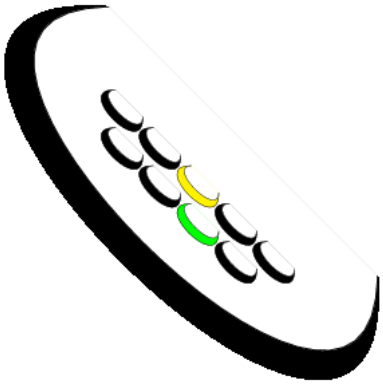
Synercon Technologies, LLC

Forensic Link Adapter User's Manual



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Contents

1 Using the Forensic Link Adapter

1.1 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 tech DPA4+ for RP1210 Compliance. The device has a GPS receiver, Real Time Clock, an accelerometer, and a rate Gyro. The display uses Organic LEDs for better sunlight readability. It runs embedded Linux and serves its own website.

1.2 Before Using the Forensic Link Adapter

1.2.1 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 4 on page 21.

1.2.2 Connect the FLA to the Internet

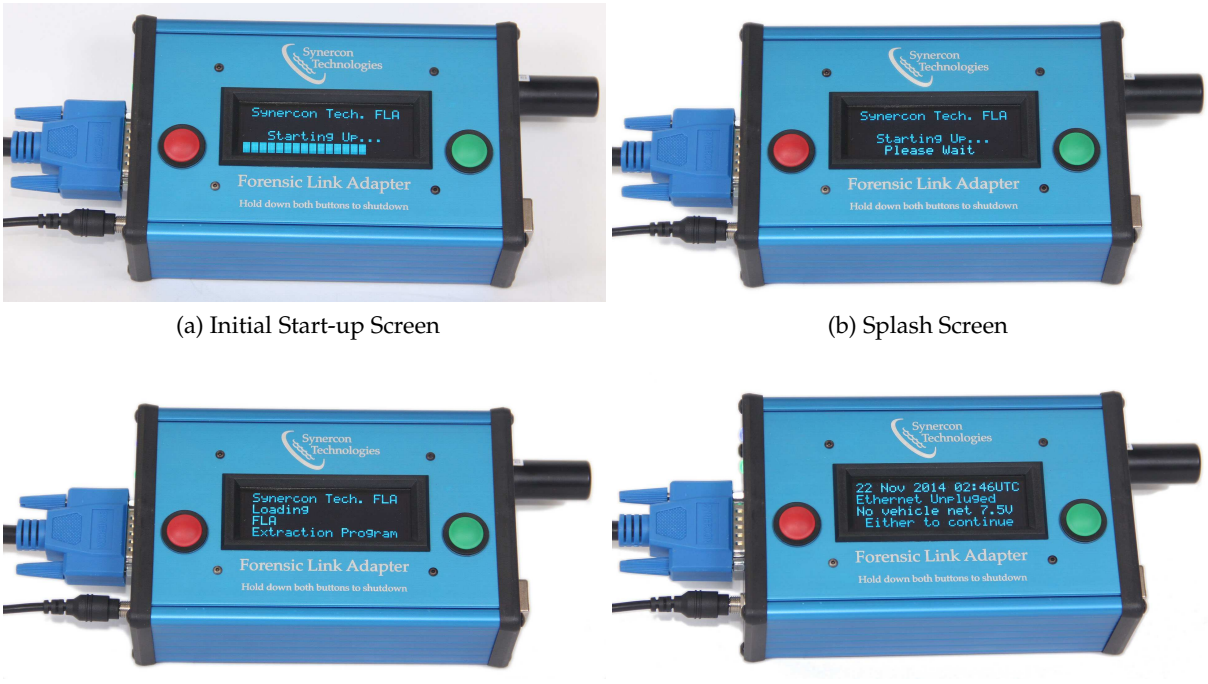
Connecting the FLA to the internet gives the FLA it full features. The best method to connect to the internet is to use a wired Ethernet connection to a router that has a DHCP server running. This is typical of most home networks.

If a hard wired connection does not have a DHCP server running to provide an IP address, then the FLA will wait for about 45 seconds then try 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.

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

1.2.3 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



(a) Initial Start-up Screen

(b) Splash Screen

(c) Program Starting

(d) Status Screen

Figure 1.1: Start up sequence on the front display panel.

Forensic Link Adapter. A record of when the time was last set is stored and included in a time log in the data report.

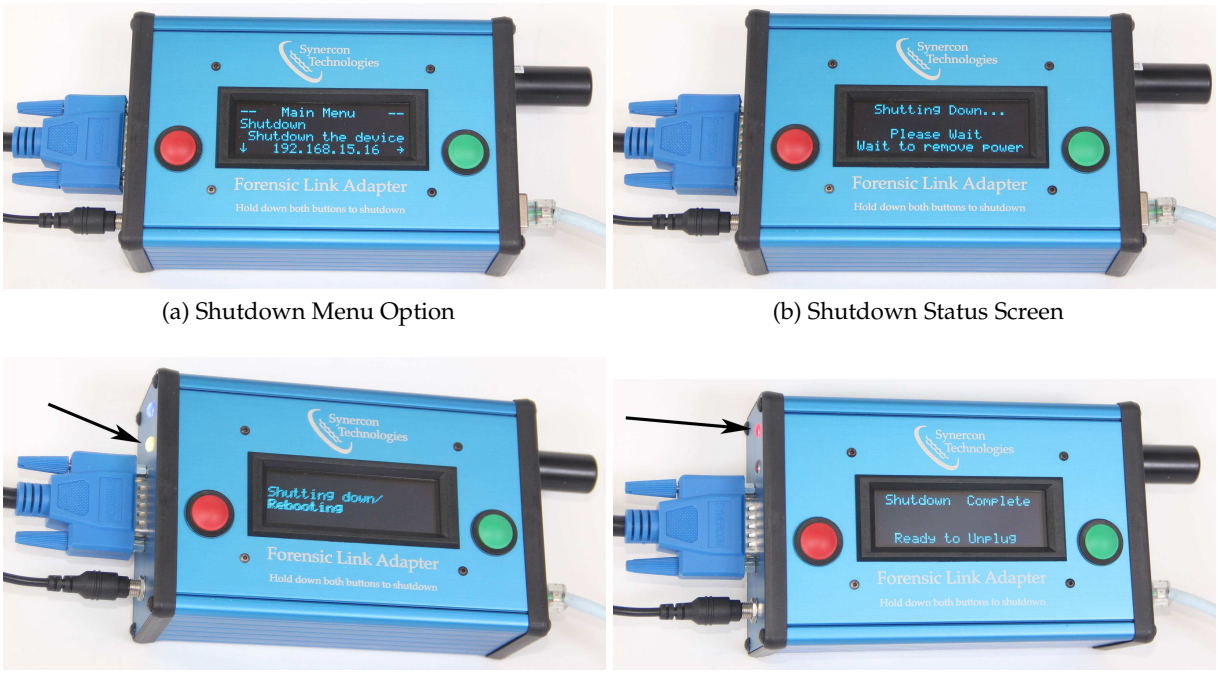
1.3 Working with the Forensic Link Adapter

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.

1.3.1 Powering Up

The FLA should start up automatically if power is available at the 9-pin diagnostic connector.

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.



(a) Shutdown Menu Option

(b) Shutdown Status Screen

(c) Shutdown Progress

(d) Shutdown Complete

Figure 1.2: Shutdown sequence for the Forensic Link Adapter.

1.3.2 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 selecting shutdown from the menu or pressing the shutdown button on the web interface.

The shut down sequence displayed on the front panel is shown in Figure 1.2. The user navigates to the Shutdown option by pressing the red button in the Main Menu. Pressing 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 1.2d. At this time, it is safe to unplug the system.

Figure 1.2c 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 1.2d.

1.3.3 Updating the FLA

To update the FLA:

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 an 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 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
5. Confirm 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 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 starup screen will display with a progress bar coming across the bottom, as shown in Figure . Once the progress bar completes, the screen will blank, and then start the FLA extraction screen.

1.5 Menu Screen Descriptions

1. A Startup Screen is shown on boot. A progress bar scrolls across the bottom in about 20 seconds. After that, the progress bar may change to say the workds “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. See Section 3.1 on page 19 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 directorys 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.

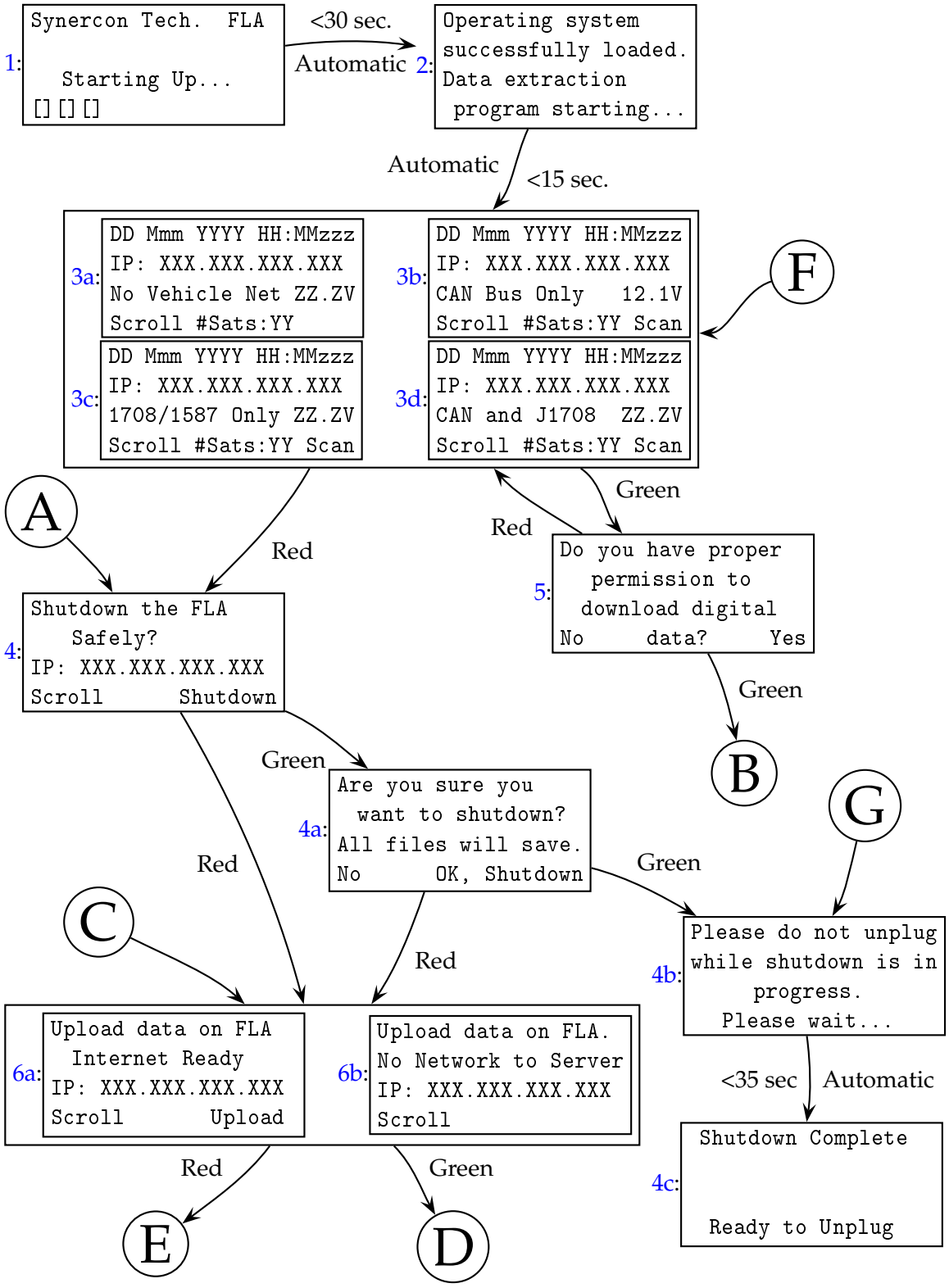


Figure 1.3: Forensic Link Adapter Screen Menu System as enumerated in Section 1.5

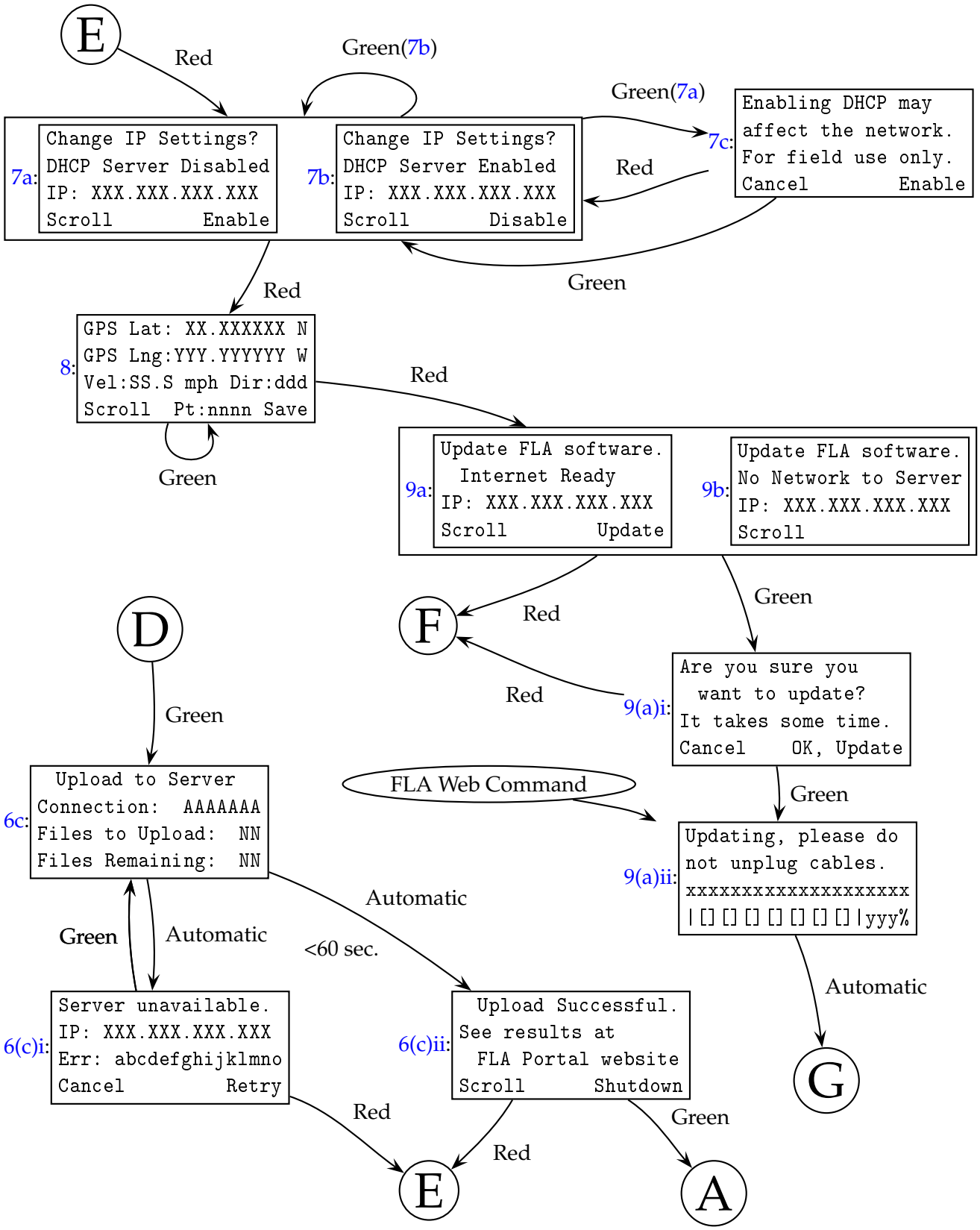


Figure 1.4: Forensic Link Adapter Screen Menu System (cont.) as enumerated in Section 1.5

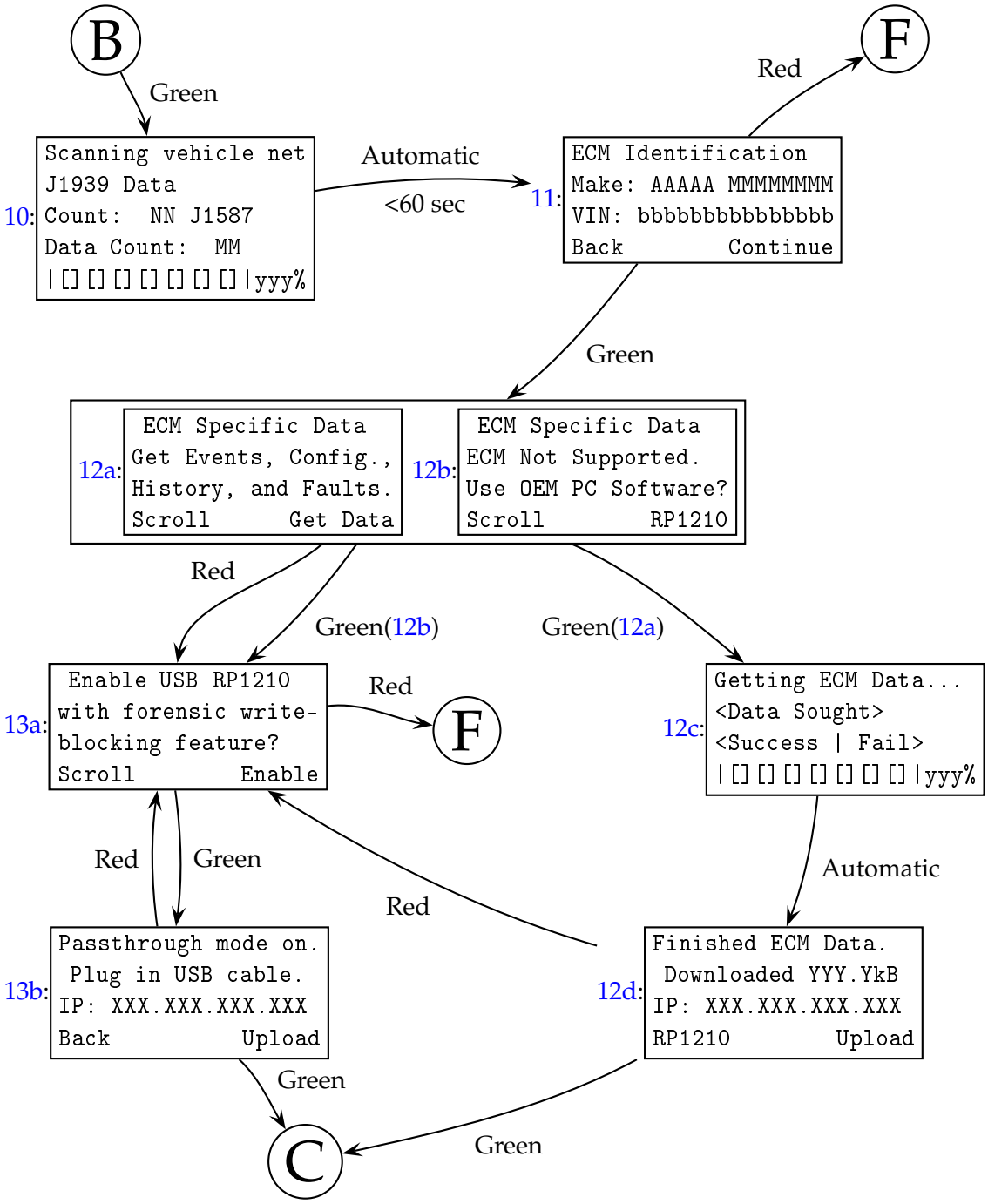


Figure 1.5: Forensic Link Adapter screen display when scanning a vehicle.

3. The Status Screen shows the current time with the time zone. The system time can be changed from the web interface.
    a) No vehicle Connected
    b) Controller Area Network (J1939)
    c) J1708
    d) Both CAN and J1708
4. Shutdown
    a) Shutdown Confirm
    b) Shutdown Sequence
    c) Shutdown Complete
5. Permission Screen
6. Upload to Server
    a) Internet is ready
    b) Internet is not ready
    c) Files to upload
        i. Upload Failed. An error code is displayed in place of abcdefghijklmno. This error code will be important to the Synercon Support staff.
        ii. Upload Successful
7. Change IP network settings
    a) Disabled
    b) Enabled
    c) Field use only
8. GPS Status Display.
9. Update FLA software.
    a) Connection is ready
        i. Update Confirm
        ii. Update Progress
    b) No access to update server
10. Scan Vehicle Network. The field of <pid> is either at J1587 PID or a J1939 SPN
11. ECM Identification.
12. ECM Specific Data

a) Vehicle supported

b) No current support for getting ECM Specific Data

c) Getting ECM data

d) Done getting ECM data

13. RP1210 Passthrough Mode

a) Choose Mode

b) Passthrough on.

1.5.1 IP Addresses

The IP address Line can have the following Statements:

IP: XXX.XXX.XXX.XXX A valid IP address

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. For example, if t

Ethernet Unplugged There is no live connection between the FLA and an outside device.

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 Manufacturer's Software

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

2.1 Installing Programs and Drivers

2.1.1 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.

2.1.2 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.

The direct download link is

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

Restart your computer after installing.

2.1.3 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

BullZip PDF printer

2.2 Enabling RP1210 Passthrough Mode

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

If the ECM is a Cummins, DDEC VI, DDEC 10, then enable J1939.

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

2.3 Cummins 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.
    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 as shown in Figure 2.1 on page 18. 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 settings like the ones shown in Figure
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 button on the FLA. Exiting this mode takes some time, so the button press may not work at first.
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.

2.4 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
   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 as shown in Figure 2.1 on the following 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.
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\DDEC 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.

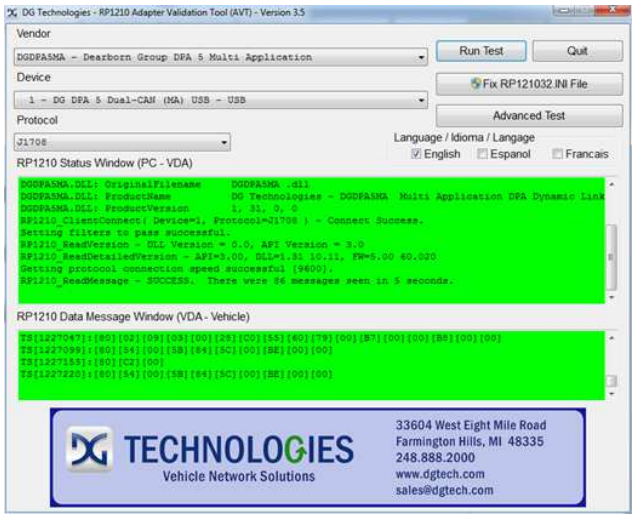


Figure 2.1: Adapter Validation Tool showing a successful connection between an ECM and the local computer.

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 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 an use both the screen menu display and the FLA web interface.

3.1 Forensic Link Adapter Fails to Boot

3.2 Screen Displays Funny Characters

3.3 Forensic Link Adapter Cannot Connect to the Internet

3.4 Software Does Not Connect to Vehicle

3.5 A System Critical Error is Displayed

4 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.

4.1 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 4.1 on the next 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 4.1.

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

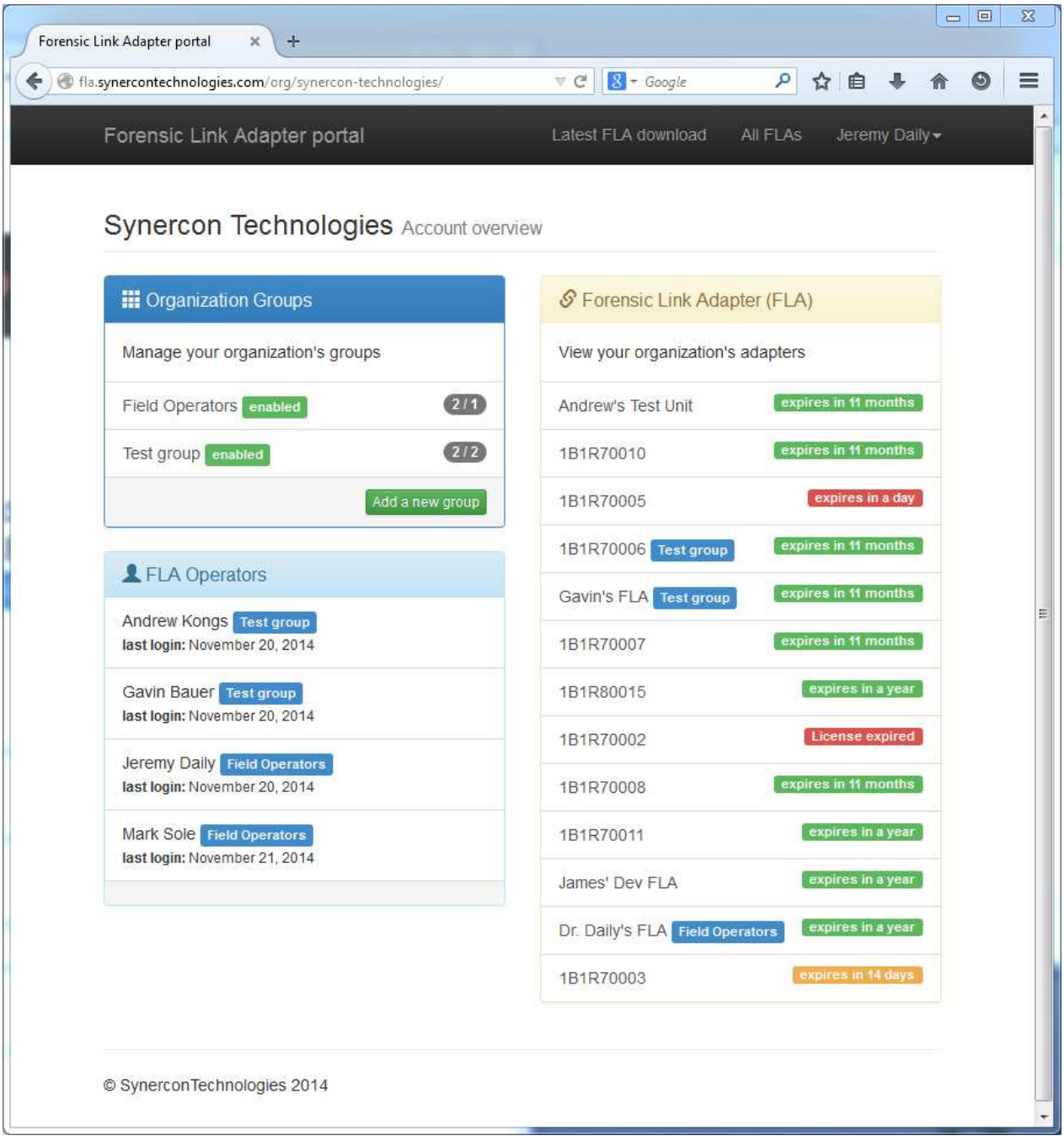


Figure 4.1: Example Forensic Link Adapter Portal web page for the Account overview

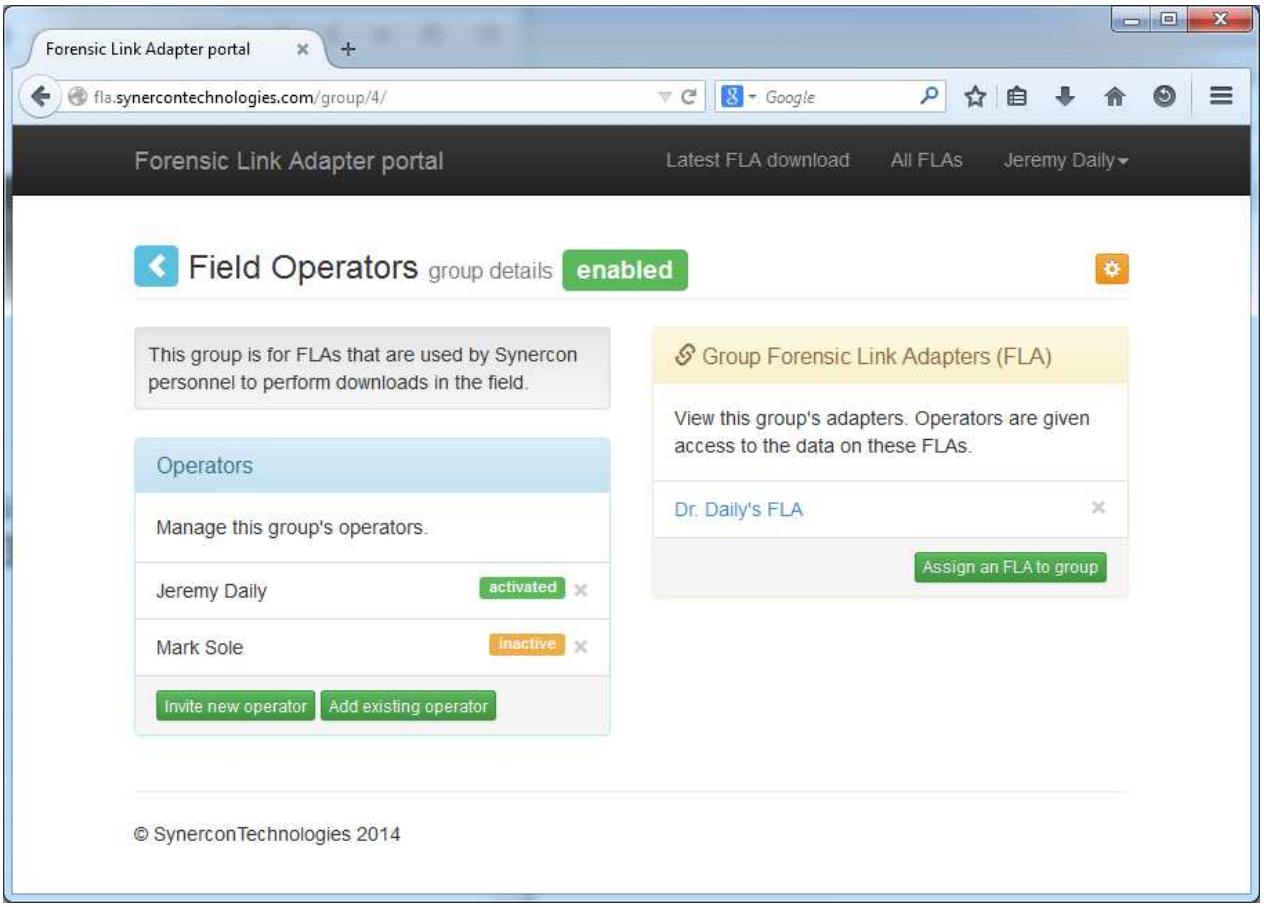


Figure 4.2: Example Group Details web page from the Forensic Link Adapter Portal.

4.2 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.

4.2.1 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 4.2, a web page similar to the one shown in 4.3 on the next 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.

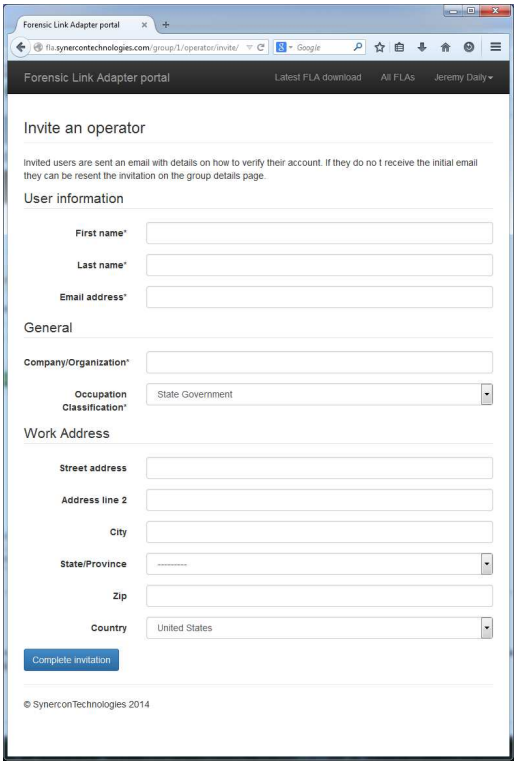


Figure 4.3: New Operator invitation form on the FLA portal website.

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

4.2.2 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

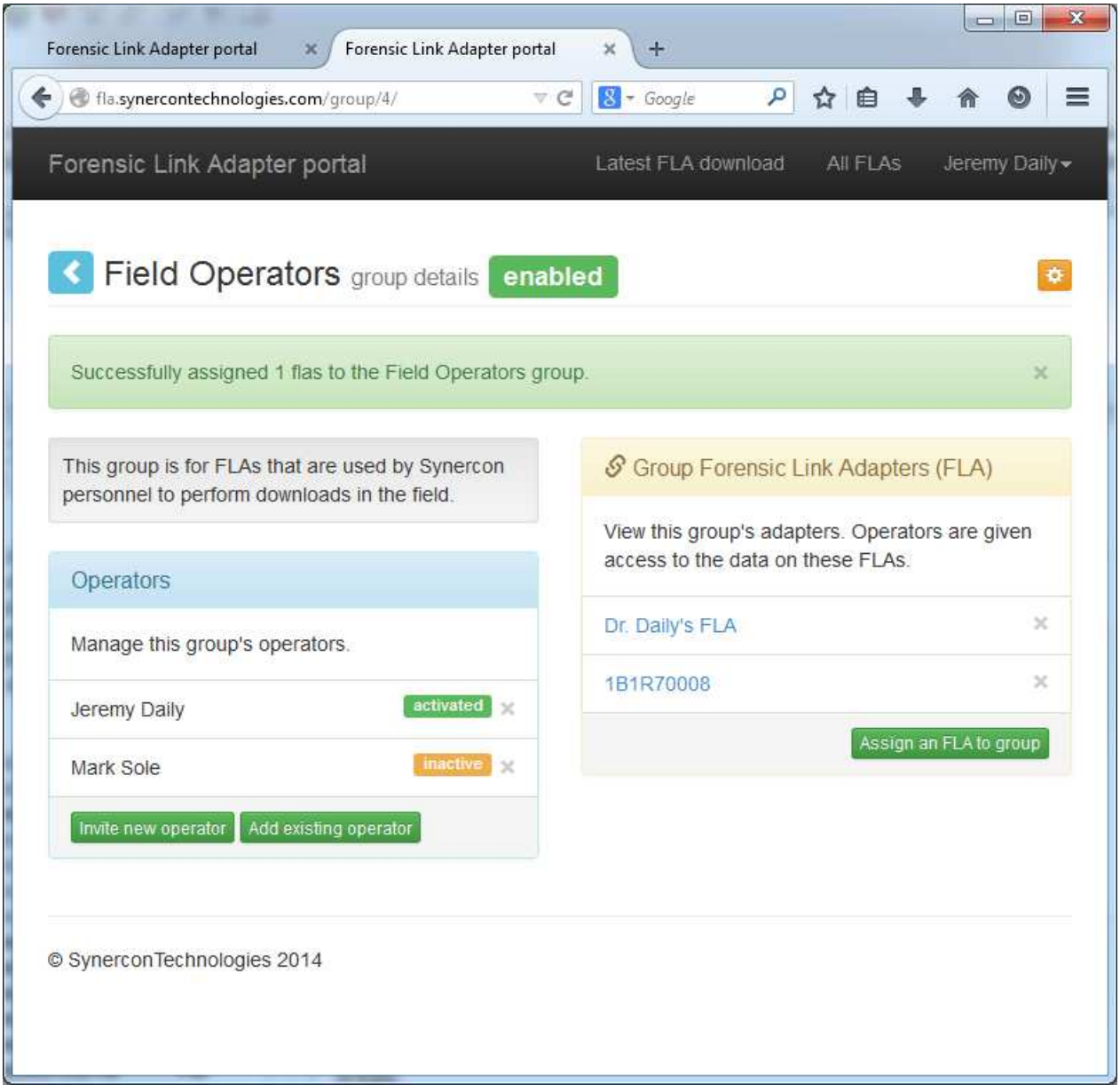


Figure 4.4: Assigned FLAs

5 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 data recorders.

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

RTC Real Time Clock

Bibliography