change as you scroll through the parameter list. The **Lock/Unlock** icon on the toolbar selects which parameters are fixed (see [Locking Parameters](#), on page 33).

Displayed data may also be paused or saved for detailed review and future reference, see [Saving Files](#), on page 36 and [Pausing and Reviewing Data Files](#), on page 37.

Customizing the Data List

The **Custom Data List** icon on the toolbar is used to determine which specific parameters display. Minimizing the number of parameters on the data list allows you to focus on any suspicious or symptom-specific data parameters. You can add or remove most parameters from the list. Certain vital parameters may not be removed. These appear in gray at the top of the list along with a lock icon, and they cannot be selected.



NOTE:

Limiting the number of parameters that display to those that apply to a particular situation results in a faster data refresh rate, and reduces the amount of memory used for saved files.



To create a custom data list:

1. Select the **Custom Data List** icon on the toolbar.

The data selection screen displays and selection icons appear. Check marks to the left of the parameter description indicate which parameters are selected for display. A second smaller check box indicates a parameter that is locked.

The toolbar icons provide options for selecting and deselecting parameters to include or remove from the custom data list:

Icon	Description
	Select/Deselect , use to mark individual parameters to hide or display. Locked parameters cannot be deselected.
	Select All/Deselect All , use to hide or display all of the parameters in the list. Locked parameters cannot be hidden. Items at the top of the list that cannot be highlighted are locked and cannot be turned off.

2. Create a custom data list by selecting (check mark box by parameter name) the parameters to include.
3. Select **Back** to display the updated data list.

Changing Screen Views

Selecting the **View** icon opens a drop-down menu of options:

- PID List
- 1 Graph
- 2 Graph
- 4 Graph

The PID (parameter identification) List view is a 2-column display with the name of the parameters in the left column and their current values in the right column.

The 1, 2, and 4 Graph views divide the screen horizontally to simultaneously display data graphs for the indicated number of parameters (Figure 3-17). Use the scroll bar or the **up** (▲) and **down** (▼) icons to view other parameters in the list.



Figure 3-16 Four graph view



NOTE:

Any previously set conditions, such as held data or locked lines of data, remain in effect when the screen view is changed.

Locking Parameters

Use the **Lock/Unlock** icon to hold selected lines of the data in place and prevent them from scrolling, or to release previously locked lines of data. Up to three lines of data may be held at a time. This feature allows you to position related parameters together, making it easier to monitor their values and spot inconsistencies.

Locked parameters display as the top frames on the main body of the display screen, as well as at their usual position within the data list (Figure 3-17). A lock icon appears to the left of the parameter name to indicate it is locked.



To lock parameters:

1. Highlight the parameter to be locked.
2. Select the **Lock/Unlock** icon on the toolbar to lock it.

A copy of the locked parameter is now shown at the top of the data list, and a lock icon appears alongside the parameter name.

3. Highlight and select additional parameters to lock.

Up to three parameters can be locked at a time. Once locked, a parameter remains locked until it is manually unlocked or communication with the vehicle is stopped.

COOLANT TEMPERATURE(°F)		
🔒	O2 SENSOR(BANK 1,BEFORE CAT)(mV)	1
🔒	O2 SENSOR(BANK 1,AFTER CAT)(mV)	12092
🔒	INJECTION TIME BANK 1(ms)	4.6
	CONTINUOUS DTC COUNTER	0
	THROTTLE POSITION SENSOR(V)	0.94
	TP MODE	C/T
	COOLANT TEMPERATURE(°F)	122

Figure 3-17 Locked parameters



NOTE:

If three parameters are locked, one of them must first be unlocked before another parameter can be locked.



To unlock parameters:

1. Scroll through the data list and highlight the parameter to be unlocked, or released.
2. Select the **Lock/Unlock** icon on the toolbar.

The released parameter and the lock icon disappear from the list at the top of the data list.

3. Repeat Step 1 and Step 2 to release other parameters if needed.

Setting Trigger Levels

The trigger icon allows you to configure the diagnostic tool to automatically save PID data from buffer memory to a file when a parameter value crosses a threshold. When triggering is armed, a "Trigger event" pauses data collection and saves data to a file.

Selecting the **Trigger** icon opens a menu that includes:

- **Set Trigger**—establishes upper and lower signal values to initiate an event capture for the highlighted parameter.
- **Arm Trigger**—activates the diagnostic tool to capture an event when the signal crosses a threshold value.

Trigger lines change colours to indicate the trigger is armed.

- **Clear All Triggers**—deletes all previously set trigger levels.

If triggers are set the menu options are:

- **Clear Trigger**—deletes set trigger levels for the highlighted parameter.
- **Disarm Trigger**—de-activates event capture capability.
- **Clear All Triggers**—deletes all previously set trigger levels.



To set trigger levels:

1. Highlight the parameter to be used for triggering the recording.
2. Select the **Trigger** icon.
3. Select **Set Trigger** from the drop-down menu.

A graph of the highlighted parameter with a trigger toolbar above it fills the main body of the screen (Figure 3-18).

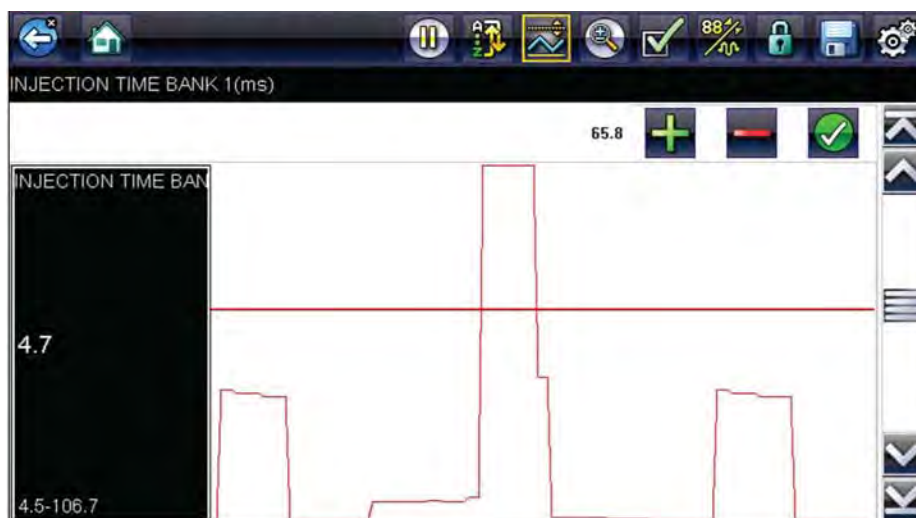


Figure 3-18 Trigger set screen

The trigger level line displays as a solid line running horizontally across the data graph. An upper and lower trigger level must be set, the upper level is set first.

4. Select the plus (+) and minus (–) icons on the toolbar, or use the up ▲ and down ▼ arrow buttons to position the upper trigger level to where you want it on the graph.
5. Select ✓ on the toolbar, or press the **Y/✓** button, to set the upper threshold.
A lower trigger level line now appears at the mid-point of the graph.
6. Select the plus (+) and minus (–) icons on the toolbar, or use the up ▲ and down ▼ arrow buttons to position the lower trigger level line to where you want it on the graph.
7. Select ✓ on the toolbar, or press the **Y/✓** button, to set the lower threshold.

The display returns to the PID data view and the trigger points appear as horizontal lines across the designated parameter graph. Repeat this procedure to establish trigger points for other parameters if desired. Once armed, any data points that register outside of your set conditions pause data collection and save data to a file.

**NOTE:**

Only three parameters can have trigger levels set at one time, but only one of the conditions needs to be satisfied for triggering to occur.

**To arm triggers:**

1. Select the **Trigger** icon on the toolbar.
2. Select **Arm Triggers** from the drop-down menu.

The trigger lines on the data graphs change colour to indicate an armed condition.

Triggers for all of the graphs are armed simultaneously. Once triggering is armed, it remains in that state until you switch it off. If trigger settings are modified or are added for other parameters, they are armed as soon as you exit the setting screen.

Saving and Reviewing Scanner / OBD-II/EOBD Data Files

The following procedures are used when saving and reviewing data files for Scanner and OBD-II/EOBD.

Saving Files

During normal operation, data from the vehicle's ECM is continuously being stored in buffer memory as it is displayed onscreen. Buffer memory is limited to a predetermined "total" size and is displayed on the counter (located below the toolbar on the right side of the screen) ([Figure 3-20](#)).

Selecting **Save** writes the stored buffer memory to a file. Saving data is useful when trying to isolate an intermittent problem or to verify a repair during a road test. The saved file can be played back (similar to a movie clip) by selecting **Previous Vehicles and Data > View Saved Data**. See [View Saved Data](#), on page 114 for additional information.

**NOTE:**

The **Save icon** performs the same function as "Save Movie" function choice for the programmable **Shortcut** button, see [Configure Shortcut Button](#), on page 117 for details.

The saved data file can also be downloaded to a personal computer (PC) using the Mini USB jack. Once connected to the PC, the data files can be printed, transferred, and copied using ShopStream Connect. ShopStream Connect is an application that creates an interface between the diagnostic tool and a PC. The ShopStream Connect application is available free online, see the ShopStream Connect website information at the front of this manual for additional information.

The toolbar control icons are described in [Scanner Control Icons](#), on page 19 and [Common Toolbar Control Icons](#), on page 14.

**To save data:**

- Select **Save**.

A save dialog box displays while data is being saved. The data is saved when the message box disappears.

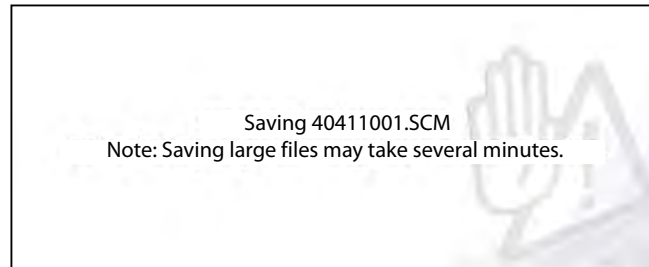


Figure 3-19 Save dialog box

Saving Screens

The **Shortcut** button can be programmed to save a snapshot of a visible screen as a bitmap file, see [Configure Shortcut Button](#), on page 117 for details. The saved file can be viewed by selecting **Previous Vehicles and Data > View Saved Data**, see [View Saved Data](#), on page 114 for additional information.

Pausing and Reviewing Data Files

During normal operation, data from the vehicle's ECM is continuously being stored in buffer memory as it is displayed onscreen. The Pause feature, allows you to temporarily pause data collection to review it in detail.

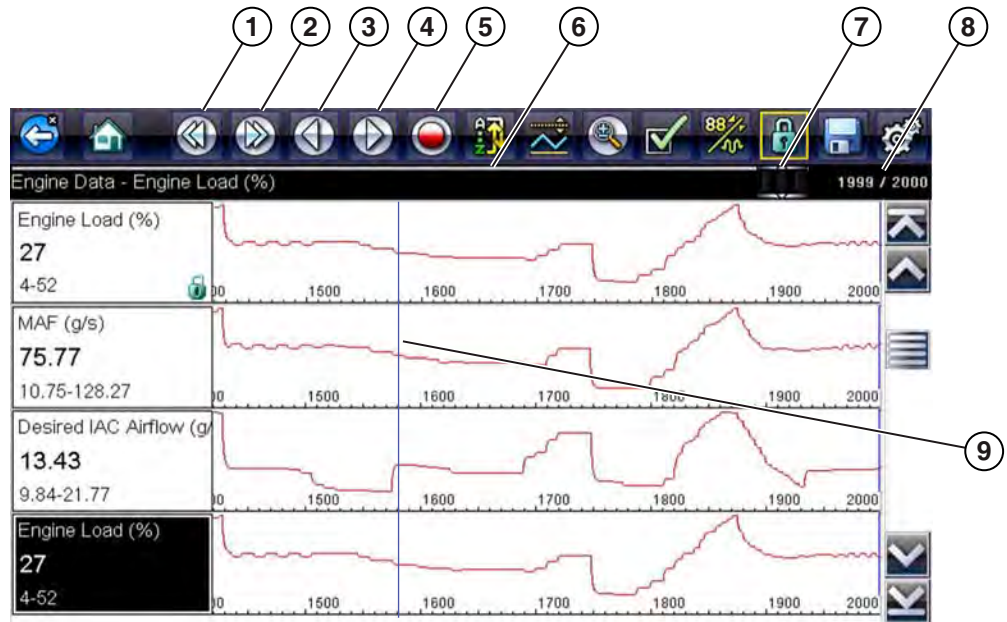
**To pause and review data**

Toolbar control icons are described in [Scanner Control Icons](#), on page 19 and [Common Toolbar Control Icons](#), on page 14.

1. While viewing data, select the **Pause** icon.

On the toolbar, the playback control icons are displayed. A counter displays along the right-hand edge of the screen between the toolbar and the main body. A bar graph to the left of the counter shows how much data is in the memory buffer. A slider on the bar graph indicates the position of the current screen in relation to the entire contents of the data buffer.

Use the slider to quickly scroll through the data. Use the control icons to accurately position the cursor. The cursor (vertical line), indicates your position when in the graph mode, appears once you begin navigating ([Figure 3-20](#)).



- | | |
|-----------------|---------------------------------------|
| 1— Skip Back | 6— Bar Graph |
| 2— Skip Forward | 7— Slider |
| 3— Step Back | 8— Counter (current position / total) |
| 4— Step Forward | 9— Cursor |
| 5— Record | |

Figure 3-20

2. Scroll up or down to review the list of data.
3. Select the desired control icon to move forward or back incrementally in the selected direction.

**To resume:**

- Select the **Record** icon.

The display changes back to display data and the **Pause** icon is shown on the toolbar. A vertical rule runs through the data graph to indicate data was paused at that point.

**NOTE:**

The **Shortcut** icon can be set to perform the Pause/Play function. See [Configure Shortcut Button](#), on page 117 for additional information.

Functional Tests

The **Functional Tests** selection is used to access vehicle-specific subsystem tests. Available tests vary by manufacturer, year, and model. Only the tests available for the identified vehicle display in the menu.

There are several types of functional tests:

- **Information Tests**—these are read-only tests, like selecting “VIN” from a Functional Tests menu to display the VIN of the identified vehicle.
- **Toggle Tests**—these tests switch a component, such as a solenoid, relay, or switch, between two operating states.
- **Variable Control Tests**—these tests command a certain value for a system or component, such as varying spark timing in 1° increments or EGR valve duty cycle in 10% increments.
- **Reset Tests**—these tests reset the adaptive, or learned, values that are stored in the vehicle electronic control module memory.
- **Scripted Tests**—these tests are software routines that place the vehicle into special operating modes for performing certain repairs, such as bleeding brakes with ABS.

Selecting Functional Tests opens a menu of test options that varies by make, year, and model. Selecting a menu option either activates the test or opens a submenu of additional choices. Follow all screen instructions while performing tests. How and what information is presented on the screen varies according to the type of test being performed and the vehicle being serviced.

Toggle and variable control tests often display functional test controls on the toolbar at the top of the screen with PID data in the main body (Figure 3-21).



Figure 3-21 Functional test screen

A Test icon on the toolbar activates the test, and a Return, or similarly named, icon cancels the test. For variable control tests, the variable value displays between the main body and the toolbar. Plus and Minus icons on the toolbar increase and decrease the variable value.



A Data List icon, shown to the left, is available on the toolbar for some tests. This feature allows you to change which data list displays in the main body without exiting the functional test. The icon is only available when the test is inactive.

Generic Functions

Generic Functions are used to perform generic OBD-II/EODB tests, for additional information see [OBD Direct](#), on page 45.

Troubleshooter (Fast-Track[®])

Fast-Track Troubleshooter is a database of experience-based repair strategies and information, that has been compiled and validated by top-notch technicians. Troubleshooter simplifies the diagnosis process, as it contains information on virtually all common diagnostic trouble code (DTC) problems and driveability symptoms.

Troubleshooter information is organized into a series of diagnostic tips that are designed to quickly lead you to the root cause of a particular problem. The tips are vehicle-specific, which means only tips that relate to the identified vehicle are presented. Selecting opens a menu that may include:

- **Code Tips**—provides detailed information on setting conditions, testing, and interpreting test results for specific codes.
- **Symptom Tips**—provides diagnostic tests and procedures based on vehicle operation.
- **Time Savers**—provides supplemental information, such as firing order and #1 cylinder location, that may be needed to make a diagnosis.
- **Common Problems**—provides advice and remedies for certain “pattern failures” that have been experienced on vehicles of the same model.
- **Tests and Procedures**—explains how to perform certain tests on the specific test vehicle. Some tips provide specifications and installation information as well.
- **Fast-Track Data Scan**—contains information and guidelines on how to validate data readings for certain sensors and actuators, PID data values are provided.
- **Fast-Track Fixes**—provides actual repair information for related repairs.



NOTE:

Troubleshooter appears in a Scanner menu only if tips are available for the system selected on the identified vehicle.

Certain PID data parameter values display directly within the tip when performing Troubleshooter tests and procedures. A tip may also contain a hyperlink to a Troubleshooter Reference, another test or procedure, or a supplemental operation, such as Clear Codes. Hyperlinks are shown in blue, and selecting them opens the link. Troubleshooter References open in a separate window. ([Figure 3-22](#)).

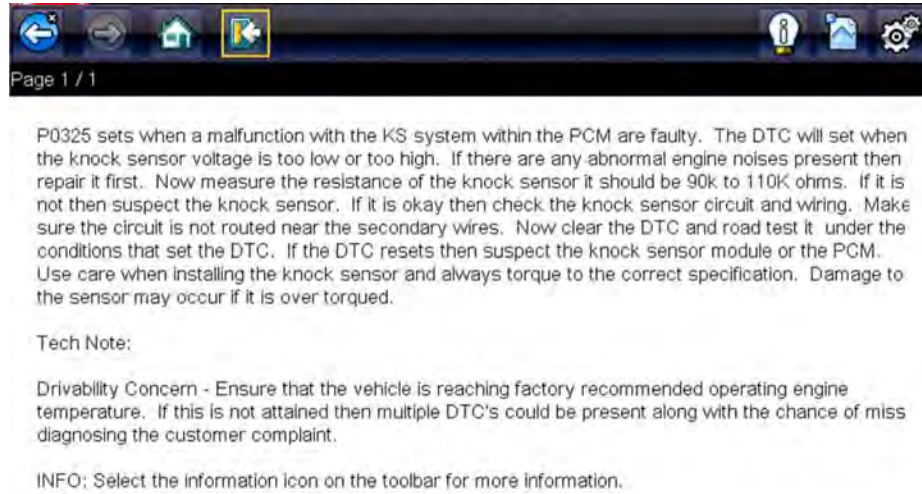


Figure 3-22 Troubleshooter tip

3.4 Exiting Scanner

Scanner function remains open as long as there is an active communication link with the vehicle. You must interrupt this communication link in order to exit from tests and power down the diagnostic tool. A warning message displays if you attempt to shut down while the diagnostic tool is communicating with the vehicle.



NOTE:

Damage to the vehicle electronic control module (ECM) may occur if communication is disrupted. Make sure the data cable is properly connected at all times during testing. Exit all tests before disconnecting the data cable or powering down the diagnostic tool.



To exit the Scanner function:

1. From any active data screen, select the **Back** icon on the toolbar.
A “stopping communications” message briefly displays followed by the Data menu.
2. From the Data Menu, select **Back** on the toolbar.
Again, a “stopping communications” message briefly displays followed by the Main menu.

Now, the diagnostic tool is no longer communicating with the vehicle and it is safe to return to the Home screen and power down the diagnostic tool.

This chapter describes the basic operation of the OBD-II/EOBD function.



The **OBD-II/EOBD** icon is located on the Home screen.

The OBD-II/EOBD function allows you to access “generic” OBD-II/EOBD data. Generic OBD-II/EOBD data is data limited to emission related diagnostics such as:

- Checking for emissions-related diagnostic trouble codes (DTCs)
- Checking the cause of an illuminated malfunction indicator lamp (MIL)
- Checking monitor status prior to emissions certification testing

To access other available electronic control module (ECM) data for vehicle specific systems, parameters or enhanced diagnostics use the Scanner function, see [Scanner on page 18](#).



NOTE:

The OBD-II/EOBD function can also be used to access “generic” OBD-II/EOBD data for OBD-II/EOBD compliant vehicles that are not included in the Scanner function databases.

4.1 Basic Operations

4.1.1 Screen Layout and Toolbar Controls

Screen layout and toolbar controls are similar to the Scanner function, see [Screen Layout and Toolbar Icons](#), on page 18.

4.1.2 Connecting the Data Cable

Connection of the data cable to the diagnostic tool and vehicle DLC is required for OBD-II/EOBD testing, see [Data Cable Connection](#), on page 17.

4.1.3 Saving and Reviewing Data Files

Save and Pause control icon operation and data review procedures are the same as used for the Scanner function, see [Saving and Reviewing Scanner / OBD-II/EOBD Data Files](#), on page 36.

4.2 OBD-II/EOBD Menu

The following options are available from the OBD-II/EOBD menu:

- [OBD Health Check](#)
- [OBD Direct](#)

4.2.1 OBD Health Check

The OBD-II Health Check offers a way to quickly check for and clear emissions-related diagnostic trouble codes (DTCs), and to check readiness monitors for emissions testing. Selecting opens a connection message. Select **Continue** or press the **Y/✓** button to open a submenu of test options (Figure 4-1).

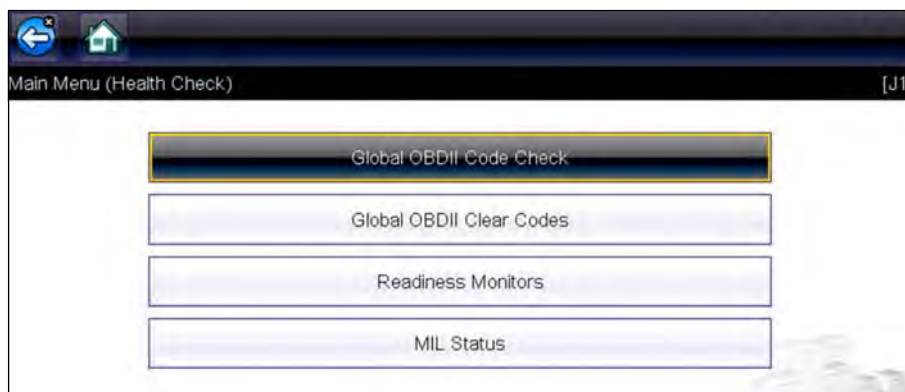


Figure 4-1 OBD Health Check menu

Global OBD II Code Check

Global OBDII Code Check displays stored emission related generic DTCs reported by the ECM. Selecting opens a submenu with two choices: Codes and Pending Codes. Either option opens a code list (Figure 4-2).

Trouble Codes	
P0108	Manifold Absolute Pressure/Barometric Pressure Sensor Circuit High
P0104	Mass or Volume Air Flow Sensor "A" Circuit Intermittent
P0102	Mass or Volume Air Flow Sensor "A" Circuit Low
P0101	Mass or Volume Air Flow Sensor "A" Circuit Range/Performance
P0110	Intake Air Temperature Sensor 1 Circuit Bank 1

Figure 4-2 Code list

Codes

The Codes option displays a list of current emission related DTCs.

OBD-II/EOBD Codes have a priority according to their emission severity. The priority of the code determines the illumination of the MIL and the code erase procedure. Vehicle manufacturers have implemented the ranking differently, so there are differences between makes.

Pending Codes

The purpose of this service is to enable the diagnostic tool to obtain “pending” or maturing diagnostic trouble codes. These are codes whose setting conditions were met during the last drive cycle, but need to be met on two or more consecutive drive cycles before the DTC actually sets.



NOTE:

Save valuable time by using this service to verify test results after a single drive cycle following a vehicle repair and code clearing procedure.

- If a test failed during the drive cycle, the DTC associated with that test is reported. If the pending fault does not occur again within 40 to 80 warm-up cycles, the fault is automatically cleared from memory.
- Test results reported by this service do not necessarily indicate a faulty component or system. If test results indicate another failure after additional driving, then a DTC is set to indicate a faulty component or system, and the MIL is illuminated.

Refer to the *Global OBD Vehicle Communication Software Manual* for additional information.

Global OBD II Clear Codes

This option is used to clear all emission related diagnostic data, such as DTCs, freeze frame data, and test results, from the memory of the selected ECM. Although OBD-II/EOBD displays generic OBD-II/EOBD data only, clearing codes erases all of the stored data, including any enhanced codes and freeze frame information.

A confirmation screen displays when the clear codes option is selected to prevent accidental loss of data. Select to continue from the confirmation screen. Refer to the *Global OBD Vehicle Communication Software Manual* for additional information.

Readiness Monitors

This test checks the status of the readiness monitoring system. An OBD-II /EOBD control system runs continuous and periodic tests to check the status of emission-related systems. Two options are available for Readiness Monitors:

- **Monitors Complete Since DTC Cleared**—displays the status of all monitors that have run since the last time ECM memory was erased.
- **Monitors Complete This Cycle**—displays the status of the monitors that ran during the current drive cycle only.

Selection of either option displays test results as shown in the data viewer (Figure 4-3).

Quick reference indicators are used to show monitor status on the left side of the screen (Figure 4-3):

- **Green icon “✓” mark** - Monitor test is complete
- **Grey icon “—” mark** - Monitor test is not complete
- **Red icon “X” mark** - Monitor test is not supported by vehicle

ID : \$		E8
✓	MISFIRE	TEST COMPLETE
✓	FUEL SYSTEM	TEST COMPLETE
✓	COMPONENTS	TEST COMPLETE
—	CATALYST	NOT COMPLETE
✗	HEATED CATALYST	NOT SUPPORTED
—	EVAPORATIVE SYSTEM	NOT COMPLETE
✗	SEC. AIR SYSTEM	NOT SUPPORTED

Figure 4-3 Readiness monitor test report

Use the scroll bar to view the entire list of Readiness Monitors.

Selecting **Save** from the toolbar saves the monitor data as an .SCM file for review at a later time. See [View Saved Data](#), on page 114 for additional information.

MIL Status

This test checks the ECM commanded state (on or off) if the malfunction indicator lamp.

4.2.2 OBD Direct

OBD Direct includes the following menu and submenu choices:

- **OBD Diagnose**
 - **Start Communication** - initiates a test session
 - **Connector Information** - provides DLC location details
 - **Manual Protocol Selection** - provides choices for communication protocol
- **OBD Training Mode** - allows you to familiarize yourself with the capabilities of OBD-II/EOBD while navigating through menus without being connected to a vehicle.

Start Communication

Use the following procedure to begin an OBD-II/EOBD test session:



To perform an OBD-II/EOBD Test:

1. Connect the data cable to the test vehicle.
2. Select **Start Communications** from the OBD-II/EOBD menu.

A series of messages are displayed indicating automatic detection of vehicle type (12 or 24 V) has occurred and then the detected controllers are displayed.

The diagnostic tool establishes a communication link with the test vehicle, then opens an information screen (Figure 4-4).



Figure 4-4 Protocol information

The information screen shows how many control modules were detected, which ECM is communicating, and which communication protocol is being used.

3. Select **Continue**.

A Select Service menu of available tests opens:

- [Readiness Monitors](#), on page 47
- [MIL Status](#), on page 47
- [Fast-Track Troubleshooter](#), on page 47
- [\(\\$01\) Display Current Data](#), on page 48
- [\(\\$02\) Display Freeze Frame Data](#), on page 48
- [\(\\$03\) Display Trouble Codes](#), on page 48
- [\(\\$04\) Clear Emissions Related Data](#), on page 48
- [\(\\$05, 06, 07\) Display Test param./Results](#), on page 49
- [\(\\$08\) Request Control of On-board System](#), on page 50
- [\(\\$09\) Read Vehicle Identification](#), on page 50
- [\(\\$09\) In-use Performance Tracking](#), on page 50
- [\(\\$0A\) Emission Related DTC with Permanent Status](#), on page 50

IMPORTANT:

All service modes are not supported by all vehicles, so the available menu selections will vary.



Figure 4-5 Service mode menu

4. Select a test to continue.

Readiness Monitors

Use this menu item to check the readiness of the monitoring system. Monitors not supported will display “not supported”. Scroll, if needed, to view the entire list of monitors (Figure 4-3). Selecting Readiness Monitors opens a submenu with two choices:

- **Monitors Complete Since DTC Cleared**—displays the results of all monitor tests that have run since the last time the vehicle electronic control module (ECM) memory was cleared.
- **Monitors Complete This Cycle**—displays only the results of monitor tests that ran during the current drive cycle, they reset when the ignition is switched off.

MIL Status

This item is used to check the current condition of the malfunction indicator lamp (MIL). Additional information, such as which ECM commanded the MIL on and the distance driven while the MIL is on (if supported), can also be displayed. The MIL Status report can also be saved as part of the vehicle records.

Fast-Track Troubleshooter

Fast-Track® Troubleshooter is a database of experience-based repair strategies and information, that has been compiled and validated by top-notch technicians. The Troubleshooter system simplifies the diagnosis process, as it contains information on virtually all common diagnostic trouble code (DTC) problems and driveability symptoms for most vehicles covered by the vehicle communication software.

(\$01) Display Current Data

Use this test to display the serial data transmitted by the selected vehicle electronic control module (ECM). The main body of the screen has two columns; the left-hand column is a description of the parameter and the right-hand column is the parameter value or state. Viewing options and operations are the same as the Scanner function, see [Data Display](#), on page 31 for more information.

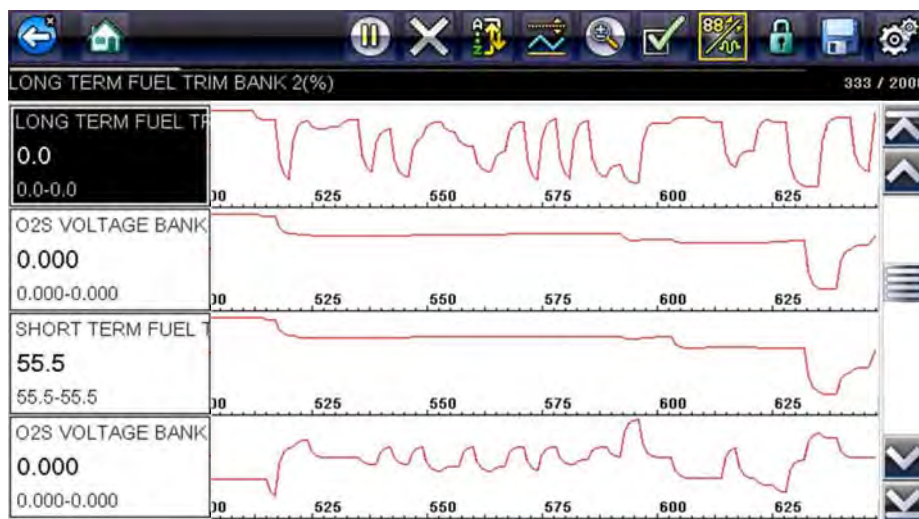


Figure 4-6 Current data display

(\$02) Display Freeze Frame Data

Freeze frame data provides a “snapshot” of critical parameter values at the time a DTC set.

This item is used to display freeze frame data for any stored emission related diagnostic trouble codes (DTCs). In most cases the stored frame is the last DTC that occurred. Certain DTCs, those that have a greater impact on vehicle emissions, have a higher priority. In these cases, the highest priority DTC is the one for which the freeze frame records are retained.

(\$03) Display Trouble Codes

This is used to display any stored emission related DTCs reported by the ECM. The display is similar to the Scanner function code display (see [Display Codes](#), on page 27 for details). The list does not include enhanced DTCs in this mode.

(\$04) Clear Emissions Related Data

This item is used to clear all emission related diagnostic data, such as DTCs, freeze frame data, and test results, from the memory of the selected ECM.



To clear emission related Data:

1. Select **Clear Emissions Related Data** from the menu.
A confirmation message displays to help prevent loss of any vital data (Figure 4-7).

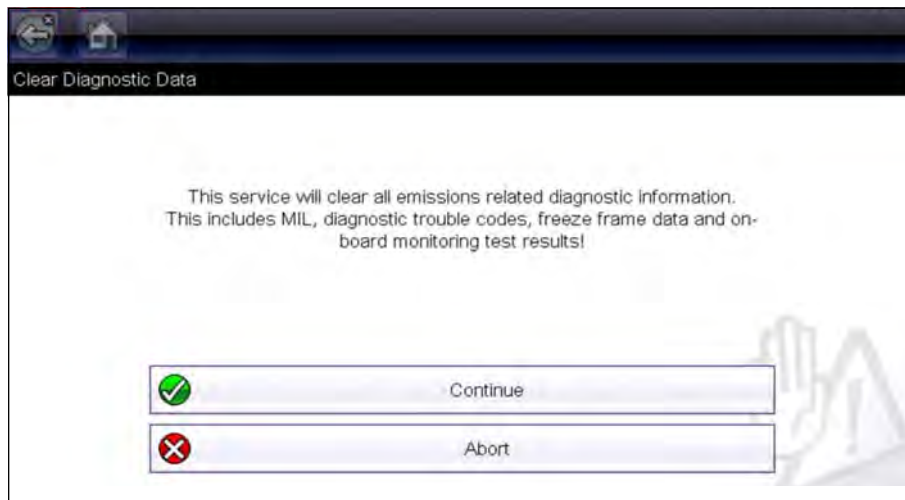


Figure 4-7 Clear codes confirmation message

2. Continue from the confirmation message.
The screen updates several times as ECM memory is erased, then a “data has been cleared” message displays.
3. Select **Continue** to return to the Select Service menu.

(\$05, 06, 07) Display Test param./Results

This option opens a submenu of parameters and test results from various sensors, monitor test results, and a record of DTC setting conditions detected during the last drive cycle. The submenu includes:

- [\(\\$05\) Oxygen Sensor Monitoring](#)
- [\(\\$06\) On-board Monitored Systems](#)
- [\(\\$07\) DTCs Detected During Last Drive](#)

(\$05) Oxygen Sensor Monitoring

This option opens a menu of tests available for checking the integrity of the oxygen (O2) sensors. Making a selection displays all of the pertinent O2 sensor parameters for the specific test. The test identification (ID) displays at the top of the data list.

(\$06) On-board Monitored Systems

This option opens a menu of tests from the monitored systems. The available data is for specific systems and components that the on-board diagnostic system monitors continuously, such as misfire, or non-continuously, such as the catalyst system. Making a menu selection displays the test results.

(\$07) DTCs Detected During Last Drive

This test opens a record of any DTCs that set during the last completed drive cycle. Select to open the DTC list.

(\$08) Request Control of On-board System

This service enables bidirectional control of the ECM. This service allows the diagnostic tool to control the operation of an on-board system, test, or component.

(\$09) Read Vehicle Identification

The purpose of this service is to enable the diagnostic tool to request and display vehicle-specific information, such as the vehicle identification number (VIN), the calibration identification, and the calibration verification number (CVN), of the test vehicle. Select a menu item to retrieve the information. Select **Return** to go back to the menu.

(\$09) In-use Performance Tracking

This option displays the "In-use Performance Tracking" of data. It is a record of the number of times each of the monitor tests have been completed. Select **Return** to go back to the menu.

(\$0A) Emission Related DTC with Permanent Status

This option displays a record of any "permanent" codes. A permanent status DTC is one that was severe enough to illuminate the MIL at some point, but the MIL may not be on at the present time.

Whether the MIL was switched off by clearing codes or because the setting conditions did not repeat after a specified number of drive cycles, a record of the DTC is retained by the ECM. Permanent status codes automatically clear after repairs have been made and the related system monitor runs successfully.

Connector Information

This option opens a database of vehicle diagnostic connector locations that includes most makes and models. The menu driven interface leads you quickly to difficult to find test connectors.

**To locate a vehicle diagnostic connector:**

1. Select **Connector Information** from the System menu.
A list of vehicle manufacturers displays.
2. Select a manufacturer from the list.
A list of models available from the selected manufacturer displays.
3. Select a model from the list.
If a cable adaptor is needed, which one and how to connect it displays.
4. Select **Continue**.
Information on where to locate the vehicle diagnostic connector displays.
5. Select **Continue** to return to the System menu.

Manual Protocol Selection

Communication protocol is a standardized way of transferring data between an ECM and a diagnostic tool. Global OBD may use the following communication protocols:

- ISO 15765-4 (CAN)
- ISO 27145 (WWHOBD CAN)
- ISO J1939 (CAN)
- ISO 9141-2 (K-LINE)
- SAE J1850 PWM (Pulse Width Modulation)
- SAE J1850 VPW (Variable Pulse Width)
- ISO 14230-4 (Keyword Protocol 2000)
- SAE J2284/ISO 15765-4 (CAN)

When initially attempting to establish communication with the ECM the diagnostic tool attempts to communicate trying each protocol in order to determine which one is being used. During normal operation the communication protocol is automatically detected. If automatic detection fails, communication protocol can be manually selected.

IMPORTANT:

Using unsupported OBD communication protocols may activate warning lights and can set network related faults. Only use the manual selection option when OBD protocol is already known.

Select **Manual Protocol Selection** to open a menu of options (Figure 4-8).



Figure 4-8 Manual protocol selection menu

Select the **Back** icon or press the **N/X** button to return to the OBD-II/EOBD Main menu.



The Scope Multimeter function allows you to perform multiple types of circuit and component measurement tests. This chapter includes general operation procedures, instructions for saving and reviewing test data, optional settings, and general reference information.

5.1 Overview

The Scope Multimeter test functions are:

- Digital Multimeter (DMM)
- Graphing Multimeter (GMM)
- Lab Scope

5.1.1 Digital Multimeter (DMM)

The digital multimeter gives you the ability to quickly make precise common electrical measurements (e.g. DC and AC voltage, resistance and amperage) on circuits and components to verify operation. The meter displays measurements in a digital numerical format, and is typically used for measuring signals that are not rapidly changing.

The DMM is ideal for performing basic tests on most standard automotive circuits, and displays the results in a large easy to see format.

To use the DMM, select the **Scope Multimeter** icon from the home screen then select **Digital Multimeter** from the menu. See [Tests and Capabilities \(Quick Reference\)](#), on page 55 for a list of available testing functions.

Specifications

Function	Range	Accuracy/Comments
Signal Measurement	Ch. 1— (yellow jack)	Input is referenced to common ground (GND— (black jack)
VDC (Full Scale)	75VDC	Do not measure greater than 75VDC
VAC (Full Scale)	50VAC	Do not measure greater than 50VAC (rms)
Signal Measurement Input Impedance	10 M Ω	-
Ohm Measurement Diode Test Continuity Test	Ch. 1— (yellow jack (-)) Ch. 2— (green jack (+))	-
Ohms	40 Ω —4 M Ω	Fixed scales or auto ranging
Glitch Capture	Approximately 50 μ S	-
Diode test	2V scale	-

5.1.2 Graphing Multimeter (GMM)

Unlike the DMM, the graphing multimeter provides two channels for testing and plots a visual graphing line of the signal instead of displaying digital values. The GMM displays a signal's measurements over time on a two-dimensional grid. This plotted graph is basically a graphical history (histogram) of the signal's measurements over time.

The GMM uses a higher sample rate (than a DMM) to calculate signal measurements. This characteristic along with the visual graph, make the GMM ideal for finding intermittent dropouts or glitches that may not be obvious when viewing a digital value. A key advantage of the GMM is being able to capture a signal over a long time interval and then review its graphical history, to visually see if and when dropouts have occurred.

In addition, the GMM uses a combination of filter and peak detect modes to provide a good balance between detecting fast glitches and preventing unwanted noise from displaying.

Unlike the lab scope, the sweep scales used with typical GMM tests are of longer time intervals, and may range from seconds to minutes, compared to the lab scope sweep scales that use relatively short time intervals (e.g. milli and micro seconds). This allows you to monitor a signal over a longer period of time when looking for erratic glitches or dropouts.

To use the GMM, select the **Scope Multimeter** icon from the home screen then select **Graphing Multimeter** from the menu. See [Tests and Capabilities \(Quick Reference\)](#), on page 55 for a list of available testing functions.

Specifications

Function	Range	Accuracy/Comments
Signal Measurement	Ch. 1— (yellow jack) Ch. 2— (green jack)	Each channel input is referenced to common ground (GND— black jack)
Sample Rate	1.5 MSPS	Continuous sampling, MSPS = mega samples per second
Band Width	3 MHz	3 db point @ 3 MHz
Input Impedance	10 M Ω @ DC 4 k Ω @ 3 MHz	Channel 1 and 2
VDC (Full Scale)	75VDC	Do not measure greater than 75VDC
VAC (Full Scale)	50VAC	Do not measure greater than 50 VAC (rms)
Ohm Measurement Diode Test Continuity Test	Ch. 1— (yellow jack (-)) Ch. 2— (green jack (+))	-
Ohms	40 Ω —4 M Ω	Fixed scales
Low Amp Probe	20A scale (100mV/Amp) 40A scale (10mV/Amp) 60A scale (10mV/Amp)	Connect the positive (+) Amp Probe lead to the yellow jack on the diagnostic tool for values on Ch.1, or to the green jack for values on Ch. 2. Connect the negative (-) lead to GND (black jack) ¹ .
1. Do not use the Low Amp Probe to measure current on conductors at a potential greater than 46VAC peak or 70VDC.		

5.1.3 Lab Scope

Similar to the GMM, the lab scope (oscilloscope) plots a visual image line of a signal's measurements over time on a two-dimensional grid. The visual line that is displayed is commonly called a trace, and the graphical form created by a signal is called a waveform.

Unlike the DMM, the lab scope allows you to visually see a signals waveform, which in turn allows you to see the strength and shape of the signal, as well as any noise that may be occurring on the circuit. The lab scope also samples signals at a high rate, which allows you to see a higher level of detail in short samples of the signal, especially in signals that change rapidly. In addition, the lab scope also provides more control over the acquisition of the signal and in how it is displayed, through the use of triggers and channel controls. All of these features allow you to analyze signals in great detail when performing diagnostics.

To use the lab scope, select the **Scope Multimeter** icon from the home screen then select **Lab Scope** from the menu. See [Tests and Capabilities \(Quick Reference\)](#), on page 55 for a list of available testing functions.

Specifications

Function	Range	Accuracy/Comments
Signal Measurement	Ch. 1— (yellow jack) Ch. 2— (green jack)	Each channel input is referenced to common ground (GND— black jack)
Sample Rate	For 50 μ S sweep 6 (MS/s) For 100 μ S sweep 3 (MS/s) For all other sweeps 1.5 (MS/s)	Continuous sampling, (MS/s) = mega samples per second
Band Width	3 MHz	3 db point @ 3 MHz
Input Impedance	10 M Ω @ DC 4 k Ω @ 3 MHz	Channel 1 and 2
VDC (Full Scale)	100mV–400V	Do not measure greater than 75VDC
VAC (Full Scale)	100mV–400V	Do not measure greater than 50 VAC (rms)
Low Amp Probe	20A scale (100mV/Amp) 40A scale (10mV/Amp) 60A scale (10mV/Amp)	Connect the positive (+) Amp Probe lead to the yellow jack on the diagnostic tool for values on Ch.1, or to the green jack for values on Ch. 2. Connect the negative (-) lead to GND (black jack) ¹ .
1. Do not use the Low Amp Probe to measure current on conductors at a potential greater than 46VAC peak or 70VDC.		

5.2 Tests and Capabilities (Quick Reference)

The following chart identifies and describes available tests by function.



NOTE:

Not all the tests listed are described in this manual. This list is intended as reference only.

D M M	G M M	LS	Test	Function
		✓	Two Channel Lab Scope	Displays two Lab Scope channels automatically
	✓		Dual Graphing Meter	Displays two Graphing Multimeter channels automatically
		✓	Ignition Probe	Measures secondary Ignition voltage 2 to 50kV. Displays secondary ignition (kV) waveforms.
✓	✓	✓	Volts DC	Measures direct current voltage. DC voltage is measured through the two test leads connected to a DC circuit.
✓	✓		Volts DC - Average	Measures DC voltage using a filter to determine the average voltage over a period in time. DC voltage is measured through the two test leads connected to a DC circuit.
✓	✓		Volts AC RMS	Measures the effective AC voltage, not the peak voltage which results in measurements with higher accuracy. The AC RMS (root mean square) voltage value can be defined as the equivalent DC voltage of the AC voltage measured. RMS values are commonly used in AC electrical measurement, as they are more representative of DC measurements.
✓	✓		Ohms (Ω)	Measures electrical resistance (opposition to current) 0 to 4 M Ω . Scope supplied DC current is passed through the circuit to measure the resistance between the two connected test leads.
✓			Diode/Continuity	Measures voltage drop across a diode and continuity through a diode. Scope supplied DC current is passed through the diode to measure the voltage drop between the two connected test leads. Typical setup for positive to negative current flow - positive lead (anode +/side) and negative (cathode -/side)
	✓		Frequency	Measures the number of times a signal repeats itself per second. Used to measure frequency of signals such as CKP, CMP and wheel speed sensors.
	✓		Pulse Width	Measures the on-time of various components (e.g. components that cycle on and off like the EGR, or canister purge).
	✓		Injector Pulse Width	Measures fuel injector on-time when checking for variances when engine load is changed and/or physical problems with the injector
	✓		Duty Cycle	Measures the ratio of the pulse width to the complete cycle width, the on-time of components that cycle on and off like EGR, or canister purge from 0–100%
✓	✓	✓	Low Amps (20)	Used to measure amperage of typical devices (e.g. ignition coils, injectors, fuel pumps) that may draw up to 20A peak (startup) when initially started. Also used to measure parasitic draw.

D M M	G M M	LS	Test	Function
✓	✓	✓	Low Amps (40)	Used to measure amperage of typical motors and devices that may draw up to 40A peak (startup) when initially started.
✓	✓	✓	Low Amps (60)	Used to measure amperage of larger motors and devices that may draw up to 60A peak (startup) when initially started.
	✓		MC Dwell (60)	Measures carburetor Mixture Control Solenoids (0–60°). The duty cycle of the solenoid is expressed in the dwell angle of a 6 cylinder engine: 100% = 60 deg.
	✓		MC Dwell (90)	Measures fuel system Mixture Control Solenoids (0–90°). The duty cycle of the solenoid is expressed in the dwell angle of a 4 cylinder engine: 100% = 90 deg.
	✓	✓	100 PSI Vacuum	Used to measure vacuum up to 20 in.Hg, using the 0–100 psi transducer
	✓	✓	100 PSI Pressure	Used to measure pressures for typical systems such as, fuel, oil, EVAP, hydraulic/transmission fluid etc. up to 100 psi, using the 0–100 psi transducer
	✓	✓	500 PSI Pressure	Used to measure pressures for typical systems such as, hydraulic/transmission fluid pressure, cylinder compression, and AC high side up to 500 psi, using the 0–500 psi transducer
	✓	✓	5000 PSI Pressure	Used to measure pressures for typical systems such as, ABS, power steering, and heavy-duty hydraulic system fluid up to 5000 psi, using the 0–5000 psi transducer
	✓	✓	MT5030 Vacuum	Used to measure vacuum up to 29 in.Hg, using the MT5030 pressure transducer adaptor
	✓	✓	MT5030 Pressure	Used to measure fluid and gas pressures up to 500 psi, using the MT5030 pressure transducer adaptor
	✓	✓	EEDM506D Temperature	Used to measure temperatures from -50° to 1800° F (-45 to 982° C), using the EEDM506D pressure transducer adaptor

5.3 Test Leads and Accessories

Some of the leads, probes and adaptors supplied with or that may be available, are explained in the following section.

**NOTE:**

Not all test leads and/or accessories may be available in all markets. Contact your sales representative for information, or to find out more about these and other available accessories.

IMPORTANT:

Avoid damaging test leads, do not pull on the wire when removing the leads from their jacks. Pull only on the lead terminal end.

5.3.1 Channel 1 Lead

The shielded yellow lead is used with channel 1, and is colour matched with the channel 1 jack on the diagnostic tool.

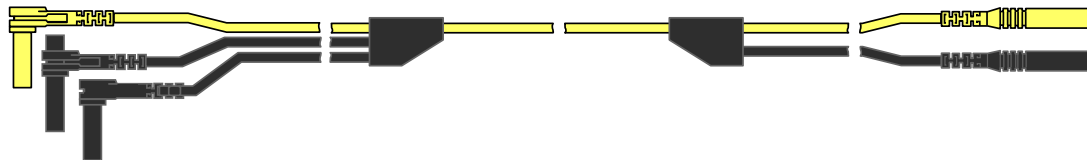


Figure 5-1 Yellow Channel 1 Lead

This lead also includes two black, right-angle common ground plugs. One plug is standard and the other is stackable. The standard ground plug should always be connected to the ground (GND) jack on the diagnostic tool.

The stackable ground plug is used for connecting additional ground leads, such as the Channel 2 or the Secondary Coil adaptor lead grounds. The stackable ground lead is internally connected to the standard ground lead, therefore it does not need to be connected to the diagnostic tool ground jack.

5.3.2 Channel 2 Lead

The shielded green lead is used with channel 2, and is colour matched with the channel 2 jack on the diagnostic tool. This lead also includes a black, right-angle stackable ground plug.

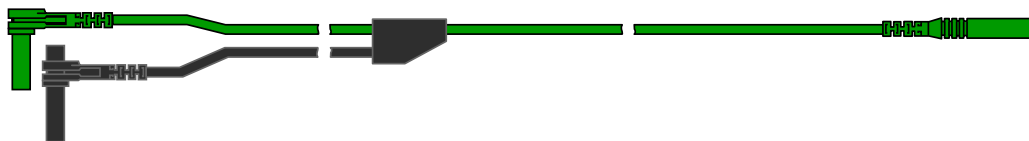


Figure 5-2 Green Channel 2 lead

5.3.3 Alligator Clips and Probes

Insulated alligator clips and probes (pointed type) can be attached to the end of the test leads. Each alligator clip is colour matched with a test lead, and the probes are available in red and black.

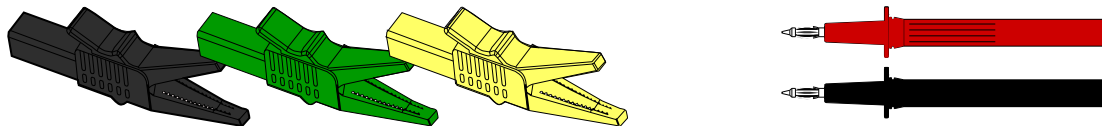


Figure 5-3 Alligator clips

5.3.4 Secondary Ignition Coil Adaptor Lead and Clip-on Adaptor (optional)

The secondary ignition adaptor lead can be used with the secondary ignition clip-on wire adaptor, coil-in-cap (CIC), or coil-on-plug (COP) secondary ignition adaptors to display secondary ignition signals. The clip-on adaptor clips over a secondary ignition wire to pickup a signal, and the CIC and COP adaptors attach to the ignition coil. The coil adaptor lead includes a black, right-angle stackable ground plug, and a RCA type connector that is used to connect the lead to a secondary ignition adaptor. The spring clamp is used to connect to a ground.

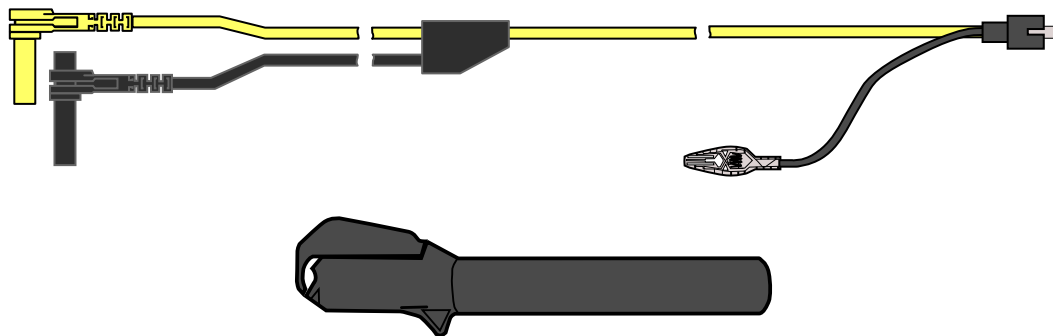


Figure 5-4 Secondary Ignition Coil Adaptor Lead and Clip-on Wire Adaptor



NOTE:

Contact your sales representative for additional information on OEM specific CIC and COP secondary ignition adaptors.

5.3.5 Low Amp Current Probe (optional)

The Low Amp Current Probe is used measure AC or DC current up to 60A. This probe includes two scales (0 to 20A) and (0 to 60A) that can be used to provide accurate and reliable non-intrusive current measurement for components such as, ignition coils, fuel injectors, fuel pumps, relays, and electric motors.



Figure 5-5 Low Amp Current Probe

5.3.6 Pressure Transducers and Adaptors (optional)

Different pressure transducers and adaptors are available for measuring positive and negative gas and liquid pressures. Depending on the adaptor, measurement capabilities range from 1 to 5000 psi and up to 29 inHg. Measurement and application capabilities vary per device.



Figure 5-6

5.4 General Information

This section describes the general Scope Multimeter control icon functions, screen layout and optional settings. The screen layout and control icon functions are shared between the digital/graphing multimeters and lab scope.



NOTE:

Scope and Multimeter tests are not vehicle specific, therefore vehicle identification is not required.

5.4.1 Scope Multimeter Screen Layout and Features







- 1— **Toolbar**—contains navigational and control icons
- 2— **Data Buffer Position Indicators**—graphical and numerical position indicators
- 3— **Main Body**—contains the meter/scope display
- 4— **Control Panel**—contains channel/trace controls
- 5— **Expand/Collapse icon**—toggles display between split and full screen views

Figure 5-7

Scope Multimeter Control Icons

The following control icons are common across most Scope Multimeter functions, however use may vary depending on the active function or test. A yellow frame surrounding an icon (highlighted), indicates it is selected. Other control icons (not shown) are described in [Common Toolbar Control Icons](#), on page 14.

Icon	Function
	<p>Stop - Stops the data buffer</p>
	<p>Control Panel - (a). In full screen mode, when selected this icon becomes surrounded by a white frame and opens the control panel at the bottom of the screen while switching active selection focus to the Show/Hide or Probe icon in the Control Panel. (b). In split screen mode (control panel open), when selected this icon becomes surrounded by a white frame and switches active selection focus to the Show/Hide or Probe icon in the Control Panel.</p> <p>Note: Switching active selection focus to the Control Panel allows manual navigation (using the directional control buttons) of the Control Panel control icons</p>
	<p>Zoom - Increases and decreases screen magnification. The zoom function is only available during data review (scope stopped).</p>
	<p>Cursors - Toggles cursors on/off.</p>

Main Body

The main body may display the following:

- Menu - Select from a menu using the touch screen or the control buttons.
- Meter/Scope Display - Up to two signal traces can be displayed simultaneously. Each trace is displayed as voltage over time and the voltage level is recorded on the vertical, or “y”, axis and time is presented on the horizontal, or “x”, axis of the screen.

Data Buffer Position Indicators

The graphing multimeter and lab scope functions have the capability to save, store and playback, data (signals) utilizing internal storage “buffer” memory.

The Data Buffer Position Indicators are used to visually see the overall amount and position of the of stored buffer data during saving and playback.

For additional information on the Data Buffer, Data Buffer Position Indicator and Saving, Storing and Reviewing Data files, see [Saving and Reviewing Scope / Multimeter Data Files](#), on page 86.

5.4.2 Measurement Out of Range (Alert)

When performing a test, if a group of arrows displays onscreen, this indicates that the measurement is out of range for the scale selected.

- Arrows pointing UP—measurement over maximum range
- Arrows pointing DOWN—measurement under minimum range

Voltage measurements also display arrows in place of live values when the voltage exceeds the input rating of the meter.



Figure 5-8

WARNING



Risk of electrical shock.

- **Do not exceed voltage limits between inputs as indicated on the rating label.**
- **Use extreme caution when working with circuits that have greater than 40 volts AC or 24 volts DC.**

Electrical shock can cause personal injury, equipment damage, or circuit damage.

IMPORTANT:

If arrows are displayed in the live voltage values, discontinue circuit testing.

Correct an out-of-range condition by selecting a scale setting appropriate for the signal being sampled. See [Scale \(Vertical scale adjustment\)](#), on page 66 for more information.

5.5 Operation and Controls

This section describes the general operation and controls used to configure the scope or meter to perform testing. All three functions share similar control panel settings, see [Control Panel and Settings](#), on page 65 for additional information.

**NOTE:**

The information in the following sections is intended as a guide and general overview of the controls and functions used within the Scope Multimeter. Not all the settings or controls described throughout this section are applicable with all functions.

**To open a scope multimeter function:**

1. Select the **Scope Multimeter** icon from the home screen.
2. Select either **Lab Scope**, **Graphing Multimeter** or **Digital Multimeter** from the menu.

5.5.1 Test Lead / Probe Connection

Standard “safety type” test lead jacks are located on the top of the diagnostic tool, and are compatible with many test leads and probes. Insert the applicable test lead or probe terminal end into the jack to complete the connection.

IMPORTANT:

To avoid damaging test leads, do not pull on the wire when removing the leads from their jacks. Pull only on the lead terminal end.



- 1— Ground Jack (Black)
- 2— Channel 1 Jack (Yellow)
- 3— Channel 2 Jack (Green)

Figure 5-9 Scope Multimeter Test Lead Jacks

5.5.2 Test Lead / Probe Calibration

Certain tests may display a confirmation prompt asking “Do you wish to calibrate this probe?” before continuing with the test. As general practice, it is important to ensure the test probe is calibrated before testing, to ensure accurate results.

Typical resistance, pressure, and vacuum tests will display the calibration message, reminding you to calibrate the probe. To perform the probe calibration, select **Yes** at the prompt and continue to follow the onscreen instructions to complete the calibration.

Example: For the ohms (resistance) calibration process, once completed, zero ohms should be displayed when the leads are connected together. When the leads are separated, the upward arrows on the display indicate infinite resistance or an open circuit.



NOTE:

During an ohms test or a pressure test, a manual probe recalibration can be initiated by selecting the probe icon from the Control Panel to open the probe menu. Then select either the **Ohms** or **Pressure (100, 500, 5000)** items from the probe menu. The menu selections will display a graphic of a balance scale with an “X” through it (on right side) to indicate that probe is not calibrated.

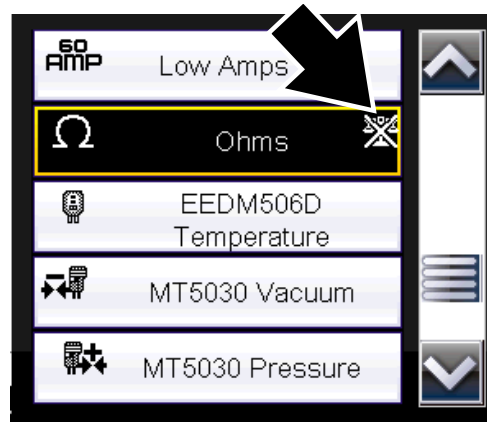


Figure 5-10 Probe menu - Ohms with “not calibrated” indicator displayed

5.5.3 Control Panel and Settings

The control panel is common to all three Scope Multimeter functions, and contains the channel (or “trace”) settings and controls that are used to monitor and adjust the signal being measured. This section provides a general overview of all the channel settings and control features used across all three Scope Multimeter functions.



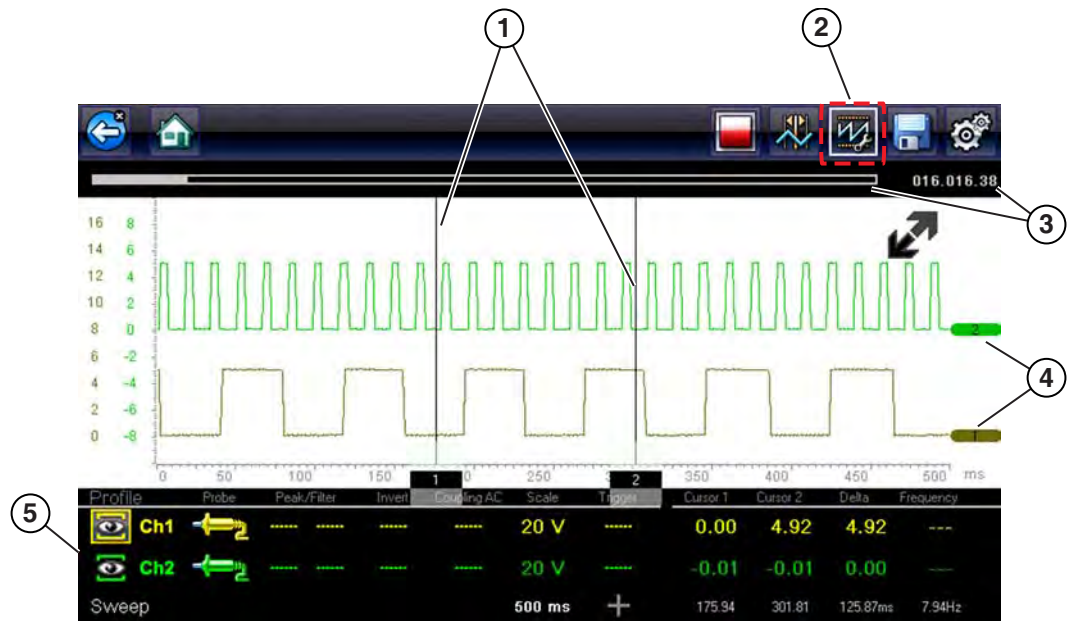
NOTE:

This section is intended as a general overview of the channel settings. Not all the settings or controls described in this section are applicable with all functions, some may be “grayed out” or not active (applicable) depending on the function or test. Function availability is noted as applicable.



NOTE:

The control panel can be toggled on/off by selecting the Expand/Collapse Icon to switch the screen between full and split test meter views.



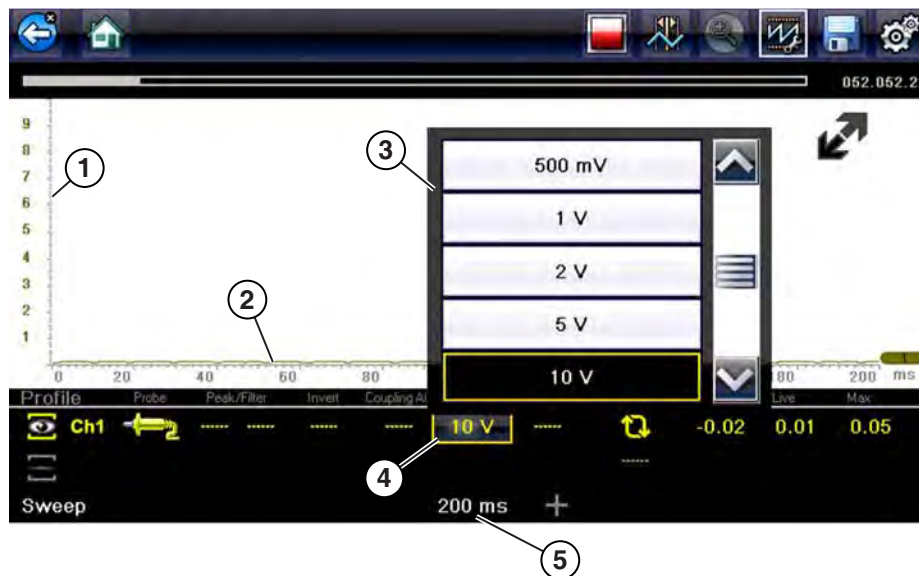
- 1— Cursors
- 2— Control Panel Icon
- 3— Data Buffer Position Indicators—graphical and numerical position indicators
- 4— Zero Base Line Indicators
- 5— Control Panel—contains channel/trace controls and settings

Figure 5-11

Scale, Sweep and Probe Settings

The most common and typically the first adjustments made when performing tests are the setup or adjustment of the scales and selection of a probe. All three of these adjustments are made from the control panel and are described in the following sections.

The following illustration is for reference, and identifies key terms and features used throughout the following sections:



- 1— Vertical Scale - [Y axis]
- 2— Horizontal (sweep or time) Scale - [X axis]
- 3— Vertical Scale Menu
- 4— Vertical Scale Icon
- 5— Sweep Scale Icon

Figure 5-12

Scale (Vertical scale adjustment)

The vertical scale (Y-axis) represents what is being measured (voltage, amperage, pressure etc.), and the unit of measurement it is being measured in. The vertical scale is “always” divided into 10 major divisions; how these divisions are defined, sets the scale of measurement.



NOTE:

Vertical scales (either channel) can be set independently.



NOTE:

Optional vertical scale preference settings are available. The Divisions option allow you to change (to your preference) how the vertical scale menu selections are represented, and the type of value that displays in the vertical scale icon. See [Divisions](#), on page 83.

To adjust the vertical scale unit of measurement, select the **Vertical Scale** icon to open the vertical scale menu. Select a value then press the **N/X** button, to exit the menu. The value displayed in the vertical scale icon indicates the active value.

Example: Selecting 10V, changes the vertical scale to a 10V volt scale. The scale is “always” divided by 10, therefore each division is incremented by 1V.

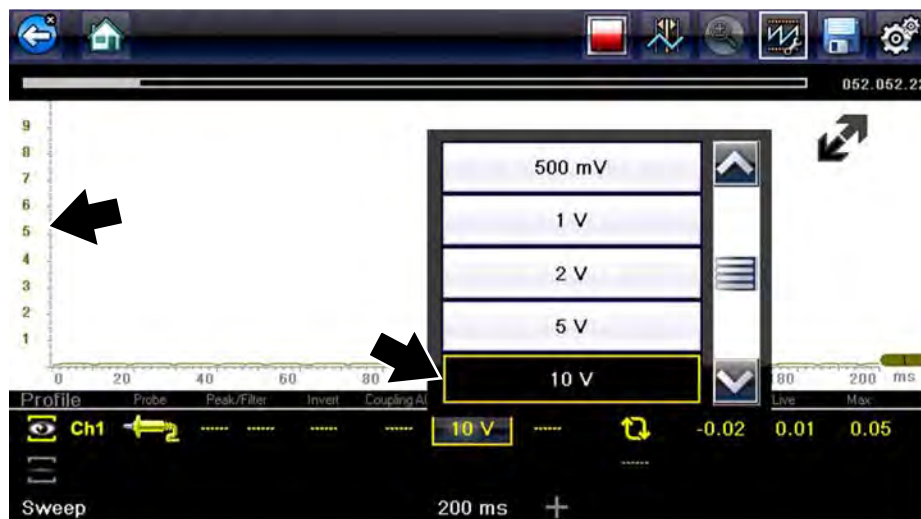


Figure 5-13

Example: Selecting 50 psi displays a 50 psi scale that is divided by 10, therefore each division is incremented by 5 psi.



Figure 5-14

Sweep (Horizontal or Time scale adjustment)

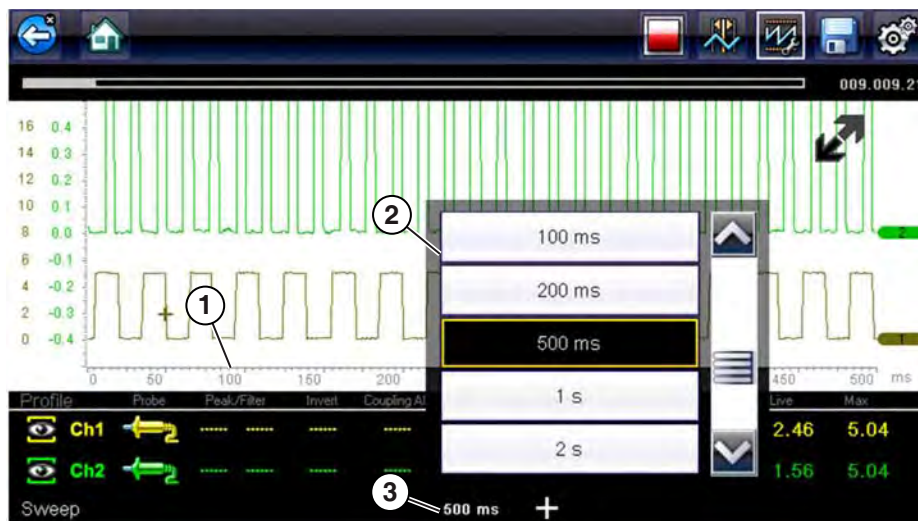
The horizontal scale (X-axis) represents time, and the unit of measurement it is being measured in. The horizontal scale is “always” divided into 10 major divisions, how these divisions are defined, sets the scale of measurement. The value displayed in the sweep Scale icon indicates the active sweep setting.



NOTE:

The sweep setting applies to all channels and cannot be set independently per channel.

To adjust the sweep scale unit of measurement value, select the Sweep Scale icon to open the sweep scale menu. Select a value then press the **N/X** button, to exit the menu.



- 1— Sweep Scale
- 2— Sweep Scale Menu
- 3— Sweep Scale Icon

Figure 5-15

Example: Selecting 500ms, changes the sweep scale to a 500ms scale. The scale is “always” divided by 10, therefore each division is incremented by 50ms.

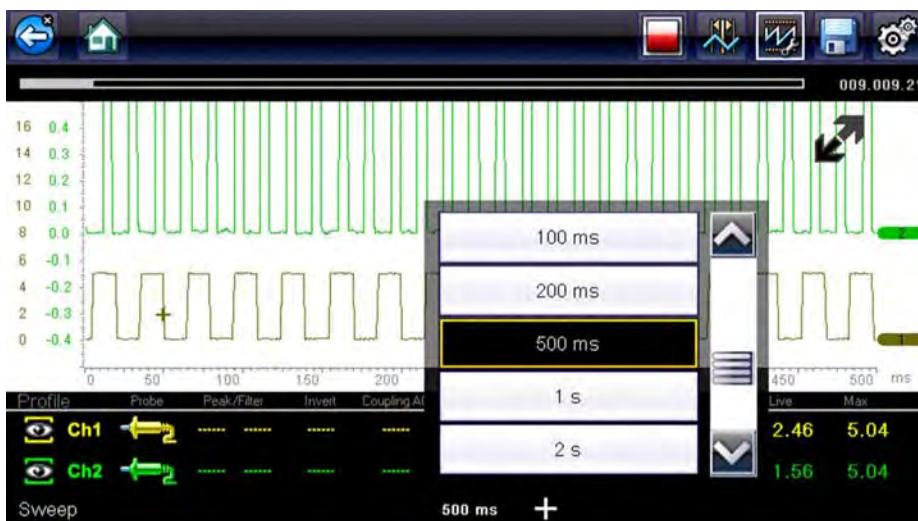


Figure 5-16

Probe (Probe type “test” selection)

Different types of Probes are available from the probe option menu, depending on which type of test you are performing. Changing the probe selection, also changes the vertical scale to the applicable type of measurement.

To select a Probe type, select the **Probe** icon to open the probe option menu, then select a probe. The probe icon will change to the selected probe. Select **Close** from the menu to close the menu.

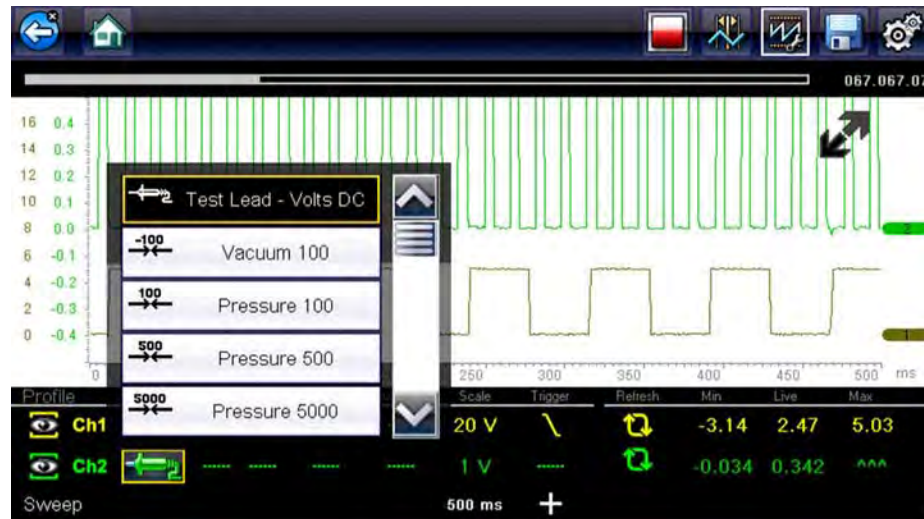


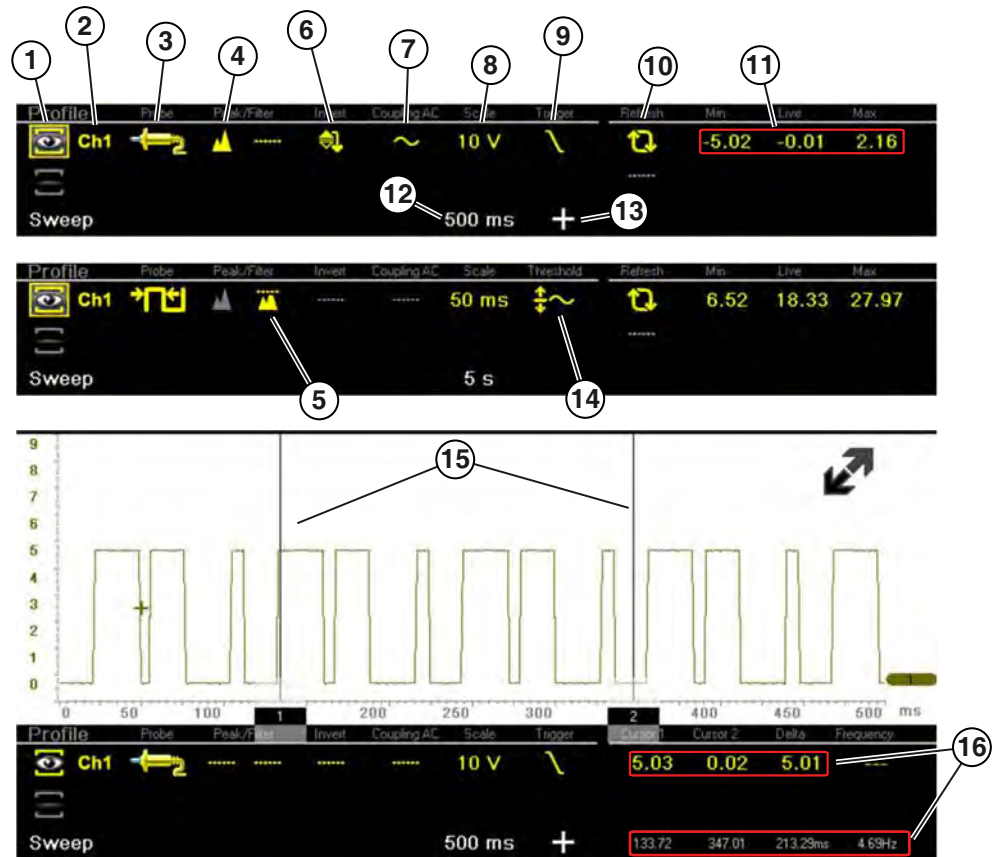
Figure 5-17 Probe option menu

For probe calibration information, see [Test Lead / Probe Calibration](#), on page 64.

Probe “test” Options	
Menu Option	Probe / Device Used
Test Lead - Volts DC	Standard Channel 1 and 2 test leads with alligator clips or test probes
Vacuum 100	(optional) 0-100 psi pressure transducer with pressure adaptor
Pressure 100	
Pressure 500	(optional) 0-500 psi pressure transducer with pressure adaptor
Pressure 5000	(optional) 0-5000 psi pressure transducer with pressure adaptor
Low Amps 20	(optional) Low Amp Probe
Low Amps 40	
Low Amps 60	
Ignition	(optional) Secondary ignition adaptor lead with desired secondary ignition coil adaptor
EEDM506D Temperature	(optional) Part number - EEDM506D temperature adaptor
MT5030 Vacuum	(optional) Part number - EEDM5030 0-500 pressure adaptor
MT5030 Pressure	

Channel Settings

The majority of the channel (trace) settings and controls are located in the Control Panel. Each setting is represented by an icon, or a value. Icons are used to make adjustments, and the displayed values represent an individual characteristic. Depending on the test, applicable settings are displayed. The following image shows different views of the control panels to identify the different controls.





- 1— **Show/Hide (Channel display on/off)**—turns channel on/off
- 2— **Trace (Zero Baseline position adjustment)**—adjusts zero baseline position
- 3— **Probe (Probe type “test” selection)**—changes test probe function
- 4— **Peak Detect**—maximizes sampling rate
- 5— **Filter**—removes signal noise or interference
- 6— **Invert**—switches signal polarity
- 7— **Coupling AC**—blocks the DC portion of signal
- 8— **Scale (Vertical scale adjustment)**—adjusts vertical scale
- 9— **Trigger**—turns triggering on/off, and sets direction of trigger slope
- 10— **Refresh**—clears Min, Max and Live values and resets to zero
- 11— **Min, Live and Max Display Panel**—displays lowest, highest and current trace measurements set since the test was activated
- 12— **Sweep (Horizontal or Time scale adjustment)**—adjusts horizontal scale
- 13— **Trigger Position Icon**—opens trigger position control panel
- 14— **Threshold**—turns auto threshold on, to provide a more accurate measurement on select tests where noise is present (GMM only)
- 15— **Cursors**—used to measure time, amplitude and frequency
- 16— **Cursor Measurements Panel**—displays signal amplitude at cursor and cursor position in time

Figure 5-18

Show/Hide (Channel display on/off)

The Show/Hide icons allow you to turn the channels on and off.

To turn a channel on and off, select the applicable channel's **Show/Hide** icon.


Show/Hide Icons	
On (Channel displayed)	Off (Channel not displayed)
	

Trace (Zero Baseline position adjustment)

The Trace icon identifies the channel number and is used to open the zero baseline adjustment controls.

To adjust the vertical position of the zero baseline (0 value) of a trace (for either channel), select the **Trace** icon or to open the zero baseline adjustment controls. Select the up/down arrows to make adjustments or press the up/down directional buttons. Tap the main body screen section or press the **N/X** button, to exit.

The zero baseline can also be repositioned by touching and dragging the baseline marker up/down on the screen.

Trace Icon


Peak Detect

Peak Detect Off

When peak detect is off, the scope samples at a high rate but saves just enough sample points to the data buffer memory to plot a waveform across the screen. No preference is given to any point during the selection process.



NOTES:

- Turning peak detect “off” is suitable for basic measurements, and viewing waveforms (e.g. oxygen (O₂) or Cam sensor) when capturing fast events is not necessary.
- The longer the time sweep, the greater the chance a glitch could be missed because it occurred in between the sample points saved to the data buffer memory. To increase the chance of capturing a glitch with peak detect “off”, a shorter time sweep should be selected.
- Turning peak detect “off” avoids the need for an external filter to decrease the display of unwanted noise, which can make diagnosis more difficult.

Example: *With a time sweep of 10 seconds on a screen 100 points wide, the effective sample rate would be 10 times a second. Decreasing the time sweep to 1 second, increases the effective sample rate to 100 times a second. At this time setting, a fast occurring event is more likely to be captured due to the increased rate. This is the standard mode of operation for many scopes.*

Peak Detect On



When peak detect is “on”, all sample points are evaluated. The points stored to the data buffer memory are intelligently selected to capture fast events that might be missed at slower effective sample rates. Peak Detect captures fast events, spikes and glitches for signals going in both positive and negative directions.



NOTES:

- Turn peak detect "on" when capturing fast events (e.g. ignition firing voltage, glitches, and intermittent events).
- Turning peak detect “on” may capture unwanted noise, therefore, using peak detect may not be suitable for some tests (e.g. oxygen (O₂) sensor), as the waveform may be more difficult to evaluate due to the additional noise that may be displayed.
- Peak Detect decreases the possibility of waveform aliasing.

To turn peak detect on and off, select the **Peak Detect** icon.

Peak Detect Icons	
On (Sampling maximized)	Off (Sampling not maximized)
	

Filter

Using the filter feature can minimize or smooth out signal spikes and fast variations, depending on which function is its used with.

Filter - Lab Scope

Using the filter with the lab scope, smooths out fast spikes, which helps to provide a good balance between noise suppression and signal integrity.

Using the filter is useful when working with scales of 5 volts and below, as the lower the voltage scale, the more likely noise can occur.

Example: *Using the filter is helpful when testing components such as, an O₂ sensor (1or 2 volt scale), or when performing a throttle position (TP) sensor sweep test (5 volt scale).*

In addition, the filter is also helpful for low amp probe tests, as a low voltage scale is used to measure the output of the probe (due to the conversion factors of the probe).



Example: *For a probe with a conversion factor of 100 mV/A connected to a 2 amp load, the scope uses a 200 mV scale to measure the output of the probe. The scope converts the measured output to 2 amps for display on the screen.*

Filter - GMM

Using the filter with the GMM, the filter minimizes noise by ignoring or smoothing out fast signal spikes.

- For a direct measurement test, such as volts, amps, or pressure, the filter minimizes the display of very fast spikes by averaging the sampled data when filter is active.
- For a calculated measurement test, such as frequency, pulse width, dwell, or duty cycle, extremely fast spikes (20 μ S and faster) from sources like the ignition system are ignored when filter is active.

To turn the filter on and off, select the **Filter** icon.



Filter Icons	
On (Interference is suppressed)	Off (Interference is not suppressed)
	

Invert

The Invert feature is used to switch signal polarity, so the trace appears upside down (inverted) on the screen. This is typically used when measuring amperage using the low amp probe, or high-voltage signals like, secondary ignition.

Example: A signal that normally rises from 0 to +5 volts, if inverted would show falling from 0 to -5 volts.

To turn inversion on/off, select the **Invert** icon.



Invert Icons	
On (Polarity is inverted)	Off (Polarity is not inverted)
	

Coupling AC

Coupling AC subtracts the average value of a signal so that small variations can be displayed in the waveform. This is accomplished by blocking the direct current (DC) portions of a signal in order to amplify (show) the alternating current (AC) portions of the signal, without driving the trace off of the screen.

Using coupling AC can be helpful when testing and diagnosing alternator ripple or fuel pump amperage, by allowing you to see any abnormal small variations or events.

To turn coupling AC on and off, select the **Coupling AC** icon.

Coupling AC Icons	
On (DC signal portion blocked)	Off (DC signal portion not blocked)
	

Trigger



NOTE:

The Trigger feature is only available in the lab scope function.

A trigger can be used to stabilize a changing or erratic signal (a signal that may flicker or drift as it refreshes), so that it is easier to view or diagnose. This stabilization effect is accomplished by basically displaying the same part of the trace repeatedly from the same starting point, thus the flicker or drift is minimized which makes the trace appear more consistent or static.

A trigger is basically a “specific point” on the display, at which a trace will start to display (start the sweep) if it crosses that point.

The trigger feature allows you to set the conditions of that “specific point” also called a “trigger point”. When the trigger conditions are set, and a trace “meets” those conditions (crosses the trigger point), the trace will start.

Trigger conditions:

- **Vertical scale position (amplitude)**
- **Sweep position** - the horizontal scale position, or position in time
- **Slope direction** - the direction the trace must be moving (up/rising or positive) or (down/falling or negative) when crossing the trigger point.

NOTES:



Triggers can be set on any channel, however only one trigger can be activated (used) at a time.

If a trigger is set outside the range of the scales, a yellow marker (e.g. arrow with plus symbol) will be displayed (Figure 5-20) indicating the trigger is out of range and a confirmation screen will display.

When a trigger is set on a channel, and more than one channel is active (displayed), trigger conditions must be met for that channel in order to display all the other channels.



To turn a trigger on/off:

A trigger is activated by selecting the trigger icon from the control panel, which then automatically initiates trigger slope setup.

1. Select the desired channel's **Trigger** icon.
Each tap of the icon sets the trigger to a different slope setting, or turns the trigger off.
2. Select the desired slope setting, to turn the trigger on.

Trigger Icon	Description
	Rising (up or positive) - Trigger is turned on to start the trace on the rising edge (as signal begins to rise)
	Falling (down or negative) - Trigger is turned on to start the trace on the falling edge (as signal begins to fall)
	Off - Trigger is turned off.

3. Proceed to “**To set trigger position**” next to complete the trigger set up.



To set trigger position:

Trigger position (also called trigger level) can be adjusted in two ways:

- Dragging the trigger marker (Figure 5-19) on the touch screen - rough adjustment
- Using the trigger position control panel (Figure 5-19) - fine adjustment

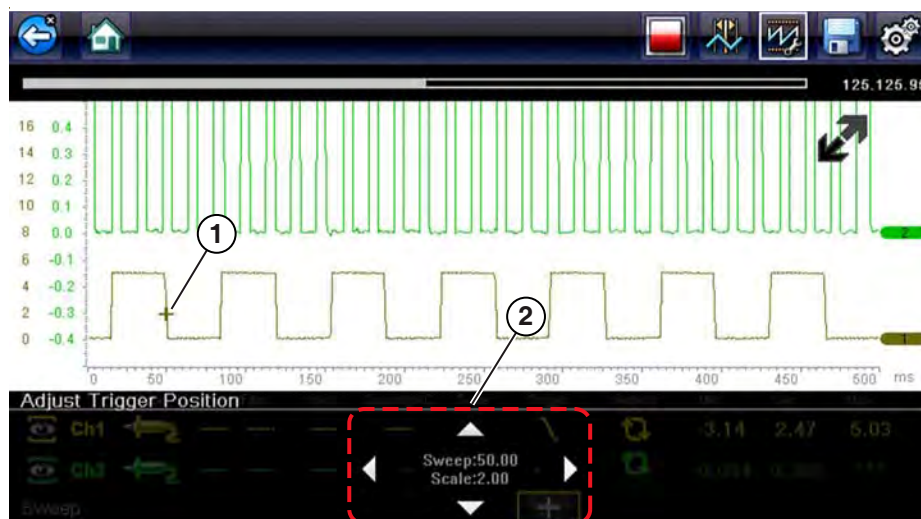
The trigger marker is indicated by a plus symbol (+) on the display (Figure 5-20). The trigger marker represents the trigger point and is displayed on the screen when the trigger is turned on.

To roughly position the trigger marker, select and drag it into position using the touch screen.

4. To more accurately position the trigger marker, select the **Trigger Position Control** icon (Figure 5-20).

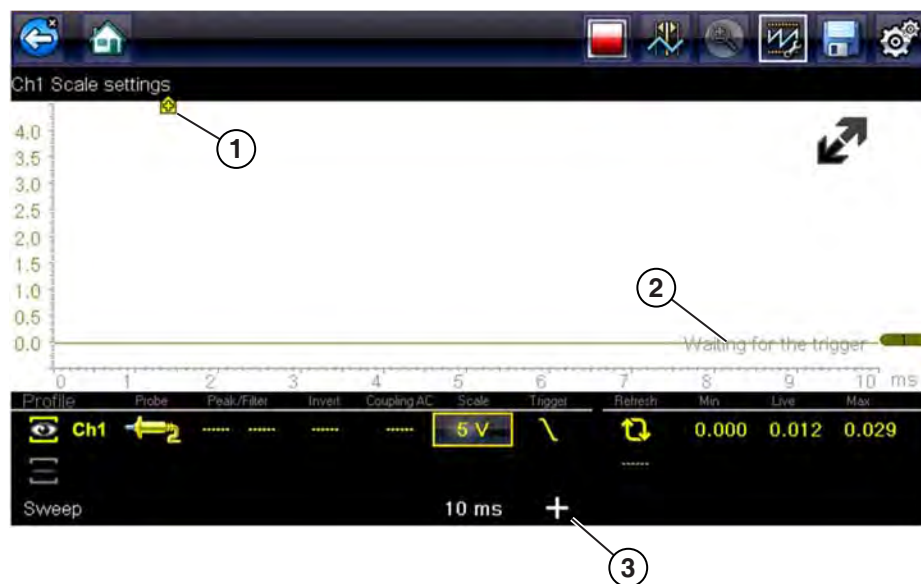
The trigger position control panel opens.

5. Use the directional controls provided, or the thumbpad directional controls to move the trigger marker into position (Figure 5-19). Sweep and vertical scale values are provided in the trigger position control panel, which gives you the precise position of the trigger marker.
6. Press the **N/X** button, to exit.



- 1— Trigger Marker
- 2— Trigger Position Control Panel

Figure 5-19 Trigger marker and position controls



- 1— Trigger Marker (out of range symbol)
- 2— Waiting for Trigger Message
- 3— Trigger Position Control Icon

Figure 5-20

Trigger Auto/Manual Mode (Optional Setting)

**NOTE:**

The Auto and Manual Trigger modes allow you to set the criteria used to display signals on the screen. To change the trigger mode, the trigger must be set on one of the channels.

In both Auto and Manual Trigger mode the screen is updated when the signal crosses the trigger point in the selected direction (rising or falling), however:

- **Auto Trigger**—(default mode)
 - when Auto Trigger is on, even if the signal does not cross the trigger point, the screen automatically updates after a short period (allowing you to see the waveform). When this occurs, the message "Waiting for the trigger" (Figure 5-20) is displayed on the screen. The trigger point can then be set to optimize viewing.
 - **Manual Trigger**
 - when Manual Trigger is on, if the signal does not cross the trigger point the screen will not update. This allows you to capture intermittent events, as the screen only updates when the signal meets your trigger selection.
-

**NOTE:**

When using Manual Trigger, it may be easier to initially set the trigger point using Auto Trigger, as the screen will update regardless if the signal crosses the trigger point. Once the trigger point is set, then switch to Manual Trigger mode.

**Selecting Trigger Auto/Manual Mode:**

1. From the Control Panel (on the test meter screen), turn the trigger on for the desired channel.
2. Select the **Settings** icon from the toolbar.
3. Select **Settings > Configure Scope / Meter > Trigger Mode** from the menu selections.
4. Select either **Auto Trigger** or **Manual Trigger**.
5. Select **Back** or press the **N/X** button to navigate back to the test meter screen.

Threshold

**NOTE:**

The Threshold function is only available in the Graphing Meter function for specific tests. This function may also be referred to as Auto Threshold Select (ATS).

The Threshold function can be used, to display and obtain a more accurate measurement when measuring signals (e.g. Frequency, Duty Cycle, MC Dwell and Pulse Width) that may be difficult to display or have noise or other undesirable variations in the signal. When selected, the Threshold function automatically sets a trigger and determines a threshold level in the middle of the signal range (calculated from the Min and Max measurements) to be used as a reference point to calculate the measurement. The falling edge (slope) of the signal is used in determining the threshold level.

To activate the Threshold function, select the **Threshold** icon, then select **Continue** from the confirmation screen (Figure 5-21). Once selected, the Threshold function remains active until the test is exited.

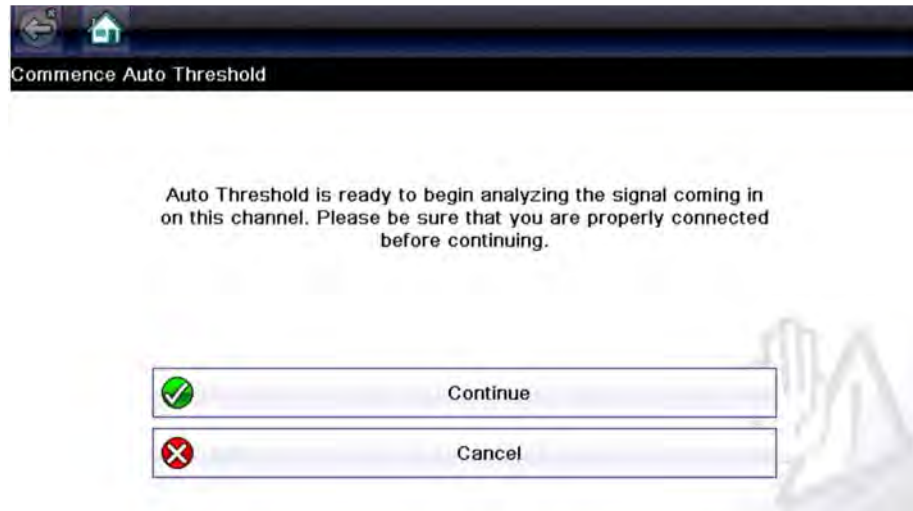


Figure 5-21 Auto Threshold Confirmation Screen

If after enabling the Threshold function, if the signal is still not displayed, reduce the vertical scale setting. Sometimes a low frequency signal may not display if the vertical scale is set too high. If the signal still seems incorrect use the lab scope to verify the signal integrity and signal spacing. Slow or unequal spacing will display as a band or ragged signal, depending on the sweep setting.

Refresh

Selecting the **Refresh** icon (Figure 5-22) clears the active trace(s) displayed and restarts the signal tracking from zero. It also clears the minimum, maximum and live measurements displayed for both channels.

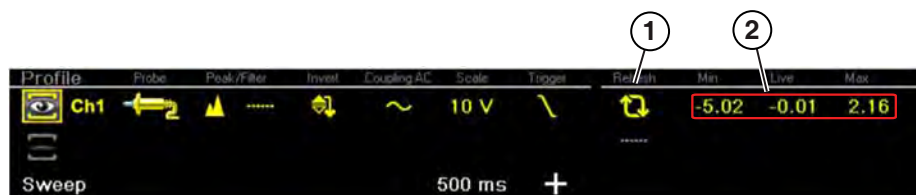
Use the Refresh feature to:

- Track the variation in a component or circuit under a certain condition. If the condition changes, Refresh lets you start tracking again to see the change.
- Verify that a connection problem you found by looking for a dropout or spike in min/max values has been fixed.

Min, Live and Max Display Panel

When Cursors are turned off, the Min, Live and Max display panel (Figure 5-22) is turned on displaying each channel's active signal minimum and maximum recorded measurements and live measurement.

- **Min** - lowest measurement recorded for the signal since the test was activated, or from the last time Refresh was selected
- **Max** - highest measurement recorded for the signal since the test was activated, or from the last time Refresh was selected
- **Live** - represents the "live" running average measurement of the signal being measured



1— Refresh Icon

2— Min, Live, Max Display Panel

Figure 5-22

Cursors



NOTE:

The Cursors feature is only available in the lab scope and Graphing Meter functions.

Two vertical cursors are provided that allow you to make precise signal measurements, when determining signal characteristics such as, amplitude at specific points, and cycle time (duration) or frequency.

Using cursors can also be helpful when performing certain diagnostic tests, such as:

- O2 sensor rich/lean switch time
- fuel injector pulse width frequency
- secondary ignition spark duration
- crankshaft position sensor frequency

Measurements can quickly be taken between the two cursors, when measuring a single cycle or across multiple cycles by positioning the cursors at the start and end of the cycle or multiple cycles.

The cursor measurements panel is displayed when using the cursors, providing you digital values of the cursor measurements. See [Cursor Measurements Panel](#), on page 80 for additional information on the values displayed in the cursor measurements panel.



To turn the cursors on/off:

- To turn the Cursors on (display), select the **Cursor** icon from the toolbar.
Two cursors are displayed on the test screen, and the Refresh, Min, Live, Max display panel is switched off and replaced by the cursor measurements panel. See [Cursor Measurements Panel](#), on page 80 for additional information on the cursor measurements panel.
- To turn the Cursors off, select the **Cursor** icon again from the toolbar.



- 1— Cursors Icon
- 2— Cursor (no. 1)
- 3— Cursor Marker (no. 2)
- 4— Cursor Measurement Panel - amplitude and delta display
- 5— Cursor Measurement Panel - time and delta display

Figure 5-23



To position the cursors:

The cursors can be positioned anywhere within the range of the sweep scale ([Figure 5-23](#)).

- Turn the Cursors on.
- Using the touch screen, select either cursor marker (base) and drag it to the desired position.

Cursor Measurements Panel

When the cursors are turned on, the Refresh, Min, Live, Max display panel is switched off and replaced by the Cursor Measurements Panel.

The cursor measurements panel displays the following signal and cursor measurements:

- Signal amplitude at two points
- Signal amplitude difference (delta) between two points
- Cursor position in time at two points
- Difference (delta) in time between the cursors
- Frequency - frequency of the signal for the time period between cursor 1 and 2

The cursor measurements panel contains values for each channel in two displays.

The amplitude and delta display is provided in the channel specific colour and includes:

- **Cursor 1** - signal amplitude at cursor 1 position
- **Cursor 2** - signal amplitude at cursor 2 position
- **Delta** - signal amplitude difference between cursor 1 and 2

The time and delta display is gray in colour and includes:

- **Cursor 1** - cursor position in time at cursor 1
- **Cursor 2** - cursor position in time at cursor 2
- **Delta** - difference in time between cursor 1 and 2
- **Frequency** - the frequency value (Hz) of the signal for the time period between cursor 1 and 2



NOTE:

Frequency is the number of times a signal repeats itself per second and is measured in hertz (Hz).

The frequency value displayed, is the inverse of the Delta value, and can also be calculated as 1 divided by Delta. The frequency value (Hz) shown is automatically calculated by the scope.

Example 1: Delta = 20.46ms, to get frequency divide 1 by .02046 ($1/.02046 = 48.87\text{Hz}$)

Example 2: Delta = 2.53ms, to get frequency divide 1 by .00253 ($1/.00253 = 395.27\text{Hz}$)

Use applicable decimal point placement during division as the Delta value changes.

5.5.4 Secondary Ignition Testing

The lab scope function can be used to display secondary ignition waveforms for conventional and select CIC and COP systems. To display secondary ignition waveforms, optional secondary ignition coil adaptor(s) and a coil adaptor lead assembly are required.

Contact your sales representative to purchase the optional adaptor leads and/or Secondary Ignition Clip-on or COP/CIC adaptors.

- Adaptor lead assembly needed:
 - Secondary Coil Adaptor Lead Assembly - connects the diagnostic tool to a secondary ignition adaptor (yellow and black scope connectors and black RCA type adaptor connector). See [Secondary Ignition Coil Adaptor Lead and Clip-on Adaptor \(optional\)](#), on page 58.
- Secondary Ignition Adaptors available:

Different secondary ignition coil adaptors are available as optional equipment. These adaptors attach to either the secondary lead (spark plug lead) or directly to the secondary ignition coil in order to pick up the secondary ignition signal.

- Universal kV Ignition Clip-on adaptor - clips over a spark plug or coil lead. See [Secondary Ignition Coil Adaptor Lead and Clip-on Adaptor \(optional\)](#), on page 58.
- Universal stick and flag type adaptors - are loosely positioned next to or on a secondary ignition coil.
 - General purpose single flag pick-up.
 - General purpose stick pick-up.
- Vehicle specific Clip-on adaptors - are directly attached to (or next to) a secondary ignition coil (COP type) or to a distributor cap (CIC type). Secondary ignition coil-on-plug (COP) and coil-in-cap (CIC) adaptors are available for universal and engine specific applications. All the adaptors listed are available individually.
 - OEM specific COP adaptors:
 - *Ford (COP-1)*
 - *Chrysler (COP-2)*
 - *VW/Audi (COP-3)*
 - *Acura/Honda/Isuzu (COP-4)*
 - *Volvo/BMW (COP-5)*
 - *Mercedes-Benz (COP-6)*
 - *Mercedes-Benz Dual Type (COP-7)*
 - *BMW (COP-8)*
 - *Lexus (COP-9)*
 - *Chrysler/Jeep/Lexus/Toyota (COP-11)*
 - OEM specific CIC adaptors:
 - *GM HEI (CIC-1)*
 - *Toyota/Honda (CIC-2)*



Connecting the Secondary Coil Adaptor Leads:

1. Connect the black (ground) lead into the diagnostic tool test lead ground jack.
2. Connect the yellow lead into the diagnostic tool test lead channel 1 jack.
3. Connect the adaptor lead ground clamp to vehicle ground. If a jumper wire is used to extend the length of the adaptor lead ground clamp lead, keep it as short as possible.
4. Connect the adaptor lead RCA plug into the secondary ignition "clip-on" or COP/CIC coil adaptor as needed.
5. Clamp the secondary clip-on adaptor over a spark plug or coil lead, or attach the applicable COP/CIC coil adaptor to the vehicle ignition coil.
6. Isolate the leads from other components, to avoid any unwanted noise that could be induced onto the signal.
7. From the lab scope function, select the Ignition Probe (probe setting).
8. If needed, turn the Invert function on.

Once a signal is displayed, further channel settings may be required to display the pattern characteristics you are looking for.

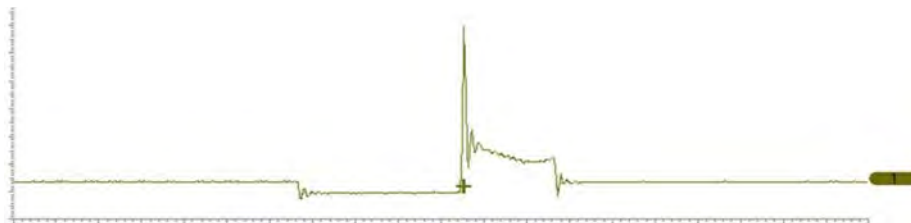


Figure 5-24 Typical Secondary Ignition Signal

5.6 Optional Settings

The following optional Scope/Meter settings are available, and can be set to your preference:

- [Trigger Auto/Manual Mode \(Optional Setting\)](#), on page 76
- [Display \(Grid on/off\)](#), on page 82
- [Divisions](#), on page 83

All optional settings are available from the Tools icon located on the Home screen. Select **Tools > Settings > Configure Scope/Meter** to access the options menu.

5.6.1 Display (Grid on/off)

The Display option allows you to turn the screen grid on/off.

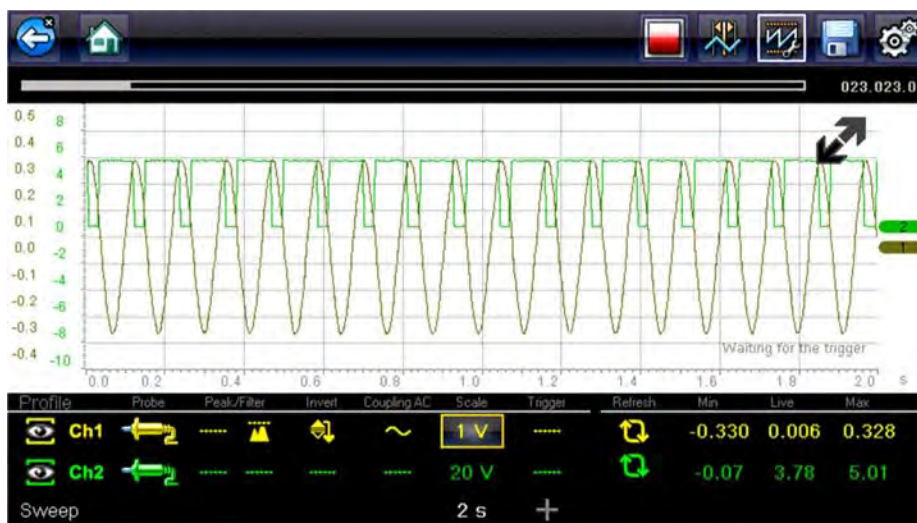


Figure 5-25 Grid on



Changing the Display (grid on/off):

1. Select the **Tools** icon from the Home screen.
2. Select **Settings > Configure Scope/Meter > Display** from the menu options.
3. Select the desired option:
 - **Show Grid**—turns grid lines on
 - **Hide Grid**—turns grid lines off
4. Select the **Back** icon or press the **N/X** button to return to the Settings menu.

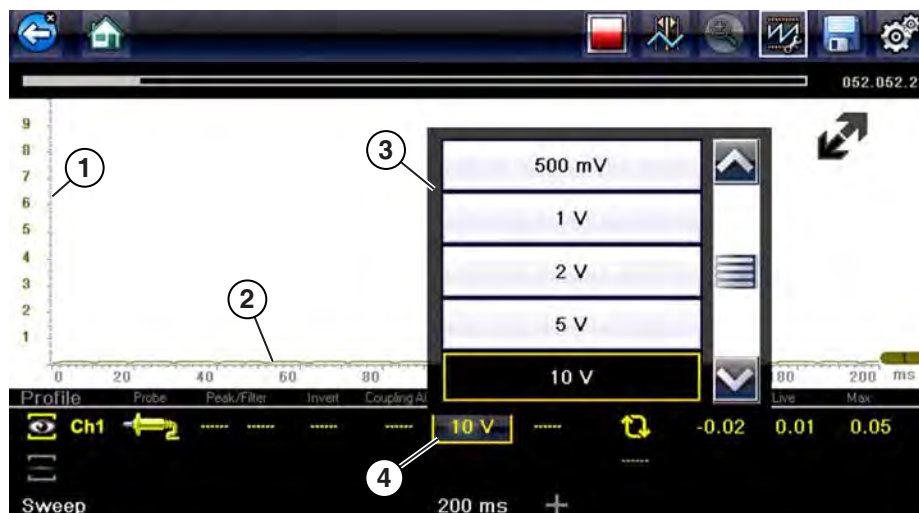
5.6.2 Divisions

The Divisions options allow you to change (to your preference) how the Vertical Scale Menu selections are represented, and the type of value that displays in the Vertical Scale icon.

This section describes the following settings:

- **Trace**
 - Trace Full Scale
 - Trace Per Division
- **Display**
 - Display Full Scale
 - Display Per Division

The following illustration is for reference, and identifies key terms and features used in this manual.



- 1— Vertical Scale
- 2— Sweep (horizontal or time) Scale
- 3— Vertical Scale Menu
- 4— Vertical Scale Icon

Figure 5-26



To access the divisions option menu:

1. Select **Tools** from the Home screen.
2. Select **Settings** from the Tools and Setup menu.
3. Select **Configure Scope/Meter** from the Settings menu.
4. Select **Divisions** from the menu.

5. Select either option:
 - **Trace Settings** - see [Trace Settings](#), on page 84
 - **Display Settings** - see [Display Settings](#), on page 85
6. Select the **Back** icon or press the **N/X** button to return to the Settings menu.

Trace Settings

The Trace Settings option allows you to change how the vertical scale menu selections are represented.



NOTE:

This setting **ONLY** changes the vertical scale, the sweep (horizontal) scale is **NOT** changed.



NOTE:

When adjusting the vertical scale setting, it is important to remember that the vertical scale is divided into 10 major divisions, and all scale adjustments reflect this factor of 10. The division set of 10 cannot be changed, divisions cannot be added or removed.

Trace Full Scale - changes the dropdown vertical scale menu selections to full scale mode, which represents the selected unit of measurement over the entire (full) scale.

Example (Figure 5-27): Selecting 10V, changes the vertical scale to a 10V volt scale. The vertical scale is “always” divided by 10, therefore each division is incremented by 1V.

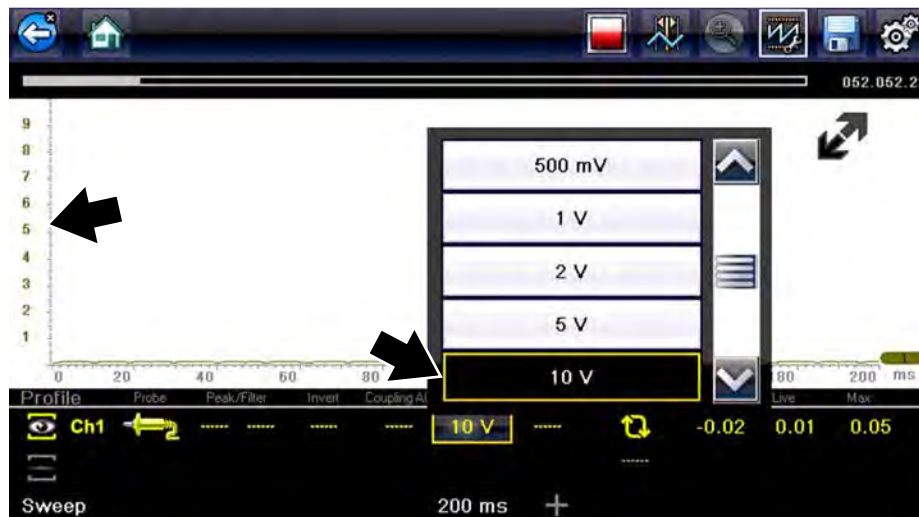


Figure 5-27

Trace Per Division - changes the dropdown vertical scale menu selections to ##/div mode, which in turn changes the vertical scale to represent ## by division.

- represents (variable) what is being measured (voltage, amperage, pressure etc.)

Example (Figure 5-28): Selecting 1.0V/div, displays a vertical scale divided by 10. The vertical scale is “always” divided by 10, therefore each division is incremented by 1.0V, thus a 10V scale.

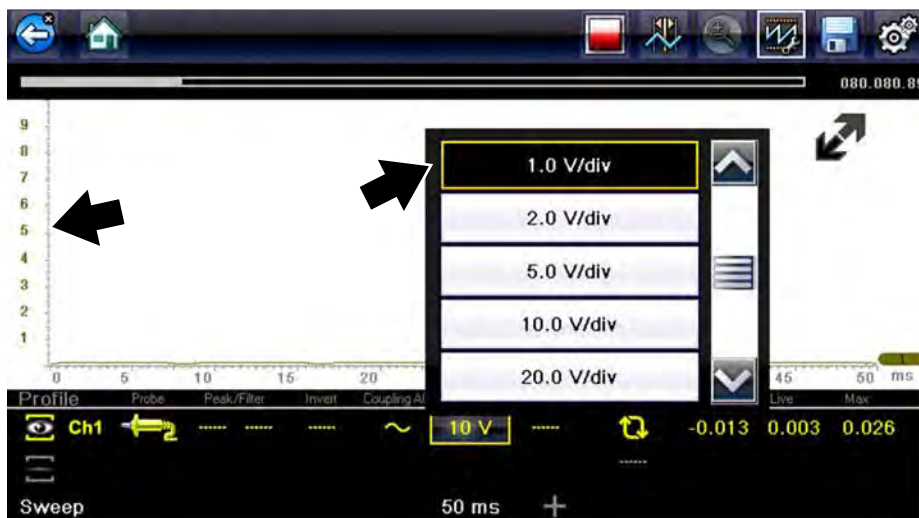


Figure 5-28

Display Settings

The Display setting allows you to change the displayed value in the Vertical Scale icon to your preference.



NOTE:

This setting ONLY changes the value displayed in the Vertical Scale icon.

Display Full Scale - displays the value of the entire (full) scale

Example (Figure 5-29): If the vertical scale is set to 1V, the value displayed is 1V.

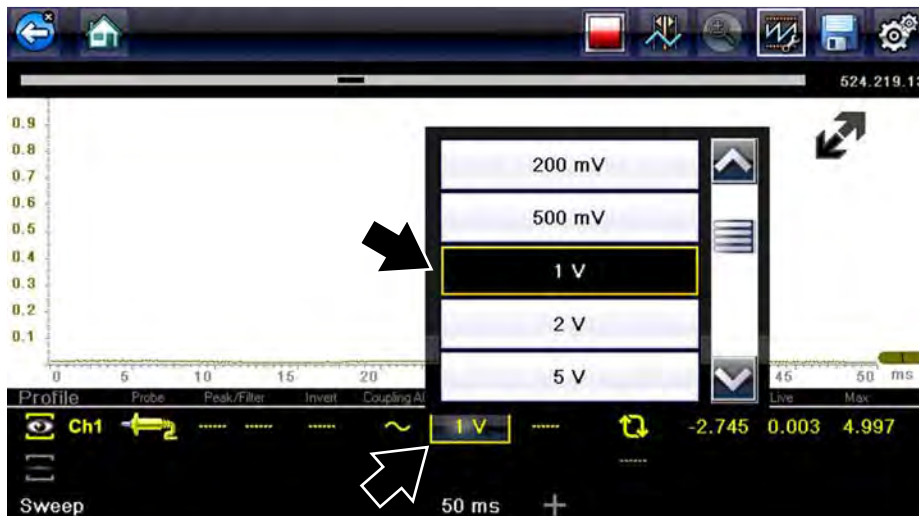


Figure 5-29

Display Per Division - displays the graduation value of the major scale divisions

Example (Figure 5-30): If the vertical scale is set to 1V, the value displayed is 0.1V.

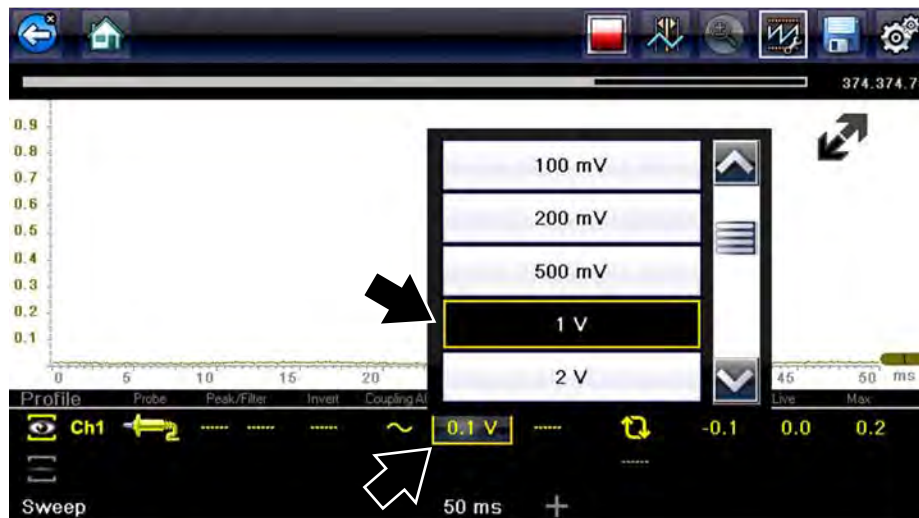


Figure 5-30

5.7 Saving and Reviewing Scope / Multimeter Data Files

The following section describes the procedures used to save and review Scope/Multimeter and Guided Component Tests data files.

5.7.1 Data Buffer

The graphing multimeter and lab scope functions have the capability to save, store and playback, data (test signals) utilizing internal storage memory and buffer memory.

When a test function (e.g. Lab Scope > DC Volts) is selected and displays onscreen, a data buffer automatically starts to store data in buffer memory. The data buffer runs continuously (storing data) until the Stop icon is selected.

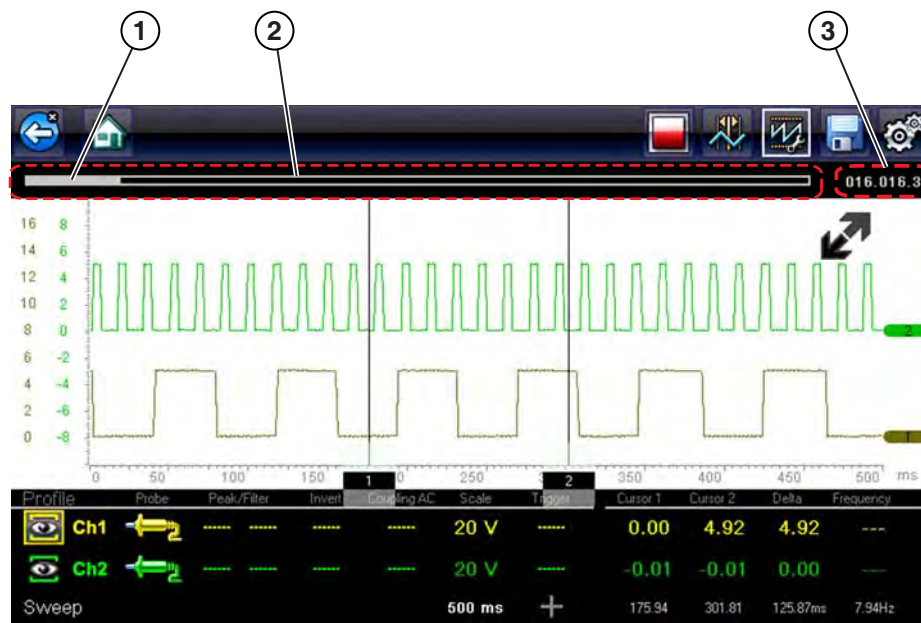


NOTE:

The data buffer starts and runs continuously with or without an active input test signal, when a test function is selected.

The Data Buffer Indicator can be used to visually see the amount of stored buffer data. This graphical indicator contains a slider within a bar graph. The bar graph shows how much stored data is in the memory buffer. The slider indicates the position of the current screen in relation to the entire memory buffer contents.

The Data Buffer Position Counter displays a numerical value, indicating the position of the current displayed frame of data within buffer memory.



- 1— Data Buffer Indicator Slider
- 2— Data Buffer Indicator Bar Graph
- 3— Data Buffer Position Counter

Figure 5-31

Buffer memory is limited to a predetermined “total” size. When buffer memory reaches its full capacity, the data buffer will continue to store new data, however earlier stored data will be removed to allow room for the new data being stored.

The most recent data is always available for review when the scope is stopped, and can be reviewed using the toolbar controls.

5.7.2 Saving Files

Selecting the **Save** icon writes the data stored in buffer memory to a file. Saving data files is useful when trying to isolate an intermittent problem or to verify a repair during a road test. The saved file can be played back (similar to a movie clip) by selecting **Previous Vehicles and Data > View Saved Data**. See [View Saved Data](#), on page 114 for additional information.



NOTE:

The **Save icon** performs the same function as “Save Movie” function choice for the programmable **Shortcut** button, see [Configure Shortcut Button](#), on page 117 for details.

The saved file can also be downloaded to a personal computer (PC) using the Mini USB jack. Once connected to the PC, the files can be printed, transferred, and copied using ShopStream Connect. ShopStream Connect is a companion application that interfaces the diagnostic tool with a PC. ShopStream Connect is available at no cost, and can be downloaded online. See the ShopStream Connect website information at the front of this manual for additional information.

The toolbar control icons are described in [Scope Multimeter Control Icons](#), on page 61 and [Common Toolbar Control Icons](#), on page 14.



To save files:

- Select the **Save** icon from the toolbar.

A save dialog box displays while files are being saved. The file is saved when the message box disappears.

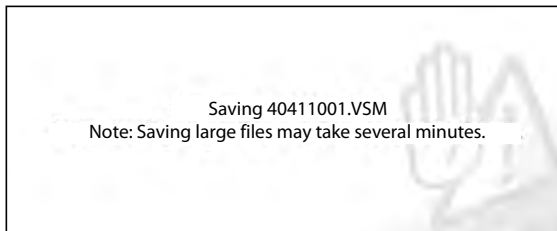


Figure 5-32 Save dialog box

5.7.3 Stopping and Reviewing Data Files

During normal scope multimeter operation, data is continuously being stored in buffer memory as it is displayed onscreen. The Stop feature, allows you to temporarily stop the waveform (signal) to review it in detail.



NOTE:

Glitches may cause drivability problems and may not turn on the MIL or set DTCs. As a general guide when looking for a suspected signal glitch, always try to verify the problem by duplicating the conditions while capturing data. Utilize the GMM to monitor the signal over longer time periods and review the histogram for possible faults.



To stop and review data files

Playback control icons are described in [Scope Multimeter Control Icons](#), on page 61 and [Common Toolbar Control Icons](#), on page 14.

1. While viewing a waveform (capturing data), select the **Stop** icon.
The playback control icons are displayed.
2. Select the desired playback control icon to step forward or backward through the data.
You can also use the data buffer indicator slider to quickly scroll through the captured data in buffer memory ([Figure 5-33](#)).



- | | |
|-----------------|---------------------------------|
| 1— Skip Back | 4— Step Forward |
| 2— Skip Forward | 5— Record |
| 3— Step Back | 6— Data Buffer Indicator Slider |

Figure 5-33



To resume:

- Select the **Record** icon.
The display changes back and the **Stop** icon is shown on the toolbar.



NOTE:

The **Shortcut** button can be set to perform the Pause/Play function. See [Configure Shortcut Button](#), on page 117 for additional information.

5.7.4 Saving Screens

The **Shortcut** button can be programmed to save a snapshot (screen shot) of a visible screen as a bitmap file, see [Configure Shortcut Button](#), on page 117 for details. The saved file can be viewed by selecting **Previous Vehicles and Data > View Saved Data**, see [View Saved Data](#), on page 114 for additional information.

5.7.5 Using the Zoom Function

The zoom function allows you to change the magnification level of the signal sweep during data review. Changing magnification levels allows you to compress or expand multiple screens of data to quickly find glitches, or signal losses.

Example: While monitoring a MAF (Mass Air Flow Sensor) signal, the waveform displays normally. As the signal is being monitored, an erratic “condition” suddenly develops, then goes away, but may have not been observed on the screen. Stopping the data capture (when such an event occurs) allows you to analyze the waveform using a higher zoom level (wider view) to look for a glitch in the signal.

During data capture, the default magnification level is 1x. The zoom function is not available until data capture is stopped by pressing the **Stop** icon (Figure 5-35).



1— Stop Control Icon

Figure 5-34



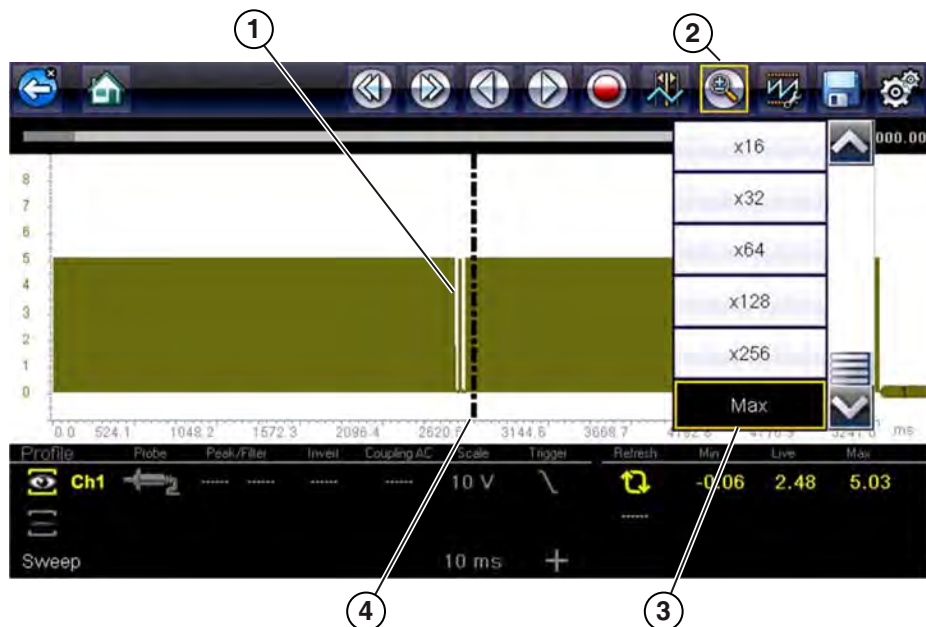
NOTE:

Zoom playback controls are identical to the standard playback controls used when reviewing data files, with the following exception:

Skip Forward / Skip Back control icons - (press once) moves multiple steps relative to set magnification level (e.g. 2X setting, moves 2 steps; 16X setting, moves 16 steps)

Additional information on playback control icons are described in [Scope Multimeter Control Icons](#), on page 61 and [Common Toolbar Control Icons](#), on page 14.

When the **Zoom** icon is selected the display defaults to the "Max" magnification level and a dropdown scroll menu displays. The dropdown menu allows you to select the display magnification level from a range of 1X to 256X. The "Max" (maximum) option displays all data captured on one screen (Figure 5-35).



- 1— Waveform Glitches
- 2— Zoom Icon
- 3— Zoom Magnification Level (Max shown)
- 4— Zoom Cursor

Figure 5-35 "Max" Magnification Level - displays all captured data

When zoom levels of 2X and higher are selected, a Zoom cursor (vertical dashed line) (Figure 5-35) displays onscreen. The cursor is used to quickly mark and navigate to points of interest or glitch in a captured waveform.

The Zoom cursor can be used to mark the approximate position of a glitch and can be manually dragged onscreen to the desired position. The new cursor position will be centered on the screen when a lower magnification level is selected. Figure 5-36 shows examples at 32X and 64X with the Zoom cursor positioned in the area of a signal drop glitch.

NOTE: To quickly identify a glitch in a pattern, it may be easier to initially view the waveform at a higher magnification level (e.g. 256X or "Max") to display the entire captured waveform, then lower the zoom level to 8X or 2X to review in detail.



1— Waveform Glitches

2— Magnification Level at 128X

3— Magnification Level at 32X

Figure 5-36 Examples of Magnification Level at 32X and 128X

Figure 5-37 shows an example at 16X of the same waveform shown in Figure 5-35 and Figure 5-36. In Figure 5-37 at 16X the glitches are easily seen as compared to higher magnification levels.

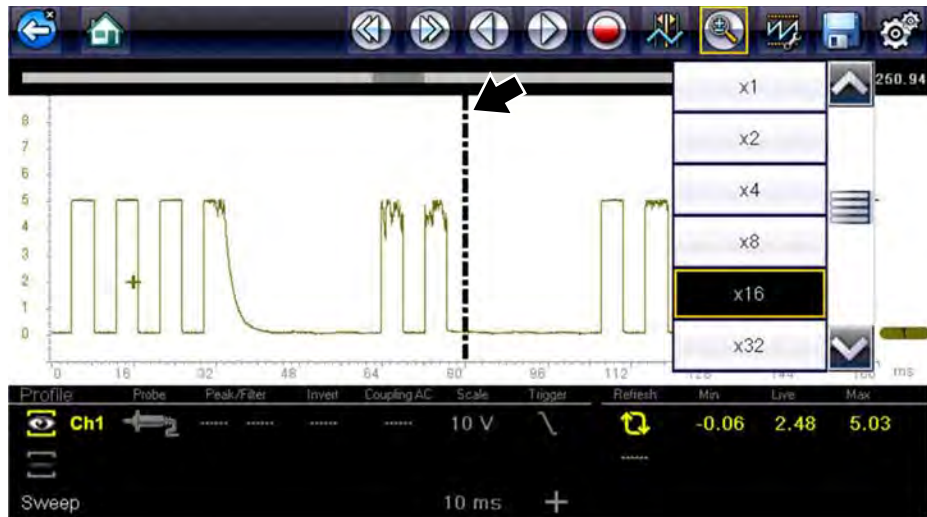


Figure 5-37 Example of Magnification Level at 16X. (For illustration purposes, the Zoom cursor has been positioned in the area near the glitches.)

5.8 General Reference

5.8.1 Basic Setup Tips (unknown signal type)

When conducting automotive diagnostics, situations may arise when you need to capture and analyze a signal that you are not familiar with, or know what the intended waveform pattern should look like, or even how to set the scope to acquire the signal.

The following tips are intended to provide guidance, at the most basic level to assist you in your lab scope diagnostics.

Testing information and/or procedures for testing certain components may be available in the Guided Component Test function, see [Guided Component Tests](#), on page 101 for additional information. If you have already narrowed down the system and/or component to test, ID the vehicle within the Guided Component Test function, and check the available tests first, as this may save you some time.

If the Guided Component Test function, does not have the test you are looking for, you need to determine a few things about what you are testing to get the scope / meter set up to capture a signal or make a measurement.



NOTE:

Testing information and known good waveform libraries may also be available from online sources. Obtaining correct testing reference information can be a key advantage in making sound repair decisions.

Listed below are a few basic questions to help narrow down the testing direction to follow.

- Are you looking to make or test a simple voltage or current level or maybe check resistance or continuity? Then you may want to use the DMM.
- Are you looking to check a circuit/component for an erratic dropout or make a frequency test? You may want to use the GMM.
- Do you need to see signal details (level, shape, frequency etc.)? The lab scope may be the best choice.
- Are you testing a DC or AC signal?
- What is the operating range of the circuit?
- Do you know what type or shape the intended waveform should be?

After answering the questions above (at a minimum), you need to determine which Scope / Multimeter test function you are going to use (e.g. Lab Scope, DMM or GMM). See [Tests and Capabilities \(Quick Reference\)](#), on page 55.

Once your test function is selected, you can now connect the test leads and select the applicable probe and scales:

Probe (test) type, see [Probe \(Probe type “test” selection\)](#), on page 69

Vertical scale, see [Scale \(Vertical scale adjustment\)](#), on page 66

Sweep scale, see [Sweep \(Horizontal or Time scale adjustment\)](#), on page 67

Connect the test leads or probe, to the applicable test point(s). Always use the correct lead or probe designed for the test and ensure the signal and ground connections are clean and secure.

For the initial setup, you may wish to turn other channel settings off (e.g. Peak, Filter, Invert, AC Coupling, Threshold etc.), as these may affect the signal display. See [Channel Settings](#), on page 70.

As a default setting, trigger is normally off. The scope/meter uses internal circuitry to display a signal if present. However, in certain circumstances additional channel adjustments may be required, or the trigger mode may have to be turned on, for a signal that is present but is not displayed. You may also need to readjust the vertical scale if set to low, in order to bring the signal into the viewable display area.

At this point you should have a visible signal on the screen. An ideal signal should be displayed within the area of the display.

- If the signal goes beyond the top and bottom of the display, try and readjust the vertical scale to a higher setting, to bring the signal into the viewable display area.

Use the zero baseline controls or move the zero baseline marker onscreen to move the zero baseline of the signal vertically on the screen to the desired position. See [Trace \(Zero Baseline position adjustment\)](#), on page 71.

- If the signal cycles are compressed (close to each other), try and readjust the sweep scale (horizontal scale) to a lower setting to display less cycles.

Once you have a usable signal displayed, if needed use the trigger function to stabilize a changing or erratic signal (a signal that may flicker or drift), so that it is easier to view. Try and set the trigger at the mid-point of the signal, and then adjust as needed from there. See [Trigger](#), on page 73.

As all signals are different, and due to other variables, additional adjustments may be needed to get the signal displayed exactly how you need. Review the channel settings section in this manual for additional information on using the settings. See [Channel Settings](#), on page 70.

At this point you should have a signal displayed that will allow you to see the overall signal characteristics, and allow you to begin your diagnosis.

Comparing your captured waveforms to known good waveforms, can be a time saver and provide supporting evidence when trying to determine a fault. See [Using Known Good Waveforms](#), on page 94 for additional information.

5.8.2 Using Known Good Waveforms

In some cases captured waveforms may not provide enough information to determine if a suspected sensor or circuit is at fault. Comparing the test vehicle waveforms to known good waveforms, can help to provide supporting evidence when trying to determine a fault.

Known good waveform examples may be available from different sources including the Guided Component Tests function, and online information sources.

As good practice, capturing waveforms before and after the repair will help you to build your own library of waveforms for future troubleshooting.

5.8.3 Troubleshooting Signals

When capturing signals, you may occasionally encounter problems with the way the signal initially displays. Noise, hash, fuzz are some of the terms used to describe, unwanted signals displaying in or on the signal you are trying to capture, basically making the signal unclear. The following tips are intended to provide some basic guidance, to help resolve these types of issues if encountered.

- Make sure you have the correct test leads connected to the applicable test point(s) and test lead jacks on the diagnostic tool.
- Ensure the signal and ground connections are clean and secure, at the test points and diagnostic tool.
- Ensure the polarity of the test leads connections are correct.
- If using stackable connectors, try to isolate or only connect the leads being used to capture the signal.
- Make sure the ground lead is providing a direct ground from the circuit to the diagnostic tool test lead jack.
- Isolate the test leads from other components, leads, or systems that may induce unwanted noise into the signal being tested (e.g. electric motors, secondary ignition components, relays, alternators, etc.)
- Use the shortest test leads possible.
- Try different test leads, to verify the issue. Use the recommended snap-on leads or probes available for the diagnostic tool or equivalent. Shielded test leads are recommended.
- Check the test lead or probes for damage.
- Enable or disable channel controls also to help try and clean the signal:
 - [Peak Detect](#)—maximizes sampling rate, but may pickup unwanted noise
 - [Filter](#)—removes signal noise or interference
 - [Invert](#)—switches signal polarity
 - [Coupling AC](#)—blocks the DC portion of signal
 - [Threshold](#)—provides a more accurate measurement on select GMM tests where noise is present
 - [Scale \(Vertical scale adjustment\)](#)—adjusts vertical scale. Using a higher setting may provide a cleaner signal in some situations.

For signals that do not display or display off the screen, erratic, compressed etc.:

- Use a trigger to help stabilize the signal. Try and set the trigger at the mid-point of the signal, and then adjust as needed from there. See [Trigger](#), on page 73.
- If the signal wraps off the top and bottom of the display, try and readjust the vertical scale to a higher setting, to bring the signal into the viewable display area. See [Scale \(Vertical scale adjustment\)](#), on page 66.
- If the signal cycles are compressed (close to each other), try and readjust the sweep scale (horizontal scale) to a lower setting to display less cycles. Try a higher setting if the cycles are spread too far across the screen and seem flat. See [Sweep \(Horizontal or Time scale adjustment\)](#), on page 67.
- Move the zero baseline marker to move the zero baseline of the signal vertically on the screen to the desired position. See [Trace \(Zero Baseline position adjustment\)](#), on page 71.
- Check calibration of test leads or probe(s) if applicable. See [Test Lead / Probe Calibration](#), on page 64.

5.8.4 Units of Measurement / Conversions

Base Units	
(Symbol) / Unit Prefix	Typical Expressions
(μ) micro	0.000001 or 10^{-6} or 1/1,000,000
(m) milli	0.001 or 10^{-3} or 1/1,000
(c) centi	0.01 or 10^{-2} or 1/100
(k) kilo	10^3 or 1,000
(M) mega	10^6 or 1,000,000

Electrical Units	
(Symbol) / Description	Equivalents
(V) Voltage	$V = I \times R$
(I) Current	$I = V \div R$
(R) or (Ω) Resistance	$R = V \div I$
(Hz) Frequency	$f(\text{freq.}) = 1 \div T(\text{time})$ or 1 cycle per second
Voltage	
(μV) microvolt	1 μV = 0.000001 V
(mV) millivolt	1 mV = 0.001 V
(V) volt	1 V = 1000 mV
(kV) kilovolt	1kV = 1,000 Volts.
Ohms	
(mΩ) milliohm	1 mΩ = 0.001 ohms
(Ω) ohm	1 Ω = 1000 mΩ
(kΩ) kilohm	1 kΩ = 1000 Ω
(MΩ) megaohm	1 MΩ = 1,000,000 Ω
Amperes	
(μA) microamps	1 μA = 0.000001 amps
(mA) milliamps	1 mA = 0.001 amps
(A) amps	1A = 1000 mA
(ka) kiloamps	1 ka = 1000 amps
Frequency	
(MHz) megahertz	1 MHz = 1,000,000 Hertz
(kHz) kilohertz	1 kHz = 1000 Hertz

Pressure Units	
(Symbol) / Description	Equivalents
(psi) pounds per square inch	1 psi = 6894.757 Pa 1 psi = 0.06894757 bar 1 psi = 2.036021 inHg
(bar)	1 bar = 14.50377 psi 1 bar = 100000 Pa 1 bar = 29.52999 inHg
(Mbar) Millibar	1 Mbar = 0.001 bar
(Pa) pascal	1 Pa = 0.0001450377 psi 1 Pa = 0.00001 bar 1 Pa = 0.0002952999 inHg

Pressure Units	
(Symbol) / Description	Equivalents
(kPa) KiloPasca	1 kPa = 1000 Pa
(MPa) Megapascal	1 MPa = 1,000,000 Pa
(inHg) inches of mercury	1 inHg = 0.03386388 bar 1 inHg = 0.4911541 psi 1 inHg = 3386.388 Pa

Pressure Conversions
psi x 0.0689 = bar
psi x 6.8950 = kPa
psi x 0.0703 = kg/cm ²
bar x 14.5030 = psi
bar x 100.0000 = kPa
bar x 29.5300 = inHg (60°F)
kPa x 0.1450 = psi
kPa x 0.0100 = bar
kPa x 0.0102 = kg/cm ²
kPa x 0.295299 = inHg
kg/cm ² x 98.0700 = psi
kg/cm ² x 0.9807 = bar
kg/cm ² x 14.2200 = kPa
inHg (60°) x 0.0333 = bar
inHg (60°) x 3.3770 = kPa
inHg (60°) x 0.0344 = kg/cm ²
inHg x 25.4 = mmHg
mmHg x 0.003994 = inHg

Temperature Units	
(Symbol) / Description	Conversions
(°C) degree Celsius	°C = 0.556 x (°F - 32)
(°F) degree Fahrenheit	°F = (1.8 x °C) + 32

Time Units	
(Symbol) / Description	Equivalents
(μs) microsecond	1 μs = 0.000001 of a second
(ms) millisecond	1 ms = 0.001 of a second
(s) second	1 s = 1000 ms

Duty % to Dwell Conversions			
Duty Cycle	Dwell		
	4 cyl	6 cyl	8 cyl
%			
10	9.0	6.0	4.5
20	18.0	12.0	9.0
30	27.0	18.0	13.5

Duty % to Dwell Conversions			
Duty Cycle	Dwell		
%	4 cyl	6 cyl	8 cyl
40	36.0	24.0	18.0
50	45.0	30.0	22.5
60	54.0	36.0	27.0
70	63.0	42.0	31.5
80	72.0	48.0	36.0
90	81.0	54.0	40.5
100	90.0	60.0	45.0

5.8.5 Glossary of Common Terms

Term / Abbreviation	Description
AC	Alternating Current - electrical current that switches polarity at regular intervals.
Aliasing	An effect that causes an incorrect signal to be displayed and/or causes a trigger to malfunction, due to the input signal exceeding the sample rate of the scope.
Amperage	The strength of an electric current, expressed in amperes
Amplitude	Vertical magnitude (level or position) of a signal, or the varying quantity from its zero value.
Buffer	An electronic reservoir for temporary storage of data
Cursor	Onscreen markers used to measure time, amplitude and frequency
Coupling AC	Function used to subtract the average value of a signal so that small variations can be displayed in the waveform.
DC	Direct Current - electrical current that flows in one direction only
Delta	Difference in time between two events.
Dropout	An intermittent or unwanted, vertical fall in a signal to zero that may cause an undesired result.
Duty cycle	Measurement of the length of a signals on time. Specified as a percentage (ratio), of the total cycle time.
Dwell	Used to measure a signals on time in degrees of dwell. Commonly used to measure mixture control solenoids on carbureted feedback engines and specified in duty cycle %.
Dwell 60	Measurement of the length of a signals on time displayed on a 0 to 60 degree scale. 0° = 0%; 30° = 50%; 60° = 100%.
Dwell 90	Measurement of the length of a signals on time displayed on a 0 to 90 degree scale. 0° = 0%; 45° = 50%; 90° = 100%.
Filter	Function used to filter or smooth out spikes and fast variations in signals.
Frequency	The number of times a signal repeats in one second. Measured in Hertz (cycles per second).
Glitch	An intermittent or unwanted, error in a signal that may cause a false or undesired result.
Grid	The graph displayed on the scope screen that is made up of the x and y axis scales that aid in the measuring of signal characteristics.

Term / Abbreviation	Description
Horizontal Scale	See Sweep Scale
Invert	Function used to switch signal polarity,
Lambda (λ)	Used to represent a numerical value denoting the actual measured air/fuel ratio with respect to the ideal air/fuel ratio at stoichiometry. Lambda equals one (1) when the actual air/fuel ratio is equal to the theoretical (stoichiometric) air/fuel ratio of 14.7 (14.66) to 1. Lambda less than 1 means excess fuel; greater than 1 means excess air.
Megasamples per second (MS/s)	Sample rate unit equal to one million samples per second
Noise or Hash	Unwanted voltage, current or signal interference that is imposed on a signal.
Parasitic Voltage	Trace voltage in a circuit after the main power source is disconnected.
Peak	The maximum amplitude value present in a varying or alternating voltage. This value may be either positive or negative.
Peak Detect	Peak detect captures and evaluates all signal sample points, in order to display fast occurring events or glitches.
Pressure Transducer	Electronic device that converts pressures (negative/positive) to electrical signals.
Pulse	A signal with abrupt (fast) signal direction changes in a positive or negative direction, with consistent level and duration.
Pulse Period	One complete on and off cycle or time period.
Pulse Train	Collection of signal pulses traveling together.
Pulse Width (duration)	Measurement of a signals on time in a circuit that pulses on and off. Specified in units of time.
Pulse Width Modulation (PWM)	A signal that continuously cycles on and off while the on-time varies within each cycle.
RMS	The RMS (root mean square) value of alternating currents and voltages is the effective current or voltage applied, rather than the peak current or voltage measurable. The AC RMS voltage value can be defined as the equivalent DC voltage of the AC voltage measured. RMS values are commonly used in AC electrical measurement, as they are more representative of DC measurements.
Sample Rate	Number of times (frequency) the scope/meter takes a sample of the signal. Specified in mega samples per second (MS/s).
Sampling	Process of obtaining a sequence of instantaneous values for a signal at regular or intermittent intervals. When a quantity of samples are collected the operational status of the device is determined.
Screen Update Rate	How often the captured data is (updated) displayed on the screen.
Signal	Detectable voltage, current, or magnetic field, by which specific information is transmitted in an electronic circuit or system.
Square Wave	A square or rectangular waveform (digital) which alternately switches high to low (on/off) for specific lengths of time, that has very fast rise and fall times.
Sweep Scale	The horizontal scale on the grid. Also referred to as time scale or x axis.

Term / Abbreviation	Description
Threshold	The threshold function automatically sets a trigger and determines a threshold level in the middle of the signal range (calculated from the Min and Max measurements) to be used as a reference point to calculate the measurement.
Trace	The actual visible line displayed on the scope screen.
Trigger	A conditional function that initiates if and when a trace is drawn on the screen.
Trigger Slope	The slope that a trigger source signal must reach before the trigger circuit initiates a sweep
VAC	Volts Alternating Current
VDC	Volts Direct Current
Vertical Scale	The vertical scale on the grid or (y-axis) represents what is being measured (voltage, amperage, pressure etc.), and the unit of measurement it is being measured in.
Volt	Unit of electric potential difference.
Voltage	Electromotive force or potential difference, expressed in volts.
Voltage (inductive) Kick	A voltage, many times higher than the applied voltage, produced by the collapsing magnetic field in a coil when the current through it is abruptly terminated.
Waveform	The graphic representation (form) of a signal over time, which the trace displays on the screen.
Zero Base Line	Reference setting or 0% level of a graph scale.

The Guided Component Tests function provides you with an extensive collection of vehicle specific component tests and reference information. It is like having access to a complete library of automotive repair manuals for testing multiple vehicle components.



The preconfigured meter tests and reference information provided are vehicle specific and designed to help save you diagnostic time, verify faulty components, and verify the repair.

Detailed instructions and reference information are provided to guide you through the testing process, from locating the component, to selecting the appropriate test, showing test lead connections, and illustrating electrical connector and pin configurations. In addition, test results (including waveform examples), procedures, tips, and specifications may also be provided.

**NOTE:**

Availability of tests and information may vary.

As an added resource, the Extras Menu provides even more support by including (non-vehicle specific) tests and resources that allow you to quickly perform common tests, review basic reference information and more.

6.1 Extras Menu (Top Level Menu Items)

The Extras Menu is a companion feature to the Guided Component Tests function. This resource includes a wide collection of common (non-vehicle specific) reference information and tests, such as measuring fuel pump current ramp, and monitoring CKP and CMP signals simultaneously. Also included are, basic component operation and theory information, testing procedures, tips, definitions, illustrations, diagnostic tool feature descriptions and accessory information.

Select the Extras icon (Figure 6-1) from the Guided Component Tests home screen to access the Extras menu options. Each menu option is described in the following sections.

- [Power User Tests](#), on page 102
- [How To Guide](#), on page 103
- [Features and Benefits](#), on page 104

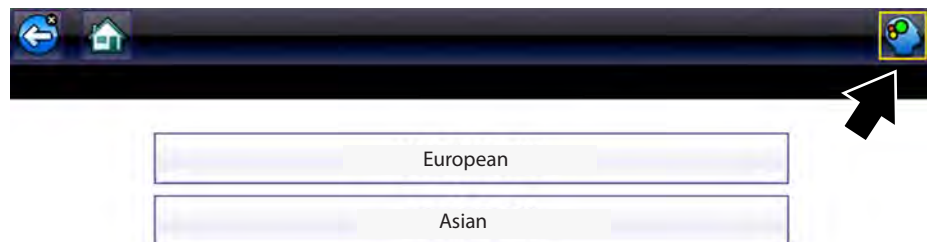


Figure 6-1 Extras Icon on Guided Component Tests Home Screen

6.1.1 Power User Tests

Power User Tests provide you quick access to preconfigured meter tests for a number of common automotive system tests. Most tests provide onscreen help and testing information along with a description of the test and the expected results, including known good waveforms.

Here is a sample listing of the types and specific tests that may be available within Power User Tests:

- Current Probe Tests - provides common tests configured to use the Snap-on Low Amp Current probes or generic Low Amp Current probes. Snap-on Low Amp Current Probe operation information is also provided within the *Snap-on Low Amp Probe Reference Manual* option.
 - Fuel Injector Current Ramp (multiple types)
 - Fuel Pump Current Ramp
 - Fuel Pump RPM Calculation
 - Ignition Coil Current Ramp (multiple types)
 - Parasitic Draw
 - Snap-on Low Amp Probe Reference Manual
- Dual Channel Tests - provides common tests configured to measure or compare two signals
 - CAN-BUS High/Low
 - CKP and CMP Relationship
 - EGR Solenoid and Position Sensor
 - EVAP Solenoid and Diagnostic Switch
 - FlexRay Bus
 - Injector and Oxygen Sensor
 - Knock Sensor and EST
 - MC Dwell and Oxygen Sensor
 - Pre and Post Cat Oxygen Sensors
 - Throttle Positions 1 & 2
 - WSS (Hall Effect Type)
- Transducer Tests - provides common single and dual channel tests configured to measure various types of pressures, voltage and current. Transducers are available as optional equipment.
 - A/T Line Pressure and Shift Solenoid
 - A/T Line Pressure Test
 - EGR Temperature Sensor and EGR Vacuum
 - Exhaust Back Pressure Test
 - Fuel Pressure and Fuel Pump Current
 - Fuel Pressure and Fuel Pump Voltage
 - Fuel Pressure Test

How To Guide

The **How To** option provides multiple topics and references ranging from instructional and basic theory to troubleshooting and testing instructions. Menu options may include:

- **10-minute Electronic Classes**—provides basic electrical theory and testing information. Topics may include:
 - Ohm's Law
 - Variable Resistors
 - Amperage
 - Diode Continuity
 - Electrical Circuits
 - Guided Voltage Drop Test
 - Other Electrical Measurements
 - Resistance
 - Scientific Notation
 - Voltage
- **15-minute Ignition Class**—provides basic introductory ignition system information. Topics may include:
 - Introduction
 - Coil on Plug (COP)
 - Conventional
 - Waste Spark
- **Illustrated Terms & Definitions**—provides common term definitions, illustrations and tips associated with automotive component testing.
- **No-Start Basics**—provides basic step-by-step procedures for the diagnosis of a no-start condition on carbureted and fuel injected vehicles.
- **O2 Sensor & Feedback System Analysis**—provides basic definition and theory information for the following O2 sensor topics:
 - Air Fuel Ratio Sensors
 - Correct PCM Response (includes configured meter test)
 - Heated Oxygen Sensor
 - Non-Heated Oxygen Sensor
 - Open and Closed Loop
 - Oxygen Sensor Types
 - Understanding Oxygen Sensors (includes configured meter test)
- **Snap-on Automotive Theory**— provides basic theory information on multiple topics including:
 - Air Conditioning
 - Diagnosing Battery Draws
 - Diesel Particulate Filters
 - Electronic Parking Assistance
 - HID Headlights
 - Hybrid Vehicles
 - LIN-BUS
 - Supplemental Restraint Systems
 - Tire Pressure Monitoring (TPMS)
- **Test Tips**—provides basic testing information, tips and procedures for specific tests and meter operations. Topics may include:
 - Alternator Ripple Test
 - EVP Sensor Test

- Frequency, Pulse Width and Duty Cycle Test
- Graphing AC Voltage
- Injector Pulse Width Test
- Parasitic Draw Test
- Reading Pulsed DTC's
- TPS Sweep Test
- Using Cursors
- Using Pressure Transducers
- Using Triggers
- Wiggle Test
- Zirconia Oxygen Sensor Rise Time
- **Theory and Operation**—provides basic theory information for the following topics:
 - Oxygen Sensors
 - Relays
- **20-minute Current Ramp Classes**—provides an introduction to current ramp testing using the Snap-on Low Amp Current Probes. Snap-on Low Amp Current Probe operation information is also provided within the *Snap-on Low Amp Probe Reference Manual* option. Topics may include:
 - Fuel Injector Current Ramp (multiple types)
 - Fuel Pump Current Ramp
 - Fuel Pump RPM Calculation
 - Ignition Coil Current Ramp (multiple types)
 - Parasitic Draw
 - Snap-on Low Amp Probe Reference Manual
 - Using Fuse Box for Current Test Hard to Reach Wiring

Features and Benefits

Selecting **Features and Benefits** provides basic feature description and operational information about the diagnostic tool. Additional information is provided for ShopStream Connect, optional waveform demonstration boards and optional accessories. Selections include:

- **5-Minute Walk Thru With Demo Board**—provides instructions on the operation of the optional waveform demonstration board(s) to sharpen your Lab Scope and Meter skills. Topics may include:
 - New Demo Board (PN) #EESX306A—provides functionality information and basic step-by-step demonstration information of multiple generated waveforms
 - Old Demo Board (PN) #SSP816—provides functionality information and basic step-by-step demonstration information for multiple generated waveforms

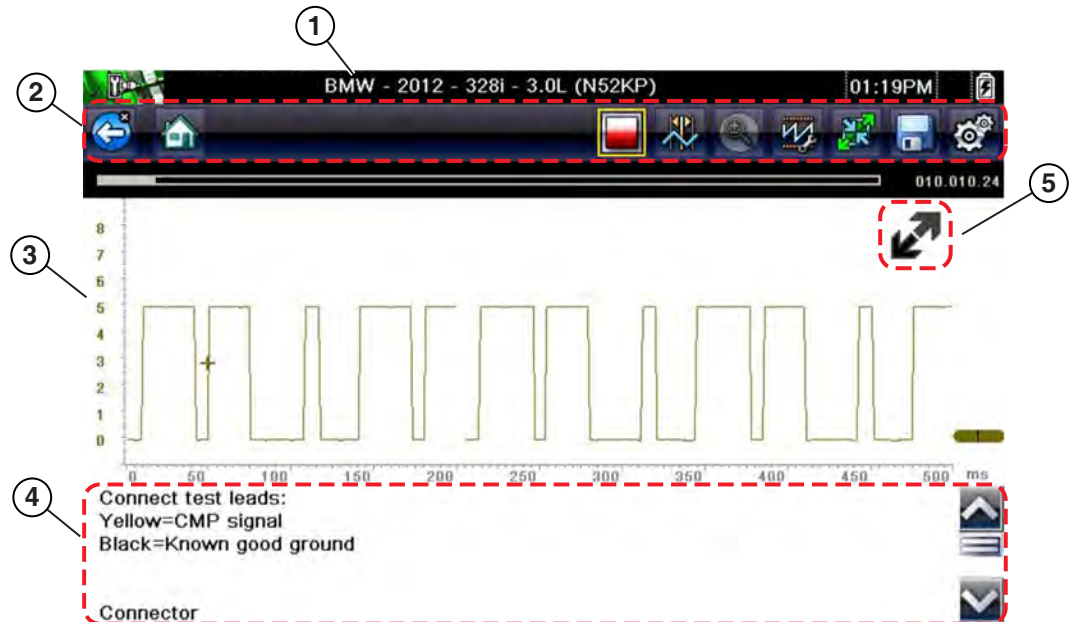
The optional demonstration board(s) generate various waveforms similar to signals commonly found on modern vehicle control systems. The demonstration board(s) not only help you learn how to use the Guided Component Tests software, it allows you to hone your skills and diagnostic techniques without connecting to an actual vehicle. Contact your sales representative for details.

- **Features & Benefits**—provides an overview of the diagnostic tool features and functions.
- **Accessories**—provides descriptions for the optional accessories available for the diagnostic tool. Accessory topics may include:
 - Low Amp Probe
 - Pressure/Vacuum Transducers
 - ShopStream Connect
 - Test Leads and Clips
- **Product Description**—provides an overview of diagnostic tool capabilities and operations.

6.2 Screen Layout and Icons

This section describes the Guided Component Tests control icon functions and screen layout.

6.2.1 Screen Layout



- 1— **Vehicle Identification**
- 2— **Toolbar**—contains control icons
- 3— **Main Body**—displays menus, information, meter scales and signal traces
- 4— **Information Panel**—displays test information
- 5— **Expand/Collapse icon**—toggles Main body view between full and split views

Figure 6-2 Test screen

Main Body

The main body of a Guided Component Test screen may display any of the following:





- **Selectable Menu** - Select menu options using the touch screen or control buttons.
- **Component Information** - Provides information to assist you with testing.
- **Test Meter** - The test meter can display up to two signals, simultaneously. Signal and display adjustments are made through the Control Panel. Signals are displayed using a grid with scales, both vertical (y axis), and horizontal (x axis).

Meter touch screen functionality is limited, however you can adjust the zero baseline position (0 value) of the signal on the horizontal scale by touching and dragging the zero baseline marker.

6.2.2 Guided Component Tests Control Icons

Guided Component Tests toolbar control icons may vary depending on the active function or test. A yellow frame surrounding an icon (highlighted), indicates it is selected. Other control icons (not shown) are described in [Common Toolbar Control Icons](#), on page 14.

Table 6-1

Icon	Function
	<p>Stop - Stops the data buffer</p>
	<p>Control Panel - (a). In full screen mode (when selected) this icon displays a white frame around it, and opens the control panel at the bottom of the screen; while switching the active selection focus to the Show/Hide or Probe icon in the Control Panel. (b). In split screen mode (control panel open), when selected this icon displays a white frame around it, and switches the active selection focus to the Show/Hide or Probe icon in the Control Panel.</p> <p>Note: Switching active selection focus to the Control Panel allows manual navigation (using the directional control buttons) of the Control Panel control icons</p>
	<p>Cursors - Toggles cursors on/off.</p>
	<p>Expand/Collapse Icon - Toggles the Main body display between full and split screen</p>

6.3 Operation

As the information and tests provided within the Guided Component Test function is vehicle specific, the vehicle must first be identified in order to retrieve the correct data.



To identify a vehicle:

The vehicle identification process is the same as the process used for the Scanner function, see [Vehicle Identification](#), on page 20 for additional information. Once the vehicle is identified, a list of Systems is displayed.



To select a system and component to test:

1. Select a system from the list ([Figure 6-3](#)).

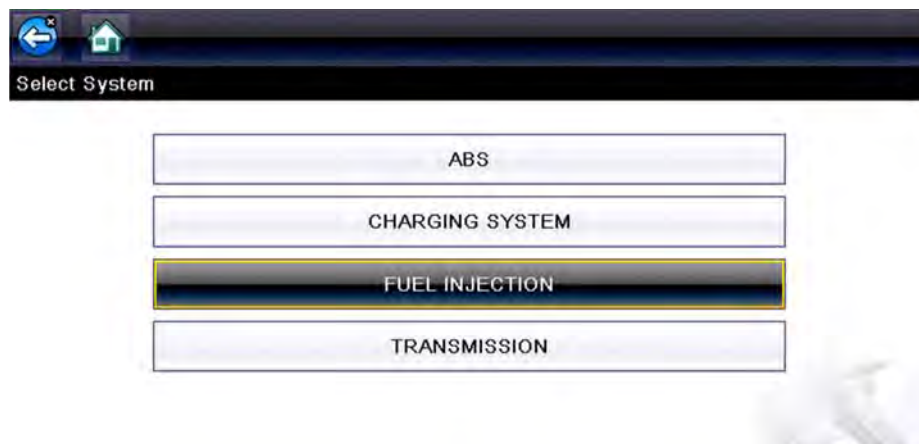


Figure 6-3 Systems Menu

A list of Components (and / or sub systems) is displayed ([Figure 6-4](#)).

2. Select a Component to continue.

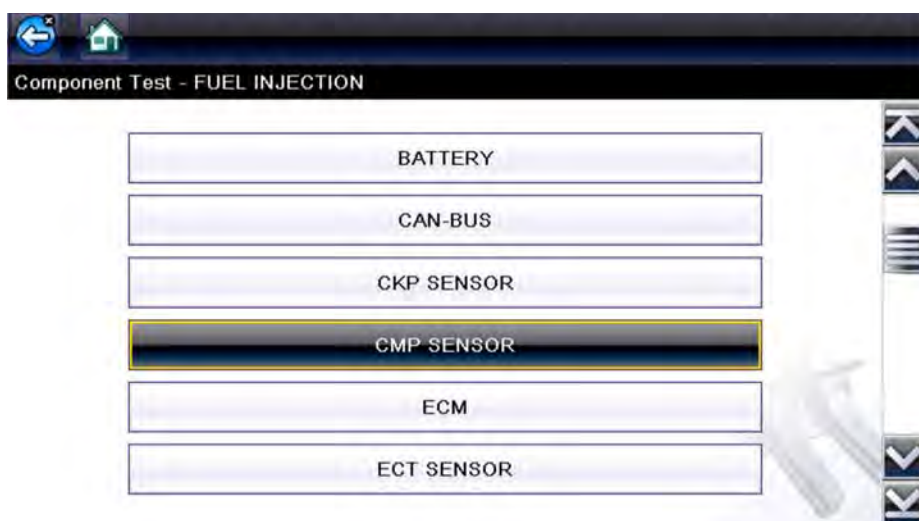


Figure 6-4 Component Menu

Depending on the vehicle and component selected, different options and sub-menus may be displayed. Information and tests may vary:

- **Component Information**— see [Component Information](#), on page 108.
- **Tests**— see [Tests](#), on page 110.
- **Reference Information**—provides identification of components, connector pin location and functions, and abbreviation reference.

6.3.1 Component Information

Component Information provides (if available) specific operational information on the selected component, and may also include electrical connector and pin location and function details



To view component information:

1. Select a component.
2. Select **Component Information** from the Component Test menu ([Figure 6-5](#)).

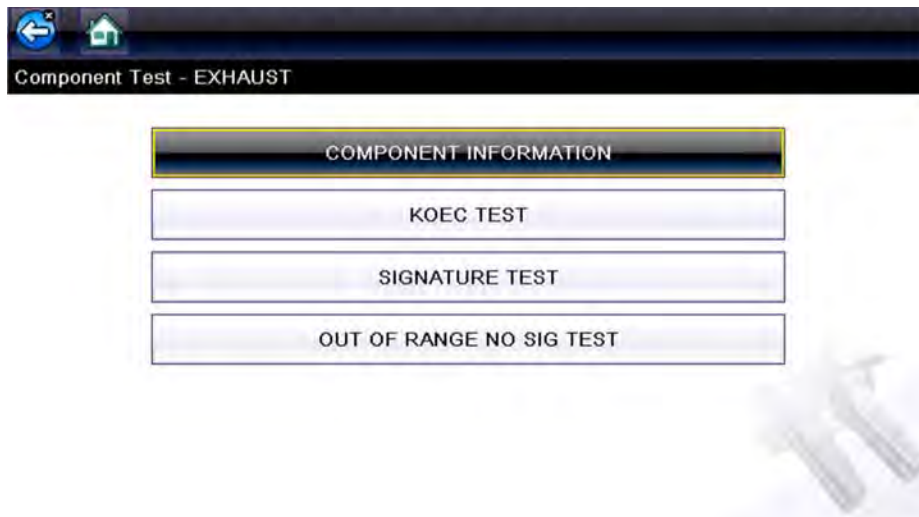


Figure 6-5 *Component Tests Menu*



NOTE:

An additional selection may be required for some components (e.g. selecting front or rear for an oxygen sensor (O2S)).

Component Information is displayed (Figure 6-6 and Figure 6-7).

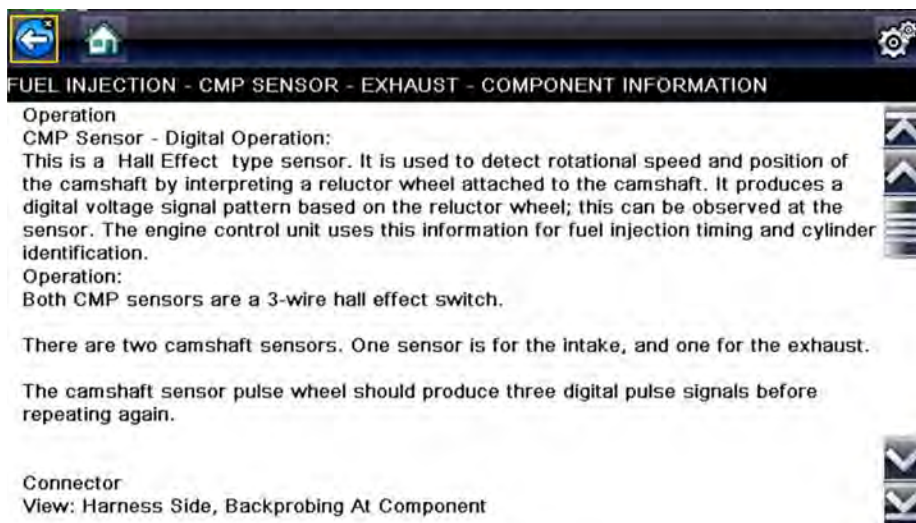


Figure 6-6 Component Information Screen

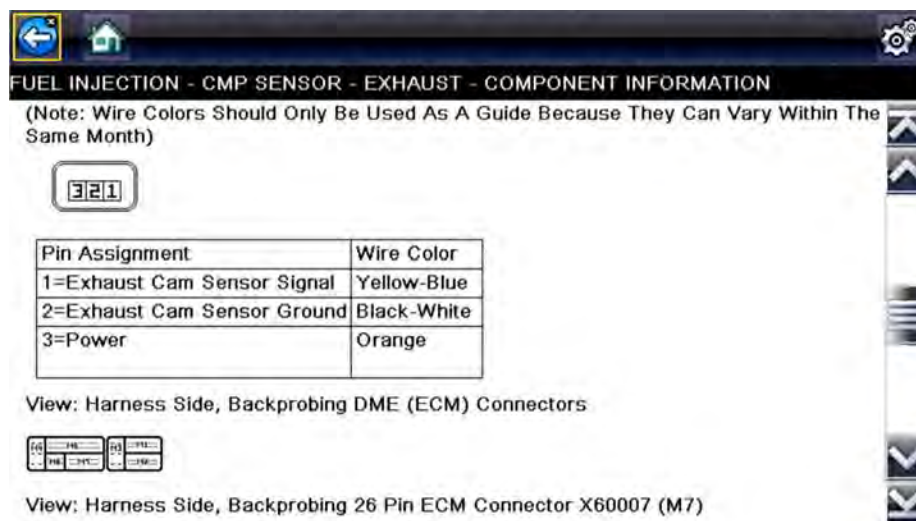


Figure 6-7 Component Information Screen - Continued

Screens are divided into sections to quickly guide you to the correct information (available sections and information will vary):

- **Operation**—provides a general description of component operation.
- **Tech note**—provides component related tips (e.g. common failures or faults), additional information may include OEM service updates and recall information.
- **Connector**—displays illustrated electrical connectors and socket/pin identification.
- **Location**—provides component locations, testing tips, and alternate testing locations if available.

Use the scroll bar to view additional information.

3. Select **Back** on the Toolbar, or press the **N/X** button, to return to the component menu.

6.3.2 Tests

Tests provides (if available) specific instructions to help you perform tests on components. Selecting a component test opens a preconfigured meter to start the test, and may also provide connection instructions, specifications and testing tips.



To select a test:

1. Select a component.
2. Select a **Test** from the Component Test menu ([Figure 6-8](#)).

The component test menu lists all of the tests available for the selected component. Choices vary by the type of component, as well as the make, model, and year of the vehicle.

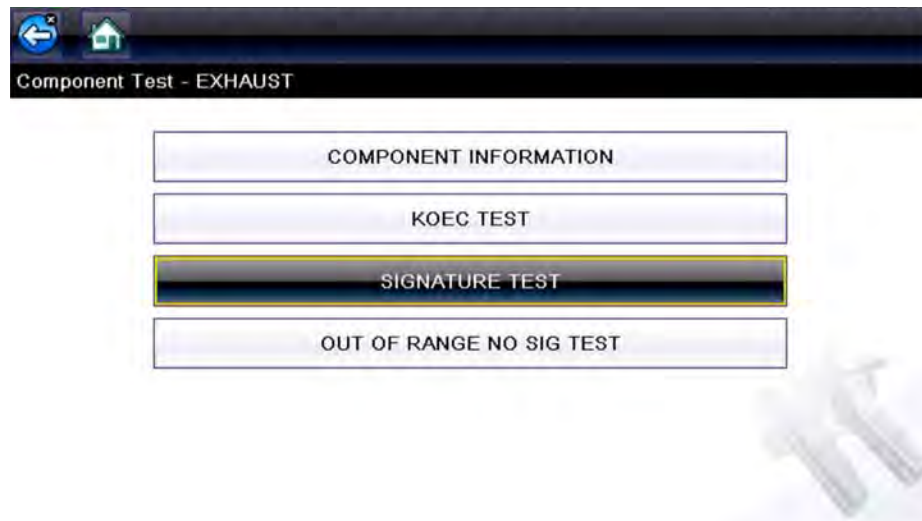


Figure 6-8 Component Test Menu



NOTE:

An additional selection may be required for some Component Tests (e.g. selecting front or rear for an oxygen sensor).

The test screen displays (Figure 6-9).

A Guided Component Test screen initially opens with the information panel below the main body. Use the scrollbar to display hidden information.

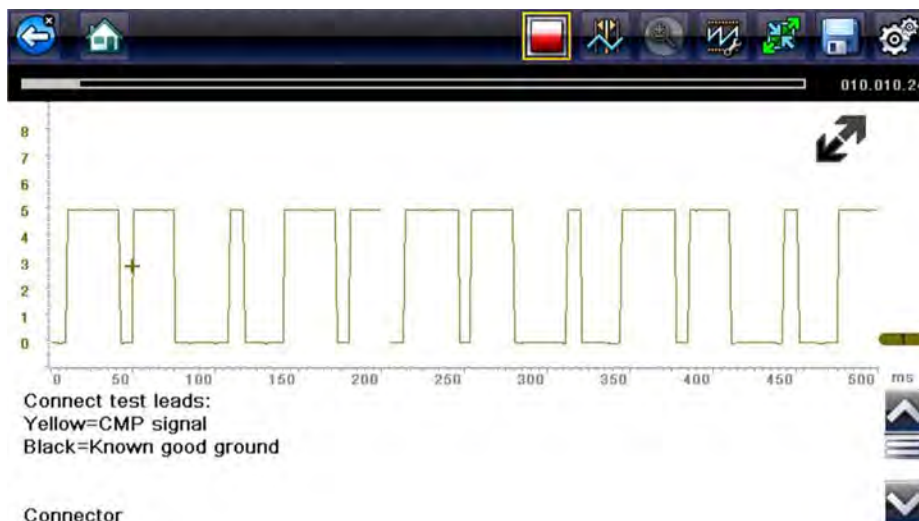


Figure 6-9 Test screen

Tap on the Information Panel once to display the information panel in full screen view. Tap on it again to return to split view. The **Expand/Collapse** icon can also be used to toggle through split and full screen views (Figure 6-10).



Figure 6-10 View Options

Some tests (e.g. signature integrity tests) may include waveform examples within the information panel. These waveform examples allow you to compare your test results for quick diagnosis (Figure 6-11).

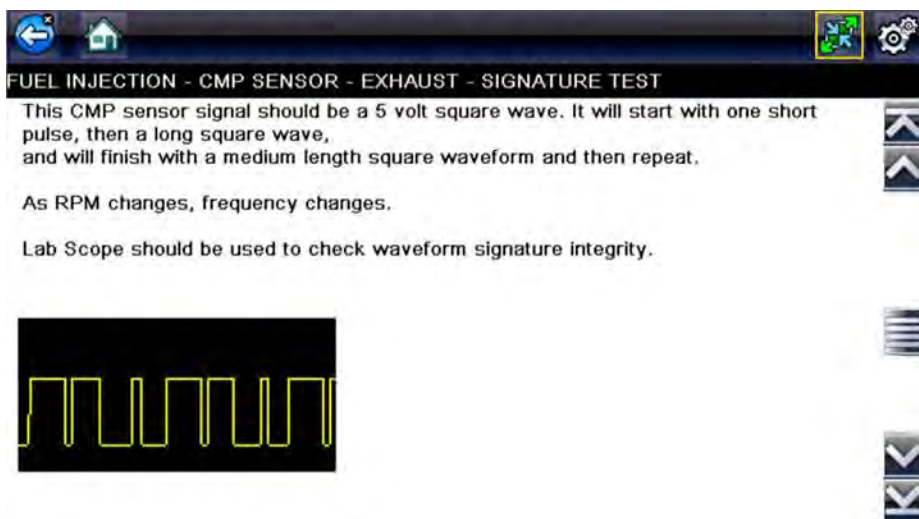


Figure 6-11 Waveform Example

3. Select **Back** on the toolbar to return to the menu.

Channel Settings

The test meter is preconfigured, for most of the component tests. However, if the need to change channel settings is needed, adjustments can be made by selecting the **Control Panel** icon from the toolbar to display the Control Panel (Figure 6-12). For additional information on channel settings, see [Control Panel and Settings](#), on page 65.

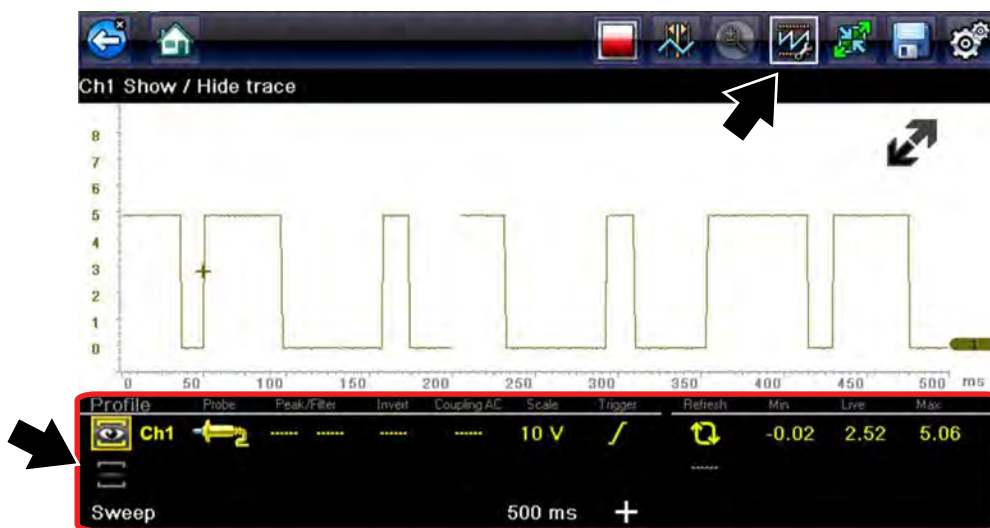


Figure 6-12 Control Panel - Channel Controls

6.3.3 Saving and Reviewing Data Files

Save and Stop control icon operation and data review procedures are the same as used for the Scope/Multimeter function, see [Saving and Reviewing Scope / Multimeter Data Files](#), on page 86.

This chapter describes the basic operation of the Previous Vehicles and Data function.



The **Previous Vehicles and Data** icon is located on the Home screen. This function allows you to select recently tested vehicles and access saved data files.

7.1 Previous Vehicles and Data Menu

The following options are available from the Previous Vehicles and Data menu:

- [Vehicle History](#), on page 113
- [View Saved Data](#), on page 114
- [Delete Saved Data](#), on page 115

7.1.1 Vehicle History

The Diagnostic Tool stores the identification of the last twenty-five vehicles tested, so there is no need to go through the complete vehicle identification sequence when performing a retest after repairs have been made. The oldest vehicle record is deleted when a new vehicle is identified once there are twenty-five vehicles on file.



Figure 7-1 Vehicle history list



To select from the vehicle History:

1. Select **Previous Vehicles and Data** from the Home screen.
2. Select **Vehicle History** from the menu.

A list of up to 25 previously tested vehicles displays. Each vehicle is given a unique file name. Scroll to view the entire list.

3. With the item to be opened highlighted, either select the vehicle ID or press the **Y/✓** button.
The appropriate software loads and a vehicle ID confirmation screen displays.
4. Select **OK** or press the **Y/✓** button to continue.
The System Menu for the selected vehicle displays.

7.1.2 View Saved Data

Selecting the **View Saved Data** menu option opens a list of all the saved data (movie) files and screen images that are stored in memory. Saved files are listed in chronological order by the date and time that they were created with the most recent files are at the top of the list.



Figure 7-2 Saved data list

Saved files can either be opened directly on the diagnostic tool, or downloaded to a personal computer and opened using ShopStream Connect. See [Connect-to-PC](#), on page 117 for additional information.



To review a saved data file or image:

1. Select **Previous Vehicles and Data** from the Home screen.
2. Select **View Saved Data** from the menu.
3. Select a file to review from the list.

7.1.3 Delete Saved Data

This menu option is used to permanently erase saved files from memory.



To delete a saved file:

1. Select **Previous Vehicles and Data** from the Home screen.
2. Select **Delete Saved Data** from the menu.

A list of saved files displays.



NOTE:

The Select All/Deselect All and Delete icons become available on the toolbar so that you can either delete individual files or clear the entire memory buffer all at once.

3. Select a file from the list and a confirmation message displays.
4. Select an option from the confirmation message:
 - **OK**—deletes the selected file and returns to the saved files list, which no longer includes the deleted file.
 - **Cancel**—returns to the saved files list without deleting the selected file.
5. Select **Back** on the toolbar to return to the Previous Vehicles and Data menu, select **Home** to return to the Home screen.

This chapter describes the basic operation of the Tools function.



The **Tools** icon is located on the Home screen. This function allows you to configure diagnostic tool settings to your preferences.

8.1 Tools Menu

The following options are available from the Tools menu:

- [Connect-to-PC](#), on page 117—use to transfer and share files with a personal computer (PC).
- [Configure Shortcut Button](#), on page 117—use to change the function of the shortcut button.
- [System Information](#), on page 118—use to view configuration information for the diagnostic tool.
- [Settings](#), on page 118—use to configure certain characteristics of the diagnostic tool.



Figure 8-1 Tools menu

8.1.1 Connect-to-PC

Connect-to-PC allows you to transfer saved data files on your diagnostic tool to your personal computer using a USB cable.

The optional ShopStream Connect™ PC software allows you to view, print and save data files on your PC. In addition, you can download software updates from the PC to the diagnostic tool. These features provide an ideal way to manage saved data files. The ShopStream Connect application is available free online, see the ShopStream Connect website information at the front of this manual for additional information.



To connect the diagnostic tool to a PC:

1. Select **Tools** from the Home screen to open the menu.
2. Select **Connect-to-PC** from the Tools and Setup menu.
A screen message displays stating that the diagnostic tool can be connected to a PC as a mass storage device.
3. Connect the supplied USB cable to the diagnostic tool and then to the PC.
4. Select **Continue**.
5. Follow the instructions on the screen to complete the operation.

A USB cable, supplied with your diagnostic tool, is used to connect the diagnostic tool to the PC. When the diagnostic tool is connected to the PC a communications icon appears on the right edge of the title bar.

8.1.2 Configure Shortcut Button

This feature allows you to change the function of the **Shortcut** button. Options are:

- **Brightness**—opens the brightness setting screen.
- **Save Screen**—saves a bitmap image of the visible screen.
- **Save Movie**—writes PID data from buffer memory to a file for future playback.
- **Show Shortcut Menu**—opens the menu so you can quickly select from any of the functions.
- **Toggle Record/Pause**—programs the Shortcut button to work as the Pause and Play icons.



To assign a function to the Shortcut button:

1. Select **Tools** from the Home screen.
The Tools menu opens.
2. Select **Configure Shortcut button** from the menu.
3. Select a function from the menu.
4. Select the **Back** on the toolbar or press the **N/X** button to return to the options menu.

8.1.3 System Information

System Information allows you to view patent information and system information such as the software version and serial number of your diagnostic tool.



Figure 8-2 System information



To display the System information screen:

1. Select **Tools** from the Home screen to open the menu.
2. Select **System Information** from the menu.
The System Information screen displays.
3. Scroll as needed to view all of the data.
4. Select **Back** on the toolbar or press the **N/X** button to return to the options menu.

8.1.4 Settings

This Tools selection allows you to adjust certain basic diagnostic tool functions to your personal preferences. Selecting opens an additional menu that offers the following:

- System Settings - see [System Settings](#), on page 118
- Configure Scanner - see [Configuring Scanner](#), on page 124
- Configure Units - see [Configure Units](#), on page 125

System Settings

Selecting System Settings opens a menu with two options; Display and Date & Time. Either selection opens an additional menu.

Display options include:

- [Brightness](#), on page 119—adjusts the intensity of the screen back lighting.
- [Colour Theme](#), on page 120—changes the background colour of the screen display.
- [High Contrast Toolbar](#), on page 120—enhances toolbar graphics for poor lighting conditions.
- [Font Type](#), on page 121—switches between standard and bold text for better visibility.
- [Backlight Time](#), on page 121—adjusts how long the screen stays on with an idle diagnostic tool.
- [Touch Screen Calibration](#), on page 122—calibrates the touch screen display.

Date & Time options include:

- [Time Zone](#), on page 122—sets the internal clock to the local time standard.
- [Clock Settings](#), on page 123—sets the time on the internal clock.
- [Daylight Savings Time](#), on page 123—configures the clock for Daylight Savings Time.
- [Time Format](#), on page 124—switches the time displays between a 12 or 24 hour clock.
- [Date Format](#), on page 124—configures how the month, date, and year displays.

Brightness

Selecting this option opens the brightness setting screen for adjusting the back lighting of the display ([Figure 8-3](#)).

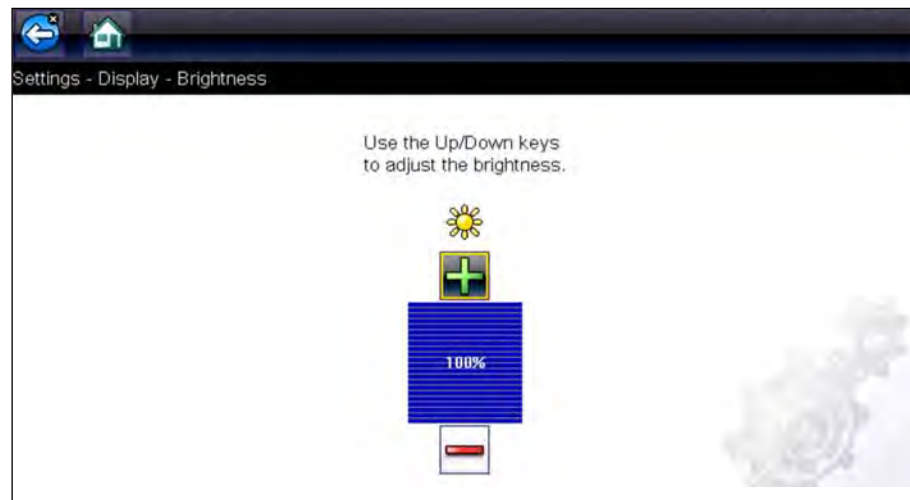


Figure 8-3 Brightness setting

Each push of the **Plus** and **Minus** icons, or the up (▲) and down (▼) arrows, incrementally changes the back lighting up or down respectively.

Select **Back** from the toolbar or press the **N/X** button to exit.

Colour Theme

This option allows you to select between a white and black background for the screen. The black background can be beneficial when working under poor lighting conditions.

Selecting opens a menu with two choices: **Day Theme** (white background) and **Night Theme** (black background). Make a selection and a “please wait” message momentarily displays followed by the Home screen. The new toolbar setting is now active.

High Contrast Toolbar

This option allows you to switch to a high contrast toolbar. This toolbar features black and white icons with crisp graphics that are easier to see in poor lighting conditions or bright sunlight.



Figure 8-4 High-contrast toolbar

Selecting opens a menu with two choices; **Colour Toolbar** and **High Contrast Toolbar**. Select and a “please wait” message displays followed by the Home screen. The new setting is now active.

Font Type

This option allows you to select between standard and bold faced type for the display screen. Bold type makes screen writing more legible under poor lighting or bright sunlight conditions.

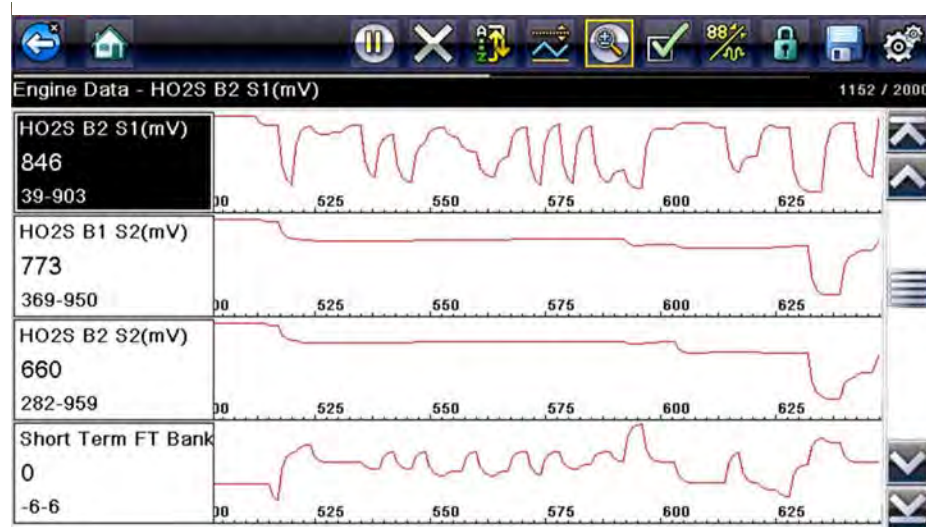


Figure 8-5 Bold type on a black background

Selecting opens a menu with two choices: Normal Font and Bold Font. Select a menu item or scroll and then press the **Y/✓** button to make a selection. The change is instantaneous. Select the Back or Home icon on the toolbar to return to either the Settings menu or the Home screen.

Backlight Time

This option allows you to configure how long the screen backlight remains on when the diagnostic tool is inactive. The following choices are available:

- Always On
- 15 Seconds
- 30 Seconds
- 45 Seconds
- 60 Seconds

Select the menu item desired, or scroll and then press the **Y/✓** button to make a selection. Select **Back** or **Home** on the toolbar to return to either the Settings menu or the Home screen.

Touch Screen Calibration

Calibrating the touch screen maintains the accuracy of the touch-sensitive display.

IMPORTANT:

To avoid serious damage to the diagnostic tool, always complete the touch screen calibration sequence once it has begun. **Never turn off the diagnostic tool while a screen calibration is in process.**

**To calibrate the touch screen:**

1. Select **Tools** from the Home screen to open the menu.
2. Select **Settings** from the menu.
3. Select **Touch Calibration** from the menu.
The calibration screen opens ([Figure 8-6](#)).



Figure 8-6 *Touch screen calibration*

4. Select each box on the screen as it displays.
The display returns to the Settings menu once the screen calibration procedure is complete.

Time Zone

This option opens a menu of time zone settings. Scroll to highlight, then select the local time zone. The display returns to the Settings menu once a time zone is selected.

Clock Settings

This option opens a window for resetting the time on the real-time clock.



To set the clock:

1. Select **Tools** from the Home screen to open the menu.
2. Select **Settings** from the menu.
3. Select **Clock Settings** from the menu.

A warning message briefly displays followed by the Clock Settings screen ([Figure 8-7](#)).



Figure 8-7 Clock settings

4. Select the **up (+)** icon on the screen or press the **up (▲)** button to incrementally increase the number in the highlighted field. Select the **down (-)** icon on the screen or press the **down (▼)** button to incrementally decrease the number.
5. Select the **check (✓)** icon on the screen or press the **Y/✓** button to move the highlight to the next field.
6. Repeat Step 4 and Step 5 until the correct time is displayed.
7. Select the **Back** icon on the toolbar or press the **N/X** button to close the Clock Settings window and return to the Settings menu.

Daylight Savings Time

This option opens a menu to configure the internal clock for Daylight Savings Time. Choose from:

- **ON**—sets the clock for Daylight Savings time.
- **OFF**—sets the clock for standard time.

Make either selection, then select the **Back** icon or press the **N/X** button to return to the menu.

Time Format

This option determines whether time is displayed on a 12 or 24 hour clock. Selecting opens a menu with two choices:

- **24 Hour Format**
- **12 Hour Format**

Make either selection, then select the **Back** icon or press the **N/X** button to return to the menu.

Date Format

This option allows you to select how date information is displayed. Select from:

- **(MM_DD_YYYY)**—Month, Day, Year
- **(DD_MM_YYYY)**—Day, Month, Year
- **(YYYY_MM_DD)**—Year, Month, Day

Make a selection, then select the **Back** icon or press the **N/X** button to return to the menu.

Configuring Scanner

This option allows you to change the scanner display to toggle scales on and off. Scales are the graduations and values that display on the horizontal axis at the base of the parameter graphs. The waveform fills the entire graph area with scales switched off.



Figure 8-8 Scales hidden (upper), displayed (lower)

**To change hide/show scales:**

1. Select **Tools** from the Home screen.
2. Select **Settings** from the Tools and Setup menu.
3. Select **Configure Scanner** from the Settings menu.
4. Highlight either menu entry to make a selection:
 - **Show Graph Scale**—to switch the scales on.
 - **Hide Graph Scale**—to switch the scales off.
5. Select the **Back** icon or press the **N/X** button to return to the Settings menu.

Configure Units

Selecting opens a dialog box that allows you to choose between US customary or metric units of measure for temperature, vehicle speed, air pressure, and other pressures.



Figure 8-9 *Configure units menu*

**To change the units setup:**

1. Select **Tools** from the Home screen to open the menu.
2. Select **Configure Units** to open the menu.
3. Select an item from the Configure Units menu.
4. Select a setting from the listed choices.
5. Select **Back** on the toolbar or press the **N/X** button to return to the options menu.

This chapter describes basic cleaning and battery replacement procedures for your diagnostic tool.

9.1 Cleaning and Inspecting the Diagnostic Tool

Periodically perform the following tasks to keep your diagnostic tool in proper working order:

- Check the housing, cables and connectors for dirt and damage before and after each use.
- At the end of each work day, wipe the diagnostic tool housing, cables and connectors clean with a damp cloth.

IMPORTANT:

Do not use any abrasive cleansers or automotive chemicals on the diagnostic tool.

9.1.1 Cleaning the Touch Screen

The touch screen can be cleaned with a soft cloth and a mild window cleaner.

IMPORTANT:

Do not use any abrasive cleansers or automotive chemicals on the touch screen.

9.2 Battery Pack Service

Follow all safety guidelines when handling the battery pack.

⚠ WARNING

Risk of electric shock.

- **Prior to recycling the battery pack, protect exposed terminals with heavy insulating tape to prevent shorting.**
- **Disconnect all test leads and turn diagnostic tools off before removing the battery pack.**
- **Do not attempt to disassemble the battery pack or remove any component projecting from or protecting the battery terminals.**
- **Do not expose the diagnostic tool or battery pack to rain, snow, or wet conditions.**
- **Do not short circuit the battery terminals.**

Electric shock can cause injury.

⚠ WARNING

Risk of explosion.

- **Use the proper factory battery pack only, incorrect replacement or tampering with the battery pack may cause an explosion.**

Explosion can cause death or serious injury.

9.2.1 Battery Pack Safety Guidelines

IMPORTANT:

The battery pack contains no user serviceable components. Tampering with the battery pack terminals or housing will void the product warranty.

Keep the following in mind when using and handling the battery pack:

- Do not short circuit battery terminals.
 - Do not immerse the diagnostic tool or battery pack in water, or allow water to enter the diagnostic tool or battery compartment.
 - Do not crush, disassemble, or tamper with the battery pack.
 - Do not heat the battery pack to over 100°C (212°F), or dispose of it in a fire.
 - Do not expose the battery pack to excessive physical shock or vibration.
 - Keep the battery pack out of reach of children.
 - Do not use a battery pack that appears to have suffered abuse or damage.
 - Store the battery pack in a cool, dry, well ventilated area.
-

**NOTE:**

The battery pack should be used within a short period of time (about 30 days) after charging to prevent loss of capacity due to self-discharging.

If long-term storage of the battery pack is necessary, it should be stored in a cool, dry, well ventilated place with a 30 to 75 percent state of charge to prevent loss of characteristics.

To prolong the life of your battery, power off the diagnostic tool when not in use. The diagnostic tool has a built in charger that recharges the battery on demand whenever it is connected to a power source.

9.2.2 Replacing the Battery Pack

If the battery pack no longer holds a charge, contact your sales representative to order a new battery.

IMPORTANT:

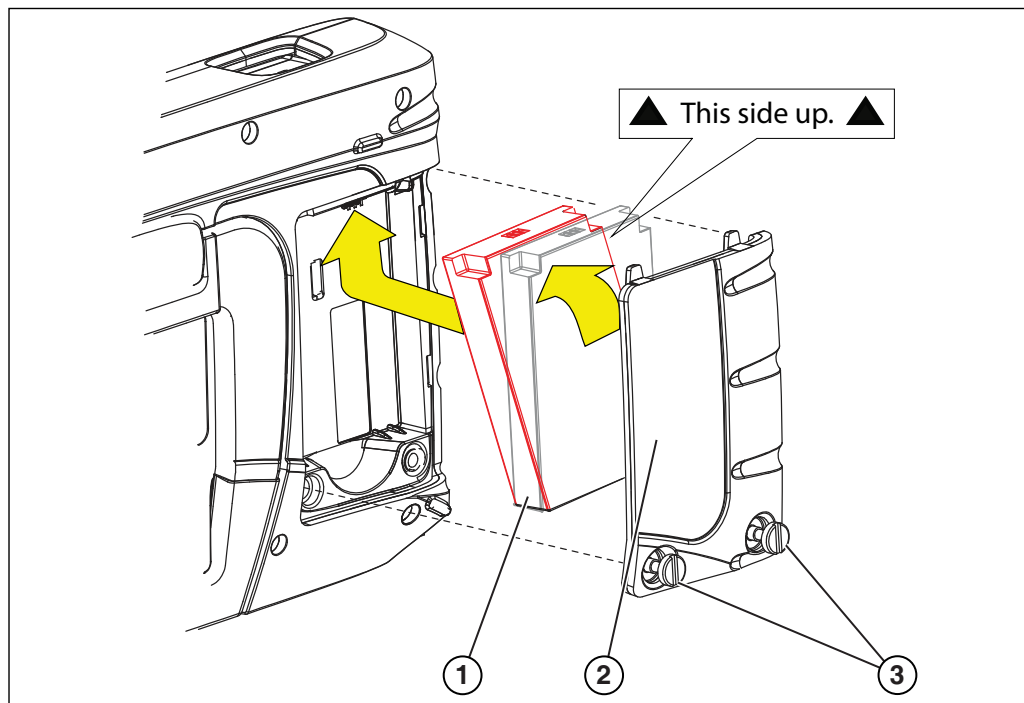
Replace the battery pack with original Snap-on replacement parts only.

**To remove the battery pack:**

1. Loosen the two battery cover screws on the back-side of the diagnostic tool.
2. Pull up and out on the lower edge of the battery cover to release it.
3. Remove the battery pack in the same manner as the battery cover, pulling the bottom edge up and tilting out.

**To install the battery pack:**

1. Position the battery pack as shown in (Figure 9-1) with the arrows facing up.
2. Tilt the top of the battery in to align the tabs, then down to install into place.
3. Install the battery pack cover, in the opposite manner as removal, aligning the tabs and tilting down and in, into place.
4. Tighten the battery cover screws. **Do not overtighten the screws!**



- 1— Battery Pack
2— Battery Cover
3— Battery Cover Screws

Figure 9-1 Battery pack installation

9.2.3 Disposing of the Battery Pack

Always dispose of the battery pack according to local regulations, which vary for different countries and regions. The battery pack, while non-hazardous waste, does contain recyclable materials. If shipping is required, ship the battery pack to a recycling facility in accordance with local, national, and international regulations. For additional information contact:

- **Australia** - Australian Battery Recycling Initiative <http://www.batteryrecycling.org.au>
- **New Zealand** - Ministry for the Environment <https://www.mfe.govt.nz/issues/waste/streams/batteries.html>

Products bearing the WEEE logo (Figure 9-2) are subject to European Union regulations.



Figure 9-2 WEEE logo



NOTE:

Always dispose of materials according to local regulations.

Contact your sales representative for details.