

Synercon Technologies, LLC

Forensic Link Adapter User's Manual



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<http://www.synercontechnologies.com>

Contents

1 Using the Forensic Link Adapter	5
1.1 Quick Start Guide	5
1.1.1 Before Going to the Field	5
1.1.2 Downloading Data	5
1.2 Specifications	7
1.3 Before Using the Forensic Link Adapter	7
1.3.1 Register as an Operator	7
1.3.2 Connect the FLA to the Internet	7
1.3.3 Setting the Time	7
1.3.4 Setting the Timezone	8
1.3.5 Updating the FLA	8
1.4 Working with the Forensic Link Adapter	9
1.4.1 Powering Up	11
1.4.2 Shutting Down	11
1.5 Display Screen Menu System	12
1.6 Menu Screen Descriptions	13
1.7 IP Addresses	20
2 Obtaining Data with the Forensic Link Adapter	21
2.1 Initiating Data Collection	21
2.2 Standards Based Data	21
2.2.1 J1587 Data	21
2.2.1.1 Configuration Data	23
2.2.1.2 Historical Data	23
2.2.1.3 Live Data	24
2.2.2 J1939 Data Message Structure	26
2.2.3 J1939 Configuration Data	29
2.2.4 J1939 Historical Data	30
2.3 Native Downloads	32
2.3.1 Detroit Diesel	32
3 Obtaining Data With Manufacturer's Software	33
3.1 Installing Programs and Drivers	33
3.1.1 RP1210 Drivers	33
3.1.2 Manufacturer's Software	33
3.1.3 PDF Printer	33
3.2 Enabling RP1210 Passthrough Mode	34

Contents

3.3	Cummins	34
3.3.1	PowerSpec Download Protocol	34
3.3.2	Insite Download Protocol	35
3.4	Detroit Diesel	35
3.4.1	DDEC Reports Download Protocol	35
3.4.2	DDDL 8 Download Protocol	36
3.5	Caterpillar ET Download Protocol	36
3.5.1	Prerequisites	37
3.5.2	Connecting to an ECM	38
3.5.3	Warranty Report	39
3.5.4	Snapshot Data	46
3.5.5	Preserving ECM Date and Time	54
3.6	Forensic Write Blocking	55
4	Using the Forensic Link Adapter Portal Website	56
5	Troubleshooting	58
5.1	Functional Tests	58
5.2	Specific Symptoms	58
5.2.1	Forensic Link Adapter Fails to Boot	58
6	Smart Sensor Simulators	60
7	Administrator's Guide	63
7.1	Account Overview	63
7.2	Group Management	65
7.2.1	Adding an Operator	65
7.2.2	Assigning an FLA to the Group	66
8	Definitions	68
9	Suggested Training and Practice	69
9.1	Powering up the FLA	69
9.2	Connecting to the Network and Internet	70
9.2.1	Using a Wired Connection	70
9.2.2	Connect Directly to a Computer	70
9.2.3	Set Up Internet Connection Sharing	71
9.3	Installing PC Software	72
9.4	Connecting to a Heavy Vehicle	73
9.5	Using the FLA Portal	73
9.5.1	Accessing the Data	73
9.5.2	Viewing Event Data	75
9.5.3	Viewing Historical Data	75
9.5.4	Viewing Configuration Data	75
9.5.5	Viewing Fault Code Data	75
9.5.6	Viewing Network Log Data	75
9.5.7	Viewing Session and Timing Data	75

Contents

9.5.8 Distributing a Report	75
9.6 Connecting to Engine Control Modules on a Bench	75
9.6.1 DDEC IV	75
9.6.2 DDEC V	75
9.6.3 DDEC 6	75
9.6.4 DDEC X	75
9.6.5 CAT ADEM III	75
9.6.6 CAT ADEM IV	75
9.6.7 Cummins CM870	75
9.6.8 Cummins CM2250	75
9.7 Understanding How Speed Records are Generated	75
9.7.1 Tracing Schematics	75
9.7.2 Signals from the Tail Shaft Speed Sensor	75
9.7.3 Troubleshooting a Vehicle Systems	75
9.8 Understanding Network Traffic	75
9.8.1 J1708	75
9.8.2 J1939	75
9.9 Understanding Data based on Standards	75
9.10 Working with Manufacturer Specific Data	75
10 Release Notes	76

1 Using the Forensic Link Adapter

This user manual is available at <http://www.synercontechnologies.com/> under the Learning tab.

1.1 Quick Start Guide

Congratulations on purchasing the only heavy vehicle scan tool purpose built for examining vehicles in a forensic or investigative context. Before using the Forensic Link Adapter, please read this section to understand some of its features. In this section, a brief overview is provided to quickly get a user up and running. More detailed discussions of the operation of the FLA are available in this manual.

1.1.1 Before Going to the Field

- Please plug in the Forensic Link Adapter into a known live and functioning Ethernet port with a connection to the Internet.
- Plug in the power cable and let the FLA boot until the screen with the date shows up on the top line.
- Using the Red button, scroll through the different menus until you can see the screen that says “Update FLA Software.” Select this option to be sure that you have the most recent version of the software. A live Internet connection is required to do an update.
- Download and install the DG Tech RP1210 drivers for the DPA4+. These drivers can be found on the downloads page at <http://www.dgtech.com/product/dpa4plus/downloads/downloads.php>. The direct link is http://www.dgtech.com/product/dpa/software/DPA4P_136.zip. You may need to be an administrator for this.
- Download and install any manufacturer’s software, such as DDEC Reports and Cummins PowerSpec.

1.1.2 Downloading Data

- Plug the FLA into the diagnostic connector in the cab of the truck. It will take a minute or two to boot.
- From the screen with the date at the top, the Green button will be enabled if the FLA can detect vehicle network traffic. Press the green button to scan the vehicle network.

1 Using the Forensic Link Adapter

- Once acknowledging permission to scan the vehicle, the FLA will poll and scan the vehicle networks for common data elements, such as VIN and Component Identification. The quantity of items found is displayed on the screen.
- Once the user continues from this screen, the FLA will detect if it supports extracting data specific to the engine and vehicle. If so, then the user can gather this data by pressing the Green button. Otherwise, the user can press the Red button to use the FLA as an RP1210 device.
- Using the FLA as an RP1210 device enables the user to download data with other software, like DDEC Reports or Cummins PowerSpec, in the passthrough mode.
- Exiting passthrough mode compresses the network traffic log file for storage and archiving. There are two passthrough modes:
 - CAN is the most common mode for interfacing with trucks. This is the passthrough mode used for J1939 and is used on all IS series Cummins, and other newer ECUs.
 - J1708 is an older protocol for DDEC 4-6 and Caterpillar. Some brake systems use this protocol too.
- Data will remain on the FLA. An upload to server option on the FLA will upload the data for viewing at <https://fla.synercontechnologies.com> with your login.
- Pressing both buttons will start the shutdown sequence. Please keep the FLA plugged in until it says that it is safe to unplug.

1.2 Specifications

The Forensic Link Adapter is based on a powerful processor based on the Texas Instruments AM335x 1GHz ARM® Cortex-A8 Processor. It has 512MB of DDR3 RAM, 16 GB of internal storage, the NEON floating-point accelerator and 2 PRU 32-bit microcontrollers. The device has 2 Controller Area Network (CAN) channels, 2 J1708 Serial Channels, 100/10 Mbps Ethernet, USB 2.0, and a full implementation of the DG Technologies DPA4+ for RP1210 based communication. The device has a GPS receiver, Real Time Clock. The display uses Organic LEDs for better sunlight readability. It runs embedded Linux and serves its own website.

1.3 Before Using the Forensic Link Adapter

1.3.1 Register as an Operator

The fla-admin should send you an email to invite you to be an operator for your FLA. The fla-admin email is initiated by the Organization administrator inviting a new operator. For more details, please see Chapter [7 on page 63](#).

1.3.2 Connect the FLA to the Internet

Connecting the FLA to the internet gives the FLA its full features. The best method to connect to the internet is to use a wired Ethernet connection to a router that has a DHCP server running. This is typical of most home and corporate networks. A DHCP server is usually built into a modem or router.

If a hard wired connection does not have a DHCP server running to provide an IP address, then the FLA can be activated to serve an IP address to other computers on the network. This is important functionality in the field where a DHCP server and router may not be available and only a direct Ethernet connection to the computer is available.

An additional DHCP server on a corporate or work network may conflict with your organization's IT policy. If there are doubts about enabling the DHCP server on the FLA, please discuss providing the FLA with a reliable internet connection with your network system administrators.

1.3.3 Setting the Time

Once connected to the Internet, the Forensic Link Adapter synchronizes the time with a network time server. This also sets the built in real time clock of the FLA, so accurate times are kept in the Forensic Link Adapter. A record of when the time was last set is stored and included in a time log in the data report.



Figure 1.1: Setting the timezone on the FLA.

1.3.4 Setting the Timezone

The timezone for the FLA can be set in the web interface. Open the web interface by typing in the IP address on the screen of the FLA into your favorite browser (e.g. Internet Explorer, Firefox, Chrome, etc.). Under the Configure menu, select the desired time zone, as seen in Figure 1.1.

1.3.5 Updating the FLA

Updating the FLA requires access to the internet through a known good internet connection. Once established and the FLA is on, scroll to the update screen (Red button) and initiate an update as shown in Figure 1.2 on the following page. It may take a while, but it is important not to unplug the FLA during this process.

To update the FLA its local web interface:

1. Plug the Ethernet connector into a known good Internet connection. This may be a live wall jack, a home router, or tethered through a laptop that is sharing a wireless internet connection. A system administrator may have to help configure a work network to provide a sufficient internet connection.
2. Power on the FLA. It will automatically boot and display an IP address on the Status Menu screen.
3. With a computer connected to the same network as the FLA, navigate a browser to the IP

1 Using the Forensic Link Adapter



Figure 1.2: Photos of the process of updating the FLA from the User Interface.

address show on the front panel of the FLA. This should pull up the web interface for the Forensic Link Adapter.

4. From the main web interface, click the Update Software link, as shown in [1.3 on the next page](#).
5. Confirm that you want a software update by clicking the link on the page to start the updating process.
6. The process to update the FLA takes a long time, so please be patient and leave the device plugged into power and the Internet as it is performing its update.

1.4 Working with the Forensic Link Adapter

Once an investigator has established permission to download the data from a vehicle, the key needs to be turned to the on (not start) position for the FLA to communicate with the Electronic Control Modules (ECMs). The FLA can be plugged into the 9-pin diagnostic connector, which is usually located below the dash on the left side or to the left of the driver's seat. If the ECM was removed, then it should be connected through a Smart Sensor Simulator that emulates a truck.

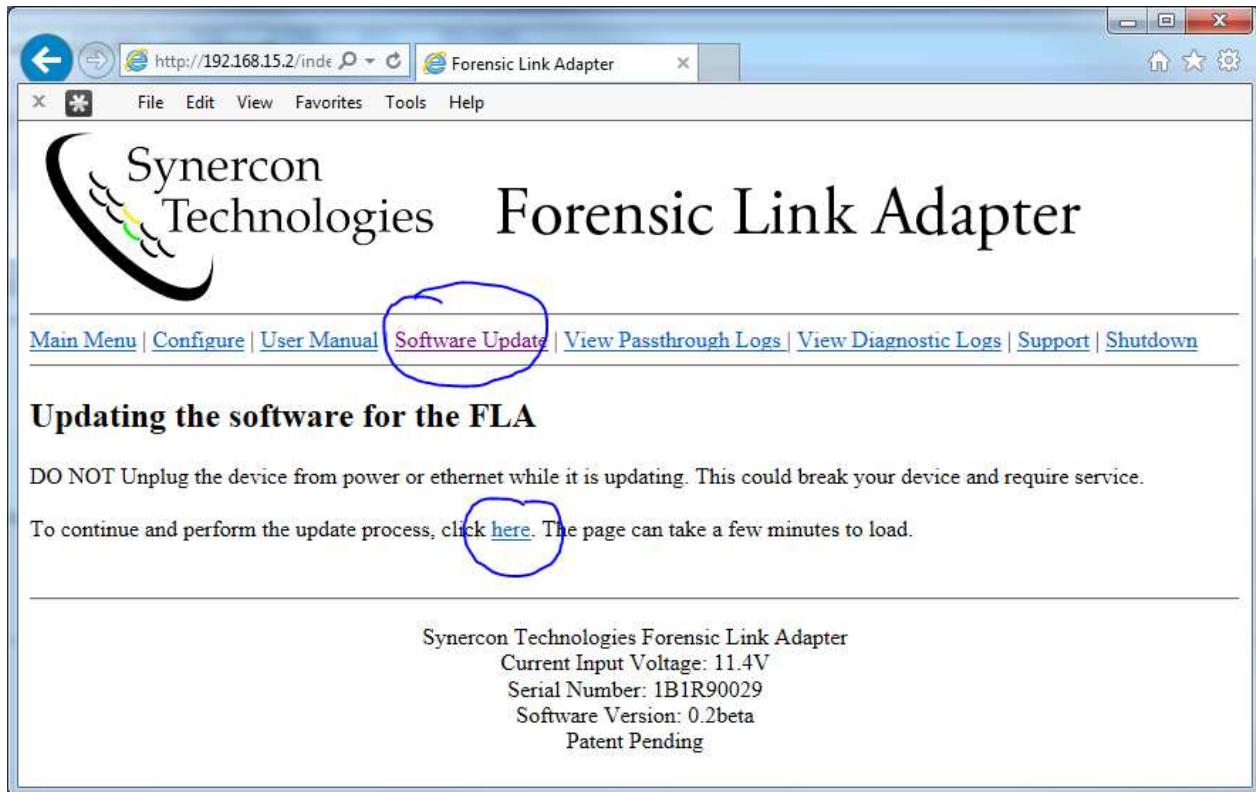


Figure 1.3: Updating the FLA through its website.

1 Using the Forensic Link Adapter



Figure 1.4: Start up sequence on the front display panel.

1.4.1 Powering Up

The FLA should start up automatically if power is available at the 9-pin diagnostic connector. In the rare case that the FLA powers on, but does not boot, try powering on the FLA from the cigarette lighter adapter first, then plug it into the diagnostic port.

If the FLA does not power up when connected, check the voltage between pins A and B with a multimeter. This should read more than 11 volts for you to have sufficient power and time to get the data. If there is power available on those pins and the FLA did not start up, check for loose cables and connections.

1.4.2 Shutting Down

Since the Forensic Link Adapter is running the Linux operating system, it is best to shut down the device through the operating system. This means the user should take care to actively shut down the device by one of the following methods:

- selecting shutdown from the on screen menu
- pressing the shutdown lin on the local web interface
- pressing both buttons on the FLA for more than 5 seconds

The shut down sequence displayed on the front panel is shown in Figure 1.5 on the following page. The user navigates to the Shutdown option by pressing the red button in the Main Menu. Pressing

1 Using the Forensic Link Adapter



Figure 1.5: Shutdown sequence for the Forensic Link Adapter.

the green button activates the shutdown sequence. The shutdown sequence starts by issuing a command to the operating system to shut down. A message is sent to the display driver to initiate the shutdown sequence also. The display driver waits till the Linux system shuts off then displays the message seen in 1.5d. At this time, it is safe to unplug the system.

Figure 1.5c shows an arrow that points to a yellow blinking status LED during the shutdown process. Once the shutdown is complete a solid red LED comes on, as shown by the arrow in Figure 1.5d.

1.5 Display Screen Menu System

The FLA has a built in 4X20 character display to give the user an indication of the status of the system. Press the red button to scroll through different menu options. Press the green button to select that highlighted function. Some screens are informational and either button can be used to advance the operation of the menu.

Upon boot, the startup screen will display with a progress bar coming across the bottom. Once the progress bar completes, the screen will blank, and then start the FLA extraction loading screen.

1.6 Menu Screen Descriptions

This section describe all the operational modes of the FLA. The graphics shown in Figures 1.6-1.8 contain screen displays that show the FLA screen. The curved arrows going to and from the boxes show the transitions that happen when the button is pressed according to the color. The numbers next to the boxes corospond to enumerated descriptions in this section.

1. A Startup Screen is shown when booting the device. A progress bar scrolls across the bottom in about 20 seconds. After that, the progress bar may change to say the words “Please Wait...” If the message to “Please Wait...” stays on and the automatic transition to display 2 does not happen within 30 seconds, the system may not have booted. The FLA may need to be unplugged and restarted if this screen does not automatically go away. See Section [5.2.1 on page 58](#) for further troubleshooting guidance.
2. The Program Loading screen shows the user that the FLA booted successfully and is loading the program needed to interface with the user through the display. It also sets up the files and directories for the current session. A few things happen in the background while this screen is present:
 - a) The FLA system time is updated. If an Internet connection is available (i.e. the Ethernet cable is plugged into a known good network), then the FLA will get its system time from the network time server at NIST. Once it automatically updates the time, it also updates the time on its battery powered real time clock (RTC). If an Internet connection is not available, then the system time is updated from the RTC.
 - b) The FLA tries to obtain a GPS lock.
 - c) The FLA looks to see if vehicle networks are present. It detects the presence of network traffic on the J1708 network (9600 baud) and the J1939 network (CAN bus).
3. The first line of the Status Screen shows the current time with the time zone. The system time zone can be changed from the web interface, as described in Section [1.3.4 on page 8](#). The second line of the status screen shows the status of the Ethernet connection, as described in Section [1.7 on page 20](#). On the third line, the status of the vehicle network connection is displayed. The following options are available:
 - a) No Vehicle Net means that network message traffic was not detected on either the J1939 network (CAN bus) or the J1708/J1587 serial bus. A message will also suggest to “Check Ing. Key” to remind the operator that the ignition key switch must be turned to the on or run position for network traffic to be present. If the key is on, sufficient power is available, and no vehicle networks are present, then the vehicle network may be compromised.
 - b) CAN Bus Only means that messages using the Controller Area Network are present. Since SAE J1939 specifies CAN as the network, this detects the presence of J1939 messages. J1708 network traffic was not detected.
 - c) 1708/1587 means no CAN or J1939 messages are present on the vehicle networks. This may be the case for older vehicles.
 - d) CAN and J1708 mean both networks are present and have traffic.

1 Using the Forensic Link Adapter

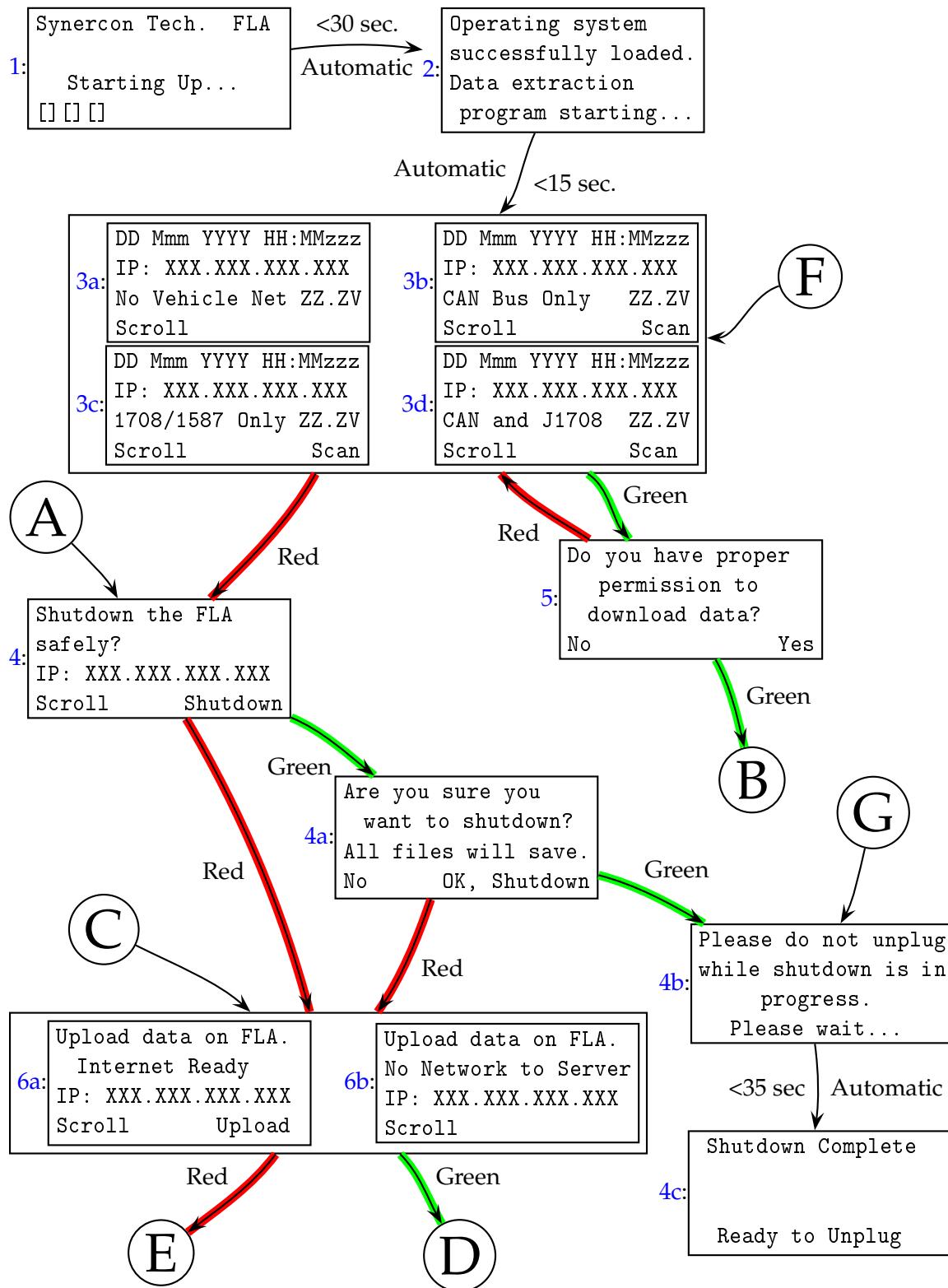


Figure 1.6: Forensic Link Adapter Screen Menu System as enumerated in Section 1.6

1 Using the Forensic Link Adapter

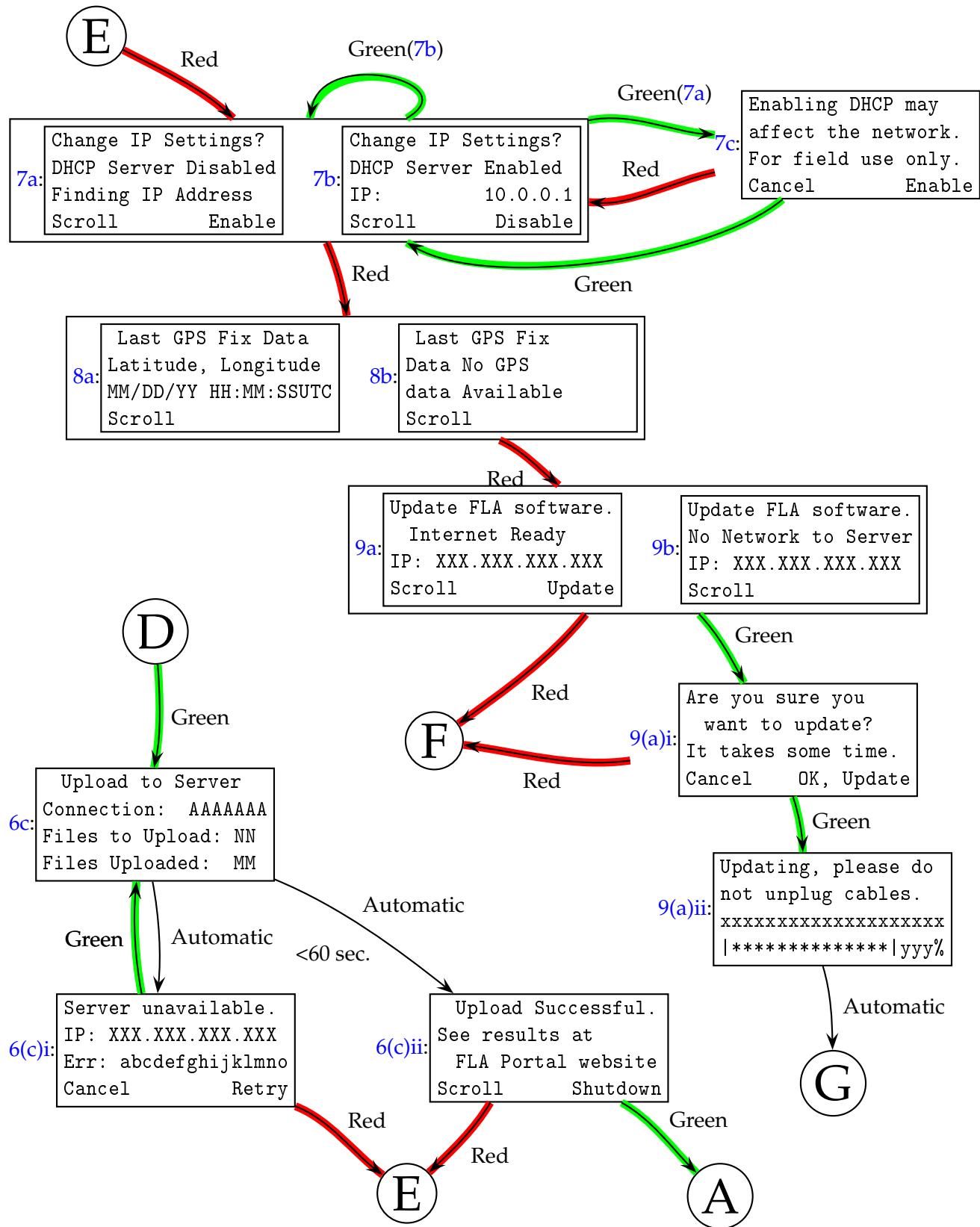


Figure 1.7: Forensic Link Adapter Screen Menu System (cont.) as enumerated in Section 1.6

1 Using the Forensic Link Adapter

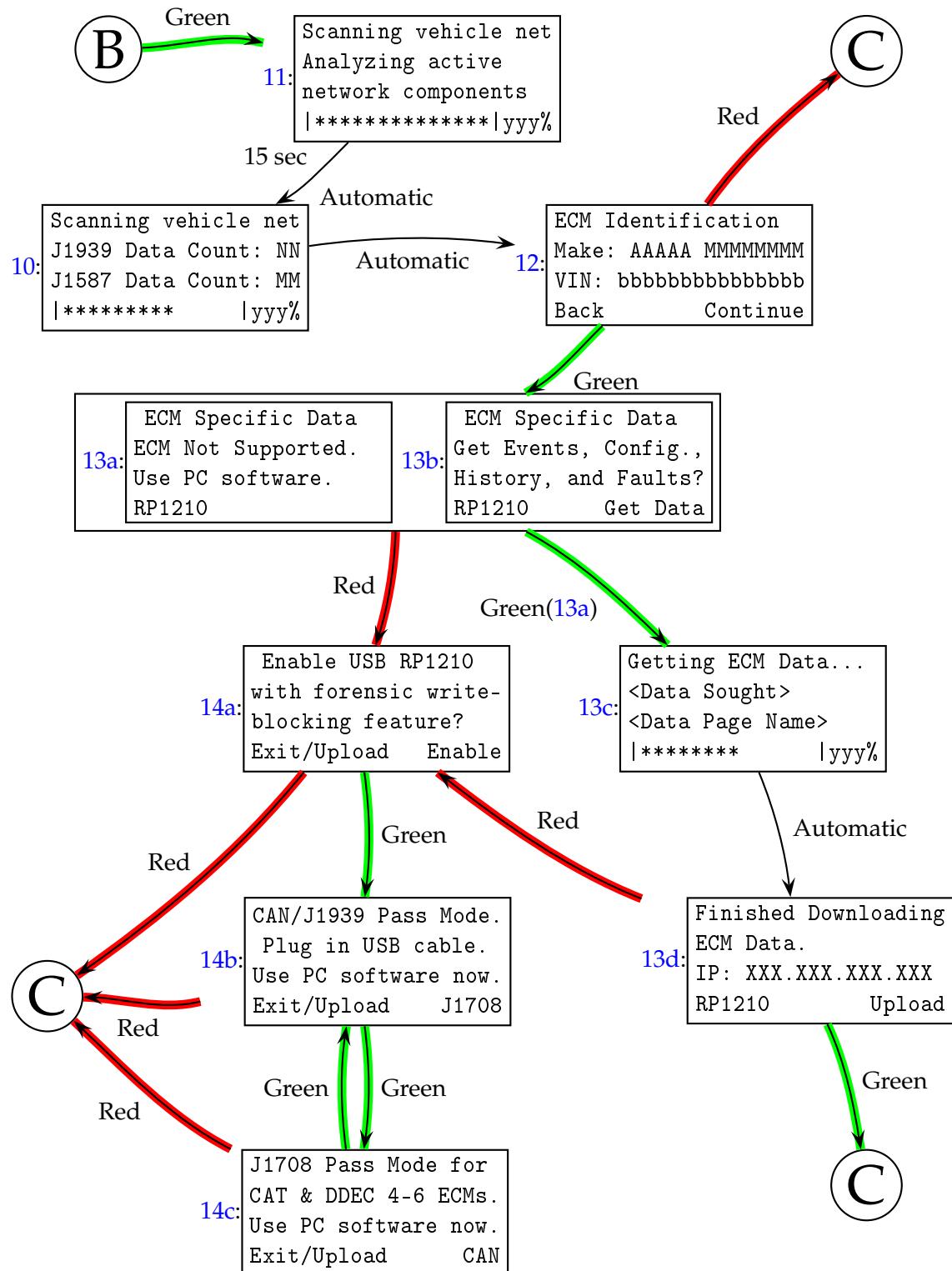


Figure 1.8: Forensic Link Adapter screen display when scanning a vehicle.

1 Using the Forensic Link Adapter

The system voltage is also displayed as detected by a voltage divider connected to the main processor. This voltage indication is not calibrated, but should give the user some feedback on the health of the vehicle system voltage. On the bottom line, there are button commands and an indicator showing the number of GPS satellites. The Red button advances the FLA to the next screen. The Green button starts the scan of the vehicle network to identify the system. The scan button is not available if no vehicle network is present.

4. The Shutdown dialog enables the user to shutdown the FLA computer system in a friendly way. This is similar to pressing the shutdown command on a PC. The shutdown command can also be invoked from within the FLA web interface. If the operator does not want to shutdown the FLA, then he or she can press the Red button to scroll to the next menu option. If the Green button is pushed, then the operator will invoke the shutdown sequence as described in the following displays
 - a) A shutdown confirmation asks the user if that was their intention. This helps catch unintended shutdowns. The Red button will escape the shutdown command and move to the next menu option. The Green button will confirm the shutdown operation. A reminder that all the files will be saved is displayed to the user as well.
 - b) The shutdown sequence requires power, so the user is advised not to unplug the device. During this phase, an LED indicator on the side may turn yellow.
 - c) When shutdown is complete the main processor has turned off power. The display driver remains on with a static message that everything is ready to unplug. No commands are available. The LED should turn Red.
5. Once the FLA detects a vehicle network and the user presses the button to scan, the FLA asks the operator if they have the proper permission to download digital data. This permission is dependent on the case and the jurisdiction. The FLA system time is recorded when permission was acknowledged. Pressing the Green button in this menu defines the start of a download. The next screen to display is number [10](#).
6. The screen that says Upload data on FLA on the first line enables the user to push data to the server for archiving, decoding, decrypting and display. Upon entry into this screen and a valid IP address, the FLA tries to ping the Synercon Server for 5 seconds or less. After the ping, the FLA will display either [6a](#) or [6b](#).
 - a) If there is a valid network connection to the Synercon Server, the message on the second line of the FLA display will say Internet Ready and the Upload option is enabled for the Green button. Pressing the Green button will display screen [6c](#).
 - b) If there is not a connection to the Network server, then a message on the second line will say No Network to Server. Be sure the Ethernet cable is connected, a valid IP address is displayed, and the network administrator has granted your device access to the internet. The operator may want to try connecting the FLA to a different network.
 - c) The Upload to Server screen displays the connection status as "OK" or "Failed." When the connection is valid, the FLA securely uploads data package files to the Synercon Server. The number of files to upload (NN) corresponds to the number of times the FLA downloaded a vehicle or ECM since the last time data packages were sent to the

1 Using the Forensic Link Adapter

Synercon Server. The number of files uploaded (MM) shows a counter that increments after each successful upload to the server.

- i. Upload Failed. An error code is displayed in place of abcdefghijklmno. This error code will be important to the Synercon Support staff and may be related to FLA authentication.
 - ii. Upload Successful. See results at <http://fla.synercontechnologies.com/>. This website is where the data will be displayed.
7. Change IP network settings. This screen enables the operator to turn the FLA into a Dynamic Host Configuration Protocol (DHCP) server and give IP addresses to other computers on the network. Since only one DHCP server should be on a network at a time, this feature off by default. However, in the field, the FLA may need to set up an FLA network so the operator can connect to the FLA web page. The following descriptions explain how to enable and disable the DHCP server.
- a) By default the DHCP server is disabled, as shown on line 2. Pressing the Green button will pull up the confirmation screen shown as display *7c*. If the words "No Valid IP Found" are displayed on line 3, then turning on DHCP may be a good idea. If a valid IP address (IP: XXX.XXX.XXX.XXX) is displayed, then DHCP may not be needed.
 - b) After the DHCP server has been enabled, line 2 will display as such. The IP address should reset to 10.0.0.1.
 - c) The field use only warning should remind the operator that an already established network does not need another DHCP server. Enabling DHCP on the FLA on an established network may lead to IP address conflicts for other devices on the network.
8. GPS Status Screen
- a) A GPS utility screen exists to enable the user to see GPS information. The GPS coordinates in decimal are displayed along with the last time the GPS obtained a lock. The source of the time on this screen is from the actual GPS signal and cannot be adjusted. These data are saved automatically and used for display in the Data Package report.
 - b) If a GPS has not obtained a signal lock, then this message will display. It is unlikely that a user will see this screen unless the FLA is new.
9. It is recommended to update the FLA software periodically. The FLA must be connected to the Internet in order to get software updates.
- a) If an Internet connection to the update server exists, then the Green button will be enabled for the user to select Update.
 - i. Once the Green button is pushed, an update confirmation display enables the user to cancel an update operation. Pressing the Green button again will confirm the update should start. It is important to not unplug the FLA power and Ethernet cables during the update.
 - ii. Update progress is displayed with current operations shown as xxxxxxxxx on display. This process takes a long time and the scroll bar jumps in 33% increments.

1 Using the Forensic Link Adapter

- b) If there is no access to the update server, then the Green button is disabled. The FLA will need to be connected to the Internet by the Ethernet cable.
10. Once permission was acknowledged, the FLA will scan the available vehicle networks. In this phase, it is looking for all the different components on the network by their MID or Source Address.
 11. The program is looking for data defined in the J1587 or J1939 standards that may be available and useful, as explained in further detail in Section [2.2 on page 21](#). As those data elements are obtained from their respective networks, the counter will increment reflecting the recording of the data. Once the data elements have been requested, the FLA will be able to identify the different ECMS. This process will re request for information if it wasn't received.
 12. The ECM Identification screen shows the identification information stored in the first Engine ECM. The ECM make (AAAAAA) and model (MMMMMM) comes from requesting the Component Identification. The Component Identification is a J1587 message with PID of 241 or a J1939 message with SPNs 586 and 587. The Vehicle Identification Number (VIN) comes from J1587 PID 237 or J1939 SPN 237. These data may or may not be present depending on how the ECM is programmed. If the data are not present from the Engine ECM, then the next source is used, if available.
 13. Once the ECM type is known, the FLA will check to see if the ECM is supported. If it is supported, then ECM specific data can be obtained.
 - a) If the ECM is supported, then different types of data can be obtained that include Event Data, Configuration Data, Historical Data, and Fault Data. If this menu screen is displayed, then the FLA detected that it can capture data from an ECM on the network. Pressing the Green button will start the process of gathering specific data.
 - b) No current support for getting ECM Specific Data exists of this screen is displayed. As such, both the Red and Green buttons move the interface to the RP1210 mode where the operator can use the FLA with other software.
 - c) Getting ECM data... is a display screen that shows the progress of the current download. The tag <Data Sought> is dependent on the ECM and may say things like Hard Brake, Engine Usage Log, Data Plate, or other phrases that to indicate the progress of the download. After each attempt, a flag saying either Success or Failed will be displayed.
 - d) Once the ECM specific data is downloaded, a message saying Finished ECM Data is displayed along with the total number of bytes downloaded. If the operator wants to continue an investigation using PC based software, then he or she can press the Red button to go into RP1210 passthrough mode. Otherwise, the Green button brings the user back to the upload menu. In the field, it may be that a data upload is possible due to the lack of an internet connection. In this case, the operator can press the Red button once to get to menu [3 on page 13](#) and again to get to the Shutdown menu.
 14. The RP1210 passthrough mode enables operators to use other PC based software to interface with the vehicle. The FLA will be connected to a PC by a USB cable to communicate on the vehicle bus. The FLA uses a DGTech eDPA to communicate with the PC. As such, it is important to have the DG Drivers installed before using the RP1210 mode, as described in

Section [3.1.1 on page 33](#). This mode invokes a write blocking feature that prevents certain messages from reaching the ECM. For more details on the messages that get blocked when the write-blocker is running, see Section [3.6 on page 55](#).

- a) This display screen asks to enable the passthrough mode. If the Red button is pressed, then the system goes back to the status display (Screen [3](#)). Pressing the Green button turns on the Passthrough mode.
- b) Passthrough mode for CAN (J1939) is on when this screen is displayed. A reminder to plug in the USB cable is printed on line 2. At any time, the operator can terminate the passthrough mode and switch to J1708 pass mode or transition to uploading the data. This mode is used for all newer ECMS.
- c) J1708 pass mode is on when this screen is displayed. A reminder to plug in the USB cable is printed on line 2. At any time, the operator can terminate the passthrough mode and switch to J1708 pass mode or transition to uploading the data. This mode is used for all Caterpillar, Mercedes, DDEC IV, DDEC V, and DDEC VI ECMS.

Network traffic is recorded and logged during screens [12](#), [13c](#), and [14b](#). A data package is defined from network data coming from the vehicle starting when the user acknowledges permission to when the operation of the FLA transitions back to the Upload option.

1.7 IP Addresses

The IP address Line can have the following statements:

IP: XXX.XXX.XXX.XXX A valid IP address. XXX can be any number between 0 and 255. Often a private home network will have a router that serves an IP address with the first numbers of 192.168.XXX.XXX.

IP: 10.0.0.1 The IP address when the FLA's DHCP server is activated. The FLA will give other devices on the network an IP address too, which may cause problems on an established network.

Ethernet Unplugged There is no live connection between the FLA and an outside device. If a network connection was present, there may be around a 30 second lag for this message to display after a cable is unplugged.

Finding IP Address The Ethernet connection is plugged in and linked to another connection, but the FLA has not been issued an IP address from the network router.

2 Obtaining Data with the Forensic Link Adapter

2.1 Initiating Data Collection

Once the FLA detects a valid network, the Scan option appears on the main screen as shown in Figure [2.1 on the following page](#).

After pressing the Scan button, the FLA prompts the user if they have proper permission to download the data from the vehicle. Proper permission depends on the context of the download. It may involve obtaining a warrant, or the operator may be acting on behalf of the owner. Acknowledgment of proper permission initiates a download. The time that the Green button shown in Figure is pushed, along with the last GPS coordinates and time of the device are recorded.

Once permission is acknowledged, the FLA begins a scan of the vehicle networks for Standards Based Data as described in Section [2.2](#).

2.2 Standards Based Data

There are two standards that define data elements for heavy vehicles that the FLA looks for. The first is the J1708 network and the second is the J1939 network. Nearly all heavy vehicles have one or both of these networks. They contain data elements that are common for all vehicles and this section describes what elements the FLA is looking for. Not all data is available depending on the vehicle. Older vehicles may not have J1939 and newer ones may not have J1708/J1587.

2.2.1 J1587 Data

The data decoded using the SAE J1587 standard is transported on the J1708 bus. The J1708 network is a legacy system based on RS-485 running at 9600 baud. It uses timing to break up message frames and checksums to ensure integrity. Messages are decoded according to a Parameter Identification character (PID). The PID defines how to decode the bytes that follow.

The FLA scans the J1708 bus for the following data according to categories. If the data is not displayed in the report, then it was not available by the network. If data is available, there will be a table per Message Identifier (MID). Common MIDs are as follows:

MID (Decimal)	128	130	136	140
MID (hex)	0x80	0x82	0x88	0x8C
Description	Engine #1	Transmission	Brakes, Power Unit	Instrument Cluster

2 Obtaining Data with the Forensic Link Adapter



Figure 2.1: Pressing the Scan button



Figure 2.2: Acknowledging proper permission to perform a download.

2.2.1.1 Configuration Data

PID	Parameter Identification Name	Description	Units
74	Maximum Road Speed Limit	Maximum vehicle velocity allowed	mph
87	Cruise Control High-Set Limit Speed	Maximum vehicle velocity allowed at any cruise control set speed	mph
88	Cruise Control Low-Set Limit Speed	Minimum vehicle velocity allowed by cruise control before a speed adjustment is called for	mph
113	Governor Droop	The difference between full load rated engine speed and maximum no-load governed engine speed.	rpm
166	Rated Engine Power	Net brake power that the engine will deliver continuously, specified for a given application at a rated speed	hp
188	Idle Engine Speed	Minimum nontransient rotational velocity of crankshaft while engine is supplying power to itself and its attendant support systems.	rpm
189	Rated Engine Speed	The maximum governed rotational velocity of the engine crankshaft under full load conditions.	rpm
233	Unit Number (Power Unit)	Owner assigned unit number for power unit of a combination vehicle, straight truck, or transit vehicle.	ASCII
234	Software Identification	Software Identification of an electronic module that is variable in length and may contain more than one software identification designator separated by an asterisk (*).	ASCII
237	Vehicle Identification Number	Vehicle Identification Number (VIN) as assigned by the vehicle manufacturer or owner.	ASCII
243	Component Identification	Used to identify the Make, Model, and Serial Number of any component on the vehicle. The Make is five characters long and shall correspond to the codes defined in the American Trucking Association Vehicle Maintenance Reporting Standard (ATA/VMRS). The model and Serial Number fields are variable in length and separated by an ASCII “*”.	ASCII
507	Driver Identification	Used to obtain the driver identity.	ASCII

2.2.1.2 Historical Data

PID	Parameter Identification Name	Description	Units
182	Trip Fuel	Fuel consumed during all or part of a journey.	gallons

2 Obtaining Data with the Forensic Link Adapter

PID	Parameter Identification Name	Description	Units
185	Average Fuel Economy	Average of instantaneous fuel economy for that segment of vehicle operation of interest.	miles/gal
235	Total Idle Hours	Accumulated time of operation of the engine while under idle conditions.	hours
236	Total Idle Fuel Used	Accumulated amount of fuel used during vehicle operation while under idle conditions.	gallons
244	Trip Distance	Distance traveled during all or part of a journey. Can be reset.	miles
245	Total Vehicle Distance	Accumulated distance travelled by vehicle during its operation.	miles
246	Total Vehicle Hours	Accumulated time of operation of vehicle	hours
247	Total Engine Hours	Accumulated time of operation of engine	hours
248	Total PTO Hours	Accumulated time of operation of power take off device	hours
250	Total Fuel Used	Accumulated amount of fuel used during vehicle operation	gallons

2.2.1.3 Live Data

Live data is information that is current and changes with use and time.

PID	Parameter Identification Name	Description	Units
71	Idle Shutdown Timer Status	State of the idle shutdown timer system (active, not active) for the various modes of operation.	binary bit-mapped
38	Second Fuel Level (Right Side)	Ratio of volume of fuel to the total volume of the second fuel storage container	%
40	Engine Retarder Switches Status	Identifies the current state of the switch contacts used in the engine retarder system. Includes number of cylinders and status	binary bit-mapped
44	Attention/Warning Indicator Lamps Status	Identifies the current state of the lamps used as driver attention or warning indicators.	binary bit-mapped
46	Vehicle Wet Tank Pressure	Identifies the current gage pressure inside the vehicle wet tank.	psi
70	Parking Brake Switch Status	Identifies the state (open/closed) of the Parking Brake Switch	binary bit-mapped
84	Road Speed	Indicated vehicle velocity.	mph

2 Obtaining Data with the Forensic Link Adapter

PID	Parameter Identification Name	Description	Units
71	Idle Shutdown Timer Status	State of the idle shutdown timer system (active, not active) for the various modes of operation.	binary bit-mapped
85	Cruise Control Status	The state of the velocity control system switches for various modes.	binary bit-mapped
86	Cruise Control Set Speed	The values of driver chosen speed for the velocity control system	mph
89	Power Takeoff Status	State of the system used to transmit engine power to auxiliary equipment. Status indication is for system (active, not active), and system switch (on, off), for various operating modes.	binary bit-mapped
91	Percent Accelerator Pedal Position	Ratio of actual accelerator pedal position to maximum pedal position.	%
92	Percent Engine Load	Ratio of current output torque to maximum torque available at the current engine speed.	%
94	Fuel Delivery Pressure	Gage pressure of fuel in system as delivered from supply pump to the injection pump.	psi
95	Fuel Filter Differential Pressure	Change in fuel delivery pressure, measured across the filter, due to accumulation of solid or semisolid matter on the filter element.	psi
96	Fuel Level	Ratio of volume of fuel to the total volume of the primary fuel storage container.	%
97	Water in Fuel Indicator	Indication (yes/no) of presence of unacceptable amount of water in fuel system.	binary bit-mapped
98	Engine Oil Level	Ratio of current volume of engine sump oil to maximum required volume.	%
99	Engine Oil Filter Differential Pressure	Change in engine oil pressure, measured after filter, due to accumulation of solid or semisolid material on or in the filter.	psi
100	Engine Oil Pressure	Gage pressure of oil in engine lubrication system as provided by oil pump.	psi
102	Boost Pressure	Gage pressure of air measured downstream on the compressor discharge side of the turbocharger.	psi
103	Turbocharger #1 Speed	Rotational velocity of rotor in turbocharger.	rpm
104	Turbo Oil Pressure	Gage pressure of oil in turbocharger lubrication system.	psi
105	Intake Manifold Temperature	Temperature of precombustion air found in intake manifold of engine air supply system.	deg F
108	Barometric Pressure	Absolute air pressure of the atmosphere.	psi

2 Obtaining Data with the Forensic Link Adapter

PID	Parameter Identification Name	Description	Units
71	Idle Shutdown Timer Status	State of the idle shutdown timer system (active, not active) for the various modes of operation.	binary bit-mapped
110	Engine Coolant Temperature	The temperature of liquid found in engine cooling system.	deg F
158	Battery Potential (Voltage) - Switched	Electrical potential measured at the input of the ECU supplied through a switching device	volts
162	Transmission Range Selected	Range selected by the operator.	ASCII
163	Transmission Range Attained	Range currently being commanded by the transmission control system	ASCII
167	Alternator Potential (Voltage)	Measured electrical potential of the alternator.	volts
168	Battery Potential (Voltage)	Measured electrical potential of the battery.	volts
171	Ambient Air Temperature	Temperature of the air surrounding the vehicle.	deg F
172	Air Inlet Temperature	Temperature of the air entering the vehicle air induction system.	deg F
174	Fuel Temperature	Temperature of fuel entering injectors.	deg F
175	Engine Oil Temperature	Temperature of engine lubricant.	deg F
177	Transmission #1 Oil Temperature	Temperature of transmission lubricant.	deg F
190	Engine Speed	Rotational velocity of crankshaft.	rpm
191	Transmission Output Shaft Speed	Rotational velocity of shaft transferring torque from the transmission to the driveshaft.	rpm
251	Clock	Seconds, minutes and hours.	
252	Date	Day, month, year. A value of 0 for the year corresponds to 1985.	

The Date and Clock parameters are used to determine the time offsets between the ECM time and the FLA system time. All time calculations are computed in Universal Coordinated Time (UTC).

2.2.2 J1939 Data Message Structure

J1939 messages are built on the Bosch Controller Area Network (CAN) Specification. Messages are broken into Frames. The J1939 protocol used an Extended CAN frame. For more details regarding the J1939 protocol for creating messages, please see J1939-21. Tables 2.4 and 2.4 use the following acronyms:

2 Obtaining Data with the Forensic Link Adapter

		Arbitration Field (29 bits)							Control Field			Data Field (8 bytes)								Error Checking	
Field:	S O F	I R D	S R E	I D E	Ex. I D	R T R	r 1	r 0	D L C	B 1 2	B 2 3	B 3 4	B 4 5	B 5 6	B 6 7	B 7 8	C R C	A C K			
Bits:	1	11	1	1	18	1	1	1	4	8	8	8	8	8	8	8	16	2			

Table 2.4: CAN Extended Frame

SOF Start of Frame Bit

ID Identifier Bit

SRR Substitute Remote Request (Always a recessive bit, which has a value of 1)

RTR Remote Transmission Request (Always a recessive bit, which has a value of 1)

r# CAN Reserved bit #n

DLC Data Length Code

B# Individual Data Bytes

CRC Cyclic Redundancy Check

SPN Suspect Parameter Number

Ack Acknowledgement bit

EOF End of Frame

EDP Extended Data Page (usually set to zero)

DP Data Page (usually set to zero)

PDU1 Protocol Data Unit

SA Source Address

DA Destination Address

PGN Parameter Group Number

FMI Failure Mode Indicator

There are two ways to interpret the Protocol Data Unit (PDU1 or PDU2) bytes to determine the 3-byte Parameter Group Number. If values of the PGN are less than 61440 (0xF000), then the PGN is in PDU1 format. The PGN is the code needed to determine what the J1939 message means. The first byte in PGN is usually zero. In PDU1 format, the third byte is 0, which means only PGN byte 2 is used for decoding. For example, the PGN for a Request Message is 59904 (0x00EA00). Another example is PGN 65265 (0x00FEF1), which is the Cruise Control Vehicle Speed Message.

While the PGN tells us what is contained in the message, the decoding of the bytes within the message is done according to the Suspect Parameter Number (SPN). These definitions are published in J1939-71.

Useful Source Addresses defined in J1939 are shown in Table 2.6 on page 29. Source Addresses and Destination Addresses use the same numbers.

The data in the following sections will be displayed for each source address on the network. After pressing the permission to download button, the FAL will scan the vehicle networks for 15 seconds to see what Source Addresses are available on the network.

		Arbitration Field (29 bits)																																										
Field:	S O F	Priority		E D	D P	PDU Format Byte										PDU Specific Byte								Source Address (SA)																				
Position	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27																
B1													PGN Byte 2										PGN Byte 3 for PDU2						SA Byte															
	Parameter Group Number (PDU2 Format)																																											
	Parameter Group Number (PGN)														Destination Address (PDU1 Format)																													

Table 2.5: Specification of the arbitration field for J1939.

2 Obtaining Data with the Forensic Link Adapter

Source Address	Name
0 (0x00)	Engine #1
3 (0x00)	Transmission #1
11 (0x0B)	Electronic Brake Controller
15 (0x0F)	Retarder (Engine Compression Brake)
23 (0x17)	Instrument Cluster
33 (0x21)	Body Controller
42 (0x2A)	Headway Controller (Adaptive Cruise Control, Collision Avoidance, etc.)
49 (0x31)	Cab Controller
74 (0x4A)	Cellular Communications Unit (Telematics System)
249 (0xFA)	Off Board Diagnostics Tool (i.e. the Forensic Link Adapter).

Table 2.6: Table of Common Source Addresses

2.2.3 J1939 Configuration Data

The Forensic Link Adapter scans the J1939 network for the following configuration data. If the data is not displayed in the report, then it was not available by the network. The units displayed in the FLA report are in US common units; whereas the J1939 specification may call for different units. Other configuration data may be available that is not listed below.

PGN	Parameter Group Name	SPN	Suspect Parameter Name	Units
65214 (0xFEBE)	Electronic Engine Controller 4 (EEC4)	166	Engine Rated Power	hp
		189	Engine Rated Speed	rpm
		3671	Crank Attempt Count	count
		3669	Engine Rotation Direction	bit-mapped
		5465	Engine Intake Manifold Pressure Control Mode	bit-mapped
65242 (0xFEDA)	Software Identification (SOFT)	234	Software Identification	ASCII
		965	Number of Software Identification Fields	count
65251 (0xFEE3)	Engine Configuration 1 (EC1)	188	Engine Speed at Idle, Point 1	rpm
		532	Engine Speed at High Idle	rpm
65259 (0xFEEB)	Component Information (CI)	586	Make	ASCII
		587	Model	ASCII
		588	Serial Number	ASCII
		233	Unit Number (Power Unit)	ASCII
65260 (0xFEEC)	Vehicle Identification (VI)	237	Vehicle Identification	ASCII
65261 (0xFEED)	Cruise Control / Vehicle Speed Setup (CCSS)	74	Maximum Vehicle Speed Limit	mph
		87	Cruise Control High Set Limit Speed	mph

PGN	Parameter Group Name	SPN	Suspect Parameter Name	Units
		88	Cruise Control Low Set Limit Speed	mph

Engine Rated Speed The maximum governed rotational velocity of the engine crankshaft under full load conditions.

Engine Rotation Direction Direction of engine rotation, as reported by the engine. Direction convention as viewed by an observer standing at the rear of the engine, viewing the flywheel.

Crank Attempt Count Reports the number of cranking cycles undergone during the present start attempt. This is intended to be used in conjunction with Maximum Crank Attempts per Start Attempt, in order to give a FMI 0 diagnostic on this parameter when the count exceeds the maximum. When the engine is not in a start attempt, this parameter can either hold the last value or return a Not Available (0xFF).

Engine Intake Manifold Pressure Control Mode Indicates that the Boost Pressure Closed Loop Control status either open loop or closed loop.

Software Identification Software identification of an electronic module. The ASCII character “**” is reserved as a delimiter.

Number of Software Identification Fields Number of software identification designators represented in the software identification parameter group.

Unit Number Power Unit number or identifier assigned by the owner.

Make Make of the component corresponding to the codes defined in the American Trucking Association Vehicle Maintenance Reporting Standard (ATA/VMRS). Note: This parameter is to be transmitted as a 5 character ASCII string; as a zero length string, if not available. For example, International is transmitted as INTXX.

Engine Speed At Idle Point 1 (Engine Configuration) Stationary low idle speed of engine which includes influences due to engine temperature (after power up) and other stationary changes (calibration offsets, sensor failures, etc). This parameter is point 1 of the engine configuration map (see PGN 65251).

2.2.4 J1939 Historical Data

The Forensic Link Adapter scans the J1939 network for the following historical data. These are data that are accumulated over time. If the data is not displayed in the report, then it was not available by the network. The units displayed in the FLA report are in US common units; whereas the J1939 specification may call for different units. Other historical data may be available that is not listed below. The preceding byte consisting of 00 is omitted on the hex representation of the PGN.

PGN	Parameter Group Name	SPN	Suspect Parameter Name	Units
65209 (0xFEB9)	Trip Liquid Fuel Information (LTFI)	1001	Trip Drive Fuel Used	gallons
		1002	Trip PTO Governor Moving Fuel Used	gallons

2 Obtaining Data with the Forensic Link Adapter

PGN	Parameter Group Name	SPN	Suspect Parameter Name	Units
		1003	Trip PTO Governor Non-moving Fuel Used	gallons
		1004	Trip Vehicle Idle Fuel Used	gallons
		1005	Trip Cruise Fuel Used	gallons
		1006	Trip Drive Fuel Economy	miles / gallon
65210 (0xFEBA)	Trip Distance Information	998	Trip Distance on Vehicle Speed Limiter (VSL)	miles
		999	Trip Gear Down Distance	miles
		1000	Trip Distance in Top Gear	miles
65248 (0xFEE0)	Vehicle Distance (VD)	244	Trip Distance	miles
		245	Total Vehicle Distance	miles
65217 (0xFEC1)	High Resolution Vehicle Distance (VDHR)	917	High Resolution Total Vehicle Distance	meters
		918	High Resolution Trip Distance	meters
65207 (0xFEB7)	Engine Speed / Load Factor Information	1013	Trip Maximum Engine Speed	rpm
		1014	Trip Average Engine Speed	rpm
		1015	Trip Drive Average Load Factor	%
		1016	Total Drive Average Load Factor	%
		1017	Total Engine Cruise Time	hours
65253 (0xFEE5)	Engine Hours, Revolutions (HOURS)	247	Engine Total Hours of Operation	hours
		249	Engine Total Revolutions	count
65255 (0xFEE7)	Vehicle Hours (VH)	246	Total Vehicle Hours	hours
		248	Total Power Takeoff Hours	hours
65244 (0xFEDC)	Idle Operation (IO)	235	Engine Total Idle Hours	hours
		236	Engine Total Idle Fuel Used	gallons

Trip PTO Governor Non-moving Fuel Used Total fuel consumed while either the PTO or remote PTO governors are in the hold state, the engine speed is greater than zero, and vehicle speed is less than 2 km/h, since the last trip reset.

Trip Vehicle Idle Fuel Used Total fuel consumed while neither the PTO or remote PTO governor is in the hold state, the engine speed is greater than zero, and vehicle speed is less than 2 km/h, since the last trip reset.

Trip Cruise Fuel Used Total fuel consumed while the engine is in the cruise hold state since the last trip reset. If both cruise control and VSL (vehicle speed limiter) are commanding the same amount of fuel, the cruise control is deemed the active torque mode and fuel will be accumulated in "trip cruise fuel used" parameter. If fuel commanded due to the accelerator pedal position is larger than fuel commanded by cruise control (e.g., accelerator override

2 Obtaining Data with the Forensic Link Adapter

torque mode), the cruise control is not deemed the active torque mode and fuel will not be accumulated in the "trip cruise fuel used" parameter.

2.3 Native Downloads

2.3.1 Detroit Diesel

3 Obtaining Data With Manufacturer's Software

There are two protocols used to communicate over a heavy truck: 1) CAN/J1939, and 2) J1708. These modes are needed to make use of the DG RP1210 embedded device used to communicate with Manufacturer's software.

3.1 Installing Programs and Drivers

3.1.1 RP1210 Drivers

The FLA uses the DG Technologies drivers to enable Windows programs to communicate with the ECMs. Download and install the drivers on your laptop or local machine from

http://www.dgtech.com/product/dpa/software/DPA4P_136.zip.

For more information, see the DG website

<http://www.dgtech.com/product/dpa4plus/downloads/downloads.php>. The Adapter Validation Tool is a useful program to test the connections between the computer, FLA, and Vehicle.

3.1.2 Manufacturer's Software

Download Cummins PowerSpec from

<http://cumminsengines.com/powerspec>.

This will only work on Windows 7 or newer. You need to register PowerSpec for free, but you do not have a license the program for it to work.

Download Detroit Diesel DDEC Reports from

<http://www.ddcsn.com/cps/rde/xchg/ddcsn/hs/3448.htm>, as shown in [3.1 on the following page](#).

The direct download link is

<http://www.ddcsn.com/cps/rde/xbcr/ddcsn/DDECReports805.exe>.

Restart your computer after installing.

3.1.3 PDF Printer

If a PDF generator is not installed on your computer system, then having the ability to print to PDF is useful. An example of a free PDF printer is the

[BullZip PDF printer](#).

3 Obtaining Data With Manufacturer's Software

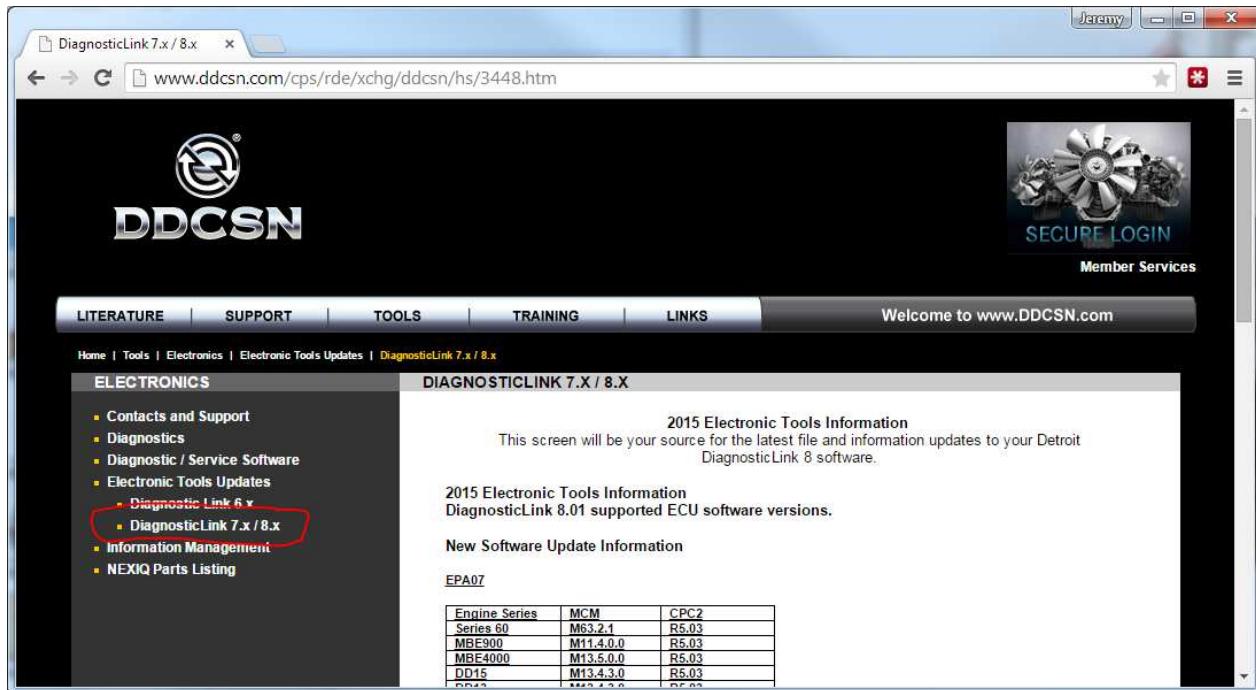


Figure 3.1: Download page for DDEC Reports. The link to download is at the bottom of the page. The link to this page is on the left menu for DiagnosticLink 7.x/8.x and is indicated with a loop.

3.2 Enabling RP1210 Passthrough Mode

If the ECM is a Caterpillar, DDEC IV DDEC V, then enable the J1708 Pass-through mode from the FLA menu screen. This is screen 14c.

If the ECM is a Cummins, DDEC VI, DDEC 10, or other then enable CAN/J1939.

Once enabled, connect a USB cable from the FLA to the laptop with the DG drivers installed.

3.3 Cummins

3.3.1 PowerSpec Download Protocol

1. Turn the ignition key to the on position (if it is not already on), but do not start the engine.
2. Plug in the FLA to the diagnostic connector. Ensure it powers on and boots.
3. Perform a Standards based download using FLA Diagnostics.
4. Enable J1939 Passthrough mode
5. Launch DG Adapter Validation Tool (AVT).
 - a) Select the appropriate installed device driver.

3 Obtaining Data With Manufacturer's Software

- b) Switch the protocol to J1939 in the adapter validation tool.
 - c) Click Run Test.
 - d) If the Adapter Validation Tool passes the test, then two windows will turn green. This means the ECM and the computer are connected through the RP1210 Device. If a test fails, review the suggestions output by the Adapter Validation Tool and try again. It may require shutting down the FLA, unplugging the USB, and disconnecting the FLA from power. Similarly, the PC may need to be rebooted.
6. Open Cummins PowerSpec.
 7. Click on Advanced -> Settings and set the Adapter to the DPA4+
 8. Click on Connect.
 9. Click Read Data
 10. If available:
 - a) Press the Fault Codes button and Save the report as a PDF file.
 - b) Press the Trip Information button and Save the report as a PDF file.
 - c) Press the Feature Settings button and Save the report as a PDF file.
 - d) Press the Sudden Decel button and Save the report as a PDF file.
 - e) Press the Dataplate button and Save the report as a PDF file.
 - f) Press the Duty Cycle button and Save the report as a PDF file.
 - g) Press the After Treatment button and Save the report as a PDF file.
 11. Exit passthrough mode by pressing a the Update (red) button on the FLA. If an Internet Connection is available, then the data can be uploaded and archived. Otherwise, shutdown.
 12. Establish Internet connection with the FLA. An IP address other than 10.0.0.1 should show up on the FLA display.
 13. Scroll to the Upload to Server option on the FLA and upload the data to the server.

3.3.2 Insite Download Protocol

3.4 Detroit Diesel

3.4.1 DDEC Reports Download Protocol

1. Turn the ignition key to the on position (if it is not already on), but do not start the engine.
2. Plug in the FLA to the diagnostic connector. Ensure it powers on and boots.
3. Perform a Standards based download using FLA Diagnostics.
4. Enable the network passthrough mode

3 Obtaining Data With Manufacturer's Software

- a) Use J1708 Passthrough mode for DDEC IV, DDEC V, and Pre-2008 Mercedes Engines.
 - b) Use J1939 Passthrough mode (selected from menu screen on FLA) for all newer DDEC or Mercedes modules.
5. Launch DG Adapter Validation Tool (AVT).
 - a) Select the appropriate installed device driver.
 - b) Switch the protocol to in the adapter validation tool to the same one selected in Step 4.
 - c) Click Run Test.
 - d) If the Adapter Validation Tool passes the test, then two windows will turn green. This means the ECM and the computer are connected through the RP1210 Device. If a test fails, review the suggestions output by the Adapter Validation Tool and try again. It may require shutting down the FLA, unplugging the USB, and disconnecting the FLA from power. Similarly, the PC may need to be rebooted.
 6. Open DDEC Reports.
 7. The Connection Manager may start automatically.
 8. Press Extract Data.
 9. Once the data is extracted, Select File -> Print and print all the data (should be over 30 pages).
Print to a PDF file
 10. Close DDEC Reports.
 11. Navigate to the DDEC Reports directory to find the recently made .XTR file. (Default installation is C:\Detroit Diesel\DDC Reports\Diagnostic\DATA PAGES\ Copy the .XTR file into your case file directory.
 12. Exit passthrough mode by pressing a button on the FLA. Exiting this mode takes some time, so the button press may not work at first.
 13. Establish Internet connection with the FLA. An IP address other than 10.0.0.1 should show up on the FLA display.
 14. Scroll to the Upload to Server option on the FLA and upload the data to the server.

3.4.2 DDDL 8 Download Protocol

3.5 Caterpillar ET Download Protocol

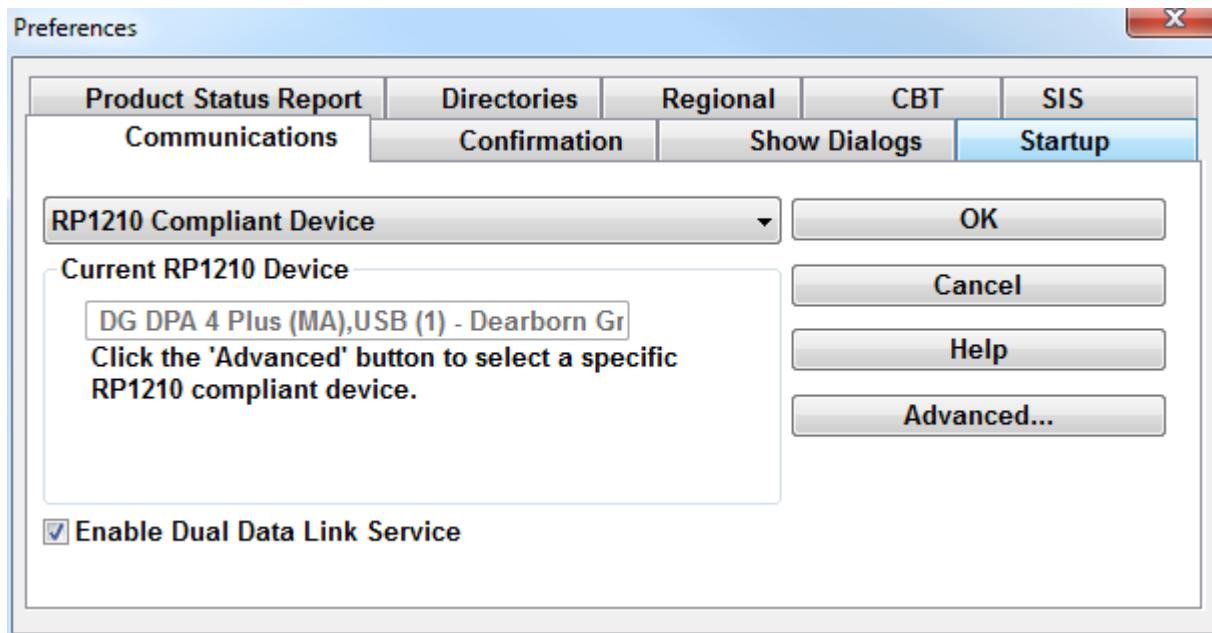
This section provides a protocol to use CatET to download Caterpillar ADEM II, ADEMIII, and ADEMIV engine control modules. These modules are found on C series engines (i.e. C-15, C-12, C-9, and C-7).

3.5.1 Prerequisites

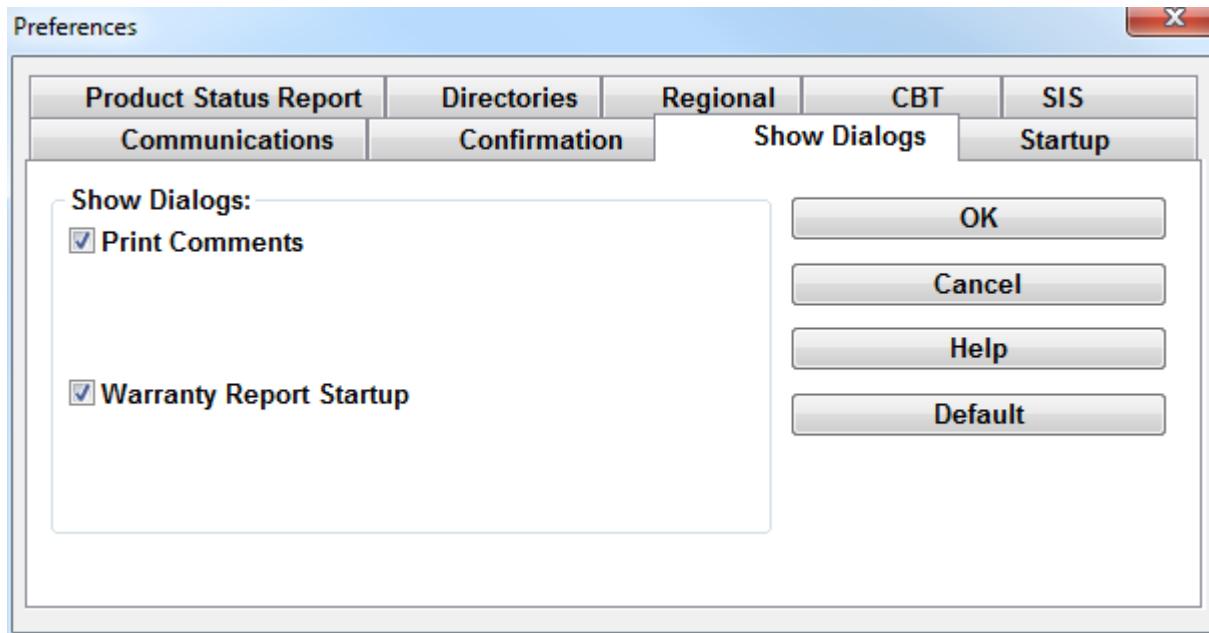
You must have the DG RP1210 drivers installed on your computer. The procedure for obtaining and installing these drivers is found in Section [3.1.1 on page 33](#).

Caterpillar Electronic Technician (ET) must be installed on your computer. The procedure described in this section was based on version 2013A.

Set the preferences in CatET to use the DG DPA 4 Plus, which is the RP1210 device built into the FLA. This is shown in the following picture.



Setting the Warranty Report Startup helps with the work flow when connected, as seen in the following picture. These settings will remain from session to session.

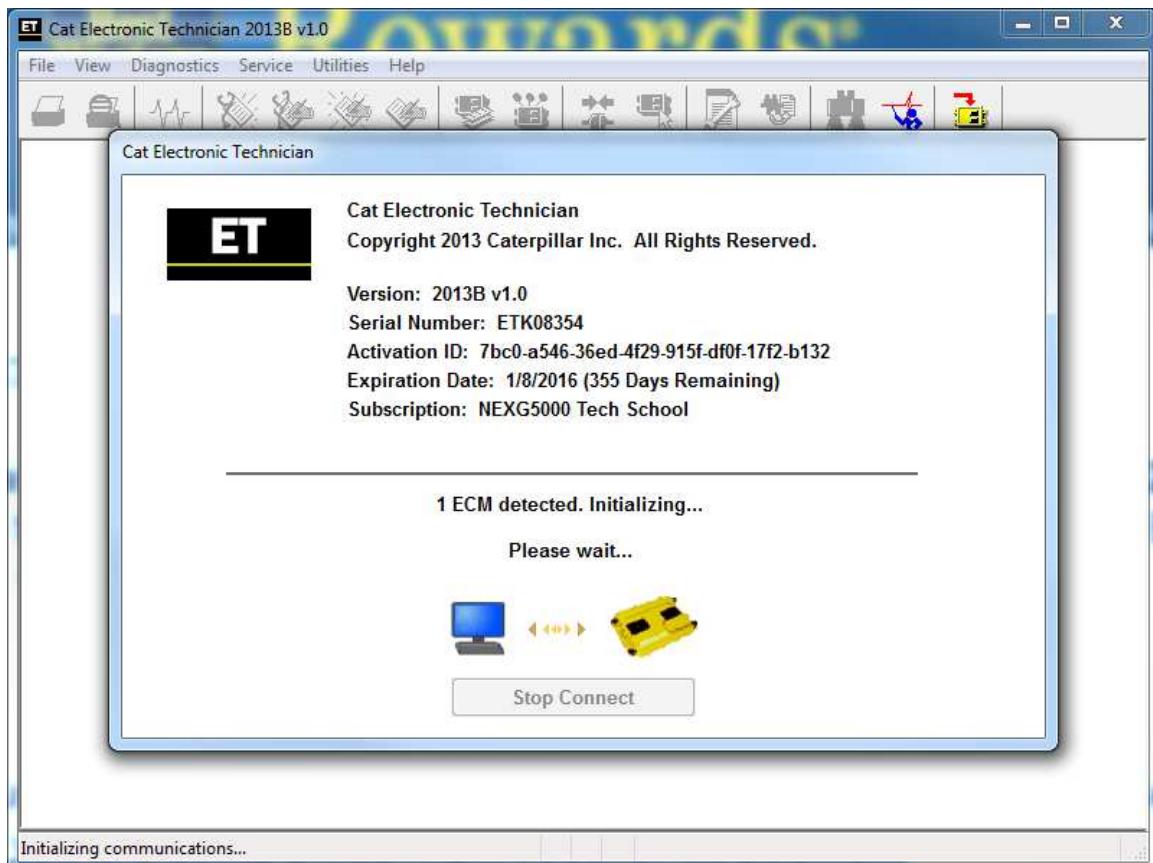


It is recommended to create a new data directory for each download to keep track of the data and not mix it with other information.

3.5.2 Connecting to an ECM

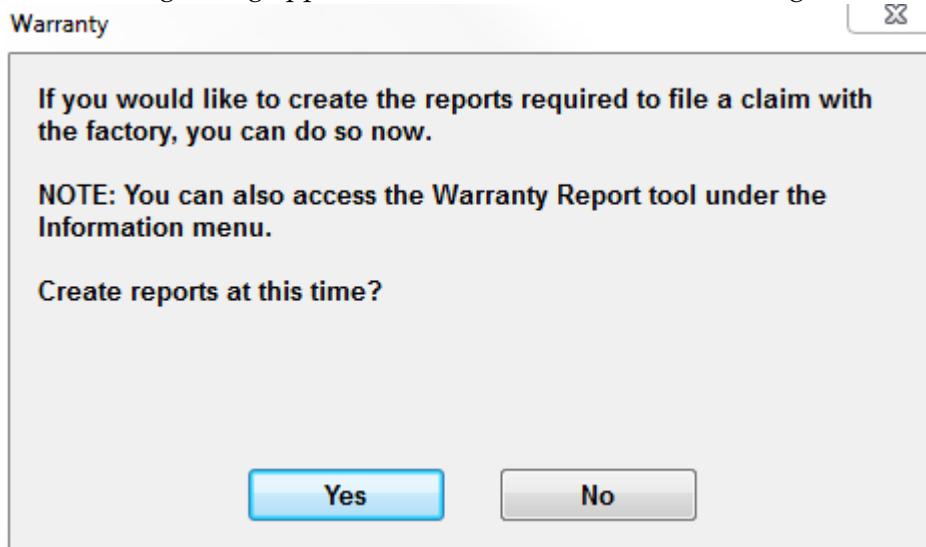
1. Turn the ignition key to the on position (if it is not already on), but do not start the engine.
2. Plug in the FLA to the diagnostic connector. Ensure it powers on and boots.
3. Perform a Standards based download using the FLA.
4. The FLA needs to be in J1708 passthrough mode, which is screen 14c. Once the FLA is in passthrough mode, it will log and preserve network traffic for a forensically verifiable record.
5. With the FLA connected through USB, start CatET. The program should automatically connect to the ECM, as shown in the following picture. If not, then the user can press F8 to connect once CatET is running.

3 Obtaining Data With Manufacturer's Software



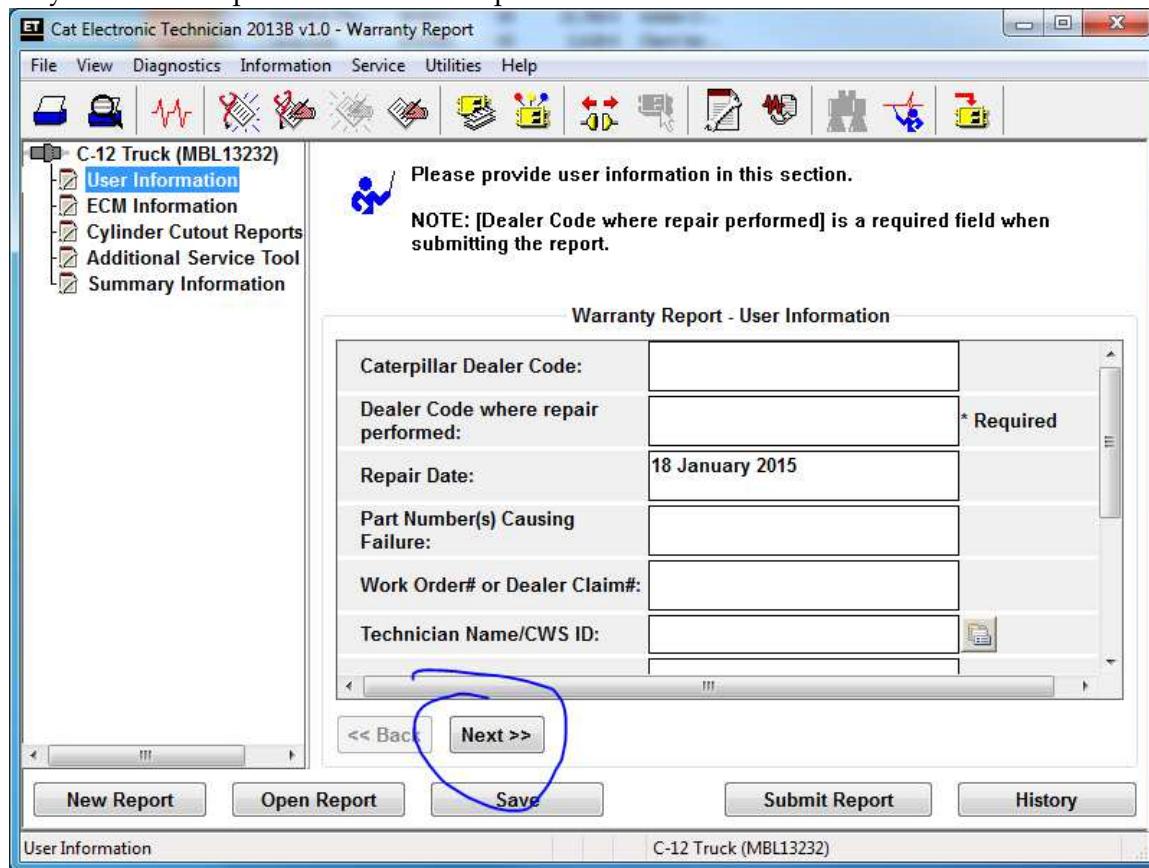
3.5.3 Warranty Report

1. CatET will automatically ask if you would like to create a Warranty Report. Press Yes when the following dialog appears. This can also be accessed through the Information menu.



3 Obtaining Data With Manufacturer's Software

2. An information screen will appear. This can be filled out as desired. Leaving the fields blank may be the best option. Press Next to proceed.

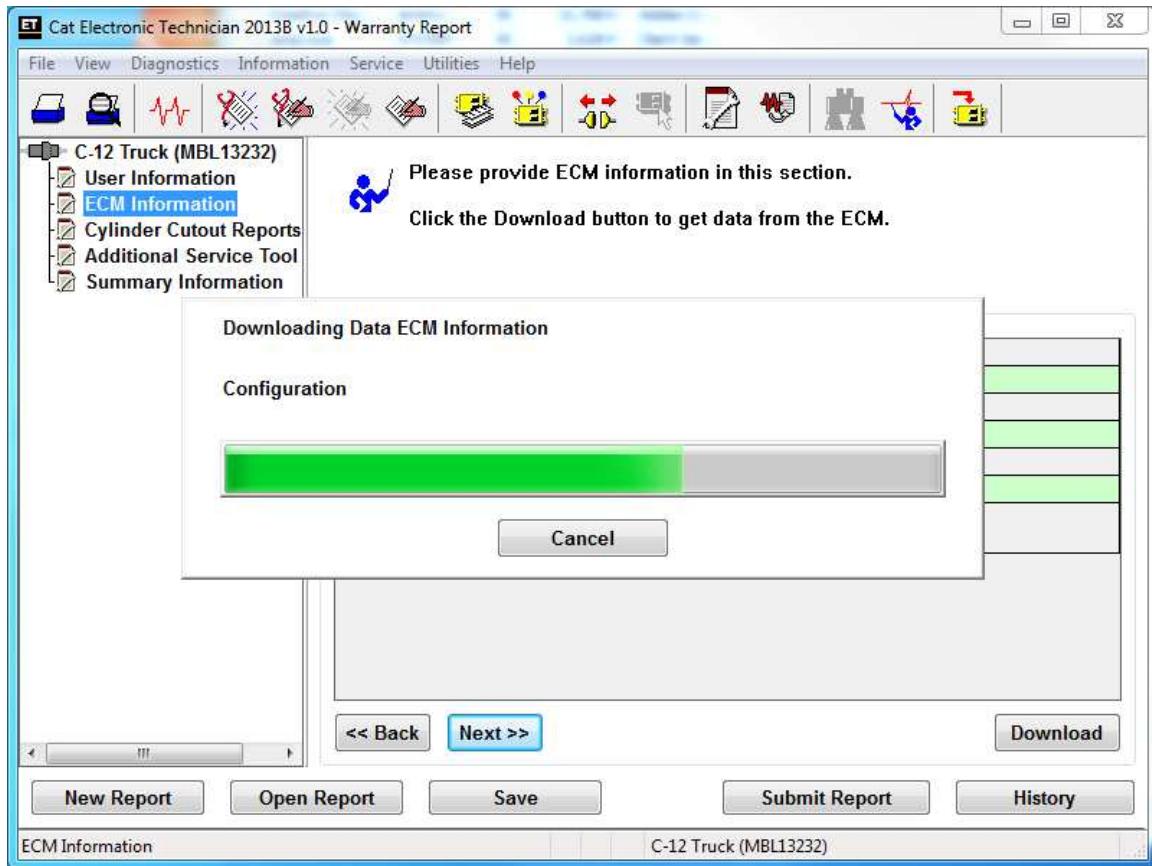


3. Press Yes when asked to download data from the ECM.



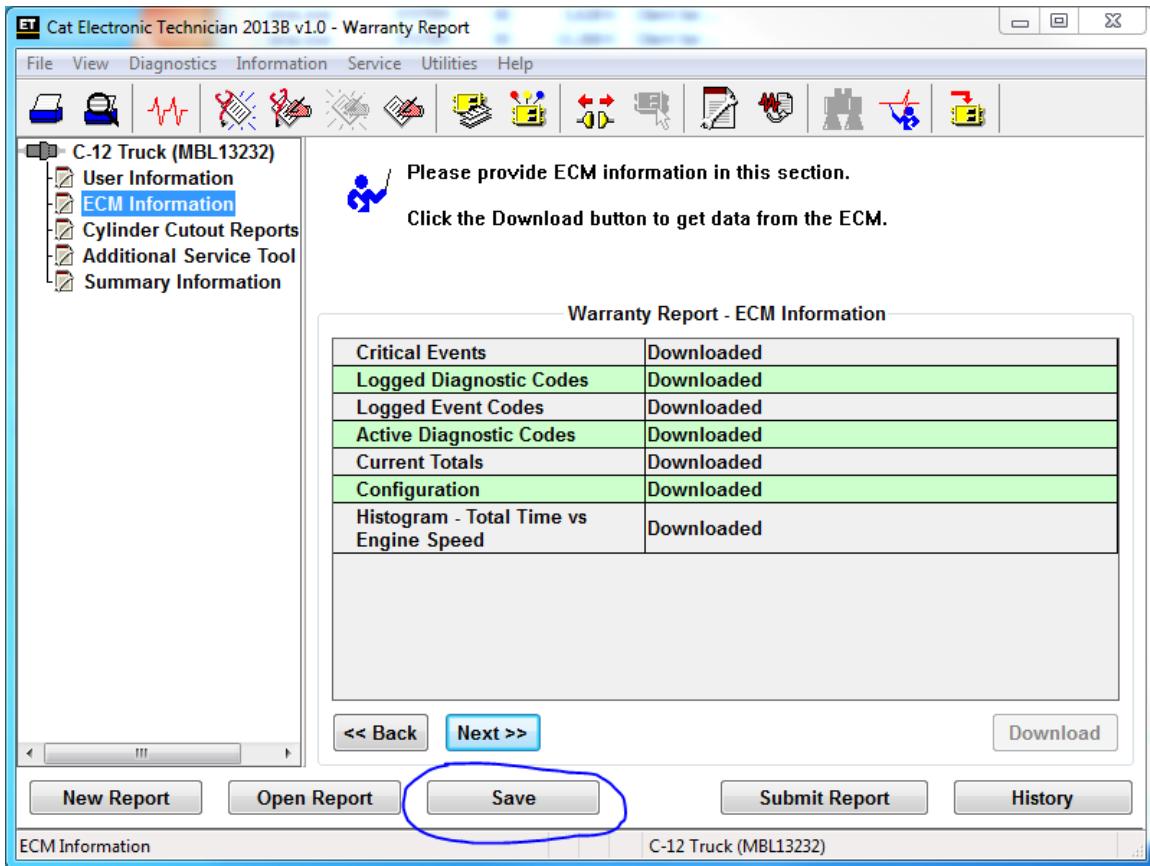
4. The software will download data for the report. The Configuration data takes the longest time.

3 Obtaining Data With Manufacturer's Software

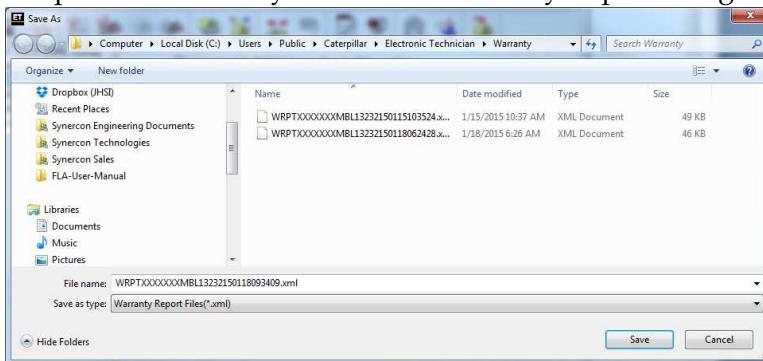


- Once the data is downloaded, press Save to create an XML file.

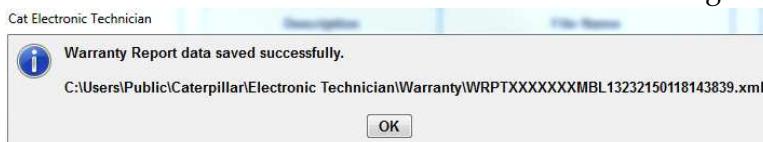
3 Obtaining Data With Manufacturer's Software



6. Keep track of where you save the Warranty Report using the Save As dialog.

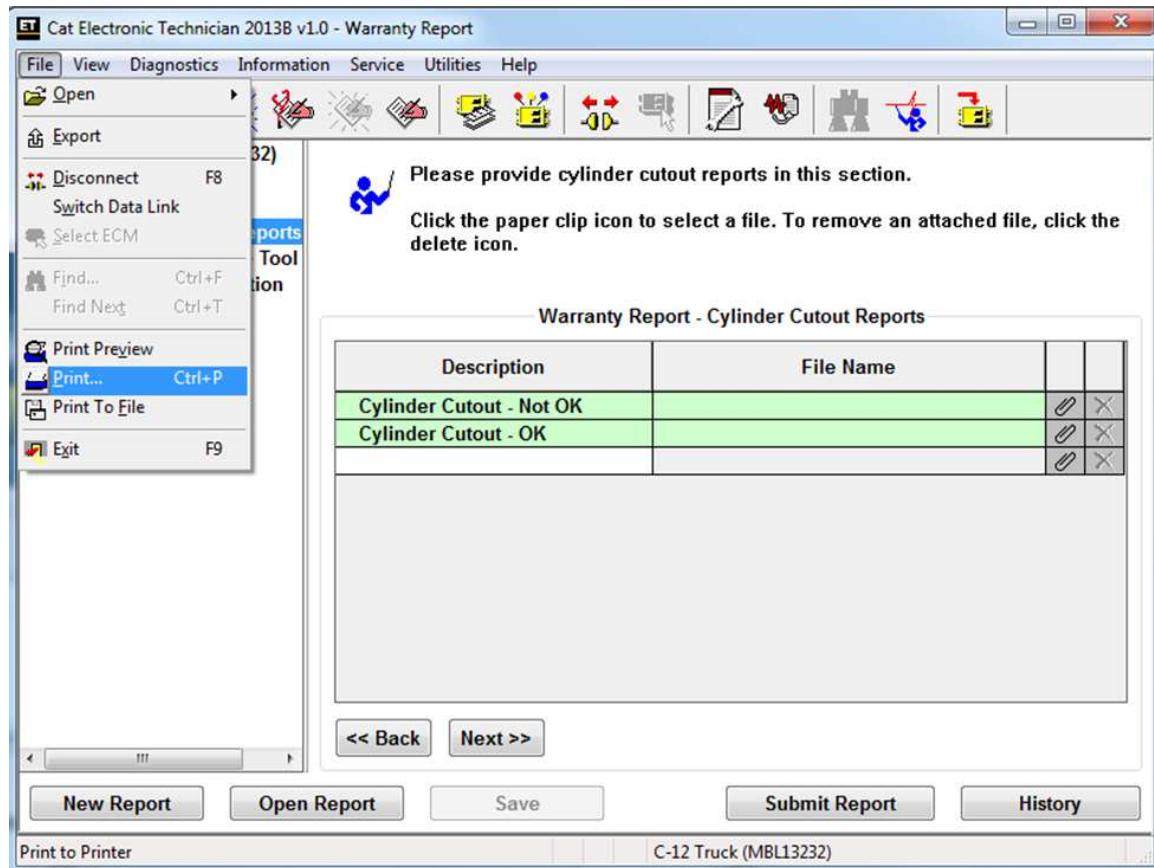


7. Record where the file was saved based off the following confirmation:



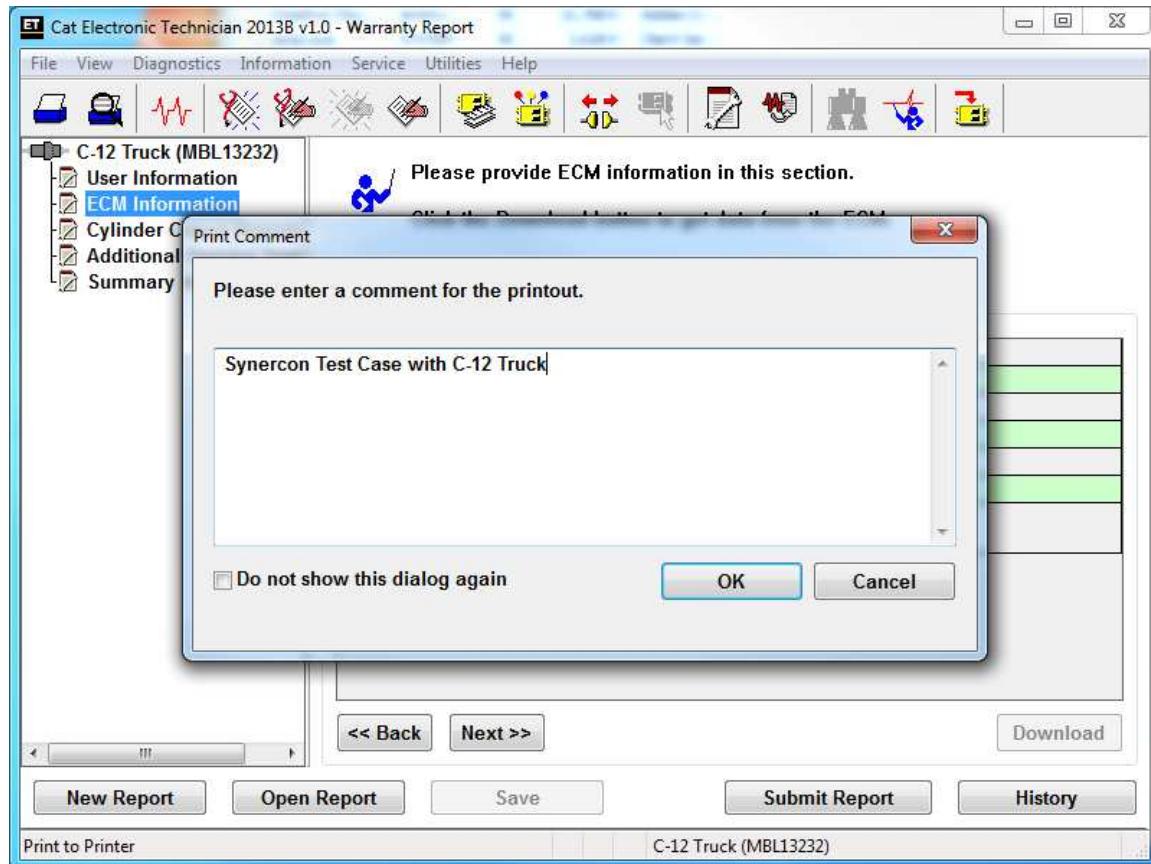
8. Print the Warranty Report using the Print menu option

3 Obtaining Data With Manufacturer's Software



9. Enter Comments that will appear on the header of the report.

3 Obtaining Data With Manufacturer's Software



10. The first page of the Warranty Report appears as follows:

**Cat Electronic Technician 2013B v1.0
Warranty Report**

1/18/2015 9:45 AM

Comments:

Synercon Test Case with C-12 Truck

C-12 Truck (MBL13232)

Parameter	Value
Vehicle ID	2HSCEAXR24C015095
Engine Serial Number	MBL13232
ECM Serial Number	21736103IK
Personality Module Part Number	2368689-00
Personality Module Release Date	may03
Personality Module Code	235
ECM Date/Time	1/18/2015 9:51:11 AM

Summary Information

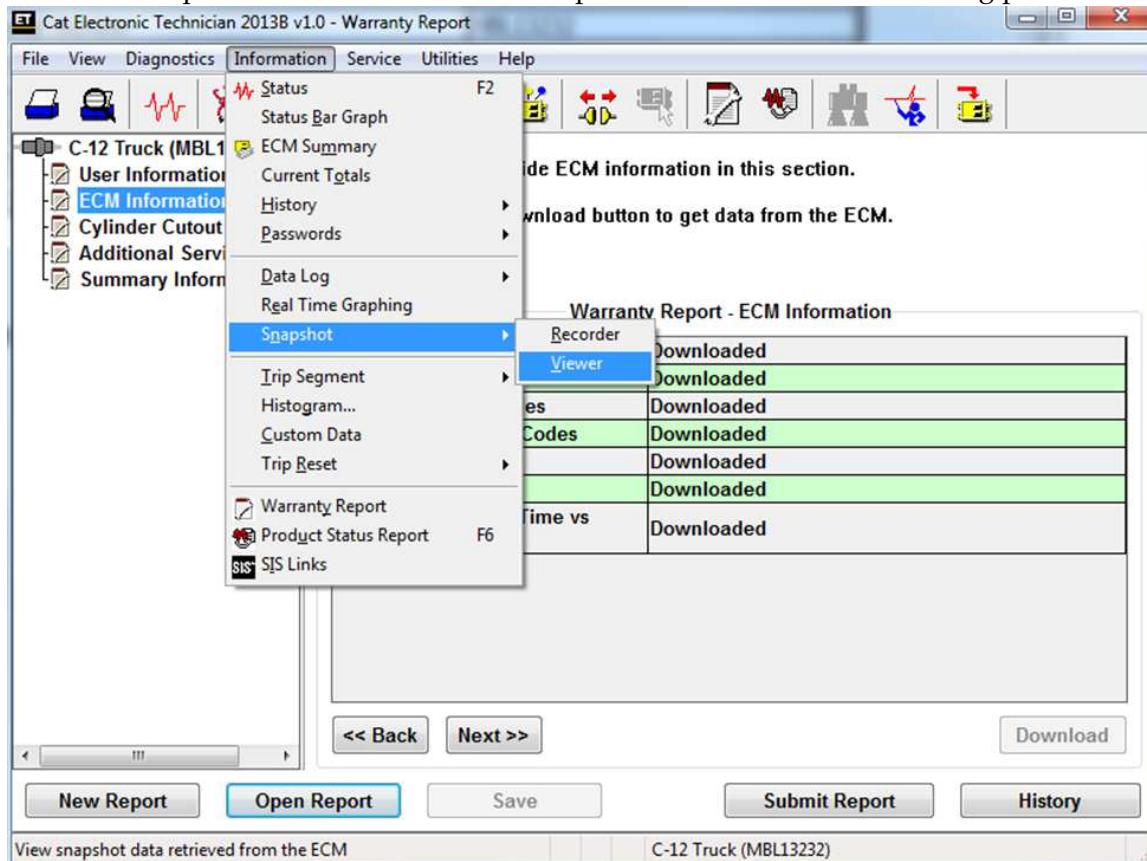
Engine Serial Number	MBL13232
ECM Date/Time	1/18/2015 9:40:47 AM
Report file Creation PC Date and Time	18/01/15 09:34:09 AM
Report file Last Modified PC Date and Time	18/01/15 09:44:32 AM
Total Distance	641486 Miles
Total Time	17850:17 hours
Total Fuel	104722 gal
Diagnostic Clock	19514 hours
Vehicle ID	2HSCEAXR24C015095
ECM Serial Number	21736103IK
Personality Module Part Number	2368689-00
Personality Module Release Date	may03
Personality Module Code	235

11. Scrolling through the Configuration data will reveal the Quick Stop Rate. If this is set to 0, then there may not be any Sudden Deceleration Snapshots.

Theft Deterrent System Control	No	
Theft Deterrent Password	****	
Quick Stop Rate	7	mph/s
Minimum Idle Time (0 = Off)	5	min
Driver Reward Enable	Enabled	

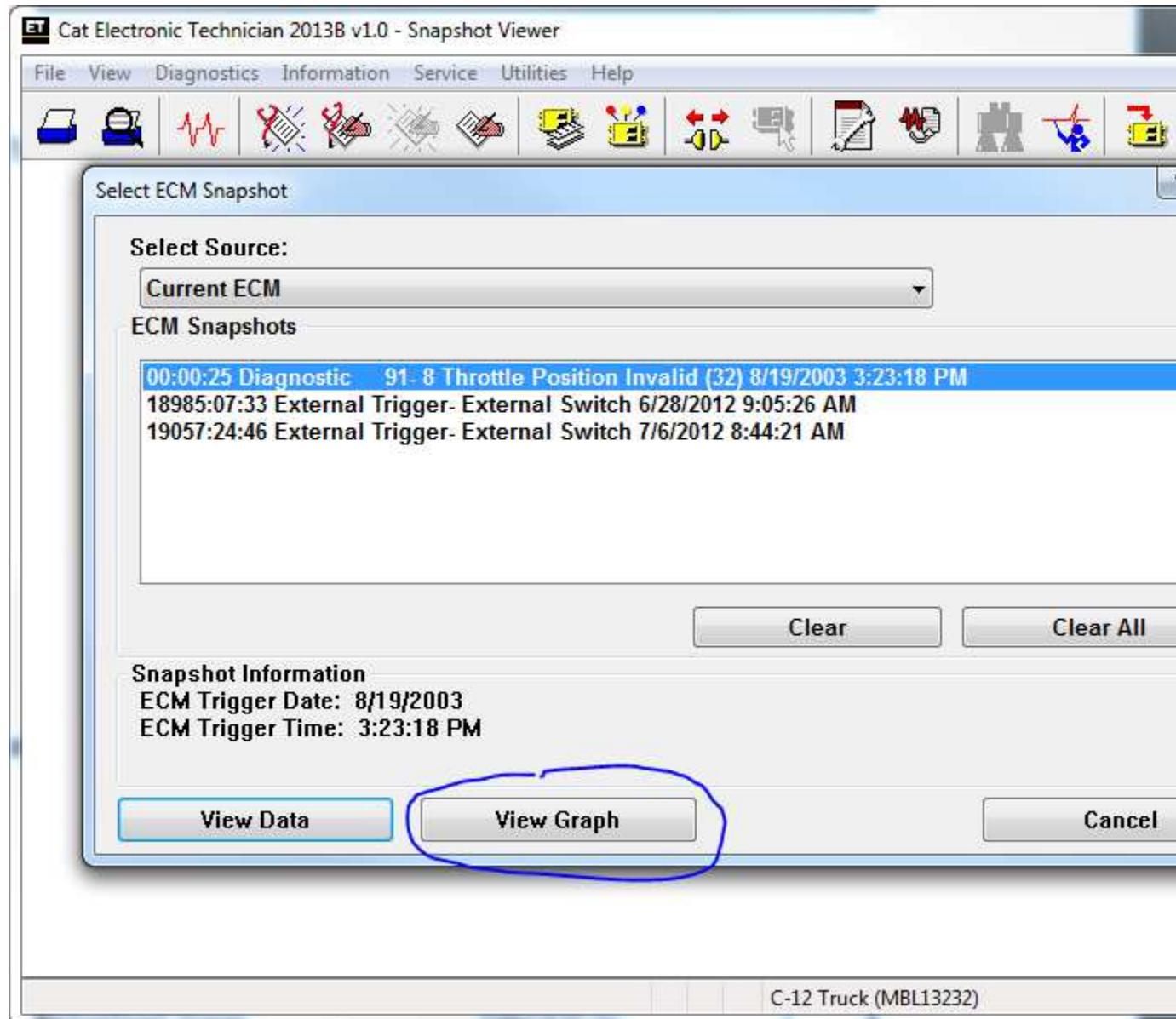
3.5.4 Snapshot Data

- Select the Snapshot Viewer from the menu options as shown in the following picture:



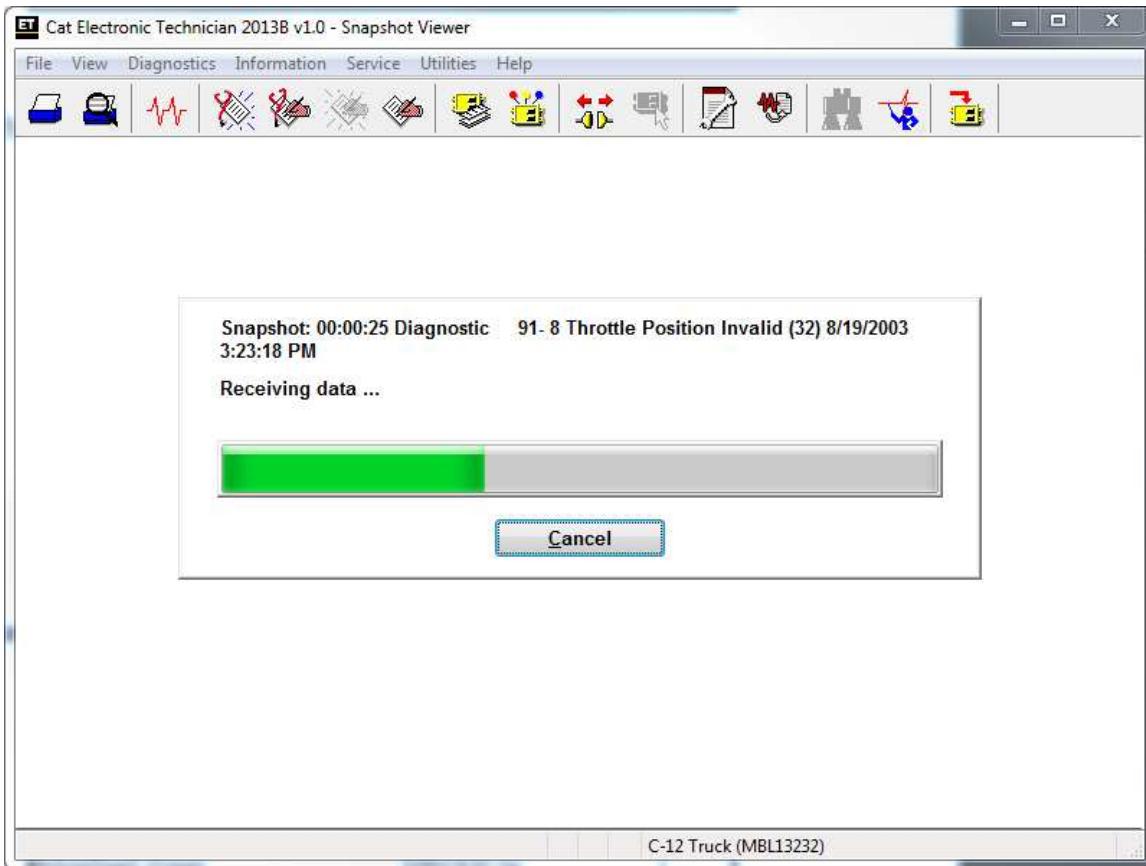
- A menu of recorded Snapshots appear. Please select next one and press View Graph. Taking a screenshot of this dialog box is a good idea to keep track of all the available Snapshots.

3 Obtaining Data With Manufacturer's Software

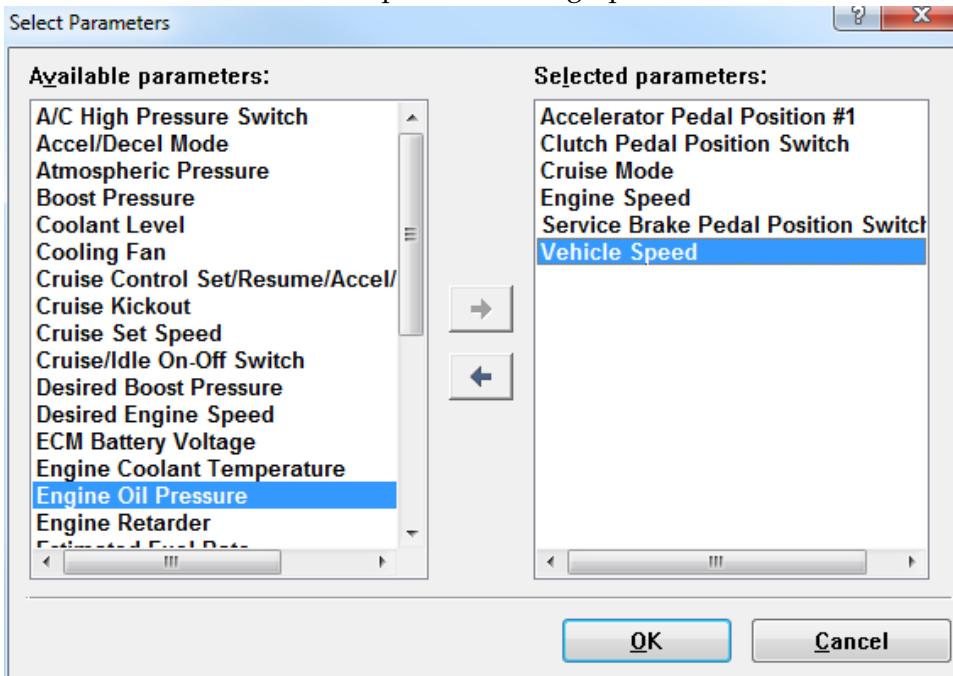


3. A progress bar will appear.

3 Obtaining Data With Manufacturer's Software



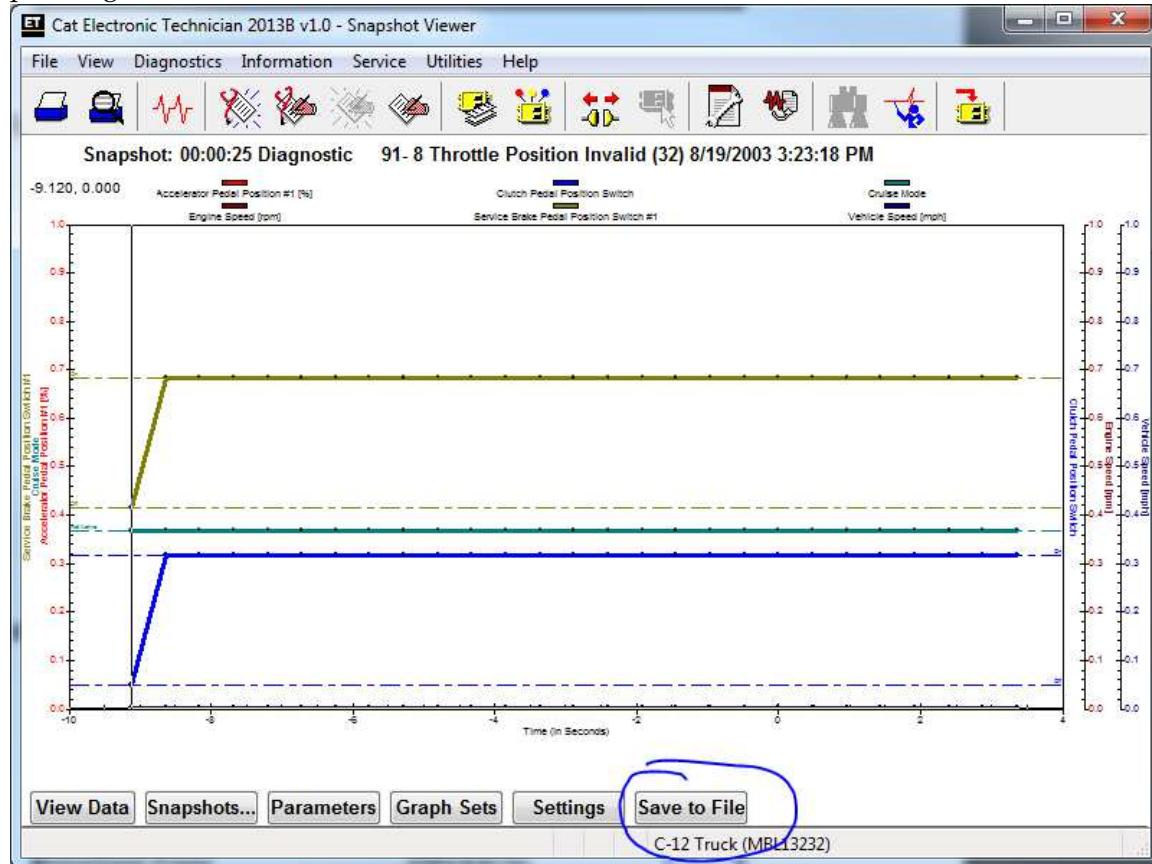
- Once downloaded, select the parameters to graph.



- The resulting graph will show and all the data (even the data not shown) can be saved by

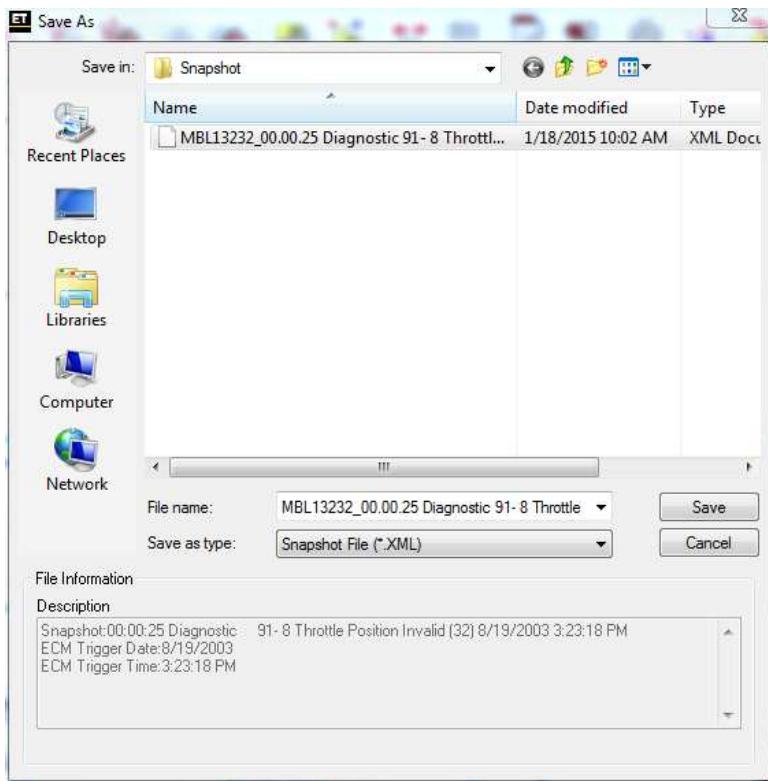
3 Obtaining Data With Manufacturer's Software

pressing Save to File.

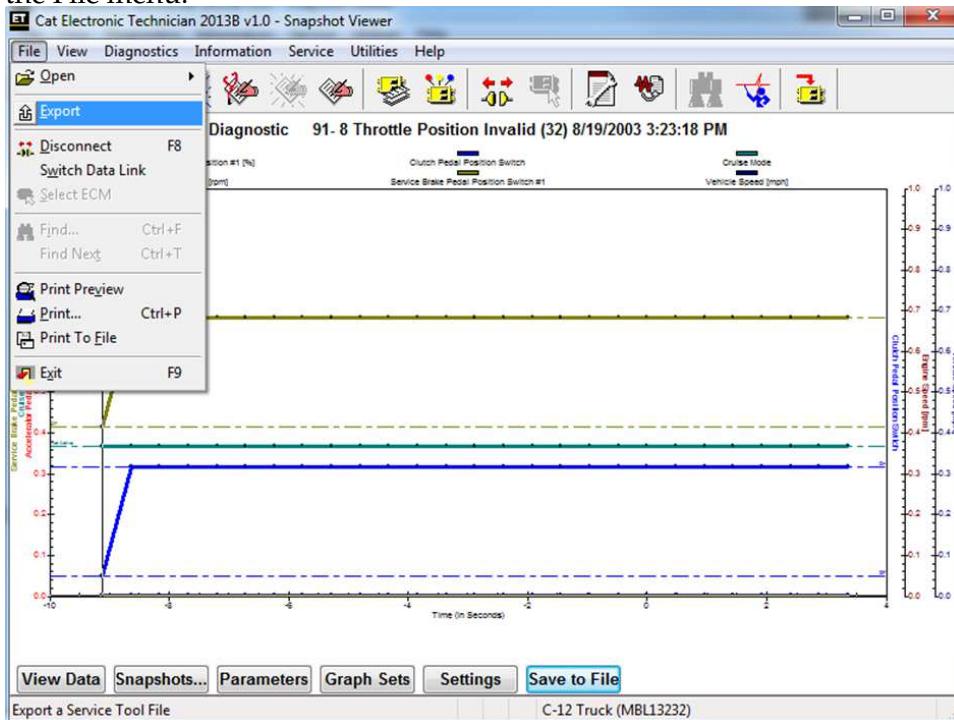


6. Record where the Snapshot File gets saved.

3 Obtaining Data With Manufacturer's Software

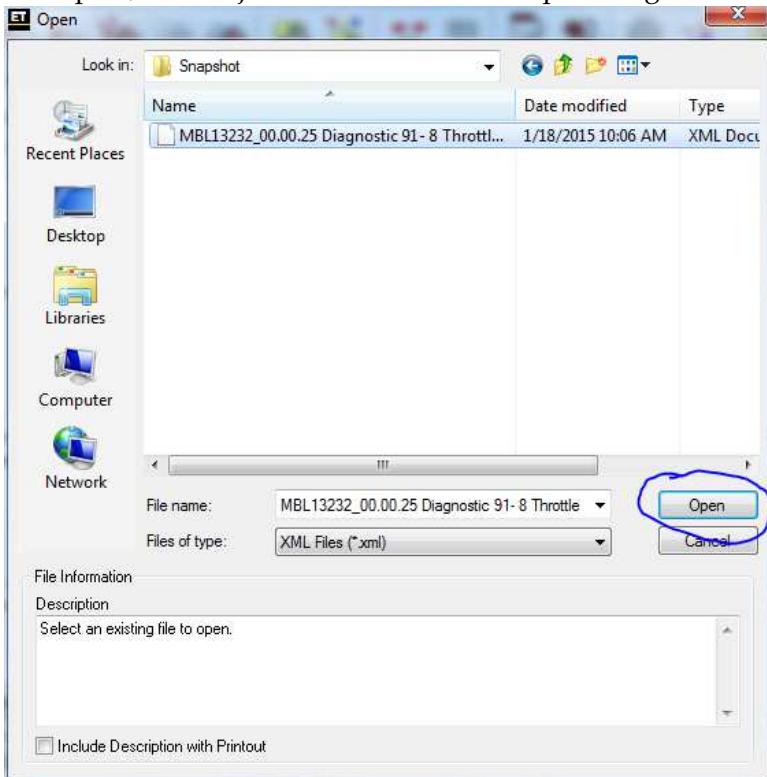


7. Print the Snapshot from the file menu.
8. Once saved, the Snapshot file can be Exported to MS Excel by pressing the Export option in the File menu.

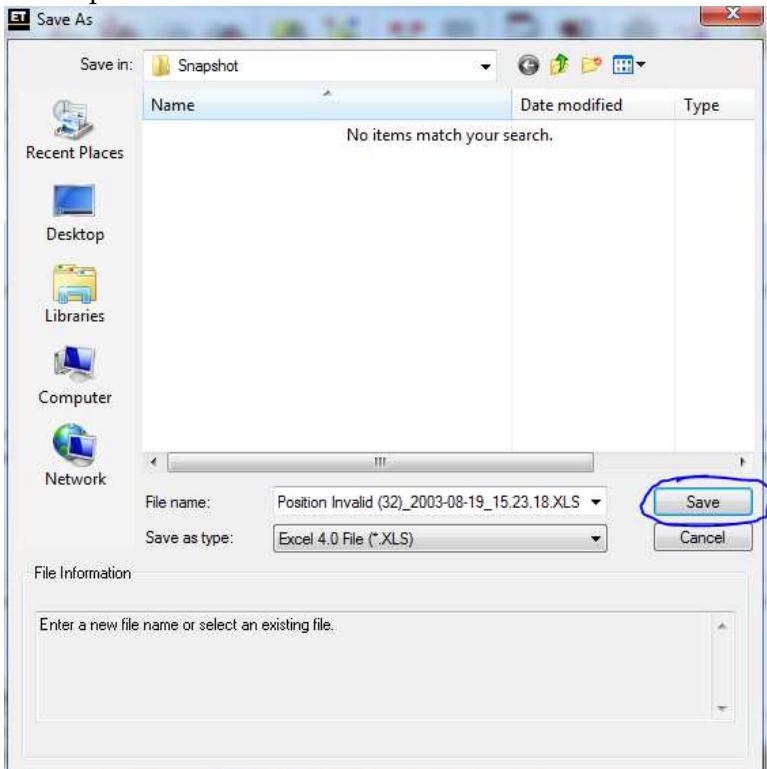


3 Obtaining Data With Manufacturer's Software

9. To Export, the file just saved needs to be opened again.

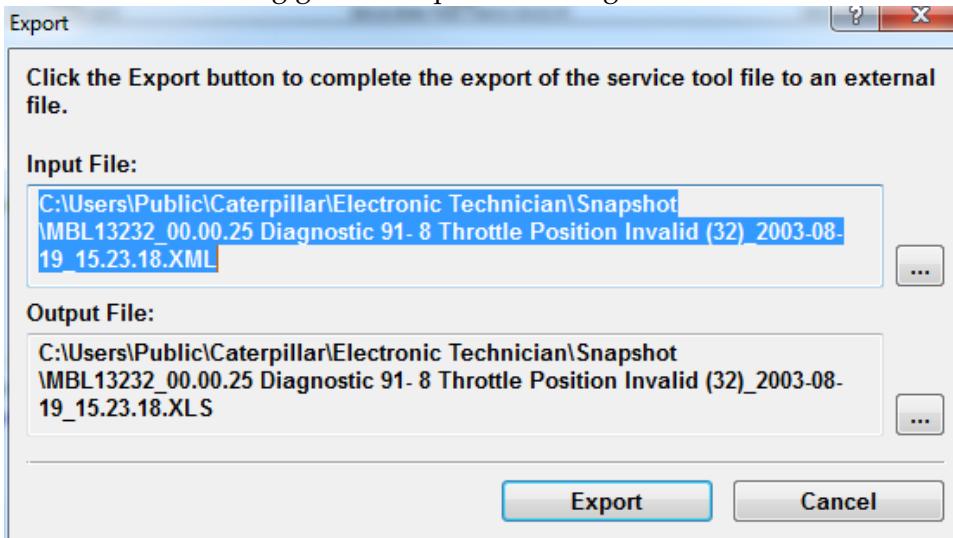


10. The exported file can be saved as an .XLS file



3 Obtaining Data With Manufacturer's Software

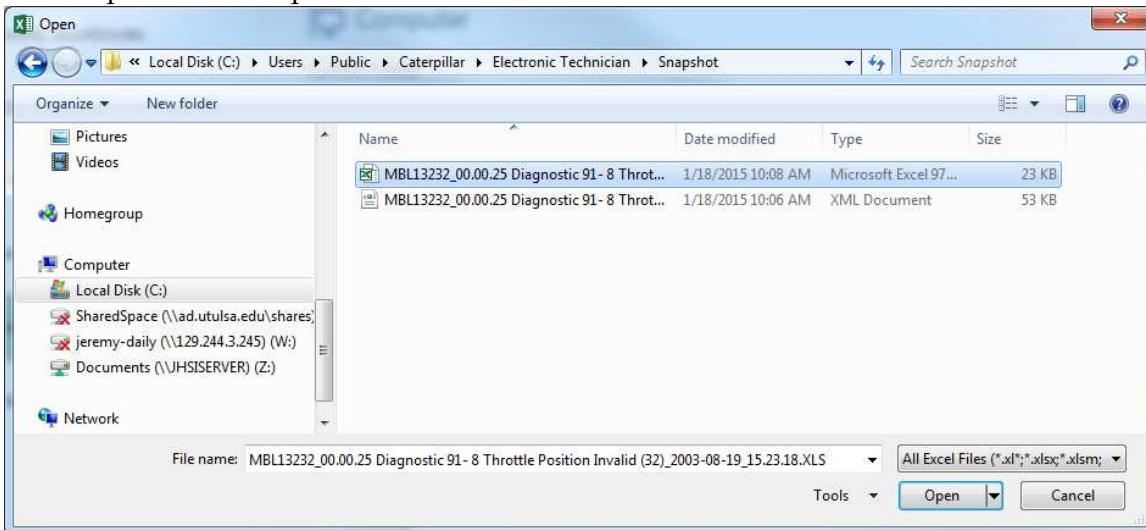
11. A confirmation dialog gives the option to change file names.



12. Record where the file was saved.



13. The Snapshot can be opened in Excel.



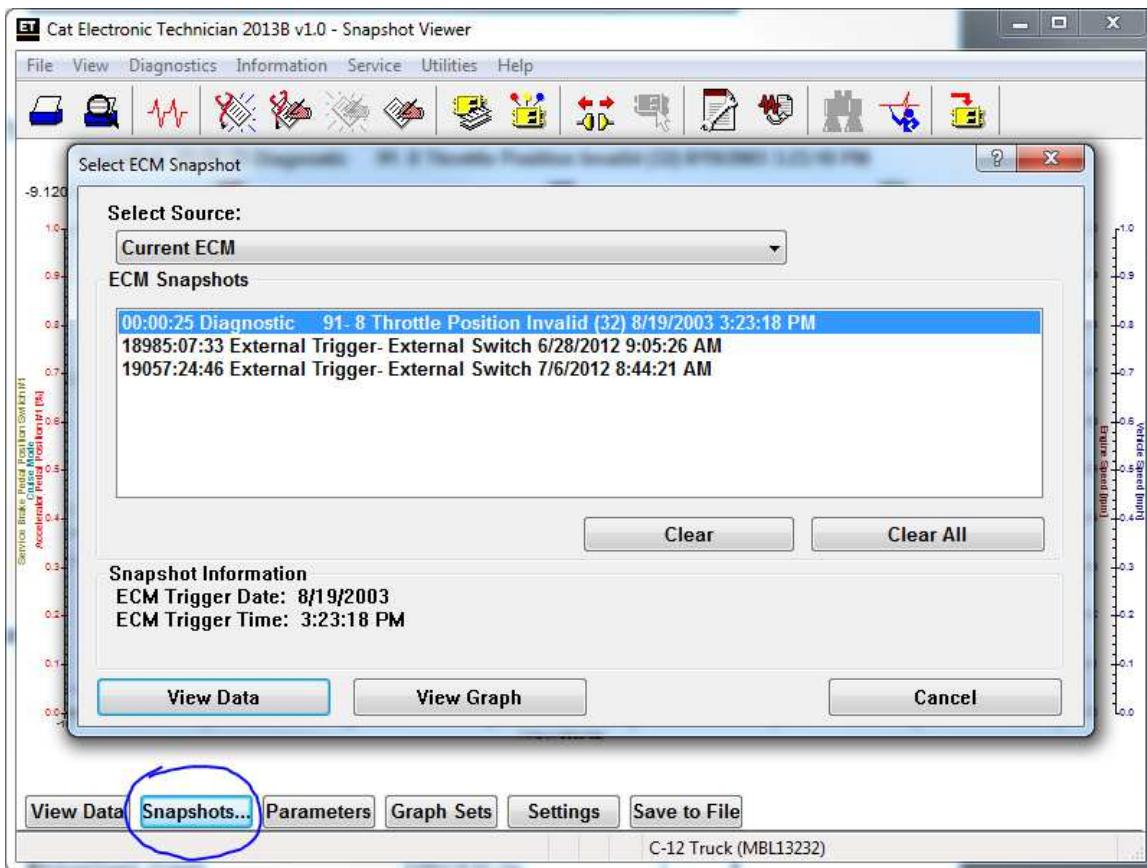
14. The excel file should appear like to picture below:

3 Obtaining Data With Manufacturer's Software

	Parameter	Value												
1	Frame	Time	Engine Speed	Desired Engine Speed	Cruise Speed	Set Speed	Idle Set Speed	Vehicle Speed	Estimated Fuel Rate	Boost Pressure	Engine Oil Pressure	Accel/Decel Mode	Engine Retarder	Coolant Level
2	Unit	Seconds	rpm	rpm	mph	mph	rpm	mph	gal/h	psi	psi			
3	Minimum Value			0	800	0	0	0	0	0	0	87		
4	Maximum Value			0	800	0	0	0	0	0	44	87		
5														
6	1	-9.12		0	800	0	0	0	0	0	0	87	Not Active	Disabled
7	2	-8.64		0	800	0	0	0	0	0	0	87	Not Active	Disabled
8	3	-8.16		0	800	0	0	0	0	0	0	87	Not Active	Disabled
9	4	-7.68		0	800	0	0	0	0	0	0	87	Not Active	Disabled
10	5	-7.2		0	800	0	0	0	0	0	0	87	Not Active	Disabled
11	6	-6.72		0	800	0	0	0	0	0	0	87	Not Active	Disabled
12	7	-6.24		0	800	0	0	0	0	0	44	87	Not Active	Disabled
13	8	-5.76		0	800	0	0	0	0	0	0	87	Not Active	Disabled
14	9	-5.28		0	800	0	0	0	0	0	0	87	Not Active	Disabled
15	10	-4.8		0	800	0	0	0	0	0	0	87	Not Active	Disabled
16	11	-4.32		0	800	0	0	0	0	0	0	87	Not Active	Disabled
17	12	-3.84		0	800	0	0	0	0	0	0	87	Not Active	Disabled
18	13	-3.36		0	800	0	0	0	0	0	0	87	Not Active	Disabled
19	14	-2.88		0	800	0	0	0	0	0	0	87	Not Active	Disabled
20	15	-2.4		0	800	0	0	0	0	0	0	87	Not Active	Disabled
21	16	-1.92		0	800	0	0	0	0	0	0	87	Not Active	Disabled
22	17	-1.44		0	800	0	0	0	0	0	0	87	Not Active	Disabled
23	18	-0.96		0	800	0	0	0	0	0	0	87	Not Active	Disabled
24	19	-0.48		0	800	0	0	0	0	0	0	87	Not Active	Disabled
25	20	0		0	800	0	0	0	0	0	0	87	Not Active	Disabled

15. The additional Snapshots can be accessed by pressing the Snapshots... button in CatET.

3 Obtaining Data With Manufacturer's Software

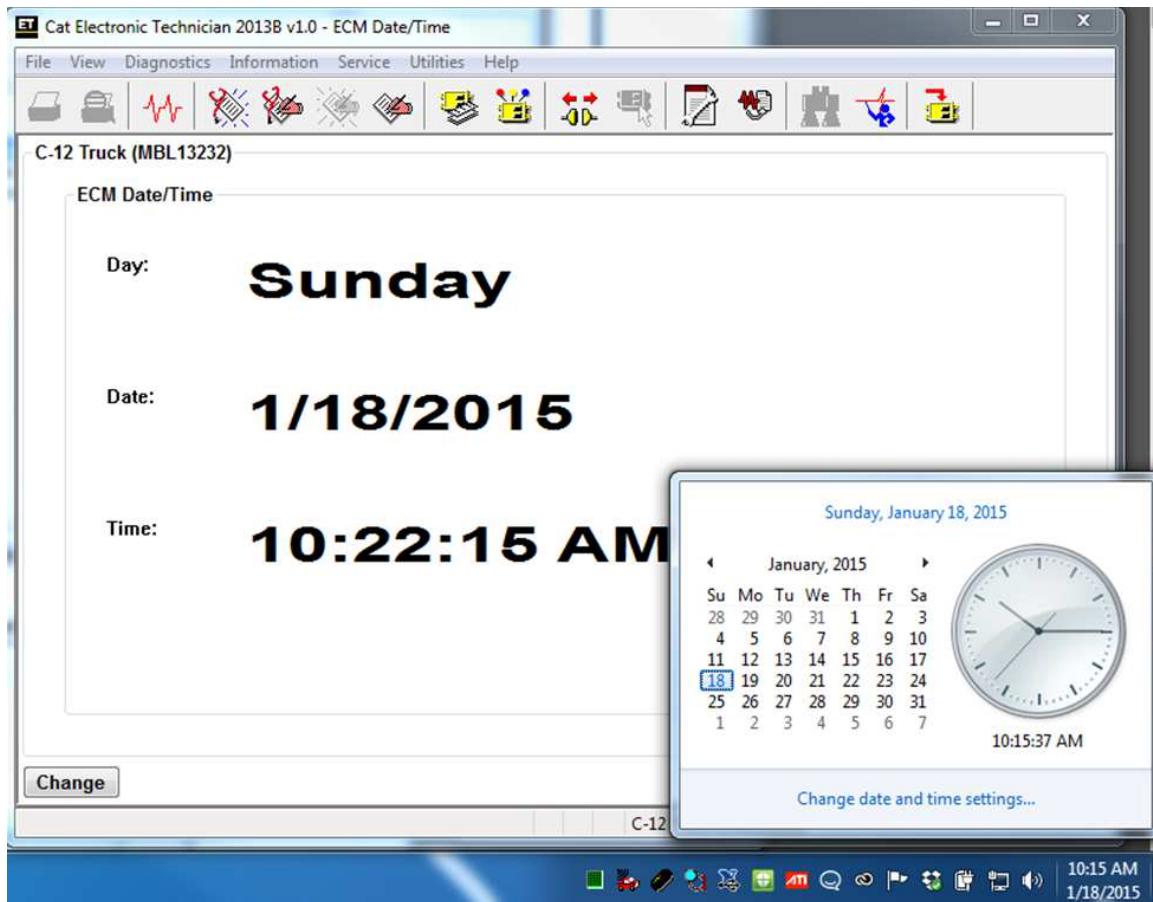


16. Repeat this Snapshots section for all the available Snapshots.

3.5.5 Preserving ECM Date and Time

1. Select ECM Date/Time from the Service Menu.
2. Open the PC System Clock and press the PrntScrn key on the PC keyboard.
3. Paste (Ctrl-v) the captured graphic into Paint or MS Word.
4. Save the document with the screenshot.

3 Obtaining Data With Manufacturer's Software



3.6 Forensic Write Blocking

There are certain messages that should not be transmitted to the ECM during a forensic examination. These messages are the kind that will change the data stored on the ECM in a meaningful way. Resetting or clearing fault codes, changing the ECM time, and resetting trip data should always be avoided.

4 Using the Forensic Link Adapter Portal Website

Once an FLA operator uploads the data to the server, the data will be decrypted and parsed on the server and made available to members of the group.

Please log in to <https://fla.synercontechnologies.com/> to access the FLA Portal as shown with the login screen in Figure 4.1 on the following page.

4.1

4 Using the Forensic Link Adapter Portal Website

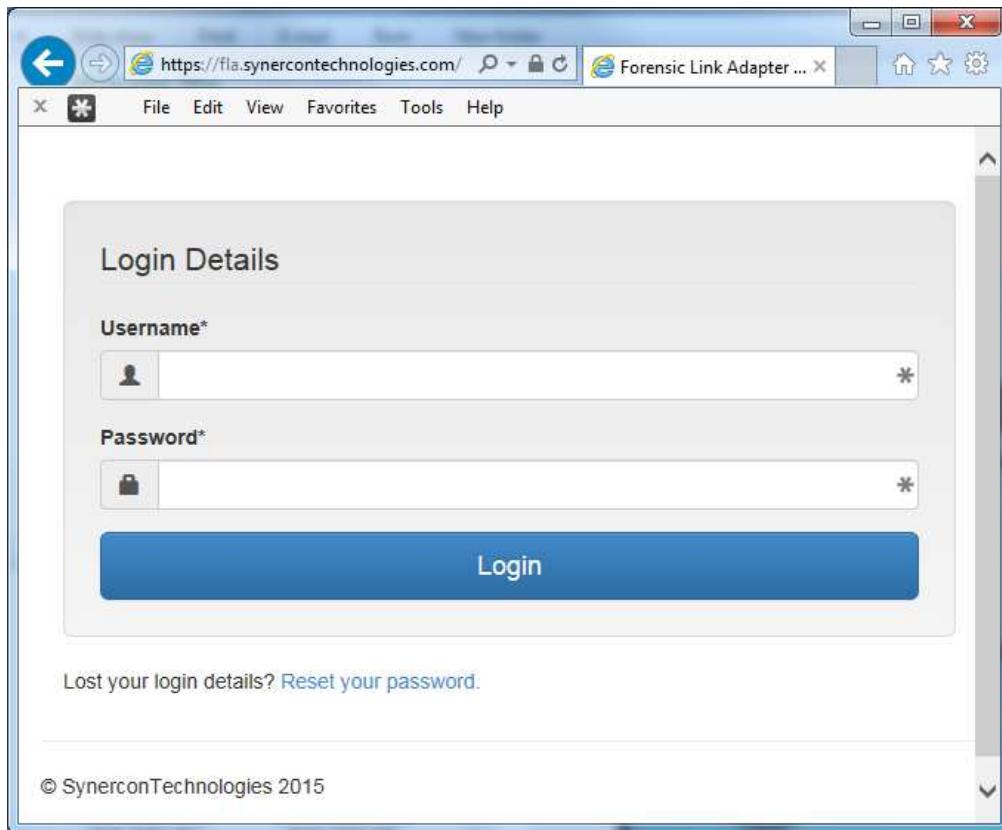


Figure 4.1: FLA Portal Login page. Your username was obtained when subscribing to the service.

5 Troubleshooting

In this chapter, a guide to overcome problems encountered in the field is presented. The troubleshooting tree will tie back into the menu system and use both the screen menu display and the FLA web interface.

5.1 Functional Tests

1. Launch DG's Adapter Validation Tool (AVT).
 - a) Select the appropriate installed device driver (DG-DPA4 +).
 - b) Switch the protocol to J1708 in the adapter validation tool.
 - c) Click Run Test. If the Adapter Validation Tool passes the test, then two windows will turn green as shown in Figure [5.1 on the next page](#). This means the ECM and the computer are connected through the RP1210 Device. If a test fails, review the suggestions output by the Adapter Validation Tool and try again. It may require shutting down the FLA, unplugging the USB, and disconnecting the FLA from power. Similarly, the PC may need to be rebooted.
 - d) Close the AVT.

5.2 Specific Symptoms

5.2.1 Forensic Link Adapter Fails to Boot

As the FLA boots, it may see something that it doesn't like and fails to pass its own self test. Often restarting will fix the problem. If connected to a truck, restart with the key in the off position so only power is connected.

Try connecting and powering with only the DC power barrel jack.

5 Troubleshooting

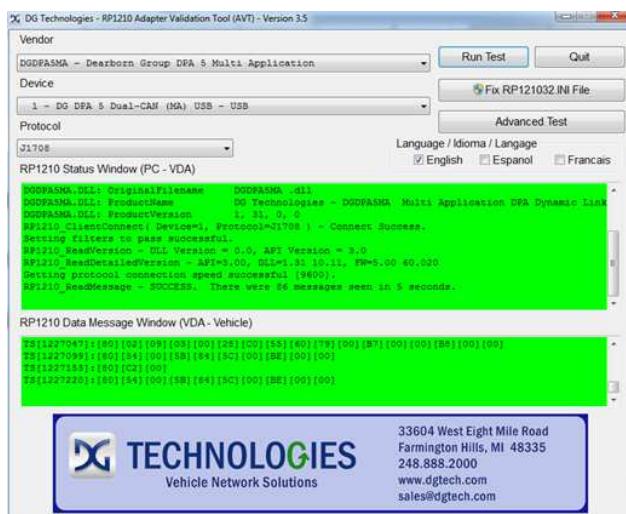
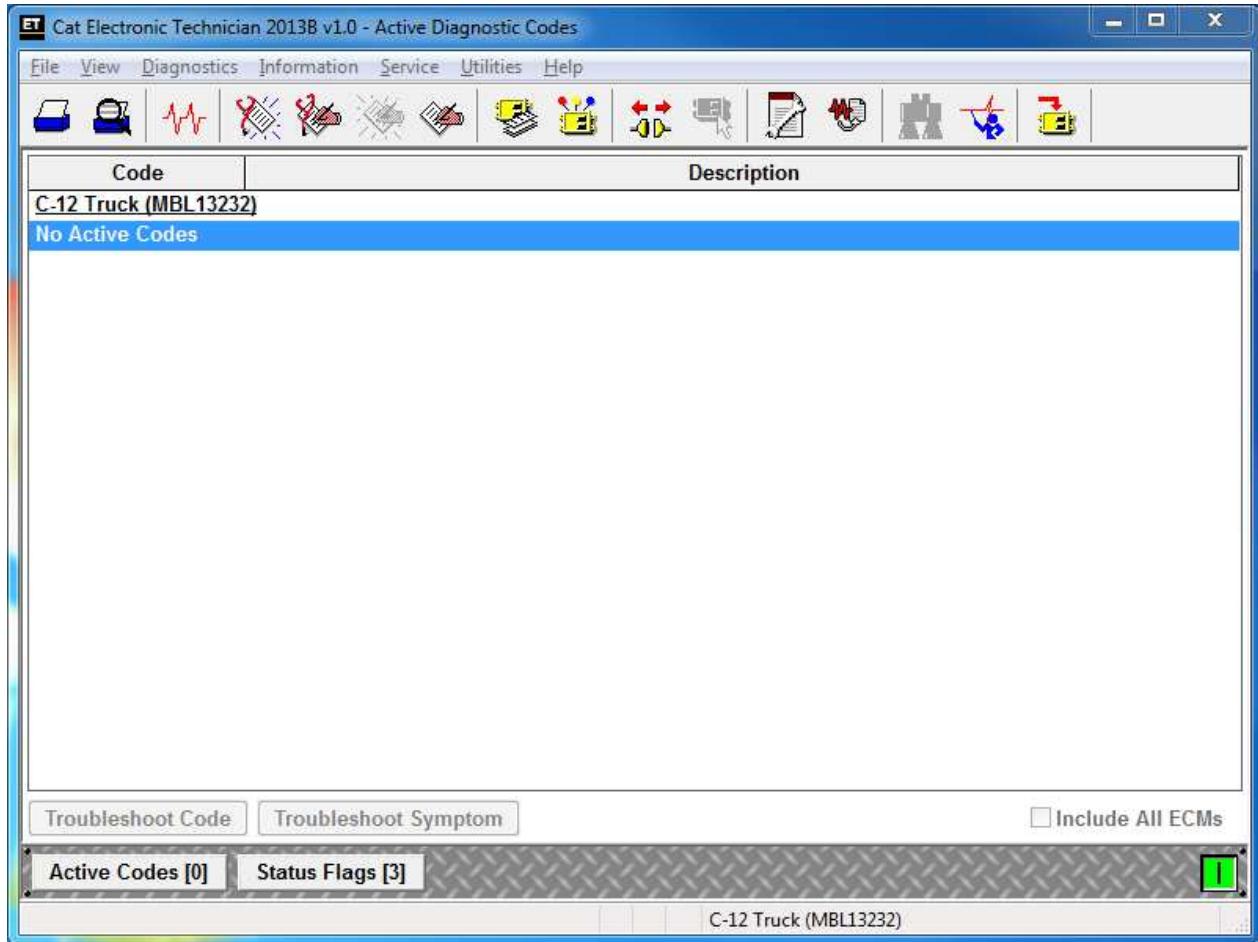


Figure 5.1: Adapter Validation Tool after successfully seeing data on the network.

6 Smart Sensor Simulators

The Smart Sensor Simulator is a bench downloading harness for different ECMS that is programmed to emulate a working truck.



6 Smart Sensor Simulators

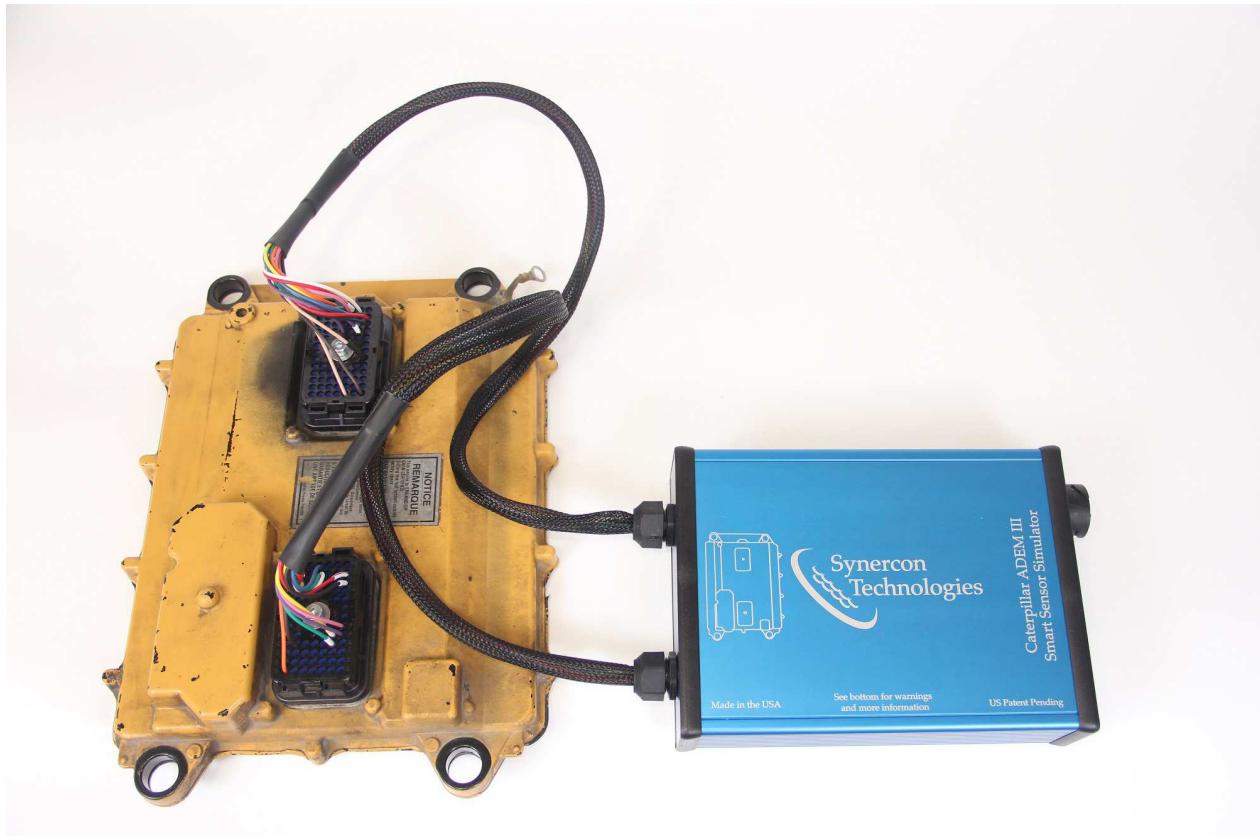


Figure 6.1: A photograph of a Smart Sensor Simulator connected to a Caterpillar ADEM III.

6 Smart Sensor Simulators

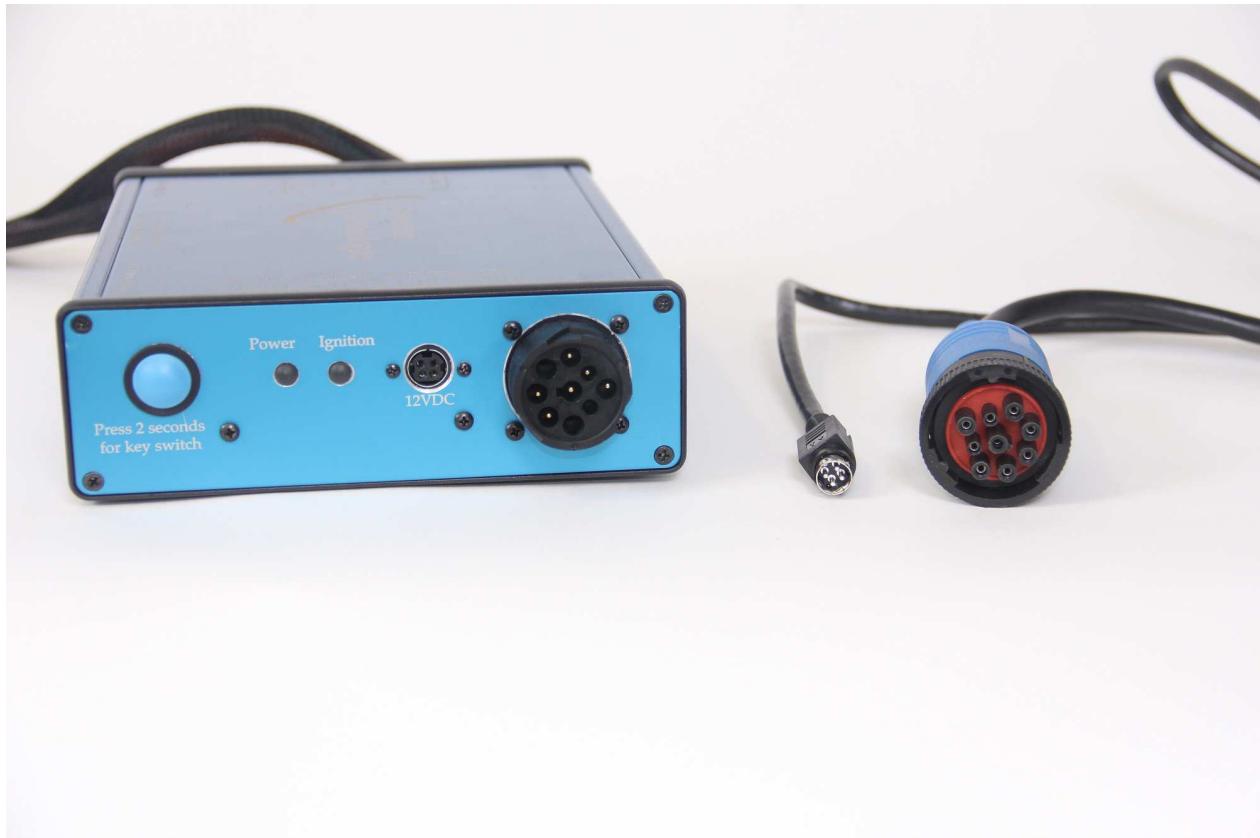


Figure 6.2: Smart Sensor Simulator connections and interface panel.

7 Administrator's Guide

The deployment of the Forensic Link Adapter software based on a hierarchy with the following tiers:

Organizations are the top level with a site administrator as the person in charge. Typically this is a highway patrol, a state police, or a company. The person in charge of the organization has the ability to oversee the data and use of the different FLAs.

Groups are a sub-level within an organization. For example, East District and West District may be groups within an State Police organization. If an organization only has a few operators and a few FLAs, it may not make sense to have different groups.

Operators are trained users of the FLA and are responsible for collecting data in the field. Operators can be assigned to different groups. Every operator in the group is able to see the data packages from all the FLAs assigned to the group, regardless of which operators downloaded the data.

Forensic Link Adapters are the hardware devices that an organization owns.

For smaller operations, it is likely that the organization, group, and operator are all the same person.

7.1 Account Overview

Forensic Link Adapters are assigned to each organization at the time of purchase. Once the organization completes the purchase, the serial numbers of each FLA will be loaded into the Organization's profile. An invitation to set up the Organization will be sent to the site administrator. For example, the Lieutenant in charge of the crash reconstruction division will become the site administrator once he or she registers by following the link sent in the invitation e-mail.

Once logged in as a Site Administrator, an account overview page will be available, much like the one shown in Figure 7.1 on the following page. Many of the fields on the web page are linked to various functions. The top bar (in black) has links to your default login page, the latest FLA download if you are an operator, a list of all the organizations, FLAs, and some account access settings. The web page is set up in three distinct tables as seen in Figure 7.1.

1. Organization Groups
2. FLA Operators
3. Forensic Link Adapter (FLA)

The screenshot shows a web browser window titled "Forensic Link Adapter portal" with the URL "fla.synercontechnologies.com/org/synercon-technologies/". The page has a dark header bar with the title and navigation links for "Latest FLA download", "All FLAs", and "Jeremy Daily". Below the header, the main content area is titled "Synercon Technologies Account overview". It contains three main sections:

- Organization Groups:** A blue box titled "Organization Groups" with the sub-instruction "Manage your organization's groups". It lists two groups:
 - Field Operators: **enabled** (2 / 1)
 - Test group: **enabled** (2 / 2)A green "Add a new group" button is at the bottom.
- FLA Operators:** A light blue box titled "FLA Operators" listing four operators with their last login date:
 - Andrew Kongs: **Test group**, last login: November 20, 2014
 - Gavin Bauer: **Test group**, last login: November 20, 2014
 - Jeremy Daily: **Field Operators**, last login: November 20, 2014
 - Mark Sole: **Field Operators**, last login: November 21, 2014
- Forensic Link Adapter (FLA):** A yellow box titled "Forensic Link Adapter (FLA)" with the sub-instruction "View your organization's adapters". It lists several FLAs with their expiration status:
 - Andrew's Test Unit: expires in 11 months
 - 1B1R70010: expires in 11 months
 - 1B1R70005: expires in a day
 - 1B1R70006: **Test group**, expires in 11 months
 - Gavin's FLA: **Test group**, expires in 11 months
 - 1B1R70007: expires in 11 months
 - 1B1R80015: expires in a year
 - 1B1R70002: License expired
 - 1B1R70008: expires in 11 months
 - 1B1R70011: expires in a year
 - James' Dev FLA: expires in a year
 - Dr. Daily's FLA: **Field Operators**, expires in a year
 - 1B1R70003: expires in 14 days

At the bottom left, there is a copyright notice: "© SynerconTechnologies 2014".

Figure 7.1: Example Forensic Link Adapter Portal web page for the Account overview

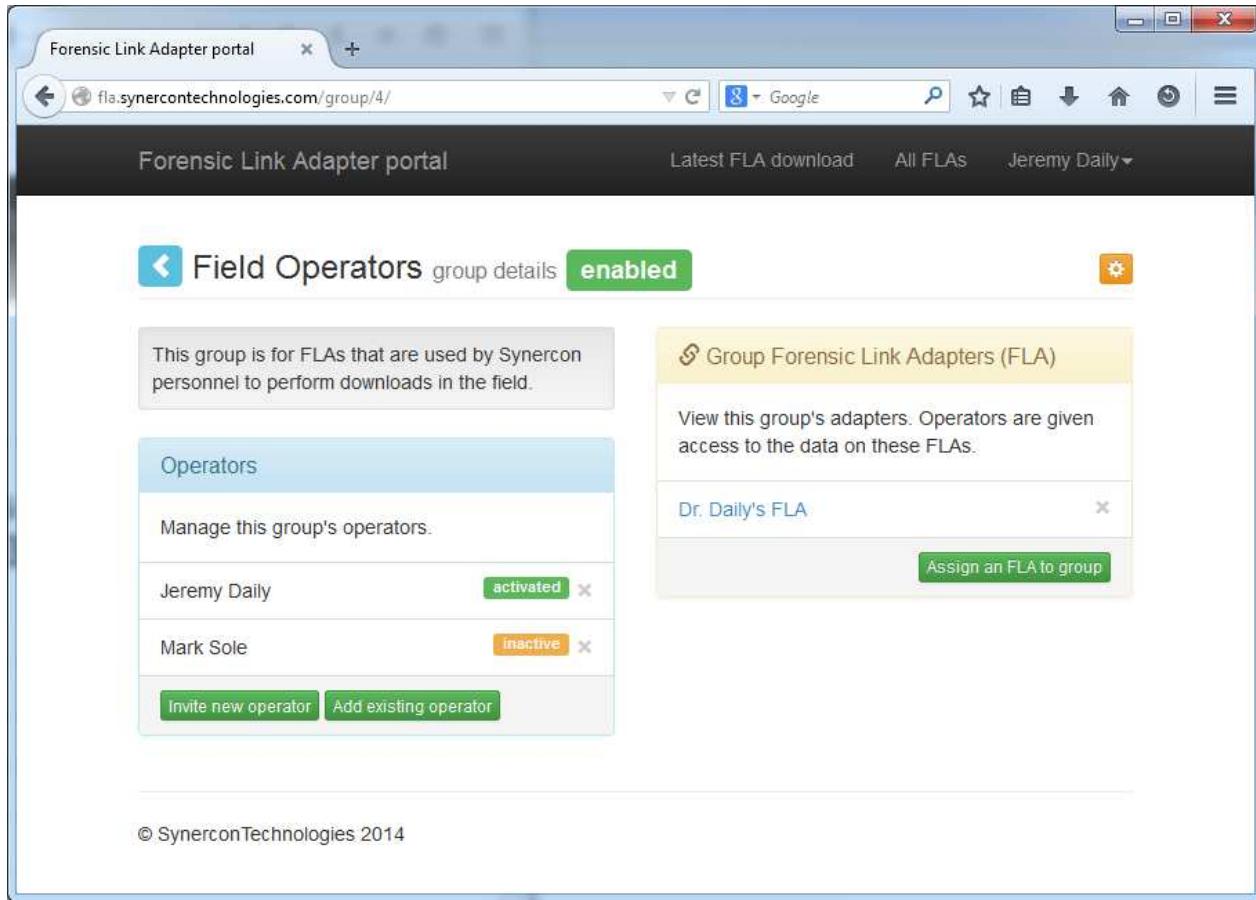


Figure 7.2: Example Group Details web page from the Forensic Link Adapter Portal.

7.2 Group Management

It is the responsibility of the Organization administrator to set up groups and operators according to the desired structure of the Organization. You can have operators that have access to more than one group.

7.2.1 Adding an Operator

There are two ways to get an operator access to the group's FLAs. The first is to invite a new operator and the second is to invite an existing operator. However, the existing operator must have accepted an invitation from the Organization under a unique e-mail address. By clicking on the lower left box the says **Invite new operator** shown in [7.2](#), a web page similar to the one shown in [7.3 on the following page](#). The required user information includes name and email address. The FLA portal uses e-mail addresses to identify operators. Therefore, if a person belongs to different organizations, they would have to use a different e-mail for each organization. New operators will get an e-mail from fla-admin@synercontechnologies.com with a link to register with the site.

The screenshot shows a Windows-style application window titled 'Forensic Link Adapter portal'. The URL in the address bar is 'http://fla.synercontechnologies.com/group/1/operators/invite/'. The main content area is titled 'Invite an operator'. It contains several input fields for 'User information': 'First name*', 'Last name*', and 'Email address*'. Below this is a 'General' section with 'Company/Organization*' and 'Occupation Classification*' dropdowns, where 'State Government' is selected. Under 'Work Address', there are fields for 'Street address', 'Address line 2', 'City', 'State/Province', 'Zip', and 'Country', with 'United States' selected. At the bottom left is a blue 'Complete invitation' button, and at the bottom right is a copyright notice: '© Synercon Technologies 2014'.

Figure 7.3: New Operator invitation form on the FLA portal website.

Many times this e-mail will be filtered as junk, so advising the recipient to check their e-mail filters and junk folder may be necessary.

The Work Address details on the Invite and operator page are used to fill in a report with

7.2.2 Assigning an FLA to the Group

Each group needs to have at least one Forensic Link Adapter assigned to it. To assign an FLA to a group, click the button to see a list of available FLAs for your organization. Only people in the group can see the data on the FLA assigned to that group

The screenshot shows a web browser window for the 'Forensic Link Adapter portal' at fla.synercontechnologies.com/group/4/. The page displays the 'Field Operators' group details, which are enabled. A success message indicates that 1 flas were successfully assigned to the group. The 'Operators' section lists two users: 'Jeremy Daily' (activated) and 'Mark Sole' (inactive). The 'Group Forensic Link Adapters (FLA)' section shows two assigned FLAs: 'Dr. Daily's FLA' and '1B1R70008'. A button to 'Assign an FLA to group' is visible. The footer contains the copyright notice '© Synercon Technologies 2014'.

Figure 7.4: Assigned FLAs

8 Definitions

When dealing with heavy truck data, there are many acronyms, symbols and phrases that are used to describe the data. This chapter presents a list to help decipher some of the terms used for dealing with heavy vehicle event recorders.

NIST National Institute for Standards and Technology (<http://www.nist.gov/>)

RTC Real Time Clock

9 Suggested Training and Practice

This chapter helps new and seasoned users of the FLA work with some of its features. Performing the exercises herein should provide the user a familiarity of the operation of the FLA.

9.1 Powering up the FLA

1. Connect the FLA to its A/C Power adapter without any other connections. Determine the following:
 - a) How many seconds it takes for the FLA to display the screen with the time at the top?_____
 - b) Is the time correct?_____
 - c) What is the voltage displayed on the screen?_____
 - d) What is the voltage rating for the A/C power adapter?_____
 - e) What does the third line of the display say?_____
2. Press the Red button once to begin the Shutdown Process. This corresponds to the transition from Screen 3 to 4, which is the Shutdown Screen.
 - a) Press the Green Button to confirm the Shutdown. How many seconds does it take for the LED to turn red and the screen say that it is ok to unplug?_____
 - b) Unplug the FLA.
3. Plug in the FLA cigarette lighter adapter into power and connect it to the FLA to boot the system.
 - a) What is the voltage displayed on the status screen?_____
 - b) Using the display buttons, shutdown the FLA. After the FLA says it's ok, unplug the 12V cigarette adapter cable.
 - c) Unscrew the tip of the 12V cigarette lighter adapter and examine the fuse. What is the fuse current rating?_____
 - d) Reassemble the 12V adapter and put it back in the FLA case.
4. Install the vehicle connection cable (CABLE-01) with a 15 pin DSub connector on one end and a Deutsch style connector with 9 pins on the other. Plug the 9-pin connector into a powered and running Smart Sensor Simulator with the key on (Both Red and Green indicators are on).
 - a) What does the voltage on the Status screen show?_____

- b) Which is faster: Boot time for the FLA or 1 minute?_____
- c) What does the FLA say on Line 3 of the status screen?_____
- d) Press the key switch on the SSS for 2 seconds to turn off the key switch. Now what does the third line on the SSS say?_____

9.2 Connecting to the Network and Internet

The learning objective of this section is to

- teach the user different ways to connect to the FLA using the Ethernet cable.
- connect the FLA to the Internet.

9.2.1 Using a Wired Connection

1. Plug the ethernet cable from the FLA into a known good wired Internet connection that is on the same network as your computer. This assumes that you have a known good network connection, usually your home router or a wired connection at the office.
 - a) What does the FLA say right after you plug in the Ethernet on the second line of the Status Screen?_____
 - b) Write down the IP address of the FLA:_____
2. Navigate to FLA Screen 6. What does line 2 say?_____
3. Navigate to FLA Screen 9a. What does line 2 say?_____
4. Open your computer's internet browser and type in the FLA's IP address in the address bar (not the search bar).
 - a) Write down your MAC address:_____
 - b) Press the Update Software link and confirm by pressing the link that says here. How many seconds does it take to update the software?_____
 - c) After the Update, click the link on the link to Shutdown. How many seconds does it take for the screen to indicate the FLA has shut down?_____

9.2.2 Connect Directly to a Computer

1. Plug the Ethernet cable from the FLA to your computer's Ethernet port. (A USB to Ethernet adapter is available in the FLA kit if your computer does not have an ethernet jack.)
2. Navigate the FLA menu to the DHCP enable screen (Screen 7c) and enable the DHCP Server on the FLA.
 - a) Why would you not enable the DHCP server on a known good network?_____

9 Suggested Training and Practice

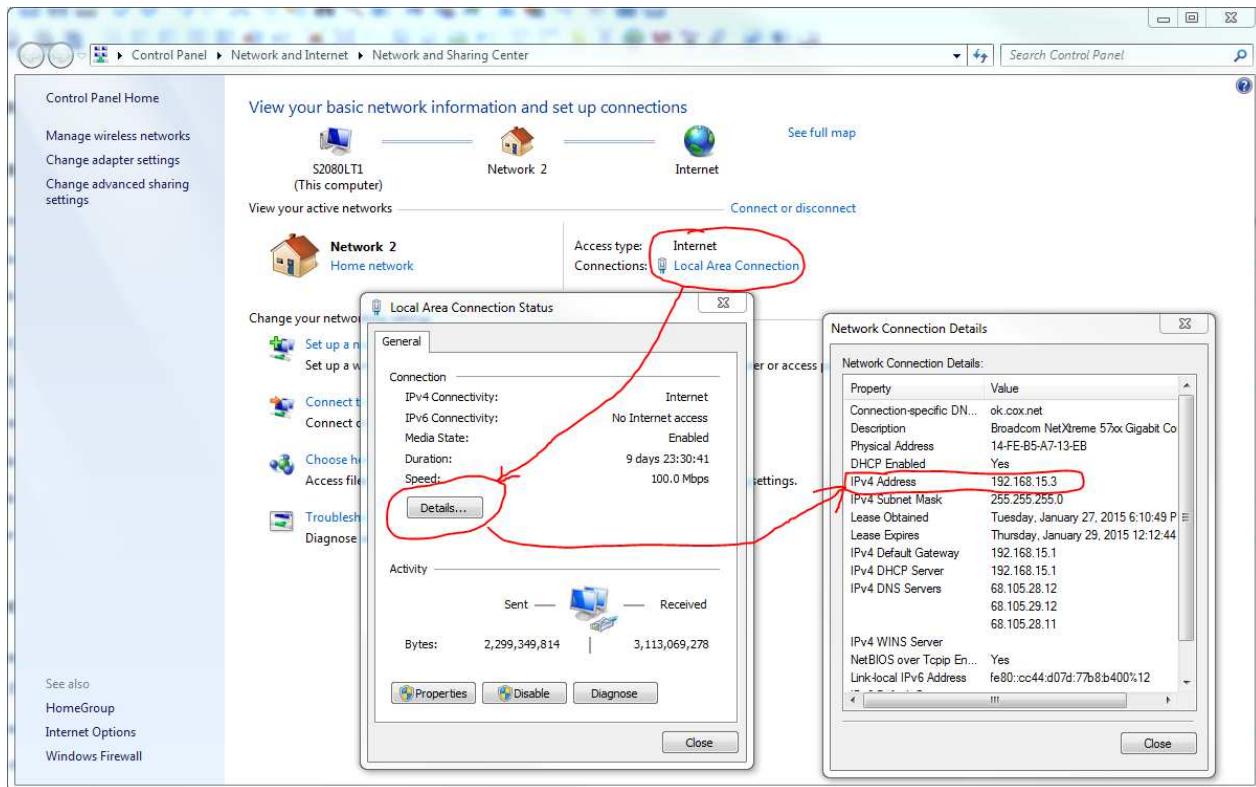


Figure 9.1: Windows 7 Network and Sharing Center with dialog boxes to show the PC IP address.

- b) What is the IP address assigned to the FLA after enabling the DHCP Server through Screen 7?_____
3. Open the Windows Network and Sharing Center through the Control Panel or by right-clicking on the network icon in the task bar.
 - a) Determine your computer's IP address when connected to the FLA. See 9.1 for guidance on where to determine the IP address. Write that number IP address down:_____
 - b) How many seconds does it take for the FLA to say Ethernet Unplugged after the Ethernet cable is disconnected?_____
4. Disable the DHCP server on the FLA.

9.2.3 Set Up Internet Connection Sharing

1. Connect to a Wireless Network and make sure you have access to the internet
2. Share the Wireless in Connection.
 - a) Click on the Change adapter settings on the left side of the Windows Network and Sharing Center.

9 Suggested Training and Practice

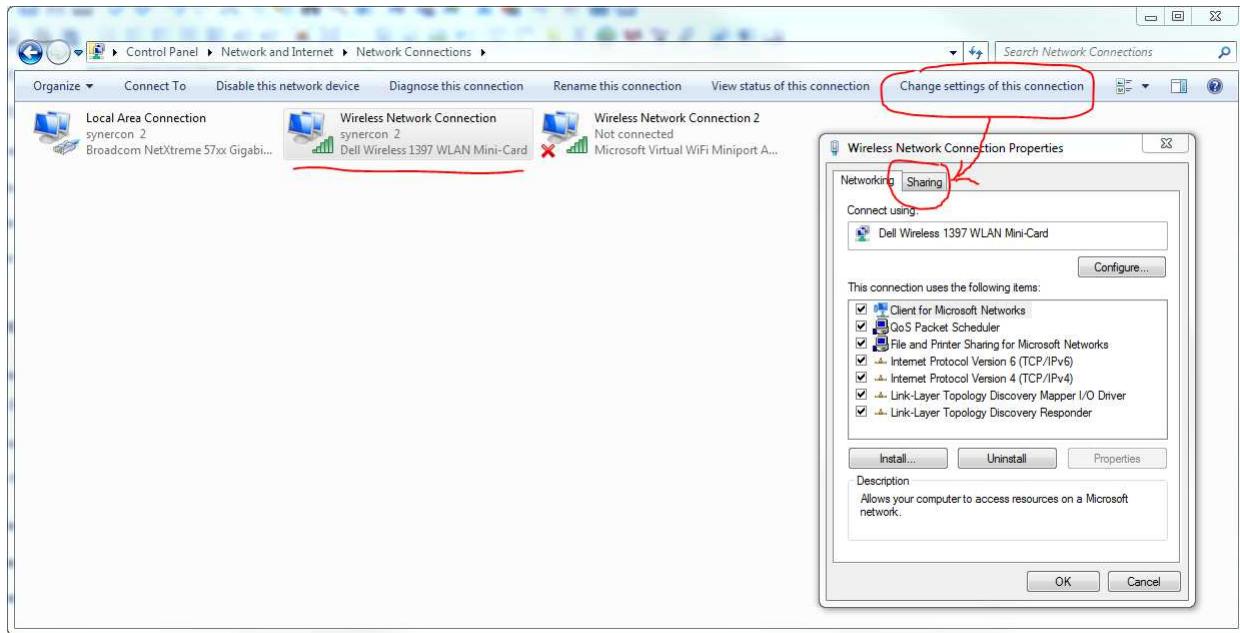


Figure 9.2: Locating the Internet Connection Sharing Tab in Windows 7.

- b) Select the Wireless connection and then press Change settings of this connection, as shown in 9.2. Press the Sharing tab.
 - c) Share the Wireless Connection with the Local Area Connection that can be plugged into the FLA.
 - d) Write down the IP address of the Local Area Connection:_____
3. Unplug and replug the FLA Ethernet Connection
- a) How many seconds does it take to get a new IP address?_____
 - b) What is the new IP address for the FLA?_____
4. Navigate the FLA to the update screen (Screen 9a). What does the second line say?_____
5. Type in the FLA IP address in your computer's web browser. Does the FLA website come up?_____

9.3 Installing PC Software

1. After installing the DG DPA4+ drivers, write down the driver version number._____
2. What version of DDEC Reports is installed?_____
3. What version of Cummins Powerspec is installed?_____
4. Use the Adapter Validation Tool

- a) On a J1939 Network
- b) On a J1708 Network

9.4 Connecting to a Heavy Vehicle

1. Plug in the FLA to the 9-Pin Diagnostics Connector
2. Turn on the ignition key to run
3. Run a vehicle Scan
4. Download Supported Data (if available)
5. Enable RP1210 Mode
 - a) Connect the USB Cable
 - b) Run OEM Software
6. Shutdown the FLA
7. Connect the FLA to the Internet
8. Upload the data from the field.

9.5 Using the FLA Portal

9.5.1 Accessing the Data

1. Login to fla.synercontechnologies.com
2. Find the latest download
3. Enter User information

9 Suggested Training and Practice

9.5.2 Viewing Event Data

9.5.3 Viewing Historical Data

9.5.4 Viewing Configuration Data

9.5.5 Viewing Fault Code Data

9.5.6 Viewing Network Log Data

9.5.7 Viewing Session and Timing Data

9.5.8 Distributing a Report

9.6 Connecting to Engine Control Modules on a Bench

9.6.1 DDEC IV

9.6.2 DDEC V

9.6.3 DDEC 6

9.6.4 DDEC X

9.6.5 CAT ADEM III

9.6.6 CAT ADEM IV

9.6.7 Cummins CM870

9.6.8 Cummins CM2250

9.7 Understanding How Speed Records are Generated

9.7.1 Tracing Schematics

9.7.2 Signals from the Tail Shaft Speed Sensor

9.7.3 Troubleshooting a Vehicle Systems

9.8 Understanding Network Traffic

9.8.1 J1708

9.8.2 J1939

9.9 Understanding Data based on Standards

9.10 Working with Manufacturer Specific Data

10 Release Notes

Version 0.4b contains several enhancements and bug fixes.

- Improved reliability and logging for both J1708 and J1939 passthrough
- Extraction of DDEC IV, V, and VI ECMs
- Improved recording and parsing of standards-based data items
- Encrypted verification file for standards-based data
- Improved real-time clock reliability
- Added GPS location data to downloads

Version 0.5b added and improved Standards Based Data extraction and rendering.