OPERATOR'S MANUAL

Scanner

P/N: **0692E9315-76**, Rev:C, PCN:02E0093

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TO THE READER

Whilst every effort has been made to ensure that the information contained in this manual is correct, complete and up-to date, the right to change any part of this document at any time without prior notice is reserved.

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

CE

Snap-on Europe Holding B.V.

Spaklerweg 69

1099 BB Amsterdam

The Netherlands

Tel : 31-(0)20-5682622

Fax: 31-(0)20-6947962

http://www.sun-diagnostics.com/

http://www.snapon.com/

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INTRODUCTION

SAFETY PRECAUTIONS

GENERAL

The Scanner and Cartridges have been supplied in a safe condition. In order to keep them in a safe condition and to ensure safe operation of the tester, the operating instructions must be followed and the warnings & cautions must be observed.

ABOUT WARNINGS

A warning gives instructions to prevent injury to people. Warnings will be given in the following list and just before the subject in this manual where the warning is applicable.

WARNINGS

1: PERFORM ALL TESTING IN A WELL-VENTILATED AREA. ROUTE THE VEHICLES EXHAUST GASES OUTSIDE IF THE TEST AREA DOES NOT HAVE ADEQUATE VENTILATION.

2: DO NOT SMOKE OR ALLOW SPARKS OR NAKED FLAMES NEAR THE FUEL SYSTEM COMPONENTS.

3: DO NOT SMOKE OR ALLOW NAKED FLAMES NEAR THE BATTERY.

4: UNLESS SPECIFICALLY DIRECTED BY THE MANUFACTURES PROCEDURE, MAKE SURE THAT THE IGNITION SWITCH IS IN THE OFF POSITION BEFORE CONNECTING OR DISCONNECTING THE SCANNER CONNECTORS OR ANY VEHICLE TERMINALS.

5: WHEN CONNECTING THE SCANNER, PLUG THE POWER CABLE INTO THE CIGARETTE LIGHTER SOCKET IF AVAILABLE OR CONNECT THE BATTERY POWER CABLE. THEN PLUG THE TEST ADAPTOR INTO THE VEHICLES CONNECTOR.

6: MAKE SURE THAT THE SCANNER POWER CABLE IS DISCONNECTED BEFORE REMOVING OR INSTALLING A CARTRIDGE.

7: WHEN USING THE SCANNER IN THE ENGINE COMPARTMENT, KEEP ALL CABLES, TEST LEADS AND TOOLS AWAY FROM DRIVE BELTS AND OTHER MOVING PARTS. DO NOT ALLOW CABLES AND TEST LEADS TO TOUCH EXHAUST MANIFOLDS OR OTHER HOT ENGINE PARTS.

8: HIGH VOLTAGES (UP TO 30 KV) ARE PRESENT ON THE SECONDARY SIDE OF THE IGNITION CIRCUIT WHILE THE IGNITION SYSTEM IS ON. ALWAYS USE AN INSULATED PLIERS WHEN HANDLING THE IGNITION SYSTEM COMPONENTS.

9: DO NOT WEAR JEWELLERY, A NECKTIE, SCARF OR LOOSE CLOTHING NEAR AN OPERATING ENGINE. KEEP HANDS AND HAIR AWAY FROM MOVING ENGINE PARTS SUCH AS FAN BLADES, BELTS OR PULLEYS. THESE CAN CAUSE A SERIOUS INJURY.

10: KEEP HANDS AND OTHER OBJECTS AWAY FROM THE ELECTRIC COOLING FAN. THE FAN CAN START UP ANYTIME.

11: BATTERY ACID CAN DAMAGE CLOTHING AND BURN SKIN OR EYES. IF CONTACT IS MADE WITH BATTERY ACID, WASH THE AFFECTED AREA WITH AS MUCH WATER AS POSSIBLE AND USE A WEAK SODA (SUCH AS BAKING SODA) TO NEUTRALISE THE ACID. IF ACID ENTERS THE EYES, GET IMMEDIATE MEDICAL ATTENTION.

12: DO NOT INHALE EXHAUST GASES. WORK IN A PROPERLY VENTILATED AREA. EXHAUST GASES CONTAIN CARBON MONOXIDE (CO) WHICH IS A COLOURLESS AND ODOURLESS LETHAL GAS.

13: WIPE UP FUEL SPILLS IMMEDIATELY AND DISPOSE OF SOAKED RAGS IN PROPER AIRTIGHT CONTAINERS. THE SOAKED RAGS PRODUCE FUMES WHICH ARE EXPLOSIVE.

14: NEVER SMOKE NEAR ENGINE FUEL. FUEL FUMES ARE EXPLOSIVE.

15: DO NOT OPEN CLOSED COOLANT SYSTEMS WHILE THE FLUID IS HOT. STEAM WILL ESCAPE WHICH CAN CAUSE SERIOUS BURNS.

16: NEVER LOOK DIRECTLY INTO THE CARBURETTOR THROAT WHEN CRANKING OR RUNNING THE ENGINE. BACKFIRING CAN CAUSE BURNS.

17: AVOID CONTACT WITH HOT SURFACES SUCH AS:
- EXHAUST MANIFOLDS AND PIPES
- MUFFLERS
- CATALYTIC CONVERTERS
- RADIATORS AND HOSES.

THESE CAN CAUSE SERIOUS BURNS.

18: NEVER USE A NAKED FLAME NEAR THE BATTERY. BATTERIES PRODUCE A HYDROGEN GAS WHICH EXPLODES WHEN IT COMES IN CONTACT WITH FIRE.

19: ALWAYS KEEP A FIRE EXTINGUISHER IN THE WORK AREA. IT SHOULD BE SUITABLE FOR A RANGE OF USES INCLUDING GASOLINE, CHEMICAL AND ELECTRICAL FIRES.

20: DO NOT LAY TOOLS OR EQUIPMENT ON THE BATTERY. ACCIDENTAL SHORTING OF THE BATTERY TERMINALS CAN CAUSE SHOCKS AND BURNS, AND DAMAGE THE VEHICLE WIRING OR THE BATTERY ITSELF.

21: SAFETY GOGGLES SHOULD BE ALWAYS WORN WHILE WORKING ON A VEHICLE TO PROTECT THE EYES FROM ACID, DUST, GASOLINE AND ANY OTHER LOOSE OBJECTS THAT MAY COME FROM ANY MOVING PARTS.

22: NEVER WEAR WRIST WATCHES, RINGS OR OTHER JEWELLERY WHEN WORKING ON A VEHICLE. SUCH ITEMS MAY CATCH ON MOVING PARTS OR CAUSE AN ELECTRICAL SHORT CIRCUIT WHICH CAN BURN OR INJURE THE WEARER.

23: NEVER SPILL ANY TYPE OF LIQUID ON OR INTO THE TESTER. THIS CAN DAMAGE THE TESTER AND RENDER IT UNSAFE.

ABOUT CAUTIONS

Cautions give instructions to prevent damage to equipment. Cautions will be given in the following list and just before the subject where the caution is applicable.

CAUTIONS

1: CHECK THE ENGINE OIL LEVEL AND ADD OIL IF NECESSARY BEFORE PERFORMING ANY TEST. AN ENGINE SHOULD NOT BE TESTED IF THE OIL LEVEL IS TOO LOW.

   THE TEST RESULTS WILL BE INFLUENCED AND THE ENGINE CAN BE DAMAGED IF A TEST IS PERFORMED WITH A LOW OIL LEVEL.

2: CHECK THE COOLANT LEVEL AND ADD COOLANT IF NECESSARY BEFORE PERFORMING ANY TESTS. AN ENGINE SHOULD NOT BE TESTED IF THE COOLANT LEVEL IS TOO LOW.

   IF THE ENGINE IS HOT, CHECK THE LEVEL AT THE OVERFLOW TANK. THE TEST RESULTS WILL BE INFLUENCED AND THE ENGINE CAN BE DAMAGED IF A TEST IS PERFORMED WITH A LOW COOLANT LEVEL.

3: FOLLOW THE CAR MANUFACTURER'S INSTRUCTIONS WHEN WORKING ON VEHICLES WITH A CATALYTIC CONVERTER.

   THE CONVERTER CAN BE DAMAGED BY BACKFIRES OR BY TOO MUCH UNBURNED FUEL GETTING INTO THE EXHAUST SYSTEM.

4: KEEP THE TEST LEADS AWAY FROM HOT SURFACES OR MOVING ENGINE PARTS. THE TEST LEADS CAN NOT WITHSTAND HIGH TEMPERATURES OR SEVERE MECHANICAL STRESS.

5: ALWAYS TEST IGNITION SYSTEMS USING TEST SPARK PLUGS.

6: TEST INJECTORS ONLY WHEN THE ENGINE IS COLD, OTHERWISE THE CATALYTIC CONVERTER CAN BE DAMAGED.

****

INTRODUCTION

NOTE: ***For simplicity, the Snap-on Scanner, MT-2500, the Sun Scanner and the Sun PDL-1000 are designated as the SCANNER in this manual.***

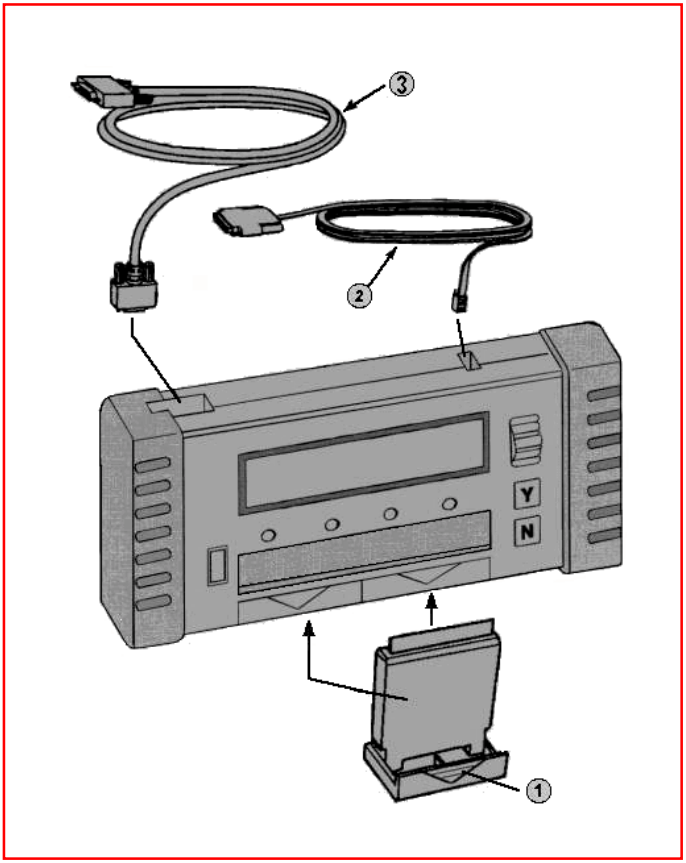


Figure 1: SCANNER, CARTRIDGE & CABLES

❶ CARTRIDGE

❷ COMMUNICATION CABLE, RS 232

❸ UNIVERSAL DATA CABLE, VEHICLE

BATTERY INSTALLATION

An alkaline battery is required for proper Scanner operation. Standard or "Heavy-Duty" 9-Volt batteries do not provide enough power. For longer battery life, install a lithium 9-Volt battery as a replacement.

1: Grasp the left handgrip and carefully pull it outwards and backwards from the Scanner. Do not remove the metal bail from the handgrip.
2: Remove and disconnect the old battery, if installed.
3: Connect the new battery to the connector and insert it into the Scanner. Make sure that the connector wires are not pinched.
4: Reinstall the handgrip.

UNIVERSAL DATA CABLE

This cable is supplied as standard with the Scanner and is connected to the top left connector on the Scanner. Use this cable to connect the ECU. Various adaptors are available for different ECU's.

COMMUNICATION CABLE, RS 232

This cable connects to the top right connector on the Scanner. This cable can be used to connect the Scanner to a Printer, (*Optional*) or to a PC, etc.

Scan Gra-Fix, Scan-Link, ScanView, (*Options*)

These are PC software programs that can be used to display, save, analyse and print vehicle data using the Scanner. Refer to the Scan Gra-Fix Operator's Manual, P/N: 0692E9312-84 for more information.

SCANNER CONTROLS

Thumbwheel is used to scroll through the menu selections and data displays. As the thumbwheel is turned (scrolled) the cursor arrow (→) also moves to indicate the current position or the list will scroll while the cursor remains fixed.

YES Button is generally used to select a menu item at the current cursor position, advance (continue) through test routines and to make choices, etc.

NO Button is generally used to reverse a step, exit from any menu or program, return to the previous menu selection and abort a program in process. It is also used to enter the Help menus.

Quick ID Button and Internal Battery is used to apply power to the Scanner from the internal battery. This is useful for checking the current software version. This button is also useful for checking the type and the location of the vehicle connector required for Scanner communication.

OPERATION OVERVIEW

The Scanner Code-Reading functions and other tests available depend on the type of vehicle tested and the cartridge. Basic operation consists of the following:

1: Insert the Cartridge.

If the cartridge does not seat smoothly and easily, do not force it. Remove it from the scanner and be sure the edge connector fingers are not bent. Check for dirt or nicks on the side of the cartridge and inside the cartridge slot. Remove dust and dirt from the cartridge edge connector with a clean, dry, soft cloth. Remove grease or oil with a clean cloth or a small amount of electronic contact cleaner. Polish the cartridge edge connectors with a pencil eraser. Remove all eraser dust before inserting the cartridge into the scanner.

Caution: ***Do not use water, solvent or abrasive material on the cartridge connector. Do not try to clean the socket inside the scanner.***

2: Use the Quick ID button or connect to the vehicle to activate the Scanner.

3: Select the model year, model type, engine type and options.

4: Follow the connection instructions displayed at the end of the Vehicle Identification and connect to the vehicle. Go to the “Main Menu”.

5: Choose the required tests.

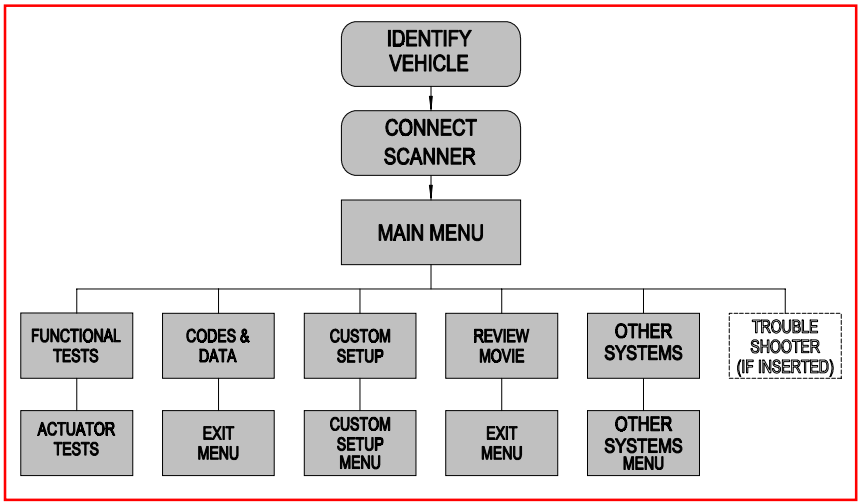
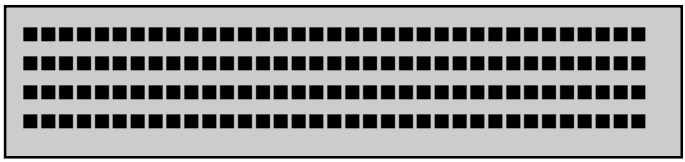


Figure 2: EXAMPLE OF THE BASIC SCANNER TEST MENUS

OPERATION

1: SCANNER START-UP

If no primary cartridge is inserted, using either the “Quick ID” button or the vehicle connector to apply power to the scanner. The following display check should be displayed:



The 4 LEDs should be on and two beeps should be heard during the display check. If the scanner battery voltage is low, a “Low Battery Voltage” message will be displayed. Refer to “Troubleshooting” section for more information.

If a cartridge is inserted, a copyright message should be displayed for approximately 2 seconds. If the cartridge was not changed since the last time that the scanner was used, the scanner displays the last vehicle selection entered in memory.

2: CARTRIDGE SELECTION

Press and hold the “Quick ID” button, or if the position of the vehicle’s Diagnostic Connector is known, connect the Scanner cable with the adaptor to the vehicle’s Diagnostic connector.

1: Scroll to select Cartridge and press **Y** to continue

2: If applicable, go to the “Custom Setup” and press **Y**.

3: Select “Left/Right Hand Drive Setup” and press **Y** to continue. Select “Left” or “Right” hand drive and press **N** the “Custom Setup” menu will be redisplayed. Press **N** again to continue with the Vehicle Selection.

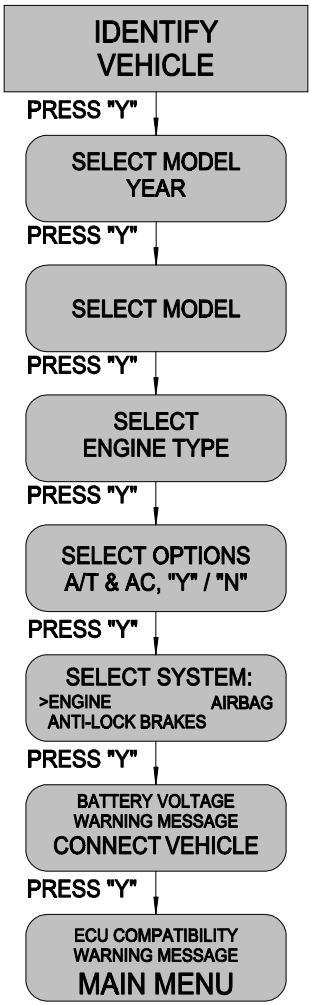
NOTE: ***Using two Primary Cartridges simultaneously is not recommended, the proper functioning of the Scanner is not guaranteed. Removing the cartridge is better, as it is not required at this time, and continue with only one Primary cartridge inserted.***

3: IDENTIFICATION

The vehicle to be tested must always be Identified first. Perform the following vehicle identification process. If an incorrect vehicle has been selected, the selection can be re-entered. To learn more about the Scanner operation there is also a **Demo Program**.

VEHICLE SELECTION

Because manufacturers' midyear changes in engine computer systems may affect data transmission, always enter a *new* identification when testing a *different* vehicle. This is true even when two different vehicles are the same year and model and have the same engine and accessory installations.



The Scanner displays the last vehicle identified, to change the vehicle id, proceed as follows:

1: If applicable, first select the manufacturer. Scroll the thumbwheel to select the Model Year and press **Y**.

2: Scroll the thumbwheel to select the Vehicle Model and press **Y**.

3: Scroll the thumbwheel to select the Engine Type and press **Y**. Also, the Engine ID characters are displayed here for ease of identification.

4: Press **Y** or **N** depending whether the vehicle has an Automatic Transmission or not. When **Y** is pressed, "A/T" will be displayed. Press **Y** or **N** depending whether the vehicle has Air Conditioning or not. When **Y** is pressed, the screen will display "A/C".

5: Verify the identification information. Press **Y** if it is correct or **N** to redo the identification.

6: If applicable, select the System to be tested, e.g. Engine, Anti-lock brakes, Air Bag, etc. Press **Y**. A battery voltage warning message can be displayed, press **Y**.

7: After pressing **Y** a message will be displayed, indicating where the diagnostic connector is mounted on the vehicle and which adaptor to use for this particular vehicle. The name is on the adaptor. Release the "Quick ID" button now if applicable.

8: Connect Scanner cable and adaptor to the vehicle's diagnostic connector and then turn key "ON", if this was not previously on.

9: Confirm by pressing **Y**.

ABBREVIATIONS

ABBR	DESCRIPTION	ABBR	DESCRIPTION
1BL	One Barrel Carburettor	L4	4-Cylinder Line Engine
2BL	Two Barrel Carburettor	MPI	Multi-Point Injection
A/C	Air Conditioning	PA	Passenger Air Bag
A/T	Automatic Transmission	PP	Passenger Pretensioner
CPI	Central Point Injection	PSA	Passenger Side Air Bag
DA	Drivers Air Bag	RL	Rear Left, (Wheel)
DP	Driver Pretensioner	RR	Rear Right, (Wheel)
DSA	Drivers Side Air Bag	T4	4-Cylinder Transverse Engine
DSL	Diesel Engine	TC	Traction Control
ECU	Electronic Control Unit	T-DSL	Turbo Diesel Engine
EFI	Electronic Fuel Injection	TPS	Throttle Position Sensor
FL	Front Left, (Wheel)	V6	6-Cylinder V-Engine
FR	Front Right, (Wheel)	VV	Variable Venturi Carburettor

NOTE: ***The Abbreviations used will vary depending on the cartridge inserted. Before the vehicle identified, press N and scroll for a listing of all of the abbreviations used for that particular cartridge.***

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4: MAIN MENU

All programs can be accessed from the “Main Menu”. To return to the “Main Menu” from the various sub-menus press **N** several times. The available items in the “Main Menu” are dependant on:

- Vehicle system to be tested
- The primary cartridge inserted
- Availability of a “Movie”
- Availability of the Troubleshooting Cartridge

NOTE: ***The “Main Menu” may be different from the illustration below.***

MAIN MENU	[PRESS N FOR HELP]
>CODES & DATA	OTHER SYSTEMS
CUSTOM SETUP	*REVIEW MOVIE*
FUNCTIONAL TESTS	*TROUBLESHOOTER*

On screen help messages are available for each of the “Main Menu” selections. To read the help message for a “Main Menu” selection, point the cursor arrow at the selection and press **N**. (Even when the message “Press N for Help” is not displayed).

To select a “Main Menu” function, move the cursor to the desired function and press **Y**. Depending on the vehicle, several options may be available:

1: CODES AND DATA

Allows the reading of input and output signals (switches, sensors and actuators, etc.). This option is available only on vehicles that can transmit ECU operating data to the Scanner. “Codes & Data” also allows the reading of trouble codes from the ECU.

Also, in a sub-menu or an exit menu the “Movie” function is available for recording continuous computer data and play it back later for review and analysis. If “Codes & Data” is displayed on the “Main Menu”, then “Code Functions” will not appear.

2: CUSTOM SETUP

Allows the selection of certain Scanner functions for a customized setup:

- Set parameters for communication between Scanner and a PC.
- Change English/Metric units.
- Assign functions to the 4 LED’s. (Right/Left Hand Drive Setup).
- Backlight setting.

3: FUNCTIONAL TESTS

For direct activation of peripheral parts, connected to the ECU. The actuator test menu displays all relevant available actuators.

The Functional Tests are also used for Ignition and Fuel adjustments on some vehicles.

4: OTHER SYSTEMS (IF APPLICABLE)

Use this item to select another system (if fitted) to be tested, e.g. Engine, Anti-lock brakes, Air Bag, etc. However, actually selecting a different system will cause any stored data to be lost and a warning message like below will be displayed:

SELECTING ANOTHER SYSTEM WILL CAUSE ANY STORED INFORMATION TO BE LOST, PRESS “N” TO RETURN TO THE PRESENTLY SELECTED SYSTEM, OR “Y” TO SELECT A DIFFERENT SYSTEM.

5: REVIEW MOVIE

Only if a movie was previously recorded, then the menu item “Review Movie” will be displayed. The recorded data can be displayed.

6: TROUBLESHOOTER

Only if the Troubleshooter Cartridge is inserted. If the Troubleshooter cartridge is inserted, specific vehicle information can be obtained, such as, Code Tips, Symptom Tips, Test Procedures, Technical Assistance and full system tests, etc.

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5: CODES AND DATA

The “Codes & Data” selection from the “Main Menu” is available on most vehicles. In this mode, the Scanner reads data available on the ECU data stream, including trouble codes that may be present in the ECU memory.

This means that “Codes & Data” can be used for testing in the workshop. The engine operates normally under ECU control.

The “Codes & Data” mode will display the following title line:

** USE CUSTOM DATA LIST FOR FASTER REFRESH **

DISPLAYING CODES AND DATA

1: The “Codes and Data” can be selected directly after the vehicle identification procedure.

2: After the communication has been established between the Scanner and the vehicles, ECU, the first line of the screen will display very important information, e.g. Engine rpm, Lambda Voltage and the Battery Voltage.

3: The second line displays a message: “Use Custom data List for faster refresh” or “Scroll for Data” or “OK to Drive”. Press **N** to leave this screen and enter the “Customer Data List” if applicable. (See section *Custom Data List*).

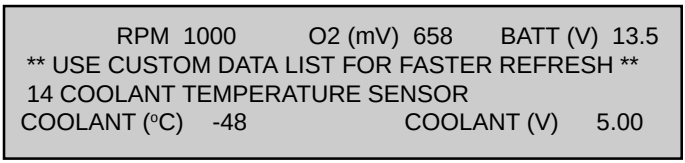
4: If applicable, on the following display lines, Fault Codes (if any) stored in the ECUs memory are displayed. If more than 2 fault codes have been stored, they can be viewed by scrolling the thumbwheel.

5: Fault codes that are set during the test, will be added to the list. The following lines display “Live Data”.

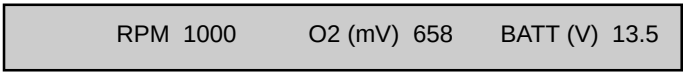
6: By pressing **N** to leave the “Codes and Data” screen and the Codes and Data “Exit” menu will be displayed.

DATA LISTS

When **Y** is pressed from the “Main Menu” to select “Codes & Data”, the Scanner displays the ECU data list and information about trouble codes, if applicable:



The data items available will vary from one vehicle to another. For some vehicles, the data list may be as short as 2 parameters. For others, it may be as long as 70. As many as 9 different parameters can be viewed on the 4-line display. The top line remains fixed.



The second line and all following lines can be scrolled forward and backwards with the thumbwheel. When the end of the list is reached, one or two blank lines will appear or the last line will not scroll if lines 2 and 3 are fixed.

BAUD RATE

To test some vehicles in the “Codes & Data” mode, the Scanner must communicate with the ECU and receive ECU data over a serial data link. “Serial” means that data parameters are transmitted one after the other, in series.

The speed at which the Scanner operates and displays data depends on the length of the serial data stream and on the baud rate of the vehicle ECU. The baud rate is the data transmission speed in digital bits per second.

The baud rate determines how fast the Scanner responds to the ECU and how fast the data readings change on the screen. It also affects the time that it takes to record a movie. Data readings from a high-baud rate ECU may appear to change almost instantly. Readings from a low-baud rate ECU will appear to change more slowly. This display speed, or “data update rate” depends on the ECU; it is *not* controlled by the Scanner.

BIDIRECTIONAL ECUS

Most vehicles offering the “Codes & Data” mode have bidirectional ECUs. This means that the ECU not only communicates with a Scanner, but it accepts commands from some test equipment. Bidirectional ECUs transmit complete data streams to the Scanner and provide functional test capabilities. The Scanner provides some bidirectional test capabilities on certain late-model vehicles. A few special test commands that override normal ECU operation, however, are restricted to manufacturers’ special test equipment.

SCANNER COMMUNICATION

The “Codes & Data” selection from the “Main Menu” requires that the Scanner communicates with the ECU. The following must be performed:

- Connect the Scanner to the Diagnostic Connector.
- Turn the ignition ON.

If one of these functions is selected before doing these things, the Scanner displays a message similar to this:

> WAITING FOR ECU TO COMMUNICATE WITH SCANTOOL.
> ENSURE SCANTOOL IS CONNECTED.
> TURN KEY ON.
> .....

This display also appears the first time “Codes & Data” is chosen from the “Main Menu”. It stays on the screen until communication is established and power is applied. The Scanner then will go to the selected function. If communication is interrupted during testing, but power remains connected, a message will be displayed:

> NO COMMUNICATION. IS KEY ON? ENSURE SCANTOOL IS CONNECTED WAIT 15 SECONDS.
> PRESS N TO REENTER VEHICLE IDENTIFICATION, OR SEE REFERENCE MANUAL.

For example, this could occur if the ignition is turned OFF.

If the Scanner establishes communication, the “Main Menu” will appear. If it does not, press **N** several times to check the vehicle identification and correct it if necessary. If the identification is correct, disconnect the Scanner and check the vehicle connector for damaged terminals and open wiring.

The “No Communication” message means that the Scanner is not receiving data from the ECU. The cause may be as simple as incorrect vehicle identification, a blown fuse or a wiring fault in the vehicle. In some cases, lack of communication may indicate an ECU problem. However, other causes are more common.

TROUBLE CODES

For most cartridges, trouble code information appears as part of the ECU data list on the Scanner. If no codes are present in the ECU, the third line displays:

> NO CODES PRESENT

If a code is present, it is displayed along with a description, like the following:

```
        RPM  1000        O2 (mV)  658      BATT (V)  13.5
** USE CUSTOM DATA LIST FOR FASTER REFRESH **
14 COOLANT TEMPERATURE SENSOR
COOLANT (°C)   -48                 COOLANT (V)    5.00
```

If two or more codes are present, scroll the thumbwheel to see any other codes and the start of the data list. If a problem occurs during testing that causes a trouble code, the code will be added to the list of codes.

On most vehicles the codes can be cleared by using the Scanner. For these vehicles, the “Clear Codes” option will be listed on the “Exit” menu, described later.

FIXING, HOLDING AND RECORDING

The Scanner allows the fixing (freeze) of selected data lines and scroll others into position to compare related parameters. It also allows the holding of a single complete data frame for review or printing and it allows the recording of a movie to troubleshoot intermittent driveability problems. The following sections explain these operations. The “Exit” section contains further instructions.

FIXING DATA LINES

One or two lines of data on the 2nd and 3rd lines of the display in “Codes & Data” can be fixed or frozen. When a line is fixed, the parameter titles stay fixed, but the data readings remain live and are continuously updated from the ECU data stream. Fixing a line allows the scrolling of other parameters into position for comparison.

To fix a line, scroll the desired data into position on line 2 or 3 of the display. Press **N** to exit and display the “Exit” menu. The available choices to fix or release line 2 or 3 are displayed on the “Exit” menu. Instructions for fixing and releasing lines are given in the “Exit Options” section. The following general rules apply:

- Line 1 is permanently fixed in position and cannot be released.
- Only lines 2 and 3 can be fixed; line 4 cannot. It always scrolls.
- The mode title line and trouble code lines cannot be fixed. Only data lines can be fixed.
- Line 2 must be fixed before line 3 can be fixed. Line 3 must be released before line 2 can be released.

Fixed lines remain fixed when exiting “Codes & Data” and then resume viewing data from the “Exit” menu. Releasing or changing line selections must be done through the “Exit” menu. Fixed lines also stay fixed if changing test functions through the “Main Menu” and if the vehicle transmits the same data list in all operating modes. If the vehicle transmits a different data list in different test conditions, fixed lines are released when making a new “Main Menu” selection.

HOLDING A FRAME OF DATA

To capture and hold a single frame of data press **Y** while in “Codes & Data”. A data frame is one data transmission cycle from the ECU data stream. When holding a frame, all data readings are locked at the last readings before pressing **Y**, the top line of the display looks like this:

HLD	RPM 1000	O2 (mV) 658	BATT (V) 13.5

HLD in the upper left corner indicates that a frame is held. It is now possible to scroll through the data readings to review the held values. Press **Y** again to release the held frame.

If **N** is pressed to exit while a frame is held, the frame will be held in Scanner memory. The frame can be printed from the “Print Fame” option on the “Exit” menu. The frame can be released after printing in two ways:

1: Select “Resume” from the “Exit” menu to re-enter “Codes & Data”. Press **Y** again to release the held frame. Continue viewing data or press **N** to exit.

2: From the “Exit” menu, press **N** for the “Main Menu”. If a frame of data is held, it will be released automatically when going to the “Main Menu”.

RECORDING A MOVIE

A lengthy data movie can be recorded. Recording time will take from a few seconds to several minutes, depending on the baud rate (speed) of the vehicle ECU and the parameters set with the Custom Data List, (if applicable).

To record a movie, first select “Codes & Data”. Press **N** for the “Exit” menu and choose “Arm Movie” from the “Exit” options. Pressing **Y** to arm the movie erases any earlier movie in the Scanner and returns to the previous data mode. The top line of the display looks like this:

ARM	RPM 1000	O2 (mV) 658	BATT (V) 13.5

ARM indicates that the movie is armed and will be triggered when **Y** is pressed. When the movie is armed, the **Y** button no longer holds a single frame of data. It now acts as a trigger for the movie recording. Press **Y** to trigger the recording of the last frames at any time. The movie will record 75 % of the data frames that occur before pressing **Y** and 25 % after. The frame count starts when the **Y** button is armed to trigger the movie. If the engine is not run long enough for the ECU to transmit 75 % of the data frames after arming the movie, the movie length before the trigger point will be shorter than the 75 % frame maximum. When **Y** is pressed to start the movie, the top display line looks like this:

..1	RPM 1000	O2 (mV) 658	BATT (V) 13.5

The frame counter in the upper left advances to show the recording speed of the movie. When the Scanner records 25 % of the frames after the trigger point, the display top line changes to:

END	RPM 1000	O2 (mV) 658	BATT (V) 13.5

N can be pressed at any time to stop the movie short of 75 % of the frames after the trigger. This does not affect the frames recorded before or after the trigger point up to the time **N** is pressed.

"End" appears in the top line when a movie is finished. "End" will appear automatically when 25 % of the frames are recorded after the trigger. If the movie is cut short by pressing **N**, "End" will appear in the top line when resuming viewing "Codes & Data". As long as a finished movie is stored in Scanner memory, "End" will appear in the top line as "live" ECU data is viewed as a reminder that a movie has been recorded.

Pressing **N** after recording a movie (whether it was cut short or let it record the full 100 % of the frames) returns to the "Exit" menu. Press **N** again to go to the "Main Menu". The "Main Menu" now contains the "Review Movie" selection. Scroll the thumbwheel to "Review Movie" and press **Y**. The recorded data can now be reviewed as explained in the "Review Movie" section. Pressing **Y** after recording a movie will again hold a frame of data as described previously.

NOTE: ***The maximum number of frames recorded before the trigger point is 75 and the maximum number of frames after the trigger point is 25 if there is sufficient memory available. If there is insufficient memory available, 3/4 of the frames will be recorded before the trigger point and 1/4 of the frames after the trigger point.***

****

6: CODES & DATA "EXIT" MENU

This menu is displayed after leaving the "Codes & Data" list by pressing **N**. Select the desired menu item using the thumbwheel and press **Y**.

NOTE: ***The "Exit Menu" may be different from the illustration. Press "N" again to return to the "Main Menu".***

> RESUME	LED MENU
PRINT SCREEN	CLEAR ECU CODES
PRINT FRAME	FIX LINE 2
ARM MOVIE	CUSTOM DATA LIST

RESUME

Press **Y** with the cursor at "Resume" to return to the last previous display in "Codes & Data". The Scanner will resume at the same screen position from which was exited. Any data lines that had been fixed will stay fixed.
If a frame of data was held when exited the data viewing mode it will still be held when resume is selected. Press **Y** to release the data held after resuming. A held frame cannot be released from the "Exit" menu, but it will be released automatically by going to the "Main Menu".

PRINT OPTIONS
The Printer (Option) must be connected:

The "Exit" menu gives two choices for printing data.

- "Print Screen" prints any 4-line display of data or codes.
- "Print Frame" prints one complete frame, or data transmission cycle, from the vehicle ECU, including any codes that may be present.

A screen or a frame can be printed in two different forms:

1: If a frame was held when exited from the data viewing mode, printing a screen will print the last four lines and the exact data values seen before exiting. Printing a frame will print the complete frame held when exited.

2: If a frame was not held before exiting, the Scanner continues to receive ECU data in the background and updates its data readings. If printing either a screen or a frame without a frame being held, the most current readings received will be printed. If printing a screen, the last four lines viewed, but the data values or trouble codes may have changed since the lines were viewed.

The Scanner must be connected to the printer with one of the optional communication cables.

Refer to the “Custom Setup” section of this manual for instructions about setting the Scanner for printer communication. Refer to the “Remote Printer Setup” section of the Reference Manual for information on setting-up the printer.

All print-outs of a screen or a frame include the vehicle identification.

After connecting the printer and ensuring that communication is set correctly, scroll the thumbwheel to “Print Screen” or “Print Frame” and press **Y**. This starts the printing operation, and the Scanner displays:

```
PRINTING.                                    WAIT.
PRESS N TO ABORT PRINTING.
```

When printing is complete, it automatically returns to the “Exit“ menu. If **N** is pressed to abort the printing, the Scanner returns to the “Exit” menu before printing is complete.

If the printer does not respond or fails during printing, the Scanner displays this additional message on lines 3 and 4:

```
PRINTING.                                    WAIT.
PRESS N TO ABORT PRINTING.
PRINTER NOT RESPONDING.  CHECK PRINTER.
CHECK PRINTER PAPER.
```

If the printer problem is corrected or if the printer recovers, it returns to the normal printing display. Lines 3 and 4 clear automatically and the printer resumes printing.

ARM MOVIE

Perform the following steps to arm the **Y** button as a trigger to record a movie:

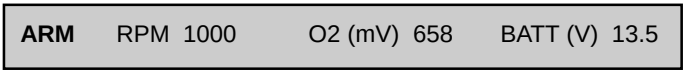
1: From the “Main Menu”, select “Codes & Data” and press **Y**.

2: After entering “Codes & Data”, press N for the “Exit” menu.

3: Scroll to “Arm Movie” and press **Y**. The following will be displayed:

```
PRESS Y TO CLEAR MOVIE MEMORY AND ARM
MOVIE TRIGGER.  FRAME NUMBERS WILL
APPEAR ON C&D SCREEN AFTER MOVIE IS
TRIGGERED.
```

4: Pressing **Y** erases any previous movie stored in Scanner memory and arms the **Y** button to trigger a new movie. The Scanner automatically returns to the previously selected data mode and “Arm” appears at the left side of the top line.



Pressing **N** aborts the “Arm Movie” selection and returns to the “Exit” menu. If a previous movie was recorded, it is erased. The current movie can be reviewed but only from the **0** Trigger point and negative frames.

5: Press **Y** to trigger the movie after returning to the data mode.

LED MENU, (If Applicable)

The “LED Menu” choice on the “Exit” menu allows the reprogramming of the operation of LED 3 or 4 to monitor various vehicle functions. The “LED Menu” also is available from the “Custom Setup” selection on the “Main Menu”. Refer to the ”Custom Setup” section in the Reference Manual for more information.

If the “LED Menu” is entered from the “Exit” menu, the Scanner returns to the last data viewing mode after checking or reassigning the LED functions.

FIX (RELEASE) LINE 2 OR 3 OPTIONS

Before selecting one of the options to fix or release line 2 or 3, the “Codes & Data” with the desired data items on the selected line must be active. Mode title lines, trouble code lines, and blank lines cannot be fixed. If any of these items are on line 2 or 3, the fix-line option for that line will not appear on the “Exit” menu.

After scrolling the desired line into position, press **N** from the data mode for the “Exit” menu. If neither line 2 nor line 3 is fixed, the display will look like this:

Scroll the thumbwheel so that the cursor points to “Fix Line 2” and press **Y**. The Scanner automatically returns to “Codes & Data”. The next time the “Exit” menu is entered, the “Fix (Release)” selection will read:

Scroll the thumbwheel either to “Release Line 2” or to “Fix Line 3” and press **Y**. The Scanner automatically returns to the previous data mode. If both lines 2 and 3 are fixed, the selection will list only:

Line 3 must be release before Line 2 can be released. Scroll to “Release Line 3” and press **Y**. Again, it will automatically return to the previous data mode. The “Exit” menu will be displayed with “Release Line 2” and “Fix Line 3” choices.

If Line 2 is released, the “Exit” menu will return to its original appearance. Fixed lines remain fixed as the various menu selections are entered and exited. Line selections must be released or changed through the “Exit” menu. Line selections are retained in Scanner memory unless the vehicle transmits different data streams or until a new vehicle identification is entered.

When a new vehicle identification is entered, any fixed lines are automatically released. Refer to the explanation of fixed lines in the “Codes & Data” section for more information.

CLEAR ECU CODES

Most vehicles allow the clearing of trouble codes from the ECU memory directly through the Scanner. If the particular ECU doesn’t have this option built in, the Scanner will display instructions how the Codes may be cleared. The item “Clear ECU Codes” will be displayed on the “Exit Menu”. If the option is not available on a vehicle, this item will not be displayed. If the option is available, scroll the thumbwheel to the selection and press **Y**.

Messages are displayed on the screen which guide the operator through the process of clearing codes from the vehicle under test.

> TO CLEAR CODES, KEY MUST BE ON AND
> ENGINE MUST BE OFF.
>
> PRESS Y TO INITIATE CODE CLEARING.

Press **Y** to initiate code clearing, depending on the ECU the following messages can appear:

> IMPORTANT: ECU NEEDS TO BE RESET!
> TURN KEY OFF, THEN ON AND WAIT 10
> SECONDS. THEN START THE ENGINE.
> PRESS Y TO CONTINUE.

> LET ENGINE RUN FOR 30 SECONDS AND THEN
> TURN ENGINE OFF. THEN TURN KEY ON.
>
> PRESS Y TO CONTINUE.

By pressing **Y** the codes will be cleared automatically, if applicable for the vehicle under test.

The Scanner returns to the previous “Codes & Data” mode, and line 3 of the display indicates that codes are cleared by displaying the message:

```
NO CODES PRESENT.
```

If the code-clearing operation fails for any reason, the previous codes will reappear at the top of the data list when returning to “Codes & Data”. Press **N** to return to the “Exit” menu and repeat the “Clear Codes” operation.

NOTES TO CLEAR CODES

NOTE: ***Be aware, some cleared codes can only be set again under certain circumstances. Note or print the codes before repair and before clearing codes.***

NOTE: ***When an error condition still exists, the code can be set again by the ECU.***

CUSTOM DATA LIST, (If Applicable)

This menu selection allows the operator to customise the data list by selecting which data parameters are displayed. This allows the operator to focus more on suspicious or symptom specific data parameters. In addition, eliminating unneeded data parameters allows for a faster Scanner display up-date rate. (The fewer data parameters there are to up-date, the faster the up-date rate). To use this function, simply select “Custom Data List” from the “Codes & Data Exit Menu”. The Data Selection Screen will be displayed:

```
SCROLL AND PRESS Y TO SELECT/DESELECT:
 >*SELECT ALL
  *CODES
  *RPM
```

An asterisk (*) next to a parameter title indicates that the parameter is selected for display. When this screen is first displayed, all data parameters available for the vehicle identified are deselected. To select or deselect a data parameter, simply move the cursor to the parameter title and press **Y**. If “Select All” is selected, all parameters will be displayed, as in the default screen. “Select All” can also be deselected. If “Codes” is selected, only the fault codes will be displayed.

When the desired parameters have been selected, press **N** to return to the “Codes & Data” display and view the customised data list. Custom Data List selections are retained in the memory until a new vehicle identification is entered, select all parameters or select another vehicle control system. If a parameter is deselected while using the troubleshooter, tips displayed for that parameter may be affected.

****

7: REVIEW MOVIE

"Review Movie" appears on the "Main Menu" only if a movie has been recorded. Subsequent movie recording or entering a new vehicle identification overwrites or erases any previous movie.

The movie can be up to 101 frames long:

- The number of frames is dependant on the ECU data and/or the custom data list.
- Maximum 25 after the trigger unless cut short.
- The trigger point is frame zero (**0**).

A movie print-out of a screen or a frame of data includes the vehicle identification. A movie display does not show the vehicle identification.

Scroll the thumbwheel to "Review Movie" on "Main Menu" and press **Y**.

The previously recorded movie is displayed in the data viewing mode:

```
0        RPM  1000        O2 (mV)  658      BATT (V)  13.5
              * * * * CODES & DATA * * * *
14 COOLANT TEMPERATURE SENSOR
COOLANT (°C)   -48                 COOLANT (V)     5.00
```

The movie can be reviewed by scrolling as in the data mode. However, these general rules apply to the "Review Movie" operation:

1: Always enter the movie from the "Main Menu". Frame "0", the trigger point is automatically chosen.

2: Upon entering a "Movie", the thumbwheel scrolls lines of data, just as it does in the data-viewing mode.

3: The **Y** button does not fix or hold a screen or a frame of data.

4: The **Y** button acts as toggle switch to change the scrolling operation of the thumbwheel as follows:

   a: When entering the movie at frame 0, the thumbwheel scrolls data lines within that frame. The frame number stays fixed in the upper left corner.
   b: Press **Y** to switch the thumbwheel action to scrolling frames. In this mode it is possible to scroll forward or back in time.
   c: The frame number will start to flash in the upper left corner.
   d: As the thumbwheel is scrolled, the frame number will change when moving to another data frame:

A positive number for a frame after the trigger point.

1	RPM 1234	O2 (mV) 689	BATT (V) 13.5

A negative number for a frame before the trigger point:

-1	RPM 1234	O2 (mV) 689	BATT (V) 13.5

e: Press **Y** to switch the thumbwheel function back and forth from scrolling frames to scrolling data within a frame.

5: With **Y** set so the thumbwheel scrolls data, the frame number remains stationary and does not flash. With **Y** set to scroll frames, the frame number flashes.

6: Scrolling from frame to frame, the data lines on the screen will stay in the same position. Parameter names will not change, but readings may change as different values were recorded from frame to frame.

7: Scrolling data lines within a frame, the thumbwheel moves the lines from top to bottom within that frame. It does not roll over into an earlier or later frame.

8: Data or test mode titles and trouble code information are on lines 2 and 3 of each frame and can be scrolled off as in normal data viewing. Codes may change from frame to frame as recorded; the mode title does not change.

9: LEDs flash to indicate the state of the selected LED assignments from frame to frame.

10: Lines may be fixed with the fix line 2 or 3 options on the “Exit” menu. Fixed lines remain fixed during horizontal and vertical scrolling until released through the “Exit” menu. Fixed lines also remain fixed during “Exit” and “Resume” operations.

11: When resuming reviewing a movie from the “Exit” menu, resume will occur at the last screen and frame viewed before exiting.

12: When resuming reviewing a movie, thumbwheel scrolling operation stays in the condition last selected by pressing **Y** before exiting.

13: Press **N** to exit from “Review Movie” at any time.

****

8: REVIEW MOVIE EXIT MENU

Press **N** to leave the Review Movie. The “Review Movie Exit” menu is displayed:

```
>RESUME                 [PRESS N FOR MAIN MENU]
  PRINT SCREEN                  LED MENU
  PRINT FRAME
```

This “Exit” menu is similar to the “Exit” menu for data viewing modes, except that “Arm Movie”, “Custom Data List” and “Clear Codes” are not available. The menu selections operate the same as the “Exit” menu selections for data viewing modes with the following variations:

RESUME

“Resume” returns to the same frame and line position from which was exited. It does not return to frame 0. Thumbwheel scrolling, fixed lines and LED operation remains as they were set before exiting.

PRINT OPTIONS

The “Print Frame” and “Print Screen” selections operate the same as “Codes & Data”. Operation is the same as explained in the earlier “Exit Menu” section of this manual.

LED MENU

The “LED Menu” selection operates the same as it does when exiting from “Codes & Data”. After resetting the LED assignments, the Scanner returns to the same movie frame and screen from which was exited. The LEDs will now flash to indicate the newly assigned parameter conditions as recorded in the movie.

****

9: FUNCTIONAL TESTS

"Functional Tests" gives the operator the possibility to activate components of the engine management system, such as Actuator Tests, Wiggle Tests, Output State Tests, etc. The number of tests depends on the primary cartridge, some examples are listed below:

REVIEW ECU ID
Information concerning the ECU is displayed in this test. Select "Functional Tests" from the "Main Menu" and press **Y**. Select "Review ECU ID" and press **Y**. The Scanner displays the identification data of the ECU under test. Press **Y** again to return to the "Functional Tests" menu.

ACTUATOR TESTS
Which actuators can be activated is dependant on the ECU under test and the vehicle itself. For example:

- Injectors
- Idle Air Stepper Motor
- Air Conditioner Relay

The Scanner commands the ECU to activate a component. But it doesn't check whether the component is actually operating correctly. In most cases the effect can be clearly heard; a relay clicks or a pump runs. Be aware, actuators can be mounted anywhere within the vehicle, e.g. under the dashboard, under the bonnet and even in the boot. If no reaction can be heard at all, measure the actuator with an Oscilloscope or a Multimeter, this will indicate whether the ECU is controlling the component properly or not.

NOTE: ***Often a certain actuator may not be present on a vehicle, although according to the manuals it should be. Please check this first after failing to hear a reaction from the actuator under test. Have the engine running only when instructed to do so by the Scanner.***

IGNITION ADJUST
Use this test to increase or decrease the ignition correction. Select "End" and press **Y** to exit this test.

FUEL ADJUST
Use this test to increase or decrease the CO correction. The engine must be running to perform this test. (The values displayed are dependant on the MAP sensor and the ECU). Select "End" and press **Y** to exit this test.

NOTE: ***For both the Ignition and the Fuel Adjustments, the maximum and minimum adjustment values are dependant on the ECU type.***

10: OTHER SYSTEMS

Use this item to select another system (if installed) to be tested, e.g. Engine, Anti-lock brakes, Air Bag, etc. However, actually selecting a different system will cause any stored data to be lost and a warning message will be displayed:

SELECTING ANOTHER SYSTEM WILL CAUSE ANY STORED INFORMATION TO BE LOST, PRESS “N” TO RETURN TO THE PRESENTLY SELECTED SYSTEM, OR “Y” TO SELECT A DIFFERENT SYSTEM.

NOTE: ***The menu displayed is dependant on the selected vehicle.***

```
SELECT SYSTEM: (IF FITTED)
  ENGINE
>ANTI-LOCK BRAKES
  AIR BAG
```

ANTI-LOCK BRAKES

1: Select “Anti-lock Brakes” and press **Y**, a message will be displayed giving information about connecting an adaptor, press **Y** to continue. The “Main Menu” will be displayed.

2: Select “Codes Only” and press **Y**, the following “Code List” should be displayed, (example):

NOTE: ***Some Systems may also display “Data”.***

```
                CODE LIST
          * * * * CODES ONLY * * * *
16 BRAKE SWITCH
24 REAR LEFT WHEEL SENSOR OPEN CIRCUIT
```

3: Use the thumbwheel to scroll through the “Code List”.

4: Press **N** to enter the “Exit Menu” functions, (these functions are exactly the same as previously described, i.e. Resume, Print Screen, etc.), press **N** again to return to the “Main Menu”.

CAUTION: ***The ABS System can be damaged or disabled if the Scanner is disconnected before communication has ceased.***

Always return to the Main Menu and select “Other Systems” before disconnecting the Scanner.

AIR BAG

1: Select “Air Bag” and press **Y**, a message will be displayed giving information about connecting an adaptor, press **Y** to continue. The “Main Menu” will be displayed.

2: Select “Codes Only” and press **Y**, the following “Code List” should be displayed, (example):

NOTE: ***Some Systems may also display “Data”.***

CODE LIST
* * * * CODES ONLY * * * *
30 PASSENGER AIR BAG DISABLED
33 BATTERY LOW VOLTAGE

3: Use the thumbwheel to scroll through the “Code List”.

4: Press **N** to enter the “Exit Menu” functions, (these functions are exactly the same as previously described, i.e. Resume, Print Screen, etc.), press **N** again to return to the “Main Menu”.

****

11: CUSTOM SETUP

Allows the selection of certain Scanner functions for a customized setup:

- Set parameters for communication between Scanner and a PC or printer.
- Change English/Metric units.
- Assign functions to the 4 LED's or Right / Left Hand Drive Setup
- Backlight setting.

Use the Thumbwheel and the **Y** and **N** buttons to select and deselect the various options.

```
>COMMUNICATION SETUP
 ENGLISH / METRIC
 LED MENU
 CONTRAST ADJUST
```

NOTE: ***"Right/Left Hand Drive Setup" will only be displayed in the start-up menu where applicable.***

COMMUNICATION SETUP
Use this selection to set the baud rate for RS 232 serial communication with a PC or a printer. The possible selections are as follows:

a: MT1670 Printer, (2400 baud)
b: Other communication, 4800 baud
c: Other communication, 9600 baud
d: Other communication, 19200 baud

ENGLISH / METRIC
Use this selection to adjust the units of measurement displayed during testing. The possible settings are as follows:

Temperature, °C or °F	Air Pressure, kPa or "Hg
Vehicle Speed, MPH or KPH	Other Pressure, PSI or kPa

RIGHT / LEFT HAND DRIVE SETUP, (If Applicable)
When the Scanner is first powered-up with no vehicle selected or identified the "Right / Left Hand Drive Setup" will be displayed on the Custom Setup Menu.

It is recommended to select whether the vehicle to be tested is a right or a left hand drive before it is identified. This is because some of the messages displayed may vary depending on the type of drive selected.

LED MENU

Parameters can only be selected to be On/Off, or Open/Closed or Rich/Lean. This is useful for a quick check when driving or accelerating to check whether a switch or an actuator is operating correctly under normal driving conditions.

To change the LED assignment, scroll to select the choice and press **Y** to set. The various LED assignments may be different for each vehicle selected.

CONTRAST (BACKLIGHT) ADJUST

Use this selection to adjust the Backlight setting. When the Scanner is powered from the vehicle the Backlight is always set to ON and can not be adjusted.

When the Scanner is powered from the PowerPac the Backlight can be switched ON or OFF by pressing and holding **N** for 4 seconds anytime. For the auto-shut off selection press **Y**. The possible selections are as follows:

a: Turn off after 2 minutes of inactivity
b: Turn off after 5 minutes of inactivity
c: Don't automatically turn off Backlight

****

REMOTE TERMINAL COMMUNICATION

The primary cartridges for the Scanner also can display test information on some other remote terminals. This communication feature is designed to work with equipment that operates in a VT100 format, which is a common industry standard for terminal operation. The VT100 terminal adapter cable (MT2500-500) can connect to a VT100 terminal or a serial port on an IBM compatible personal computer (PC). If the scanner is used with a PC, *VT100 emulation* software must be installed in the PC.

All remote terminal displays will be in the same format as the 4-line scanner display screen except the CODES and LIVE DATA display. If more than four lines are required to display any service codes found in the vehicle, the complete code list will appear on the screen at one time.

All scanner operations can be controlled from the remote terminal keyboard or from the scanner. Using the scanner with a remote terminal requires an optional terminal communication cable, which connects to the RS232 communication port on the top right of the scanner.

The VT100 terminal adaptor cable (MT2500-500) for the scanner has a 25-pin (DB25) female connector. The scanner transmits data on pin 3 and receives data on pin 2 at the DB25 connector. If the remote terminal connector matches this arrangement, the MT2500-500 terminal adapter cable can be used. If it does not, another adaptor (usually called a “null modem” adaptor) or a special cable may be required. Refer to installation manuals for specific equipment for connector and cable information.

Follow these steps to connect the scanner to the terminal and use the communication program:

1: Use the COMMUNICATION SETUP program on the CUSTOM SETUP menu to set the scanner at a baud rate that is compatible with the terminal. See the “Custom Setup” section for more information.

2: Refer to the terminal manufacturer’s instructions for information on baud rates and any required switch settings or start-up conditions for the terminal. (The communication parameters for a PC should be set to 4800 Baud, No Parity, 8 Data bits,1 Stop Bit.)

3: Connect the terminal communication cable to the scanner and to the terminal. The scanner can be connected to vehicle power and at any desired menu or test mode when the cable is connected.

4: Press either the **Y** or **N** or up-arrow or down-arrow key (s or t, or equivalent) on the terminal to start the scanner communication with the terminal.

5: Use either the scanner controls or the terminal keyboard to operate all scanner functions. The **Y** and **N** keys on the keyboard correspond to the **Y** and **N** buttons on the scanner. The up-arrow and down-arrow keys on the keyboard correspond to the forward and backward directions of the thumbwheel.

6: On some keyboards, the arrow keys may be combined with the number keys on a numeric keypad. Such keyboards include a NUM LOCK key, which locks the keys in the numerical condition. Be sure the NUM LOCK key is unlocked, or off, so that the arrow keys will act as the scanner thumbwheel.

7: After completing operation of the scanner with the remote terminal, disconnect the scanner from the terminal. Then disconnect it from vehicle power to remove it from the communication mode.

****

TROUBLESHOOTER

The *Troubleshooter* system simplifies the time consuming part of diagnosis.

The *Troubleshooter* system provides on-line diagnostic information on the scanner screen as you work on a vehicle. It greatly minimizes the time-consuming chore of digging through bulky repair manuals for the information you need to solve a problem. The *Troubleshooter* contains information on many common trouble code problems and driveability complaints for vehicles covered by the scanner primary cartridges. It does *not*, however, contain information for *every* possible code and *every* possible problem that could occur on *all* vehicles.
Follow these nine steps to use the *Troubleshooter* system:

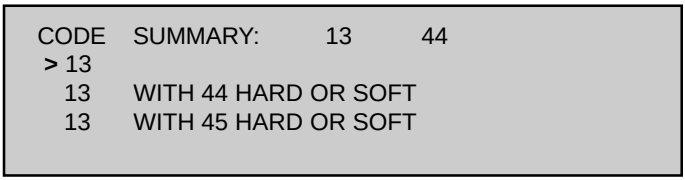
1: Insert the *Troubleshooter* cartridge with power off.

2: Apply power and enter vehicle identification.

3: Use the primary cartridge to read codes or study CODES & DATA to determine the problem symptoms.

4: Select TROUBLESHOOTER from the MAIN MENU. To select *Troubleshooter*, scroll the cursor to TROUBLESHOOTER and press **Y**. If the *Troubleshooter* cartridge does not contain information for a vehicle identification entered into the scanner, TROUBLESHOOTER will not appear on the MAIN MENU.

5: Select a tip from the *Troubleshooter* menu that most closely matches the problem with the vehicle. The *Troubleshooter* menu appears similar to this:



6: Scroll the thumbwheel to view the individual checks in each tip. Each tip listed on the *Troubleshooter* menu contains one or more checks to be made on the vehicle. The checks may include instructions to read one or more parameters, to take voltage measurements, or to inspect various components.

7: Press **N** to exit from any tip.

8: Scroll the thumbwheel and press **Y** to select any other tip listed on the menu for the vehicle being tested. The *Troubleshooter* menu lists all tips available for the vehicle being tested. It is not limited in any way by codes that may or may not be present.

9: Press **N** to leave the *Troubleshooter* menu and return to the primary cartridge MAIN MENU. The primary cartridge and the *Troubleshooter* cartridge work interactively. You can switch back and forth between the *Troubleshooter* menu and the primary cartridge MAIN MENU to perform any available diagnostic reading or test function.

Using *Troubleshooter* Effectively

The checks in each *Troubleshooter* tip begin with the most likely cause of a problem or with the tests that should be made first. The checks then progress through other possible causes and tests. All checks in a *Troubleshooter* tip are common causes of a problem or important basic tests, but the most important are listed first. For the most effective use of the *Troubleshooter* tips, follow the checks in the order in which they are given.

Many checks in the *Troubleshooter* tips will refer to references in the *Troubleshooter Reference Manual*. Consult the references as directed by the tips on the *Troubleshooter* cartridge. Trying to use the references by themselves may cause the missing of important information or to perform some test or adjustment out of sequence.

NOTE: ***Refer to the Troubleshooter Reference Manuals for more details.***

****

TROUBLESHOOTING

1: START-UP PROBLEMS

If the display does not light up when using the Quick ID button or connecting the Scanner to vehicle power, check the following:

- The Scanner battery, located under the left handgrip.
- For a blown cigarette lighter fuse in the vehicle.
- For bent or broken pins at both ends of the data cable and on the test adaptor.
- For a loose cable connection.
- For an open ground wire in the vehicle connector wiring harness.
- For correct connection at the battery if using the battery power adaptor.

Replace the internal battery if the Scanner operates erratically in any way when using the Quick ID button or if recorded data is not retained in the memory.

If the Scanner displays incomplete characters, remove the cartridge and carefully clean the edge connector with a fibreglass pencil eraser, or equivalent. Wipe off eraser dust with a clean cloth.

2: INTERNAL BATTERY VOLTAGE LOW

If the internal battery is low, but still has enough power to light the display, the following message will be displayed:

> KEEP-ALIVE BATTERY VOLTAGE IS LOW
> REPLACE SOON.
> BATTERY IS LOCATED UNDER LEFT HANDGRIP.
> PRESS Y TO CONTINUE.

If the battery is very low but still has enough power to light the display, the message above may be displayed when the Quick ID button is pressed. The screen may then go blank before the cartridge selection display appears. In this case, replace the battery immediately, or the Quick ID button cannot be used. Also, custom setup selections and recorded data may not be saved in memory.

3: VEHICLE BATTERY VOLTAGE LOW

If the vehicle battery is low (less than 10 V), the following will be displayed:

> CAR BATTERY BELOW 10.0 VOLTS.
> CAUTION: ECU'S MAY BEHAVE STRANGELY!
>
> PRESS Y TO CONTINUE.

Replace or recharge the vehicle battery and try again.

4: COMMUNICATION PROBLEMS / STATUS

When the Scanner is unable to establish communication with the ECU in the vehicle under test, or when the communication is interrupted, a message will be displayed.

Wait to see whether the communication is established again or interrupted.

Press **N** to abort.

In this case the communication status is displayed on the screen:

- BEN = engine number in the software, Code1-7 and Baud rate of the communication between Scanner and the ECU.

Switching off-and-on the ignition and a re-enter the ID may reset this. If not successful in reestablishing communication, send the communication status information to Sun Electric, for further investigation of communication problems.

****

GLOSSARY

Code A numerical code or an alphanumerical code, generated by the vehicle control system to indicate that a fault has occurred in a particular sub-system, circuit or component.

Codes & Data The test mode that displays trouble codes and engine computer data parameters for those vehicles that transmit ECU data. Not all Cartridges support “Codes & Data”, some Cartridges will have menu items such as, “Service Codes” or “Data (No Codes)”.

Cursor The arrow that appears on menus and some other displays. In most cases, the cursor moves as the thumbwheel is scrolled.

Fix For vehicles that can transmit “Codes & Data” to lock up a single line of the display in a fixed position on the display to prevent it from scrolling. Data readings remain live while the parameter categories are fixed.

Frame One complete data package or transmission cycle from a vehicle that provides control system operating parameters, (transmits “Codes & Data”).

Hold For vehicles that transmit “Codes & Data”, to capture and hold a single data frame for review and/or printing. Data readings, (measured values) are locked at that frame, while the data parameters and code lines can be scrolled. A data line may be held while the selected lines are either fixed or released.

Movie A vehicle data records up to 101 frames for vehicles that can transmit “Codes & Data”.

Menu A list of vehicle tests or programs which can be selected. Use the thumbwheel to place the cursor at the desired function and press **Y** to select that function.

Parameter A measured value of a control system input or output operation. Parameters include voltage signals, temperature, pressure, speed and other data.

Release To unlock a fixed line and allow it to scroll.

Screen Any given four line display.

Scroll To rotate the thumbwheel for menu selections and to view data.

NOTE: ***Refer to the Reference Manuals for more information.***

****

Introduction

NOTE: ***Only the additional key and functions are explained here. For standard operating features, refer to the Scanner section and the Primary Cartridge operator's manual.***

The Colour Graphing Scanner has the ability to select and graph parameters from a 'live data' menu, e.g. 'Codes and Data' or 'Data only', on screen in a graphical format (refer to Figure 1). This mode is called Graphing Mode.

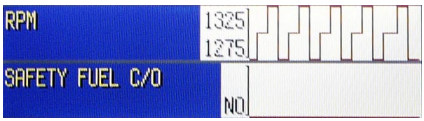


Figure 1

The advantages of the Graphing Mode are:

- it allows the operator to quickly spot glitches, dropouts, spikes and other signal inconsistencies. This comes in handy when conducting a wiggle test or trying to induce symptoms, because it eliminates the need to constantly monitor the screen while watching for parameter values to change. Now full attention can be applied to the testing procedure, with only an occasional glance at the screen to see if the graph pattern has changed.
- it allows the operator to quickly compare the activity of two parameter signals to see if they are synchronized or if they both respond correctly to changes in operating condition (example—comparing the crankshaft position sensor to the camshaft sensor signal).

The Colour Graphing Scanner also provides a capture function that allows the live data to be frozen on the screen for review. This feature is ideal for capturing intermittent failures during a test drive.

The Colour Graphing Scanner uses the same Primary and Trouble Shooter cartridges as the Scanner.

Baud rate settings

Prior to entering the Graphing Mode, ensure that the baud rate is set to **4800**, **9600** or **19200** baud.
Setting the baud rate is described in the relevant section of this manual.

Layout

Following elements are specific to the Colour Graphing Scanner. All other buttons and their functionality are described in the Scanner section.

Refer to Figure 2.
1 -Connection for battery charger
2 -'Graphing' button

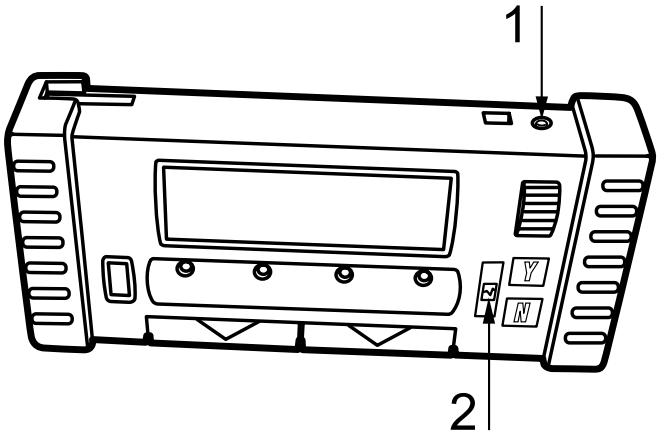


Figure 2

Understanding the Display

Refer to Figure 1. The parameter description appears on the left side of the screen and the graph appears on the right hand side.

NOTE: ***The graph area of the screen has a variable time base and the time interval of the display is determined by the baud rate (the data transmission speed) of the ECU on the test vehicle, not the baud rate setting of the Scanner.***

The Scanner draws the graph from the right side to the left. To get a rough idea of how quickly the ECU transmits data, time how long it takes for the graph to fill the entire screen area when the Graphing Mode is activated for the first time on the vehicle.

The graphs on the screen are digitally compiled based data signals from the ECU of the vehicle. Although the graph may look similar to a graph on a lab scope or graphing multimeter, there are some significant differences:

- the display shows the vehicle data stream information, **not** actual sensor and actuator signals, in a graphical format.

NOTE: ***If the ECU is operating in a default mode (substituting pre-programmed values to control the actuators due to absent or unreliable input signals), these default values transmit on the data stream of some vehicles.***

- the graph plots trends of the parameter signals and is **not** intended to be used for measuring voltage level, frequency, amplitude, or other signal characteristics. Use a lab scope, or digital / graphing multimeter for taking accurate signal measurements.

When a parameter changes, the graph responds immediately and plots the change. Refer to Figure 3. Note that both graphs change simultaneously.

Figure 3

Since the graph represents a period of time the glitch stays on screen for a while, it gradually moves across the screen as the data continues to update. Remember that the amount of time represented on the Scanner screen graph is dependent upon the baud rate of the ECU being tested. Typically, newer ECUs transmit data at a faster rate and the entire screen refreshes in about 20 seconds. The screen updates considerably slower on older ECUs that have a lower baud rate.
Regardless of the data transmission rate, the Scanner graph reflects the most recent frames of data.

Entering Graphing Mode

The following steps describe how to move from normal Scanner functions into Graphing mode.

NOTE: ***If the Colour Graphing Scanner is powered by its internal battery, the Graphing Mode can not be entered. Ensure the Scanner is powered by the (optional) Power Pack or by the vehicle (Data Cable).***

- Only from a live data screen (in the **Data** or **Codes and Data Menu**), press the **Graphing** button on the scanner. The Graphing Menu displays, refer to Figure 4.

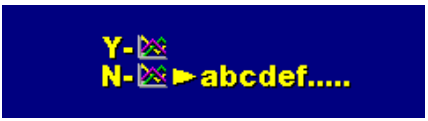


Figure 4

- Press the **Y** button to enter the Graphing Mode. The program will setup the communication. Figure 5 should appear. If not, refer to the Trouble Shooting section at the end of this appendix.

Figure 5

Live data parameters for the vehicle under test will be displayed, for a sample refer to Figure 6.

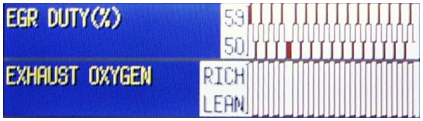


Figure 6

- Scroll the thumbwheel to select the parameter to be viewed.

Locking a parameter

- Scroll the thumbwheel to position the parameter that will be 'locked', on the top half of the display.
- Press the **Y** button to lock the top line of the display. A lock icon appears to show the parameter is locked. Refer to Figure 7.

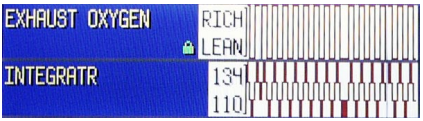


Figure 7

- Scroll the thumbwheel until the second sensor parameter to be viewed displays on the bottom line.
  Now the two graphs build simultaneously. In this example there seems to be a relation between the parameters, e.g. pulse width.

Unlocking a parameter

- Press **Y** again to unlock the top line of the display. It is now possible again to scroll both lines to select parameters for viewing.

Capturing data in Graphing Mode

The capture function allows one to instantly capture and hold the data on the display. This function freezes all parameters transmitted on the data stream. One can scroll through the entire data parameter list to get an accurate picture of everything that was occurring when the capture function was invoked.

To capture data:

- press the **Graphing** button.
  The displayed data is now captured and held. Refer to Figure 8.

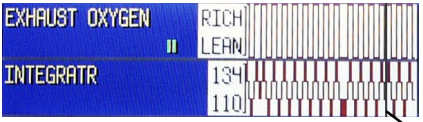


Figure 8

appears on the display to indicate that no “live” data is shown.
To return to “live” data:

- press the **Graphing** button.
  A vertical grey line (Figure 8, *1*) will appear to indicate that a restart was made.

Resetting Min/Max Parameter Values

The minimum and maximum values on the vertical axis to the left of the graph, represent the highest and the lowest values the Scanner has displayed.
To recalculate minimum and maximum values in Graphing Mode:

- press and hold the **Graphing** button for two seconds.
  The values are changed to reflect the data that is visible on the screen.

Exiting Graphing Mode

To exit Graphing Mode:

- press the **N** button once. The Scanner returns to the Graphing Scanner Menu, Figure 9.

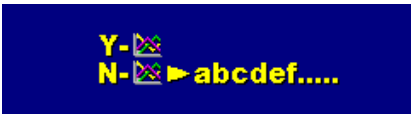


Figure 9

- to exit the Graphing Mode, press the **N** button. The display will equal Figure 10. The Scanner returns to the “live data” screen in text mode.

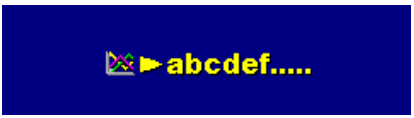


Figure 10

- To return to the Graphing Mode from the Graphing Scanner menu, press the **Y** button.

Trouble Shooting the Colour Graphing Scanner

Only Trouble Shooting specific to the Colour Graphing Scanner is described here.

Baud rate setting error.

If:

- the baud rate is not set to 4800, 9600 or 19200 and
- if the Graphing Mode is entered and the Y button is pressed,

the display will equal Figure 11 (in stead of Figure 5).

Figure 11

The Colour Graphing Scanner will try to set up communication at 4800, 9600 and successively 19200 baud. Refer to Figures 12-1 and 12-2.

Figure 12-1

Figure 12-2

Figure 12-3

If the communication could not be set up, the display will equal Figure 12-4.

Figure 12-4

To proceed properly:

- Press the **N** key to exit.
- Select the correct baud rate and enter the Graphing Mode.

Communication error

If a severe communication error happens, the display equals Figure 13.

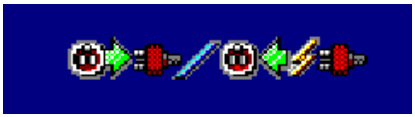


Figure 13

- Disconnect and reconnect the Data Cable to remove power. This will reset the Colour Graphing Scanner.

Internal Battery Pack

The internal battery pack(part number EAA0278B04A) is used **only** to power the Scanner during the Quick ID procedure. During normal operation, the Scanner will receive power through the connection to the vehicle you are testing. Depending upon use and care, the long-life battery pack can last up to several years.

Recharging Procedures

The internal battery pack that comes with the Scanner is fully rechargeable. When recharging is necessary a screen message displays to alert you that "keep-alive battery voltage is low."
Remember to use only the battery adapter wall unit supplied with your Scanner to recharge the battery. Part number of this adapter unit:

- 115 V~: part number MT2500-600-2
- 230 V~ (UK): 7096E4060-95
- 230 V~ (EU): 7096E4060-96

Allow 8 hours to fully recharge the battery.
To recharge the battery, plug the adapter lead into the right connector on the top of the Scanner (Figure 14, item 1) and insert the adapter unit into an appropriate power outlet socket.

If after prolonged use, your battery consistently fails to hold a charge, the battery must be replaced. To obtain the required replacement battery, contact your Sales Representative.

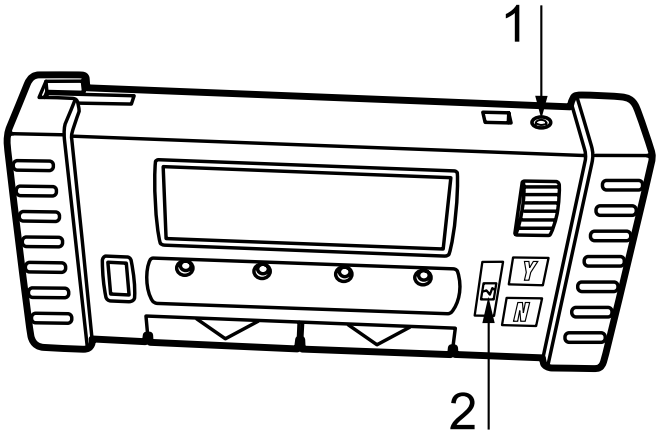


Figure 14

Battery Replacement Procedures

To replace the battery:

1. Grasp the left handgrip and carefully pull it outward and backward off of the Scanner body. Do not remove the metal bail from the handgrip.
2. Slip the battery pack out of the Scanner body and separate the wire connector, Figure 15.
3. Connect the new battery pack to the Scanner making sure the connector is fully seated, then slip the assembly back into the Scanner body.
4. Fit the hand grip onto the end of the Scanner.

WARNING! Do not dispose of the battery in fire. A nickel metal hydrite battery is used in this product and may be considered hazardous waste. Dispose of the old battery pack following all applicable regulations.

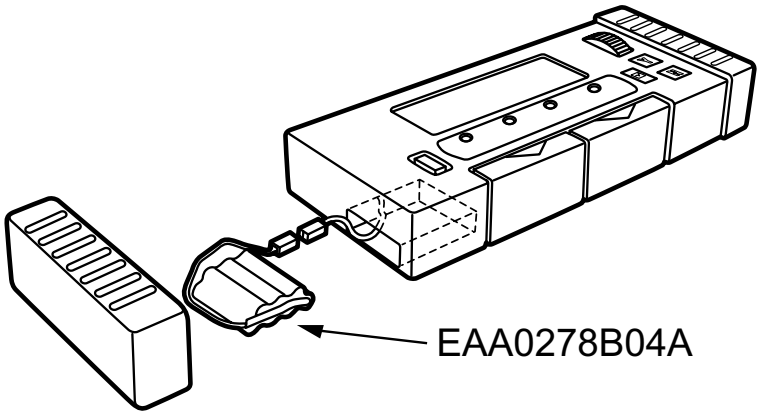


Figure 15

The EMB cartridge.

The Scanner can work either with:
- the Primary Cartridge (for communication with the car) plus an (optional) expert system (Trouble Shooter) cartridge, or
- the Extended Memory Board (EMB) Cartridge plus the Vehicle Communication Interface (VCI) Cartridge.

The advantages of the EMB Cartridge over the Primary Cartridge are:
- The EMB can contain software for either one car brand (previously referred to as Primary Cartridge) or a range of car brands for easier and faster working procedures.
- It can also contain the expert system software on the same EMB cartridge.
- The EMB is re-programmable giving a flexible approach to updates.

In order to operate the Scanner with the EMB, both slots in the Scanner are used:

- One slot for the Vehicle Communication Interface (VCI)
  Contains the communication interface between the EMB Cartridge and the Vehicle.
- One slot for the EMB Cartridge
  Contains the program(s) per car brand.

The Cartridges can be identified by the decal.

Installation Instructions.

1. Insert the VCI Cartridge in the left hand slot at the bottom of the Scanner.
2. Insert the EMB Cartridge in the right hand slot.

Note: ***The EMB Cartridge will not work if the VCI is replaced by a Primary Cartridge or Trouble Shooter Cartridge.***

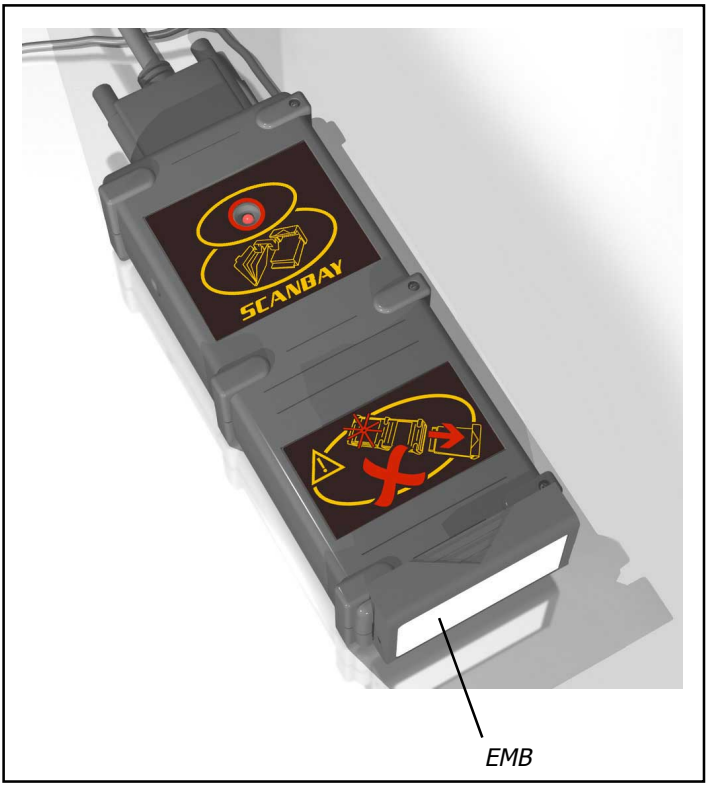
Note: ***If you wish to use a Primary Cartridge or Trouble Shooter Cartridge, refer to the setup as described in Scanner Manual, Section Operation.***

Operation.

Apart from the installation and the introduction of the selection of the car brand in the first menu, there is no difference in operation when compared to the Primary Cartridge.

Installing additional Primary Software on the EMB.

This procedure is described in the Operator's Manual of the ScanBay. The ScanBay can download software onto the EMB Cartridge in order to update the software or expand the amount of Primaries installed.



1: Scanbay