

Vehicle Spy 3

Multipurpose Vehicle Network Tool



Vehicle Spy Quick Start Guides *Using Vehicle Spy with Ethernet*

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1 Introduction

Welcome to *Using Vehicle Spy with Ethernet*, one of the quick start guides for Intrepid's powerful *Vehicle Spy* (VSpy) network analysis and diagnostics software. In this guide you will learn about the new VSpy features implemented to support working with Automotive Ethernet, and go "hands on" to perform basic tasks such as viewing Ethernet traffic, decoding Ethernet signal data, and creating and transmitting Ethernet messages.

1.1 About the Vehicle Spy Ethernet Quick Start Guide

The purpose of this guide is to help you quickly get up to speed in using Vehicle Spy with Automotive Ethernet messages and hardware. The guide contains the following six chapters:

1. **Introduction:** You're reading it!
2. **Configuring Vehicle Spy for Ethernet:** Explains how to set up Vehicle Spy to use an Ethernet interface and work with Intrepid Ethernet hardware and databases.
3. **Viewing and Analyzing Ethernet Messages and Data:** Shows you how to go online to view Ethernet traffic on a database, and how best to work with Ethernet messages and data within *Messages View*.
4. **Simulating and Reviewing Ethernet Message Files:** Demonstrates how to simulate saved Ethernet data for analysis purposes, or simply review the contents of a file.
5. **Receiving Ethernet Messages and Decoding Signals:** Walks you through creating an Ethernet receive message in the *Messages Editor*, including defining a signal, and then simulating a buffer to view decoded data.
6. **Creating and Transmitting Ethernet Messages:** Takes you through the process of defining an example Ethernet message with a signal, setting the signal value, and transmitting the message both manually and automatically.

Most people learn more readily by doing than reading. Accordingly, this is an interactive guide that uses examples with step-by-step instructions that you can do on your own computer as you follow along. Many screenshots are provided to help you understand exactly what is happening. Action items, meaning steps where you need to actively do something, are set apart from the rest of the text for greater visibility using a right-facing pointer character ("►").

1.2 Summary of Ethernet Support Features in Vehicle Spy

Interest in Automotive Ethernet has grown rapidly over the last few years, and Intrepid Control Systems has positioned itself as a leader in the field. If you are new to the technology, you may wish to pick up a copy of Intrepid's book, *Automotive Ethernet - The Definitive Guide* (Figure 1). This 1,100+ page reference provides a thorough description of Automotive Ethernet, as well as a comprehensive description of TCP/IP protocols.



Figure 1: Automotive Ethernet - The Definitive Guide. Intrepid's industry-leading book will help you understand Automotive Ethernet.

Over the last two years, Intrepid has worked hard to implement support for Automotive Ethernet networks within its flagship Vehicle Spy product. Here are just some of the key features that have been added:

- Logon screen shows Ethernet interfaces and allows one to be selected to work with.
- Support for displaying Ethernet messages in *Messages View*.
- Built-in, independent TCP/IP stack with ability to easily set and change IP address and other parameters.
- Support for TCP/IP and AVB message types (UDP, TCP, ARP, PTP, etc.)
- Custom column sets and filters for Ethernet, TCP, FSA and PTP.
- *Messages Editor* can generate Ethernet messages with pre-configured headers for IP, TCP, UDP, ICMP and other protocols.
- Automatic default settings loaded for TCP/IP and AVB protocol header fields.
- Ethernet packet template editor allows customization of default settings for protocol headers.
- Support for Intrepid hardware tools (see Section 1.3).
- Support for the standard Ethernet PCAP driver and loading and saving .PCAP files.
- Support for GM-only FSA view and databases, and transmitting/receiving FSA data.
- *Details View* shows Ethernet messages broken down by layer and protocol with individual signals decoded for TCP/IP, AVB and PTP protocols.

- Byte highlighting based on selected protocol and field within *Details View*.
- Support for .VSB (Vehicle Spy binary) files for Ethernet frames, including saving error frames that are not supported in .PCAP format.
- Support for native MAC address and IP address notation in *Messages Editor*, *Tx Panel* and *Application Signals*.

1.3 Overview of Intrepid Ethernet Hardware Devices

Intrepid Control Systems offers a growing array of network tools to assist you in the development of your Automotive Ethernet network:

- **RAD-Moon:** A simple media converter that allows a BroadR-Reach (100BASE-T1) device to be connected to a conventional Ethernet network.
- **RAD-Star:** An active tap that allows messages between two BroadR-Reach devices to be monitored and sent to a PC, and messages also to be sent to BroadR devices from the PC.
- **RAD-Galaxy:** A set of six active taps with a high-speed Gigabit Ethernet connection and many additional features.
- **Ethernet Evaluation Board (EEVB):** A special board with two complete BroadR-Reach nodes and a Lab Manual with more than 20 hands-on experiments to help you quickly become an Automotive Ethernet expert.
- **neoVI FIRE 2:** Intrepid's latest-generation general network interface device includes Ethernet and Diagnostics over IP (DoIP) support.

In addition, Intrepid's neoVI ION and neoVI PLASMA products support Automotive Ethernet data logging when used in conjunction with a RAD-Galaxy or RAD-Star.

For more information on Intrepid hardware products, please contact Intrepid Control Systems or visit our website at <http://intrepidcs.com>.

1.4 Recommended Prerequisites for Using this Guide

Due to the large number of features in Vehicle Spy, complete coverage of the program is beyond the scope of this document. We recommend that you be familiar with basic Vehicle Spy operations before continuing, such as how to start VSpy, navigate menus, go online/offline, and switch among VSpy window. Experience with *Messages View* and the *Messages Editor* is also recommended. If you are new to Vehicle Spy, you may wish to attend one of Intrepid's Vehicle Spy Basics training courses, which are offered both in-person and online.

You can use Vehicle Spy Ethernet features either with the Intrepid Ethernet hardware tools discussed in Section 1.3, or simply by monitoring a wired or wireless network interface in a

PC. However, in order to take Vehicle Spy online, you will need an Intrepid hardware device with a hardware license. This can be any of the Intrepid Ethernet hardware tools discussed in Section 1.3, except for the RAD-Star or RAD-Moon (which do not use a hardware license). If you have only a RAD-Star or RAD-Moon, you can use any other Intrepid device, such as a ValueCAN or neoVI FIRE / FIRE 2, to activate VSpy.

Figure 2 shows an example of what Vehicle Spy may look like when you first launch it with an Ethernet EVB properly installed. Notice the picture of the device near the bottom of the screen, and its two nodes listed along with their serial numbers and node letter designations (“A” and “B”).

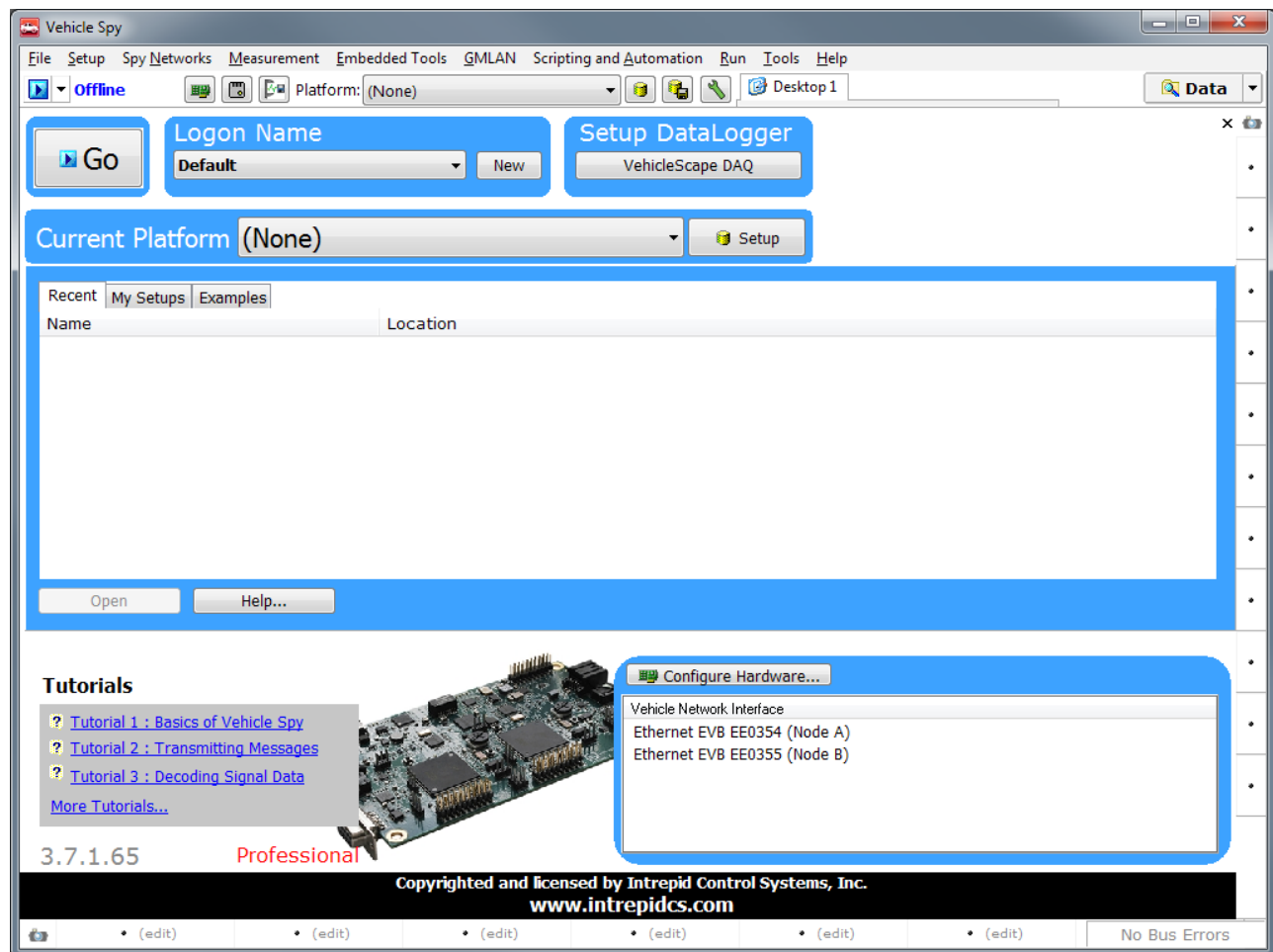


Figure 2: Vehicle Spy Logon Screen with Ethernet EVB Device Installed.

2 Configuring Vehicle Spy for Ethernet

We'll begin by showing you how to configure Vehicle Spy to work with Ethernet. Most of the Ethernet features within Vehicle Spy are integrated seamlessly into the program, so no effort is required on your part to make use of them. All we really need to do is enable PC Ethernet interface support, and then choose an interface to work with. We'll also briefly look at the Ethernet-related networks that come predefined within VSpy, and how to set up an Ethernet database platform.

2.1 Enabling PC Ethernet Interface Support

Since Automotive Ethernet is new, many Vehicle Spy users are not yet working with the technology. For this reason, the program begins by default with support for monitoring a PC Ethernet interface disabled. Naturally, we want this turned on, so let's take care of that first. We only have to do it once, and then VSpy will remember to keep Ethernet interfaces turned on whenever we later start the software.

► **Open Vehicle Spy 3 Options:** Select *Options...* from the *Tools* menu.

The Vehicle Spy *Options* dialog box will open. The setting we are looking for is called *Use PC Ethernet interface*, and is located near the bottom left of the window (Figure 3).

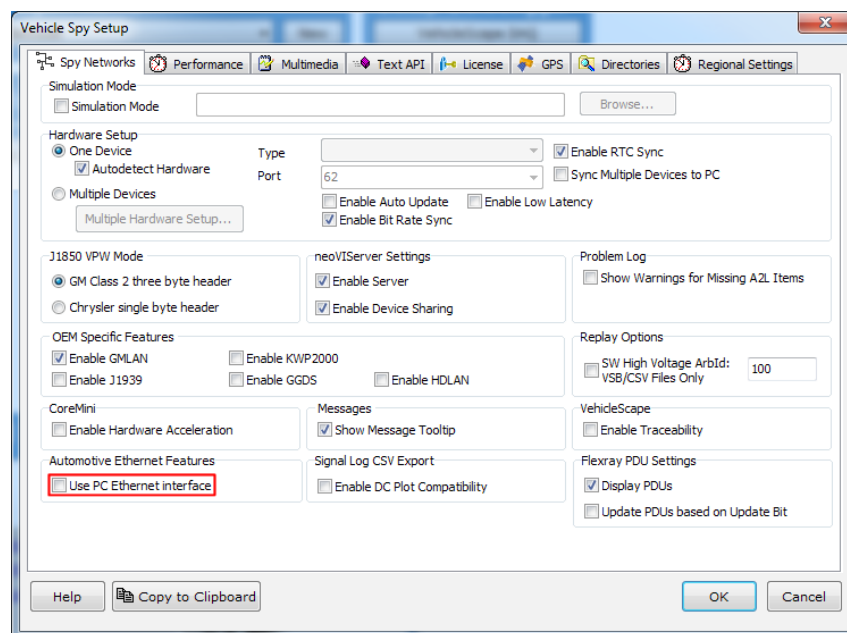



Figure 3: Vehicle Spy Options Dialog.

1. **Enable PC Ethernet Interface:** Click the square checkbox next to *Use PC Ethernet Interface*, and then click .

A prompt will now appear suggesting that you restart the program.

2. **Restart Vehicle Spy 3:** Click and Vehicle Spy will close. (If you are prompted to save changes, select “No”.) Start the program again from the Windows start menu or desktop.

When the program loads again you will now see a list of Ethernet interfaces at the bottom right of the screen, as shown in Figure 4. In this case we have three interfaces shown. Due to the small window size we use to keep screenshots legible, the names are shortened and hard to read, but we'll show you in a moment how to get around that.

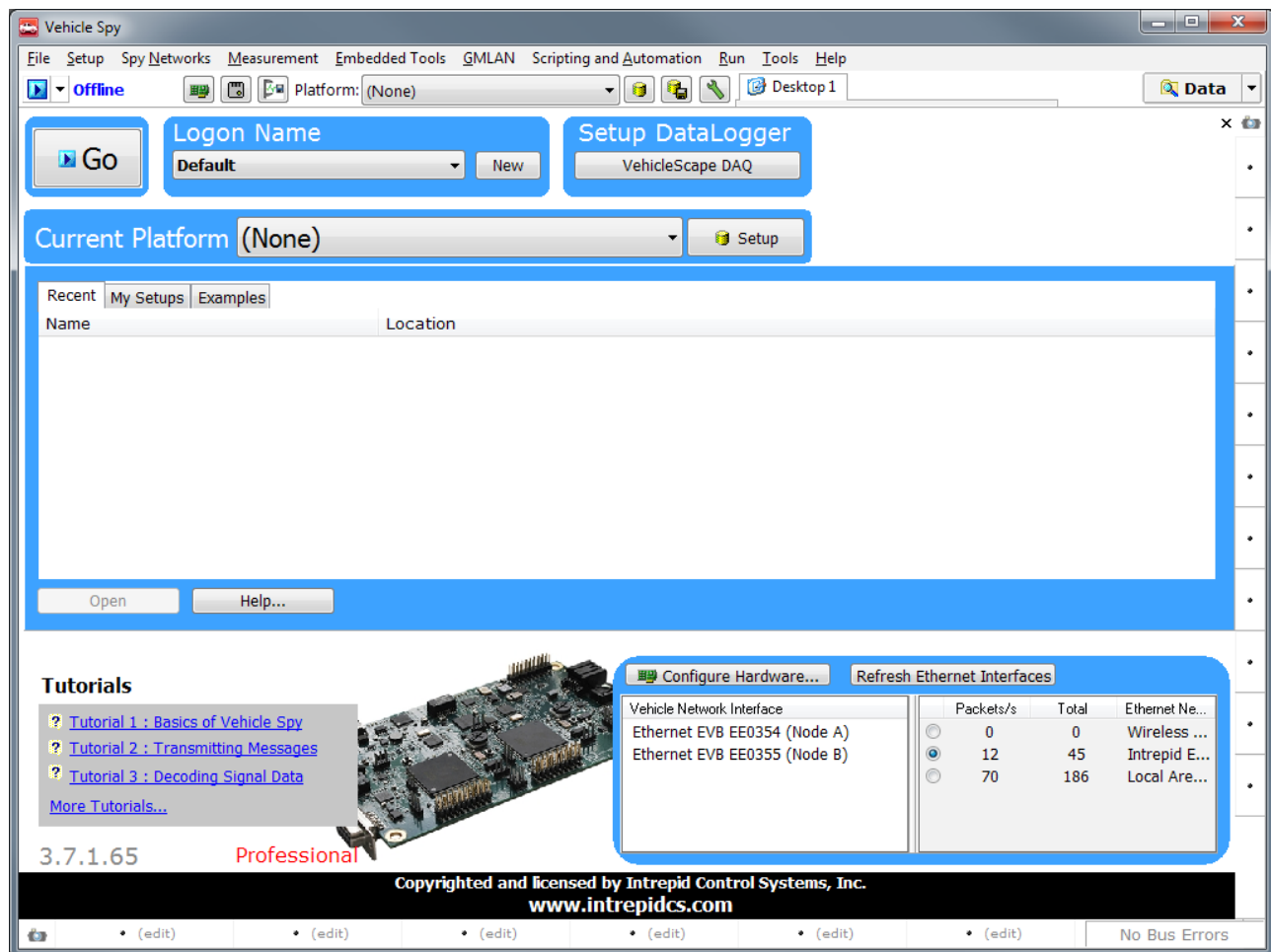


Figure 4: Vehicle Spy Logon Screen with PC Ethernet Interfaces Enabled.

2.2 Working with the PC Ethernet Interface List

With PC Ethernet interface support now enabled, we have a list of Ethernet interfaces in the bottom right of the Vehicle Spy *Logon Screen*. However, Figure 4 uses a relatively small window size. You can see more of the interface list by enlarging the window, or by dragging to the left the vertical slider that divides the hardware device list and Ethernet interface list. You can also do both, as we did to create Figure 5.

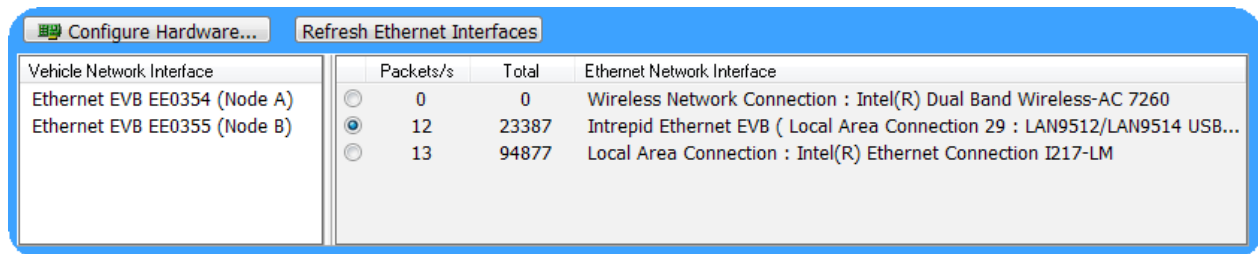


Figure 5: Resized Hardware Device and Ethernet Interface Lists.

After resizing, we can see that this computer currently has three interfaces: a wireless (“Wi-Fi”) network adapter, the Ethernet EVB, and the PC’s wired Ethernet adapter. Note that from Vehicle Spy’s perspective, all of wired Ethernet, Wi-Fi and Bluetooth are considered Ethernet interfaces and will show up here.

Selecting an Ethernet Interface

The radio buttons are used to select which interface you want Vehicle Spy to use; here the Ethernet EVB has been selected by default. We are going to start working with Ethernet by looking at live Internet traffic in Chapter 3, so let’s select the interface that the PC is using for its Internet connection. On the PC used for this guide, that’s the wired Ethernet interface; select whichever one is appropriate for your machine.

- **Select the Interface Used by the PC to Connect to the Internet:** Click the radio button to the left of the appropriate interface. In our example, it would be the one that says *Local Area Connection* (the last one, on the bottom).

Viewing Ethernet Interface Statistics

Notice the two columns on the left side of the Ethernet interface list. The *Packets/s* column shows approximately how many messages are being received on the interface each second, while *Total* counts all messages seen by Vehicle Spy 3, either since it was started, or since the list was refreshed.

You can use these columns to monitor overall traffic on the PC’s Ethernet interfaces. This can be handy in certain cases. For example, if we weren’t sure whether the PC was connected to the Internet over its wired or wireless interface, the data here would tell us pretty quickly which one is actually active.

Refreshing Ethernet Interfaces

The **Refresh Ethernet Interfaces** button can be used for two purposes. First, it tells Vehicle Spy to update the interface list, adding any new network connections that have been added since the program was started, and removing any that have been disabled. Second, it can be used to reset the statistics in the two columns.

- **Refresh the Ethernet Interfaces List:** Click **Refresh Ethernet Interfaces**.

Your list of interfaces should remain the same, but notice that the packet counts of all interfaces are reset to zero, and then the active ones begin counting up again.

2.3 Examining PC Ethernet Networks

Vehicle Spy comes pre-configured with a number of different commonly-used automotive networks. This now includes Automotive Ethernet and related networks. You can view VSpy networks and manage their parameters in the Networks setup area.

- **View Vehicle Spy Networks:** Select *Networks* from the *Spy Networks* menu.

Since Ethernet is relatively new, most of its relevant information is found near the bottom of the network list.

- **Scroll to the Bottom of the Network List.**

You should now see a display similar to that seen in Figure 6.

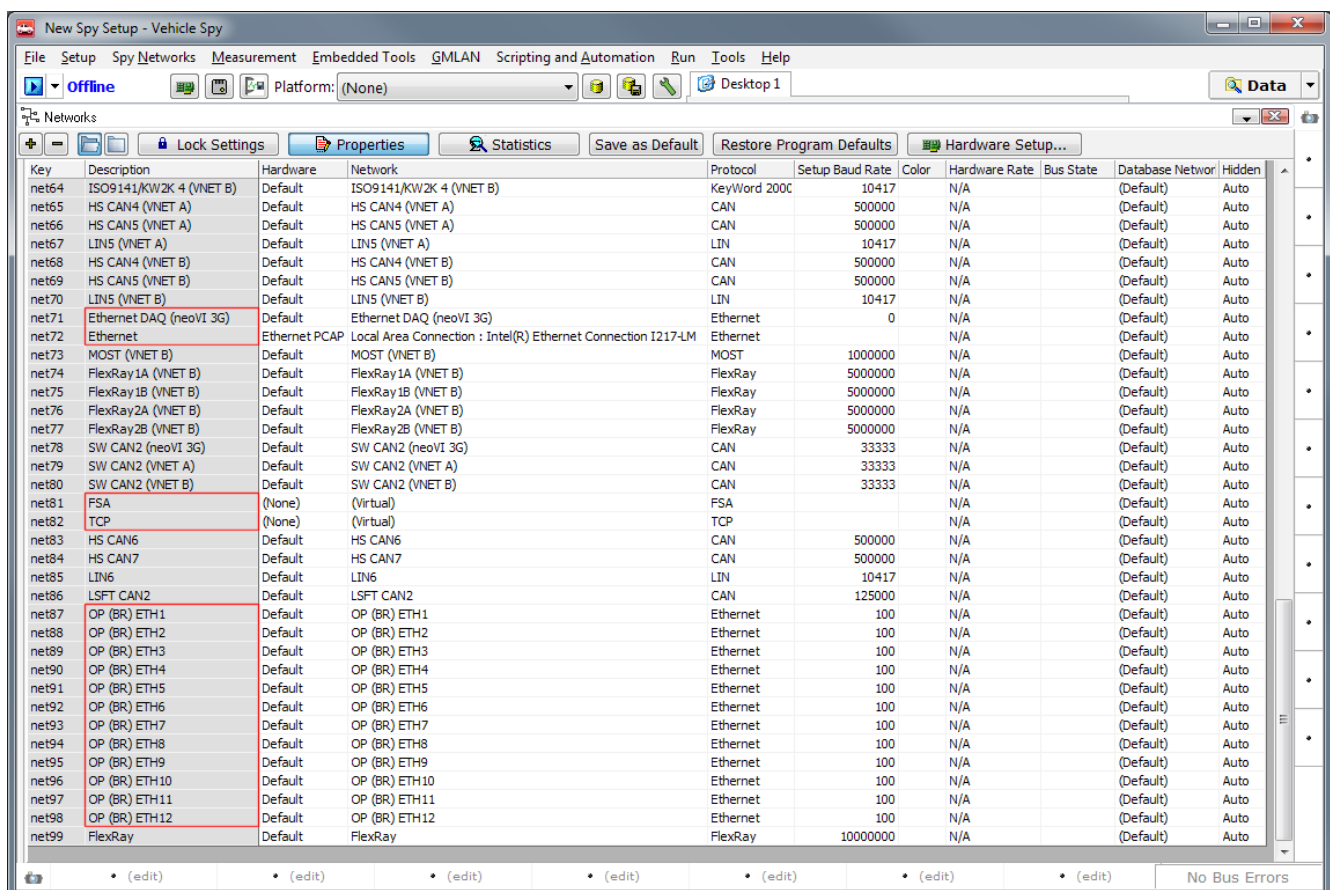


Figure 6: Vehicle Spy Network List with Ethernet and Related Networks Highlighted.

The networks relevant to Ethernet are:

- **Ethernet:** This is the “main” Ethernet interface. The *Network* column will show the interface last used when Vehicle Spy went online.
- **Ethernet DAQ (neoVI 3G):** Used to received Ethernet traffic from supported Intrepid hardware devices such as the neoVI PLASMA and neoVI ION.
- **FSA:** A virtual network to support GM’s FSA technology.
- **TCP:** A virtual network that displays logical data carried in TCP messages on the Ethernet network.
- **OP (BR) ETHn:** These 12 networks carry individual traffic streams from the tap inputs on the RAD-Galaxy.

Note that you normally won’t need to change any of the defaults in this area when working with Ethernet.

2.4 Setting Up an Ethernet Platform

A platform is a collection of database files that is loaded within Vehicle Spy to provide information about messages. A platform can be used to create transmit messages that send data in a particular format, or receive messages that decode data read in from the network.

Platforms are important for many Automotive Ethernet applications, so we’ll now spent a bit of time learning about them, and how to set them up specifically for Ethernet. In particular, we’ll see how to create a platform from an AUTOSAR database file.

Selecting a Platform

The current platform is always displayed in a drop-down box at the top of Vehicle Spy. To change the current platform, simply select the one you want from the box; VSpy will automatically load its associated databases. Choosing the default platform, “(None)”, will unload all databases. The two buttons to the right of the drop-down box are used to set up databases for a platform, and to save pending platform changes, respectively.



Figure 7: Platform Drop-Down Box with Platform Database Setup and Platform Save Buttons.

Creating a New Platform

Let’s make a new platform that we can use for working with Ethernet.

- **Launch Platform Setup:** Select *Setup Platforms* from the *Setup* menu. A dialog box appears to allow you to work with platforms. Figure 8 shows how this dialog box appears before any platforms have been created.

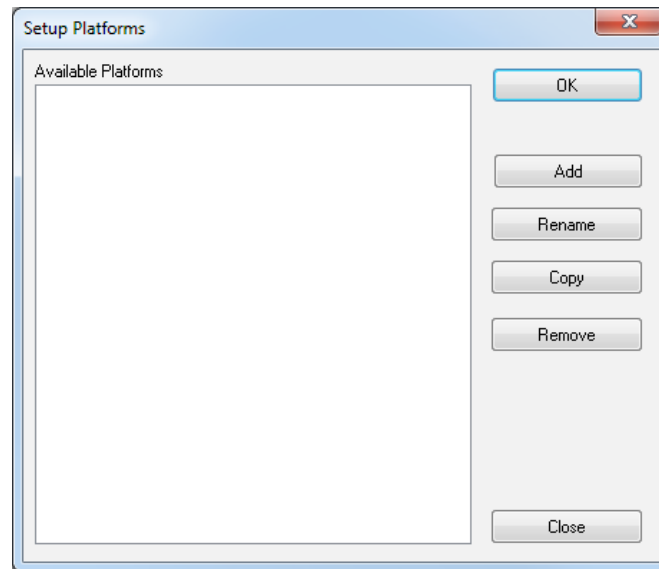



Figure 8: Platform Setup Dialog Box.

- **Add Ethernet Platform:** Click the  button; another dialog box appears. Enter the name “Ethernet” and press *Enter*. Click  to exit platform setup.

Vehicle Spy will create your new Ethernet platform, and also set the current platform to “Ethernet”; you should see this in the drop-down box on top of VSpy now.

Adding an ARXML Database File to the Ethernet Platform

We have our platform created but it is currently empty, so we will now want to add a database to it. Vehicle Spy offers many ways of doing this, but we will focus on doing this via an AUTOSAR database file, which uses the .ARXML format. For this demonstration, we are using a custom example file; you should have your own database file you can substitute in the instructions below.

- **Enter Network Database Setup:** Select *Network Databases* from the *Setup* menu, or click the  button next to the platform selection drop-down box.

The *Network Databases* view opens, with a list of networks on the left, and tabs along the top corresponding to different methods of adding databases.

- **Go to the ARXML Area:** Click the *ARXML / UEF / VSDB Support* tab.
- **Assign an ARXML File to the Platform:** Click .

The *ARXML Import* dialog box appears (Figure 9) to allow you to select ARXML files and associate clusters with VSpy networks.

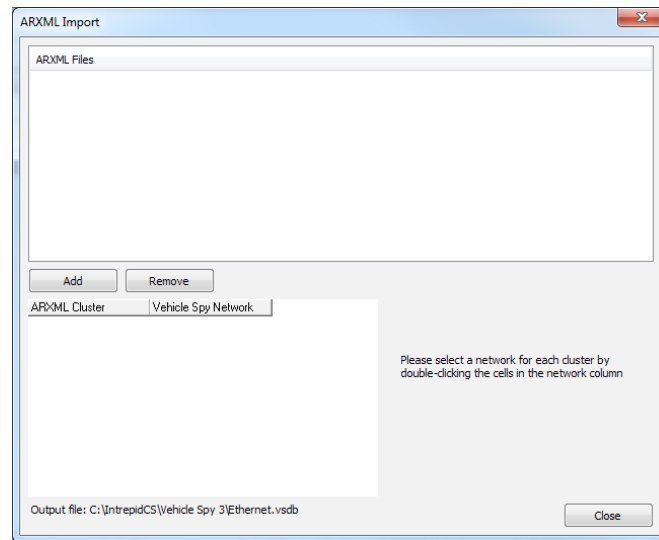



Figure 9: ARXML Import Dialog Box.

- **Add ARXML File:** Click , navigate to the folder containing your .ARXML file, and select it. The file we are using is called “ethernet_sample.arxml”; yours will probably have a different name.

Vehicle Spy will show the name of the file in the file list in the top half of the screen, and list the clusters it references in the cluster/network list in the bottom half.

- **Assign Network(s) to ARXML Cluster(s):** Double-click in the cell under *Vehicle Spy Network* for the clusters that were loaded, and choose which networks you want to associate with each. In our example we have just one cluster, called “EtherSample”, which we’ll link to the *Ethernet* network (Figure 10).

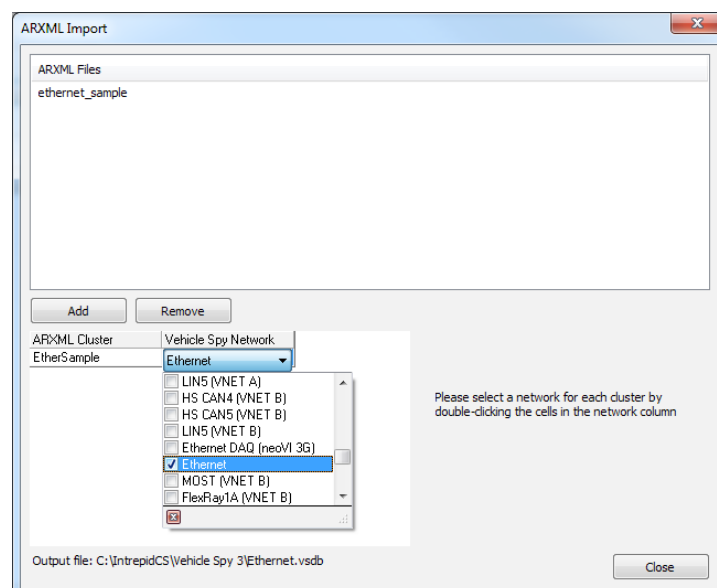
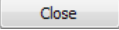


Figure 10: ARXML Import Dialog Box Showing Assignment of Ethernet Network to ARXML Cluster.

- **Finish ARXML Import:** After making the appropriate network assignments, press the  button.

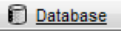
Vehicle Spy will now load the database in the .ARXML file and prompt you to save the changes you have made to your platform (quite visibly, to ensure you don't lose your work!)

- **Save Database Changes:** Press either of the flashing buttons to save the changes to your platform.

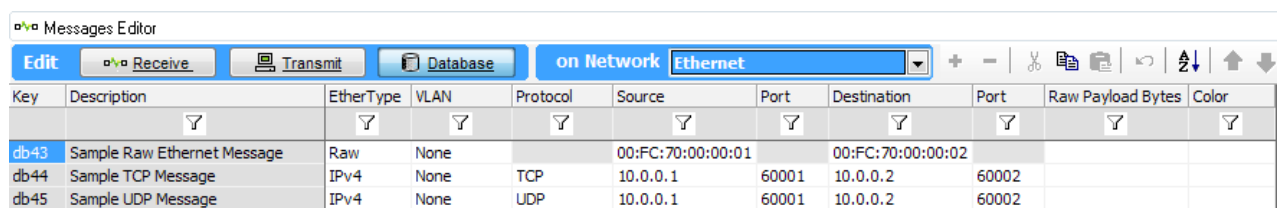
Your platform is now set up.

Viewing Platform Database Messages

Platform database messages appear within the database area of the *Messages Editor*, where they can be copied to quickly make transmit or receive messages. Let's take a look.

- **Open Messages Editor:** Select *Messages Editor* from the *Spy Networks* menu.
- **Select Ethernet Network:** Click the drop-down box next to the words *on Network* in the blue header, scroll down until you find the "Ethernet" entry, then select it.
- **Select Database Messages:** Press the  button.

You should now see a set of database messages that you can use with your Ethernet network. Exactly what appears here will, of course, depend on the contents of the database you loaded. Figure 11 shows a few example messages from our sample database.



Key	Description	EtherType	VLAN	Protocol	Source	Port	Destination	Port	Raw Payload Bytes	Color
db43	Sample Raw Ethernet Message	Raw	None		00:FC:70:00:00:01		00:FC:70:00:00:02			
db44	Sample TCP Message	IPv4	None	TCP	10.0.0.1	60001	10.0.0.2	60002		
db45	Sample UDP Message	IPv4	None	UDP	10.0.0.1	60001	10.0.0.2	60002		

Figure 11: Sample Ethernet Database Messages.



3 Viewing and Analyzing Ethernet Messages and Data


Now that we have Vehicle Spy properly set up, we are ready to begin working with Ethernet messages and data. In this chapter we'll learn how to go online to view "real world" Ethernet / TCP/IP messages from the Internet, and see how to work with them effectively within VSpy's *Messages View*. This will include tailoring the display of messages for Ethernet, seeing how to sort and filter Ethernet messages, using *Details View* to look at the data within messages, and learning how to save Ethernet data for later analysis.



This chapter assumes that you have followed the instructions in Chapter 2 to enable PC Ethernet interfaces, and have chosen the interface that your PC uses to connect to the Internet.

3.1 Going Online to View Ethernet Messages

Support for displaying Ethernet messages is built into Vehicle Spy, so to start looking at Ethernet messages, we simply need to go online.

- **Go Online:** Press the  button located near the top left of the *Logon Screen*. You can also press the  button found just below it (these can be seen near the top left of Figure 4).

Vehicle Spy 3 will automatically switch to *Messages View* and begin displaying the Ethernet traffic found on the selected interface. If for some reason the view does not change, simply select *Messages* from the *Spy Networks* menu. Note that if you have previously been simulating a file in Vehicle Spy, you may need to click the drop-down box next to the  button and explicitly choose *Run with Transmit*.

You should see a display similar to Figure 12. Notice that the  button has changed to the  (Stop) button at the top left, and the word *Online* appears next to it, showing that we are online. *Messages View* begins by default in *static mode*, which groups together similar messages to make it easier to monitor the network as a whole. In the case of Ethernet, messages are grouped based on their source and destination addresses, as well as the message type (*EtherType*).

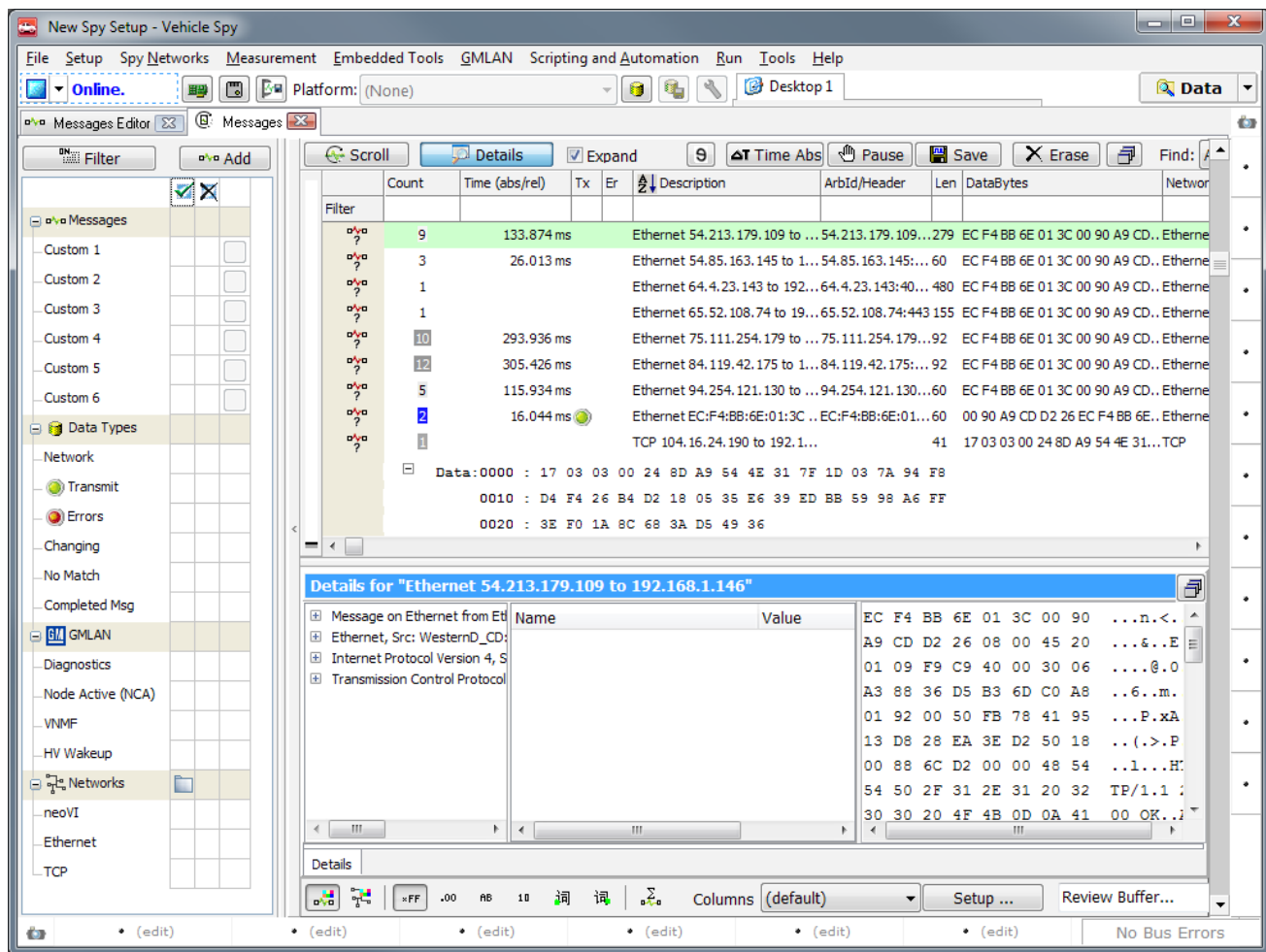


Figure 12: Initial Messages View Display with Ethernet Messages.

You may see some TCP entries in the display; there is one at the bottom of the displayed message list in the figure. These are logical displays of TCP data carried within Ethernet messages. To make it easier to see more message types, we can suppress the display of this inline data in *Messages View*:

- **Disable Display of Inline TCP Data:** Near the top of *Messages View*, find the checkbox next to the word *Expand*. Click the box to clear the checkmark from it.

TCP messages will now collapse down so they take up less space. Later on we'll see how we can use network filters to isolate or suppress network types.

For now, let's go offline.

- **Go Offline:** Press the  button to go offline.

3.2 Selecting the Ethernet Column Set

By default, Vehicle Spy begins with the *Messages View* in its generic display format, which is designed to support many types of vehicle networks. Since we are specifically interested in Ethernet, we will change the display to one that provides more information relevant to Ethernet messages.

- **Change the Messages View Columns Display to Ethernet:** Near the bottom of the *Messages View* you should see the word *Columns*, and to the right, a drop-down box in which “(default)” is currently selected. Click the box, scroll down, and change the setting to “Ethernet” (Figure 13).

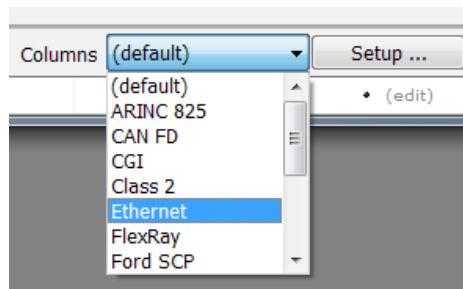


Figure 13: Selecting the Ethernet Column Display. This setting will cause *Messages View* to display information pertinent to work with Automotive Ethernet.

The information in the *Messages View* will immediately change to more Ethernet-specific data. Depending on the size of your display, you may or may not see all of the columns available; you may also find that some are too narrow to see all of their contents. Enlarge the window and adjust the columns until you can see all the columns up to *Len* (short for “Length”). You should see something similar to Figure 14.

The *Count*, *Time*, *Tx*, *Er* and *Len* columns are used in the same way as they are with more conventional networks such as CAN. Here is a brief explanation of the Ethernet-specific columns:

- **Description:** For Ethernet messages these summaries begin with “Ethernet” and then generally contain the source and destination addresses. These will be either MAC addresses for plain Ethernet or AVB frames, or IP addresses for TCP/IP messages.
- **Source and Destination:** The sender and receiver of the message, which again will be either MAC addresses or IP addresses.
- **Src Port and Dst Port:** The source and destination port numbers for UDP and TCP messages.
- **EtherType:** The interpreted value of the two-byte *EtherType* field in the Ethernet header, indicating the type of data being carried in the frame. Typical values are “IPv4”, “IPv6” or “ARP”.

- **Protocol:** The interpreted value of the IPv4 *Protocol* field or IPv6 *Next Header* field, specifying the higher-level protocol message being carried in an IPv4/IPv6 message. This will normally be either “UDP” or “TCP”, or blank for non-IP messages.

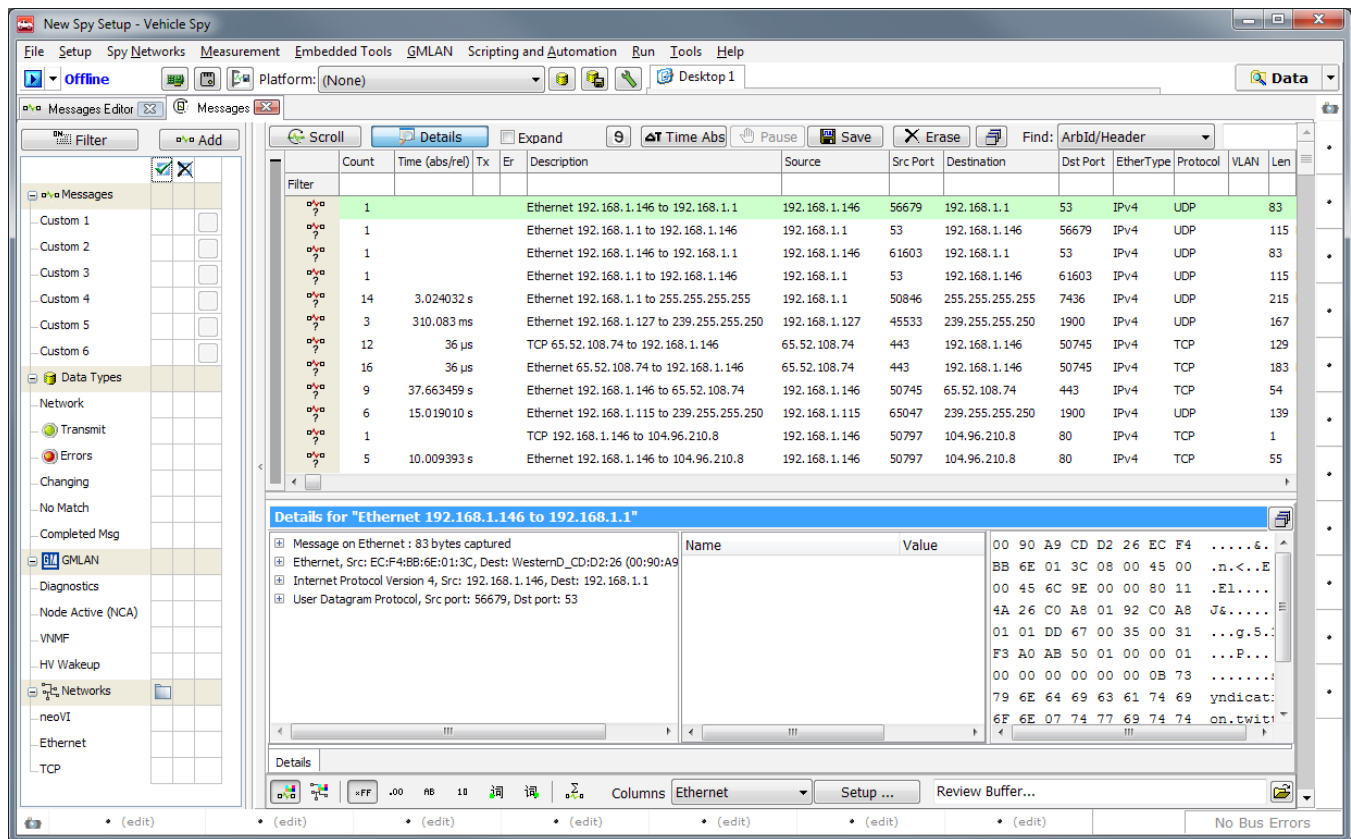


Figure 14: Messages View After Selecting Ethernet Columns and Adjusting Column Sizes. We can now see several new columns specific to Ethernet messages: *Source*, *Src Port*, *Destination*, *Dst Port*, *EtherType*, *Protocol* and *VLAN*.

3.3 Saving an Ethernet Column Setup

Ethernet setups in Vehicle Spy can be saved for later use in exactly the same way you would do when working with other networks. In this case, since we have now tailored the *Messages View* to look good when working with Ethernet messages, we'll save the setup. Then we can reload it at any time in the future when we want to work with Ethernet.

- **Create a New Setup File:** Select *Save As* from the *File* menu. When the dialog box appears, enter “Ethernet Column Setup”.

That's it. Your setup is now saved, and the next time you load it *Messages View* will immediately be ready for working with Ethernet.

3.4 Viewing Messages in Scroll Mode

We mentioned earlier that Vehicle Spy defaults to aggregating similar messages for easier tracking and analysis. However, when working with Ethernet it is often useful to see messages sequentially rather than having them grouped in this manner. Naturally, we can easily change between the two modes.

► **Go Online:** Press .

► **Enable Scroll Mode:** Press the  button, located near the top left of *Messages View*.

You will immediately see the change in the message display, as it (appropriately enough) begins scrolling, each new message appearing in a separate line rather than being grouped (Figure 15). Notice also that the *Count* column has now been replaced by a *Line* column, the number of which increases sequentially.

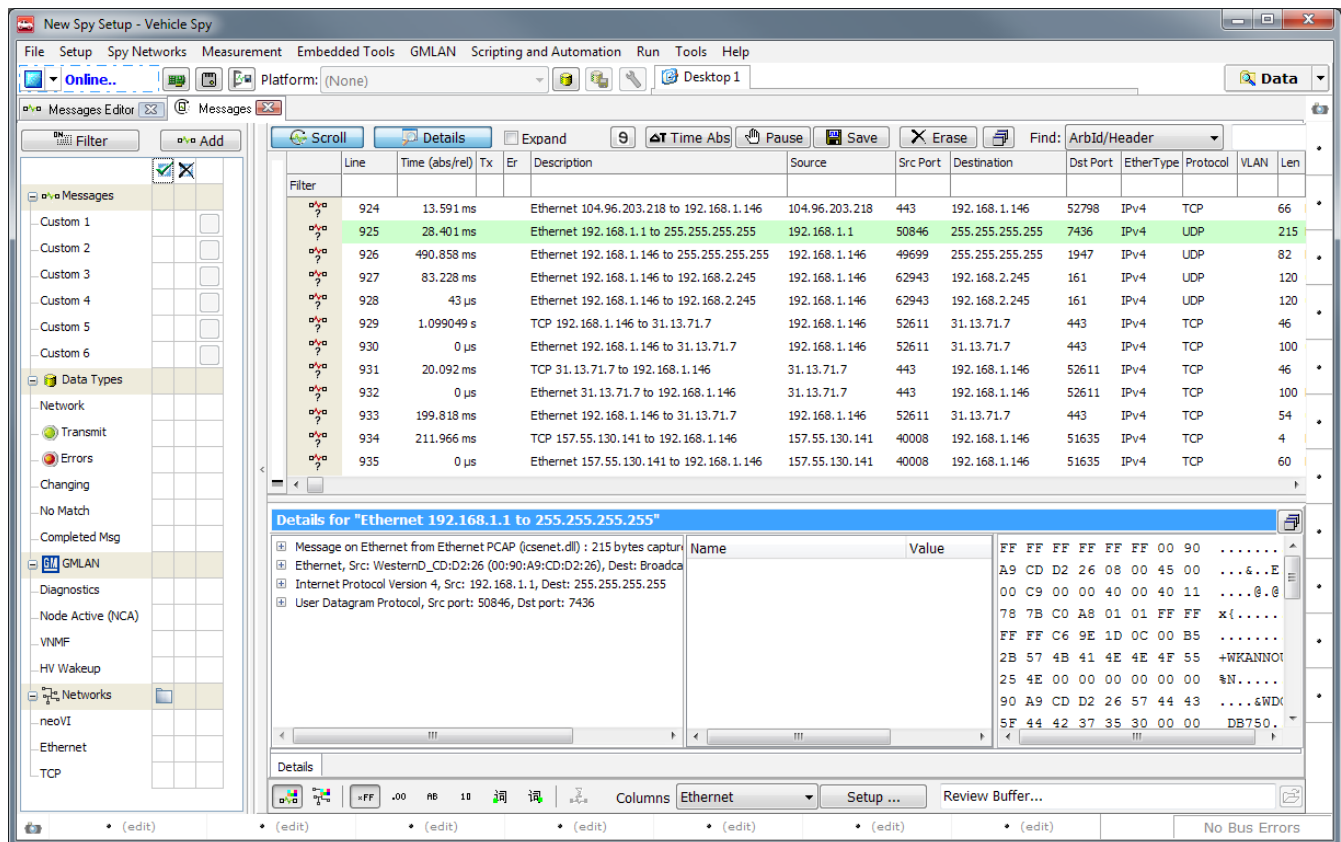



Figure 15: Messages View After Enabling Scroll Mode.

Ethernet traffic can come into Vehicle Spy quickly, so you may find it helpful to make use of the  button to temporarily halt the message scrolling when in this mode.

Now let's go back to static mode and go offline again.

► **Enable Static Mode:** Press  again to turn off scroll mode.

Vehicle Spy 3 resumes showing you messages statically aggregated by type with counts.

► **Go Offline.**

3.5 Sorting Messages by Column Value

Ethernet messages in *Messages View* can be sorted by clicking on column headers in exactly the same way as you might do with other networks. Let's try an example.

► **Sort by Source Column:** Click on the *Source* column.

All of the messages in the buffer will now be sorted based on their source IP address or MAC address; you should see something similar to Figure 16. As always, you can choose from ascending order (A↓ symbol shows in the column) or descending order (Z↓ symbol). Of course, you can also sort using the standard columns, such as *Count* or *Len*.

Filter	Line	Time (abs/rel)	Tx	Er	Description	Source	Src Port	Destination	Dst Port	EtherType	Protocol	VLAN	Len
o/a ?	3193	52.456 ms			TCP 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		69
o/a ?	603	0 μs			Ethernet 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		123
o/a ?	602	43.633 ms			TCP 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		69
o/a ?	599	0 μs			Ethernet 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		123
o/a ?	598	45.316 ms			TCP 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		69
o/a ?	3849	301 μs			TCP 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		69
o/a ?	3852	0 μs			Ethernet 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		123
o/a ?	3851	50.810 ms			TCP 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		69
o/a ?	2315	0 μs			Ethernet 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		123
o/a ?	2314	47.557 ms			TCP 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		69
o/a ?	3850	0 μs			Ethernet 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		123
o/a ?	2311	0 μs			Ethernet 23.92.109.10 to 192.168.1.146	23.92.109.10	443	192.168.1.146	60500	IPv4	TCP		123

Figure 16: Messages View with Ethernet Data Sorted by Source Address. This is the top of the buffer, showing messages with the lowest-numbered *Source* addresses captured in this session: 23.92.109.10.

Let's now remove the sorting:

► **Remove Sort:** Click the *Source* column two more times to return to the default view.

3.6 Column Filtering with Ethernet Data

Filtering using columns is a quick and easy way of isolating groups of messages from what can be a very large buffer of Ethernet data. Simply enter the filter criteria into the *Filter* bar as you would when working with CAN or another network. As always, you can use question marks and asterisks as wildcards, hyphens for ranges, and commas to create lists of values.

As an example, suppose we want to find all of the Domain Name System (DNS) messages sent by our PC. These requests are used to resolve names like "www.intrepidcs.com" into IP addresses. DNS requests are sent to the connected Internet provider's server on destination port 53.

- **Filter for Outgoing DNS Messages:** Enter “53” into the *Filter* bar cell under the *Dst Port* column.

The message display will now change to show only the messages we are interested in; an example can be seen in Figure 17.

	Count	Time (abs/rel)	Tx	Er	Description	Source	Src Port	Destination	Dst Port	EtherType	Protocol	VLAN	Len
Filter									53				
<input checked="" type="checkbox"/> ?	1				Ethernet 192.168.1.146 to 192.168.1.1	192.168.1.146	57424	192.168.1.1	53	IPv4	UDP		133
<input checked="" type="checkbox"/> ?	1				Ethernet 192.168.1.146 to 192.168.1.1	192.168.1.146	61558	192.168.1.1	53	IPv4	UDP		82
<input checked="" type="checkbox"/> ?	1				Ethernet 192.168.1.146 to 192.168.1.1	192.168.1.146	56737	192.168.1.1	53	IPv4	UDP		133
<input checked="" type="checkbox"/> ?	1				Ethernet 192.168.1.146 to 192.168.1.1	192.168.1.146	59963	192.168.1.1	53	IPv4	UDP		78
<input checked="" type="checkbox"/> ?	1				Ethernet 192.168.1.146 to 192.168.1.1	192.168.1.146	50774	192.168.1.1	53	IPv4	UDP		78
<input checked="" type="checkbox"/> ?	1				Ethernet 192.168.1.146 to 192.168.1.1	192.168.1.146	61041	192.168.1.1	53	IPv4	UDP		83
<input checked="" type="checkbox"/> ?	1				Ethernet 192.168.1.146 to 192.168.1.1	192.168.1.146	54843	192.168.1.1	53	IPv4	UDP		133

Figure 17: Messages View with Active Column Filter.

Let's now remove the filter.

- **Clear DNS Filter:** Remove the “53” from the *Dst Port* filter cell.

Messages View will return to showing all messages.

3.7 Ethernet Network Filtering

Sometimes you may be working with a mixed network containing Ethernet, CAN, LIN and possibly other types of messages. In addition, as we've already seen, some Ethernet messages actually generate two lines in *Messages View*: one for the basic Ethernet message, and one for the virtual TCP network. If FSA is in use, these messages too will show up with both Ethernet and FSA entries.

To view traffic from specific networks, use the network filter columns on the left side of *Messages View*. The left-most column with the checkmark at the top is used to include networks you want to see, and the center column with the “X” excludes networks you do not want. (The right-most column is for custom filters, which we won't be covering in this guide.)

For example, suppose we want to see only the logical TCP messages on the network, and not the underlying Ethernet messages that carry them.

- **Include the TCP Network:** Click the box in the left-hand column for the TCP network. A checkmark appears.
- **Exclude the Ethernet Network:** Click the box in the center column for the Ethernet network. An “X” appears.

Figure 18 shows what the filter area should look like. After entering these filters, you should see only TCP messages in the message display area of *Messages View*. (You may need to click the mouse in the messages area for it to update.)

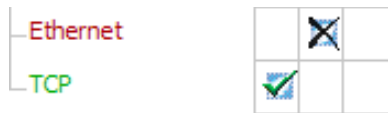


Figure 18: Filters to Show TCP Messages and Exclude Ethernet Messages.

Note that, as always is the case in Vehicle Spy, if you want to exclude a network, you must include at least one network explicitly or nothing will be shown.

- **Remove the TCP Network Inclusion:** Click the checkmark next to the TCP network to remove it.

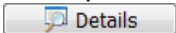
Since no network is now included, you should now see the messages area go completely blank (again, you may need to click in the messages area to see this).

- **Remove the Ethernet Network Exclusion:** Click the “X” next to the Ethernet network.

Messages from all networks are now displayed again.

3.8 Using Details View to Examine Message Headers and Data

The blue rectangular area at the bottom of *Messages View* is sometimes called *Details View* or the *Details Pane*, and allows you to dig into the fields in any message to let you see what’s really going on in your network. It’s an especially powerful tool for Automotive Ethernet because you can use it to examine each of the layers of headers and data found in complex encapsulated messages such as those used in TCP/IP.

You should see *Details View* open, unless it was previously disabled in a prior use of VSpy on your machine. If you don’t see it, press the  button to enable it.

The *Details View* window contains three panes. The information pane on the left shows a list of messages and decoded information about them; for Ethernet messages, you will see here a list of the headers in the message. On the right is a byte/character display of the selected message. In the center, you’ll see an area with *Name* and *Value* columns that are used to display the values of decoded messages. The contents of all of these panes will change depending on the type of message is selected in the *Messages View*. The relative sizes of the three panes can be changed by dragging the vertical dividers between them.

As an example, let’s try looking at a TCP/IP UDP message. We can find one easily by using a filter.

- **Filter for UDP Messages:** Enter “UDP” in the *Protocol* filter cell.

Now just click any of these messages.

- **Select a UDP Message:** Click any UDP message currently shown in *Messages View*.

You should now see details for the message shown in *Details View*, like the example in Figure 19.

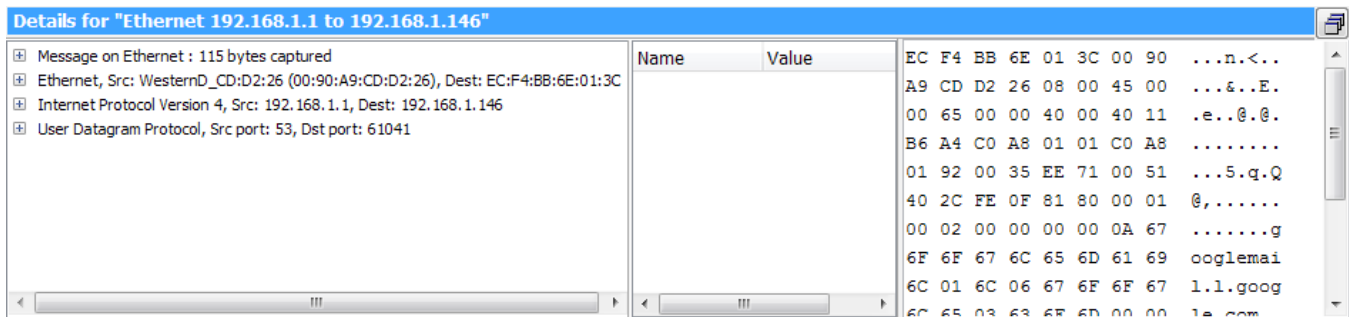


Figure 19: Details View for a UDP Message.

As you can see, there are four lines in the left-hand pane. The first is the general information line for an Ethernet message. The next three show the nested headers for a UDP message: *Ethernet*, *Internet Protocol* and *User Datagram Protocol*.

If you select one of these lines, the corresponding header bytes in the message will be highlighted in the data area on the right.

- **Select the Internet Protocol Header:** Click the *Internet Protocol Version 4* header in the information pane.

You should see 20 bytes highlighted in gray in the byte area, corresponding to the 20 bytes in a standard IPv4 header (Figure 20).

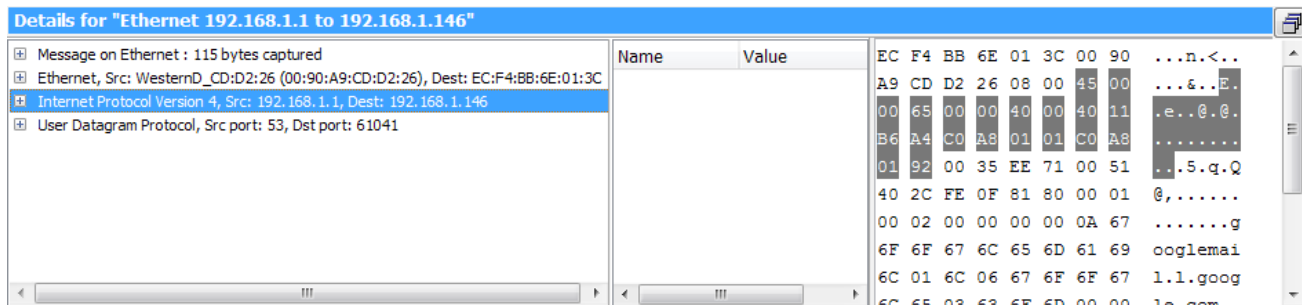



Figure 20: Details View Display for a UDP Message with IP Header Highlighted. Here we have the *Details View* display for a typical UDP message. When the IPv4 header is selected in the information pane, Vehicle Spy 3 highlights its 20 bytes in the byte/character display area.

Notice that each header has a “+” button to its left. We can use these to “drill down” into the headers to look at the fields they contain.

- **Expand the UDP Header:** Click the *UDP* header in the *Details View* information pane, and then click the  button to the left of it.

Vehicle Spy now highlights the UDP data bytes in gray (right-hand pane), and shows you the values of the fields within the UDP header in this message (left-hand pane). An example is shown in Figure 21.

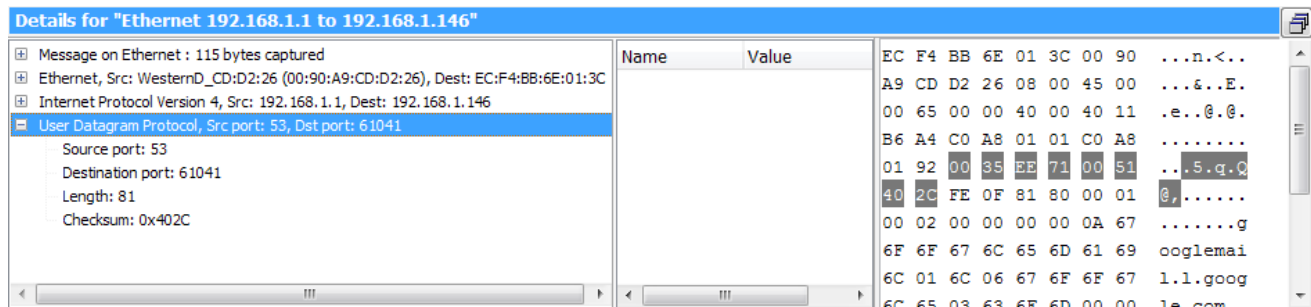


Figure 21: UDP Message Details View with Expanded Ethernet Header. The same UDP message shown in Figure 20, but with the UDP header selected and expanded to show its fields. Notice the change to the highlighting in the byte/character display area.

You can also highlight specific fields in the headers to find exactly where they are located in the bytestream of the message.

- **Highlight the Source Port Field:** Click the *Source Port* field under the UDP header.

You will now see just two bytes highlighted in gray on the right, since this field is 16 bits long (Figure 22).

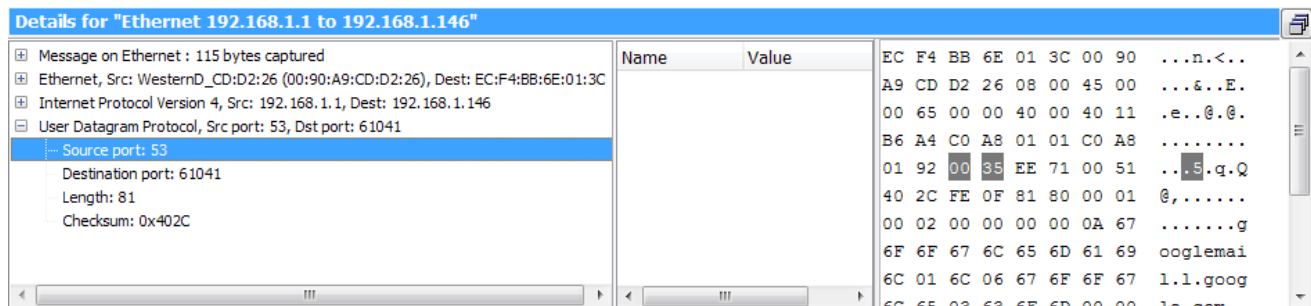



Figure 22: UDP Message Details View with Source Port Field Selected. Note that the value of the field is 53 (decimal) corresponding to the byte value 35 (hexadecimal) in the byte/character display.

3.9 Saving the Message Buffer

After you capture some important data from your network, you can easily save it to a file for later analysis.

- **Click the Save Button:** Click the  **Save** button near the top of *Messages View*.

You will be prompted with an options dialog box like the one in Figure 23.

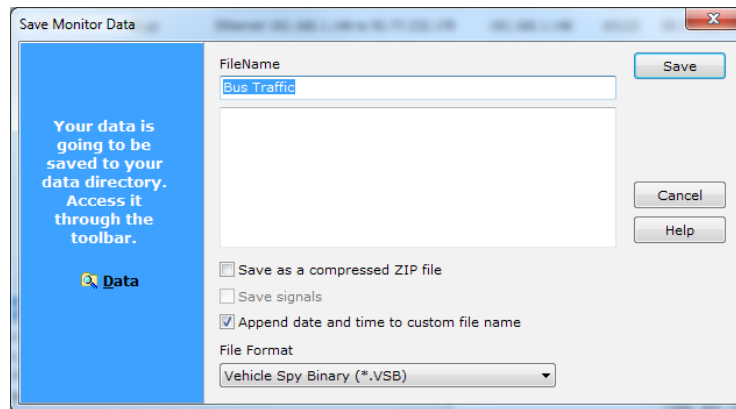


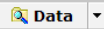
Figure 23: Save Buffer Data Dialog Box.

In most cases the defaults here are what you want: the .VSB format is ideal for Ethernet messages. Having *Append date and time to custom file name* checked will make it easy to find saved buffers, and ensure that later buffer saves don't overwrite newer ones.

Note that Ethernet data can also be stored in .PCAP files (which are compatible with other TCP/IP network analysis tools) but not in VSpy's traditional .CSV format.

- **Save the Buffer:** Click the  button.

The buffer will be stored in your current data directory.

- **Open the Data Directory:** Click the  button located near the top right of Vehicle Spy.

VSpy will launch Windows Explorer set to the location of your data directory. Sort the list by *Date Modified* and you should see your buffer at the top.

One important note: be sure to clear network filters that exclude underlying Ethernet messages—like the one we used in Section 3.7—before saving the buffer. If you include a virtual network like TCP or FSA, but exclude Ethernet, then no messages will be saved.

4 Simulating and Reviewing Ethernet Message Files


Once you have saved Ethernet data to a file, you have several options for working with it. Two of the most important are *simulating* the file and *reviewing* it, which we'll show you how to do in this chapter.

Note that this part of the guide assumes that you saved a buffer of Ethernet data in Section 3.9. If you have not done this yet, please review the relevant parts of Chapter 3 and save an Ethernet buffer before proceeding here.

4.1 Simulating an Ethernet Data File

Simulating a data file is an alternative to going online with a live network. Vehicle Spy will replay the file, causing its messages to appear in *Messages View* in the same order, and with the same timing, as occurred on the network when they were captured. This is a useful tool for diagnosing problems, since you can repeat a message exchange in the same way multiple times. You can also control the speed of the simulation, slowing it down for easier observation.

If you've simulated a file in Vehicle Spy before, the process is pretty much the same for Ethernet data files.

- **Browse to Data Directory:** Click the down-arrow next to the  button, hover the mouse over *Run Simulation*, and when the submenu appears, select *Browse...* (Figure 24).

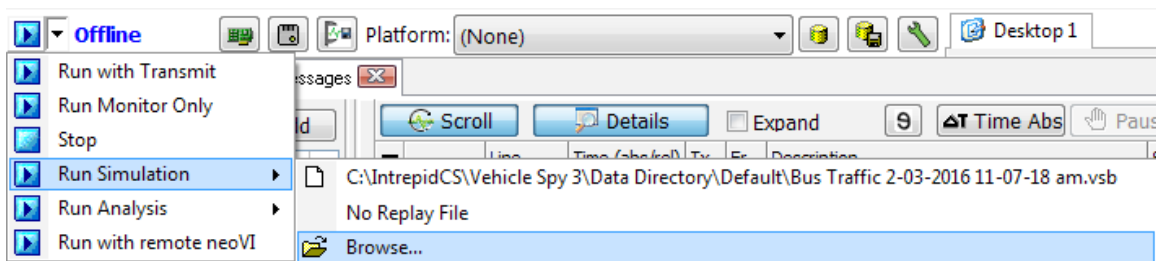
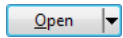


Figure 24: Browsing to a Simulation File.

A Windows file selection box will now appear opened on your data directory.

- **Select a Simulation File:** Click the file you want to simulate (probably the one you saved earlier in the guide), then click the  button.

Assuming that a valid file was selected, Vehicle Spy will begin playing back its messages within *Messages View*. The screen will appear quite similar to how it did when going online live, except that you will notice the simulation bar at the top, which shows you VSpy's progress as it goes through the file (Figure 25). The current speed of the simulation is shown in the bar (in the figure it says "speed: 1.00x"). You can change this by moving the adjacent speed slider left or right, selecting a speed from 0.01x to 20x.

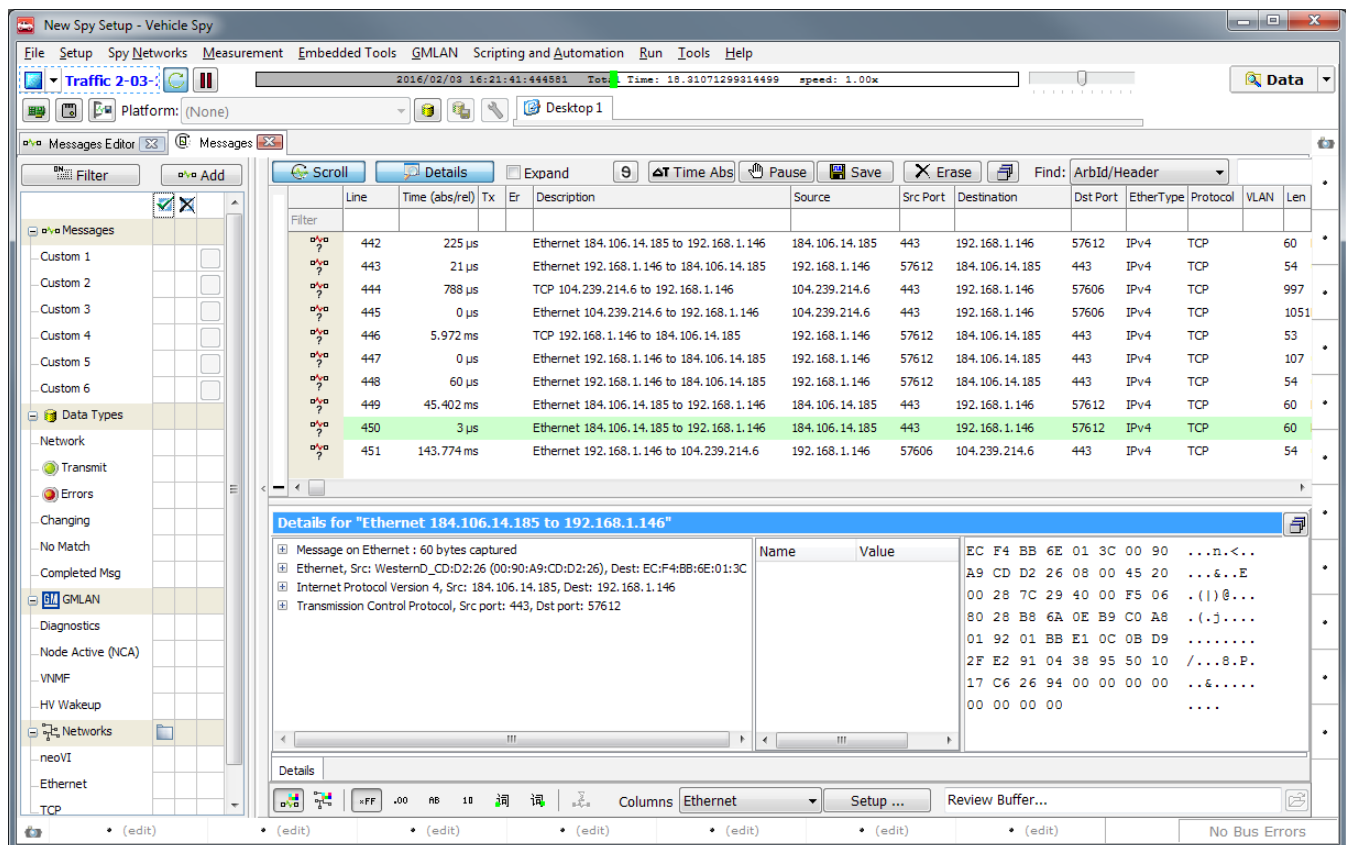



Figure 25: Simulating an Ethernet Data File.

By default, the simulation will continuously loop through the file. You can turn this off by clicking the  button.

You stop the simulation by going offline.

- **Go Offline:** Press the  button.

4.2 Reviewing an Ethernet Data File

Reviewing a file is used most often to simply look at what messages it contains. You choose the file and the messages are shown in the order they were stored with the same timestamps. Again, this process is pretty much the same for Ethernet data as it is for other networks.

Let's try an example.

- **Tell Vehicle Spy to Review a File:** Choose *Review Buffer...* from the *File* menu.
- **Select a File:** When the Windows file selection dialog appears, select a file from your data directory.

Vehicle Spy will now present a dialog box allowing you to choose what platform you want to use and whether you want to load the file in standard or streaming mode. Again, this is

identical to what happens when reviewing a .VSB file with CAN or other network data. In most cases we can leave these options at their default settings.

► **Proceed with File Review:** Click the  button.

Vehicle Spy will load the buffer file, stopping with the last message showed at the bottom of the *Messages View* display.

5 Creating Ethernet Receive Messages and Decoding Signals

In the preceding chapters we have learned how to view and work with live Ethernet messages on an Internet connection. You can work with your automotive network in exactly the same way, going online and monitoring network traffic. When working with actual ECUs and other Ethernet nodes, however, you will often want to create Vehicle Spy *receive messages* that describe particular message types and provide information for VSpy to decode their contents.

This can be accomplished with Ethernet messages in a manner similar to how you have traditionally worked with CAN and other network data. However, due to the complexity of many Automotive Ethernet message formats, Intrepid has added special capabilities to make working with Ethernet messages more user-friendly.

In this chapter we'll see how to define an Ethernet receive message, add a signal to it, and then decode Ethernet data using the message definition. We have created a special data buffer of Ethernet messages and put it on our website to assist with this demonstration. Before proceeding, please download the file from the following location, and store it in your data directory or anywhere else on your PC: http://www.intrepidcs.com/ae/ethernet_data.vsb

5.1 Creating an Ethernet Receive Message


We'll begin by defining a basic Ethernet receive message. Again, the process is very similar to doing this for a CAN message, so assuming you have some VSpy experience, much of the following should be familiar.

Let's clear out anything that may already be present within Vehicle Spy, and then go to the *Messages Editor*.


- ▶ **Reset Vehicle Spy to Start Configuration:** Select *New* from the *File* menu.
- ▶ **Open Messages Editor:** Select *Messages Editor* from the *Spy Networks* menu.

Since we want to work with Ethernet, we will change the default in the *on Network* drop-down box from the default of "HS CAN" to "Ethernet".

- ▶ **Select Ethernet Network:** Click the drop-down box in the blue header and scroll down until you find the "Ethernet" entry, then select it.

We should already be on the "receive side" of the Messages Editor, as indicated by the blue highlighting on the  button. If for some reason it is not blue, press this button to select receive messages.

Finally, create the message.

- ▶ **Create Receive Message:** Click the  button to the right of the *on Network* drop-down box.

Vehicle Spy will create a default Ethernet receive message, like the one in Figure 26.

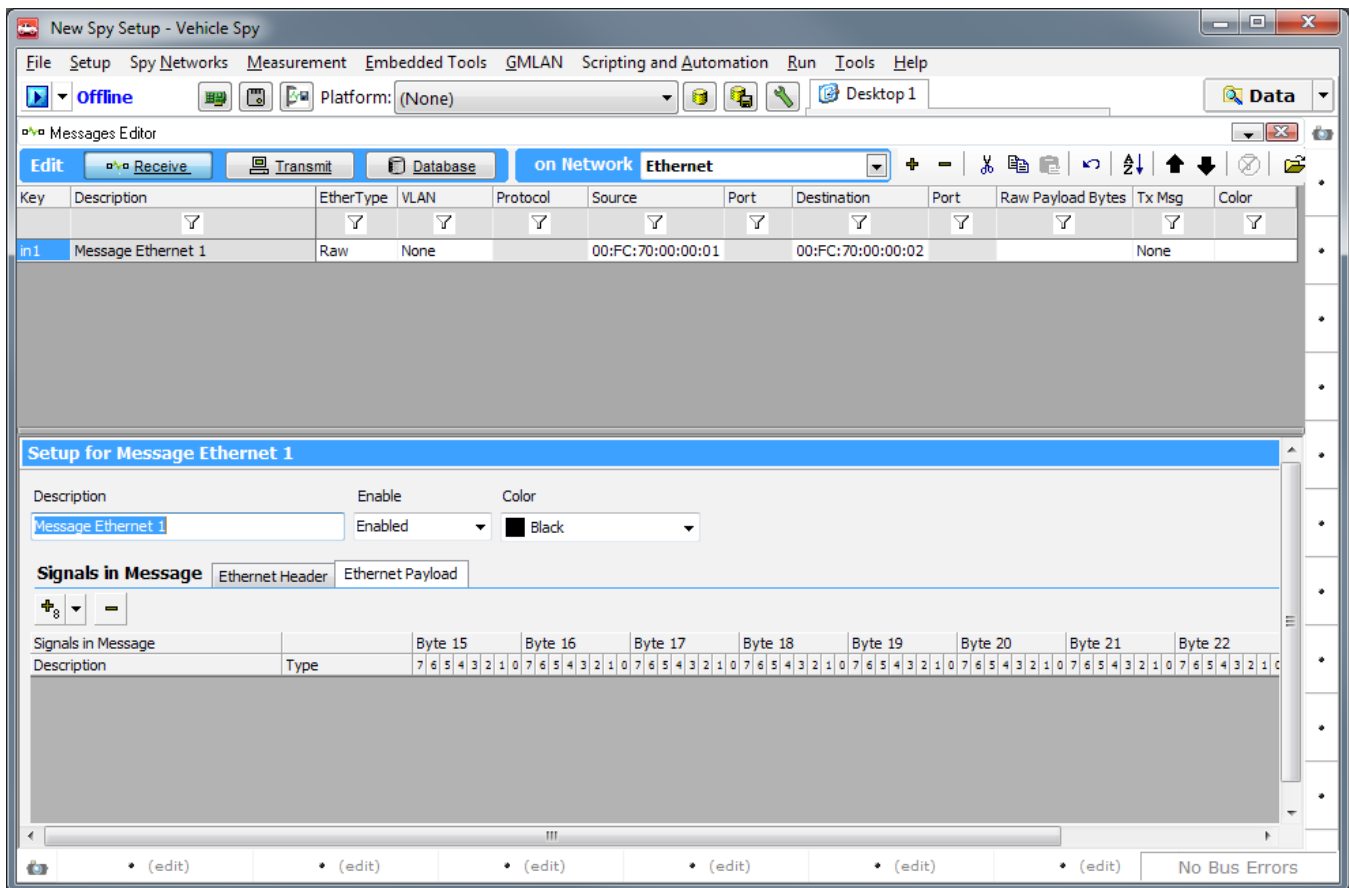


Figure 26: Default Ethernet Receive Message.

As with any VSpy message, we can rename the message or change other parameters. Let's change the default name to something more descriptive.

- **Rename Receive Message:** Double-click the current message name ("Message Ethernet 1") and change it to "Decoded Ethernet Message".

5.2 Working with EtherTypes and Ethernet Headers

Creating an Ethernet receive message is similar to creating one for CAN, but as you can see in Figure 26, the message itself is quite different. Here are a few things to note about this message:

- In the message list at the top, there are Ethernet-specific columns such as *EtherType*, *Protocol*, *Source*, *(Source) Port*, *Destination* and *(Destination) Port*.
- The setup area currently has two tabs: *Ethernet Header* and *Ethernet Payload*.

By default, Vehicle Spy creates a so-called "raw" Ethernet message, which includes only the basic 14-byte Ethernet header and room for arbitrary signals (fields) in the payload section. Let's take a look at the Ethernet header.

- **Select Ethernet Header:** Click the *Ethernet Header* tab in the setup area for our message.

A set of three signals is displayed. If you widen the window you can see the byte positions they occupy, as shown in Figure 27. As you can see, the standard header contains three signals (fields): *Destination MAC Address*, *Source MAC Address* and *EtherType or Length*. The total length of the header is 14 bytes.

Signals in Message		Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11	Byte 12	Byte 13	Byte 14	Byte 15
Description	Type															
Destination MAC Address	Analog															
Source MAC Address	Analog															
EtherType or Length	StateEncoded															

Figure 27: Receive Message Ethernet Headers.

This is one of the Ethernet -time-savers built into Vehicle Spy. These fields are always required, so VSpy creates them for you. Note that they can be viewed, but not edited.

Vehicle Spy also sets default values for the standard header fields, which you can see in the message list: the default *Source MAC Address* is “00:FC:70:00:00:01”, and the default *Destination MAC Address* is “00:FC:70:00:00:02”. These values can be changed, either here or in the *Tx Panel*.

The *EtherType* entry in the message list controls the type of Ethernet message that is defined; you can see that it is currently set to “Raw”. For this example, we actually want to create an IPv4/UDP message, so let’s change the *EtherType*.

- **Change EtherType to IPv4:** Double-click on the word “Raw” in the *EtherType* column, and a drop-down box appears. Select “IPv4”.

The *Source* and *Destination* fields change their values to “10.0.0.1” and “10.0.0.2” respectively. These are default IPv4 address values pre-assigned by Vehicle Spy.

Look in the message details area and you will now see that the tabs have changed: *Ethernet Payload* has been replaced by two new tabs: *IPv4 Header* and *IPv4 Data*.

- **Select the IPv4 Header:** Click the *IPv4 Header* tab.

You will now see about a dozen new fields have been defined to meet IPv4 protocol requirements. These ensure that your TCP/IP messages are valid, and are preloaded with default values that normally do not need to be changed.

Finally, let’s set this to be a UDP message carried within an IPv4 message:

- **Change Protocol to UDP:** Double-click the word “Raw” under the *Protocol* column and select “UDP”.

Again the message is updated automatically with new headers and defaults. Since UDP uses port numbers, default values (60001 and 60002) have been provided. New *UDP Header* and *UDP Data* tabs have replaced the *IPv4 Data* tab.

- **Select the UDP Header:** Click the *UDP Header* tab.


You should now see four signals as shown in Figure 28. Notice how these correspond to the fields we saw when looking at real UDP messages from the Internet (refer to Figure 22).

Signals in Message		Byte 35	Byte 36	Byte 37	Byte 38	Byte 39	Byte 40	Byte 41	Byte 42
Description	Type	7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0							
Source Port	Analog	F E D C B A 9 8 7 6 5 4 3 2 1 0							
Destination Port	Analog	F E D C B A 9 8 7 6 5 4 3 2 1 0							
UDP Header + Data Length	Analog								
UDP Checksum	Analog								

Figure 28: Receive Message UDP Headers.

5.3 Defining a Signal in a Receive Message

The process to define custom signals in Ethernet receive messages is the same as that used for traditional networks. The file we will be using in the next section was created as a TCP/IP UDP message with a single 8-bit field used as a sequential counter. Let's add this signal now to the UDP data area so that we can decode it when we simulate the file.

- **Select UDP Data Section:** Click the *UDP Data* tab in the signals area.
- **Add Signal:** Click the  button to create a signal.

A signal with the default name “Signal 22” is created. Let's rename this.

- **Rename Signal:** Double-click the signal name “Signal 22” and change it to “Counter”.

Your Vehicle Spy window should now look like Figure 29. Our receive message is ready to use.

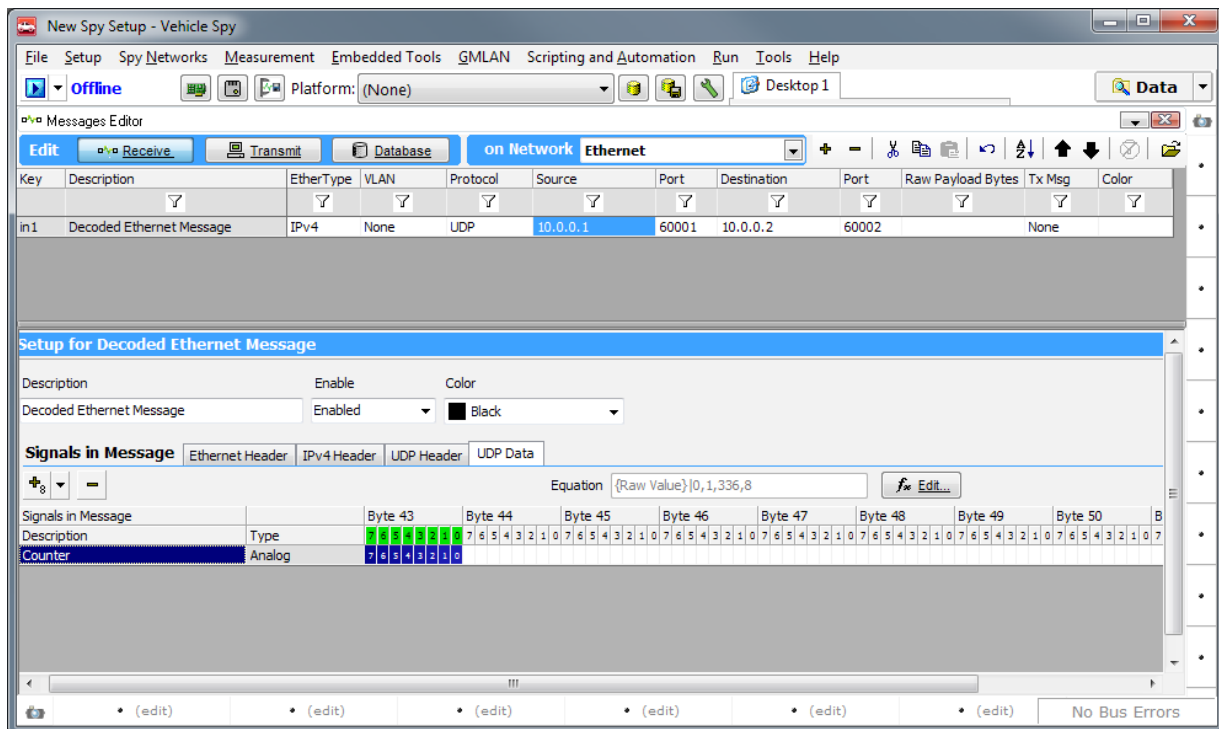


Figure 29: UDP Receive Message with Counter Signal.

5.4 Simulating an Ethernet Data Buffer to View Decoded Signals

Now that we have a receive message defined, let's simulate the Ethernet data buffer we downloaded earlier, and see how the receive message decodes it.

- **Run Simulation on Downloaded Ethernet Data File:** Click the down arrow next to the online/offline button, hover the mouse over *Run Simulation*, select *Browse...* and navigate to the location where you saved the file you downloaded from the Intrepid website. Then select that file.
- **Switch to Messages View:** Select *Messages View* from the *Spy Networks* menu.
- **Select Ethernet Column Set:** Change the column set to Ethernet as you did earlier in the guide.

You should now see something similar to Figure 30. The simulated messages are recognized as matching our receive message, *Decoded Ethernet Message*. Notice in the *Details View* area, center pane, that the signals/fields have all been decoded, including our custom *Counter* field. This counter should steadily increase as a new message is played back from the simulation every 500 milliseconds.

- **Go Offline.**

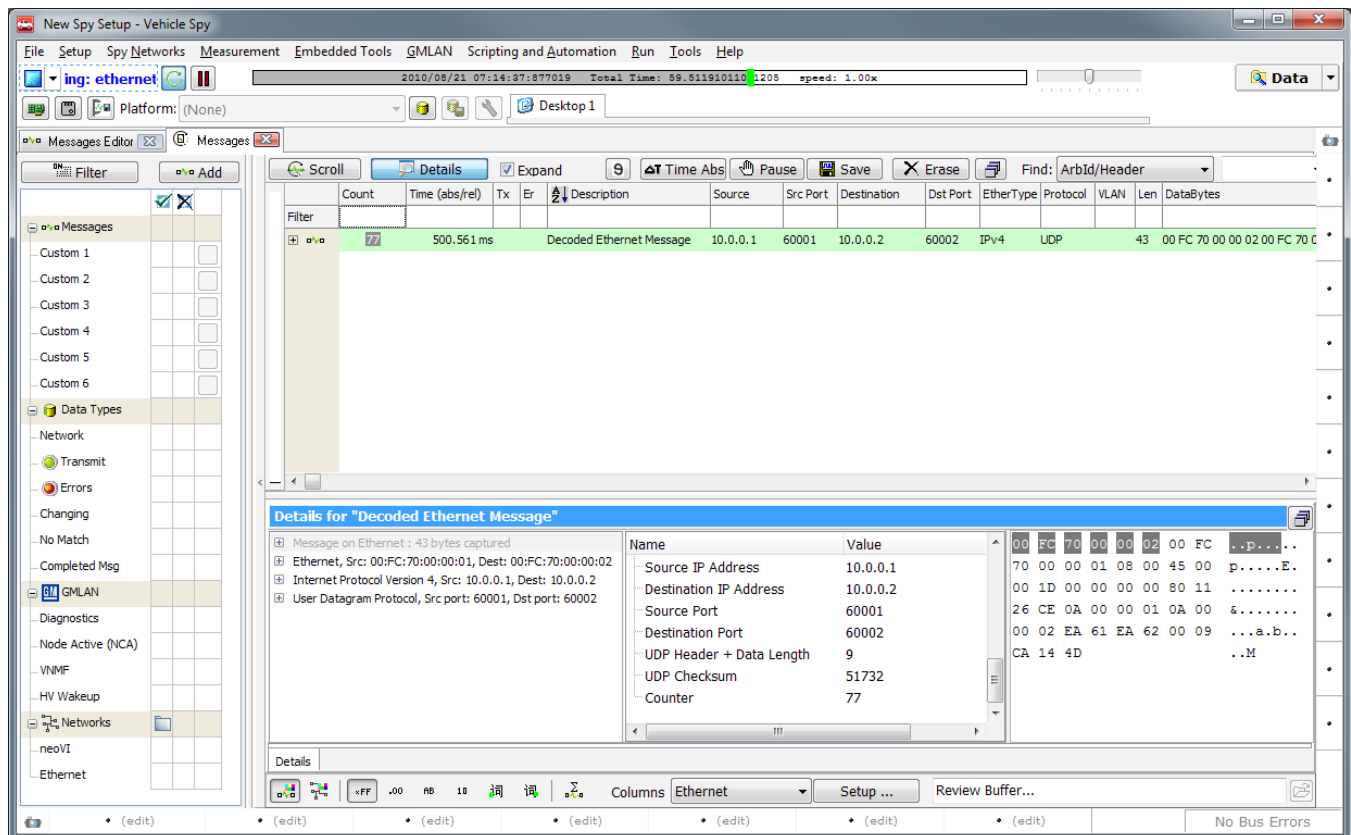


Figure 30: Messages View with Decoded Messages.

6 Creating and Transmitting Ethernet Messages

Now that we've seen how to create and work with Ethernet receive messages, let's try our hand at transmit messages. These can be used for a variety of purposes, such as communicating with an Automotive Ethernet ECU, simulating the behavior of a network, or diagnosing a network problem.

In this chapter we'll create a sample Ethernet transmit message and then transmit it both manually and automatically.

6.1 Creating an Ethernet Transmit Message

We saw in Chapter 5 that creating Ethernet receive messages is pretty much the same as creating CAN receive messages, with the differences being mainly with respect to the structure and contents of the messages themselves. The same is basically true of transmit messages as well.

Once again we'll begin by resetting Vehicle Spy to a clean slate, and then head over to the *Messages Editor*.

- ▶ **Reset Vehicle Spy:** Select *New* from the *File* menu.
- ▶ **Open Messages Editor:** Select *Messages Editor* from the *Spy Networks* menu.

And again let's switch to work with Ethernet.

- ▶ **Select Ethernet Network:** Click the drop-down box in the blue header and scroll down until you find the "Ethernet" entry, then select it.

Since we start by default on the "receive side" of the Messages Editor, we will switch to the "transmit side".

- ▶ **Switch to Transmit Messages:** Click the  **Transmit** button, which will change to have blue highlighting.

And now we can create our message.

- ▶ **Create Transmit Message:** Click the  button to the right of the *on Network* drop-down box.

Vehicle Spy will create a default Ethernet transmit message, which actually will look very similar to the receive message we created earlier (see Figure 26). As before, we can rename the message easily if we wish.


- ▶ **Rename Transmit Message:** Double-click the default message name "Tx Message Ethernet 1" and change the name to "Transmit Test Message".

As with the receive message, there are *Ethernet Header* and *Ethernet Payload* tabs in the setup area. We can likewise change the message type by editing the *EtherType* field in the

message summary if we wish, but for this exercise, we are going to stick with a raw Ethernet message.

6.2 Defining a Signal in a Transmit Message

Defining signals in transmit messages is done in the same way that we saw for receive messages in Section 5.3. Let's create a 16-bit field this time. Since this is a raw Ethernet message, the signal will be placed into the *Ethernet Payload* area.

- **Select Ethernet Payload:** Click the *Ethernet Payload* tab in the signals area.
- **Add Signal:** Click the down-arrow next to the  button and select *Add 16 Bit Signal*.

Vehicle Spy creates a signal spanning bytes 15 and 16 of the message (recall that the Ethernet header takes up 14 bytes). Let's change the default name.

- **Rename Signal:** Double-click the signal name "Signal 3" and change it to "Random Data".

Your Vehicle Spy window should now appear similar to that seen in Figure 31.

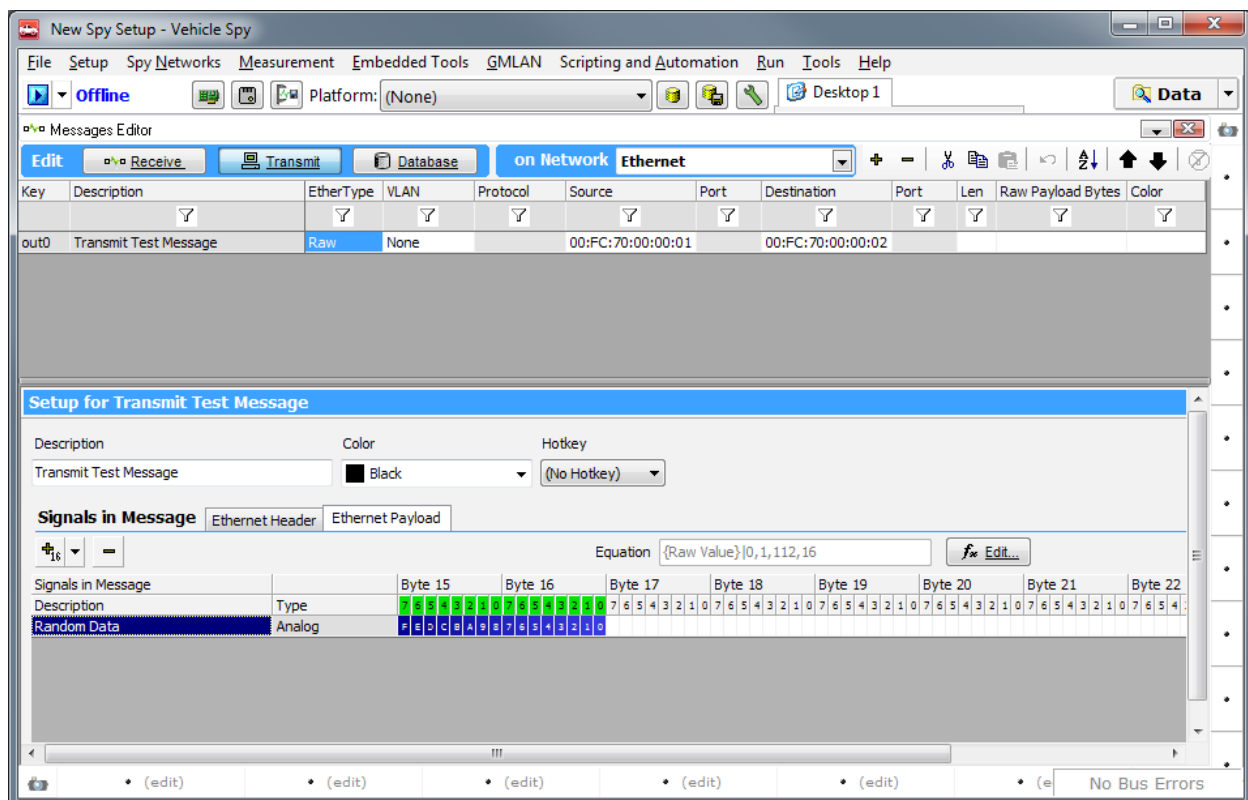


Figure 31: Raw Ethernet Transmit Message.

6.3 Using the Tx Panel to Set Transmit Message Signal Values

Since we are working with a transmit message, we will want to define the values we wish to transmit when we go online. To do this, we will use the *Tx Panel*.

- ▶ **Switch to Tx Panel:** Select *Tx Panel* from the *Spy Networks* menu.
- ▶ **Move Divider Bar:** Slide the vertical divider bar left so the signals area is easier to see.
- ▶ **Select Transmit Message:** Click on *Transmit Test Message* in the message list on the left side.

You should now see the four signals in the transmit message on the right. As we've already seen, the Ethernet header fields are preloaded with default values; these can be changed here if desired, but we will leave them alone. The fourth signal/field, *Random Data*, is the custom one we defined. Its *Value* field is blank because we have not yet defined a value for it.

We could simply enter a numeric value into this field. But to make this exercise a bit more interesting, let's make use of Vehicle Spy's ability to fill in signals with calculated values.

- ▶ **Edit Value Field for Random Data Signal:** Double-click the cell under *Value* for the *Random Data* signal.
- ▶ **Select Random Data Equation:** Click the down-arrow and choose *Equation...*

A calculated signal dialog box appears. It is already set to *Random Data* by default, so we only need to specify the *Min* and *Max* values for the data. This is a 16-bit signal, so we'll allow the value to be anything in a 16-bit range.

- ▶ **Set Min and Max Values:** Enter "0" for the *Min* value and "65535" for the *Max* value.

Vehicle Spy will show you a preview of what the signal will look like with random data; an example can be found in Figure 32. Let's accept these changes.

- ▶ **Accept Calculated Signal Parameters:** Click .

Our transmit message is now ready, and will send a random value in its payload each time it is transmitted.

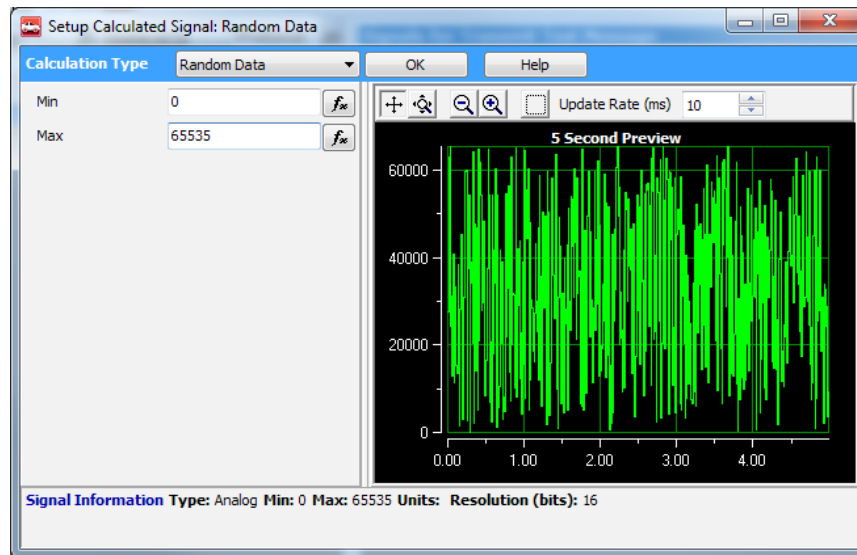


Figure 32: Setting Parameters for a Calculated Signal.


6.4 Transmitting a Message Manually

Let's start by manually transmitting our message. We assume here that you are still set to transmit on the same Internet connection you selected in Section 2.2. If for whatever reason you no longer have this interface selected, go back to the *Logon Screen* now and be sure the radio button is set to the right Ethernet adapter.

Appropriately enough, transmitting data is done within the *Tx Panel*. However, it is useful for us to also have the *Messages View* visible as we do this, so we can see the messages as they are going out. Vehicle Spy has a docking capability that makes this possible, so let's dock the *Tx Panel*.

- ▶ **Dock Tx Panel:** Click the *Tx Panel* tab within Vehicle Spy and drag it until a blue box appears. Continue dragging until the mouse is over the docking icon at the bottom of the window and the blue box fills the lower half of the program. Then release the mouse.
- ▶ **Reduce the Size of the Tx Panel:** Drag the horizontal divider bar that currently separates the *Messages Editor* from the docked *Tx Panel* down so the latter takes up less space.
- ▶ **Switch to Messages View:** Select *Messages* from the *Spy Networks* menu. Messages View now replaces the Messages Editor.
- ▶ **Select the Ethernet Column Set.**
- ▶ **Reduce the Size of the Details View Pane:** Drag the divider within *Messages View* to make *Details View* smaller.

The Tx Panel includes a manual transmit button for each transmit message. We need only click this to send our message.

- **Go Online with Transmit:** Since in an earlier exercise we were simulating a file, you will need to click the down-arrow and explicitly select *Run with Transmit*.
- **Transmit Message:** Click the  button for *Transmit Test Message*.

Our message should now have been transmitted. However, because of the amount of messages constantly being sent back and forth in a typical PC, it may be hard to find. We can use a filter to make this easier.

- **Filter for Our Transmit Message:** Enter “transmit” as a column filter under *Description*.

All of the other messages are hidden and we can now see our message. Your Vehicle Spy screen should look something like Figure 33. Notice the *Random Data* signal, which in our case has a value of 23298; yours will probably be different.

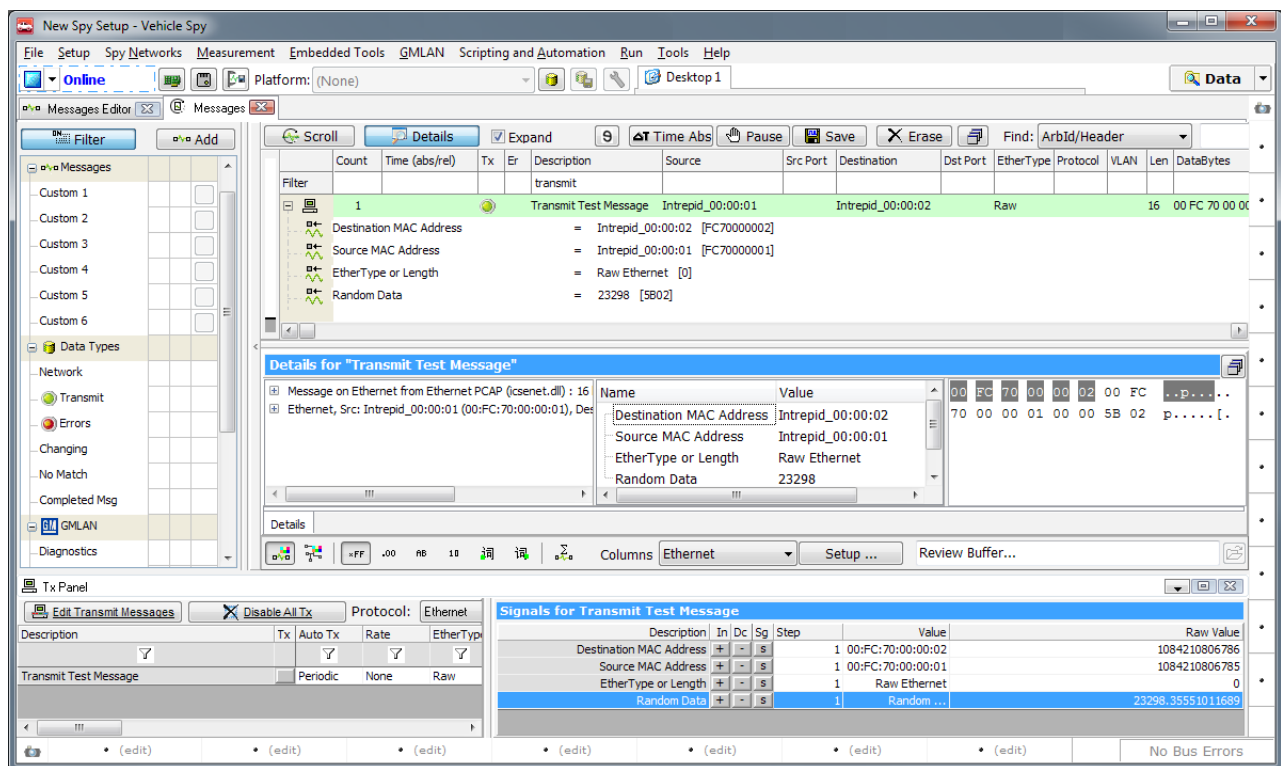


Figure 33: Messages View and Tx Panel Display After Transmitting Ethernet Message.

6.5 Transmitting a Message Automatically

Sending a message manually is only practical if you need to send it a few times, or you are trying to look for a specific response to a transmission. In many cases what we want is to send the message periodically over time. Fortunately, VSpy makes this easy to do.

Notice in the *Tx Panel* the word “Periodic” next to the transmit button you pressed, under the *Auto Tx* column. This means that the message is already set to automatically transmit



periodically. However, we see “None” under the adjacent *Rate* column, so Vehicle Spy will not actually send the message yet. We need to set an actual period rate, and then it will.

- **Set Periodic Transmit Rate:** Double-click the word “None” for our transmit message; a drop-down box appears. Select “0.250” and hit Enter.

You will now see a new transmission of our message approximately every 250 milliseconds. This also makes it easy to see that our selection to send random data is working correctly.

6.6 Graphing Signal Data

If we wish, we can use a signal graph to view our random data transmissions more easily.

- **Open Signal Plot Window:** Select *Signal Plot* from the *Measurement* menu.
- **Select Signal to Plot:** Click the  button near the top of the *Signal Plot* window.
- **Select Random Data Signal:** Click *Tx Messages* in the left menu, expand the *Transmit Test Message* message if necessary, double-click *Random Data* and click .

Vehicle Spy plots the random data in our signal. You should see a view similar to Figure 34.

- **Go Offline.**

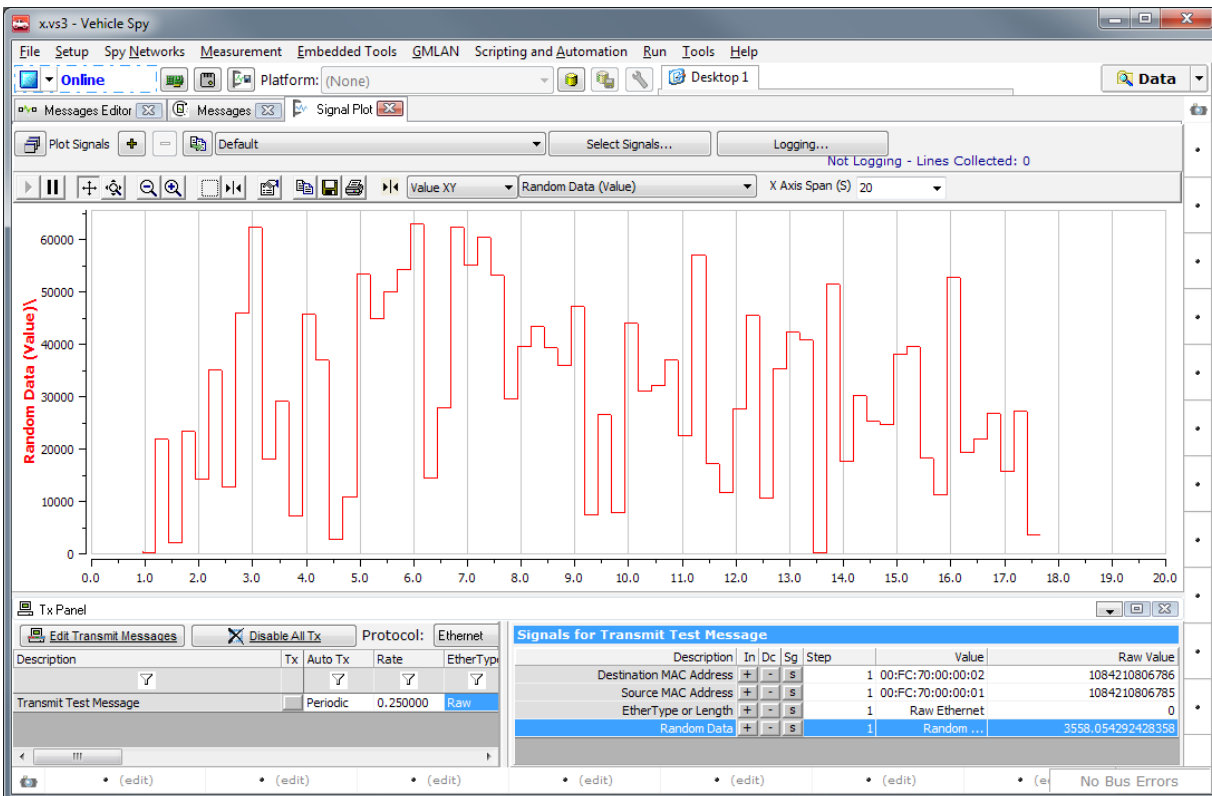


Figure 34: Signal Plot Showing Random Data from Transmitted Message.