

frontline[®]

NetDecoder Async

User Manual

TELEDYNE LECROY

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Welcome to Frontline NetDecoderAsync

Welcome to Frontline Test Systems (FTS). The design of Frontline allows you to conduct data analysis of protocols using your personal computer. The Frontline interface is easy to use without training, but we recommend you read the online Help to take maximum advantage of all the features.

We designed the online Help with complete explanations and easy to use systematic instructions. Access the online Help by choosing Help Topics from the Help menu, or by pressing the F1 key on any window.

Chapter 1 Getting Started: The Control Window

The analyzer displays information in multiple windows, with each window presenting a different type of information. The Control window provides access to each window as well as a brief overview of the data in the capture file. Each [icon on the toolbar](#) represents a different data analysis function.

Because the Control window can get lost behind other windows, every window has a Home icon  that brings the Control window back to the front. Just click on the Home icon to restore the Control window.

1.1 Control Window Toolbar

Table 1.1 - NetDecoder Async Control Window Toolbar Icons

Icon	Description
	Start Capture - Begins data capture to disk.
	Stop Capture - Available after data capture has started. Click to stop data capture. Data can be reviewed and saved, but no new data can be captured.
	Save - Saves the file the capture file.
	Clear - Clears or saves the capture file.
	Signal Display - Opens The Signal Display dialog.
	Breakout Box - Opens the Breakout Box dialog.
	Transmit - Opens the Transmit dialog.
	Network View - Opens the Network View Window.

Table 1.1 - NetDecoder Async Control Window Toolbar Icons (Continued)

Icon	Description
	Dashboard - Opens the Dashboard dialog
	Signal Display - Opens The Signal Display dialog.
	Breakout Box - Opens the Breakout Box dialog.
	Transmit - Opens the Transmit dialog.
	Network View - Opens the Network View Window.
	Dashboard - Opens the Dashboard dialog.

1.2 Menus

The menus that you see on the Control Window and dialogs like Frame Display and Event Display vary depending on whether the data is being captured live or whether you are looking at a [.cfa file](#). You will see File, Edit, View, Filter, Bookmarks, Live, Options, Window, and Help. Most of the options are self explanatory.

- Many of the File/Edit menu items are standard Windows type commands: Open, Close, Save, Recent Files, etc. There are, however, several of these menu items that have unique functionality:
- Recreate Companion File: This option is available when you are working with decoders. If you change a decoder while working with data, you can use Recreate Companion File to recreate the .frm file, the companion file to the .cfa file. Recreating the .frm file helps ensure that the decoders will work properly.
- Reload Decoders: When Reload Decoders is clicked, the plug-ins are reset and received frames are decoded again.
- Under the View menu you can choose which Frontline windows are available to open.
- Live contains commands that are used in capturing data.
- Under Options you have opportunities to set/modify various system settings. These include:
 - Hardware Settings
 - I/O Settings
 - System Settings
- Check for New Releases at Startup: When this is enabled, the application automatically checks for the latest Frontline releases. If a new version is detected, the following dialog appears.



Figure 1.1 - New Release Available Dialog

- The Window menu displays the open Frontline dialogs and standard options like Cascade, Minimize, Tile, etc.
- Within the Help menu you can open the electronic Help file, About Frontline , and access the Frontline web site for additional help.

1.3 Configuration Information on the Control Window

The **Configuration** bar (just below the toolbar) displays the hardware configuration and may include I/O settings. It also provides such things as name of the network card, address information, ports in use, etc.

Configuration: Displays hardware configuration, network cards, address information, ports in use, etc.

1.4 Status Information on the Control Window

The **Status** bar located just below the **Configuration** bar on the **Control** window provides a quick look at current activity in the analyzer.

Capture Status: ● Not Active (Capture to Single File) | N/A used | Utilization: 0% | Host | 0% Control | Events: 0

- Capture Status displays Not Active, Paused or Running and refers to the state of data capture. It will also display whether you are [capturing to a series of files or capturing to a single file](#).
- Not Active means that the analyzer is not currently capturing data.
- Paused means that data capture has been suspended.
- Running means that the analyzer is actively capturing data.
- % Used
- The next item shows how much of the buffer or capture file has been filled. For example, if you are capturing to disk and have specified a 200K capture file, the bar graph tells you how much of the capture file has been used. When the graph reaches 100%, capture either stops or the file begins to overwrite the oldest data, depending on the choices you made in the [System Settings](#).
- Utilization/Events
- The second half of the status bar gives the current utilization and total number of events seen on the network. This is the total number of events monitored, not the total number of events captured. The analyzer is always

monitoring the circuit, even when data is not actively being captured. These graphs allow you to keep an eye on what is happening on the circuit, without requiring you to capture data.

1.5 Opening NetDecoder

On product installation, the installer creates a folder on the windows desktop labeled “Frontline NetDecoder [Version #]”.

1. Double-click the Frontline NetDecoder desktop folder.



This opens a standard Windows file folder window.

Name	Size	Type	Date Modified
Optional Components		File Folder	1/15/2009 11:18 AM
Setup		File Folder	1/15/2009 11:18 AM
Capture File Viewer	3 KB	Shortcut	1/15/2009 11:18 AM
Frontline NetDecoder	2 KB	Shortcut	1/15/2009 11:18 AM
Quick-Start Guide	1 KB	Shortcut	1/15/2009 11:18 AM

2. Double-click on Frontline NetDecoder and the system displays the Select Data Capture Method dialog.

Note: You can also access this dialog by selecting Start > All Programs > Frontline NetDecoder (Version #) > Frontline NetDecoder.

This dialog lists all the protocols NetDecoder supports in a tree control. See [Protocol List](#)

Three buttons appear at the bottom of the dialog; **Run**, **Cancel**, and **Help**. When the dialog first opens, Cancel and Help are active, and the Run button is inactive (grayed out).



starts NetDecoder using the selected protocol stack.



closes the dialog and exits the user back to the desktop.



takes the user to this help file as does pressing the F1 key.

Select a Protocol

Expand the folder containing the desired protocol and select the protocol that matches your configuration.

Note: If you don't need to identify a capture method, then click the Run button to start the analyzer.

Data Capture Method

This pane is located on the Choose Protocol to Analyze dialog just below the protocol list, and lists the methods by which Frontline can capture data.

The following selections appear in this list:

- Serial Ports
- RS-232 ComProbe
- Ethernet Card
- LiveImport

These selections are exclusive radio buttons and are inactive (grayed out) until a protocol selection is made.

If the protocol selection has only one method of data capture, then the system automatically selects that capture method and the buttons remain inactive (grayed out).

If the selected protocol has more than one capture method, then the selection buttons that correspond to the possible capture methods become active, allowing you to make a selection. When multiple selections are available, the system defaults to Serial Ports.

After making a capture method selection, click the Run button to start the analyzer.

Creating a Shortcut

A checkbox labeled Create Shortcut When Run is located near the bottom of the dialog. This box is un-checked by default.

Select this checkbox, and the system creates a shortcut for the selected protocol, and places it in the NetDecoder desktop folder and in the start menu when you click the Run button.

This function allows you the option to create a shortcut icon that can be placed on the desktop. In the future, simply double-click the shortcut to start the analyzer in the associated protocol.

Predefined Stacks, Rules and Decoders

Each Datasource type loads all decoders appropriate for that type. All Predefined Stacks and Traversal Rules associated with those decoders are also loaded.

Ethernet selections load the “Ethernet with autotraverse” predefined stack. All rules and Ethernet decoders are also loaded.

Async and sync selections have all predefined stacks available for all appropriate protocols. The stack selected on start up is the one specified by the selection made in the Choose Protocol to Analyze dialog.

Making all appropriate predefined stacks available allows you to switch stacks if you need to after start up.

1.6 NetDecoder Protocol List

In the list below, folder names are in bold type, and protocol shortcuts are in normal type. Selecting any of the protocol shortcuts activates the “Run” button at the bottom of the dialog.

- A folder icon precedes all folder names in the dialog
- An icon precedes all protocol selections in the dialog

See: [Choosing a Protocol](#)

The Protocols available for selection include:

ABB Automation - Use NetDecoder to capture and analyze COMLI communications.

- COMLI

Bristol Babcock - Use NetDecoder to analyze Bristol Babcock network communications.

- BSAP

Building Automation and Control Networks - Use NetDecoder to capture and analyze BACNet communications.

- BACnet MSTP Frame
- BACnet PTP
- BACnet/IP

CC Link - Use NetDecoder to analyze CC-Link network communications

- CC - Link IE
- CC - Link Serial

Controller Area Network (CAN) - Use NetDecoder to analyze CAN network communications.

- CAN 2.0A using SST's interface cards

Distributed Network Protocol - Use NetDecoder to analyze DNP3 network communications.

- DNP3 Ethernet
- DNP3 Serial

Emerson Process Management - Use NetDecoder to capture and analyze Emerson-ROC protocol communications.

- ROC Plus Master
- ROC Plus over Ethernet
- ROC Plus Slave
- ROC Master
- ROC Slave

Ethernet Analyzer - Use NetDecoder to capture and analyze Ethernet communications.

- Ethernet

Generic Asynchronous Serial Protocols - Use NetDecoder to capture and analyze Asynchronous RS-232/422/485 Serial Communications.

- Asynchronous Point-to-Point Protocol
- RS-232 ComProbe II without stack
- RS-422/485 ComProbe without stack
- Serial Line Internet Protocol

International Electrotechnical Commission (IEC) - Use NetDecoder to analyze IEC 60870 networking technologies.

- IEC-60870-5-101
- IEC-60870-5-102
- IEC-60870-5-103
- IEC-60870-5-104

Modbus - Use NetDecoder to analyze any of these Modbus networking technologies.

- ASCII
- 2 Wire
- Master
- Slave
- Modbus TCP

Capture and analyze Modbus TCP communications over Ethernet.

- RTU
- 2 Wire
- Master
- Slave
- TANO

ODVA - Use NetDecoder to analyze these ODVA networking technologies.

- ControlNet using 1784-PCC card
- ControlNet using 1784-U2CN
- DeviceNet using SST's interface cards
- DeviceNet using the 1784-U2DN device
- Ethernet/IP

PROFINET - Use NetDecoder to analyze PROFINET networking technologies.

- PROFINET

Rockwell Allen Bradley - Use NetDecoder to analyze any of these Rockwell Automation networking technologies.

- CSP
- DFI
- Full Duplex
- DF1 Full-Duplex/Radio Modem with BCC
- DF1 Full-Duplex/Radio Modem with CRC

- Half Duplex
- DF1 Half Duplex with BCC
- DF1 Half Duplex with CRC
- DH+ using the 1784-U2DHP Cable
- DH+ with a DHM-3500
- DH+ with Allen Bradley Manchester Decoder
- DH-485

Saia-Burgess S-Bus - Use NetDecoder to analyze S-Bus Protocols, including Parity Mode, Data Mode, and Secure Mode.

- Data Mode
- Parity Mode (RS-232)
- Parity Mode (RS-485)
- Secure Mode

1.7 RS-232 ComProbe II Driver Installation

Note: The following process supposes that NetDecoder has already been installed.

When first connecting the USB ComProbe to your PC you will be directed to install the required Frontline interface driver.

1. Connect the USB cable into the back of the RS-232 ComProbe II.
2. Connect the other end to a USB port on the computer with Frontline software installed.

The Found New Hardware Wizard dialogue box appears which may ask you if you want to connect to Windows Update to search for software.

3. Choose No, not this time and click Next.
4. Choose Install from a list or specific location and click Next.

Now you have to locate the USB driver.

5. Click the Browse button.
6. Locate the directory where you installed NetDecoder (the default is C:\Program Files\Frontline Test System II\NetDecoder [version #]\Drivers\RS-232 ComProbe II)
7. Select the appropriate directory and click OK.
8. Click the Next button to finish the installation.
9. If you get a dialog box indicating that the software has not passed Windows logo test, don't worry—click Continue Anyway.

Your computer will now install the USB ComProbe II driver from the directory you selected; you'll get a dialog box saying that the installation is finished.

10. Click the Finish button to close the wizard.

The installation of the RS-232 ComProbe II driver is now complete. Your computer will remember this USB application. The next time you plug in the RS-232 ComProbe II, it will automatically find the appropriate interface driver.

Chapter 2 NetDecoderAsync Configuration Settings

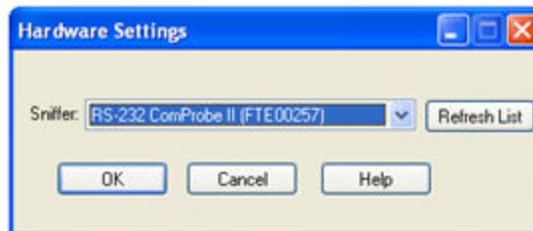
2.1 Hardware Settings

2.1.1 NetDecoderAsync Hardware Settings

The **Hardware Settings** dialog is used to select a device to sniff/scan.

To access the **Hardware Settings** dialog:

1. Select **Hardware Settings** from the **Options** menu on the Control window.



NetDecoderAsync Hardware Settings Dialog

Note: This dialog is used for both RS-232 and RS 422/485.

2. Select a device from the drop-down list.
3. Select OK.

If no devices are found, the list will be blank. You can also select **Refresh List** to make sure the list is complete.

2.1.2 CC-Link Hardware Settings

When establishing CC-Link settings, if you have multiple ComProbes you must select which device to sniff. You do that with **CC-Link Hardware Settings**.

Note: We do not recommend running more than one CC-Link sniffing session at a time on the same PC. CC-Link runs at a maximum baud rate of 10 Mbps. At that rate the PC will have significant performance issues while trying to capture data from multiple CC-Link ComProbes.

1. Connect the CC-Link ComProbe to an available USB port.
2. Start the analyzer.
3. Select Hardware Settings from Options menu on the Control Window.

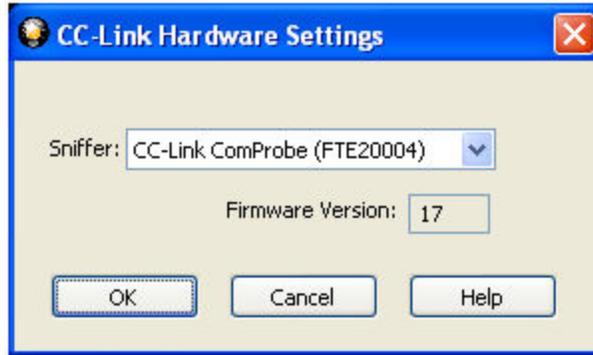


Figure 2.1 - **CC-Link Hardware Settings** Dialog

4. Choose a ComProbe device to use from the drop-down list. If you have only one ComProbe connected to your PC, that device is used automatically and you don't need to select it.
5. Select OK to save the settings, Cancel to close the dialog without saving the settings, or Help to access the electronic help file.

2.2 I/O Settings

2.2.1 Bit Order

Choose LSB (least significant bit) first or MSB (most significant bit) first. LSB first is normal, while MSB first is considered "reversed" from normal. This option reverses the order of the bits within each byte.

All options on the I/O Settings window are valid when in MSB mode except for parity. The parity must be None when using MSB bit order.

Bit reversal occurs when monitoring and transmitting data. For example, if the analyzer is monitoring data in LSB mode and sees 0000 0001 on the circuit, it displays this as hex 01. In MSB mode, the analyzer reverses the order of the bits as they come in and display this byte as 1000 0000, or hex \$80.

When transmitting data, the analyzer reverses the bits before they are sent out over the circuit. For example, if you are transmitting data in LSB mode and you enter the pattern \$01, the analyzer sends out 0000 0001. If you are transmitting in MSB mode and you enter the pattern \$01, the analyzer bit reverses this and transmit 1000 0000.

The analyzer remembers what bit order was used to capture the data with. If you create a capture file with the bit order set to MSB, the data always is displayed in that form.

If you are monitoring HDLC or SDLC data and the bit order is set to MSB, it is probable that the CRC's is not calculated correctly.

2.2.2 Selecting a Custom Protocol Stack

To change the protocol stack:

1. Click on the Custom Protocol Stack button  to start the [Protocol Stack Wizard](#).

If you are capturing framed data but did not select a protocol stack before capturing, your data needs to be framed. To frame your data, complete the following steps:

1. Select a protocol stack.
2. Go to the Control window and choose Reframe from the File menu. See [Reframing a Function](#) for more information.

2.2.3 I/O Settings Dialog in Capture File Viewer

The I/O Settings dialog only appears when viewing serial data. It displays the settings that were in effect when the file was captured. The window looks different depending on whether you are viewing asynchronous or synchronous data.

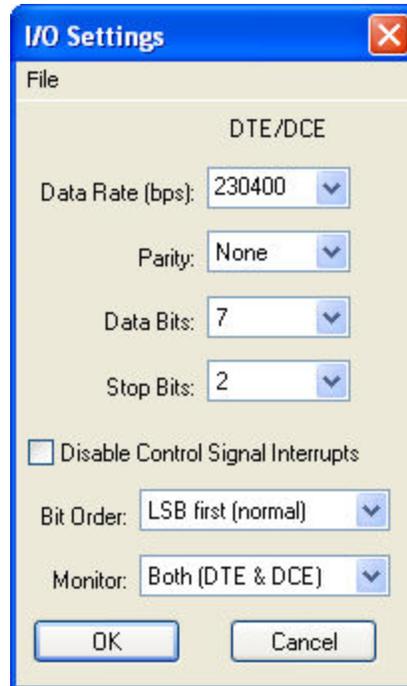
When using capture file viewer, the I/O Settings dialog is grayed out except for the Custom Protocol Stack button and the Names button.

The analyzer knows which protocols were used when the file was captured, and automatically decodes the data in the file according to those protocols. If you need to change the protocol, click the Custom Protocol Stack button to [create a custom stack](#).

Click the Names button to [change the labels](#) for errors, control signals and the sides displayed in the other windows of the analyzer.

2.2.4 RS-232 ComProbe II I/O Settings

Before you can begin capturing data, you must set the data rate and several other variables. You provide this information in the I/O Settings window.



RS-232 ComProbe II I/O Settings Dialog

1. Click on the I/O Settings icon  on the Control window toolbar, or choose **I/O Settings** from the **Options** menu.
2. For the **Data Rate (bps)**, select a rate from 300 to 921,600 or enter a unique data rate up to 954,861.

I/O Settings Options

Option	Selections
Data Rate (bps)	Select a rate from 300 to 921,600 or enter a unique data rate up to 954,861.
	Data Rates supported
	300 - 220000
	220353 - 238715
	240385 - 260416
	264424 - 286458
	293804 - 318287
	330529 - 358072
	377748 - 409226
	440706 - 477430
	528847 - 572916
	661058 - 716145
	881411 - 954861
Parity	None (Default)
	Odd
	Even
	Mark
Data Bits	5
	6
	7
	8 (Default)
Stop bits	2
	1.5
	1 (Default)
Disable Control Signal Interrupts	Active when checked.
Monitor	Capture DTE (Data Terminal Equipment)
	Capture DCE (Data Communications Equipment)
	Both (DTE & DCE)

Click the **OK** button when finished configuring the ComProbe.

Once you have configured the I/O Settings, you can save those settings. [Click here to see how to save configuration settings.](#)

2.2.5 Defining RS-232 ComProbe I/O Settings

Before you can begin capturing data, you must set the data rate and several other variables. You provide this information in the I/O Settings window.

1. Click on the I/O Settings icon  on the Control window toolbar, or choose **I/O Settings** from the **Options** menu.
2. In the Operating Mode box, choose Monitor Both. If you want to transmit data, select either Source DTE or Source DCE.
3. If your circuit is asynchronous, set your Communication Mode to Async.
4. If your circuit is synchronous, set the Communication Mode to either Sync (NRZ External Clock) or Sync (NRZI External Clock). Do not choose Internal Clock when monitoring synchronous data. Set the Sync Mode to Monosync, Bisync, or HDLC/SDLC. Choose HDLC/SDLC if you are monitoring HDLC, SDLC, Frame Relay or other protocol that uses hex 7e as the framing byte. If your circuit is Monosync or Bisync, you also need to set the parity and sync characters, and tell Frontline when to strip sync characters and when to drop sync.
5. Set the baud, parity, word length and stop bits to the correct settings for both sides of the circuit.
6. [optional] Click the Custom Protocol Stack button to select a protocol stack. Select the correct stack (stacks are usually named by their base layer) and click Finish. To set up a stack not listed, select the "Build Your Own" option from the top of the list and click Next. For more information on how to set up a custom stack see [Creating and Removing a Custom Stack](#).
7. Click the Close button on the I/O Settings window.

2.2.6 CC-Link I/O Settings

The I/O Settings dialog is used to set the data rate for a CC-Link device.

1. Connect the CC-Link ComProbe[®] to an available USB port.
2. Start the analyzer.
3. Select I/O Settings from the Options menu on the Control Window.

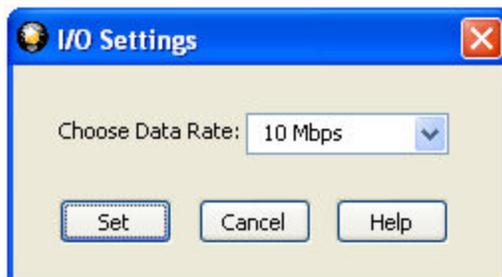


Figure 2.2 - CC-Link I/O Settings Dialog

4. Select a data rate from the drop-down list.

The options conform to standard CC-Link Baud Rates and include:

- 156 Kbps
 - 625 Kbps
 - 2.5 Mbps
 - 5 Mbps
 - 10 Mbps
5. Select **Set** to save the rate, **Cancel** to close the dialog without saving the rate, or **Help** to access the electronic help file.

2.2.7 Saving Configurations

2.2.7.1 Saving a Configuration to a File

1. Set up your configuration on the I/O Settings window.
2. If a configuration is already open and you have altered it, go to the File menu and choose Save As; otherwise, click on the Save Settings icon.
3. In the File name box, type a name for your configuration. You do not need to add an extension. the system adds a .cfg extension automatically.
4. By default, the analyzer saves the configuration in the My Configurations directory. Choose a different directory to save the configuration elsewhere. Click here to see how to change the default location for configurations.
5. Click on Save.

If you make a new configuration and do not save it, the system asks you if you want to save your configuration when you exit the program. If you want to save your configuration, choose Save and the Save File dialog box appears. If you do not want to save your configuration, choose Cancel.

2.2.7.2 Opening a Saved Configuration File

1. Click on the Open Configuration icon, or choose Open Configuration from the File menu on the I/O Settings dialog. If other configurations have been used recently, a menu listing the last four configurations used is displayed.
2. Select a recent configuration file, or choose Open to load an unlisted configuration.
3. If you have saved your configurations in the default directory, they are listed in the window. Choose a different directory if your configurations are saved elsewhere.
4. Select the configuration you want to use, and click on Open.

Configurations are saved with a .cfg extension, and are located in the C:\Program Files\Common Files\FTE\My Configurations directory by default.

The name of the open configuration file is displayed at the top of the Set I/O Configuration window. If no configuration file is open, "Untitled" is displayed.

2.2.7.3 Saving I/O Settings configurations for RS-422/485 ComProbe

Saving a new configuration

If you have never saved the I/O Settings configuration before:

1. Make [changes to the existing settings](#) on the I/O Settings window.
2. Select Save from the File menu.
3. In the File name box, type a name for your configuration. You do not need to add an extension. the system adds a .cfg extension automatically.
4. By default, the analyzer saves the configuration in the My Configurations directory. Choose a different directory to save the configuration elsewhere. [Click here](#) to see how to change the default location for configurations.
5. Click on Save.

2.2.7.4 Saving an existing configuration:

1. Make [changes to the existing settings](#) on the I/O Settings window.
2. Select Save from the File menu.

Saving a configuration with a new file name:

1. Make [changes to the existing settings](#) on the I/O Settings window.
2. Select Save As from the File menu.
3. In the File name box, type a name for your configuration. You do not need to add an extension. the system adds a .cfg extension automatically.
4. By default, the analyzer saves the configuration in the My Configurations directory. Choose a different directory to save the configuration elsewhere. [Click here](#) to see how to change the default location for configurations.
5. Click on **Save**.

If you make a new configuration and do not save it, the system asks you if you want to save your configuration when you exit the program. If you want to save your configuration, choose Save and the Save File dialog box appears. If you do not want to save your configuration, choose Cancel.

2.2.8 NetDecoder - RS-232 ComProbe II Setup (USB Interface)

The NetDecoder analyzer is moving to the RS-232 ComProbe II, which is a USB flash drive sized interface to a PCs USB port. With the ComProbe II you do not lose timing and control signal information.

Monitoring serial communications by NetDecoder analyzer is passive. Some serial analyzers receive the data from one side of the circuit under test and retransmit it to the other side. NetDecoder does not work that way. NetDecoder taps the circuit under test using a simple "Y" cable and there are no active electronics inserted into the communication path.

To assist customers in tapping into Async RS-232 bus configurations, Frontline provides customers with a lot of flexibility to address different monitoring situations. The RS-232 ComProbe II can be used directly in-line, or

connected via a combination of a provided Y-cable and/or an RS-232 extension cable. Some monitoring situations may require a pair of 25-pin to 9-pin adapters.

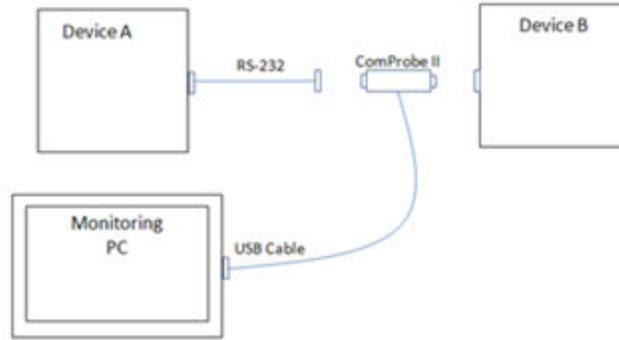


Figure 2.3 - Monitoring Connection Option 1 – ComProbe II Only

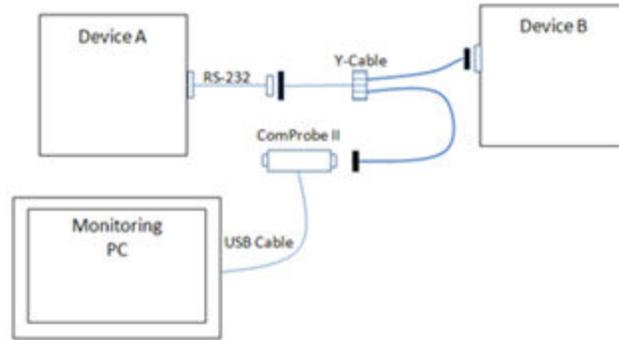


Figure 2.4 - Monitoring Connection Option 2 – ComProbe II with Y-Cable

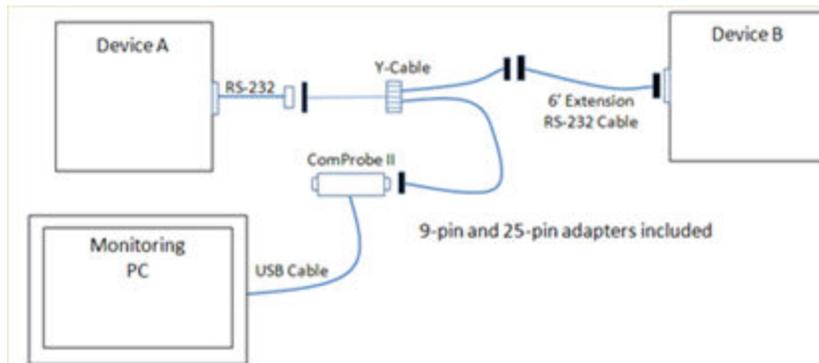


Figure 2.5 - Monitoring Connection Option 3 – ComProbe II with Y-Cable and Extension

2.2.9 Port Assignments: Adding and Changing

TCP and UDP are Transport layer protocols in the IP protocol suite. These transport layer protocols use ports to establish communication between application layer protocols. For example, all Web traffic uses the HTTP protocol. HTTP is an application layer protocol that uses the standard TCP/UDP port 80. The Internet Assigned Numbers Authority (IANA) is responsible for maintaining the list of standard port numbers and their assignments. For an up-to-date listing of all standard TCP/UDP port assignments, visit www.iana.org.

When the analyzer reads a TCP, UDP or IPX packet, it infers the upper layer protocols by using pre-defined rules of traversal. For example, if the packet has a TCP source or destination port number 80, then the upper layer protocol is HTTP. These rules, which are built in to the software, determine the upper layers of the protocol stack based on the source or destination port numbers in the packet. The built-in rules are based on the standard port assignments. However, it is quite common to come across network systems in which upper layer protocols use user-defined port numbers for both standard and custom protocols. In such cases, the analyzer users can tell the software which port numbers are assigned to which protocols.

The analyzer autotraverses the stack from TCP, UDP and IPX based on the source or destination port number. Many systems use user-defined port numbers for both standard and custom protocols. Here's how to tell the analyzer about a custom port assignment on the system you are monitoring.

Add a New Port Assignment

1. Choose **Set Initial Decoder Parameters** from the **Options** menu on the Control  window.
2. Click the **TCP** tab (or UDP or IPX for those protocols).
3. Choose the **Single Port** radio button
4. Enter the port number in the **Port Number** box.
5. In the **Protocol** drop-down list, choose the protocol to traverse to.
6. Click the **Add** button.

The system adds the new entry to the bottom of the port number list.

Modify an Existing Port Assignment

1. Choose **Set Initial Decoder Parameters** from the **Options** menu on the Control window.
2. Click the **TCP** tab (or UDP or IPX for those protocols).
3. Select (click on and highlight) the port assignment to modify.
4. Change the port number and/or choose the protocol to traverse to.
5. Select the **Port Range** radio button and specify the starting and ending port numbers. The range is inclusive.
6. Click the Modify button.

The system displays the changes in port assignment.

Delete a Port Assignment

1. Choose **Set Initial Decoder Parameters** from the **Options** menu on the Control window.
2. Click the **TCP** tab (or UDP or IPX for those protocols).
3. Select (click on and highlight) the port assignment to delete.
4. Select **Delete**. The system deletes the port assignment.

Move a Port Assignment

If you need to move an entry to ensure it is processed before or after another entry, select the entry in the list and then click the **Move Up** or **Move Down** buttons.

Two considerations are:

- The analyzer traverses an entry if either the source or destination port match.
- The analyzer processes port number entries in order from top to bottom.

2.2.10 Using the Node Database Manager

Modbus TCP and ROC Plus over Ethernet protocols are designed around a Master-Slave communication model. In order to correctly decode these protocols, the analyzer needs to know which IP addresses are Master devices and which IP addresses are Slave devices. When the analyzer reads an IP packet from the wire, it automatically decodes the IP addresses in the packet. However, it is not always possible to automatically determine whether a particular IP address is a Master device or a Slave device. For such cases, the software provides an interface that allows the user to define the IP addresses and node types (Master or Slave) of devices on their network. This information about the nodes and their roles are stored in a node database.

Node Assignment: The process of designating a particular IP address as either Master or Slave device (on a Modbus TCP or ROC Plus over Ethernet network) is called node assignment. For example, in a Modbus TCP network, a node with the IP address 192.168.0.2 could be the Master device and a node with the IP addresses 192.168.0.8 could be the Slave device.

Templates: The software allows the user to define any number of IP Addresses and Node Type combinations and save them in a Template for later use. The Template function lets you create multiple templates that contain different node assignments. This capability allows the user to maintain individual templates for each network that is being monitored.

2.2.10.1 Selecting and Applying a Node Assignment Template

This procedure demonstrates how to select and apply a Node Assignment Template. A template is a collection of node assignments required to completely decode communications between multiple devices.

[To learn more about node assignments and templates, go here.](#)

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.
2. Click on the tab of the desired protocol (Modbus TCP or ROC Plus over Ethernet).

The dialog displays the most recently selected template and the associated node assignments in the middle of the dialog. If the template displayed is the desired template, then skip to step 4. If it is not, then continue with step 3.

3. If you want to select a different another template, then click the **Open File** icon and select the desired template from the Popup list.



4. Click the **OK** button to apply the selected template and exit the **Set Initial Decoder Parameters** dialog.

2.2.10.2 Adding a Node Assignment Template

This procedure adds a Node Assignment Template to the system and saves it for later use. A template is a collection of node assignments required to completely decode communications between multiple devices.

[To learn more about node assignments and templates, go here.](#)

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.

2. Click on the tab of the desired protocol (Modbus TCP or ROC Plus over Ethernet).

The dialog displays the most recently selected template and the associated node assignments in the middle of the dialog.

3. Click the **Reset to Defaults**  icon at the top of the dialog to clear the list.

4. Enter the IP Address in the **IP Address** text box.

5. Select the **Node Type**.

6. Click the **Add** button above the list.

The system displays the new node assignment in the list window. Repeat steps 4 and 5 until all desired node assignments are added.

7. Click the Save icon at the top of the dialog to display the **Template Manager** dialog.

8. Enter a name for the new template

9. Click **OK**.

The system saves the template and closes the **Template Manager** dialog.

10. Click the **OK** button on the **Set Initial Decoder Parameters** dialog to apply the template and close the dialog.

2.2.10.3 Deleting a Node Assignment Template

This procedure deletes a Node Assignment Template from the system. A template is a collection of node assignments required to completely decode communications between multiple devices.

[To learn more about node assignments and templates, go here.](#)

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.
2. Click on the tab of the desired protocol (Modbus TCP or ROC Plus over Ethernet).
The dialog displays the most recently selected template and the associated node assignments in the middle of the dialog.
3. Click the Delete Template  icon at the top of the dialog.
The system displays the **Delete** dialog with a list of saved templates.
4. Select (click on and highlight) the template marked for deletion
5. Click the **Delete** button on the **Delete** dialog.
The system removes the selected template from the list of saved templates.
6. Click the **Ok** button on the **Delete** dialog to complete the deletion process and close the **Delete** dialog.
7. Click the **Ok** button on the **Set Initial Decoder Parameters** dialog to apply the deletion and close the dialog.

2.2.10.4 Adding a Node Assignment

This procedure adds one or more node assignments to an existing Node Assignment Template.

[To learn more about node assignments and templates, go here.](#)

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.
2. Click on the tab of the desired protocol (Modbus TCP or ROC Plus over Ethernet).

The dialog displays the most recently selected template and the associated node assignments in the middle of the dialog.

3. If you want to add the node assignment to a different another template, then click the **Open File** icon and select the desired template from the popup list.



4. Enter the IP Address in the **IP Address** text box.
5. Select the **Node Type**.
6. Click the **Add** button above the list.
The system displays the new node assignment in the list window.

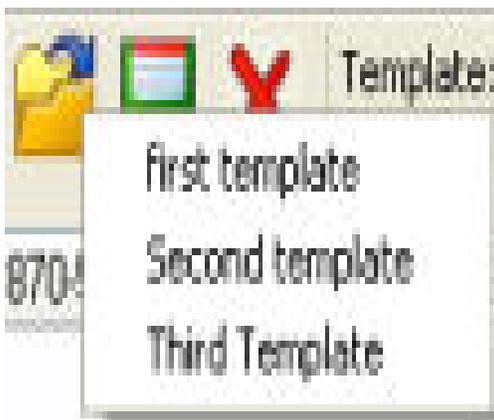
7. Repeat steps 4, 5, and 6 until all desired node assignments are added.
8. Click the Save icon at the top of the dialog to display the **Template Manager** dialog.
9. Ensure that the name of the template is listed in the **Name to Save Template As** text box and click **OK**.
The system displays a dialog asking for confirmation of the change to the existing template.
10. Click the **Yes** button.
The system saves the new node assignment to the template and closes the **Save As** dialog.
11. Click the **OK** button on the **Set Initial Decoder Parameters** dialog to apply the template and close the dialog.

2.2.10.5 Modifying a Node Assignment

This procedure modifies a node assignments to an existing Node Assignment Template.

[To learn more about node assignments and templates, go here.](#)

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the Set Initial Decoder Parameters dialog.
2. Click on the tab of the desired protocol (Modbus TCP or ROC Plus over Ethernet).
The dialog displays the most recently selected template and the associated node assignments in the middle of the dialog.
3. If the node assignment you want to modify is in another template, then click the Open File icon and select the desired template from the popup list.



4. Edit the IP Address in the **IP Address** text box and/or Select the **Node Type**.
5. Click the **Modify** button above the list.
The system displays the modified node assignment in the list window. Repeat step 4 until all desired node assignments are modified.
6. Click the Save icon at the top of the dialog to display the **Template Manager** dialog.

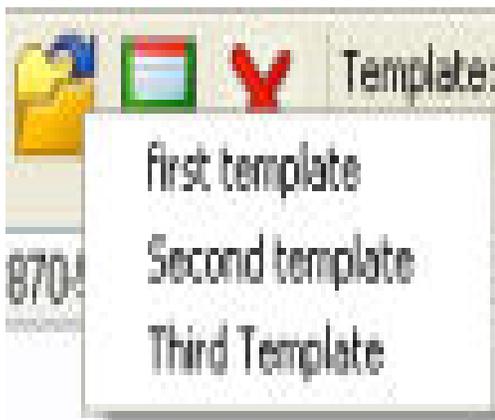
7. Ensure that the name of the template is listed in the **Name to Save Template As** text box and click **OK**.
The system displays a dialog asking for confirmation of the change to the existing template.
8. Click the **Yes** button.
The system saves the new node assignment to the template and closes the **Save As** dialog.
9. Click the **OK** button on the Set Initial Decoder Parameters dialog to apply the template and close the dialog.

2.2.10.6 Deleting a Node Assignment

This procedure deletes a node assignments from an existing Node Assignment Template.

[To learn more about node assignments and templates, go here.](#)

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.
2. Click on the tab of the desired protocol (Modbus TCP or ROC Plus over Ethernet).
The dialog displays the most recently selected template and the associated node assignments in the middle of the dialog.
3. If the node assignment you want to delete is in another template, then click the Open File icon and select the desired template from the Popup list.



4. Select (click on and highlight) the node assignment that you want to delete.
5. Click the **Delete** button above the list.
The system removes the selected node assignment from the list. Repeat steps 4 and 5 until all desired node assignments are deleted.
6. Click the Save icon at the top of the dialog to display the **Template Manager** dialog.
7. Ensure that the name of the template is listed in the **Name to Save Template As:** text box and click **OK**.
The system displays a dialog asking for confirmation of the change to the existing template.

8. Click the **Yes** button.

The system saves the changes to the template and closes the **Save As** dialog.

9. Click the **OK** button on the Set Initial Decoder Parameters dialog to apply the template and close the dialog.

2.2.11 Decoder Parameters

Some protocol decoders have user-defined parameters. These are protocols where some information cannot be discovered by looking at the data and must be entered by the user in order for the decoder to correctly decode the data. For example, such information might be a field where the length is either 3 or 4 bytes, and which length is being used is a system option.

If you have decoders loaded which require decoder parameters, a window with one tab for every decoder that requires parameters appears the first time the decoder is loaded.

For help on setting the parameters, click the Help button on each tab to get help information specific to that decoder.

If you need to change the parameters later,

- Choose **Set Initial Decoder Parameters** from the **Options** menu on the Control or **Frame Display** windows.
- Each entry in the **Set Initial Decoder Parameters** dialog takes effect from the beginning of the capture onward or until redefined in the **Set Subsequent Decoder Parameters** dialog.

The **Set Subsequent Decoder Parameters** dialog allows the user to override an existing parameter at any frame in the capture where the parameter is used.

If you have a parameter in effect and wish to change that parameter

- Select the frame where the change should take effect
- Select Set Subsequent Decoder Parameters from the Options menu, and make the needed changes.
- Each entry in the Set Subsequent Decoder Parameters dialog takes effect from the specified frame onward or until redefined in this dialog on a later frame.

If you do not have decoders loaded that require parameters, the menu item does not appear and you don't need to worry about this feature.

2.2.11.1 Decoder Parameters for IEC 60870-5-101/-102/-104 Protocols

Note: These instructions apply to IEC 60870-5-101, IEC 60870-5-102 and IEC 60870-5-104 protocols only. IEC 60870-5-103 does not require any additional setup. For the remainder of the setup instructions, IEC 60870-5-101, IEC 60870-5-102 and IEC 60870-5-104 are referred to as simply IEC 60870.

Decoder Parameters

An interesting attribute of IEC 60870 is that the sizes of certain fields and the mode of transmission (balanced or unbalanced) must be specified by the user. Such values are called decoder parameters. Decoder parameters are

set by the user in the Decoder Parameters window. To open this window, choose **Set Initial Decoder Parameters** from the **Options** menu on the Control window.

This window pops up automatically the first time that a capture file is loaded. The two tabs are titled "[protocol] Application Layer" and "[protocol] Link Layer" where "[protocol]" refers to the specific protocol.

IEC 60870-5-101 & IEC 60870-5-104 Application Layer Parameters

- "Does Originator Address exist?" specifies whether the application layer "Originator Address" field exists. Permissible values are Yes and No. The field is 1-byte long if it exists.
- "Size of the ASDU address field in bytes" specifies the number of bytes in the application layer "ASDU Address" field. The permissible range is 1-2.
- "Size of info object address" specifies the number of bytes in the application layer "Information Object Address" field. The permissible range is 1-3.

IEC 60870-5-102 Application Layer Parameters

- "Size of the Integrated Total address field in bytes" specifies the number of bytes in the application layer "ASDU Address" field. The permissible range is 1-2.

IEC 60870-5-101 & IEC 60870-5-102 Link Layer Parameters

- "Is transmission balanced?" specifies whether transmission is balanced or unbalanced.
- Permissible values are Yes and No.
- Balanced transmission mode is when two devices can both send at the same time.
- Unbalanced transmission mode is when only one device can send at a time.
- In the decode, three fields are affected by the transmission mode, and all are in the control byte of the link layer.
 - Bit 8 is labeled "Direction" in balanced mode and "Reserved" in unbalanced mode.
 - Bit 6 for secondary-to-primary is labeled "Reserved" in balanced mode and "Access Demand for Class 1 Data Transmission" in unbalanced mode. (For primary-to-secondary, the label is always "Frame Count Bit" regardless of transmission mode.)
 - Bits 1-4 are always labeled "Function Code", but have different values for balanced mode versus unbalanced mode.
- "Size of the address field in bytes" specifies the number of bytes in the link layer "Address" field. The permissible range for the protocol itself is 0-2 in balanced mode and 1-2 in unbalanced mode, but the dialog accepts a range of 0-2 regardless of mode.

2.2.11.2 About ROC Decoder Parameters

There may be times when the context for decoding a frame is missing. For example, if the analyzer captured a response frame, but did not capture the command frame, then the decode for the response may be incomplete. The **Set Initial Decoder Parameters** dialog provides a means to supply the context for any frame. The system allows the user to define any number of parameters and save them in Parameter Templates for later use.

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.

For more on setting parameters, see [Selecting and Applying a ROC Parameter Template](#).

The Parameter Template function provides the capacity to create multiple Parameter Templates that contain different parameters. This capability allows the user to maintain individual Parameter Templates for each Remote Operations Controller (ROC) network monitored. Applying a Parameter Template containing only those parameters necessary to decode transmissions particular to an individual network, enhances the efficiency of the analyzer to decode data.

Each entry in the Set Initial Decoder Parameters dialog takes effect from the beginning of the capture onward or until redefined in the Set Subsequent Decoder Parameters dialog.

The **ROC Set Initial Decoder Parameters** dialog requires the following user inputs to complete a parameters:

Device Address

- Device Address Complete the following fields to identify the device address:
 - Unit - The 1-byte unit code of the individual device
 - Group - The 1-byte group code of the group that contains the individual device identified in the "Unit" field
 - Device - Type Select the device type from the following:
 - FlashPAC
 - FloBoss 2xx
 - FloBoss 407
 - FloBoss 503
 - FloBoss 504
 - RegFlo 2xx
 - ROC 809
 - ROCPAC

Sort and order the parameters list using the Sort Order and Sort Direction drop down fields at the top of the dialog.

2.2.11.2.1 Adding a ROC Parameter Template

This procedure adds a Parameter Template to the system and saves it for later use. A Parameter Template is a collection of parameters required to completely decode communications between multiple devices. To add a parameter to an existing Parameter Template, see [Adding a Parameter](#).

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.
2. Click on the **ROC** tab.

The dialog displays the most recently selected Parameter Template content in the list at the bottom of the tab.

3. Click the Reset to Defaults icon at the top of the dialog to clear the list.
4. Enter the Device Address as follows:
 - Enter the 1-byte unit code of the individual device in the Unit field
 - Enter the 1-byte group code of the group that contains the individual device identified in the "Unit" field in the Group field
 - Select the Device Type from the list
5. Click the Add button

The system displays the new parameter in the list at the bottom of the tab. Repeat steps 4 and 5 until all desired parameters are added.

6. Click the Save icon at the top of the dialog to display the **Save As** dialog.
7. Enter a name for the new Parameter Template and click **OK**.

The system saves the Parameter Template and closes the **Save As** dialog.

8. Click **OK** button on the **Set Initial Decoder Parameters** dialog to apply the Parameter Template and close the dialog.

2.2.11.2.2 Selecting and Applying a ROC Parameter Template

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.

2. Click on the **ROC** tab

The dialog displays the content of the most recently selected Parameter template in the list at the bottom of the tab. If the Parameter Template displayed is the desired Parameter Template, then skip to step 4. If it is not, then continue with step 3.

3. Click the Open File icon at the top of the dialog and select the desired Parameter Template from the popup list.

The system displays the content of the selected Parameter Template in the list at the bottom of the dialog.

4. Click the **OK** button to apply the selected Parameter Template and exit the **Set Initial Decoder Parameters** dialog.

2.2.11.2.3 Deleting a ROC Parameter Template

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.

2. Click on the **ROC** tab.

The dialog displays the most recently selected Parameter Template content in the list at the bottom of the tab.

3. Click the Delete icon at the top of the dialog.

The system displays **Delete** dialog with a list of saved Parameter Templates.

4. Select (click on and highlight) the Parameter Template marked for deletion and click the **Delete** button on the **Delete** dialog.
5. The system removes the selected Parameter Template from the list of saved Parameter Templates.
6. Click the **OK** button on the **Delete** dialog to complete the deletion process and close the **Delete** dialog.
7. Click the **OK** button on the Set Initial Decoder Parameters dialog to apply the deletion and close the dialog.

2.2.11.2.4 Adding an ROC Parameter

This procedure adds one or more parameters to an existing Parameter Template. To create a new Parameter Template, see [Adding a Parameter Template](#).

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.

2. Click on the **ROC** tab.

The dialog displays the most recently selected Parameter Template content in the list at the bottom of the tab. If the parameter must reside in another Parameter Template, then click the Open File icon and select the desired Parameter Template from the Popup list.

3. Enter the **Device Address** as follows:

- Enter the 1-byte unit code of the individual device in the Unit field
- Enter the 1-byte group code of the group that contains the individual device identified in the "Unit" field in the Group field
- Select the **Device Type** from the list

4. Click the **Add** button

The system displays the new parameter in the list. Repeat steps 3 and 4 until all desired parameters are added.

5. Click the Save icon at the top of the dialog to display the **Save As** dialog.

6. Ensure that the name of the Parameter Template is listed in the **Save As** text box and click **OK**.

The system displays a dialog asking for confirmation of the change to the existing Parameter Template.

7. Click the **Yes** button.

The system saves the new parameter to the Parameter Template and closes the **Save As** dialog.

8. Click the **OK** button on the **Set Initial Decoder Parameters** dialog to apply the Parameter Template and close the dialog.

2.2.11.2.5 Editing a ROC Parameter

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.
2. Click on the **ROC** tab.

The dialog displays the most recently selected Parameter Template content in the list at the bottom of the tab. If the Parameter marked for edit resides in another Parameter Template, then click the Open File icon and select the desired Parameter Template from the Popup list.
3. Double click to select the Parameter marked for edit from the list.

Double clicking the **Connection Statement** populates the edit fields.
4. Edit the values in the fields as needed.
5. Click the **Modify** button above the list
6. Click the Save icon at the top of the dialog to display the **Save As** dialog.
7. Ensure that the name of the Parameter Template is listed in the **Save As** text box and click **OK**.

The system displays a dialog asking for confirmation of the change to the existing Parameter Template.
8. Click the **Yes** button.

The system saves the new Parameter to the Parameter Template and closes the Save As dialog.
9. Click the **OK** button on the **Set Initial Decoder Parameters** dialog to apply the Parameter Template and close the dialog.

2.2.11.2.6 Deleting a ROC Parameter

1. Select **Set Initial Decoder Parameters** from the **Options** menu on the Control  window or the **Frame Display**  window to display the **Set Initial Decoder Parameters** dialog.
2. Click on the **ROC** tab.

The dialog displays the most recently selected Parameter Template content in the list at the bottom of the tab. If the Parameter marked for edit resides in another Parameter Template, then click the Open File icon and select the desired Parameter Template from the Popup list.
3. Select (click on and highlight) the Parameter marked for deletion from the **Initial Connection** list and click the **Delete** button above the list.

The system removes the selected Parameter from the list.
4. Click the Save icon at the top of the dialog to display the **Save As** dialog.
5. Ensure that the name of the Parameter Template is listed in the **Save As** text box and click **OK**.

The system displays a dialog asking for confirmation of the change to the existing Parameter Template.
6. Click the **Yes** button.

The system saves the Parameter Template and closes the Save As dialog.

7. Click the **OK** button on the **Set Initial Decoder Parameters** dialog to apply the Parameter Template and close the dialog.

2.2.12 CAN 2.0 Special Instructions

This section contains hardware and software setup information for using the Frontline NetDecoder to analyze CAN 2.0 networks.

This section contains the setup instructions for CAN 2.0 using the Molex SST-DN4-USB interface card.

2.2.12.1 CAN I/O Device Setup

CAN Device setup configures a specific Molex module to use for the capture.

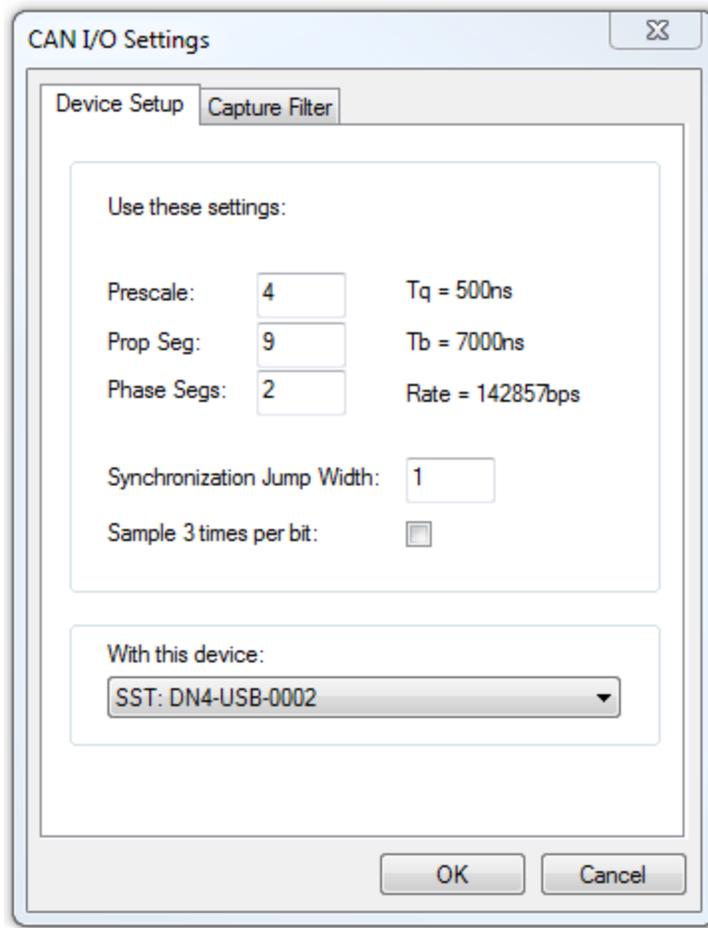


Figure 2.6 - CAN Device Setup

Table 2.1 - CAN I/O Device Setup Fields

Sections	Field	Description
Use These Settings	Prescale	This value is multiplied by the minimum time quantum of 125 nsec to produce the time quantum.
	Prop Seg	This value is multiplied by the time quantum to produce the propagation time segment that compensates for physical network delays.
	Phase Segs	This value is multiplied by the time quantum to produce phase buffer segment 1 and phase buffer segment 2 that may be lengthened or shortened to compensate for phase errors. The nominal bit time is the sum of the synchronization segment (one time quantum), propagation time segment, and phase buffer segments. The nominal bit rate is the inverse of the nominal bit time.
	Synchronization Jump Width	Each bit is sampled at the end of phase buffer segment 1. The synchronization jump width is the number of time quanta by which phase buffer segment 1 is lengthened, or phase buffer segment 2 shortened, to resynchronize upon detection of a phase error.
	Sample 3 times per bit	When checked, this feature enables two additional samples to be taken, one ahead of the normal sample point and one behind it to eliminate detection of false bit values on noisy networks.
With this device	Device drop down list	Select an SST-DN4-USB device from the list of aliases. See Adding SST-DN4-USB Card Alias on page lvi .

2.2.12.2 Capture Filter Toolbar

Toolbar Icons

Icon	Description
	Clears the current filter settings
	Loads a filter from disk
	Saves the current filter to disk
	Opens the Add Message dialog
	Expands all nodes in the filter display
	Collapses all nodes in the filter display

2.2.12.3 CAN I/O Capture Filter Settings

The **CAN I/O Settings Capture Filter** tab displays the CAN node IDs from which NetDecoder will capture data. In this tab CAN IDs can be created, added, and deleted to configure a unique capture scenario. The displayed CAN IDs is the current filter. The user must have prior knowledge of the network CAN node IDs.

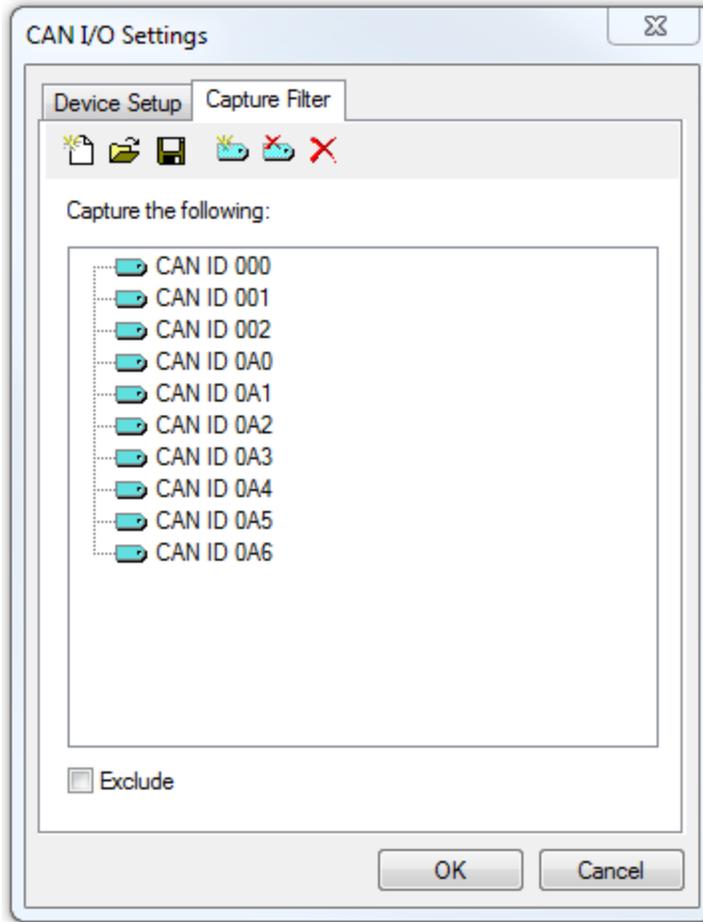


Figure 2.7 - CAN Filter Settings Tab

CAN Filter Toolbar Tools

Tool	Icon	Description
Create Filter		Deletes the currently displayed CAN IDs.
Load Filter		Loads a previously saved filter with the .csFilter file extension.
Save Filter		Saves the current filter to a Windows file with the .csFilter file extension.
Add CAN IDs		Adds one or more CAN IDs to the current filter. The range of IDs is 0x00 to 0xFF
Delete CAN IDs		Delete one or more CAN IDs from the current filter. The range of IDs is 0x00 to 0xFF.
Delete Selected		Delete the CAN ID selected in the current filter.

Create Filter

1. Click on the Create Filter tool . If the current filter has not been saved a warning will appear, otherwise the filter displayed in the **Capture the following:** field is erased. This step must be followed with Load Filter  or Add CAN ID .

Load Filter

1. Click on the Load Filter tool . If the current filter has not been saved a warning will appear, otherwise the loaded filter will overwrite the currently displayed filter.

Save Filter

1. Click on the Save Filter tool . A Windows **Save As** dialog will open.
2. Once the filter is saved, the filter will remain in the **Capture in the following** field.

Add CAN IDs

1. Click on the Add CAN IDs tool . The **ADD CAN IDs** dialog opens.

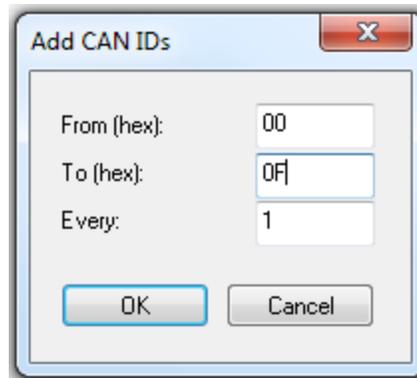


Figure 2.8 - **Add CAN IDs** dialog

2. In the From (hex) field and the To (hex) field, enter a starting node and ending node value from 0x00 to 0xFF in ascending order from start to end. If you are entering only one node enter the same value into both fields.
3. Enter a decimal number in the **Every** field to represent the ID interval. For example, entering "1" will add every ID in the entered range, and entering 2 will enter every other ID beginning at the **From (hex)** field ID, that is, 00, 02, 04,...0E from [Add CAN IDs dialog on page xxxviii](#).
4. Click on OK and all the CAN IDs between and including the ID values in the From and Start fields are added to the **Capture in the following** field.
5. If your filter will not include contiguous CAN IDs, repeat this process for various ranges, or use the Delete CAN ID tool  or the Delete tool  after a contiguous range has been entered to deleted specific IDs.

Delete CAN IDs

1. Click on the Delete CAN IDs tool . The **Delete CAN IDs** dialog opens.

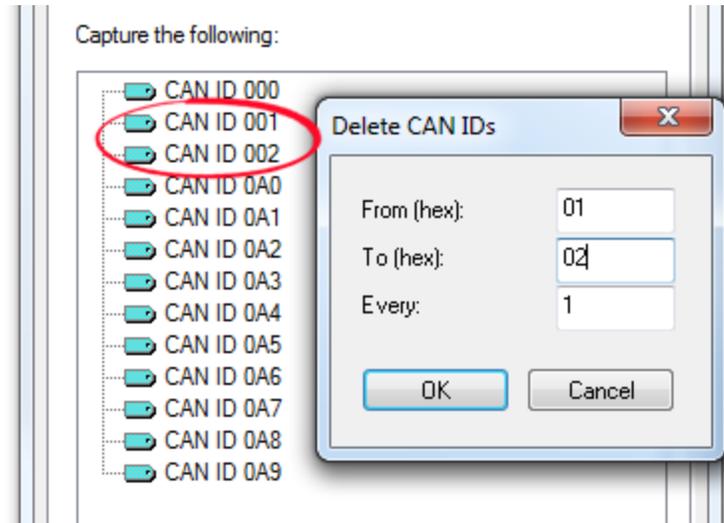


Figure 2.9 - **Add CAN IDs** dialog

2. In the From (hex) field and the To (hex) field, enter a starting node and ending node value from 0x00 to 0xFF in ascending order from start to end. If you are entering only one node enter the same value into both fields.
3. Enter a decimal number in the **Every** field to represent the ID interval. For example, entering "1" will delete every ID in the entered range, and entering 2 will enter every other ID beginning at the **From (hex)** field ID.
4. Click on OK and all the CAN IDs between and including the ID values in the From and Start fields are deleted from the **Capture in the following** field.

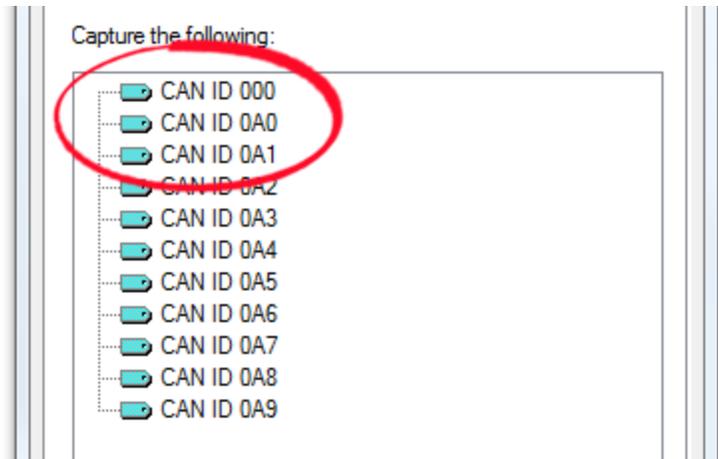


Figure 2.10 - Deleted Can IDs.

Delete Selected

1. Click on a CAN ID in the current filter. Click on the Delete Selected tool . The ID will be erased from the filter list. Because the filter has changed you must save it with the same name or another name.

Using the Filter in a CAN capture

To use the filter in a CAN capture, you must first save the filter, then click on the **OK** button.

All of the CAN IDs in a filter are an inclusive capture. That is, data is captured only from those network nodes listed in the filter and excludes all data from nodes not listed. In a very large network, creating an inclusive filter could be demanding. The **Exclude** checkbox will make the CAN IDs in the filter exclude data from those node and include data from all other nodes.

2.2.12.4 Adding SST-DN4-USB Card Alias

Card aliases are used by an application to access Molex DeviceNet scanner modules. Each DeviceNet channel that exists in a system must be assigned a unique name.

1. From the Window **Start, SST, DeviceNet Software Suite, DeviceNet Remote Diagnostics**.
2. Click on the **Config** tab.

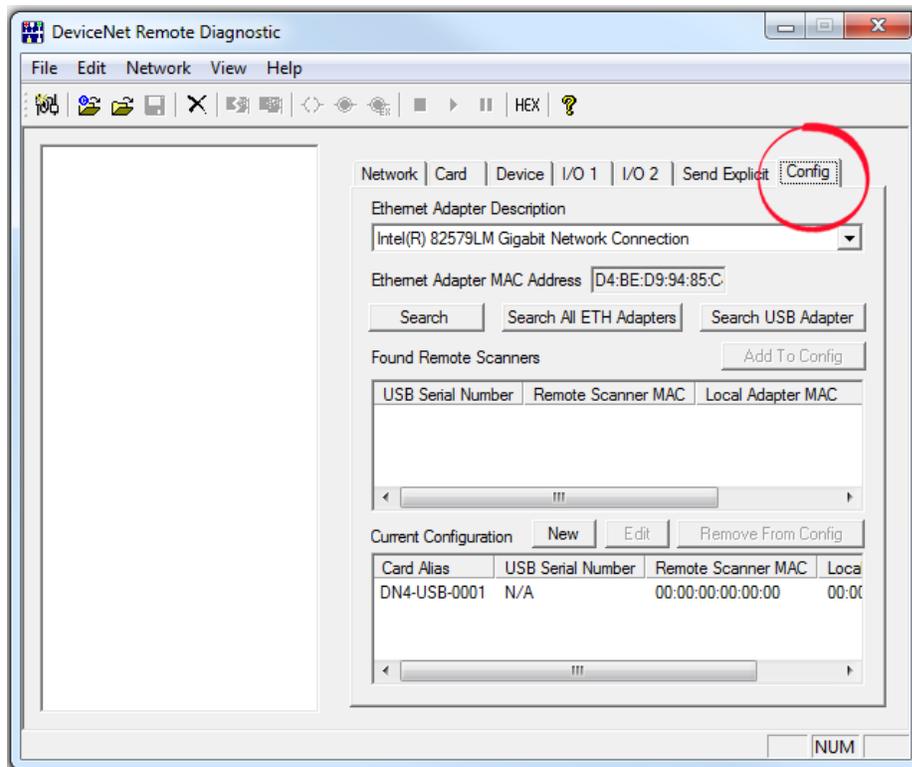


Figure 2.11 - DeviceNet Remote Diagnostics Config Tab.

3. Click on the **Search USB Adapter** button to locate the connected USB scanner.

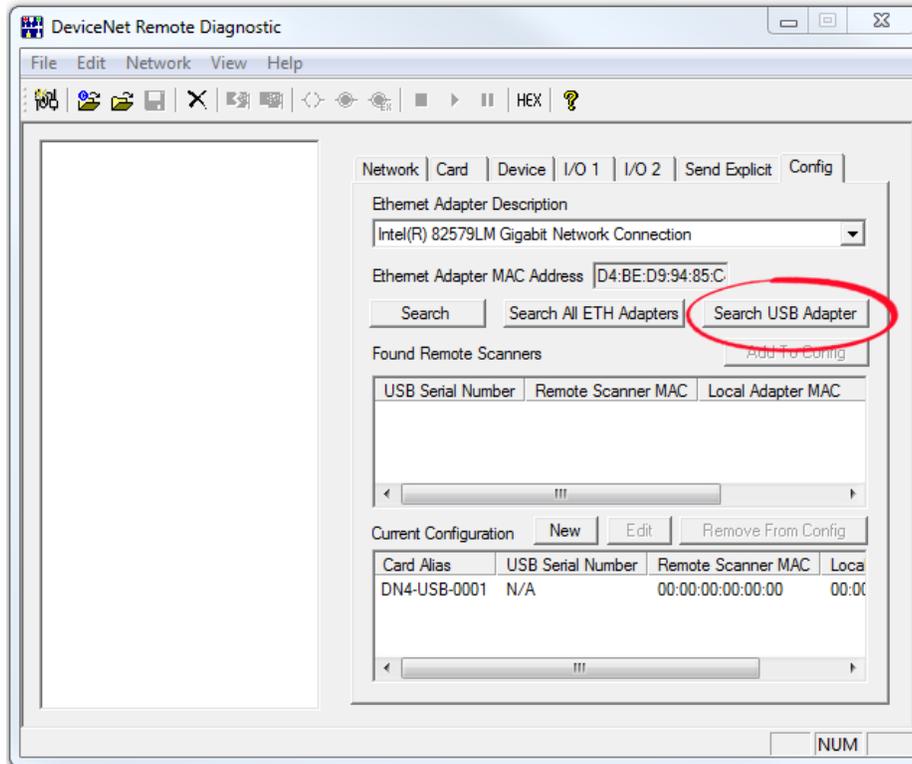


Figure 2.12 - DeviceNet Remote Diagnostics Search USB Adapter

4. In the **Found Remote Scanners** list click on the USB device, and click on the **Add to Config** button.

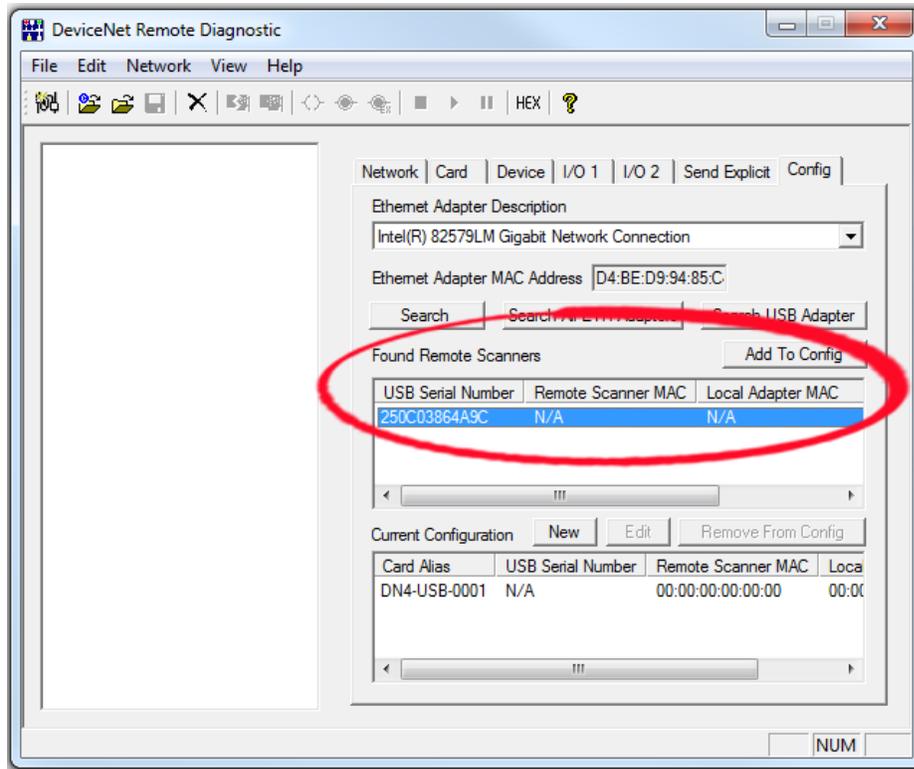


Figure 2.13 - DeviceNet Remote Diagnostics Add to Config

- The **ADD USB Remote Scanner Serial** dialog opens. In the **Card Alias** enter an alias for the connected USB scanner. The alias can be any name. In this example, this is the second DN4-USB to be configured.

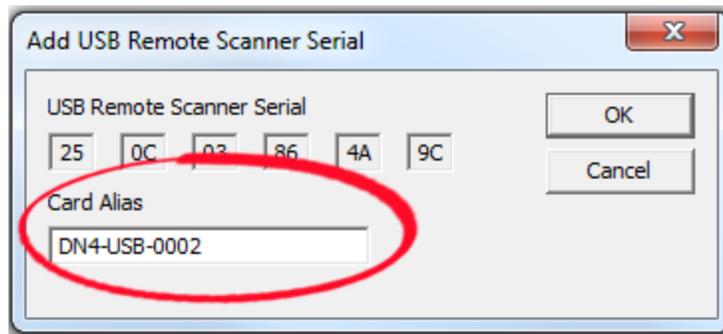


Figure 2.14 - DeviceNet Remote Diagnostics Set Alias

Click the **OK** button when finished and the USB device is added to the **Current Configuration** list.

The SST-DN4-USB is now installed and named on your computer or system and is ready to be used to capture DeviceNet data.

2.2.13 ControlNet Instructions for the 1784-PCC

2.2.13.1 Capturing ControlNet Data

Before you begin, ensure that a 1784-PCC hardware interface card is connected to the analysis computer and that it is connected to the node you wish to monitor.

1. Start the analyzer and select ControlNet from the [Choose Protocol to Analyze](#) dialog.
2. (Optional) Choose **Hardware Settings** from the **Options** menu on the Control window and [check the status](#) of the 1784-PCC card.
3. Choose [I/O Settings](#) from the **Options** menu on the Control window and select the start and stop [triggers](#) or times, and [capture filters](#) to use.
4. Once the start trigger (or time) is detected, data capture begins and continues until the stop trigger (or time) is detected, or the buffer or file becomes full.

2.2.13.2 ControlNet I/O Settings

2.2.13.2.1 ControlNet Hardware Settings

The Hardware Settings display provides the current status of the installed 1784-PCC card in the following fields:

ControlNet Hardware Settings Fields

Filed	
Sniffer Hardware	Identifies the card currently installed. If this field is blank, then no card is installed.
Memory Address	Identifies the dual-port memory address
IRQ Number	Identifies the number of the protocol analyzer application
Card Status	Indicates whether any application has "locked" the card
Application Using the Card	If the card status is "Locked", then this indicates the application using the card.
Firmware Version	Identifies the firmware version of the card

The 1784-PCC card is also used by other applications such as RSLinx. Only one application can have access to the 1784-PCC card at a time. When one of these applications is running, it locks the card and prevents other applications from accessing it.

2.2.13.2.2 ControlNet I/O Settings

Use the I/O Settings  dialog to select a buffer size, set and apply start and stop times or triggers to the capture session, and apply any capture filters to the data on the network. Selections made in the I/O Settings dialog are persistent during the analyzer session, but revert to the defaults when the analyzer is shutdown and re-started. The default settings are 32 Mbyte buffer size, no start or stop triggers selected, and no filters selected.

To Access the I/O Settings Dialog

1. Choose **I/O Settings** from the **Options** menu on the Control window.
2. Select a buffer size from the **BUFFER SIZE** list, or accept the default value.
3. If you want the capture to begin and end based on triggers, then select the start and stop triggers in the **START TRIGGERS** and **STOP TRIGGERS** panes by checking the boxes to the left of the trigger definitions.

If the triggers you want to use are not in the list, then you must define them. See [Defining and Maintaining ControlNet Start and Stop Triggers](#)

For more information on triggers see [About Triggers](#)

4. Select the filters you want to use in the **CAPTURE FILTERS** pane by checking the boxes to the left of the filter definitions.

If the filters you want to use are not in the list, then you must define them. See [Defining and Maintaining ControlNet Capture Filters](#)

5. Click the **OK** button at the bottom of the **I/O Settings** dialog, and start the analyzer.

2.2.13.2.3 Defining and Maintaining ControlNet Start and Stop Triggers

Start and Stop triggers are defined on the frame conditions.

See [About Triggers](#) for more information on making entries in the following dialogs.

Defining a Start Trigger

The screenshot shows a dialog box titled "Set Start Trigger Conditions". It has a blue title bar with a close button (X) in the top right corner. The dialog is divided into three main sections:

- MAC Frame:** A text box labeled "Producer MAC-ID" is currently empty.
- MAC Frame Definition:** This section is divided into two columns of checkboxes:
 - Status:** "Good" (checked), "Bad" (unchecked), "Null" (unchecked).
 - Type:** "Scheduled" (checked), "Unscheduled" (checked), "Moderator" (unchecked).
- L- Packet:** A text box labeled "Prod/Cons MAC ID" is currently empty.

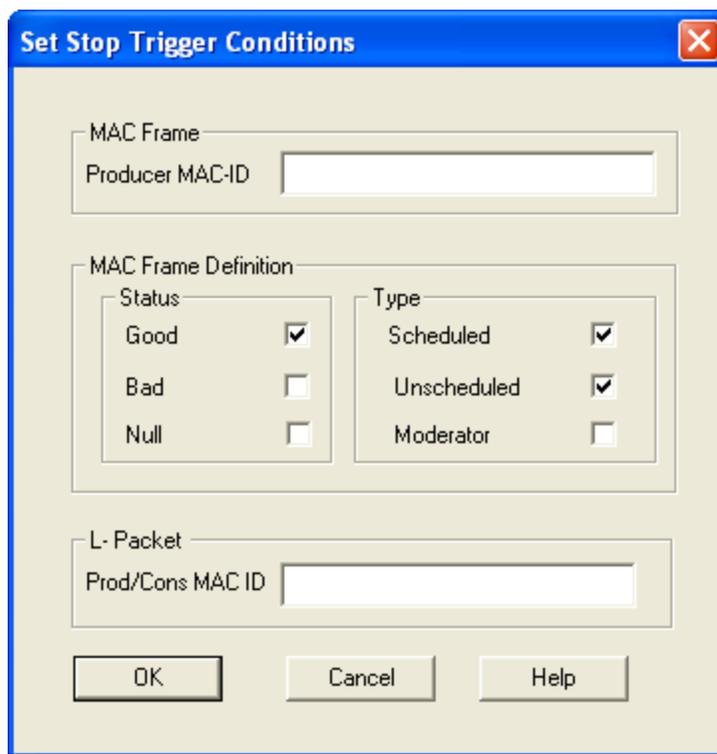
At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help".

Start Trigger Dialog

1. Choose **I/O Settings** from the **Options** menu on the Control window.
2. Click on the **Add Start Conditions** button to display the **Set Start Trigger Conditions** dialog.
3. Enter the **Producer MAC ID** in the **MAC Frame** section. If you do not enter a value or values in this field, the full range (0-255) becomes the default value.
4. Select the **Status** in the **MAC Frame Definition** section. One or more of these statuses may be selected, however, at least one must be selected. **Good** is the default.
5. Select the **Type** in the **MAC Frame Definition** section. One or more of these types may be selected, however, at least one must be selected. **Scheduled** and **Unscheduled** is the default selections.
6. In the **L-Packet** section, enter the **Prod/Cons MAC ID** that you want to trigger in each LPacket . If you do not enter a value or values in this field, the full range (0-255) becomes the default value.
7. Click the **OK** button.

The **Set Start Trigger Conditions** dialog closes and the new start trigger definition appears in the **START TRIGGERS** list on the **I/O Settings** dialog. This start trigger can now be selected and applied to the next capture session.

Defining a Stop Trigger



Stop Trigger Dialog

1. Choose **I/O Settings** from the **Options** menu on the Control window.
2. Click on the **Add** button to the right of the **STOP TRIGGERS** pane in the middle of the **I/O Settings** dialog to display the **Set Stop Trigger Conditions** dialog.
3. Enter the **Producer MAC ID** in the **MAC Frame** section. If you do not enter a value or values in this field, the full range (0-255) becomes the default value.
4. Select the **Status** in the **MAC Frame Definition** section. One or more of these statuses may be selected, however, at least one must be selected. **Good** is the default.
5. Select the **Type** in the **MAC Frame Definition** section. One or more of these types may be selected, however at least one must be selected. **Scheduled** and **Unscheduled** is the default selections.
6. In the **L-Packet** section, enter the **Prod/Cons MAC ID** that you want to trigger in each LPacket . If you do not enter a value or values in this field, the full range (0-255) becomes the default value.
7. Click the **OK** button.

The **Set Stop Trigger Conditions** dialog closes and the new stop trigger definition appears in the **STOP TRIGGERS** list on the **I/O Settings** dialog. This stop trigger can now be selected and applied to the next capture session.

Edit Trigger Definitions

1. Choose **I/O Settings** from the **Options** menu on the Control window.
2. Highlight the trigger you want to change in the list pane.
3. Click the **Edit** button to the right of the list pane with the highlighted trigger definition.
The system displays the appropriate edit screen with the definition of the highlighted trigger.
4. Edit the fields you want to change and click the OK button.

Deleting Trigger Definitions

1. Choose **I/O Settings** from the **Options** menu on the Control window.
2. Highlight the trigger you want to change in the list pane.
3. Click the **Delete** button to the right of the list pane with the highlighted trigger definition.
The system deletes the highlighted trigger from the list.

2.2.13.2.4 About Triggers

In this topic we define in greater detail the inputs to the Start and Stop triggers dialogs. Except for the dialog titles, the Start and Stop trigger dialogs have identical fields and the range of inputs are identical.

Start and Stop triggers are defined on the frame conditions. Selections for frame parameters on which to trigger are outlined in the following table.

Start/Stop Trigger Settings

Setting	Description	Value/Selection
Producer MAC ID¹	A single producer ID	Example: "123" range 0-255
	A group of IDs, separated by a hyphen	Example: "2-88" Values in the range of 0-255
	Multiple IDs separated by a semicolon	Example:: "2;9;27" Values in the range of 0-255
	A group and multiple IDs	Example: "2-7;3;8" Values in the range of 0-255

Start/Stop Trigger Settings (continued)

Setting	Description	Value/Selection
Status Select all that apply	A frame correctly received by the Traffic Analyzer tool.	Good
	The Traffic Analyzer tool has detected a problem with this frame (e.g. a CRC problem).	Bad
	A frame without any data.	Null
Type Select all that apply	Every scheduled node in sequential order is guaranteed one opportunity to transmit. Information that is time-critical is sent during the scheduled part of the interval. The bandwidth is reserved in advance to support real time data transfers. Real time data transfers include: <ul style="list-style-type: none"> • real time control data (I/O updates) • analog data • peer to peer interlocking 	Scheduled
	All nodes transmit on a rotating basis in sequential order. This rotation repeats until the time allocated for the unscheduled portion is used up. The amount of time available for the unscheduled portion is determined by the traffic load of the scheduled portion. ControlNet guarantees at least one node will have the opportunity to transmit unscheduled data every interval. The starting node for each NUT rotates to guarantee each node will have an unscheduled transmit time. The remaining bandwidth supports non time-critical data transfers. Non time-critical data transfers include: <ul style="list-style-type: none"> • connection establishment • peer to peer messaging • programming (uploads and downloads) 	Unscheduled
	The node with the lowest MAC ID (node address) assumes the moderator role. The moderator frame is transmitted to keep the other nodes synchronized. This moderator frame is sent in the guardband.	Moderator
Prod/Cons MAC ID^{1,2}	A single producer/consumer ID	Example: "123" range 0-255
	A group of IDs, separated by a hyphen	Example: "2-88" Values in the range of 0-255
	A group and multiple IDs	Example: "2-7;3;8" Values in the range of 0-255

Start/Stop Trigger Settings (continued)

Setting	Description	Value/Selection
	1. If you do not enter a value in this field, the full range (0-255) becomes the default value. 2. LPacket: <ul style="list-style-type: none"> a. Generic = Produccter Consumer ID b. Fixed = Destination ID c. Broadcast ID = 255 	

2.2.13.2.5 Defining and Maintaining ControlNet Capture Filters

Capture filtering allows frames that meet a specified condition to pass from the network to the buffer. If the frame does not satisfy the filter criteria, it is thrown away. Data that is filtered out using a capture filter cannot be recovered. For example, you may set up a capture filter that only allows frames with a source MAC ID of 10 to pass from the network to the collection buffer. Frames from all source MAC IDs other than 10 are discarded.

After capturing frame data (filtered or unfiltered), the buffer or file can be filtered further by using a display filter. A display filter looks at frames that have already been captured. It looks at every frame in the capture buffer or file and displays those that match the filter criteria. Frames that do not match the filter criteria are not displayed. Unlike a capture filter, where data that does not match is thrown away, all the data is kept when using a display filter. The filter just displays a subset of the data. Multiple display filters can be used simultaneously, and different windows can be displaying data using different filters.

2.2.13.3 ControlNet Statistics: Network Monitoring

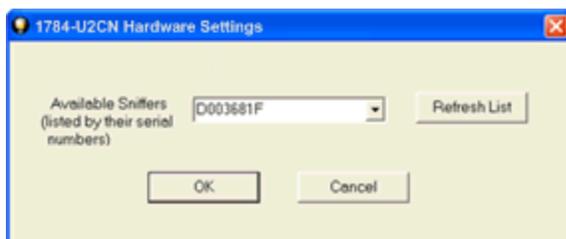
The network information corresponds to dynamic data collection over the ControlNet network. The following information is contained within the Network Information dialog box:

- Network Grid - displays the active nodes on the network.
- Network Attributes - the network attribute commands analyze the current moderator frames and display the following attributes:
 - Network Update Time (ms)
 - Scheduled Max. Node
 - Unscheduled Max. Node
 - Slot Time (ms)
 - Blanking Time
 - Guard Band Start (ms)
 - Guard Band Center (ms)
 - Guard Band Prestart (ms)
 - Interval Modulus (NUTs)

- Additional network information that does not come from the moderator. This information corresponds to Scheduled and Unscheduled elements, for which the following information is provided:
- Scheduled information in the Interval Modulus average bandwidth used and maximum bandwidth used
- Average available unscheduled information and average used unscheduled information in the Interval Modulus, both expressed in bytes per second

2.2.14 ControlNet Instructions for 1784-U2CN

2.2.14.1 ControlNet 1784-U2CN Hardware Settings



The **1784-U2CN Hardware Settings** dialog allows you to select a device to sniff/scan. You access the Hardware Settings dialog by selecting Hardware Settings from the Options menu on the NetDecoder Control window.

Frontline software automatically scans and identifies all the 1784-U2CN devices plugged into the PC. These devices, identified by their Serial Numbers, are displayed in the drop-down list of **Available Sniffers**.

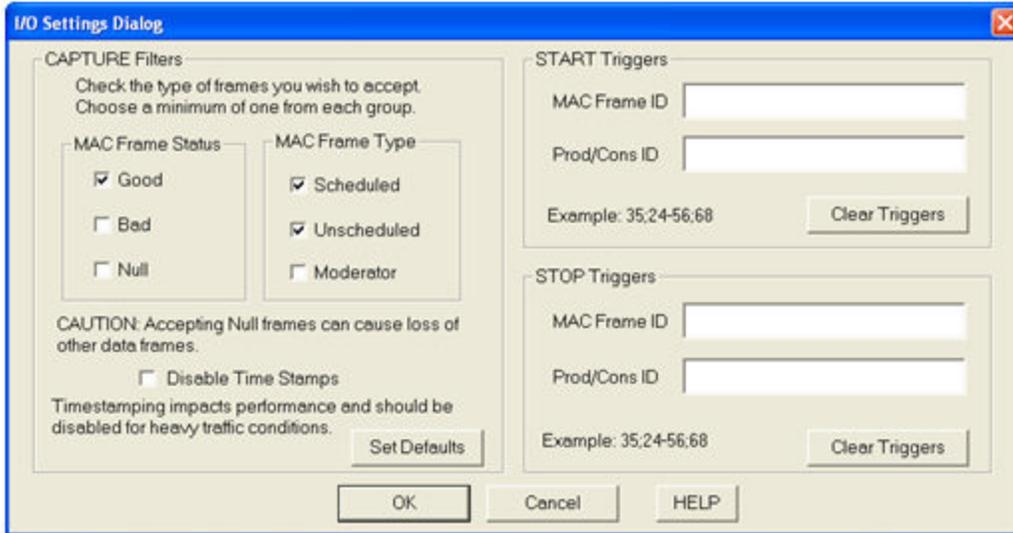
1. Select a device from the drop-down list
2. Click the **OK** button.

Selecting **Cancel** overrides all the selections and returns the user to the Control window.

Note: You can select Refresh List to update the list of devices.

2.2.14.2 ControlNet 1784-U2CN I/O Settings

The ControlNet 1784-U2CN **I/O Settings Dialog** provides the user options for setting **Capture Filters**, as well as **START** and **STOP** triggers.



CAPTURE Filters

While capturing ControlNet traffic, the I/O Settings Dialog in the 1784-U2CN indicates the MAC Frame Status and the MAC Frame Type of each of the captured frames.

Table 2.2 - Capture Filter Settings

Setting	Description	Value/Selection
MAC Frame Status	A frame correctly received by the Traffic Analyzer tool.	Good (default)
	The Traffic Analyzer tool has detected a problem with this frame (e.g. a CRC problem).	Bad
Select all that apply	A frame without any data.	Null
	Accepting Null frames can cause loss of other data frames.	

Table 2.2 - Capture Filter Settings (continued)

Setting	Description	Value/Selection
MAC Frame Type Select all that apply	Every scheduled node in sequential order is guaranteed one opportunity to transmit. Information that is time-critical is sent during the scheduled part of the interval. The bandwidth is reserved in advance to support real time data transfers. Real time data transfers include: <ul style="list-style-type: none"> • real time control data (I/O updates) • analog data • peer to peer interlocking 	Scheduled (default)
	All nodes transmit on a rotating basis in sequential order. This rotation repeats until the time allocated for the unscheduled portion is used up. The amount of time available for the unscheduled portion is determined by the traffic load of the scheduled portion. ControlNet guarantees at least one node will have the opportunity to transmit unscheduled data every interval. The starting node for each NUT rotates to guarantee each node will have an unscheduled transmit time. The remaining bandwidth supports non time-critical data transfers. Non time-critical data transfers include: <ul style="list-style-type: none"> • connection establishment • peer to peer messaging • programming (uploads and downloads) 	Unscheduled (default)
	The node with the lowest MAC ID (node address) assumes the moderator role. The moderator frame is transmitted to keep the other nodes synchronized. This moderator frame is sent in the guardband.	Moderator
Disable Timestamps	You can also choose to disable timestamps. When you activates Disable Time Stamps, the values in the place holders for the timestamps are random and the Frame Display will show incorrect values for the timestamps. You should ignore those values if timestamping is disabled.	Checked disables timestamps. Unchecked is default.

START and STOP Triggers

A **START Triggers** is defined as the event that starts data capture. The capture engine ignores all frames prior to the specified start trigger. All subsequent frames are captured until either a user-defined stop trigger occurs or the user manually stops data capture.

A **STOP Triggers** is defined as the event that stops data capture. The capture engine stops capturing all frames after the specified stop trigger is reached.

You can define the **START Triggers** and **STOP Triggers** according to the contents of the source and destination MAC IDs in the ControlNet frame.

Table 2.3 - **START/STOP Triggers** Settings

Trigger	Description	Setting
MAC Frame ID ¹ and Prod/Cons MAC ID ¹	A single producer ID	Example: "123" range 0-255
	A group of IDs, separated by a hyphen	Example: "2-88" Values in the range of 0-255
	Multiple IDs separated by a semicolon	Example:: "2;9;27" Values in the range of 0-255
	A group and multiple IDs	Example: "2-7;3;8" Values in the range of 0-255
1. If you do not enter a value in this field, the full range (0-255) becomes the default value.		

The **Start/Stop Clear Triggers** buttons will remove all ID values.

2.2.15 Data Highway Plus Special Instructions

2.2.15.1 Data Highway Plus Setup for DL3500-DHM

The DL3500-DHM (Data Highway Monitor) adapter for use with NetDecoder is a special version of the product that was developed for Frontline Test Equipment, Inc. It includes firmware that allows the unit to promiscuously capture the data passing on a Data Highway Plus (DH+) network. The unit supports capturing data at 57.6k, 115.2k or 230.4kbps. The DL3500-DHM hardware automatically senses the DH+ data rate and set the serial port interface to twice the DH+ rate. Apply power to the DL3500-DHM and then connect the network cable in order for the unit to automatically sense the network data rate.

There are two basic steps to beginning data capture:

- Connecting the DL3500-DHM hardware to the DH+ circuit and the PC running NetDecoder
- Configuring the I/O Settings in NetDecoder.

The following items are included with the DL3500-DHM:

- DL3500-DHM hardware
- Power supply
- 9-pin cable

You have to acquire a Blue Hose 3-wire cable.

Connecting the DL3500-DHM

1. If you have not already done so, install the NetDecoder software and decoders on the PC you use to monitor the DH+ network.
2. Obtain a Blue Hose 3-wire cable. Attach one end of the Blue Hose to the DL3500-DHM's CHA Network interface and then attach the other end to the DH+ Port on one of the PLCs located on the DH+ network you wish to monitor.
3. Attach one end of the 9 pin cable supplied with the DL3500-DHM to the CHB/RS-232 interface on the DL3500-DHM and then attach the other end to a serial port on the PC you are running the NetDecoder software on.
4. Wire-up the power supply to the DL3500-DHM and plug it into a wall outlet.

Configuring NetDecoder

1. If you have not already done so, connect the DL3500-DHM hardware.
2. Start NetDecoder and select from the Rockwell Allen Bradley folder.
3. Choose **I/O Settings** from the **Options** menu on the Control window, or click the I/O Settings icon to open the **I/O Settings** window.
4. In the **Baud** box, set the rate to twice the rate of the DH+ network. This is the rate at which data is received from the DL3500-DHM. The default value is 115.2K.

In the DH+ Network box, set the rate to match the rate of the DH+ network. This network rate is used for calculation of some statistics in NetDecoder. The default value is 57.6k.

See the online Help for information on the other settings in the I/O Settings window and how to save the configuration.

Now you are ready to capture data with NetDecoder! See the accompanying Quick Start Guide or the online Help to learn how to capture and review data using the NetDecoder software.

Changes to Header Bytes as a Result of Using the DL3500-DHM

The DL3500-DHM changes some of the data seen on the Data Highway Plus network in order to convert it to a form Frontline can use.

First, the DL3500-DHM converts the data from synchronous to asynchronous. Second, it formats the frame as a DF1 full duplex with CRC message, which means it strips off 5 bytes from the original message and adds 6 DF1 bytes. A 0x1002 is placed at the beginning of the message, and a 0x1003, followed by two CRC bytes, is placed at the end. The CRC is an error check between the DL3000-DHM and Frontline only, NOT an error check between any DH+ devices or the DH+ network and Frontline.

2.2.15.2 1784-U2DHP Special Instructions

2.2.15.2.1 Data Highway Plus Set up Information for the 1784-U2DHP

In order to use the 1784-U2DHP with NetDecoder, you need to perform the following steps:

- Install the 1784-U2DHP on your analysis PC
- Update the firmware version on the 1784-U2DHP to version 1.7

- Shutdown RS-Linx completely before using NetDecoder
- Configure Hardware Settings in NetDecoder

Install the 1784-U2DHP on your analysis PC

Please follow the installation instructions provided by Rockwell Automation to install your 1784-U2DHP. An instruction booklet is included in your 1784-U2DHP shipping box. The instructions are also available on Rockwell Automation's website: http://literature.rockwellautomation.com/idc/groups/literature/documents/in/1784-in045_-en-p.pdf

Update the firmware version on the 1784-U2DHP to version 1.7

1. If you bought the 1784-U2DHP from Frontline, then the device is already updated with firmware version 1.7. You do not need to do anything else.
2. If you bought your 1784-U2DHP from some other source, then you must update your firmware.
 - a. Go to <http://compatibility.rockwellautomation.com/Pages/MultiProductDownload.aspx?crumb=112> and download the ControlFlash upgrade kit from Rockwell Automation.
 - b. Extract the zip file and run 'ControlFLASH.msi'. This will install the ControlFLASH utility.
 - c. Run ControlFLASH and follow instructions on the wizard to update your firmware to version 1.7.

Shutdown RS-Linx completely before running NetDecoder

The 1784-U2DHP installs itself as a serial port (COM port) on your PC. To prevent port conflict, RS-Linx must be completely shut down before starting NetDecoder. It is not enough to simply close the RS-Linx window. Right click on the RS-Linx icon on your system tray and select: Shutdown RS-Linx.

Note: To identify the COM port number used by the 1784-U2DHP, open your PC's Device Manager and look under the Ports (COM & LPT) section.

Configure Hardware Settings in NetDecoder

1. Start NetDecoder.
2. In the start-up wizard, choose **Rockwell Allen Bradley -> Data Highway Plus using 1784-U2DHP**.
3. Click **Run**.

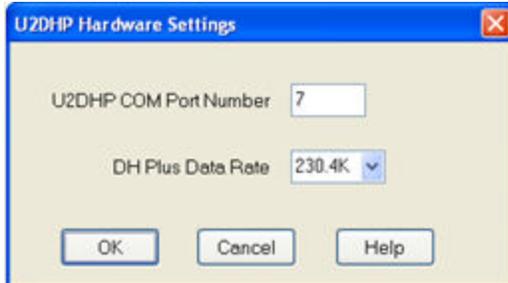
This brings up the NetDecoder Control Window.
4. Select **Hardware Settings** in the **Options** menu.
5. Enter the correct COM Port number and the data rate.
6. Click **OK**.

You are now set to use the NetDecoder analyzer software with the 1784-U2DHP.

2.2.15.2.2 1784-U2DHP Hardware Settings

The 1784-U2DHP installs itself as a Serial COM Port on your PC. The Hardware Settings dialog allows you to set the COM Port number and the data rate that your device is using.

Note: Before starting data capture with the 1784-U2DHP, you must: 1) Shut down RSLinx, and 2) Set the correct COM Port number in this dialog.



Access the **U2DHP Hardware Settings** dialog by selecting **Hardware Settings** from the Options menu on the NetDecoder Control window.

There are two values you have to set: COM Port Number and Data Rate.

To identify the COM port number, open your PC's Device Manager and look under the "Ports (COM & LPT)" section. Enter that number in this dialog. If the correct number is not set, then

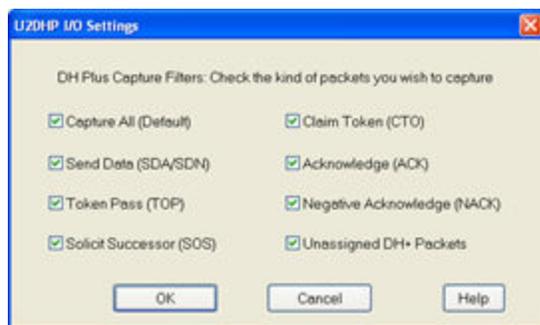
the data capture fails because NetDecoder will not be able to read the right data.

DH+ can run at baud rates of 57.6K, 115.2K or 230.4K. The 1784-U2DHP has a knob to set the data rate. Make sure that the setting on your 1784-U2DHP matches your DH+ networks data rate. Then choose the right value in the drop down menu on the Hardware Settings dialog.

1. Enter the **U2DHP COM Port Number**.
2. Select a **DH Plus Data Rate** from the drop-down list.
3. Select **OK** to accept the values and close the dialog or **Cancel** to disregard the settings and close the dialog.

2.2.15.2.3 DH Plus 1784-U2DHP I/O Settings

The DH Plus analyzer, using the 1784-U2DHP, allows users to select what type of packets are captured. This type of filtering eliminates capturing unnecessary frames and allows the user to quickly pin-point the source of the network problem. You select which frames to capture using the I/O settings dialog.



You access the I/O Settings dialog by selecting **IO Settings** from the **Options** menu on the NetDecoder Control window.

1. Select the kind of DH+ frames you need to capture by clicking the appropriate check boxes.
 - If more than one box is checked, then the selection is treated as a logical AND condition.
 - The default setting is to capture all traffic.
 - If none of the items are checked on the dialog, the program defaults to a 'capture-all' state.
2. Select **OK** to accept the values and close the dialog or **Cancel** to disregard the settings and close the dialog.

2.2.16 DeviceNet Instructions for the Woodhead SST

2.2.16.1 Software and Driver installation

Download the Molex software and driver from <http://www.molex.com/molex/mysst/searchBrad.action?partnumber=SST-DN4-USB>. Download version 13.10 or higher.

Follow the manufacturer's instructions to install the software and drivers.

2.2.16.2 Hardware Setup

1. Connect the Molex SST-DN4-USB module to the USB TypeB connector on the module's cable.

Note: The DeviceNet software should be installed prior to connecting the interface module on the computer.

2. Connect the other end of the USB cable to a High-Speed USB 2.0 Type A port on the host computer.
3. Connect the Molex SST-DN4-USB module to a DeviceNet network.

2.2.16.3 SST Interface Card Setup to Capture DeviceNet Data

To capture DeviceNet data using the Frontline NetDecoder, the DeviceNet I/O must be configured followed by setting DeviceNet capture filters.

Note: You must complete [Software and Driver installation on page lvi](#) before starting this procedure.

2.2.16.3.1 Adding SST-DN4-USB Card Alias

Card aliases are used by an application to access Molex DeviceNet scanner modules. Each DeviceNet channel that exists in a system must be assigned a unique name.

1. From the Window **Start, SST, DeviceNet Software Suite, DeviceNet Remote Diagnostics**.
2. Click on the **Config** tab.

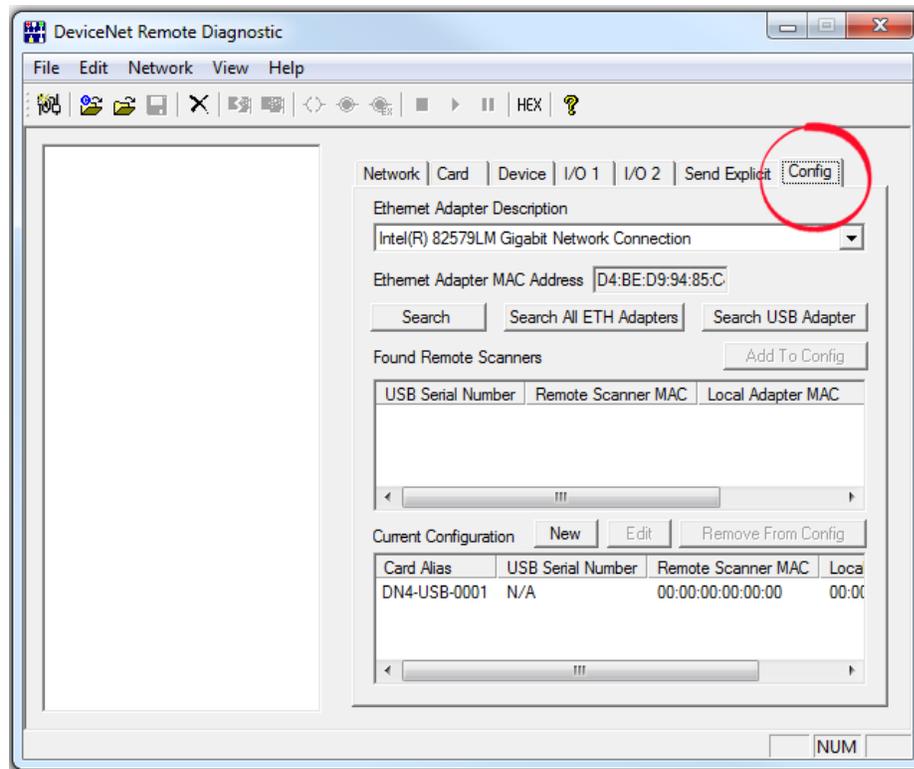


Figure 2.15 - DeviceNet Remote Diagnostics Config Tab.

3. Click on the **Search USB Adapter** button to locate the connected USB scanner.

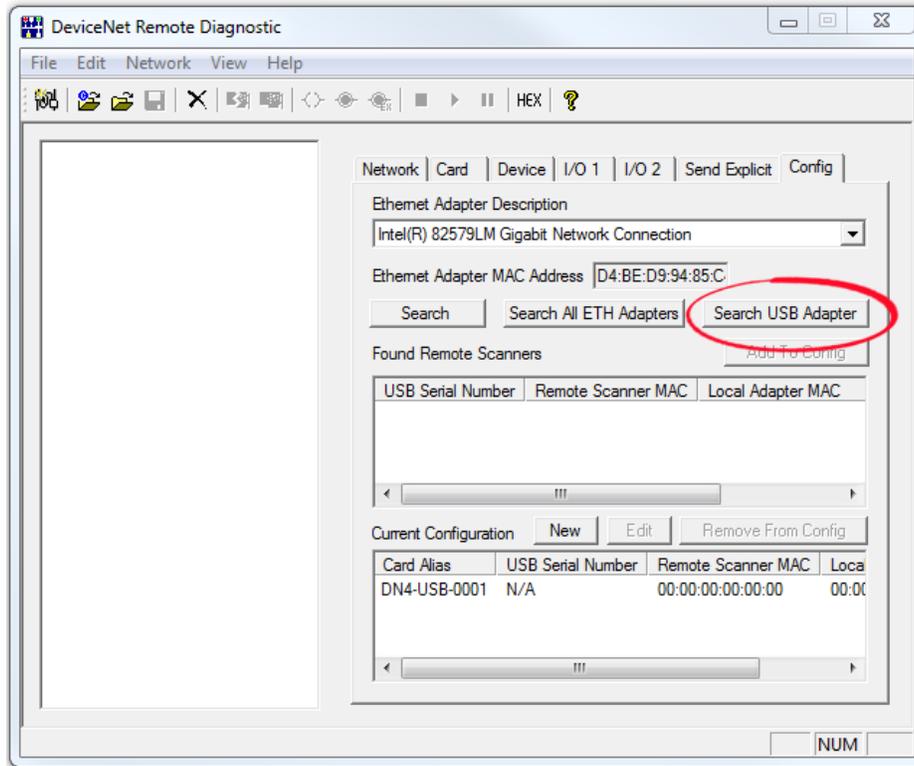


Figure 2.16 - DeviceNet Remote Diagnostics Search USB Adapter

4. In the **Found Remote Scanners** list click on the USB device, and click on the **Add to Config** button.

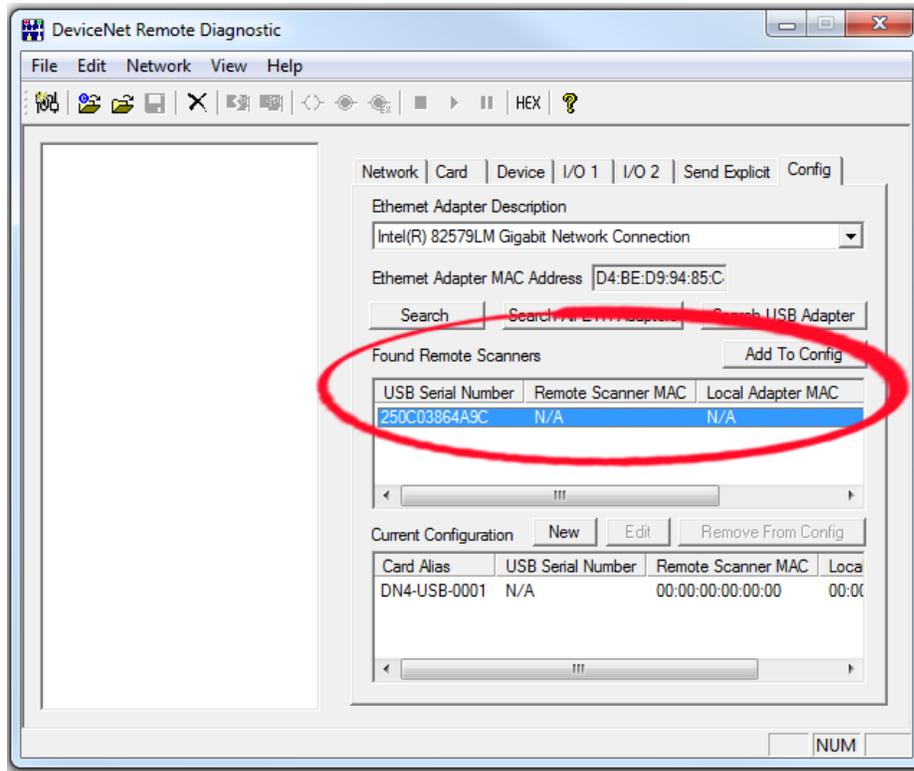


Figure 2.17 - DeviceNet Remote Diagnostics Add to Config

- The **ADD USB Remote Scanner Serial** dialog opens. In the **Card Alias** enter an alias for the connected USB scanner. The alias can be any name. In this example, this is the second DN4-USB to be configured.

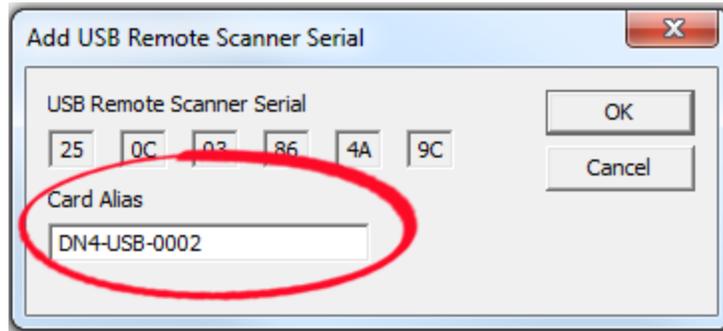


Figure 2.18 - DeviceNet Remote Diagnostics Set Alias

Click the **OK** button when finished and the USB device is added to the **Current Configuration** list.

The SST-DN4-USB is now installed and named on your computer or system and is ready to be used to capture DeviceNet data.

2.2.16.3.2 NetDecoder DeviceNet Capture Settings

1. If the **DeviceNet I/O Settings** dialog is already open proceed to step 2, otherwise, from the Windows **Start** select **All Programs, Frontline NetDecoder <version#>, Frontline NetDecoder**.

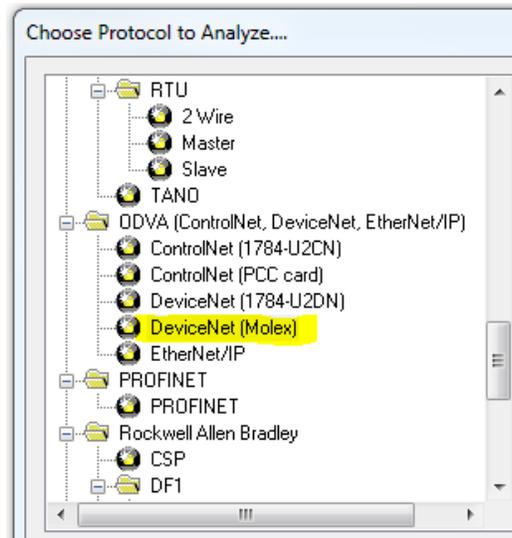


Figure 2.19 - Choose the DeviceNet (Molex) Protocol

- a. In the **Choose Protocol to Analyze**, select **ODVA (ControlNet, DeviceNet, EtherNet/IP)**.
 - b. Select **DeviceNet (Molex)** and then click the **Run** button.
 - c. Then choose **Hardware Settings** from the **Options** menu on the **Control** window.
2. Then choose **Hardware Settings** from the **Options** menu on the **Control** window.

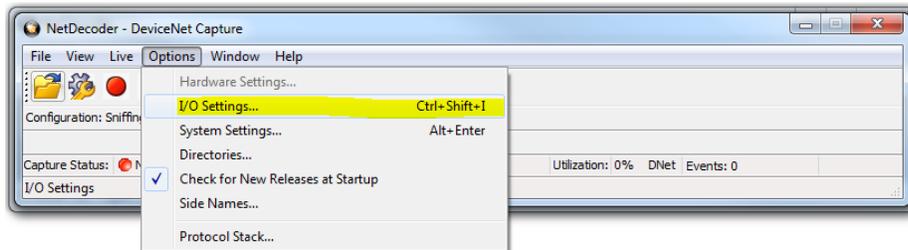


Figure 2.20 - Device Net Capture Control Window

3. In the **DeviceNet I/O Settings** dialog, select the **Capture Filter** tab.

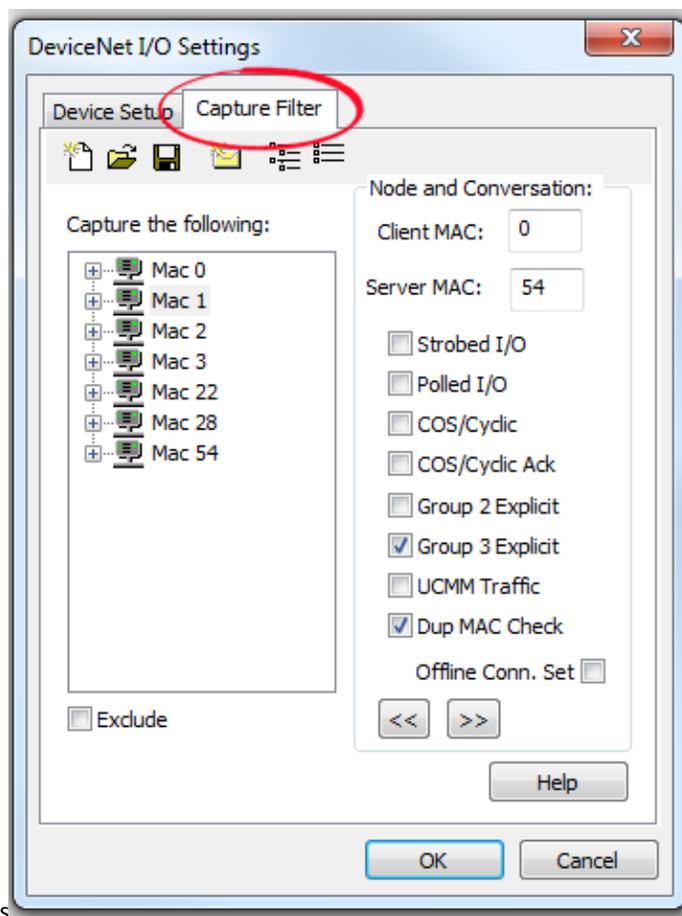


Figure 2.21 - NetDecoder DeviceNet I/O Settings Capture Filter Tab

4. Filters are defined as the combination of a node identifier and the messages to include with that node. Filters are created in the Node and Conversation: section of the Capture Filter Tab. In this section the nodes are defined in the Client MAC and Server MAC and the messages for those nodes is set in the check boxes.

Figure 2.22 - DeviceNet I/O Settings Node and Conversation Section

Client MAC - When a number is added to this box, messages associated with the client side of the conversation are added for this MAC ID. In [Figure 1.4 on page 1](#), node 0 is selected for the **Client MAC**. If the node box is empty **Client MAC** is not included in the filter.

Server MAC - When a number is added to this box, messages associated with the server side of the conversation are added for this MAC ID. In [Figure 1.4 on page 1](#), node 54 is selected for the **Server MAC**. If the node box is empty **Server MAC** is not included in the filter.

Messages to include in the conversation are listed below the **Client** and **ServerMAC**s. The group of messages can have two states.

- **All boxes unchecked:** All messages are include in the node conversation.
- **Some boxes checked:** Only the checked messages are included int he node conversation.

If the **Offline Conn. Set** is checked Group 4 messages are included in the filter but there is no associated MAC.

To add, delete, or change a filter:

- **Add:** To add the node and conversation filter selection to the DeviceNet I/O Settings click on the  button.
- **Delete:** To delete or remove the node and conversation filter from the DeviceNet I/O Settings click on the  button, or click on the node in the **Capture the following:** pane and click ont he the  button.
- **Change:** Delete the filter, then change the node and conversation settings, and add the new filter.

To exclude certain messages from the conversation (a NOT function), set the note and conversation as described in previous steps, and check the **Exclude** box, then click the  button.

5. Once the node and conversation filters are set , click on the **Save filter** icon  in the toolbar. A

Windows **Save As** dialog opens. Set a filter file name and location and click **Save**. Click on the **Capture FilterOK** button. Refer to [Capture Filter Toolbar below](#).

The NetDecoder is now ready to capture and analyze network data using the SST-DN4-USB scanner.

2.2.16.3.2.1 Capture Filter Toolbar

Toolbar Icons

Icon	Description
	Clears the current filter settings
	Loads a filter from disk
	Saves the current filter to disk
	Opens the Add Message dialog
	Expands all nodes in the filter display
	Collapses all nodes in the filter display

2.2.17 DeviceNet Using Rockwell Automation 1784-U2DN

NetDecoder also supports Rockwell Automation’s 1784-U2DN DeviceNet interface. The 1784-U2DN interfaces to the host computer through a USB port. You can analyze your DeviceNet network using the 1784-U2DN interface.

Refer to Rockwell Automation’s documentation for installing the 1784-U2DN. The instructions may be downloaded from Rockwell Automation’s online document library. There are no additional installation instructions for using the 1784-U2DN as the sniffer interface.

2.2.17.1 DeviceNet Hardware Settings

The Hardware Settings dialog allows you to select a device to sniff/scan. You access the **1784-U2DN Hardware Settings** dialog by selecting **Hardware Settings** from the **Options** menu on the NetDecoder Control window.

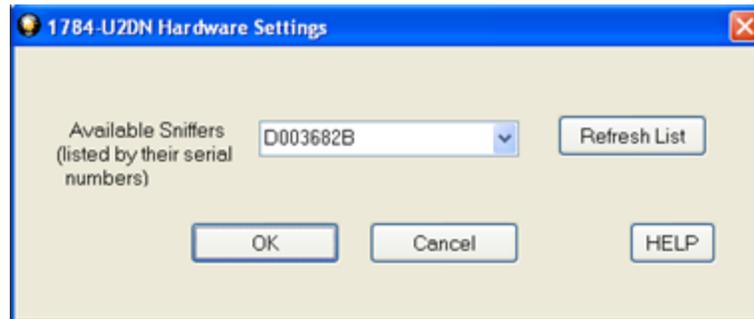


Figure 2.23 - 1784-U2DN Hardware Settings

Frontline NetDecoder software automatically scans and identifies all the 1784-U2DN devices plugged into the host computer. These devices, identified by their serial numbers, are displayed in the drop-down list of **Available Sniffers**.

1. Select a device from the **Available Sniffers** drop-down list.
2. Click the **OK** button.

Clicking the **Cancel** button overrides all the selections and returns the user to the **Control** window.

Click on the **Refresh List** button to update the list of connected devices.

For additional information about the 1784-U2DN device, please refer to the documentation from Rockwell Automation (RA). The relevant RA document numbers are:

- Publication: 1784-IN046
- MM (PN): PN-25191
- DIR: 10000017341/PUB
- Knowledge Base Tech Note: <http://www.rockwellautomation.com/knowledgebase/>, ID 53280.

2.2.17.2 START and STOP Triggers for the 1784-U2DN Interface

NetDecoder allows you to define **START** and **STOP** Triggers while using the 1784-U2DN interface module. The triggers can be accessed through the **NetDecoder Control** window **Options** menu **I/O Settings**.

The user defines the **START** and **STOP** Triggers according to the contents of the Controller Area Network (CAN) Identifier field in the DeviceNet frame. The CAN ID of a DeviceNet frame consists of three parts: the Group Number, the MAC ID and the Message ID.

- A **START Trigger** is defined as the event that starts data capture. The capture engine ignores all DeviceNet frames prior to the enabling of the specified START trigger. All subsequent frames are captured until either a

user-defined **STOP Trigger** fires or the user manually stops data capture.

- A **STOP Trigger** is defined as the event that stops data capture. The capture engine stops capturing all frames after the specified **STOP Trigger** event is enabled.

The **START** or **STOPTrigger** is enabled when an incoming DeviceNet frame has a CAN ID value equal to the value in the Simple or Compound trigger. If user has defined multiple CAN IDs, then the condition is met if the CAN ID of the incoming frame matches any one of the defined IDs. If the user enters a blank field in the trigger dialog, then that implies that the trigger condition is met on any value of CAN ID.

In the case of a **START Trigger**, the particular frame matching the condition will be the first frame in the capture and all subsequent frames will be captured. In the case of a **STOP Trigger**, the particular frame matching the condition will be the last frame in that capture session.

The user can define and store multiple **START** or **STOPTriggers**. The triggers are displayed in the list control boxes shown in [Figure 1.1 on page 1](#). Though multiple triggers can be created and saved, only a single set of **START** or **STOPTriggers** can be selected at a time.

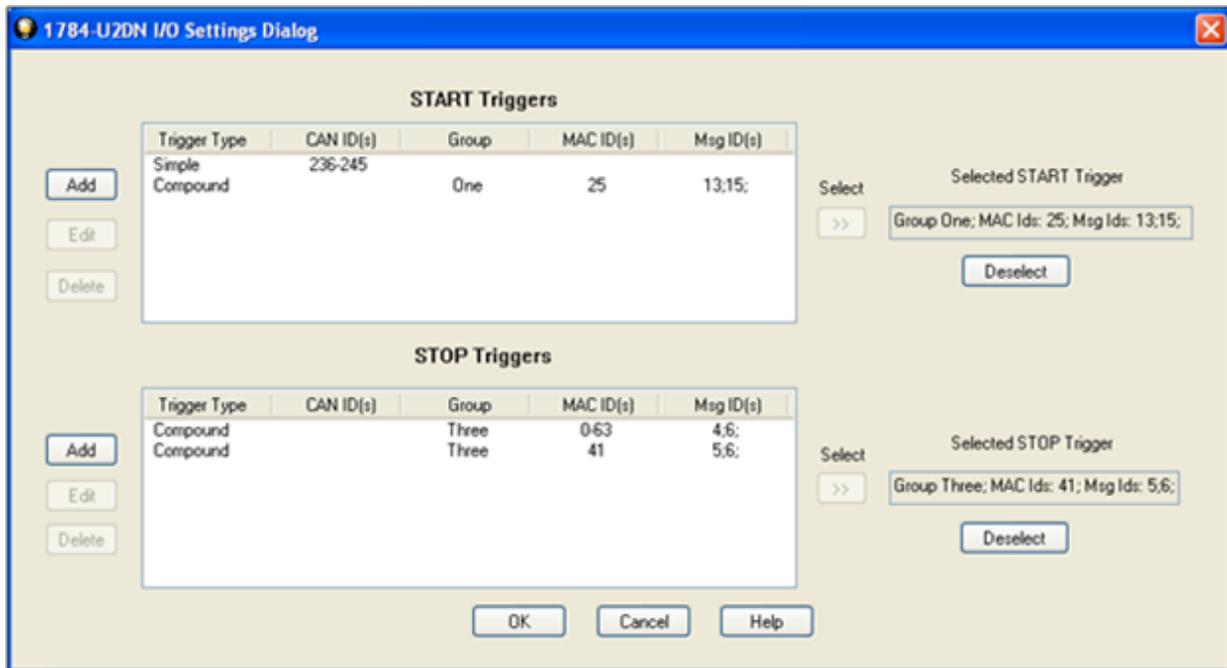


Figure 2.24 - NetDecoder 1784-U2DN I/O Settings

The triggers are saved in a NetDecoder .ini file. The saved triggers appear in the I/O Settings dialog the next time the application is opened.

The I/O Settings option is not available during the middle of a data capture. Only when the data capture is stopped, the user will be able to select the I/O settings menu and bring up the triggers.

2.2.17.2.1 Adding Simple Start/Stop Triggers

The user can add a new set of **START** or **STOPTriggers** by clicking on the **Add** button to the right of the triggers control boxes (See [2.2.17.2 on the previous page](#)). Clicking the **Add** button opens the **Set Start/Stop Trigger Conditions** dialog. The process for creating a **Start Trigger** or a **Stop Trigger** is identical.

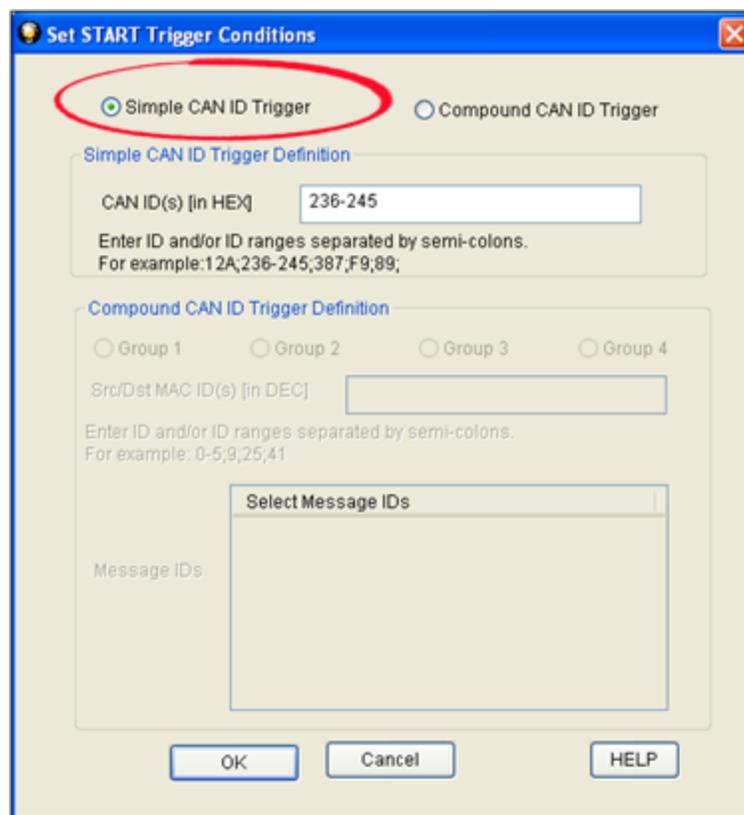


Figure 2.25 - Example: Set START Trigger Conditions

To create a simple start trigger, for example,

1. Select the **Simple CAN ID Trigger** radio button. Only the **Simple CAN ID Trigger Definition** section is active.
2. In the CAN ID(s) field enter CAN IDs formatted using the following rules:
 - All values are hexadecimal.
 - Value range is 0x000 to 0x7FF.
 - Enter a single value, such as 12, or
 - Enter multiple values separated by a semicolon, such as 34;12;AB;fc;;2, or
 - Enter a range of values, such as 12-29, or
 - Enter a combination of individual values and ranges, such as 12;34;56-7a;1.
3. Click the **OK** button when finished.

If all the trigger values are valid, then the values are stored in the list control box on the **I/O Settings** dialog. The last trigger created is shown at the bottom of the list.

Clicking on the **Cancel** button overrides all the CAN IDs and returns the user to the **I/O Settings** dialog.

2.2.17.2.2 Adding Compound Start/Stop Triggers

The **Compound CAN ID Trigger** option allows you to define triggers based on the exact values of group numbers, MAC IDs and Message IDs. There are four groups to choose from. [Figure 1.1 on page 1](#), taken from the official DeviceNet specification, shows how the 11 bits of the CAN ID are used by the DeviceNet messaging protocol and the values in the four groups.

IDENTIFIER BITS											HEX RANGE	IDENTITY USAGE		
10	9	8	7	6	5	4	3	2	1	0				
0	Group 1 Message ID			Source MAC ID								000 – 3ff	Message Group 1	
1	0	MAC ID			Group 2 Message ID								400 – 5ff	Message Group 2
1	1	Group 3 Message ID			Source MAC ID								600 – 7bf	Message Group 3
1	1	1	1	1	Group 4 Message ID (0 – 2f)						7c0 – 7ef	Message Group 4		
1	1	1	1	1	1	1	X	X	X	X	7f0 – 7ff	Invalid CAN Identifiers		
10	9	8	7	6	5	4	3	2	1	0				

Figure 2.26 - CAN ID Groups

The process for setting a **START Trigger** or a **STOP Trigger** is identical.

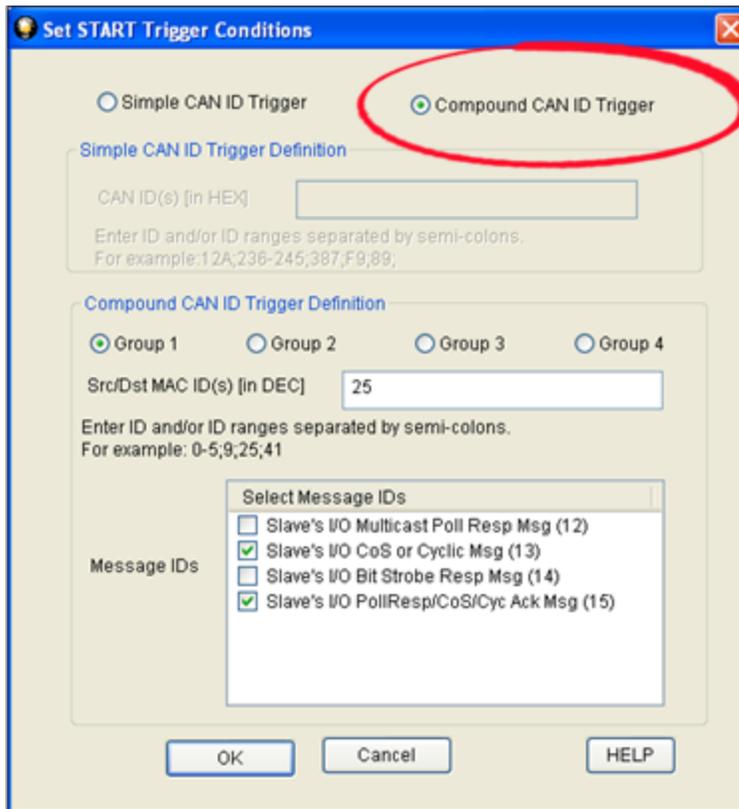


Figure 2.27 - Example, Set Compound Start Trigger Conditions

To set up a compound trigger:

1. Select the **Compound CAN ID Trigger** radio button. **Only the Compound CAN ID Trigger Definition** section is active.
2. In the **Str/Dst ID(s)** field, enter the source destination MAC ID(s) using the following rules.
 - Values are decimal.
 - Value range is from 0 to 63.
 - Enter a single value, such as 12, or
 - Enter multiple values separated by a semi-colon, such as 34;12;22;34;61, or
 - Enter a range of values, such as 12-28, or
 - Enter a combination of individual values and ranges, such as 12;34;56-59;61.
3. Select a radio button for **Group 1, Group 2, Group 3, or Group 4**. The messages associated with the selected group will appear in the **Message IDs** field. Check one or more messages to associate with the trigger. The compound trigger will activate when one of the messages associated with the MAC ID(s) appears on the network, that is the when messageID₁ OR messageID₂ OR messageID₃ OR ...messageID_n occurs.

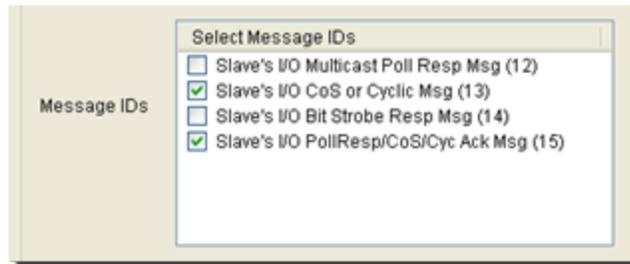


Figure 2.28 - Example: Compound Trigger Group Message Selection

When the compound filter is completed, click on the **OK** button. The **I/O Settings** dialog appears with the **Trigger Type** field = **Compound**, **Group** field = Group Name, and **MAC Id(s)** = Source/Destination settings. Not all columns will have data. For example, **Group** = Four will not have a **MAC ID** field value.

Clicking on the **Cancel** button overrides all the selection and returns the user to the **I/O Settings** dialog.

2.2.17.2.3 Editing a Trigger

To edit a simple or compound trigger:

1. From the **1784-U2DN I/O Settings** dialog do one of the following actions:
 - Double-click on the trigger in the trigger list control box.
 - Select the trigger in the list control box and click on the **Edit** button.

The **Set START/STOP Trigger Conditions** dialog opens populated with the selected trigger's stored values.

2. Make changes to the trigger.

3. When changes are complete, click on the **OK** button. If all the changes are valid, the new trigger values are stored in the same position in the **1784-U2DN I/O Settings** dialog trigger list control box. If the values are not valid, an error message appears. Selecting **Cancel** overrides any changes and returns to the **1784-U2DN I/O Settings** dialog and the selected filters appears unchanged.

2.2.17.2.4 Delete a Trigger

To delete a simple or compound filter:

1. From the **1784-U2DN I/O Settings** dialog, select the trigger in the list control box and click on the **Delete** button.
2. The trigger is deleted from the list.

2.2.17.2.5 Selecting a Trigger for Capturing

Once **START** and **STOP Triggers** are set, select a trigger for use during the network capture. These procedures are identical for both the **START** and **STOP Triggers**.

1. In the **1784-U2DN I/O Settings Dialog** select a trigger in the trigger list by clicking on it.
2. Click on the Select button  on the right of the list box. The selected trigger appears in the **Selected START/STOP Triggers** field. This is the START/STOP trigger that will be use in the next capture session.
3. To empty the **Selected START/STOP Trigger** field, click the **Deselect** button below the field.

2.2.18 IEC 870-5-101/-104 Special Instructions

What To Do When The Correct Values Of Decoder Parameters Are Unknown

It is important to note that in many cases a useful decode can be obtained even if the correct decoder parameter values are unknown to the user.

Link Layer Values

An incorrect value in the "Size of the address field in bytes" is easy to determine because fixed-length frames are invalid and shown in red. The length of fixed-length frames is in the range 4-6. They begin with byte 0x10 and end with byte 0x16 (there can also be bytes with those values elsewhere in the frame). To correct the problem, you can change the values in "Size of the address field in bytes" field until fixed-length frames no longer appear in red.

An incorrect value of "Is transmission balanced?" has no effect on the rest of the decode, and it can be left as it is if the user doesn't care about the three fields directly affected by it (see description above). There is no way to find the correct value by looking at the data, with the exception if the size of the link layer address field is 0, then the transmission mode must be balanced.

Application Layer Values

The application layer parameters are Does Originator Address Exist, Size Of ASDU Address Field In Bytes, and Size Of Info Obj Address Field In Bytes. They apply only to variable-length frames, which can be of almost any size. Variable-length frames start with byte 0x68, end with byte 0x16 (there can also be bytes with those values elsewhere in the frame), and come in two forms, identified by the value of the SQ bit, which is contained in the variable structure qualifier. The spec describes them this way:

- SQ=0: There are one or more information objects, each with a single set of information elements.
- SQ=1: There is only one information object, which contains one or more sets of information elements.

That's equivalent to saying this:

- SQ=0: There is a separate information object address for each set of information elements.
- SQ=1: There is one information object address and one or more sets of information elements.

When SQ=1, there is only one instance of the information object address, and finding a combination of values for the parameters that yields an otherwise valid decode is a generally simple matter of trial-and-error. If the detail pane indicates that there are extra data bytes (indicated by the presence of the Data field at the end), selectively increase the values of those parameters to use up the extraneous data. If the detail pane indicates that a field is missing, selectively decrease the values of those parameters until all fields are present. The fields that these parameters refer to are contiguous; therefore no intervening fields are compromised. What can make this process tricky is that some frames may in fact have the wrong number of bytes in them. When experimenting with parameter values, use frames which appear to be the same type and length as other frames in the decode since this generally indicates that those frames are of valid length.

When SQ=0, things are trickier. In this case, the information object address can appear multiple times, and not contiguously. It is technically possible to set the parameters such that there is neither extra Data nor missing fields but the decode itself is invalid. There is no surefire approach to this.

2.2.19 Modbus Special Instructions

2.2.19.1 Modbus Register Display Format Settings

Modbus protocol messages do not provide data formatting information but simply transmit holding and input registers as byte streams. The Modbus Register Display Settings dialog provides a method for users to define display formats to be utilized when displaying the values in these registers.

To access this dialog:

1. Go to the Options menu on the Control window and choose Set Initial Decoder Parameters
2. Select the Modbus tab.
3. To add a new entry, fill in the fields and click the Add button. Double-clicking a setting, copies its values to the input fields.
4. To replace a setting with a new setting created from the input fields, click the setting to replace and then click the Modify button.

When you close a capture file, you are asked whether you want to save the current register settings into it. To save settings independent of a specific capture file:

1. Type any string in the "Apply Template" field and click Save.
2. To restore those settings to the dialog, select the desired setting in the "Apply Template" drop down list.

New settings do not take effect in a currently opened capture file until the frame display is closed and then reopened.

Register Display Settings

- Default Display Format_Bits

This field specifies the default display format for registers that have no user defined setting (such registers are always assumed to be 2 bytes long). The default display format is limited to single-register display formats to prevent implicit register range overlap and to ensure that explicitly defining a setting in which one display format item uses multiple registers does not change the locations of subsequent default settings.

- Station Address

The IP Address or Station Address field (its name changes to reflect the loaded decoder) is used to enter the desired IP or station address for each setting. Enter an asterisk to specify that a setting applies to all IP or station addresses. Station address ranges are from 0 to 248 and IP address ranges can be any valid IP Address.

- Register Type

The Register Type field specifies the type of register, either HOLDING or INPUT.

- Bytes Per Register

This field defaults to 2, indicating that standard Modicon registers are 2 bytes each. If you are dealing with a third party implementation of Modbus, you may need to adjust this field to reflect the actual number of bytes in a single register.

- Register Start Address

Enter the address of the first register you want to specify settings for.

- Display Format_Bits

The Display Format_Bits field specifies the desired display format. Display formats ASCII and HEX are variable-length and display a char or hex byte respectively for each byte in a register. The other display formats (INT_16, FLOAT_32, etc) have a bit count suffix in their names and use as many registers as they need, based on the bytes per register field. Choose a format for the specified register range.

- Length

This field is the desired number of data items (e.g. INT_32s), not the number of registers. The number of registers are calculated and displayed in the text description.

Example

If you want to specify Station 3's input registers 0-99 as INT_16s, you would enter 3 for the Station Address, INPUT for the Register Type, 0 for the Start Address, 2 for Bytes Per Register, INT_16 for the Display Format and 100 for the Length, indicating that you have 100 INT_16s starting at Input Register Address 0 where each register is 2 bytes long.

2.2.19.2 Setup For Modbus RTU and ASCII

Modbus ASCII and Modbus RTU protocols have three selections on the launcher menu. The appropriate selection depends upon physical characteristics of your network.

If your system is running over a physical layer that is 2-wire RS-422/485, select either the Modbus RTU on 2-Wire RS422/485 or the Modbus ASCII on 2-Wire RS422/485, depending upon which protocol your system is using. In this case there are no special wire tapping instructions. If your system is not a 2-wire RS422/485 system, you must select the correct launcher item based upon the following information.

There are two decodes for Modbus RTU: Modbus RTU Master and Modbus RTU Slave. Similarly, there are two decodes for Modbus ASCII: Modbus ASCII Master and Modbus ASCII Slave. The Master and Slave refer to where in

the circuit the analyzer is connected. The rest of this topic simply refers to Modbus Master or Modbus Slave, as the principles are the same.

Modbus Master assumes that data from the Master is on the DTE side (i.e. master data is on the TxD pin and slave data on the RxD pin). If the analyzer is connected to a Master device, choose the Modbus Master decode.

Modbus Slave assumes that data from the slave is on the DTE side (i.e. slave data is on the TxD pin and master data on the RxD pin). If the analyzer is connected to any Slave device, choose the Modbus Slave decode.

The diagram below illustrates conceptually which decoder to choose. Your configuration may be different from the diagram. The important thing is to choose Modbus Master if the master data is on the transmit line, or Modbus Slave if the slave data is on the transmit line.

Once you have selected the correct protocol, be sure to set the [Register Display Settings](#) so your data is decoded correctly.

If you have a custom protocol and need help connecting the analyzer to the right location, see [Generic Channel Dependent Decodes Setup](#).

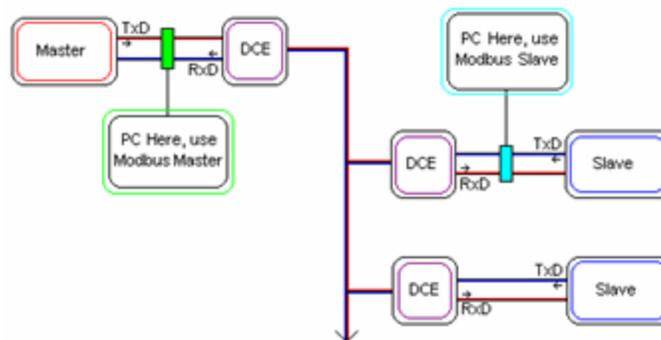


Figure 2.29 - Conceptual Modbus decoder setup.

2.2.19.3 Setup for Modbus TCP

In order to correctly decode Modbus TCP, the software needs to know the IP Addresses of the Master and Slave devices. The system allows the user to define any number of IP Address and Node Type combinations and save them in a template for later use.

The Node Template function provides the capacity to create multiple templates that contain different node assignments. This capability allows the user to maintain individual templates for each network monitored. Applying a template containing the node assignments necessary to monitor transmissions particular to an individual network, enhances the efficiency of the analyzer to decode data.

Select the task you wish to perform from the following:

[Adding a Node Assignment](#)

[Modifying a Node Assignment](#)

[Deleting a Node Assignment](#)

[Selecting and Applying a Node Assignment Template](#)

[Adding a Node Assignment Template](#)

[Deleting a Node Assignment Template](#)

2.2.20 Generic Channel Dependent Decodes Setup

Channel dependent decodes are decodes for protocols where frames do not contain information about what type of data it contains.

A common situation in which this occurs are simple master/slave circuits, where there is one master which sends commands and a slave responds to the most recent command. In these types of protocols, there may not be any indication that the data is in the form of a command or is a response to a command. The decodes for each are usually different, but without a field in the data specifying which is being carried, the analyzer has no way to know whether to use the decode for a command frame or a response frame. Usually the only way to know which decode to use is to assume that master data is always coming from the DTE side and the slave data is always on the DCE side (or vice versa). This often means the analyzer must be connected to the circuit in such a way that master data is on TxD and slave data is on RxD.

These diagrams assume the two devices are a master and a slave, but they might be a host and a controller or two PCs or any other type of device. The diagrams assume that the data from the master must be on the DTE channel and data from the slave on the DCE channel. This may differ for your particular protocol.

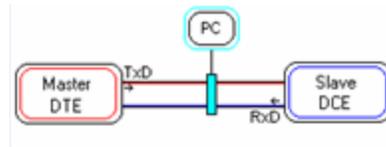


Figure 2.30 - DTE device connected to DCE device.

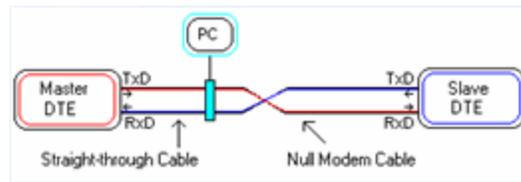


Figure 2.31 - DTE device connected to another DTE device with a null modem cable.

Chapter 3 Capture/Analyze

3.1 Capturing Data

Note: Data Capture is not available in Viewer mode.

1. Click the Start Capture icon  to begin capturing to a file. This icon is located on the Control, **Event Display**, and **Frame Display** windows.

Files are placed in My Capture Files by default and have a .cfa extension. Choose **Directories** from the **Options** menu on the Control window to change the default file location.

2. Watch the status bar on the Control window to monitor how full the file is. When the file is full, it begins to wrap, which means the oldest data will be overwritten by new data.
3. Click the Stop icon  to temporarily stop data capture. Click the Start Capture icon again to resume capture. Stopping capture means no data will be added to the capture file until capture is resumed, but the previously captured data remains in the file.
4. To clear captured data, click the Clear icon .
 - If you select Clear after selecting Stop, a dialog appears asking whether you want to save the data.
 - You can click Save File and enter a file name when prompted .
 - If you choose Do Not Save, all data will be cleared.
 - If you choose Cancel, the dialog closes with no changes.

- If you select the Clear icon while a capture is occurring, the capture stops.
 - A dialog appears asking if you want to save the capture.
 - You can select Yes and save the capture or
 - select No and close the dialog.
 - In either case, the existing capture file is cleared and a new capture file is started.
 - If you choose Cancel, the dialog closes with no changes.

To change the [size of the capture file](#) or to see how to [capture to a series of files or single file](#), choose [System Settings](#) from the Options menu on the Control window.

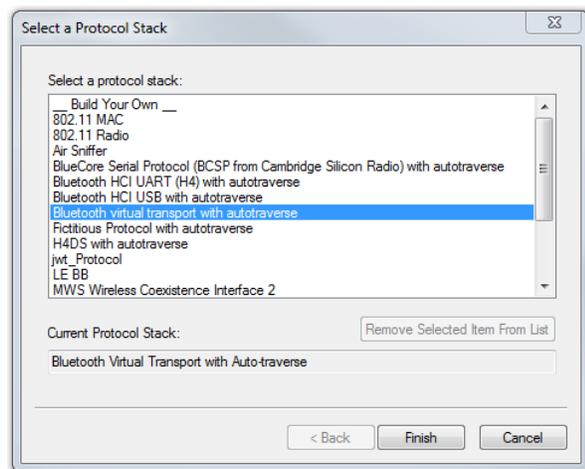
3.2 Protocol Stacks

3.2.1 Protocol Stack Wizard

The Protocol Stack wizard is where you define the protocol stack you want the analyzer to use when decoding frames.

To start the wizard:

1. Choose **Protocol Stack** from the **Options** menu on the **Control** window or click the **Protocol Stack** icon  on the **Frame Display**.
2. Select a protocol stack from the list, and click **Finish**. Click for information on how the analyzer [auto-traverses the protocol stack](#).



Most stacks are pre-defined here. If you have special requirements and need to set up a custom stack, see [Creating and Removing a Custom Stack on page lxxvi](#).

1. If you select a custom stack (i.e. one that was defined by a user and not included with the analyzer), the **Remove Selected Item From List** button becomes active.
2. Click the **Remove Selected Item From List** button to remove the stack from the list. You cannot remove stacks provided with the analyzer. If you remove a custom stack, you need to define it again in order to get it back.

If you are changing the protocol stack for a capture file, you may need to reframe. See [Reframing on page 1](#) for more information.

You cannot select a stack or change an existing one for a capture file loaded into the Capture File Viewer (the Capture File Viewer is used only for viewing capture files and cannot capture data). Protocol Stack changes can only be made from a live session.

Note for BCSP:

If you are using the BCSP protocol stack, you must connect the analyzer to the circuit such that the data on the DTE line comes from the host, and data on the DCE line comes from the controller. [Click here](#)

Note for Modbus RTU:

If you are using the Modbus RTU protocol stack, you must select either Modbus RTU Master or Modbus RTU Slave depending on where the analyzer taps into the circuit. [Click here](#) for more information.

Note for Modbus TCP:

If you are using Modbus TCP over Ethernet, you need to set up a node database giving the IP addresses for the Master and Slave devices. [Click here](#) for more information.

Note for Data Highway Plus (DH+):

There are special hardware and software configuration instructions for setting up the DL3000 DHM device used to tap into the Data Highway Plus network. [Click here](#) for more information.

Note for IEC 870-5-101:

You need to give the decoder information on the sizes of some fields and whether or not other fields are present. There are all system configurable options and therefore the decoder has no way of knowing this information from the data. [Click here](#) for more information.

Note for DeviceNet

You need to install the DeviceNet card before beginning data capture. Then you need to setup the device in the Hardware Settings window, and optionally select any capture filters.

[DeviceNet Card Installation Instructions](#)

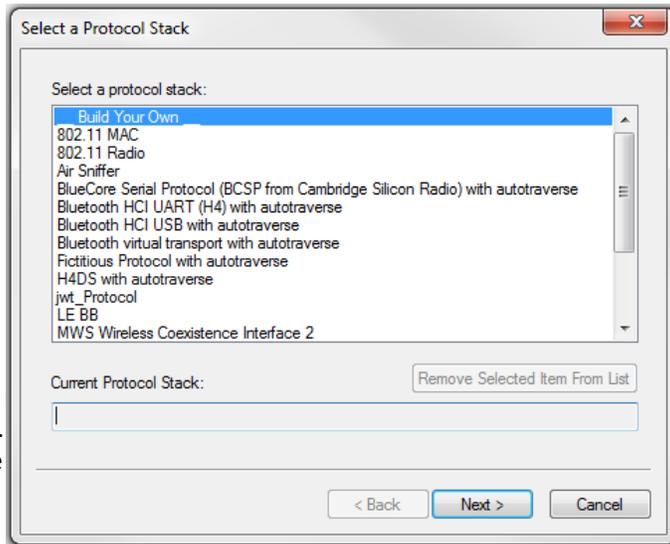
[DeviceNet Device Setup](#)

[DeviceNet Capture Filters](#)

3.2.2 Creating and Removing a Custom Stack

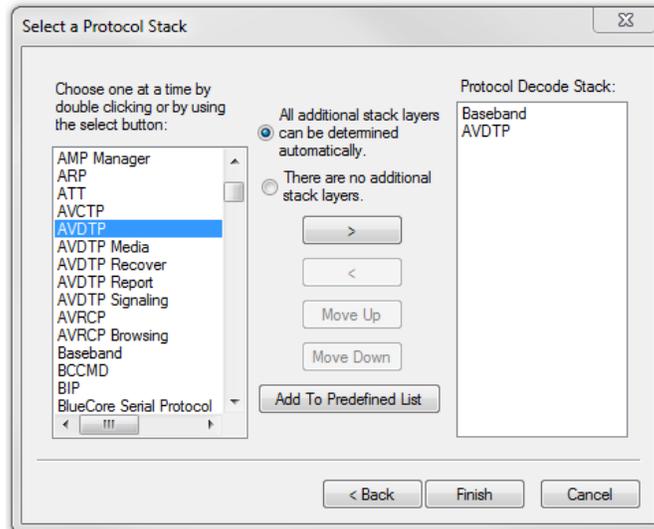
To create a custom stack:

1. Choose **Protocol Stack** from the **Options** menu on the **Control** window or click the Protocol Stack icon  on the **Frame Display** toolbar.
2. Select **Build Your Own** from the list and click **Next**.
3. The system displays an information screen that may help you decide if you need to define your own custom stack. Defining a custom stack means that the analyzer uses the stack for every frame. Frames that do not conform to the stack are decoded incorrectly. Click **Next** to continue.



Select Protocols

1. Select a protocol from the list on the left.
2. Click the right arrow button to move it to the **Protocol Decode Stack** box on the right, or double-click the protocol to move it to the right.
3. To remove a protocol from the stack, double-click it or select it and click the left arrow button.
4. If you need to change the order of the protocols in the stack, select the protocol you want to move, and click on the **Move Up** and **Move Down** buttons until the protocol is in the correct position.
5. The lowest layer protocol is at the top of the list, with higher layer protocols listed underneath.



Auto-traversal (Have the analyzer Determine Higher Layers)

If you need to define just a few layers of the protocol stack, and the remaining layers can be determined based on the lower layers:

1. Click the **All additional stack layers can be determined automatically** button.
2. If your protocol stack is complete and there are no additional layers, click the **There are no additional stack layers** button.

3. If you select this option, the analyzer uses the stack you defined for every frame. Frames that do use this stack are decoded incorrectly.

Save the Stack

1. Click the Add To Predefined List button.
2. Give the stack a name, and click Add.

In the future, the stack appears in the **Protocol Stack List** on the first screen of the Protocol Stack wizard.

Remove a Stack

1. Select it in the first screen and click Remove Selected Item From List.
2. If you remove the stack, you must to recreate it if you need to use it again.

Note: If you do not save your custom stack, it does appear in the predefined list, but applies to the frames in the current session. However, it is discarded at the end of the session.

3.2.3 Reframing

If you need to change the protocol stack used to interpret a capture file and the framing is different in the new stack, you need to reframe in order for the protocol decode to be correct. You can also use **Reframe** to frame unframed data. The original capture file is not altered during this process.

Note: You cannot reframe from the Capture File Viewer .

To reframe your data, load your capture file, select a protocol stack, and then select **Reframe** from the **File** menu on the **Control** window. **Reframe** is only available if the frame recognizer used to capture the data is different from the current frame recognizer.

In addition to choosing to **Reframe**, you can also be prompted to Reframe by the Protocol Stack Wizard.

1. Load your capture file by choosing **Open** from the **File** menu on the **Control** window, and select the file to load.
2. Select the protocol stack by choosing **Protocol Stack** from the **Options** menu on the **Control** window, select the desired stack and click **Finish**.
3. If you selected a protocol stack that includes a frame recognizer different from the one used to capture your data, the **Protocol Stack Wizard** asks you if you want to reframe your data. Choose **Yes**.
4. The analyzer adds frame markers to your data, puts the framed data into a new file, and opens the new file. The original capture file is not altered.

See [Unframing on page lxxvii](#) for instructions on removing framing from data.

3.2.4 Unframing

This function removes start-of-frame and end-of-frame markers from your data. The original capture file is not altered during this process. You cannot unframe from the Capture File Viewer (accessed by selecting Capture File Viewer or Load Capture File to start the software and used only for viewing capture files).

To manually unframe your data:

1. Select **Unframe** from the **File** menu on the **Control** window. **Unframe** is only available if a protocol stack was used to capture the data and there is currently no protocol stack selected.

In addition to choosing to **Unframe**, you can also be prompted to Unframe by the Protocol Stack Wizard.

1. Load your capture file by choosing **Open** from the **File** menu on the **Control** window.
2. Select the file to load.
3. Choose **Protocol Stack** from the **Options** menu on the **Control** window
4. Select **None** from the list
5. Click **Finish**. The Protocol Stack Wizard asks you if you want to unframe your data and put it into a new file.
6. Choose **Yes**.

The system removes the frame markers from your data, puts the unframed data into a new file, and opens the new file. The original capture file is not altered.

See [Reframing on page lxxvii](#) for instructions on framing unframed data.

3.2.5 How the Analyzer Auto-traverses the Protocol Stack

In the course of doing service discovery, devices ask for and receive a Protocol Descriptor List defining which protocol stacks the device supports. It also includes information on which PSM to use in L2CAP, or the channel number for RFCOMM, or the port number for TCP or UDP. The description below talks about how the analyzer auto-traverses from L2CAP using a dynamically assigned PSM, but the principle is the same for RFCOMM channel numbers and TCP/UDP port numbers.

The analyzer looks for SDP Service Attribute Responses or Service Search Attribute Responses carrying protocol descriptor lists. If the analyzer sees L2CAP listed with a PSM, it stores the PSM and the UUID for the next protocol in the list.

After the SDP session is over, the analyzer looks at the PSM in the L2CAP Connect frames that follow. If the PSM matches one the analyzer has stored, the analyzer stores the source channel ID and destination channel ID, and associates those channel IDs with the PSM and UUID for the next protocol. Thereafter, when the analyzer sees L2CAP frames using those channel IDs, it can look them up in its table and know what the next protocol is.

In order for the analyzer to be able to auto-traverse using a dynamically assigned PSM, it has to have seen the SDP session giving the Protocol Descriptor Lists, and the subsequent L2CAP connection using the PSM and identifying the source and channel IDs. If the analyzer misses any of this process, it is not able to auto-traverse. It stops decoding at the L2CAP layer.

For L2CAP frames carrying a known PSM (0x0001 for SDP, for example, or 0x0003 for RFCOMM), the analyzer looks for Connect frames and stores the PSM along with the associated source and destination channel IDs. In this case the analyzer does not need to see the SDP process, but does need to see the L2CAP connection process, giving the source and destination channel IDs.

3.2.6 Providing Context For Decoding When Frame Information Is Missing

There may be times when you need to provide information to the analyzer because the context for decoding a frame is missing. For example, if the analyzer captured a response frame, but did not capture the command frame indicating the command.

The analyzer provides a way for you to supply the context for any frame, provided the decoder supports it. (The decoder writer has to include support for this feature in the decoder, so not all decoders support it. Note that not all decoders require this feature.)

If the decoder supports user-provided context, three items are active on the **Options** menu of the **Control** window and the **Frame Display** window. These items are **Set Initial Decoder Parameters**, **Automatically Request Missing Decoding Information**, and **Set Subsequent Decoder Parameters**. (These items are not present if no decoder is loaded that supports this feature.)

Set Initial Decoder Parameters is used to provide required information to decoders that is not context dependent but instead tends to be system options for the protocol.

Choose **Set Initial Decoder Parameters** in order to provide initial context to the analyzer for a decoder. A dialog appears that shows the data for which you can provide information.

If you need to change this information for a particular frame :

1. Right-click on the frame in the Frame Display window
2. Choose Provide <context name>.

Alternatively, you can choose **Set Subsequent Decoder Parameter** from the **Options** menu.

3. This option brings up a dialog showing all the places where context data was overridden.
4. If you know that information is missing, you can't provide it, and you don't want to see dialogs asking for it, un-check **Automatically Request Missing Decoding Information**.
5. When unchecked, the analyzer doesn't bother you with dialogs asking for frame information that you don't have. In this situation, the analyzer decodes each frame until it cannot go further and then simply stop decoding.

3.3 Analyzing Byte Level Data

3.3.1 Event Display

To open this window click the **Event Display** icon  on the **Control** window toolbar.

The **Event Display** window provides detailed information about every captured event. Events include data bytes, data related information such as start-of-frame and end-of-frame flags, and the analyzer information, such as when the data capture was paused. Data bytes are displayed in hex on the left side of the window, with the corresponding ASCII character on the right.

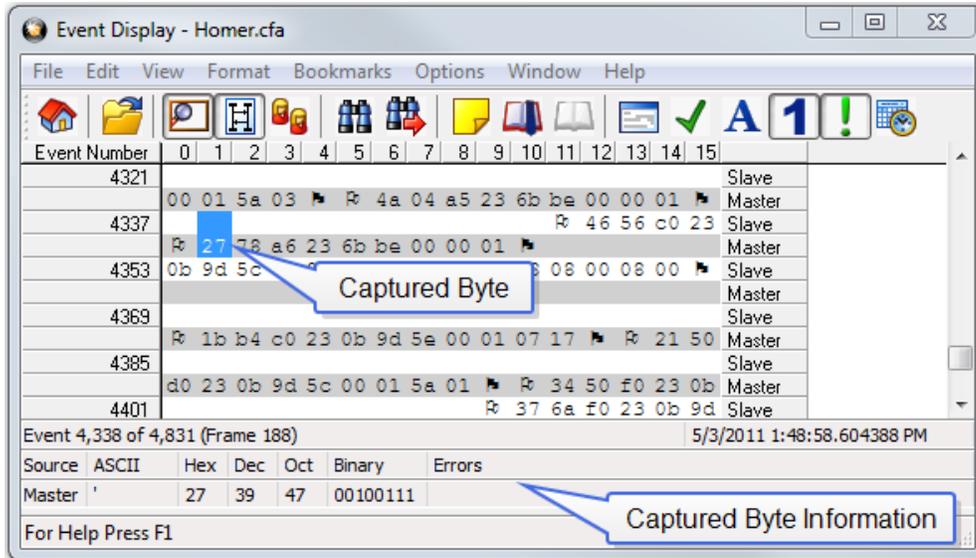


Figure 3.1 - Event Display

Click on an event to find out more about it. The three status lines at the bottom of the window are updated with information such as the time the event occurred (for data bytes, the time the byte was captured), the value of the byte in hex, decimal, octal, and binary, any errors associated with the byte, and more.

Events with errors are shown in red to make them easy to spot.

When capturing data live, the analyzer continually updates the Event Display as data is captured. Make sure the **Lock** icon  is displayed on the toolbar to prevent the display from updating (Clicking on the icon again will unlock the display). While locked, you can review your data, run searches, determine delta time intervals between bytes, and check CRCs. To resume updating the display, click the **Lock** icon again.

You can have more than one **Event Display** open at a time. Click the **Duplicate View** icon  to create a second, independent **Event Display** window. You can lock one copy of the **Event Display** and analyze your data, while the second **Event Display** updates as new data is captured.

Event Display is synchronized with the **Frame Display** dialogs. Selecting a byte in **Event Display** will also select the related frame in the **Frame Display**.

3.3.2 The Event Display Toolbar

-  Home – Brings the Control window to the front.
-  Open a capture file
-  Start Capture - Begins data capture to disk.
-  Sodera Only: Start Analyze- Begins data analysis..
-  Stop Capture - Closes a capture file and stops data capture to disk.

-  **Sodera Only: Stop Analyze-** Stops the analysis and clears the data from the ComProbe analyzer.
-  **Save -** Prompts user for a file name. If the user supplies a name, a .cfa file is saved.
-  **Clear-** Discards the temporary file and clears the display.
-  **MSC Chart -** Opens the Message Sequence Chart
-  **Signal Display -** Opens The Signal Display dialog.
-  **Lock -** In the Lock state, the window is locked so you can review a portion of data. Data capture continues in the background. Clicking on the Lock icon unlocks the window.
-  **Unlock -** In the Unlock state, the screen fills in the data captured since the screen lock and moves down to display incoming data again. Clicking on the Unlock icon locks the window.
-  **Open Breakout Box window** that provides a real-time graphical view of control signals.
-  **Duplicate View -** Creates a second Event Display window identical to the first.
-  **Frame Display - (framed data only)** Brings up a Frame Display, with the frame of the currently selected bytes highlighted.
-  **Display Capture Notes -** Brings up the Capture Notes window where you can view or add notes to the capture file.
-  **Add/Modify Bookmark -** Add a new or modify an existing bookmark.
-  **Display All Bookmarks -** Shows all bookmarks and lets you move between bookmarks.
-  **Find -** Search for errors, string patterns, special events and more.
-  **Go To -** Opens the Go To dialog, where you can specify which event number to go to.
-  **CRC -** Change the algorithm and seed value used to calculate CRCs. To calculate a CRC, select a byte range, and the CRC appears in the status lines at the bottom of the Event Display.
-  **Mixed Sides - (Serial data only)** By default, the analyzer shows data with the DTE side above the DCE side. This is called DTE over DCE format. DTE data has a white background and DCE data has a gray background. The analyzer can also display data in mixed side format. In this format, the analyzer does not separate DTE data from DCE data but shows all data on the same line as it comes in. DTE data is still shown with a white background and DCE data with a gray background so that you can distinguish between the two. The benefit of using this format is that more data fits onto one screen.

-  **Character Only** - The analyzer shows both the number (hex, binary, etc.) data and the character (ASCII, EBCDIC or BAUDOT) data on the same screen. If you do not wish to see the hex characters, click on the Character Only button. Click again to go back to both number and character mode.
-  **Number Only** - Controls whether the analyzer displays data in both character and number format, or just number format. Click once to show only numeric values, and again to show both character and numeric values.
-  **All Events** - Controls whether the analyzer shows all events in the window, or only data bytes. Events include control signal changes and framing information.
-  **Timestamping Options** – Brings up the timestamping options window which has options for customizing the display and capture of timestamps.

3.3.3 Opening Multiple Event Display Windows

Click the **Duplicate View** icon  from the **Event Display** toolbar to open a second **Event Display** window.

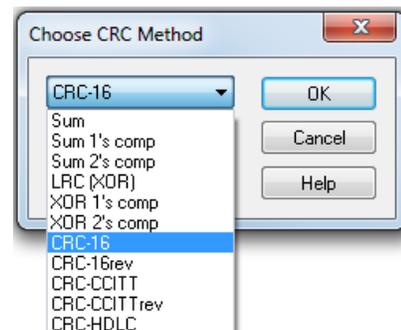
You can open as many **Event Display** windows as you like. Each **Event Display** is independent of the others and can show different data, use a different radix or character set, or be frozen or live.

The **Event Display** windows are numbered in the title bar. If you have multiple **Event Displays** open, click on the **Event Display** icon  on the **Control** window toolbar to show a list of all the **Event Displays** currently open. Select a window from the list to bring it to the front.

3.3.4 Calculating CRCs or FCSs

The cyclic redundancy check (CRC) is a function on the **Event Display** window used to produce a checksum. The frame check sequence (FCS) are the extra checksum characters added to a frame to detect errors.

1. Open the **Event Display**  window.
2. Click and drag to select the data for which you want to generate a CRC.
3. Click on the **CRC** icon .
4. In the **CRC** dialog box, click on the down arrow to show the list of choices for CRC algorithms. Choose an algorithm to use. Choose CRC 32 (Ethernet). Choose CRC 32 (Ethernet) for Ethernet data or the appropriate CRC type for serial data.
5. Enter a **Seed** value in hexadecimal if desired.
6. Click **OK** to generate the CRC. It appears in the byte information lines at the bottom of the Event Display window. Whenever you select a range of data, a CRC using the algorithm you selected is calculated automatically.



"CRC!" in Ethernet data

Ethernet network cards do not normally send the CRC with the frame to the upper layers of the system. The hardware on the card checks that the CRC is correct and then throws it away. Frontline marks the place where the CRC would be in the data with "CRC!". When viewing Ethernet capture files made with other programs, the CRC may or may not be included, depending on the specifications of the capturing software/hardware.

Reversed CRCs on the Event Display with Ethernet data

The CRC calculated in the Event Display window is reversed from the CRC shown in the data. CRCs are calculated in network data order from Most Significant Byte (MSB) to Least Significant Byte (LSB). The Ethernet specification says to send data in host data order (LSB to MSB). Therefore the CRC as captured in the data is the reverse of the CRC as calculated.

Example: If the CRC in the data is shown as 00 01 02 03, the Event Display calculated the CRC and show it in the status lines as 03 02 01 00. This is correct.

Calculating CRC for interwoven data

Frontline calculates the CRC for either side of the interwoven data. Which side it calculates is determined by the first byte selected. If the first byte is from one side, then Frontline calculates the CRC for just the bytes on that side. If the first byte is from the other side, then Frontline calculates the CRC for just the bytes on that side.

Incorrect results with CRC16 for serial data

If you are calculating CRCs using the CRC16 algorithm and the CRCs do not match what you know they should be, try CRC16rev. What hardware often calls CRC16 is what software calls CRC16rev.

3.3.5 Calculating Delta Times and Data Rates

1. Click on the **Event Display** icon  on the **Control** window to open the **Event Display** window.
2. Use the mouse to select the data you want to calculate a delta time and rate for.
3. The **Event Display** window displays the delta time and the data rate in the status lines at the bottom of the window.

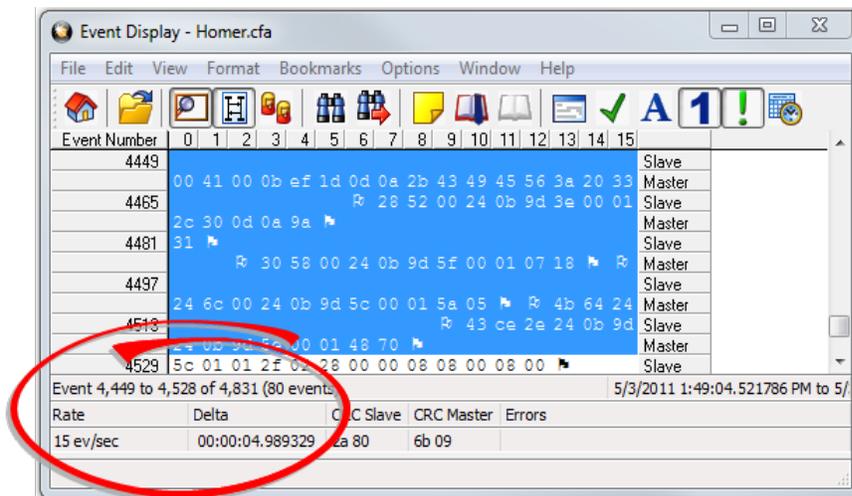


Figure 3.2 - Delta fields

3.3.6 Switching Between Live Update and Review Mode

The **Event Display** and **Frame Display** windows can update to display new data during live capture, or be frozen to allow data analysis. By default, the **Event Display** continually updates with new data, and the **Frame Display** is locked.

1. Make sure the **Lock** icon  is active so the display is locked and unable to scroll.
2. Click the **Unlock**  icon again to resume live update.

The analyzer continues to capture data in the background while the display is locked. Upon resuming live update, the display updates with the latest data.

You can have more than one **Event Display** or **Frame Display** window open at a time. Click the **Duplicate View** icon  to open additional Event or Frame Display windows. The lock/resume function is independent on each window. This means that you can have two **Event Display** windows open simultaneously, and one window can be locked while the other continues to update.

3.3.7 Data Formats and Symbols

3.3.7.1 List of all Event Symbols

By default, the **Event Display** shows all eventsevents, which includes control signal changes, start and end of frame characters and flow control changes. If you want to see only the data bytes, click on the All Events button . Click again to display all events.

Click on a symbol, and the analyzer displays the symbol name and sometimes additional information in the status lines at the bottom of the **Event Display** window. For example, clicking on a control signal change symbol displays which signal(s) changed.

In addition to data bytes, the events shown are (in alphabetical order):

Table 3.1 - Event Symbols

Symbol	Event
	Abort
	Broken Frame - The frame did not end when the analyzer expected it to. This occurs most often with protocols where the framing is indicated by a specific character, control signal change, or other data related event.
	Buffer Overflow - Indicates a buffer overflow error. A buffer overflow always causes a broken frame.
	Control Signal Change - One or more control signals changed state. Click on the symbol, and the analyzer displays which signal(s) changed at the bottom of the Event Display window.
	Data Capture Paused - The Pause icon was clicked, pausing data capture. No data is recorded while capture is paused.
	Data Capture Resumed - The Pause icon was clicked again, resuming data capture.

Table 3.1 - Event Symbols (continued)

Symbol	Event
	Dropped Frames - Some number of frames were lost. Click on the symbol, and the analyzer displays many frames were lost at the bottom of the Event Display window.
	End of Frame - Marks the end of a frame.
	Flow Control Active - An event occurred which caused flow control to become active (i.e. caused the analyzer to stop transmitting data) Events which activate flow control are signal changes or the receipt of an XON character.
	Flow Control Inactive - An event occurred which caused flow control to become inactive (i.e. caused the analyzer to transmit data). Events which deactivate flow control are signal changes or the receipt of an XOFF character.
	Frame Recognizer Change - A lowest layer protocol was selected or removed here, causing the frame recognizer to be turned off or on.
	I/O Settings Change - A change was made in the I/O Settings window which altered the baud, parity, or other circuit setting.
	Long Break
	Low Power - The battery in the ComProbe® is low.
	Short Break
	SPY Event (SPY Mode only) - SPY events are commands sent by the application being spied on to the UART.
	Start of Frame - Marks the start of a frame.
	Begin Sync Character Strip
	End Sync Character Strip
	Sync Dropped
	Sync Found
	Sync Hunt Entered
	Sync Lost
	Test Device Stopped Responding - The analyzer lost contact with the ComProbe for some reason, often because there is no power to the ComProbe.
	Test Device Began Responding - The analyzer regained contact with the ComProbe.
	Timestamping Disabled - Timestamping was turned off. Events following this event are not timestamped.

Table 3.1 - Event Symbols (continued)

Symbol	Event
	Timestamping Enabled - Timestamping was turned on. Events following this event have timestamps.
	Truncated Frame- A frame that is not the same size as indicated within its protocol.
	Underrun Error
	Unknown Event

3.3.7.2 Switching Between Viewing All Events and Viewing Data Events

By default, the analyzer on the Event Display dialog shows all events that include:

- Data bytes
- Start-of-frame
- End-of-frame characters
- Data Captured Was Paused.

Click on the **Display All Events** icon  to remove the non-data events. Click again to display all events.

See [List of all Event Symbols on page 1](#) for a list of all the special events shown in the analyzer and what they mean.

3.3.7.3 Switching Between Hex, Decimal, Octal or Binary

On the Event Display window the analyzer displays data in Hex by default. There are several ways to change the radix used to display data.

Go to the **Format** menu and select the radix you want. A check mark next to the radix indicates which set is currently being used.

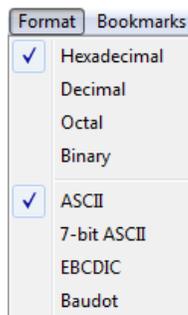


Figure 3.3 - Format Menu

1. Right-click on the data display header labels and choose a different radix.

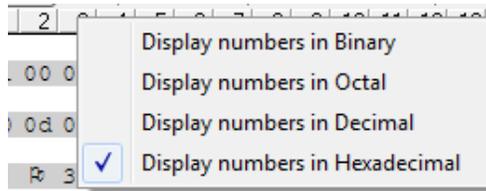


Figure 3.4 - Header labels, right click

2. Or right-click anywhere in the data display and select a different radix.

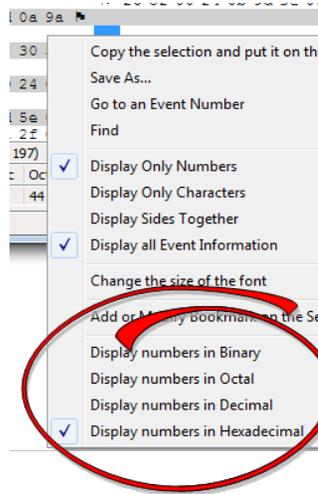


Figure 3.5 - Data display right click menu

If you want to see only the numerical values, click on the **Numbers Only** icon  on the **Event Display** toolbar.

3.3.7.4 Switching Between ASCII, EBCDIC, and Baudot

On the **Event Display** window, the analyzer displays data in ASCII by default when you click on the **Characters Only** icon . There are several ways to change the character set used to display data.

1. Go to the **Format** menu and select the character set you want. A check mark next to the character set indicates which set is currently being used.
2. With the data displayed in characters, right-click on the data panel header label to choose a different character set.

If you want to see only characters, click on the **Characters Only** icon  on the **Event Display** toolbar.

3.3.7.5 Viewing Only ASCII (or EBCDIC or Baudot)

On the Event Display toolbar you can choose to view data in ASCII, EBCDIC, or Baudot format only click on the Characters Only icon  on the Event Display toolbar.

To add the numerical values back to the display click the Characters Only icon again.

3.3.7.6 Viewing Only Hex (Or Decimal or Octal or Binary)

On the **Event Display** toolbar you can choose to view data as numeric only. Click on the Numbers Only icon  on the **Event Display** toolbar.

To display the characters back to the display click the Number Only icon again.

3.3.7.7 Selecting Mixed Channel/Sides

If you want to get more data on the **Event Display** window, you can switch to mixed sides mode. This mode puts all the data together on the same line. Data from one side (**Slave**) is shown on a white background and data from the other side (**Master**) is shown on a gray background.

1. Click once on the **Mixed Sides** icon  to put the display in mixed sides mode.
2. Click again to return to side over side mode.
3. You can right click in the center of the data display window to change between mixed and side over side modes by selecting **Display Sides Together**. A check mark is displayed. Click on **Display Sides Together** to remove the check mark and return to side-by-side display.
4. Right click in the sides panel on the right of the data display and select **Display Sides Together**. A check mark is displayed. Click on **Display Sides Together** to remove the check mark and return to side-by-side display.
- 5.

3.3.7.8 Font Size

The font size can be changed on several **Event Display** windows. Changing the font size on one window does not affect the font size on any other window.

To change the font size:

1. Click on **Event Display** menu **Options**, and select **Change the Font Size**.

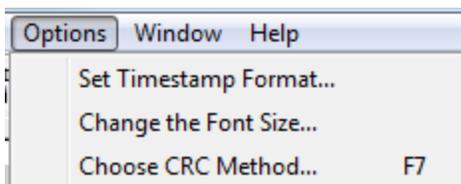


Figure 3.6 - Event Display Options menu

2. Choose a font size from the list.

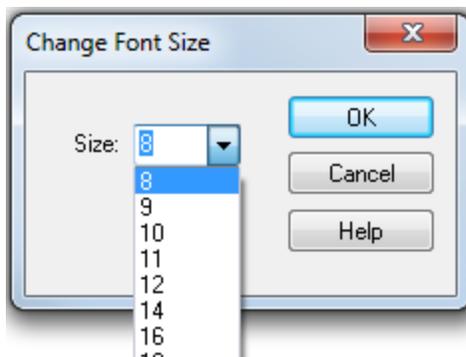


Figure 3.7 - Event Display Font Size Selection

3. Click **OK**.

3.4 The Frame Display

To open this window

Click the **Frame Display** icon  on the **Control** window toolbar, or select **Frame Display** from the **View** menu.

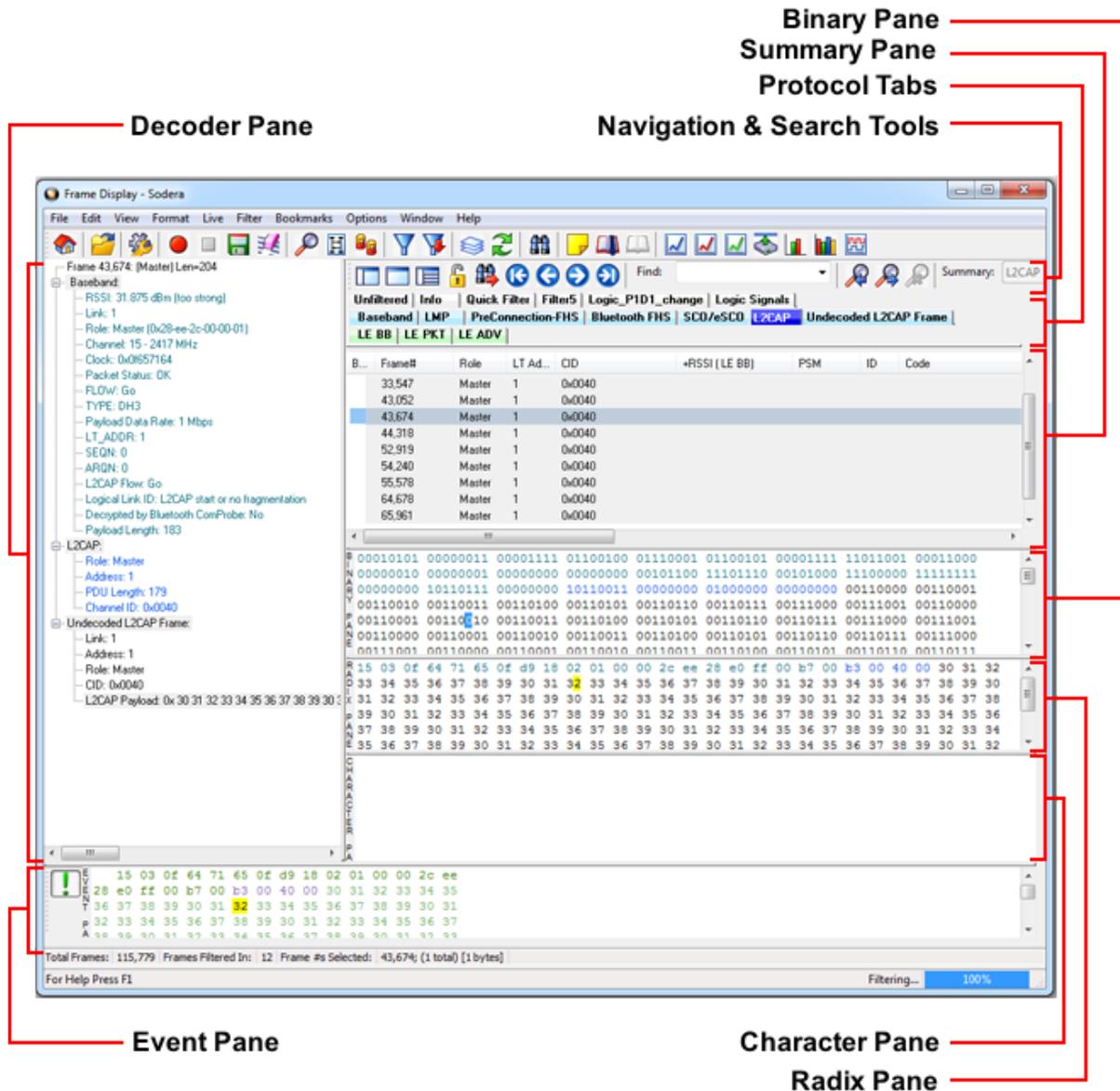


Figure 3.8 - Frame Display with all panes active

Frame Display Panes

The **Frame Display** window is used to view all frame related information. It is composed of a number of different sections or "panes", where each pane shows a different type of information about a frame.

- **Summary Pane** - The **Summary Pane** displays a one line summary of each frame for every protocol found in the data, and can be sorted by field for every protocol. Click [here](#) for an explanation of the symbols next to the frame numbers.

- [Decode Pane](#) - The **Decode Pane** displays a detailed decode of the highlighted frame. Fields selected in the **Decode Pane** have the appropriate bit(s) or byte(s) selected in the **Radix, Binary, Character**, and **Event** panes
- [Radix Pane](#) - The **Radix Pane** displays the [logical data bytes](#) in the selected frame in either hexadecimal, decimal or octal.
- [Binary Pane](#) - The **Binary Pane** displays a binary representation of the logical data bytes.
- [Character Pane](#) - The **Character Pane** displays the character representation of the logical data bytes in either ASCII, EBCDIC or Baudot.
- [Event Pane](#) - The **Event Pane** displays the physical data bytes in the frame, as received on the network.

By default, all panes except the **Event Pane** are displayed when the Frame Display is first opened.

Protocol Tabs

Protocol filter tabs are displayed in the **Frame Display** above the Summary pane.

- These tabs are arranged in separate color-coded groups. The General group applies to all technologies. The other groups are technology-specific.
- Clicking on a protocol filter tab in the General group filters in all packets containing that protocol regardless of each packet's technology.
- Clicking on a protocol filter tab in a technology-specific group filters in all packets containing that protocol on that technology.
- A protocol filter tab appears in the General group only if the protocol occurs in more than one of the technology-specific tab groups.

Select the **Unfiltered** tab to display all packets.

There are several special tabs that appear in the **Summary Pane** when certain conditions are met. These tabs appear only in the General group and apply to all technologies. The tabs are:

- **Bookmarks** appear when a bookmark is first seen.
- **Errors** appear when an error is first seen. An error is a physical error in a data byte or an error in the protocol decode.
- **Info** appears when a frame containing an Information field is first seen.

The tabs disappear when the capture buffer is cleared during live capture or when decoders are reloaded, even if one of the tabs is currently selected. They subsequently reappear as the corresponding events are detected.

Comparing Frames

If you need to compare frames, you can open additional **Frame Display** windows by clicking on the **Duplicate View** icon . You can have as many **Frame Display** windows open at a time as you wish.

Frame Wrapping and Display

In order to assure that the data you are seeing in **Frame Display** are current, the following messages appear describing the state of the data as it is being captured.

- All **Frame Display** panes except the [Summary pane](#) display "No frame selected" when the selected frame is in the buffer (i.e. not wrapped out) but not accessible in the **Summary** pane. This can happen when a tab is selected that doesn't filter in the selected frame.
- When the selected frame wraps out (regardless of whether it was accessible in the [Summary pane](#)) all **Frame Display** panes except the **Summary** pane display "Frame wrapped out of buffer".
- When the selected frame is still being captured, all **Frame Display** panes except the [Summary pane](#) display "Frame incomplete".

3.4.1 Frame Display Toolbar

The buttons that appear in the **Frame Display** window vary according to the particular configuration of the analyzer. For controls not available the icons will be grayed-out.

Table 3.2 - Frame Display Toolbar Icons

Icon	Description
	Control – Brings the Control window to the front.
	Open File - Opens a capture file.
	I/O Settings - Opens the I/O Settings dialog.
	Start Capture - Begins data capture to a user designated file.
	Sodera Only: Start Analyze- Begins data analysis..
	Stop Capture - Closes a capture file and stops data capture to disk.
	Sodera Only: Stop Analyze- Stops the analysis and clears the data from the ComProbe analyzer.
	Save - Save the currently selected bytes or the entire buffer to file.
	Clear- Discards the temporary file and clears the display.
	Event Display – Brings the Event Display window to the front.
	Show Message Sequence Chart - Message Sequence Chart (MSC) displays information about the messages passed between protocol layers.

Table 3.2 - Frame Display Toolbar Icons(continued)

Icon	Description
	Show Statistics - Opens Statistics dialog
	Duplicate View - Creates a second Frame Display window identical to the first.
	Apply/Modify Display Filters - Opens the Display Filter dialog.
	Quick Protocol Filter - brings up a dialog box where you can filter or hide one or more protocol layers.
	Protocol Stack - brings up the Protocol Stack Wizard where you can change the stack used to decode framed data
	Reload Decoders - When Reload Decoders is clicked, the plug-ins are reset and received frames are re-decoded. For example, If the first frame occurs more than 10 minutes in the past, the 10-minute utilization graph stays blank until a frame from 10 minutes ago or less is decoded.
	Find - Search for errors, string patterns, special events and more.
	Display Capture Notes - Brings up the Capture Notes window where you can view or add notes to the capture file.
	Add/Modify Bookmark - Add a new or modify an existing bookmark.
	Display All Bookmarks - Shows all bookmarks and lets you move between bookmarks.
	<i>Bluetooth</i> Timeline - Opens the Bluetooth Timeline
	Coexistence View - Opens the Coexistence View
	low energy Timeline- Opens the low energy Timeline
	Extract Data - Opens the Extract Data dialog.

Table 3.2 - Frame Display Toolbar Icons(continued)

Icon	Description
	<i>Bluetooth</i> low energy Packet Error Rate Statistics Opens the Packet Error Rate Statistics display
	<i>Bluetooth</i> Classic Packet Error Rate Statistics - Opens the Packet Error Rate Statistics display.
	Logic Analyzer - Opens the logic analyzer used for logic signal and packet timing analysis.
	Signal Display - Opens The Signal Display dialog.
	Breakout Box - Opens the Breakout Box dialog.
	Audio Extraction - Opens the Audio Extraction dialog.
	Pie Chart - This icon displays a chart that displays the number of frames with and without errors.
Reload Decoders - When Reload Decoders is clicked, the plug-ins are reset and received frames are re-decoded. For example, If the first frame occurs more than 10 minutes in the past, the 10-minute utilization graph stays blank until a frame from 10 minutes ago or less is decoded.	
	Filter: Text giving the filter currently in use. If no filter is being used, the text reads "All Frames" which means that nothing is filtered out. To see the text of the entire filter, place the cursor over the text and a ToolTip pops up with the full text of the filter.
<u>The following icons all change how the panes are arranged on the Frame Display. Additional layouts are listed in the View menu.</u>	
	Show Default Panes - Returns the panes to their default settings.
	Show Only Summary Pane - Displays only the Summary pane.
	Shall All Panes Except Event Pane - Makes the Decode pane taller and the Summary pane narrower.

Table 3.2 - Frame Display Toolbar Icons(continued)

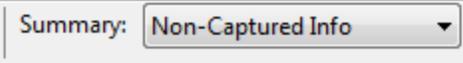
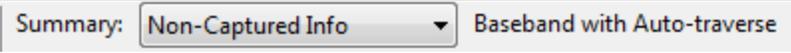
Icon	Description
	Toggle Display Lock - Prevents the display from updating.
	Go To Frame
	First Frame - Moves to the first frame in the buffer.
	Previous Frame - Moves to the previous frame in the buffer.
	Next Frame - Moves to the next frame in the buffer.
	Last Frame - Moves to the last frame in the buffer.
Find:	Find on Frame Display only searches the Decode Pane for a value you enter in the text box.
	Find Previous Occurrence - Moves to the previous occurrence of the value in the Frame Display Find.
	Find Next Occurrence - Moves to the next occurrence of the value in the Frame Display Find.
	Cancel Current Search - Stops the current Frame Display Find.
Summary:	<p>Summary Drop Down Box: Lists all the protocols found in the data in the file. This box does not list all the protocol decoders available to the analyzer, merely the protocols found in the data. Selecting a protocol from the list changes the Summary pane to display summary information for that protocol. When a low energy predefined Named Filter (like Nulls and Polls) is selected, the Summary drop-down is disabled.</p> 

Table 3.2 - Frame Display Toolbar Icons(continued)

Icon	Description
	Text with Protocol Stack: To the right of the Summary Layer box is some text giving the protocol stack currently in use.

Note: If the frames are sorted in other than ascending frame number order, the order of the frames in the buffer is the sorted order. Therefore the last frame in the buffer may not have the last frame number.

3.4.2 Frame Display Status Bar

The **Frame DisplayStatus** bar appears at the bottom of the **Frame Display**. It contains the following information:

- **Frame #s Selected:** Displays the frame number or numbers of selected (highlighted) frames, and the total number of selected frames in parentheses
- **Total Frames:** The total number of frames in the capture buffer or capture file in real-time
- **Frames Filtered In:** The total number of frames displayed in the filtered results from user applied filters in real-time

3.4.3 Hiding and Revealing Protocol Layers in the Frame Display

Hiding protocol layers refers to the ability to prevent a layer from being displayed on the **Decode** pane. Hidden layers remain hidden for every frame where the layer is present, and can be revealed again at any time. You can hide as many layers as you wish.

Note: Hiding from the **Frame Display** affects only the data shown in the **Frame Display** and not any information in any other window.

There are two ways to hide a layer.

1. Right-click on the layer in the **Decode** pane, and choose **Hide [protocol name] Layer In All Frames**.
2. Click the **Set Protocol Filtering** button on the **Summary** pane toolbar. In the **Protocols to Hide** box on the right, check the protocol layer(s) you want hidden. Click **OK** when finished.

To reveal a hidden protocol layer:

1. Right-click anywhere in the **Decode** pane
2. Choose **Show [protocol name] Layer** from the right-click menu, or click the **Set Protocol Filtering** button and un-check the layer or layers you want revealed.

3.4.4 Physical vs. Logical Byte Display

The **Event Display** window and **Event Pane** in the **Frame Display** window show the physical bytes. In other words, they show the actual data as it appeared on the circuit. The Radix, Binary and Character panes in the Frame Display window show the logical data, or the resulting byte values after escape codes or other character altering codes have been applied (a process called frame transformation).

As an example, bytes with a value of less than 0x20 (the 0x indicates a hexadecimal value) cannot be transmitted in Async PPP. To get around this, a 0x7d is transmitted before the byte. The 0x7d says to take the next byte and subtract 0x20 to obtain the true value. In this situation, the Event pane displays 0x7d 0x23, while the Radix pane displays 0x03.

3.4.5 Sorting Frames

By default, frames are sorted in ascending numerical sequence by frame number. Click on a column header in the **Summary** pane to sort the frames by that column. For example, to sort the frames by size, click on the **Frame Size** column header.

An embossed triangle next to the header name indicates which column the frames are sorted by. The direction of the triangle indicates whether the frames are in ascending or descending order, with up being ascending.

Note that it may take some time to sort large numbers of frames.

3.4.6 Frame Display - Find

Frame Display has a simple **Find** function that you can use to search the Decode Pane for any alpha numeric value. This functionality is in addition to the more robust [Search/Find dialog](#).

Frame DisplayFind is located below the toolbar on the **Frame Display** dialog.



Figure 3.9 - Frame Display Find text entry field

Where the more powerful [Search/Find](#) functionality searches the **Decode**, **Binary**, **Radix**, and **Character** panes on **Frame Display** using Timestamps, Special Events, Bookmarks, Patterns, etc.,

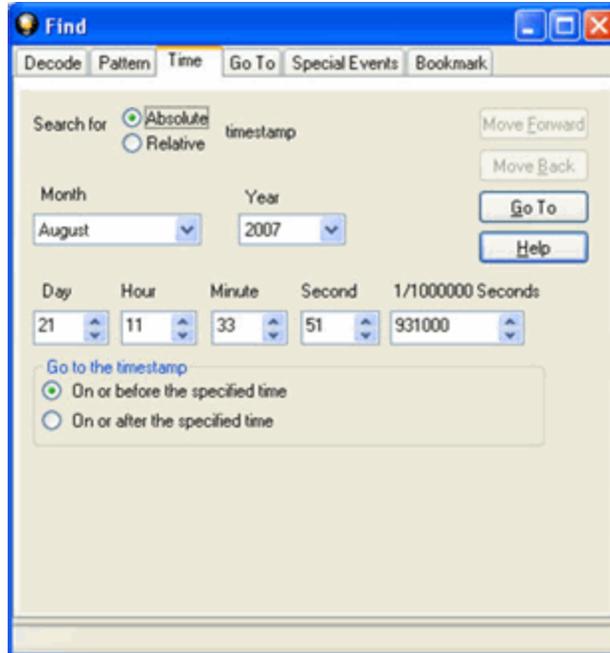


Figure 3.10 - Search/Find Dialog

Find on Frame Display only searches the [Decode Pane](#) for a value you enter in the text box.

To use **Find**:

1. Select the frame where you want to begin the search.
2. Enter a value in the **Find** text box.



Note: The text box is disabled during a live capture.

Select **Find Previous Occurrence**  to begin the search on frames prior to the frame you selected,

or **Find Next Occurrence**  to begin the search on frames following the frame you selected.

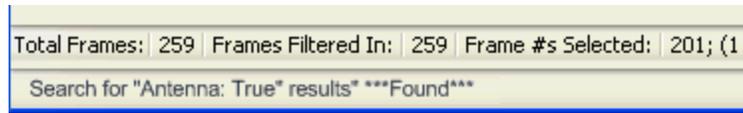


The next occurrence of the value (if it is found) will be highlighted in the Decode Pane.

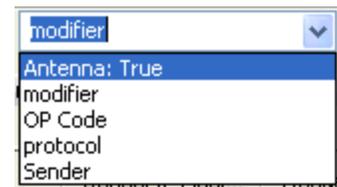
4. Select **FindPrevious Occurrence** or **FindNext Occurrence** to continue the search.

There are several important concepts to remember with Find.

- When you enter a search string and select Enter, the search moves forward.
- If you select **Find Previous Occurrence**, when the search reaches the first frame it will then cycle to the last frame and continue until it reaches the frame where the search began.
- Shift + F3 is a shortcut for Find Previous Occurrence.
- If you select **Find Next Occurrence**, when the search reaches the last frame it will then cycle to the first frame and continue until it reaches the frame where the search began.
- F3 is a shortcut for Find Next Occurrence.
- You cannot search while data is being captured.
- After a capture is completed, you cannot search until Frame Display has finished decoding the frames.
- Find is not case sensitive.
- The status of the search is displayed at the bottom of the dialog.



- The search occurs only on the protocol layer selected.
- To search across all the protocols on the Frame Display, select the Unfiltered tab.
- A drop-down list displays the search values entered during the current session of Frame Display.
- The search is cancelled when you select a different protocol tab during a search.
- You can cancel the search at any time by selecting the **Cancel Current Search**  button.



3.4.7 Synchronizing the Event and Frame Displays

The **Frame Display** is synchronized with the **Event Display**. Click on a frame in the **Frame Display** and the corresponding bytes is highlighted in the **Event Display**. Each **Frame Display** has its own **Event Display**.

As an example, here's what happens if the following sequence of events occurs.

1. Click on the **Frame Display** icon  in **Control** window toolbar to open the **Frame Display**.
2. Click on the **Duplicate View** icon  to create **Frame Display #2**.
3. Click on **Event Display** icon  in **Frame Display #2**. **Event Display #2** opens. This **Event Display** is labeled #2, even though there is no original **Event Display**, to indicate that it is synchronized with **Frame Display #2**.

4. Click on a frame in **Frame Display #2**. The corresponding bytes are highlighted in **Event Display #2**.
5. Click on a frame in the original **Frame Display**. **Event Display #2** does not change.

3.4.8 Working with Multiple Frame Displays

Multiple Frame Displays are useful for comparing two frames side by side. They are also useful for comparing all frames against a filtered subset or two filtered subsets against each other.

- To create a second Frame Display, click the **Duplicate View** icon  on the **Frame Display** toolbar.

This creates another **Frame Display** window. You can have as many **Frame Displays** open as you wish. Each **Frame Display** is given a number in the title bar to distinguish it from the others.

- To navigate between multiple Frame Displays, click on the **Frame Display** icon  in the Control window toolbar.

A drop-down list appears, listing all the currently open Frame Displays.

- Select the one you want from the list and it comes to the front.

Note: When you create a filter in one **Frame Display**, that filter does not automatically appear in the other **Frame Display**. You must use the Hide/Reveal feature to display a filter created in one Frame Display in another.

Note: When you have multiple **Frame Display** windows open and you are capturing data, you may receive an error message declaring that "Filtering cannot be done while receiving data this fast." If this occurs, you may have to stop filtering until the data is captured.

3.4.9 Working with Panes on Frame Display

When the **Frame Display** first opens, all panes are displayed except the **Event** pane (To view all the panes, select **Show All Panes** from the **View** menu).

- The **Toggle Expand Decode Pane** icon  makes the decode pane longer to view lengthy decodes better.
- The **Show Default Panes** icon  returns the **Frame Display** to its default settings.
- The Show only Summary Pane icon  displays on the Summary Pane.

To close a pane, right-click on the pane and select **Hide This Pane** from the pop-up menu, or de-select **Show [Pane Name]** from the **View** menu.

To open a pane, right-click on the any pane and select **Show Hidden Panes** from the pop-up menu and select the pane from the fly-out menu, or select **Show [Pane Name]** from the **View** menu.

To re-size a pane, place the cursor over the pane border until a double-arrow cursor appears. Click and drag on the pane border to re-size the pane.

3.4.10 Frame Display - Byte Export

The captured frames can be exported as raw bytes to a text file.

1. From the **Frame Display File** menu select **Byte Export...**

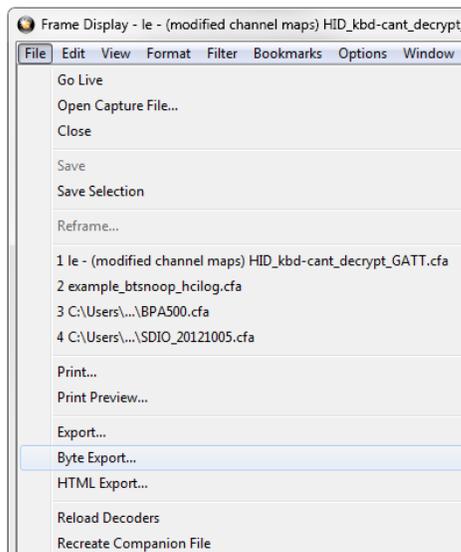


Figure 3.11 - Frame Display File menu, Byte Export

2. From the Byte Export window specify the frames to export.
 - All Frames exports all filtered-in frames including those scrolled off the **Summary** pane. Filtered-in frames are dependent on the selected **Filter** tab above the **Summary** pane. Filtered-out frames are not exported.
 - Selected Frames export is the same as **All Frames** export except that only frames selected in the **Summary** pane will be exported.

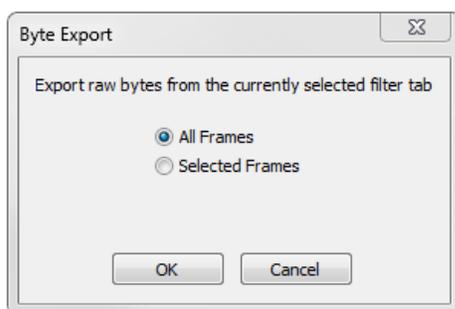


Figure 3.12 - Byte Export dialog

Click the **OK** button to save the export. Clicking the **Cancel** button will exit Byte Export.

3. The **Save As** dialog will open. Select a directory location and enter a file name for the exported frames

file.

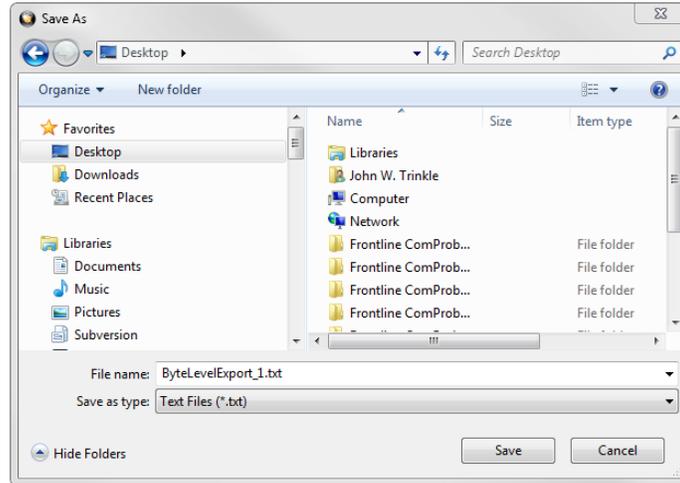


Figure 3.13 - Save As dialog

Click on the **Save** button.

The exported frames are in a text file that can be opened in any standard text editing application. The header shows the export type, the capture file name, the selected filter tab, and the number of frames. The body shows the frame number, the timestamp in the same format shown in the **Frame DisplaySummary** pane, and the frame contents as raw bytes.

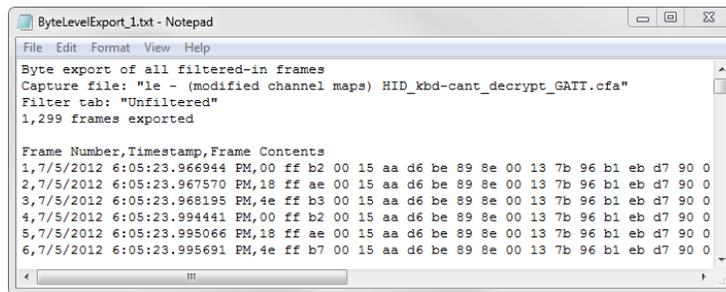


Figure 3.14 - Sample Exported Frames Text File

3.4.11 Panes in the Frame Display

3.4.11.1 Summary Pane

The **Summary** pane  displays a one-line summary of every frame in a capture buffer or file, including frame number, timestamp, length and basic protocol information. The protocol information included for each frame depends on the protocol selected in the summary layer box (located directly below the main toolbar).

On a two-channel circuit, the background color of the one-line summary indicates whether the frame came from the DTE or the DCE device. Frames with a white background come from the DTE device, frames with a gray background come from the DCE device.

The ComProbe USB **Summary** pane displays a one-line summary of every transaction in a capture buffer or file. Whenever there is a transaction it is shown on a single line instead of showing the separate messages that comprise the transaction. The **Msg** column in that case says "Transaction".

Each message in a transaction contains a packet identifier (PID). All of the PIDs in a transaction are shown in the transaction line.

All "IN" transactions (i.e. transactions that contain an IN token message) are shown with a purple background. All other transactions and all non-transactions are shown with a white background. "IN" transactions have special coloring because that is the only place where the primary data flow is from a device to the Host.

The protocol information included for each frame depends on the protocol selected in the summary layer box (located directly below the main toolbar).

Frame numbers in red indicate errors, either physical (byte-level) or frame errors. If the error is a frame error in the displayed protocol layer, the bytes where the error occurred is displayed in red. The [Decode Pane](#) gives precise information as to the type of error and where it occurred.

The **Summary** pane is synchronized with the other panes in this window. Click on a frame in the **Summary** pane, and the bytes for that frame is highlighted in the **Event** pane while the **Decode** pane displays the full decode for that frame. Any other panes which are being viewed are updated accordingly. If you use one pane to select a subset of the frame, then only that subset of the frame is highlighted in the other panes.

Protocol Tabs

Protocol filter tabs are displayed in the Frame Display above the Summary pane.

- These tabs are arranged in separate color-coded groups. The General group applies to all technologies. The other groups are technology-specific.
- Clicking on a protocol filter tab in the General group filters in all packets containing that protocol regardless of each packet's technology.
- Clicking on a protocol filter tab in a technology-specific group filters in all packets containing that protocol on that technology.
- A protocol filter tab appears in the General group only if the protocol occurs in more than one of the technology-specific tab groups.

Select the Unfiltered tab to display all packets.

There are several special tabs that appear in the **Summary** pane when certain conditions are met. These tabs appear only in the General group and apply to all technologies. The tabs are:

- **Bookmarks** appear when a bookmark is first seen.
- **Errors** appear when an error is first seen. An error is a physical error in a data byte or an error in the protocol decode.
- **Info** appears when a frame containing an Information field is first seen.

The tabs disappear when the capture buffer is cleared during live capture or when decoders are reloaded, even if one of the tabs is currently selected. They subsequently reappear as the corresponding events are detected.

The tabs disappear when the capture buffer is cleared during live capture or when decoders are reloaded, even if one of the tabs is currently selected. They subsequently reappear as the corresponding events are detected.

Use the navigation icons, keyboard or mouse to move through the frames. The icons  and  move you to the first and last frames in the buffer, respectively. Use the [Go To](#) icon  to move to a specific frame number.

Placing the mouse pointer on a summary pane header with truncated text displays a tooltip showing the full header text.

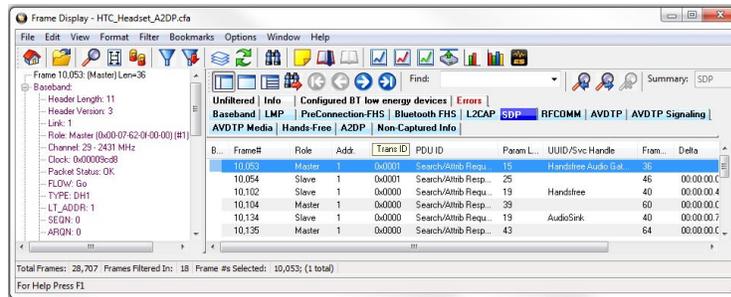


Figure 3.15 - Summary pane (right) with Tooltip on Column 5 (Tran ID)

Sides in Bluetooth low energy

A Bluetooth low energy data connection consists of connection events, which are a series of transmissions on the same channel. In each connection event the master transmits first, then the slave, and then the devices take turns until the connection event is finished.

When the data connection is encrypted and the packets are successfully decrypted, the sniffer can determine exactly who sent which packet (only non-empty, encrypted packets – empty packets are never encrypted). These packets are labeled either 'M' for master or 'S' for slave.

When the data connection is unencrypted or when encrypted packets are not successfully decrypted by the sniffer, the sniffer cannot distinguish the two devices' (master and slave) packets by their content, just by the packet timing. In those cases we label each device as side '1' or '2', not as master or slave. In each connection event, packets sent by the device which transmitted first in the connection event are labeled '1', and packets sent by the device which transmitted second are labeled '2'.

If no packets in the connection event are missed by the sniffer, the device labeled '1' is the master and the device labeled '2' is the slave. However, if we do not capture the very first packet in a connection event (i.e. the packet sent by the master) but do capture the packet sent by the slave, we label the slave as side '1' since it is the first device we heard in the connection event. Because there is potential clock drift since the last connection event, we cannot use the absolute timing to correct this error; there would still be cases where we get it wrong. Therefore we always assign '1' to the first packet in a connection event. So even though it is rare, there are connection events where packets sent by the slave device are labeled '1' and packets sent by the master are labeled '2'.

Finally, in a noisy environment it is also possible that the sniffer does not capture packets in the middle of a connection event. If this occurs and the sniffer cannot determine the side for the remaining packets in that connection event, the side is labeled 'U' for "unknown".

3.4.11.2 Customizing Fields in the Summary Pane

You can modify the **Summary** Pane in **Frame Display**.

Summary pane columns can be reordered by dragging any column to a different position.

Fields from the **Decode** pane can be added to the summary pane by dragging any **Decode**pane field to the desired location in the **summary** pane header. If the new field is from a different layer than the summary pane a plus sign (+) is prepended to the field name and the layer name is added in parentheses. The same field can be added more than once if desired, thus making it possible to put the same field at the front and back (for example) of a long header line so that the field is visible regardless of where the header is scrolled to.

An added field can be removed from the **Summary** pane by selecting **Remove New Column** from the right-click menu.

The default column layout (both membership and order) can be restored by selecting **Restore Default Columns** from the **Format** or right-click menus.

Changing Column Widths

To change the width of a column:

1. Place the cursor over the right column divider until the cursor changes to a solid double arrow.
2. Click and drag the divider to the desired width.
3. To auto-size the columns, double-click on the column dividers.

Hiding Columns

To hide a column:

1. Drag the right divider of the column all the way to the left.
2. The cursor changes to a split double arrow when a hidden column is present.
3. To show the hidden column, place the cursor over the divider until it changes to a split double arrow, then click and drag the cursor to the right.
4. The **Frame Size**, **Timestamp**, and **Delta** columns can be hidden by right-clicking on the header and selecting **Show Frame Size Column**, **Show Timestamp Column**, or **Show Delta Column**. Follow the same procedure to display the columns again.

Moving Columns - Changing Column Order

To move a column :

1. Click and hold on the column header
2. Drag the mouse over the header row.
3. A small white triangle indicates where the column is moved to.
4. When the triangle is in the desired location, release the mouse.

Restoring Default Column Settings

To restore columns to their default locations, their default widths, and show any hidden columns

1. Right-click on any column header and choose **Restore Default Column Widths**, or select **Restore Default Column Widths** from the **Format** menu.

3.4.11.3 Frame Symbols in the Summary Pane

Table 3.3 - Frame Symbols

Symbol	Description
	A green dot means the frame was decoded successfully, and the protocol listed in the Summary Layer drop-down box exists in the frame. No dot means the frame was decoded successfully, but the protocol listed in the Summary Layer drop-down box does not exist in the frame.
	A green circle means the frame was not fully decoded. There are several reasons why this might happen. <ul style="list-style-type: none"> • One reason is that the frame compiler hasn't caught up to that frame yet. It takes some time for the analyzer to compile and decode frames. Frame compilation also has a lower priority than other tasks, such as capturing data. If the analyzer is busy capturing data, frame compilation may fall behind. When the analyzer catches up, the green circle changes to either a green dot or no dot. • Another reason is if some data in the frame is context dependent and we don't have the context. An example is a compressed header where the first frame gives the complete header, and subsequent frames just give information on what has changed. If the analyzer does not capture the first frame with the complete header, it cannot decode subsequent frames with partial header information.
	A magenta triangle indicates that a bookmark is associated with this frame. Any comments associated with the bookmark appear in the column next to the bookmark symbol.

3.4.11.4 Frame Display - Right Click Filtering

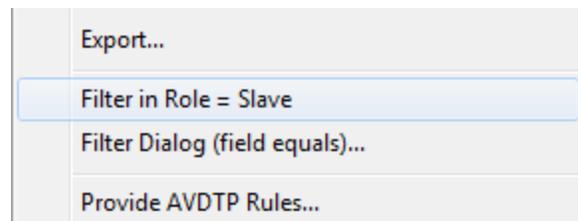
In **Frame Display**, protocols are displayed as tabs in the **Summary** pane. When you select a tab, the protocol layers are displayed. The layers vary depending on the protocol.

You can create additional protocol tabs that highlight specific layers in the **Summary** pane using the **Filtering Results** dialog.

Note: The **Filtering Results** dialog is not available for all layers because the information within those layers is not sortable, like time.

To use the Filtering Results dialog:

1. Right-click on a value in the **Summary** pane. For example, the "S" for Slave under Role
2. On the drop-down list select **Filter in** name = value, where name is the column name and value is the column-value to filter. For our example "Filter in Role = Slave" appears in the menu.



The Filtering Results dialog appears.

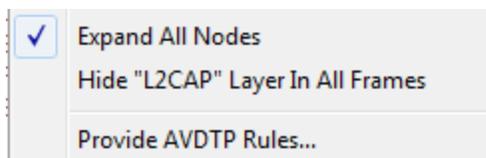
3. Enter a name for the Filter or use the default name.
4. Click **OK**.

 A new protocol tab with the "Filter Name" you just created appears in the **Summary** pane. The new tab displays data specific to the layer you selected.

3.4.11.5 Decode Pane

The **Decode** pane (aka detail pane)  is a post-process display that provides a detailed decode of each frame

transaction (sometimes referred to as a frame). The decode is presented in a layered format that can be expanded and collapsed depending on which layer or layers you are most interested in. Click on the plus sign to expand a layer. The plus sign changes to a minus sign. Click on the minus sign to collapse a layer. **Select Show All** or **Show Layers** from the **Format** menu to expand or collapse all the layers. Layers retain their expanded or collapsed state between frames.



Protocol layers can be hidden, preventing them from being displayed on the **Decode** pane. Right-click on any protocol layer and choose **Hide** [protocol name] from the right-click menu.

In a USB transaction, all messages that comprise the transaction are shown together in the detail pane. The color coding that is applied to layers when the detail pane displays a single message

is applied to both layers and messages when the detail pane displays a transaction. To keep the distinction between layers and messages clear, each header of each message in the detail pane ends with the word "Message" or "Messages". The latter is used because data and handshake messages are shown as a single color-coded entry

Each protocol layer is represented by a [color](#), which is used to highlight the bytes that belong to that protocol layer in the **Event**, **Radix**, **Binary** and **Character** panes. The colors are not assigned to a protocol, but are assigned to the layer.

The **Event**, **Radix**, **Binary**, **Character** and **Decode** panes are all synchronized with one another. Clicking on an element in any one of the panes highlights the corresponding element in all the other panes.

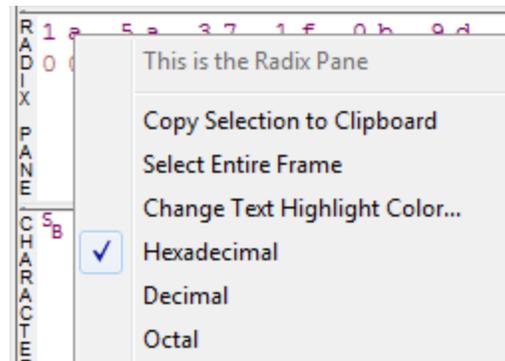
Click the **Toggle Expand Decode Pane** icon  to make the **Decode** pane taller. This allows for more of a lengthy decode to be viewed without needing to scroll.

3.4.11.6 Radix or Hexadecimal Pane

The **Radix** pane displays the logical bytes in the frame in either hexadecimal, decimal or octal. The radix can be changed from the **Format** menu, or by right-clicking on the pane and choosing **Hexadecimal**, **Decimal** or **Octal**.

Because the Radix pane displays the logical bytes rather than the physical bytes, the data in the Radix pane may be different from that in the Event pane. See [Physical vs. Logical Byte Display](#) for more information.

[Colors](#) are used to show which protocol layer each byte belongs to. The colors correspond to the layers listed in the Decode pane.



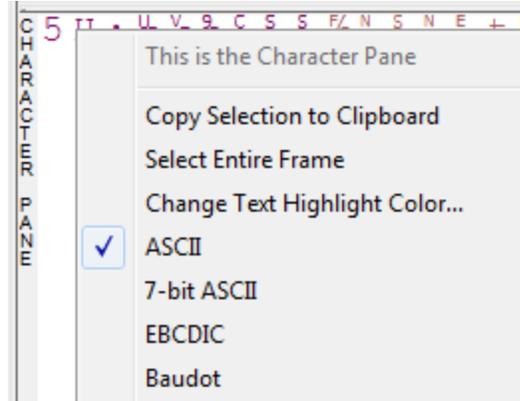
The Event, Radix, Binary, Character and Decode panes are all synchronized with one another. Clicking on an element in any one of the panes highlights the corresponding element in all the other panes.

3.4.11.7 Character Pane

The **Character** pane represents the logical bytes in the frame in **ASCII**, **EBCDIC** or **Baudot**. The character set can be changed from the **Format** menu, or by right-clicking on the pane and choosing the appropriate character set.

Because the **Character** pane displays the logical bytes rather than the physical bytes, the data in the **Character** pane may be different from that in the **Event** pane. See [Physical vs. Logical Byte Display](#) for more information.

[Colors](#) are used to show which protocol layer each byte belongs to. The colors correspond to the layers listed in the **Decode** pane.



The **Event**, **Radix**, **Binary**, **Character** and **Decode** panes are all synchronized with one another. Clicking on an element in any one of the panes highlights the corresponding element in all the other panes.

3.4.11.8 Binary Pane

The **Binary** pane displays the logical bytes in the frame in binary.

Because the **Binary** pane displays the logical bytes rather than the physical bytes, the data in the Binary pane may be different from that in the **Event** pane. See [Physical vs. Logical Byte Display](#) for more information.

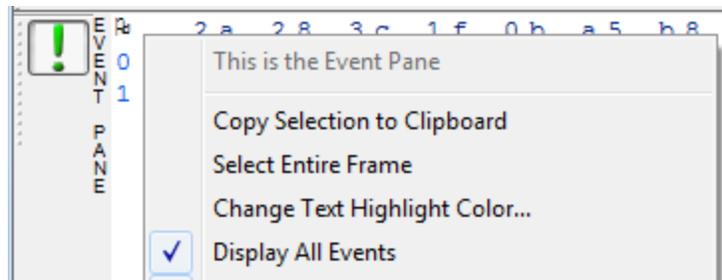
[Colors](#) are used to show which protocol layer each byte belongs to. The colors correspond to the layers listed in the **Decode** pane.

The **Event**, **Radix**, **Binary**, **Character** and **Decode** panes are all synchronized with one another. Clicking on an element in any one of the panes highlights the corresponding element in all the other panes.

3.4.11.9 Event Pane

The **Event** pane shows the physical bytes in the frame. You can choose between displaying only the data events or displaying all events by clicking the **All Events** icon .

Displaying all events means that special events, such as **Start of Frame**, **End of Frame** and any signal change events, are displayed as special symbols within the data.



The status lines at the bottom of the pane give the same information as the status lines in the **Event Display** window. This includes physical data errors, control signal changes (if appropriate), and timestamps.

Because the **Event** pane displays the physical bytes rather than the logical bytes, the data in the **Event** pane may be different from that in the **Radix**, **Binary** and **Character** panes. See [Physical vs. Logical Byte Display](#) for more information.

[Colors](#) are used to show which protocol layer each byte belongs to. The colors correspond to the layers listed in the Decode pane.

The **Event**, **Radix**, **Binary**, **Character** and **Decode** panes are all synchronized with one another. Clicking on an element in any one of the panes highlights the corresponding element in all the other panes.

3.4.11.10 Change Text Highlight Color

Whenever you select text in the **Binary**, **Radix**, or **Character** panes in **Frame Display**, the text is displayed with a highlight color. You can change the color of the highlight.

1. Select **Change Text Highlight Color** from the **Options** menu. You can also access the option by right clicking in any of the panes.
2. Select a color from the drop-down menu.
3. Click **OK**.



The highlight color for the text is changed.

Select **Cancel** to discard any selection. Select **Defaults** to return the highlight color to blue.

3.4.12 Data Byte Color Notation

The color of the data in the panes specifies which layer of the protocol stack the data is from. All data from the first layer is bright blue, the data from the second layer is green, the third layer is pink, etc. The protocol name for each layer in the **Decode** pane is in the same color. Note that the colors refer to the layer, not to a specific protocol. In some situations, a protocol may be in two different colors in two different frames, depending on where it is in the stack. You can [change the default colors](#) for each layer.

Red is reserved for bytes or frames with errors. In the **Summary** pane, frame numbers in red mean there is an error in the frame. Also, the **Errors** tab is displayed in red. This could be a physical error in a data byte or an error in the protocol decode. Bytes in red in the **Radix**, **Character**, **Binary** and **Event** panes mean there is a physical error associated with the byte.

3.4.12.1 Red Frame Numbers and Bytes

Red is reserved for bytes or frames with errors. In the **Summary** pane, frame numbers in red mean there is an error in the frame. This could be a physical error in a data byte or an error in the protocol decode. Bytes in red in the **Radix**, **Character**, **Binary** and **Event** panes mean there is a physical error associated with the byte.

3.4.12.2 Changing Protocol Layer Colors

You can differentiate different protocol layers in the **Decode**, **Event**, **Radix**, **Binary** and **Character** panes.

1. Choose **Select Protocol Layer Colors** from the **Options** menu to change the colors used.
The colors for the different layers is displayed.
2. To change a color, click on the arrow next to each layer and select a new color.
3. Select **OK** to accept the color change and return to **Frame** Display.

Select **Cancel** to discard any selection. Select **Defaults** to return the highlight colors to the default settings.

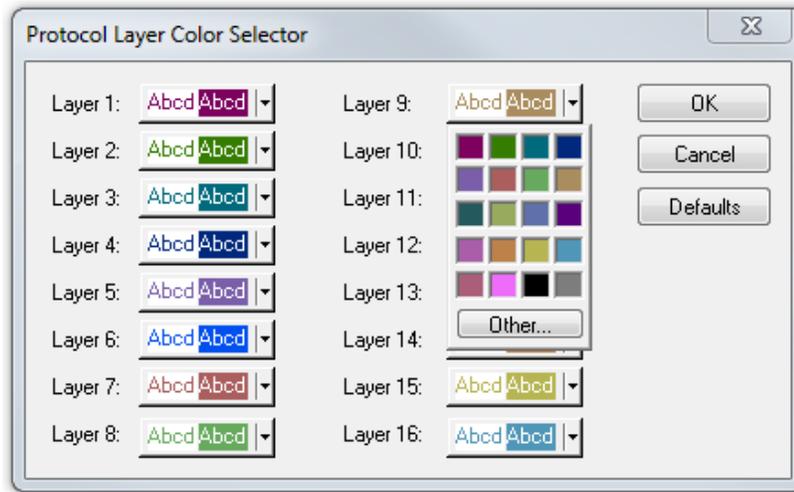


Figure 3.16 - Frame Display Protocol Layer Color Selector

3.4.13 Filtering

Filtering allows the user to control the display which capture frames are displayed. Filters fall into two general categories:

1. **Display filters** allow a user to look at a subset of captured data without affecting the capture content. Frames matching the filter criteria appear in the **Frame Display**; frames not matching the criteria will not appear.

3.4.13.1 Display Filters

A display filter looks at frames that have already been captured. It looks at every frame in the capture buffer and displays those that match the filter criteria. Frames that do not match the filter criteria are not displayed. Display filters allow a user to look at a subset of captured data without affecting the capture content. There are three general classes of display filters:

- Protocol Filters
- Named Filters
- Quick Filter

Protocol Filters

Protocol filters test for the existence of a specific single layer. The system creates a protocol filter for each decoder that is loaded if that layer is encountered in a capture session.

There are also three special purpose filters that are treated as protocol filters:

- All Frames with Errors
- All Frames with Bookmarks
- All Special Information Nodes

Named Filters

- Named filters test for anything other than simple single layer existence. Named filters can be constructed that test for the existence of multiple layers, field values in layers, frame sizes, etc., as well as combinations of those things. Named filters are persistent across sessions.
- Named filters are user-defined. User-defined filters persist in a template file. User defined filters can be deleted.

Quick Filters

- Quick Filters are combinations of Protocol Filters and/or Named Filters that are displayed on the Quick Filter tab.
- Quick Filters cannot be saved and do not persist across sessions.
- Quick Filters are created on the Quick Filter Dialog.

3.4.13.1.1 Creating a Display Filter

There are two steps to using a display filter. Define the filter conditions, and then apply the filter to the data set. The system combines both filter definition and application in one dialog.

1. Click the **Display Filters** icon  on the **Frame Display**  window or select **Apply/Modify Display Filters** from the **Filter** menu to open the **Set Condition** dialog box. The Set Condition dialog is self configuring which means that when you **Select each frame** under **Conditions** the following displayed fields depend on your selection. With each subsequent selection the dialog fields will change depending on you selection in that field.

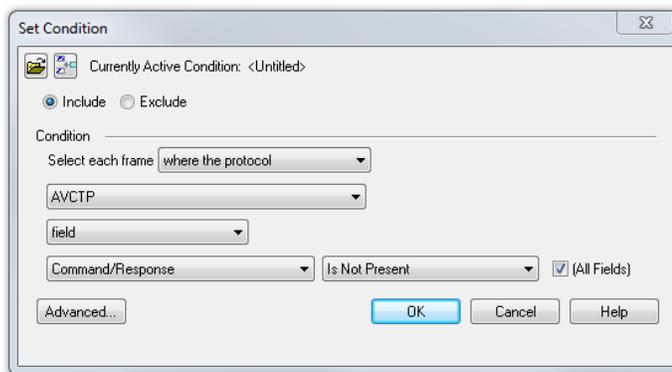


Figure 3.17 - Example: Set Conditions Self Configuring Based on Protocol Selection

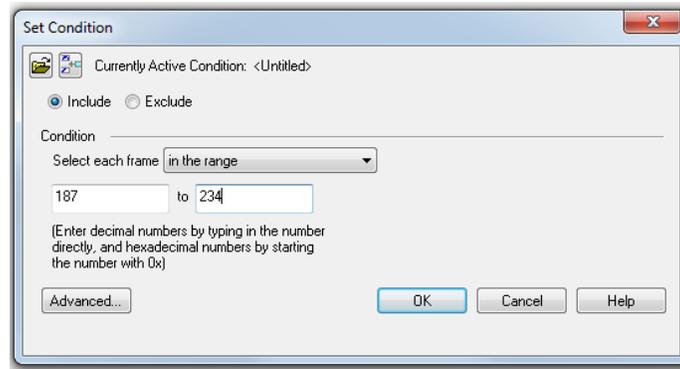


Figure 3.18 - Example: Set Conditions Self Configuring Based on Frame Range

2. Select **Include** or **Exclude** to add filtered data or keep out filtered data respectively.
3. Select the initial condition for the filter from the drop-down list.
4. Set the parameters for the selected condition in the fields provided. The fields that appear in the dialog box are dependent upon the previous selection. Continue to enter the requested parameters in the fields provided until the condition statement is complete.
5. Click OK. The system displays the **Save Named Condition** dialog. Provide a name for the filter condition or accept the default name provided by the system and click **OK**. Prohibited characters are left bracket '[', right bracket ']' and equal sign '='. The **Set Condition** dialog box closes, creates a tab on the **Frame Display** with the filter name, and applies the filter.

The filter also appears in the [Quick Filtering and Hiding Protocols](#) dialog.

When a display filter is applied, a description of the filter appears to the right of the toolbar in the **Frame Display** windows.

Notes:

- The system requires naming and saving of all filters created by the user.
- The **OK** button on the **Set Condition** dialog box is unavailable (grayed out) until the condition selections are complete.
- When you have [multiple Frame Display windows](#) with a display filter or filters, those filter do not automatically appear in other **Frame Display** windows. You must use the [Hide/Reveal](#) feature to display a filter created in one Frame Display in different **Frame Display** window.

3.4.13.1.2 Including and Excluding Radio Buttons

All filter dialog boxes contain an **Include** and an **Exclude** radio button. These buttons are mutually exclusive. The **Include/Exclude** selection becomes part of the filter definition, and appears as part of the filter description displayed to the right of the Toolbar.

Include: A filter constructed with the "Include" button selected, returns a data set that includes frames that meet the conditions defined by the filter and omits frames that do not.

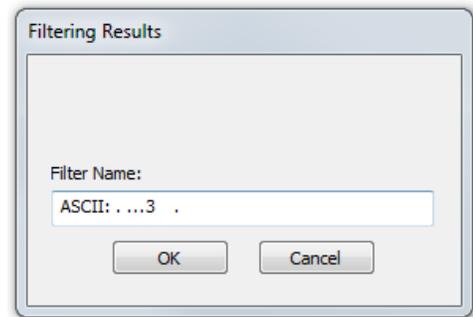
Exclude: A filter constructed with the "Exclude" button selected, returns a data set that excludes frames that meet the conditions defined by the filter and consists of frames that do not.

3.4.13.1.3 Named Display Filters

You can create a unique display filter by selecting a data type on the **Frame Display** and using a right click menu. When you create a **Name Filter**, it appears in the [Quick Filtering](#) dialog, where you can use it to do customize the data you see in the **Frame Display** panes.

1. Select a frame in the **Frame DisplaySummary** Pane.
2. Right click in the one of the data columns in the **Summary** Pane: CRC, NESN, DS, Packet Success, Ethertype, Source Address, etc.
3. Select **Filter in (data type) =** . The **Filtering Results** dialog appears.
4. Enter a name for the filter
5. Select **OK**.

The filter you just created appears in the **Named Filters** section of the [Quick Filtering](#) dialog.



3.4.13.1.4 Using Compound Display Filters

Compound filters use boolean logic to create complex and precise filters. There are three primary Boolean logic operators: **AND**, **OR**, and **NOT**.

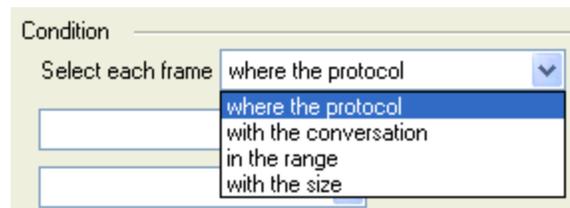
The **AND** operator narrows the filter, the **OR** operator broadens the filter, and the **NOT** operator excludes conditions from the filtered results. Include parentheses in a compound filter to nest condition sets within larger condition sets, and force the filter-processing order.

There are two steps to using a compound filter. Define the filter conditions, and then apply the filter to the data set. The analyzer combines both filter definition and application in one dialog.

1. Click the **Display Filters** icon  on the **Frame Display** window or select **Apply/Modify Display Filters...** from the filter menu to open the **Set Condition** dialog box.
2. Click the **Advanced** button on the **Set Condition** dialog box.
3. Select **Include** or **Exclude** radio button.

Now you can set the conditions for the filter.

4. Select the initial condition for the filter from the combo box at the bottom of the dialog for **Select each frame**.
5. Set the parameters for the selected condition in the fields provided. The fields that appear in the dialog box are dependent upon the previous selection. Continue to enter the requested



parameters in the fields provided until the conditions statement is complete.

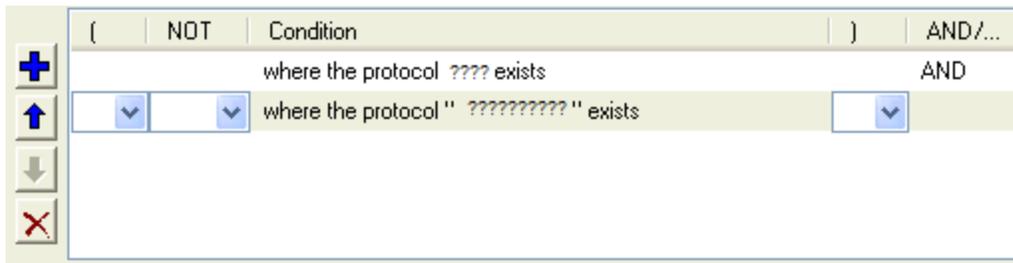


Figure 3.19 - Two Filter Conditions Added with an AND Operator

6. Click the plus icon  on the left side of the dialog box and repeat steps 4 and 5 for the next condition. Use the up  and down  arrow icons on the left side of the dialog box to order your conditions, and the delete button  to delete conditions from your filter.
7. Continue adding conditions until your filter is complete.
8. Include parentheses as needed and set the boolean operators.
9. Click **OK**.
10. The system displays the **Save Named Condition** dialog. Provide a name for the filter condition or accept the default name provided by the system and click **OK**.

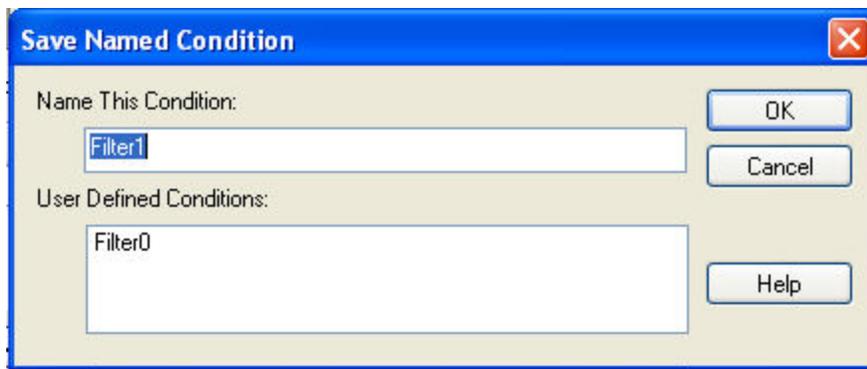


Figure 3.20 - Save Named Filter Condition Dialog

The **Set Condition** dialog box closes, creates a tab on the **Frame Display** with the filter name, and applies the filter.

Filter: Include each frame where the protocol Data exists

When a display filter is applied, a description of the filter appears to the right of the toolbar in the **Frame Display** windows.

Note: The **OK** button on the **Set Condition** dialog box is unavailable (grayed out) until the condition selections are complete.

3.4.13.1.5 Defining Node and Conversation Filters

There are two steps to using Node and Conversation display filter. Define the filter conditions, and then apply the filter to the data set. The analyzer combines both filter definition and application in one dialog.

1. Click the **Display Filters** icon  on the **Frame Display** window or select **Apply/Modify Display Filters...** from the filter menu to open the **Set Condition** dialog box.
2. From the **Select each frame** combo box choose **frames with the conversation** as the initial condition.
3. Select an address type—IP, MAC, TCP/UDP—from the **Type** combo box (The address type selection populates both Address combo boxes with node address in the data set that match the type selection).
4. Select a node address from the first **Address** combo box.
5. Choose a direction arrow from the direction box. The left arrow filters on all frames where the top node address is the destination, the right arrow filters on all frames where the top node address is the source, and the double arrow filters on all frames where the top node address is either the source or the destination. 
6. If you want to filter on just one node address, skip step 7 and continue with step 8.
7. If you want to filter on traffic going between two address nodes (i.e. a conversation), select a node address from the second Address combo box..
8. Click **OK**. The **Set Condition** dialog box closes and the analyzer applies the filter.

When a display filter is applied, a description of the filter appears to the right of the toolbar in the **Frame Display** windows.

Note: The **OK** button is unavailable (grayed out) until the condition selections are complete.

3.4.13.1.6 The Difference Between Deleting and Hiding Display Filters

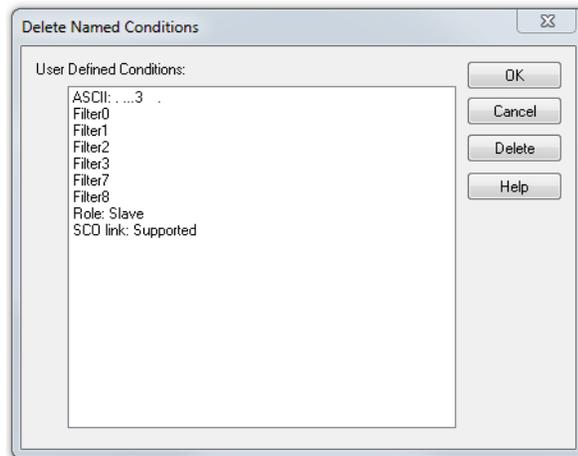
If you wish to remove a filter from the system permanently, then use the [Delete](#) procedure. However, if all you want to do is remove a filter as a means to un-clutter the display, then use the [Hide](#) procedure.

Deleting a saved filter removes the filter from the current session and all subsequent sessions. In order to retrieve a deleted filter, the user must recreate it using the **Set Conditions** dialog.

Hiding a filter merely removes the filter from the display. A hidden filter can be reapplied using the [Show/Hide](#) procedure.

Deleting Saved Display Filters

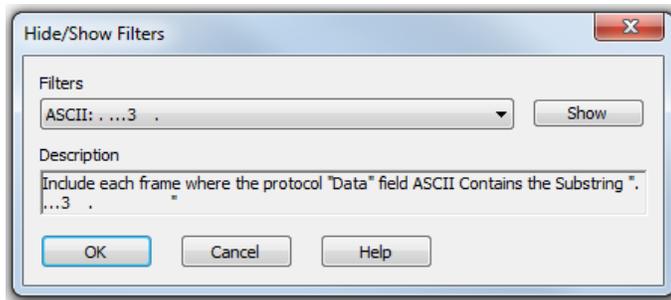
1. Select **Delete Display Filters** from the **Filter** menu in the **Frame Display**  window to open the **Delete Named Condition** dialog. The system displays the **Delete Named Condition** dialog with a list of all user defined filters.
2. Select the filter to be deleted from the list.
3. Click the **Delete** button.
4. Click **OK**. The **Delete Named Condition** dialog box closes and the system deletes the filter.



Hiding and Revealing Display Filters

If a display filter is showing the following steps will hide that filter but will not delete it.

1. Select **Hide/Show Display Filters...** from the **Filter** menu on the **Frame Display**  window to open the **Hide/Show Filters** dialog. The system displays the **Hide/Show Filters** dialog with a list of all user defined filters.
2. Select the filter to be hidden from the combo box.
3. Click the **Hide** button. The **Hide** button is only showing if the selected filter is currently showing in the **Frame Display**.
4. Click **OK**. The **Hide/Show Filters** dialog box closes, and the system hides the filter and removes the filter tab from the **Frame Display**.



If a display filter is hidden the following steps will reveal that filter in the **Frame Display**.

1. Select **Hide/Show Display Filters...** from the **Filter** menu in the **Frame Display**  window to open the **Hide/Show Filters** dialog. The system displays the **Hide/Show Filters** dialog with a list of all user defined filters.
2. Select the filter to be revealed from the combo box.
3. Click the **Show** button.
4. Click **OK**. The **Hide/Show Filters** dialog box closes and the system reveals the filter in the **Frame Display**.

You can also open the [Quick Filter](#) dialog and check the box next to the hidden filter to show or hide a display filter.

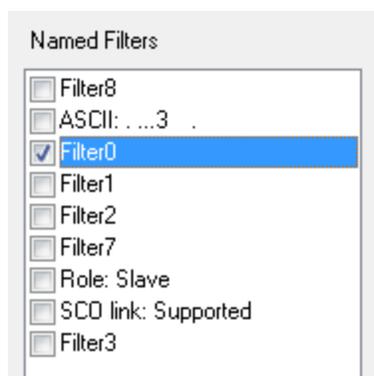


Figure 3.21 - Using Named Filters Section of Quick Filters to Show/Hide Filters

Note: When you have [multiple Frame Display windows](#) with a display filter or filters, those filter do not automatically appear in other Frame Display windows. You must use the Hide/Show dialog to display a filter created in one Frame Display in different Frame Display window.

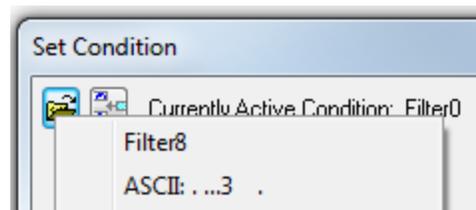
3.4.13.1.7 Editing Filters

Modifying a Condition in a Filter

1. Click the **Display Filters** icon  on the **Frame**

Display  window or select **Apply/Modify Display**

Filters... from the **Filter** menu to open the **Set Condition** dialog box. The **Set Condition** dialog box displays the current filter definition at the top of the dialog.



To display another filter, click the **Open**  icon, and select the filter from the pop-up list of all the saved filters.

2. Edit the desired parameter of the condition: Because the required fields for a condition statement depend upon previously selected parameters, the Set Condition dialog box may display additional fields that were not present in the original filter. In the event this occurs, continue to enter the requested parameters in the fields provided until the condition statement is complete.
3. Click **OK**. The system displays the **Save Named Condition** dialog. Ensure that the filter name is displayed in the text box at the top of the dialog, and click **OK**. If you choose to create an additional filter, then provide a new name for the filter condition or accept the default name provided by the system and click **OK**.) The **Set Condition** dialog box closes, and the system applies the modified filter.

Note: When a display filter is applied, a description of the filter appears to the right of the toolbar in the Frame Display windows.

Deleting a Condition in a Filter

If a display filter has two or more conditions you can delete conditions. If there is only one condition set in the filter you must delete the filter using **Delete Display Filters...** from the **Filters** menu.

1. Click the **Display Filters** icon  on the **Frame Display** window or select **Apply/Modify Display Filters...** from the **Filter** menu to open the **Set Condition** dialog box. Click on the **Advanced** button to show the condition in Boolean format. The dialog box displays the current filter definition. To display another filter, click the **Open**  icon, and select the filter from the pop-up list of all the saved filters.

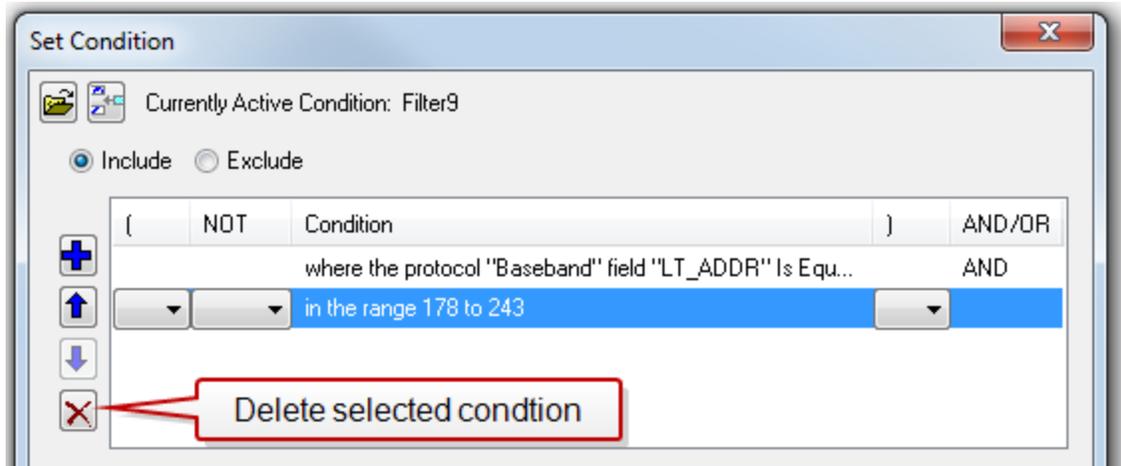


Figure 3.22 - Set Condition Dialog in Advanced View

2. Select the desired condition from the filter definition.
3. Click the **Delete Selected Line**  icon.
4. Edit the Boolean operators and parentheses as needed.
5. Click **OK**. The system displays the **Save Named Condition** dialog. Ensure that the filter name is displayed in the text box at the top of the dialog, and click **OK**. (If you choose to create an additional filter, then provide a new name for the filter condition or accept the default name provided by the system and click **OK**.) The **Set Condition** dialog box closes, and the system applies the modified filter.

Note: When a display filter is applied, a description of the filter appears to the right of the toolbar in the **Frame Display** windows.

Renaming a Display Filter

1. Select **Rename Display Filters...** from the **Filter** menu in the **Frame Display**  window to open the **Rename Filter** dialog. The system displays the **Rename Filter** dialog with a list of all user defined filters in the **Filters** combo box.

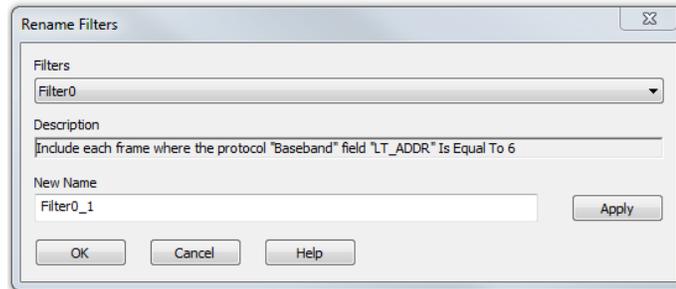


Figure 3.23 - Rename Filters Dialog

2. Select the filter to be renamed from the combo box.
3. Enter a new name for the filter in the **New Name** box. Optionally click the **Apply** button and the new name will appear in the **Filters** combo box and the **New Name** box will empty. This option allows you to rename several filters without closing the **Rename Filter** dialog each time.
4. Click **OK**. The **Rename Filter** dialog box closes and the system renames the filter.

3.4.13.2 Protocol Filtering from the Frame Display

3.4.13.2.1 Quick Filtering on a Protocol Layer

On the **Frame Display**, click the **Quick Filtering** icon  or select **Quick Filtering** from the **Filter** menu.

This opens a dialog that lists all the protocols discovered so far. The protocols displayed change depending on the data received.

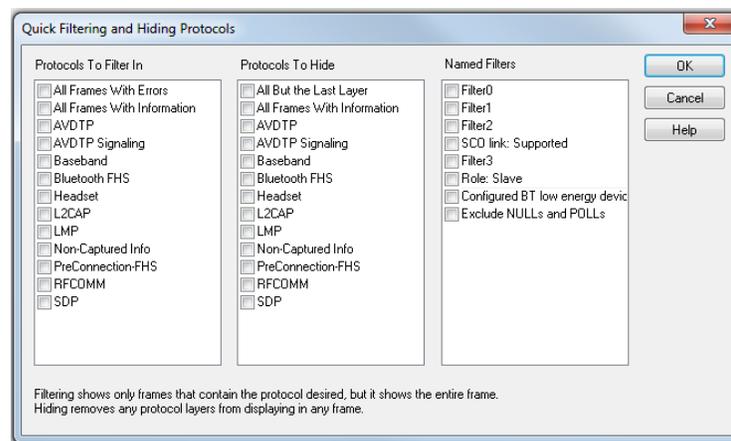


Figure 3.24 - Frame Display Quick Filtering and Hiding Protocols Dialog

The box on the left is **Protocols To Filter In**. When you select the checkbox for a protocol in the **Protocols to Filter In**, the **Summary** pane will only display those frames that contain data from that protocol.

If you filter on more than one protocol, the result are all frames that contain at least one of those protocols. For example, if you filter on IP and IPX NetBIOS, you receive all frames that contain either IP or IPX NetBIOS (or both). A **Quick Filter** tab then appears on the **Frame Display**. Changing the filter definition on the **Quick Filter** dialog changes the filter applied on the **Quick Filter** tab. Quick filters are persistent during the session, but are discarded when the session is closed.



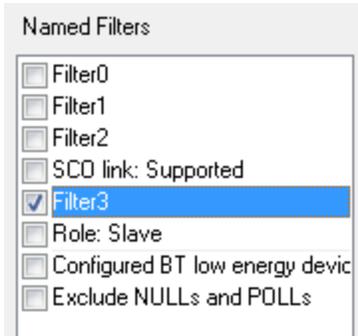
The box in the center is the **Protocols To Hide**. When you select the checkbox for a protocol in the **Protocols To Hide**, data for that protocol will not appear in the **Decode, Binary, Radix**, and **Character** panes. The frames containing that type data will still appear in the **Summary** pane, but not in the **Decode, Binary, Radix**, and **Character** panes.

The box on the right is the **Named Filters**. It contains filters that you create using the and dialogs. When you select the checkbox for the **Name Filters**, a tab appears on the Summary Pane that displays the frame containing the specific data identified in the filter. The named Filter tab remains on the Frame Display Summary Pane unless you hide it using the dialog.



With low energy, the Configured BT Low energy devices and Exclude NULLS and POLLS are default named filters.

Check the small box next to the name of each protocol you want to filter in, hide, or **Named Filter** to display.



Then click **OK**

3.4.13.2.2 Easy Protocol Filtering

There are two types of easy protocol filtering. The first method lets you filter on the protocol shown in the **Summary** pane, and the second lets you filter on any protocol discovered on the network so far.

Filtering on the Summary Layer Protocol

To filter on the protocol in the **Summary** in the **Frame Display** window pane:

1. Select the tab of the desired protocol, or open the **Summary** combo box.
2. Select the desired protocol.
3. To filter on a different layer, just select another tab, or change the layer selection in the combo box.

Filtering on all Frames with Errors

To filter on all frames with errors:

1. Open the **Frame Display**  window.
2. Click the starred **Quick Filter** icon  or select **Quick Filtering** from the **Filter** menu
3. Check the box for **All Frames With Errors** in the **Protocols To Filter In** pane, and click **OK**.
4. The system creates a tab on the **Frame Display** labeled "Errors" that displays the results of the **All Frames With Errors** filter. 

Note: When you have multiple Frame Display windows open and you are capturing data, you may receive an error message declaring that "Filtering cannot be done while receiving data this fast." If this occurs, you may have to stop filtering until the data is captured.

3.5 Analyze Control Signal Changes - Breakout Box

The **Breakout Box** window provides a real-time graphical view of control signals. The window is customizable based on the control signals you wish to view and your preference of indicators (+/-, 1/0, T/F, arrows, and simulated LEDs). Also included are counters showing the number of times a control signal has changed.

To open this window click the **Breakout Box** icon  on the **Control** window.

Whenever an enabled input changes state it will issue an event and be tagged with a timestamp of when the input was interpreted by the analyzer. Digital inputs can not exceed a rate of 30 MHz. Digital inputs that occur faster than that are not guaranteed to be interpreted correctly by the analyzer. Also, only one digital input event may occur per active packet. All other digital input events can only be handled after the packet has completed. Digital inputs, although guaranteed to have the correct timestamp given the previous conditions, have the possibility of being presented out of order because they are provided randomly by the user and have no direct correlation to the bus. It is important to note that the digital inputs are susceptible to cross-talk if they are not being actively driven. A situation like this could occur if a digital input has been enabled, but has not been tied to a signal. Any other nearby signal (i.e., other digital inputs or outputs) could cause the input to activate. It is recommended that all undriven digital inputs be disabled or tied to ground.

USB: Name - Pin 1, 2, 3, and 4

ComProbe USB monitors four control signals.

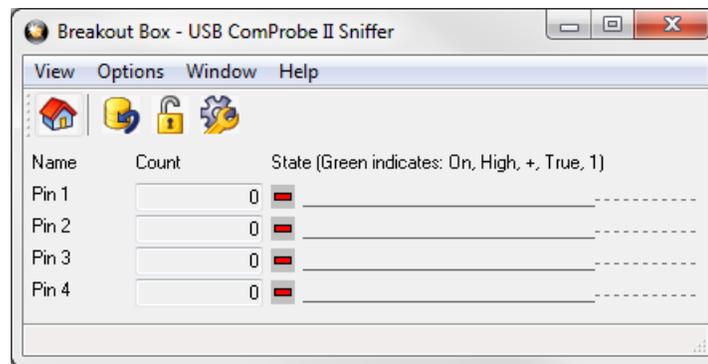


Figure 3.25 - ComProbe USB Breakout Box Display

Digital inputs provide a means for users to insert events into the data stream. There are four digital inputs that can be enabled individually.

HSU: Frontline monitors six RS-232 control signals

DTE Signals

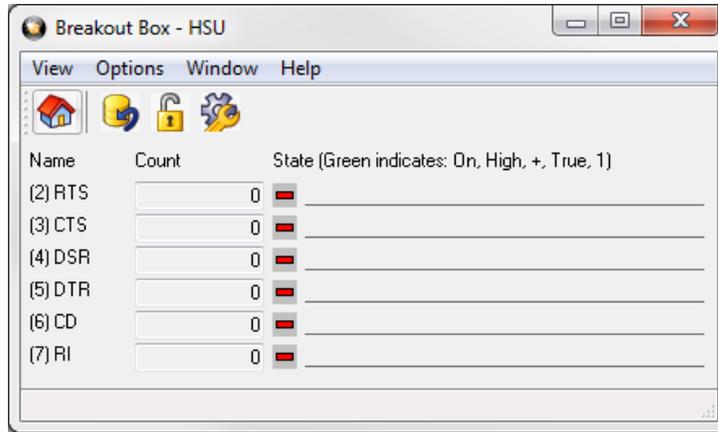


Figure 3.26 - ComProbe HSU Breakout Box Display

When monitoring a synchronous circuit, the analyzer also displays clock signals at the bottom of the window. These signals rotates when clock is present, and has an X over them if clock is not detected.

3.5.1 The Breakout Box Toolbar

Table 3.4 - Breakout Box Toolbar Icons

Icon	Description
	Home - brings the Control window to the front.
	Reset - resets the Breakout Box window.
	Lock - Locks the display. Clicking on the Lock icon, unlocks the window.
	Unlock - In the Unlock state, the screen fills in the data captured since the screen lock and moves down to display incoming data again. Clicking on the Unlock icon, locks the window.
	Options - Brings up the Breakout BoxOptions window. This window allows you to change the window refresh rate and choose which control signals to display.

3.5.2 Reading the Breakout Box Window

The **Breakout Box** display is divided into three main parts. The first part (to the far left of the screen) shows the abbreviated name of the control signal being monitored. These names can be changed in the I/O Settings window by selecting **Names** from the **Options** menu.

The second part shows the control signal counters. The counters show how many times each control signal has changed state. This is useful in situations when signals may be changing state too rapidly to be displayed graphically.

Below the counters are the clock indicators. The indicators rotate when clock is present, and have an X over them when clock is not detected.

The third part of the **Breakout Box** shows the current states of the control signals. The indicators show the state that the control signal is currently in, and the line graph displays the state of the signal over time. A single line means that the signal is logically off, while a double line means that the signal is logically on. A half-height "tick"

means that a signal has gone through one full transition (from off to on to off, or vice versa) since the analyzer last updated the screen.

To change the indicators, hide the clock signals, or change the rate at which the analyzer updates the window, click on the Options icon .

3.5.3 Selecting Breakout Box Options

To access **Options** click the **Options** icon  on the **Breakout Box** toolbar or choose **Breakout Box options** under the **Options** menu.

Display Signal - This box shows which control signals the analyzer monitors.

- A check mark next to a control signal name indicates that the breakout box displays the status of that control signal.
- To prevent the analyzer from displaying the status of a signal, un-check the box next to it.

Display Clocks - Click to place a check mark in this box if you want the **Breakout Box** window to display the clock indicators. Un-check to hide the clock indicators. (This option is only shown when in synchronous or isochronous mode.)

Window Refresh Rate - The refresh rate is the rate at which the analyzer updates the window.

- By default, the analyzer refreshes the display once every 1,000 milliseconds (one second.)
- To change the rate, highlight the number in the box and enter a new number. See [Performance Notes](#) for information on how Window Refresh Rate can affect performance.

Indicators - You can choose what type of indicators the analyzer uses.

- The default indicators are a green "+" sign to show a logically high state, and a red "-" sign to show a logically low state.
- To change the indicators, click on the down arrow and choose a pair of indicators from the list.
- As a reminder, the analyzer gives the definition of the indicators in the top part of the Breakout Box window.

3.5.4 Viewing Historical Signal Changes

The **Signal Display** window provides a graphical view of control signal transitions that you can manipulate. You can zoom in to view the state of control signals for a range of events, or zoom out to view control signal changes over the course of an entire capture session.

To open this window click the **Signal Display** icon  on the **Control** window toolbar, or choose **Signal Display** from the **Window** menu.

The **Signal Display** window does not provide a real-time view of control signal changes. It is intended to be used as a post-process review screen. Use the **Breakout Box** window to view real-time control signal changes. Note that if you bring up the **Signal Display** window while data is being captured, the window shows you the state of the control signals at the time the window was opened. This is called a "snapshot" because it is a picture of the buffer at the time the **Signal Display** was opened. To update the display to reflect the current state of the

buffer, use the **New Snapshot** icon  .

When you open Signal Display you will see a set of codes. For USB ComProbe II, USB, you will see Pin Codes 1, 2, 3, and 4. These correspond to the four Digital Input Enabling Options explained in [USB I/O Settings](#).

For all High Speed Serial Sniffing options you will see six control signals. These include:

- RTS(Request to Send DCE Signal)
- CTS (Clear to Send)
- DSR (Data Set Ready)
- DTR (Data Terminal Ready)
- CD (Carrier Data)
- RI (Ring Indicator)

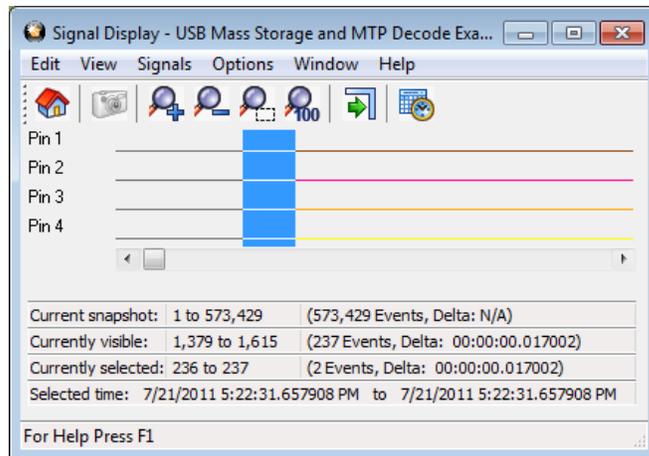


Figure 3.27 - USB Signal Display Window

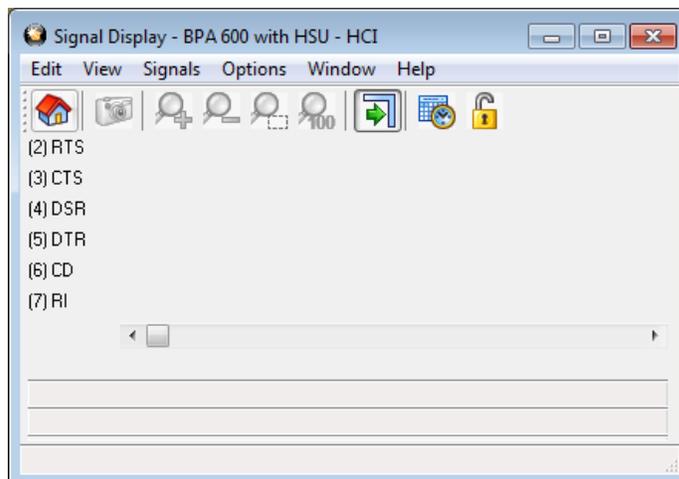


Figure 3.28 - HSU Signal Display Window

When using the SST interface cards for analyzing DeviceNet traffic, the following signals are displayed:

- BP - Bus Power
- OL - Online
- BW - Bus warning, either the receive or transmit error counter (incremented and decremented at various rates according to the Bosch CAN specification) has reached 128.
- BO - Bus off, either the receive or transmit error counter has reached 255 and the CAN chip has been forced offline.
- RO - Receive buffer overrun, one or more messages has been lost due to a full queue in the on-card firmware.
- ML - Message lost, one or more messages has been lost due to a slow interrupt response by the on-card firmware.
- ER - Error, one or more CAN error frames has been detected.

Note: The messages received by NetDecoder are still correct when the ER flag shows some activity, as re-transmission is automatic and only error-free frames result in a receive interrupt from the CAN controller.

3.5.4.1 Signal Display Toolbar

Table 3.5 - Signal Display Toolbar

Icon	Description
	Home - brings the Control window to the front.
	Take New Snapshot - Takes a new "picture" of the capture buffer. If you are capturing data when you open the Signal Display window, the window shows only the state of the control signals that were in the buffer when the window was opened. Click this button to update the window with the contents of the current buffer.
	Zoom In - "Zooms in" on the signal display. How much you zoom in is determined by your selection in the Signals menu. You can zoom in by a factor of 2, 4, or 8.
	Zoom Out - Reverse of Zoom In.
	Zoom to Selection - Zooms to show only the region highlighted on the screen. If the highlighted area contains few events, the Signal Display window may also display additional events in order to fill up the screen.
	Display Entire Buffer - Zooms all the way out to display the contents of the entire buffer in the window.
	Find - Opens the Control Signal change window.

Table 3.5 - Signal Display Toolbar (continued)

Icon	Description
	<p>Snap to Nearest Change - Moves the cursor to the nearest signal change whenever you click on the line graphics in the window. Find the line for the control signal whose changes you want to see. Click on that line, and the analyzer moves to the nearest signal change for that control signal. You can also highlight a range, and the analyzer snaps to the 2 nearest changes on either side of the range.</p>
	<p>Timestamping Options - Opens the Timestamping Options window, where you can change the timestamping resolution and how timestamps are displayed.</p>

3.5.4.2 Reading the Signal Display

Control signal changes are displayed in a graphical format. On the left side of the screen is a list of the signals currently being displayed, and to the right of each name is a line displaying the state of the signal over time. A single line means that the signal was logically off, while a double line means that the signal was logically on. Dotted lines are used for signals that were not present at the time of capture. For example, if you are monitoring a circuit that does not use CD, that line appears as a dotted line in the control signal display.

The four information lines at the bottom of the window tell you what events are being shown in the window, and where you are in relation to the buffer as a whole.

- **Current Snapshot:** The first line tells you what event numbers are in the current snapshot, the total number of events, and the amount of time that passed between the first event in the snapshot and the last event (called Delta).
- **Current Visible:** The second line gives the same information about the events that are currently visible in the window. Because you can zoom in and out, often the events being shown in the window are not the same as the number of events in the current snapshot.
- **Currently Selected:** The third line gives the same information for the currently selected events. You can highlight a range of events by clicking at any point on the graphical display and dragging the mouse to the left or the right. The third line shows information for the selected range.
- **Selected Time:** The fourth and last line shows the exact timestamps of the first and last bytes in the currently selected range. Note that this does not tell you the timestamp for the entire snapshot or the events displayed in the window, just the highlighted events. The raw timestamp value is the number of 100-nanosecond intervals since the beginning of January 1, 1601. This is standard Windows time.

A single mouse click places the cursor in the window. The analyzer highlights all sixfour signal changes in one color, and uses a different color to specify the control signal line clicked on. You can highlight a range by clicking and dragging the mouse to the right or left. You can also use the arrow keys to move the cursor to the right or left.

The Signal Display window is synchronized with other windows in the analyzer. A range highlighted in the Signal Display window is also highlighted in the **Event Display** and **Frame Display** windows.

The **Snap to Nearest Change** icon  lets you place the cursor on the signal change you want to look at

without needing to click on exactly the right spot. Find the line corresponding to the control signal you want to look at. Click on the line, and the analyzer moves the cursor to the nearest change. If you highlight a range, the analyzer "snaps to" the nearest changes on either side. This feature is active when the Snap To button is pressed, and inactive when the button is not pressed.

Use the **Zoom In** and **Zoom Out** buttons to increase and decrease the magnification of the window. The analyzer changes the magnification by a factor of 2, 4 or 8, depending on the option selected in the Signals menu.

If you want to see a range in greater detail, highlight the range you want to view and click on the **Zoom to Selection** icon . The analyzer zooms in to show only that range in the window. If the range is small, the analyzer may add additional events to fill up the window. To view the entire snapshot in the window, click on the **Display Entire Buffer** icon .

Note that if you bring up the **Signal Display** window while data is being captured, the window shows you the state of the control signals at the time the window was opened. To update the display, use the New Snapshot icon .

3.5.4.3 Selecting Signal Display Options

To access **Signal Display Options** Click the Signal Display icon  on the **Control** window toolbar. From the **Options** menu, select **Signal Display Options**.

To choose which control signals to display in the **Signal Display** window:

- Click on a box to check or un-check it the control signal name.
- A check mark next to a control signal name means that the signal is displayed.

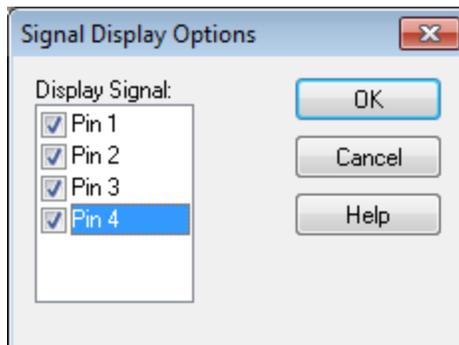


Figure 3.29 - USB Signal Display Options

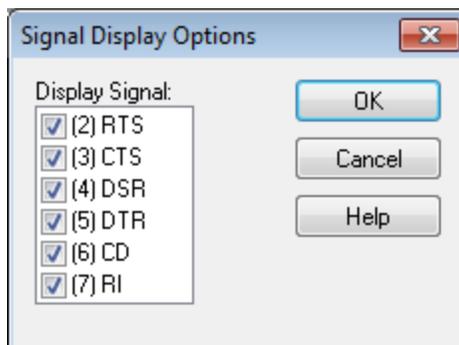


Figure 3.30 - HSU Signal Display Options

3.6 Statistics Window

The Statistics window supplies basic information about the data on the network. When reviewing a capture file, the **Statistics** window shows a summary of the data in the file.

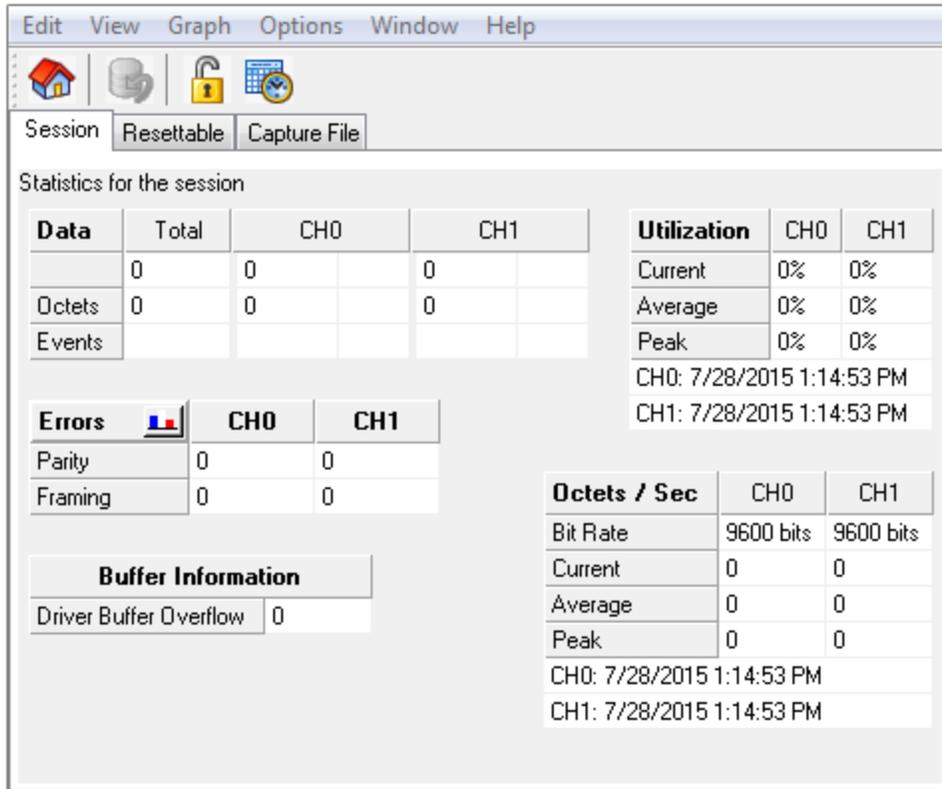


Figure 3.31 - Statistics Window

To open the **Statistics** window, click the Statistics icon  on the **Control** window toolbar, or choose **Statistics** from the **View** menu on the **Control** window.

The analyzer monitors the network and collects statistics all the time, even when data is not actively being captured. Activate the **Lock** icon  to stop the window from updating. Click the **Unlock** icon  again to resume updating. The analyzer continues to monitor network traffic while the **Statistics** window is locked, so you may see the numbers jump right after updating has resumed, reflecting all the statistics that were gathered while the window was locked.

Statistics Window Menus

Table 3.6 - Statistics Window Menus

Menu	Selection	Description
Edit	Copy All To Clipboard	Copies all collected statistics to the Windows clipboard.
	Notes	Opens the notes dialog for recording comments on a capture file. Only available when view a capture file.
	Copy Utilization To Clipboard	Copies the channel utilization statistics to the Windows clipboard.
	Copy Octets/Sec To Clipboard	Copies throughput rate statistics to the Windows clipboard.
	Copy Data To Clipboard	Copies data statistics to the Windows clipboard.
	Copy Errors To Clipboard	Copies channel parity and framing errors to the Windows Clipboard.
	Copy Buffer To Clipboard	Copies the current buffer data to the Windows clipboard
View	Control Window	When checked will open the window or Statistics Window bar. When not checked, the window or bar is closed.
	Event Display	
	Frame Display	
	Signal Display	
	Breakout Box	
	Toolbar	
	Status Bar	
	Toggle Display Lock	When checked, the displayed statistics will stop updating, although data is still being captured. Unchecking will resume statistics updating.
Reset	Available during live capture. Resets all displayed statistics and restarts the calculations.	
Graph	Graph Errors...	Opens the Errors HSU window.
Options	I/O Settings...	Performs the same function as the control Window Options Menu, I/O Settings
	Set Timestamping Format	Opens the Timestamping Options window that allows for changing the resolution of the timestamps.
	Change the Font Size	Opens a pop-up with font size selections.

Table 3.6 - Statistics Window Menus (continued)

Menu	Selection	Description
Window	Close Window	Closes the Statistics Window
	ComProbe Protocol Analysis System	Clicking on these selections will change the focus from the Statistics Window to the selected window.
	Statistics	
	Errors	
Help	Help Topics	Opens the ComProbe Help window.
	About ComProbe Protocol Analysis System	Provides a pop-up showing the version and release information, Frontline contact information, and copyright information.
	Support on the Web	Opens a browser to fte.com technical support page.

Statistics Window Toolbar

Table 3.7 - Statistics Window Toolbar Icons

Icon	Description
	Changes the focus to the Control Window
	Reset the statistics tables
	Display Lock/Unlock
	Timestamp Format

3.6.1 Session, Resettable and Capture File Tabs

The Session and Resettable tabs are parts of the Statistics window.

Information about all data collected since the analyzer was started is shown in the Session tab. The Session tab cannot be reset; in this sense, it is like the odometer on a car. The odometer on a car shows you all the miles driven since the car was built, and the Session tab shows you all the data collected since the analyzer was started.

If you think of the Session tab as the odometer, then the Resettable tab is the trip odometer. It can be reset, and allows you to record statistics for a new "trip". In this way you can effectively start a new session without having to restart the analyzer.

The Capture File tab shows information on the data that is currently in the capture.

Occasionally some of the statistics read n/a, for Not Available. This happens for various reasons. For example, many of the items on the Capture File tab become not available (n/a) if the buffer becomes full and wraps. When this happens, the analyzer can no longer provide accurate statistics for the data in the file, because some of the data that the statistics are based on has been lost.

3.6.2 Copying Statistics To The Clipboard

To copy the information from an individual table to the clipboard (where it can be pasted into any application),

1. Choose the name of the table from the **Edit** menu.
2. To copy the contents of all the tables, choose **Copy All to Clipboard**.

3.6.3 Statistics Graphs

Open the Statistics window and click on the picture of a graph  on the table header, or choose the graph name from the Graph menu on the Statistics window.

The Frame Sizes Graph window has [Session, Resettable and Buffer tabs](#) that correspond to the tabs on the Statistics window. Each tab shows the data that corresponds to the appropriate tab on the Statistics window.

The Frame Sizes Graph window displays the number of frames of each length in either a pie chart or bar graph format. Click the Pie icon  to display a pie chart, and click the Bar icon  to display a bar graph.

For networks with more than one side, the analyzer displays one graph for each side. To view the aggregate of all sides, click the Aggregate icon .

3.6.3.1 Viewing Percentages or Values

On the Statistics window you can view data expressed as a percentage.

1. Open the Statistics window
2. Select the graph to display.

On the graph window,

3. Click the **Percentages** icon  to view data expressed as a percentage.
4. Click the **Percentages** icon again to view the actual number of items of each type.
5. Click the **Show Data Grid** icon  to view both the number and percentage of the total for each item.

The analyzer places a grid in the legend.

3.6.3.2 Changing the Graph Refresh Rate

The graphs window refreshes once every second.

To change the refresh rate:

1. Click the Options icon  on the **Errors** dialog.
2. Enter a new refresh rate in milliseconds in the **Time Interval (ms)** text box.

3.6.3.3 Printing Graphs

1. Click the Print icon  to print the graph. The analyzer prints exactly what is shown on the window.

3.6.4 Session Tab Tables

The **Statistics** dialog **Session** tab contains tables that display information about the current capture session.

Table 3.8 - **Frames per Second** Table Fields

Field	Description
Current	The current number of frames per second
Average	The average number of frames per second for the current session
Peak	The highest number of frames per second.

Table 3.9 - **Characters per Second** Table Fields

Field	Description
Baud	The current baud rate. A baud rate is the number of times per second a signal in a communications channel changes.
Current	The current number of characters per second.
Average	The average number of characters per second for the current session
Peak	The highest number of characters per second.

Table 3.10 - **Utilization** Table Fields

Field	Description
Current	The current number of bits per second divided by the maximum speed of the network, expressed as a percentage.
Average	The average number of bits per second divided by the maximum speed of the network, expressed as a percentage.
Peak	The highest recorded utilization.

Table 3.11 - **Data** Table Fields

Field	Description
Data	The amount of data captured by the analyzer. Data information varies depending on the type of data in the capture.

Table 3.12 - **Buffer Information** Table Fields

Field	Description
Driver Buffer Overflow	The number of times the analyzer lost frames because it could not retrieve them from the driver buffer fast enough.

Table 3.13 - **Errors** Table Fields

Field	Description
Errors	The number of errors seen on the network. To graph, click the bar graph  icon on the Errors table header.

3.6.5 About DH+ Statistics

The Frontline DH+ product includes powerful statistical analysis capabilities. Easily accessible and up to date statistical data provides the user with valuable information when starting up, surveying, benchmarking, and troubleshooting DH+ networks.

DH+ statistics runs automatically when a capture file is loaded or when a live capture is performed and cannot be turned off. All of its dialogs can be brought down, however.

Note: Driver buffer overflows and UART overruns during live capture cause data loss that can result in some invalid frames. This can affect the values shown in DH+ statistics. To prevent driver buffer overflows, try increasing "Driver Receive Buffer Size in Operating System Pages" in the Control window **Options** menu: **System Settings > Advanced**. To prevent UART overruns, try running on a faster machine. Driver buffer overflows and UART overruns are also displayed on the regular Statistics screen, accessible from the Control window **Statistics**

3.6.5.1 Starting DH+ Statistics

DH+ Statistics is started from the NetDecoder application. DH+ Stats should launch automatically when the application is started. However, if it does not start automatically, then follow the steps below.

Launch NetDecoder Protocol Analyzer for DH+, and perform the following:

1. From the **File** menu on the Control window., open the desired capture file
2. The system should display the **DH+ Overview** dialog.
3. If the dialog does not appear, then open the **View** menu on the Control window.
4. Select **DH+ Statistics**.

3.6.5.2 About the Statistics Overview Dialog

The DH+ Statistics Overview screen displays key information pertaining to the overall health of the network in tabular format, as well as an [Active Devices](#) grid that identifies all the devices currently on the network.

The three table displays on the overview screen provide the user with current statistical information on [Top Talkers](#), [Top Conversations](#) and [Token Rotation Times](#). The overview screen affords the user easy access to detailed information on individual devices, graphs of statistical data, and statistics on [Network Bytes Sent](#), [Transactions Summary](#), and a [Network Event Log](#). The Overview dialog is the main dialog. All other dialogs are reached either directly or indirectly from this dialog.

DH+ Statistics provides powerful network monitoring capabilities. For this reason, the Overview dialog displays statistical data updated in real-time, as do all dialogs in DH+ Statistics.

The Active Devices grid appears in the upper-left corner of the dialog. This simplifies network monitoring by allowing the user to drag the Overview dialog to the lower right-hand corner of the computer screen hiding all but the Active Devices grid and the Synopsis information.

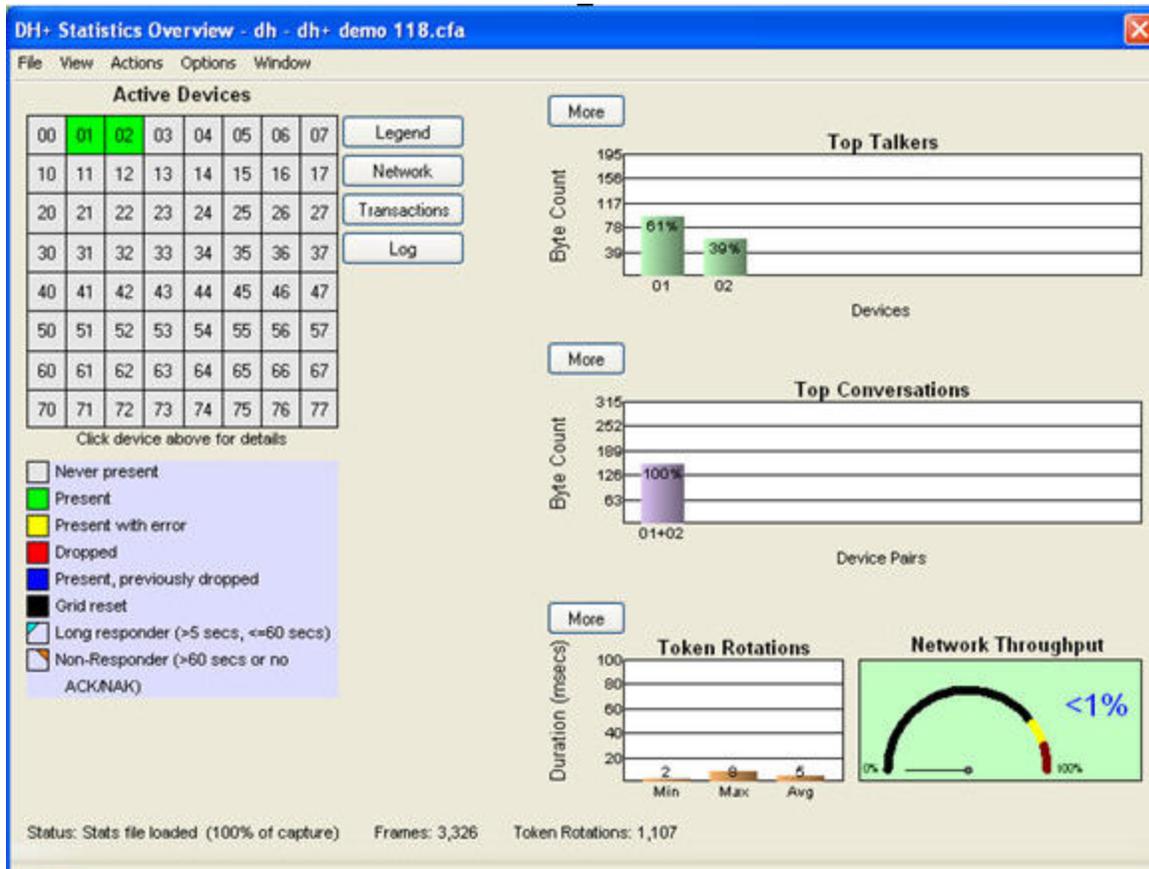


Figure 3.32 - DH+ Statistics Overview dialog.

3.6.5.2.1 Active Devices Grid

The Active Devices grid appears on the [Statistics Overview](#) dialog. This grid is a color-coded 8 x 8 grid that shows the current status of each device. Clicking on a device square in the grid brings up the [Device Transactions](#) dialog for that device. A colored square is used for conditions where the device is or has been present. A triangle in the upper-right corner of a square is used for conditions where the device may never have been present.

The Active Devices Grid color code is as follows:

-  Gray: Device never present
-  Green: Device present and OK
-  Yellow: Device present with at least one error
-  Red: Device absent (dropped off bus)
-  Blue: Device present, previously dropped off bus (supercedes yellow)
-  Black: (Optional) Device has not reappeared after grid reset
-  Cyan Triangle: A long-responder takes between 5 seconds and 60 seconds to respond
-  Orange Triangle: A non-responder takes more than 60 seconds to respond or no immediate ACK/NAK

Yellow Grid Errors

A device can have the following "condition yellow" errors:

- Sent NAK to a Command or Reply.
- Had missing or truncated field in a frame.
- Sent a Token, Solicit, Command, or Reply but wasn't the token holder.
- Sent ACK or NAK but hadn't received a Command or Reply.
- Sent to an invalid (out of range) device number.
- Sent to itself.

3.6.5.2.1.1 Device Transactions Dialog

The **Device Transactions** dialog shows transaction statistics for a selected device.

Access this dialog by clicking on the desired device number in the [Active Devices](#) grid on the **Overview** dialog. A transaction is a sequence of messages consisting of a Command followed by a Reply, with an ACK or NAK after each one, as follows:

1. Device A sends a Command to device B.
2. Device B sends an ACK or NAK to device A.
3. If device B sent an ACK, it then sends a Reply to device A.
4. Device A sends an ACK or NAK to device B.

The **Device Transactions** dialog provides detailed statistics on all traffic to and from the selected device. This dialog lists the conversation types on the left side, and displays the statistics for each in the adjacent table. The list items contain both the message type (Commands, Replies, ACKS, NAKS) and the associated action (Sent to,

Received from). In addition, the table contains statistics on device response times. Response time statistics used in conjunction with statistics from other devices assist in identifying worst-case conditions.

The top table displays statistics for traffic originating from the selected device. Conversely, the bottom table displays statistics for traffic originated by other devices and directed toward the selected device.

On a well-behaved network with no errors, the numbers of Commands, Command ACKs, Replies, and Reply ACKs are all equal. These numbers can be unequal in the table due to many factors, including transmission noise, partial token rotations discarded by DH+ Stats (this is normal behavior), un-captured frames (frames that occurred before or after the capture session), frames missed by DH+ Stats, and absent devices. To determine whether network or device errors have occurred, consult either the [Network Event Log](#) or the [Active Devices](#) grid (look for a device box that is yellow, red, or blue, or has an orange/cyan triangle in the upper right corner).

Minimum, maximum, and average response times are displayed at the bottom of each table. A response time is the amount of time between a Command and its Reply. Commands and Replies are tied together by looking for equal transaction numbers in the PCCC layer. Negative response times and response times that exceed 10 seconds are discarded (the former is an error and the latter is assumed to be an error). In the minimum and maximum fields, the Command and Reply frame numbers can be displayed by checking the “Show frame numbers” checkbox.

The device number is displayed in the header and in each corner of the dialog to enable easy identification of each dialog when multiple device dialogs overlap each other on the screen.

The top table of the Device Transactions dialog shows statistics for transactions which begin when the device specified in the dialog header receives Commands from a device specified at the top of a table column.

Table 3.14 - Received Transactions

Transaction (row)	Description
Recvd Cmds	Commands that the header device received from a column device.
Sent Cmd ACKs	ACKs that the header device sent to a column device in response to a Command from the column device.
Sent Cmd NAKs	NAKs that the header device sent to a column device in response to a Command from the column device.
Sent Replies	Replies that the header device sent to a column device.
Recvd Reply ACKs	ACKs that the header device received from a column device in response to a Reply from the header device.
Recvd Reply NAKs	NAKs that the header device received from a column device in response to a Reply from the header device.
Min Response Time	Minimum response time
Max Response Time	Maximum response time
Avg Response Time	Average response time
No Reply Within 60 Secs	Number of occurrences of no reply within 60 seconds

The bottom table of the Device Transactions dialog shows statistics for transactions which begin when the device specified in the dialog header sends Commands to a device specified at the top of a table column.

Table 3.15 - Sent Transactions

Row	Description
Sent Cmds	Commands that the header device sent to a column device.
Recvd Cmd ACKs	ACKs that the header device received from a column device in response to a Command from the header device.
Recvd Cmd NAKs	NAKs that the header device received from a column device in response to a Command from the header device.
Recvd Replies	Replies that the header device received from a column device.
Sent Reply ACKs	ACKs that the header device sent to a column device in response to a Reply from the column device.
Sent Reply NAKs	NAKs that the header device sent to a column device in response to a Reply from the column device.
Min Response Time	Minimum response time
Max Response Time	Maximum response time
Avg Response Time	Average response time
No Reply Within 60 Secs	Number of occurrences of no reply within 60 seconds

The drop down menu provides selections to display the data as:

- Message Count
- Message Count Percentage (Percentage of the total number of messages)
- Byte Count
- Byte Count Percentage (Percentage of the total number of bytes)

Clicking the **Apply settings to all transaction dialogs** button applies the selection in the drop down box to the [Transaction Summary](#) dialog.

3.6.5.2.2 Active Devices Grid Buttons

These buttons, located to the right of the **Active Devices Grid** on the **DH+ Statistics Overview** window activate the following displays:

Table 3.16 - Active Devices Grid Buttons

Button	Description
	Displays the help topic for the Active Devices Grid
	Displays the Network Bytes Sent dialog
	Displays the Transactions Summary dialog
	Displays the Network Event Log dialog

With the exception of the grid, numbers of devices that have never been present are enclosed in double parentheses, and numbers of devices that are currently absent but have been present are enclosed in single parentheses.

Note: Driver buffer overflows and UART overruns (both shown on the regular Statistics screen, reachable via the Control window **View** menu **Statistics** selection) during live capture cause data loss that can result in some invalid frames. This can affect the values shown in DH+ Stats. To prevent driver buffer overflows, try increasing **Driver Receive Buffer Size in Operating System Pages** in the Advanced in the "Control Window **System Settings** menu. To prevent UART overruns, try running on a faster machine. For further assistance please contact Technical Support.

3.6.5.2.3 Status

Status appears just below the **Synopsis**.

Status can display the following:

Table 3.17 - DH+ Statistics **Status** Remarks

Remark	Description
Capturing to file	Displayed during a live capture to file
Done capturing to file	Displayed when a live capture to file finishes
Reading capture file	Displayed when the capture file is first opened, before displaying any statistics
Reading capture file (n%)	Displayed when there are statistics displayed for one or more frames. This indicates how much of the capture file has been processed by the plug in
Loading stats file	Displayed while a statistics file is being loaded
Stats file loaded (n% of capture)	Displayed when a statistics file is fully loaded. The "n%" is the percentage of the capture file's frames that were sent to DH+ Stats (some of which may have been missed by DH+ Stats).

Table 3.17 - DH+ Statistics Status Remarks (continued)

Remark	Description
Unable to load stats file	Displayed when a statistics file cannot be loaded. Usually caused by an obsolete version number contained in the statistics file.
Exiting	Displayed when DH+ Stats is being terminated. This status usually appears for just an instant.

3.6.5.2.4 Top Talkers Chart

The Top Talkers chart appears in the top right portion of the **DH+ Statistics Overview** dialog.

- The **Top Talkers** display sorts the device list by Byte Count , allowing the user to identify which devices use most of the available network bandwidth.
- The calculated statistics displayed in the **Top Talkers** table include data only from Command and Reply messages, and does not include data from required protocol messages (ACK, NAK, Token and Solicit).

Selecting the **More** button displays the [Top Talkers Dialog](#), which displays both a graph and a table.

3.6.5.2.5 Top Conversations Chart

The Top Conversations information table appears in the middle right portion of the **DH+ Statistics Overview** dialog.

- The **Top Conversations** statistic sorts the device list by Byte Count, allowing the user to quickly identify which pair of devices generate the most traffic on the network.
- The statistics displayed in the **Top Conversations** table includes data only from Command and Reply messages, and does not include data from required protocol messages (ACK, NAK, Token and Solicit).

Selecting the **More** button displays the **Top Conversations Dialog** which displays both a graph and a table.

3.6.5.2.6 Token Rotations Summary Chart

The Token Rotation Summary information table appears across the bottom portion of the **DH+ Statistics Overview** dialog. This table contains information about the Token Rotation Times, including minimum, maximum, average and current values. Token Rotation Times directly relate to network performance. The values in the summary table are an indicator of system throughput and performance. DH+ Statistics calculates and displays actual response times on the individual [Device Transaction](#) dialog as well as the [Transaction Summary](#) dialog.

The measured Token Rotation Time for each of the four indicators (minimum, maximum, average, and current) appears in the Duration column. Typically, a complete Token Rotation starts when a Token passes from a higher device ID number to a lower device ID number. Then it passes up through incrementing device ID numbers. When the highest active ID numbered device obtains the Token and passes it to a lower device ID number, the Token Rotation ends and the next one begins.

Selecting the **More** button displays the [Token Rotations dialog](#) which displays both a graph and a table.

3.6.5.2.6.1 Device Token Rotations Dialog

The Device Token Rotation dialog is accessed by clicking on the Rotations button in a [Device Transactions](#) dialog. The Device Token Rotation dialog displays minimum, maximum, average, and total values for the selected device against the following parameters:

- duration token held
- total Bytes sent per token rotation (this is all bytes from all messages)
- Command Bytes Sent Per Token Rotation
- Reply Bytes Sent Per Token Rotation

For the minimum and maximum values, the **Date and Time of Occurrence** and the **Frame range** are also displayed against each of the above parameters. The frame range begins with the frame in which the specified device receives the token, and ends with the frame in which the specified device sends the token to another device. This means that the last frame of a given token rotation and the first frame of the next token rotation are the same frame. The device number is displayed in the header and in each corner of the dialog to enable easy identification of each dialog when multiple device dialogs overlap each other on the screen. Pressing the Transactions button returns to the Device Transactions dialog.

Note: The **Duration Token Held** field is negative (and is discarded) when the same device receives the token, then sends it, then receives it again within what appears to be a single token rotation (when this happens it is typically due to missing frames). Since DH+ Stats simply saves the time-stamp each time and subtracts the receive time-stamp from the send time-stamp, the result is negative (and is discarded).

3.6.5.2.7 Network Throughput

DH+ “Message” frames carry PCCC payload. The “Message” frames are either ‘Commands’ or ‘Replies’. Throughput for a single frame is defined as the ratio of the actual number of data bytes (PCCC payload plus any Data layer) that constitute either the Command or Reply to the total number of bytes sent in the frame. In other words, the throughput is a measure of the overhead involved in transferring data over a DH+ network. If the throughput is high, then it implies that the control messaging overhead is low.

NetDecoder displays the throughput value for all frames seen in the most recent second. Let’s look at an example to get a better idea of how the NetDecoder software computes this value.

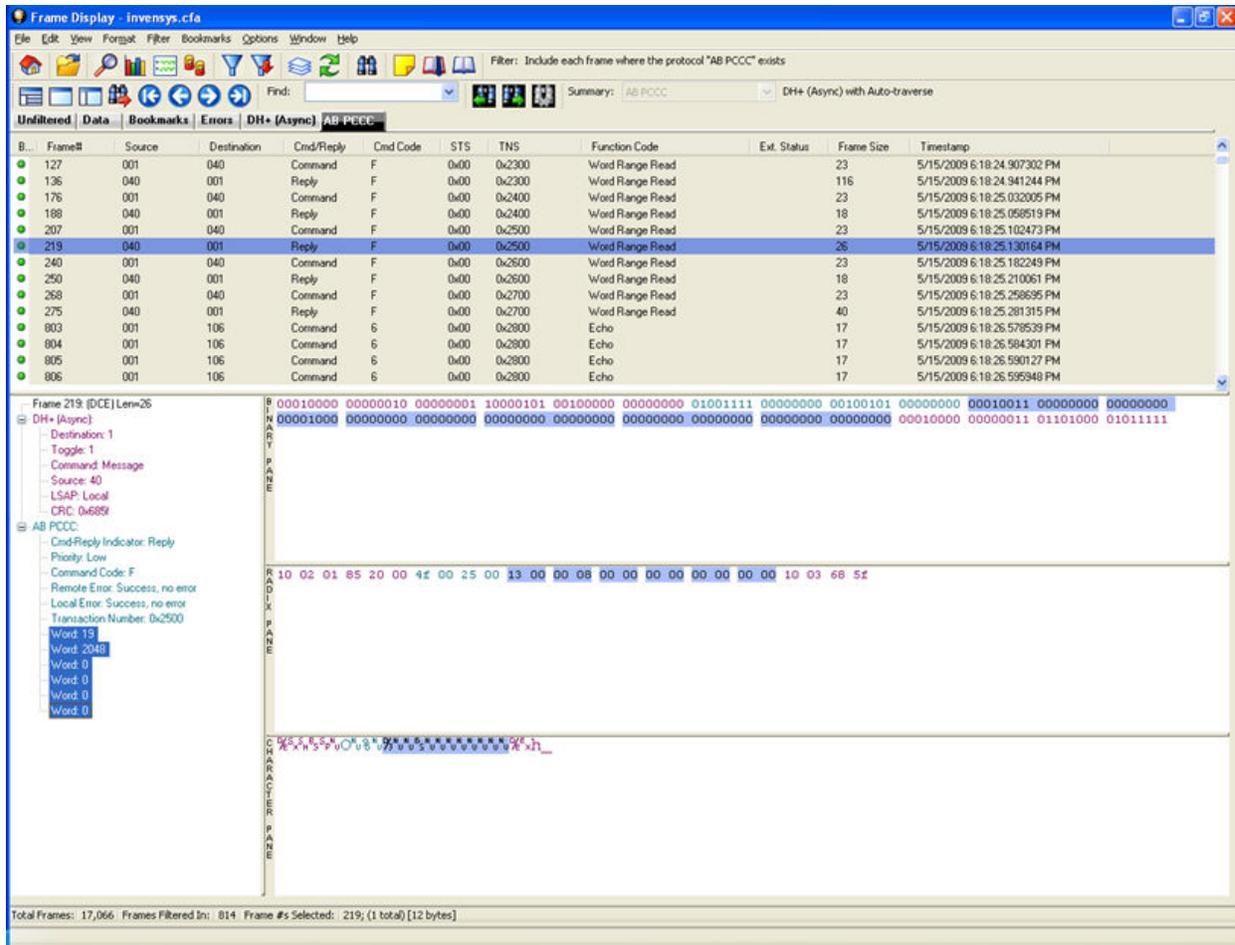


Figure 3.33 - DH+ in the **Frame Display**, example

In this screenshot, Frame 219 is a Reply from Node 40 to a Command from Node 1. Notice that the actual Reply part of the PCCC layer is only 12 bytes. But the total length of Frame 219 is 26 bytes. So the throughput for this single frame is $12/26 = 46.15\%$.

The NetDecoder software keeps a running tally of the total bytes and actual data bytes in every frame it encounters. These values are used to compute the throughput for the most recent second.

3.6.5.2.8 Setting Display Options

Display Options selections affect how statistics data is displayed by DH+ Statistics, not how it is stored.

To access the **Display Options** dialog:

1. Select **Options** from the **Options** menu on the **Overview** dialog, and the system displays the **DH+ Options** dialog

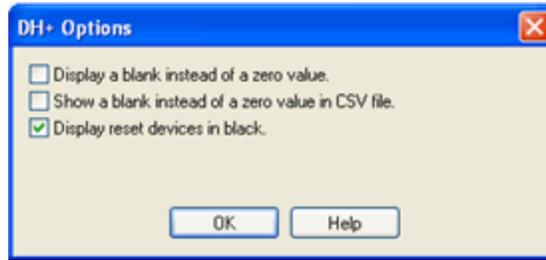


Figure 3.34 - DH+ Options dialog

2. Add or remove the desired display options using the check boxes
3. Click the **OK** button to apply the display options

The **Display Options** dialog closes, and applies the selected options

Display Options definitions

DH+ Display Options

Options	Default	Description
Display a blank instead of a zero value	Unchecked	Statistical data is often displayed in tabular format. DH+ Statistics stores a value for each cell in these tables. If there is no value for a particular cell, then the system stores a value of zero. Some tables may contain many cells with a zero value, and when these tables are displayed, they may appear cluttered and hard to read. Selecting this option changes the table displays to hide zeros in the cells that contain only a zero value.
Show a blank instead of a zero value in CSV file	Checked	This option hides the zeros in cells that contain a zero value in a CSV file in the same way that the "Display a blank instead of a zero value" does in the tables.
Display reset devices in black	Checked	This option affects the Active Devices grid display. DH+ Statistics is equipped with a means to reset all of the colors displayed in the active devices grid to Gray. This option allows the user to reset previously active devices to display in black instead of gray. This separates those devices from the ones in the grid that were never active.

3.6.5.3 Network Statistics

3.6.5.3.1 Busy Tokens Dialog

To access the **Busy Tokens** dialog, select **Busy Tokens** from the **View** menu in the **Overview** dialog.

The **Busy Tokens** dialog shows busy token data in both a graph and a table.

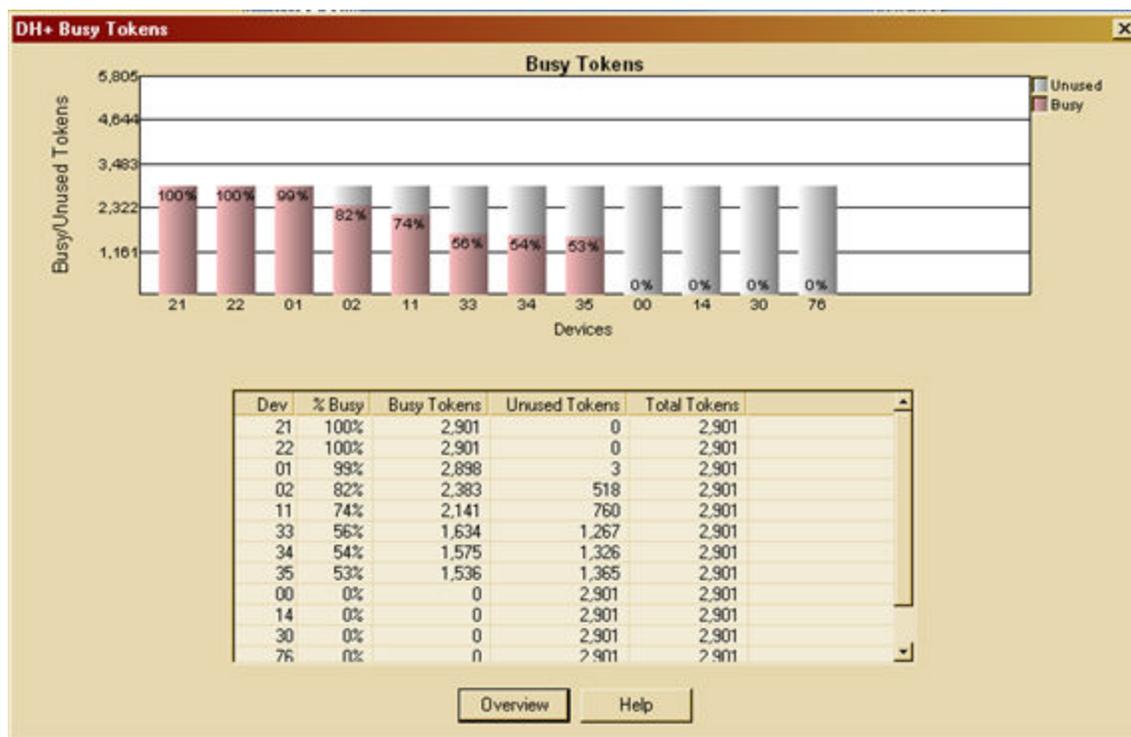


Figure 3.35 - DH+ **Overview Busy Tokens** dialog

The graph displays the percentage of busy and unused tokens for the active devices in stacked bars, mauve for Busy, white for Unused.

The table displays:

- Device Identifier
- Percentage of busy tokens
- Number of busy tokens
- Number of unused tokens
- Total tokens

3.6.5.3.2 Network Bytes Sent Dialog

To access the **Network Bytes Sent** dialog, select **Network Bytes Sent** from the **View** menu or select the **Network** button from the **Overview** dialog.

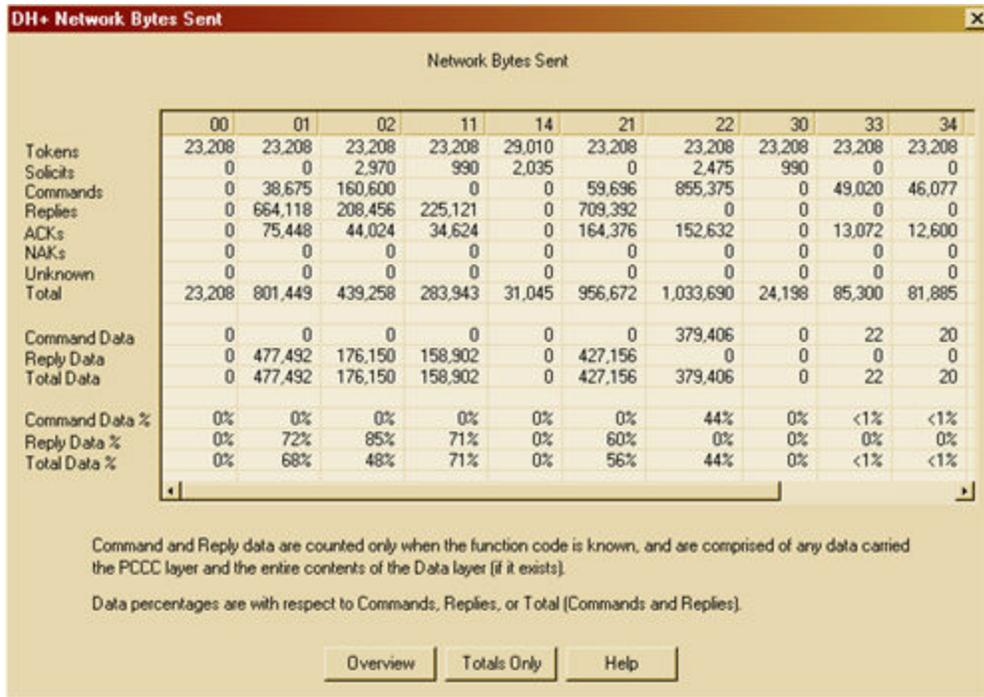


Figure 3.36 - DH+ **Overview Network Bytes Sent** dialog

The **Network Bytes Sent** dialog is simple and comprehensive. It shows the number of bytes sent by each device, by message type, including unknown messages. The value in the **Total** column of the **Total** row is the same number displayed in the Byte Count field of the **Overview** dialog.

The device numbers are displayed at the top of each column.

The **Totals Only** button displays the [Network Bytes Sent Totals](#) dialog.

3.6.5.3.3 Network Bytes Sent Totals Dialog

To access the **Network Bytes Sent Totals** dialog, select **Network Bytes Sent Totals** from the **View** menu in the **Overview** dialog, or click on the **Totals Only** button on the [Network Bytes Sent](#) dialog.

	Total
Tokens	284,298
Solicits	25,669
Commands	1,255,523
Replies	1,807,087
ACKs	509,064
NAKs	0
Unknown	0
Total	3,881,641
Command Data	379,470
Reply Data	1,239,700
Total Data	1,619,170
Command Data %	30%
Reply Data %	69%
Total Data %	53%

DH+ **Overview Network Bytes Sent** dialog

The **Network Bytes Sent Totals** dialog is a copy of the **Total** column of the **Network Bytes Sent** dialog. The **Devices** button displays the [Network Bytes Sent](#) dialog.

DH+ Statistics uses the size of the frame as it appears on the DH+ wire to compute Byte Count. This is equivalent to the size of the Frontline software physical frame minus one byte.

3.6.5.3.4 Network Event Log Dialog

To access the **Network Event Log** dialog, click on the **Log** button or select Network Event Log from the **View** menu in the [Overview](#) dialog.

The **Network Event** Log dialog displays a breakdown of various network events that are automatically logged. This information provides additional details about the health of the network. This log stores the most recent 2000 events. Checkbox selections at the bottom of the dialog determine which events the system logs.

Events

The system logs the following events:

Table 3.18 - Network Event Log Events

Event	Description	Color and Shape
Event	Description	Color and Shape in Grid
Appeared	Device appeared for the first time	Green square
Dropped off bus	Device dropped off the bus	Red square
Reappeared	Device reappeared after dropping off the bus	Blue square (supercedes a yellow square)

Table 3.18 - Network Event Log Events (continued)

Event	Description	Color and Shape
Sent NAK to a Command or Reply	Device sent a NAK immediately after receiving a Command or Reply	Yellow square
Had missing or truncated field in a frame.	Device had one or more decode errors.	Yellow square
Token/Solicit/Command/Reply sent but not by token holder	Device sent a token, solicit, Command, or Reply but was not the most recent device to be sent the token.	Yellow square
Sent ACK or NAK but hadn't received Command or Reply	Device sent an ACK or NAK, but the previous message on the wire was not a Command or Reply that was sent to that device.	Yellow square
Sent to an invalid (out of range) device number	Device sent a message with a destination device number that was not in the range 00..77 octal.	Yellow square
Sent from an invalid (out of range) device number	A source device number in a message was not in the range 00..77 octal.	n/a
Sent to itself	The source and destination device numbers in a message were the same.	Yellow square
Long Responder - (reply took longer than 5 seconds)	Device was the destination of a Command and immediately sent ACK but the reply took between 5 and 60 seconds	Cyan triangle in upper-right-corner of square
Non-Responder - (no reply within 60 seconds)	A non-responder takes more than 60 seconds to respond or does not respond at all	Orange triangle in upper-right-corner of square
Non-Responder - (no ACK or NAK)	Device was the destination of a Command and didn't send an ACK or NAK	Yellow square
Gap in frame sequence numbers	One or more frames are missing as determined by noting a gap in the frame sequence numbers. Detailed info is shown in the "Missing and Excluded Frames" dialog.	n/a
Duration between frames exceeds 0.5 seconds	Bytes are assumed to be missing because the duration between two adjacent frames exceeded 0.5 seconds. Detailed info is shown in the "Missing and Excluded Frames" dialog.	n/a

Table Columns

- Each table column is sorted in each direction by clicking on the column header.
- When any column except the first (Seq) is sorted, the first column is used as a secondary sort key so that the seq nums are also sorted within each range of equal fields in the sorted column.
- When writing to the CSV file, the current sort order is used.
- While a device is absent, Non-Responder events for that device are condensed (logged only once with a count range, with all other fields set to the first event in the range).
- All future occurrences of an event are logged if the corresponding event checkbox is checked, and excluded if the corresponding event checkbox is unchecked.
- Sequence number gaps indicate excluded or condensed events.

Table columns are as follows:

Network Event Log Columns

Column	Description
Seq	Event sequence number, starting at 1. Every event receives a sequence number, even events that are not logged (due to being excluded or condensed).
Dev	Device number
Event	Event description
Count	Number of occurrences of that combination of Event, Dev, and Msg Dev (device numbers that appear in the Event field are ignored). This is shown as a range for condensed events.
Frame	Frame number where event occurred.
Rotation	Token rotation number where event occurred. In the case of a gap in the frame sequence numbers or more than 0.5 seconds between frames, the token rotation is excluded and its number is shown in parentheses. Note that the next included token rotation has the same number (i.e. excluding a token rotation does not result in a gap in the token rotation numbers).
Timestamp	Time of occurrence
Msg Dev	Number of device that sent a Command or Reply. Set only when the event is "Non-Responder...".
Msg Frame	Frame number of a Command or Reply. Set only when the event is "Non-Responder ...".

3.6.5.3.5 Top Talkers Dialog

The Top Talkers dialog displays statistics on bandwidth usage by device.

You access the **Top Talkers** dialog by clicking on the **More** button located above the **Top Talkers** table on the **Overview** dialog, or by selecting **Top Talkers** from the **View** menu on the **Overview** dialog.

The graph displays Command and Reply byte count sent by a single device in byte count order. All devices that have ever been present on the bus appear in the graph, regardless of whether they sent any Command or Reply messages. Graph bars display the byte count percentage at the top of each bar.

The table displays device **Command** and **Reply** byte count, percentage of total Command and Reply bytes on the network, Command and Reply message count, percentage of total Command Reply message count, and average length. The table sorts the device list by **Byte Count**, allowing the user to identify which devices use most of the available network bandwidth.

The calculated statistics displayed in the **Top Talkers** table and graph only includes data from Command and Reply messages, and does not include data from required network Protocol messages (ACK, NAK, Token and Solicit).

Top Talkers Column Headings:

DH+ Overview Top Talkers Columns

Column	Description
Dev Num	Device address in octal
Byte Count*	Number of Command and Reply bytes sent by a device
%Bytes	Percentage of all network Command and Reply bytes sent by a device
Msg Count	Number of Command and Reply messages sent by a device
%Msgs	Percentage of all network Command and Reply messages sent by a device
Avg Len	Average Length of Command and Reply messages sent by a device
* DH+ Statistics uses the size of the frame as it appears on the DH+ wire to compute Byte Count . This is equivalent to the size of the Frontline software physical frame minus one byte.	

3.6.5.3.6 Top Listeners Dialog

Access the **Top Listeners** dialog by selecting **Top Listeners** from the **View** menu on the **Overview** dialog.

The graph displays Command and Reply byte count received by a single device in byte count order. All devices that have ever been present on the bus appear in the graph, regardless of whether they received any Command or Reply messages. Graph bars display the byte count percentage at the top of each bar.

The table displays device Command and Reply byte count, percentage of total Command and Reply bytes on the network, Command and Reply message count, percentage of total Command Reply message count, and average length. The table sorts the device list by Byte Count .

The calculated statistics displayed in the Top Listeners table and graph includes only data from Command and Reply messages, and does not include data from required network protocol messages (ACK, NAK, Token and Solicit).

Top Listeners Column Headings:

DH+ Overview Top Listeners Columns

Column	Description
Dev Num	Device address in octal

DH+ OverviewTop Listeners Columns (continued)

Column	Description
Byte Count*	Number of Command and Reply bytes received by a device
%Bytes	Percentage of all network Command and Reply bytes received by a device
Msg Count	Number of Command and Reply messages received by a device
%Msgs	Percentage of all network Command and Reply messages received by a device
Avg Len	Average Length of Command and Reply messages received by a device
* DH+ Statistics uses the size of the frame as it appears on the DH+ wire to compute Byte Count . This is equivalent to the size of the Frontline software physical frame minus one byte.	

3.6.5.3.7 Top Conversations Dialog

The Top Conversations dialog displays conversation statistics.

Access the **Top Conversations** dialog by clicking on the **More** button located above the **Top Conversations** table on the [Overview](#) dialog, or by selecting **Top Conversations** from the **View** menu on the **Overview** dialog.

A “conversation” consists of Command and Reply messages sent between two specific devices. The graph shows command and reply byte count for each pair of devices sorted first by byte count and then by device pair. All device pairs are shown for all devices that appeared on the bus, regardless of whether the devices in the pair communicated with each other.

The scale across the bottom of the graph identifies the device pair using their two digit octal number identifiers, and the scale up the side of the graph lists the byte count. Each bar provides a graphic representation of its associated device pair's byte count usage with respect to other device pairs on the network, and the percentage of total byte usage by each device pair appears on each bar.

The table below the graph sorts the device list by Byte Count. The statistics displayed in the table includes only data from device-controlled command and reply messages, and does not include data from required protocol messages (ACK, NAK, Token and Solicit).

Top Conversations Column Headings include:

DH+ OverviewTop Conversations Columns

Column	Description
Dev Num	Device pair addresses in octal
Byte Count*	Number of Command and Reply bytes sent between a device pair
%Bytes	Percentage of all network Command and Reply bytes sent between a device pair
Msg Count	Number of Command and Reply messages sent between a device pair

DH+ OverviewTop Conversations Columns (continued)

Column	Description
%Msgs	Percentage of all network Command and Reply messages sent between a device pair
Avg Len	Average Length of Command and Reply messages sent between a device pair
* DH+ Statistics uses the size of the frame as it appears on the DH+ wire to compute Byte Count . This is equivalent to the size of the Frontline software physical frame minus one byte.	

3.6.5.3.8 Transactions Summary Dialog

Access the **Transactions Summary** dialog by clicking the **Transactions** button on the [Overview](#) dialog or selecting **Transactions Summary** from the **View** menu on the **Overview** dialog. This dialog lists a breakdown of the Command and Reply transactions as well as response times for each device on the network.

On a well-behaved network with no errors, the numbers of Commands, Command ACKs, Replies, and Reply ACKs are all equal. These numbers can be unequal in the table due to many factors, including transmission noise, partial token rotations discarded by DH+ Stats (this is normal behavior), un-captured frames (frames that occurred before or after the capture session), frames missed by DH+ Stats, and absent devices. To determine whether network or device errors have occurred, consult either the [Network Event Log](#) or the [Active Devices](#) grid (look for a device box that is yellow, red, or blue, or has a red triangle in the upper right corner).

Response time statistics reflect network throughput and assist with identifying worst-case conditions.

The top table of the Transactions Summary dialog shows statistics for transactions which begin when other devices receive Commands from a device specified at the top of a table column.

Table 3.19 - DH+ Receive Commands Transaction Summary Rows

Row	Description
Recvd Cmds	Commands that other devices received from a column device.
Sent Cmd ACKs	ACKs that other devices sent to a column device in response to a Command from the column device.
Sent Cmd NAKs	NAKs that other devices sent to a column device in response to a Command from the column device.
Sent Replies	Replies that other devices sent to a column device.
Recvd Reply ACKs	ACKs that other devices received from a column device in response to a Reply from other devices.
Recvd Reply NAKs	NAKs that other devices received from a column device in response to a Reply from other devices.
Min Response Time	Minimum response time
Max Response Time	Maximum response time
Avg Response Time	Average response time
No Reply Within 60 Secs	Number of occurrences of no reply within 60 seconds

The bottom table of the **Transactions Summary** dialog shows statistics for transactions which begin when other devices send Commands to a device specified at the top of a table column.

Table 3.20 - DH+ Sent Commands Transaction Summary Rows

Row	Description
Sent Cmds	Number of commands received
Recvd Cmd ACKs	ACKs that other devices received from a column device in response to a Command from the other device.
Recvd Cmd NAKs	NAKs that other devices received from a column device in response to a Command from the other device.
Recvd Replies	Replies that other devices received from a column device.
Sent Reply ACKs	ACKs that other devices sent to a column device in response to a Reply from the column device.
Sent Reply NAKs	NAKs that other devices sent to a column device in response to a Reply from the column device.
Min Response Time	Minimum response time
Max Response Time	Maximum response time
Avg Response Time	Average response time
No Reply Within 60 Secs	Number of occurrences of no reply within 60 seconds

Clicking the **Show Frame Numbers** check box adds the frame numbers to the **Minimum Response Time** and **Maximum Response Time** associated with this data in both tables.

The drop down menu provides selections to display the data as:

- Message Count
- Message Count Percentage (Percentage of the total number of messages)
- Byte Count
- Byte Count Percentage (Percentage of the total number of bytes)

Clicking the **Apply settings to all transaction dialogs** button applies the selection in the drop down box to the individual [Device Transaction](#) dialogs.

3.6.5.3.9 Token Rotations Dialog

You access the **Token Rotations** dialog by clicking on the **More** button located above the **Token Rotations** table on the **Overview** dialog, or by selecting **Token Rotations** from the **View** menu on the **Overview** dialog.

The **Token Rotations** dialog displays the values of the last 2000 maximum and the last 2000 minimum **Token Rotation Times**, and is limited to 4000 total entries. If no more than 4000 token rotations are processed, then all are shown.

The table shows a sequence number (where the first token rotation is number 1), the token rotation, duration, the date and time of occurrence, and the number of the first frame in the token rotation. The graph shows token rotation durations in order of occurrence. These values identify the best and worst case Token Rotation Times. Token Rotation Times directly affect the throughput capabilities of the network.

Sorting

The table can be sorted by sequence number or token rotation duration in ascending or descending order. Whenever the sorting method is changed, the table automatically scrolls back to the top. Choose the sorting method from the drop down field just above the table display. The graph, however, cannot be sorted.

Scrolling

When the table or graph scroll bar slider is at the top or leftmost it stays there while additional events accumulate in the log, otherwise it is adjusted as necessary so that the first displayed entry retains its position. If that entry is removed (because it is no longer one of the 2000 max or 2000 min durations), then an adjacent entry takes its place on the display.

Graph Points

The number of points in the graph is selectable in multiples of 10 from 10 to 300. Click the up and down arrows in the Max Points field to change the number of points displayed in the graph.

Selecting Entries

Selecting an entry in the graph automatically selects the corresponding entry in the table and vice versa, regardless of how the data is sorted in the table. Use the Ctrl and Shift keys to select contiguous and non-contiguous entries. When a graph entry is selected and the corresponding entry is not already visible in the table, the selected entry is highlighted and scrolled to the top of the table. When a table entry is selected and the corresponding entry is not already visible in the graph, the selected entry is highlighted and scrolled to the middle of the graph.

Y-Axis Max

The "Y-Axis Max" field sets the height of the y-axis and is provided primarily to allow the user to deal with the degenerate case of the entire network pausing for a long time. When that happens, the single token rotation duration that includes the time that the network was paused can dwarf the other token rotation durations to the point of near-invisibility. Setting the y-axis height to an appropriate value pushes the outlier(s) past the top of the graph while placing the rest of the values below the top of the graph. Checking the Auto box causes the y-axis height to be adjusted dynamically such that the height of the largest token rotation duration is 95-99% of the height of the graph (regardless of whether that token rotation duration is currently visible on the graph). The Auto box is checked by default.

The **Token Rotations Summary** displays minimum, maximum, average, and current values against the following parameters:

- Duration (the token rotation duration time)
- Date and Time of Occurrence (of token rotation)
- Frame (the number of the first frame in the token rotation)
- Busy (the number of busy tokens)
- %Busy (the percentage of busy tokens)

The following parameters display "Message Count", or "Byte Count" depending upon the selection made in the Messages drop down box located just above the Token Rotations Summary table.

- Token
- Solicits
- Commands
- Replies
- ACKs
- NAKs

3.6.5.4 Statistics Files

The statistics file contains all of the stats data in binary format. It has the base name of the capture file and the extension "sts", and is located in the same directory as the capture file. It is created automatically when a capture file is opened or when a live capture is begun, and is updated every 10 seconds while frames are being received and once more when frames stop being received. It's closed after each update so that it persists after a system crash.

When a capture file is opened, the associated stats file is loaded if it exists. Displaying a stats file results in the exact same stats data being displayed that were displayed when either the capture file was closed or live mode was exited, except that the Status field on the Overview dialog says "Stats file loaded" instead of "Done reading capture file".

Each stats file contains the version number of DH+ Stats that created it followed by the version number of the stats file itself.

A stats file that reflects only part of the capture file results when the capture file is closed before DH+ Stats has received all of its frames. When such a stats file is loaded, the Status field on the Overview dialog indicates what percentage of the capture file is reflected by the stats file.

Currently, DH+ Stats does not verify that the stats file was derived from the capture file. Because of this, it's possible for the capture file and stats file to get out of sync if one or the other is copied from somewhere else. In that case, the stats file can be recreated by selecting "Recreate Stats File" from the Overview dialog File menu.

When capturing to a buffer, the stats file is named "DhPlusStats-yyyy-mm-dd_HHMMSS.sts", where yyyy = year, mm = month, dd = day, HH = hours (00..23), MM = minutes, and SS = seconds (this is, incidentally, the same format used in Frontline for capture to series). The only way to load such a stats file is to rename an arbitrary capture file to the same name as the stats file but with a "cfa" extension and open it. Clearly this is a very bad way to do it as it creates a bogus capture file and also defeats the Frontline model of all screens pertaining to the open capture file, but it's all that's available until DH+ Stats API is augmented. It does, however, make it possible for a user to view a stats file that may have been many days or weeks in the creating. Capturing to a file is a far better approach since both the stats file and the capture file are created.

When a wrapping capture is performed, Frontline stops sending frames to DH+ Stats as soon as the next frame for DH+ Stats is overwritten by the frame compiler. At some point this probably changes so that Frontline instead sends the most recent frame, but even then large numbers of frames is not seen by DH+ Stats.

3.6.5.4.1 CSV Files

You can create a CSV file from the Statistics window.

1. Open the **File** menu on the [Overview](#) dialog
2. Selecting **Make CSV File**.

DHPlus Statistics creates an Excel spreadsheet file and displays the **Save As** dialog. The CSV file contains all of the tabulated information from all dialogs in DHPlus Statistics for the current file. The contents of tables that have a selector box are displayed separately for each possible entry in the selector box with the exception of the [Token Rotations](#) dialog where only **Ascending Sequence** and **Descending Duration** are displayed. Depending on the amount of statistical data generated, the Excel spreadsheet may contain tens of thousands of rows.

Note: This menu entry is not available while capturing live data, reading a capture file, or loading a statistics file.

3.6.5.4.2 Backward Compatibility

All statistics files from later versions are backward compatible. Statistics files produced by earlier versions can be read by any subsequent versions. If DH+ Stats has a version number later than the statistics file, the system displays a screen that lists the differences.

3.6.6 CC-Link Dashboard

The CC-Link ComProbe is an option in the Frontline NetDecoder software that allows you to capture and analyze CC-Link protocol messages.

Once messages are captured using CC-Link, you can use the CC-Link Dashboard which provides a graphical overview of the CC-Link network health.

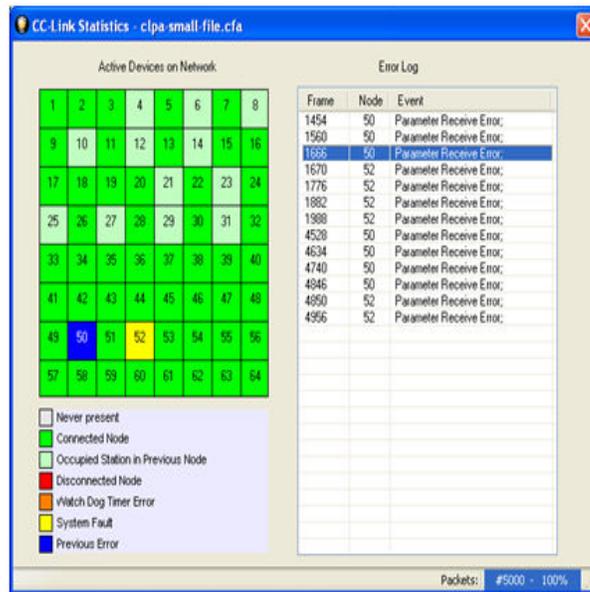
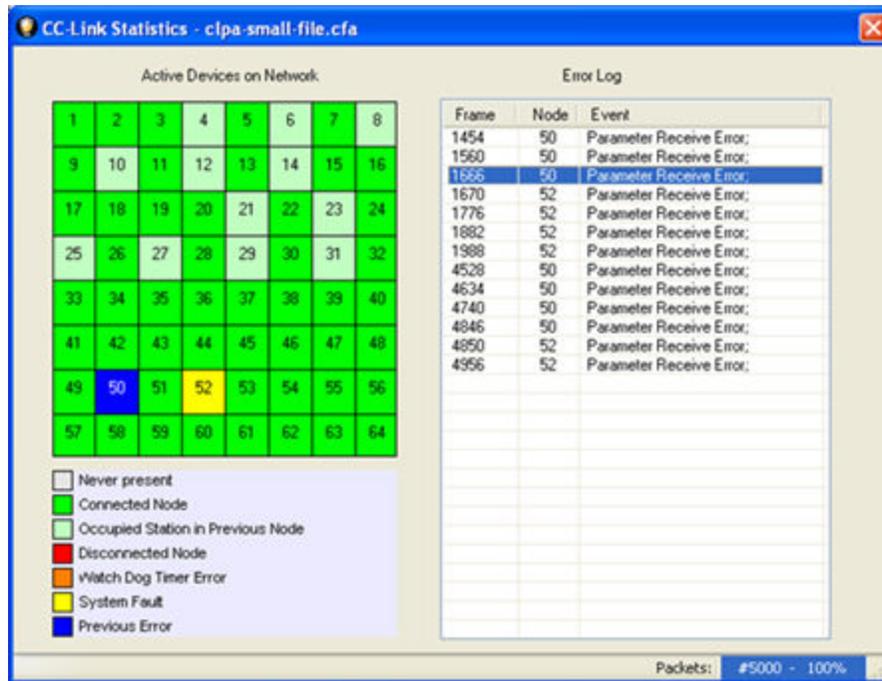


Figure 3.37 - CC-Link Dashboard

There are two main features to the dashboard: The [Active Devices Grid](#) and the [Error Log](#). Select these links to learn more about each

3.6.6.1 CC-Link Active Devices Grid

The **Active Devices on Network** grid shows all 64 nodes on a CC-Link network with each node represented by a numbered square on the grid.



CC-Link Devices Grid on the left

The squares are color coded to indicate the state of the node. The coded states include: Click on each node state to learn more.

Table 3.21 - CC-Link Devices Grid Color Codes

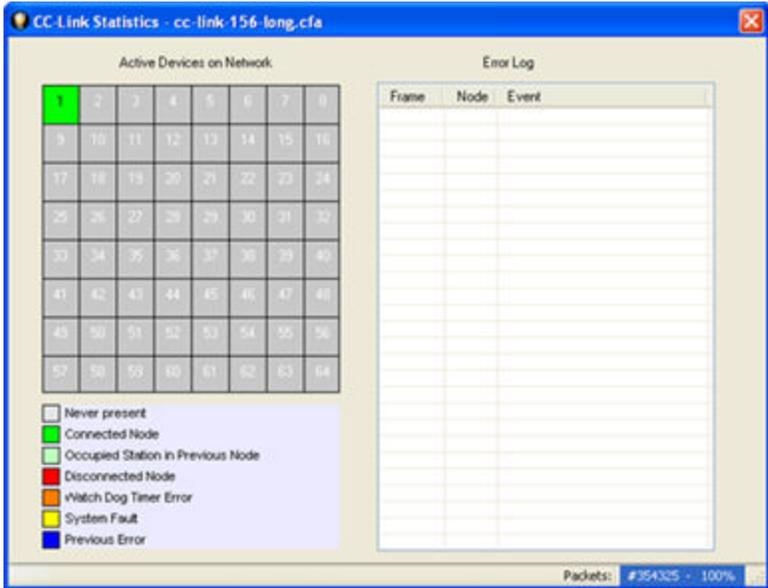
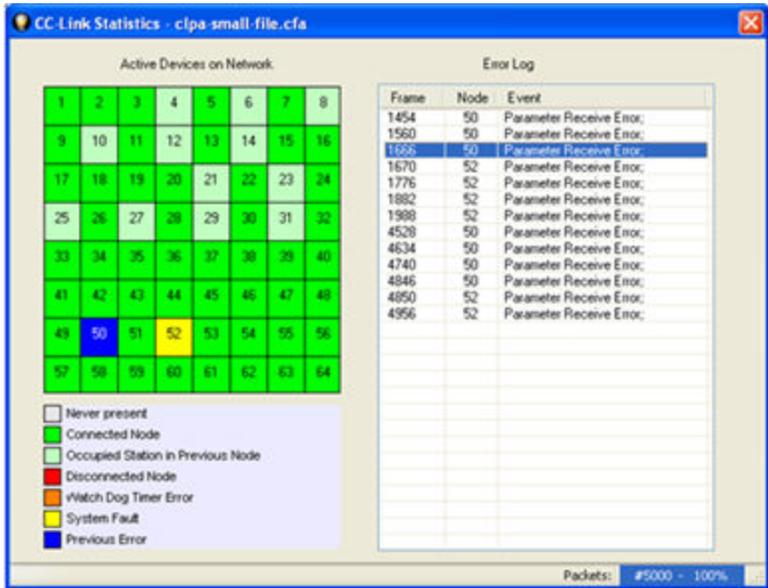
Color Code	Description
	<p>Grey: Node Not Present on the network</p> <p>In this example we see only one connected node, with all other nodes grayed out indicating that they are absent from the network.</p> 
	<p>Green: A Connected Node operating normally without errors.</p> <p>The image below shows all the nodes present, with the nodes in green operating normally, with no error</p> 

Table 3.21 - CC-Link Devices Grid Color Codes (continued)

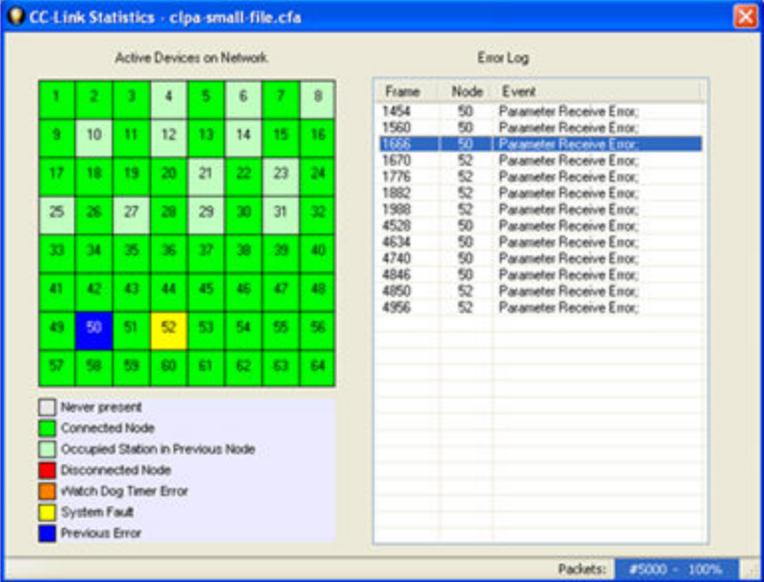
Color Code	Description
	<p>Light Green: An Occupied Station within a Previous Node.</p> <p>CC-Link supports the concept of Occupied Stations, in which a single node on the network can be considered to have multiple stations.</p> <p>In the image below, Node 4 is an Occupied Station. This means that Node 3 is configured to have two occupied stations: Node 3 and Node 4. Similarly, Nodes 5, 7, 9, 11, 13, 20, 22, 24, 26, 28, and 30 have two occupied Stations.</p>  <p>The screenshot shows a window titled 'CC-Link Statistics - ctpa-small-file.cfa'. It contains two main sections: 'Active Devices on Network' and 'Error Log'. The 'Active Devices on Network' section is a grid of 64 nodes (8x8). Nodes 1-49 are green, node 50 is blue, node 52 is yellow, and nodes 51, 53-64 are light green. A legend below the grid defines the colors: Never present (white), Connected Node (green), Occupied Station in Previous Node (light green), Disconnected Node (red), Watch Dog Timer Error (orange), System Fault (yellow), and Previous Error (blue). The 'Error Log' section is a table with columns 'Frame', 'Node', and 'Event'. It lists several 'Parameter Receive Error' events for nodes 50 and 52.</p>
	<p>When you look at the same information in Frame Display in the image below, you can see that in Frame 6 that Node 3 has two occupied stations. This means that Node 4 is actually an occupied station in Node 3. Therefore, after a response from Node 3 in Frame 6, the Master then polls Node 5 and not Node 4. In Frame 8, Node 5 responds and there is information that it also occupies two stations. This implies that Node 6 is an occupied station.</p>

Table 3.21 - CC-Link Devices Grid Color Codes (continued)

Color Code	Description																																																																																																																																				
	<p>The screenshot shows a network analysis tool window titled "Frame Display - c:\pa-small-file.cfa". The interface includes a menu bar (File, Edit, View, Format, Filter, Bookmarks, Options, Window, Help), a toolbar with various icons, and a filter setting: "Filter: Include each frame where the protocol 'CC-Link' exists". Below the toolbar are navigation buttons and a search field. The main area displays a table of frames with the following columns: Bookmark, Frame#, A1, A2, NO. of Stations, and Timestamp. The table contains 21 rows of data, with the 6th row highlighted in blue. At the bottom, a status bar indicates "Total Frames: 5,000. Frames Filtered In: 5,000. Frame #s Selected: 6; (1 total)".</p> <table border="1"> <thead> <tr> <th>Bookmark</th> <th>Frame#</th> <th>A1</th> <th>A2</th> <th>NO. of Stations</th> <th>Timestamp</th> </tr> </thead> <tbody> <tr><td></td><td>1</td><td>Master: Polling & Refresh Data</td><td>1</td><td></td><td>2/16/2011 12:09:09.531000 PM</td></tr> <tr><td></td><td>2</td><td>Slave: Response of Polling & Refresh Data</td><td>1</td><td>1</td><td>2/16/2011 12:09:09.531016 PM</td></tr> <tr><td></td><td>3</td><td>Master: Polling Data</td><td>2</td><td></td><td>2/16/2011 12:09:09.531028 PM</td></tr> <tr><td></td><td>4</td><td>Slave: Response of Polling Data</td><td>2</td><td>1</td><td>2/16/2011 12:09:09.531044 PM</td></tr> <tr><td></td><td>5</td><td>Master: Polling Data</td><td>3</td><td></td><td>2/16/2011 12:09:09.531056 PM</td></tr> <tr style="background-color: #ADD8E6;"><td></td><td>6</td><td>Slave: Response of Polling Data</td><td>3</td><td>2</td><td>2/16/2011 12:09:09.531088 PM</td></tr> <tr><td></td><td>7</td><td>Master: Polling Data</td><td>5</td><td></td><td>2/16/2011 12:09:09.531100 PM</td></tr> <tr><td></td><td>8</td><td>Slave: Response of Polling Data</td><td>5</td><td>2</td><td>2/16/2011 12:09:09.531133 PM</td></tr> <tr><td></td><td>9</td><td>Master: Polling Data</td><td>7</td><td></td><td>2/16/2011 12:09:09.531145 PM</td></tr> <tr><td></td><td>10</td><td>Slave: Response of Polling Data</td><td>7</td><td>2</td><td>2/16/2011 12:09:09.531177 PM</td></tr> <tr><td></td><td>11</td><td>Master: Polling Data</td><td>9</td><td></td><td>2/16/2011 12:09:09.531189 PM</td></tr> <tr><td></td><td>12</td><td>Slave: Response of Polling Data</td><td>9</td><td>2</td><td>2/16/2011 12:09:09.531221 PM</td></tr> <tr><td></td><td>13</td><td>Master: Polling Data</td><td>11</td><td></td><td>2/16/2011 12:09:09.531233 PM</td></tr> <tr><td></td><td>14</td><td>Slave: Response of Polling Data</td><td>11</td><td>2</td><td>2/16/2011 12:09:09.531265 PM</td></tr> <tr><td></td><td>15</td><td>Master: Polling Data</td><td>13</td><td></td><td>2/16/2011 12:09:09.531277 PM</td></tr> <tr><td></td><td>16</td><td>Slave: Response of Polling Data</td><td>13</td><td>2</td><td>2/16/2011 12:09:09.531309 PM</td></tr> <tr><td></td><td>17</td><td>Master: Polling Data</td><td>15</td><td></td><td>2/16/2011 12:09:09.531321 PM</td></tr> <tr><td></td><td>18</td><td>Slave: Response of Polling Data</td><td>15</td><td>1</td><td>2/16/2011 12:09:09.531337 PM</td></tr> <tr><td></td><td>19</td><td>Master: Polling Data</td><td>16</td><td></td><td>2/16/2011 12:09:09.531349 PM</td></tr> <tr><td></td><td>20</td><td>Slave: Response of Polling Data</td><td>16</td><td>1</td><td>2/16/2011 12:09:09.531365 PM</td></tr> <tr><td></td><td>21</td><td>Master: Polling Data</td><td>17</td><td></td><td>2/16/2011 12:09:09.531377 PM</td></tr> </tbody> </table>	Bookmark	Frame#	A1	A2	NO. of Stations	Timestamp		1	Master: Polling & Refresh Data	1		2/16/2011 12:09:09.531000 PM		2	Slave: Response of Polling & Refresh Data	1	1	2/16/2011 12:09:09.531016 PM		3	Master: Polling Data	2		2/16/2011 12:09:09.531028 PM		4	Slave: Response of Polling Data	2	1	2/16/2011 12:09:09.531044 PM		5	Master: Polling Data	3		2/16/2011 12:09:09.531056 PM		6	Slave: Response of Polling Data	3	2	2/16/2011 12:09:09.531088 PM		7	Master: Polling Data	5		2/16/2011 12:09:09.531100 PM		8	Slave: Response of Polling Data	5	2	2/16/2011 12:09:09.531133 PM		9	Master: Polling Data	7		2/16/2011 12:09:09.531145 PM		10	Slave: Response of Polling Data	7	2	2/16/2011 12:09:09.531177 PM		11	Master: Polling Data	9		2/16/2011 12:09:09.531189 PM		12	Slave: Response of Polling Data	9	2	2/16/2011 12:09:09.531221 PM		13	Master: Polling Data	11		2/16/2011 12:09:09.531233 PM		14	Slave: Response of Polling Data	11	2	2/16/2011 12:09:09.531265 PM		15	Master: Polling Data	13		2/16/2011 12:09:09.531277 PM		16	Slave: Response of Polling Data	13	2	2/16/2011 12:09:09.531309 PM		17	Master: Polling Data	15		2/16/2011 12:09:09.531321 PM		18	Slave: Response of Polling Data	15	1	2/16/2011 12:09:09.531337 PM		19	Master: Polling Data	16		2/16/2011 12:09:09.531349 PM		20	Slave: Response of Polling Data	16	1	2/16/2011 12:09:09.531365 PM		21	Master: Polling Data	17		2/16/2011 12:09:09.531377 PM
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Table 3.21 - CC-Link Devices Grid Color Codes (continued)

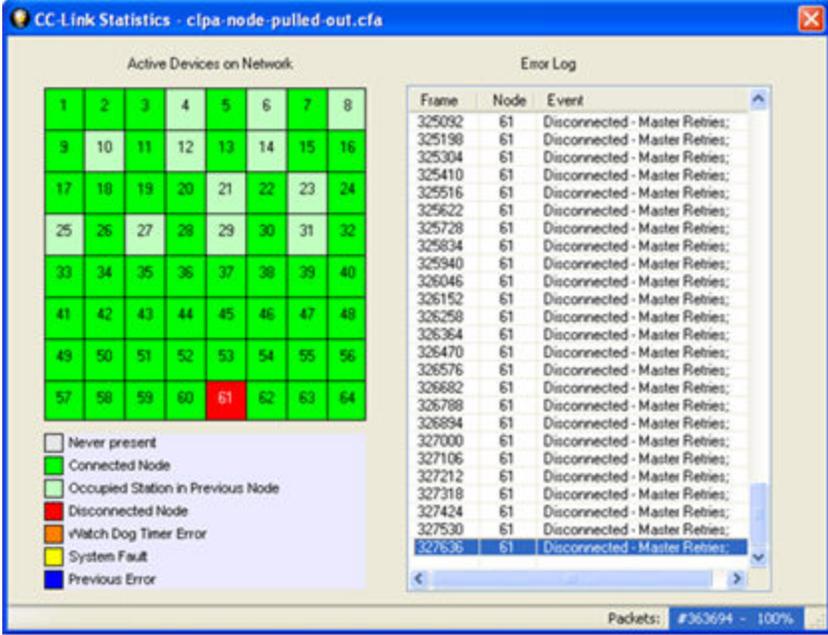
Color Code	Description
	<p>Red: Disconnected Node</p> <p>If a node that is working properly gets disconnected for any reason, then the Dashboard shows the node marked in red.</p> <p>In the image below, Node 61 was pulled out of the network. The Dashboard marks the node in red and the Error Log shows the exact Frame number at which the Master is retrying to poll the node 61. The Error Log shows, the Frame number, the node and the error event that happened on that frame.</p>  <p>When you look at the same information in Frame Display in the image below, you can see that in Frame 6 that Node 3 has two occupied stations. This means that Node 4 is actually an occupied station in Node 3. Therefore, after a response from Node 3 in Frame 6, the Master then polls Node 5 and not Node 4. In Frame 8, Node 5 responds and there is information that it also occupies two stations. This implies that Node 6 is an occupied station.</p>

Table 3.21 - CC-Link Devices Grid Color Codes (continued)

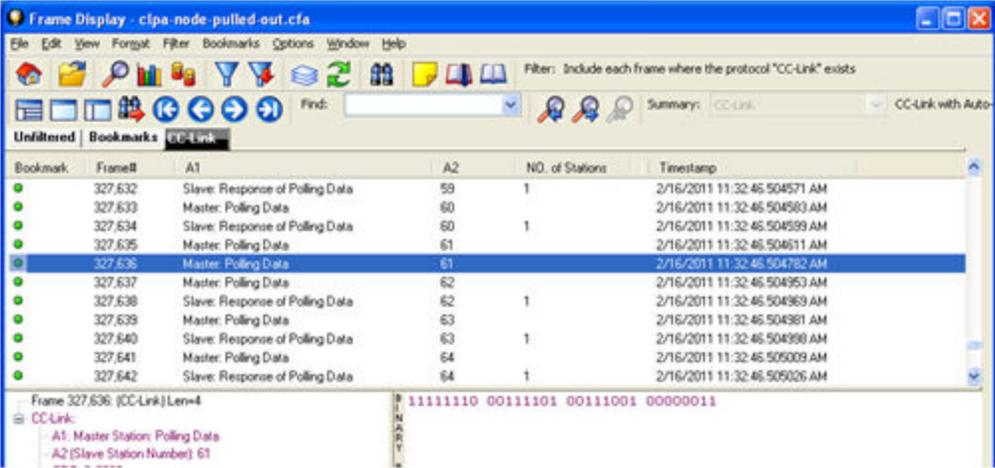
Color Code	Description
	
	<p>Orange: Node with a Watch Dog Timer Error</p> <p>When a Slave node responds to a Master's Poll request, the response frame contains a Station Information (ST1) byte. The first bit of the ST1 byte indicates a Watchdog Timer error. If a node sends a frame with this bit set, then the node is marked in orange and error is logged in the error list.</p>

Table 3.21 - CC-Link Devices Grid Color Codes (continued)

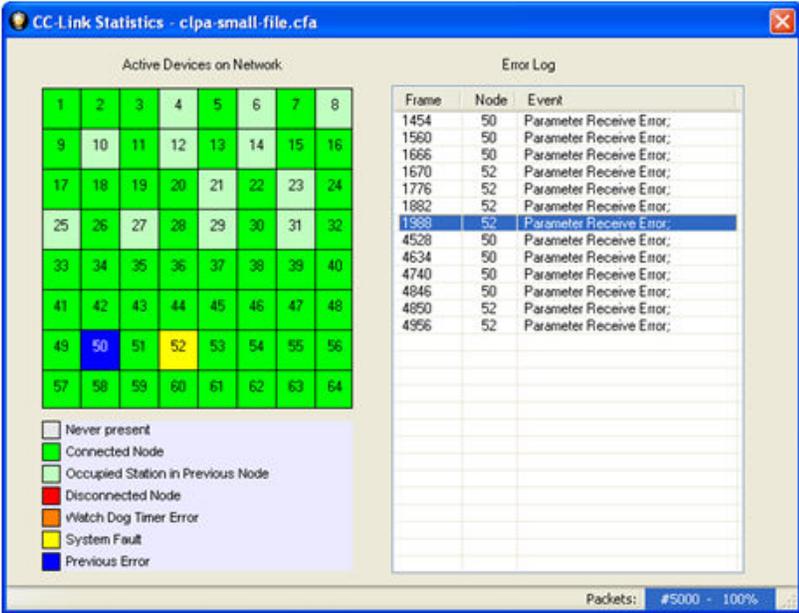
Color Code	Description
	<p>Yellow: Node with a System Fault</p> <p>When a Slave node responds to a Master's Poll request, the response frame contains a Station Information (ST1) byte. Apart from the Watchdog Timer bit and the Cyclic Transmission flag, this field contains five bits that provide information on the node's status. These fields include:</p> <ol style="list-style-type: none"> 1. Switch Change Detection 2. Parameter Receive 3. Refresh Receive 4. Unit Error/Invalid Number of Points 5. Fuse Status <p>If any of these 5 flag bits are enabled, then the node is flagged as having a System Fault.</p> <p>The image below shows Nodes 50 and 52 in System Fault. The Error Log lists the exact frame number that has the error and the actual error. In this case, both Nodes 50 and Node 52 were responding with a 'Parameter Receive' error.</p>  <p>If you look at Node 52 in Frame Display in the image below, Frame 1988 (which is listed in the Error Log above) shows that the 'Parameter Receive' bit in the ST1 field is set to 'Not Received'. Therefore, Node 52 is tagged as having a System Fault.</p>

Table 3.21 - CC-Link Devices Grid Color Codes (continued)

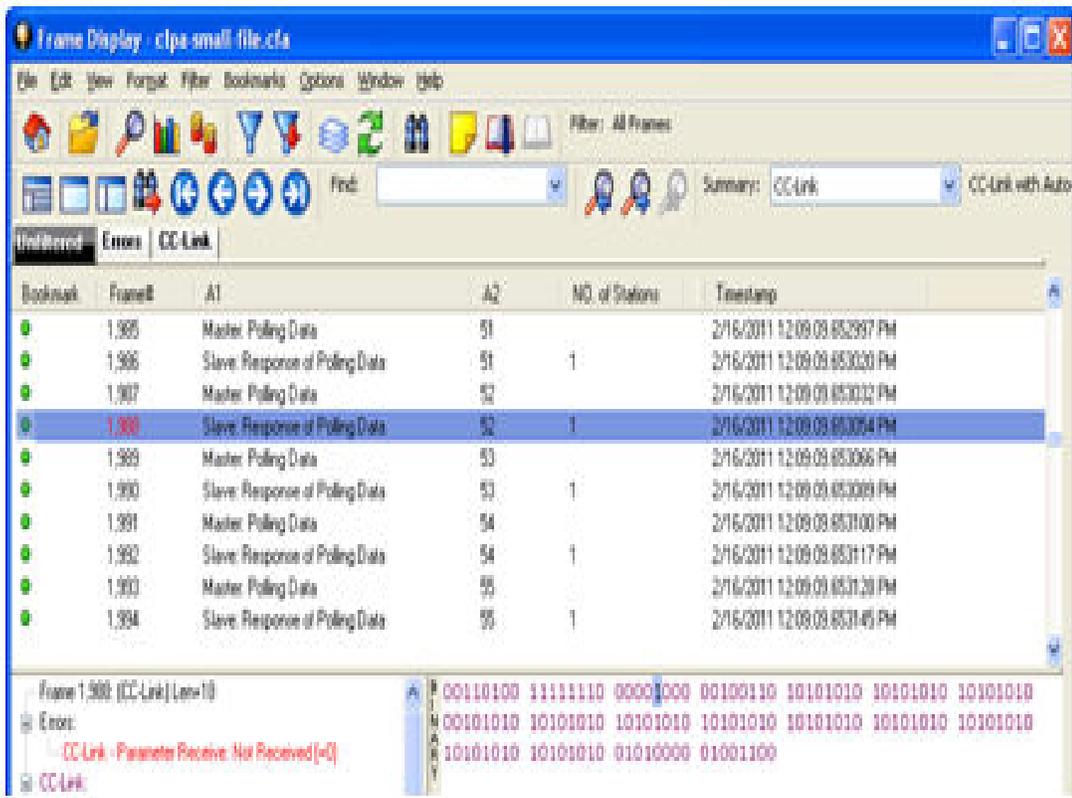
Color Code	Description																																																																							
	 <p>The screenshot shows a software window titled "Frame Display - c:\pa-small file.cta". It contains a table with columns: Bookmark, Frame#, A1, A2, NO. of Stations, and Timestamp. The table lists several frames, with Frame 1,988 highlighted in blue. Below the table, there is a hex dump for Frame 1,988 (CC-Link) with a length of 10. The hex dump shows the following data: 00110100 11111110 00000000 00100110 10101010 10101010 10101010 00101010 10101010 10101010. An error message is displayed: "Error: CC-Link - Parameter Receive: Not Received (=0)".</p> <table border="1" data-bbox="316 567 1372 976"> <thead> <tr> <th>Bookmark</th> <th>Frame#</th> <th>A1</th> <th>A2</th> <th>NO. of Stations</th> <th>Timestamp</th> </tr> </thead> <tbody> <tr> <td></td> <td>1,985</td> <td>Master: Polling Data</td> <td>51</td> <td></td> <td>2/16/2011 12:09:03.652987 PM</td> </tr> <tr> <td></td> <td>1,986</td> <td>Slave: Response of Polling Data</td> <td>51</td> <td>1</td> <td>2/16/2011 12:09:03.653020 PM</td> </tr> <tr> <td></td> <td>1,987</td> <td>Master: Polling Data</td> <td>52</td> <td></td> <td>2/16/2011 12:09:03.653032 PM</td> </tr> <tr style="background-color: #ADD8E6;"> <td></td> <td>1,988</td> <td>Slave: Response of Polling Data</td> <td>52</td> <td>1</td> <td>2/16/2011 12:09:03.653054 PM</td> </tr> <tr> <td></td> <td>1,989</td> <td>Master: Polling Data</td> <td>53</td> <td></td> <td>2/16/2011 12:09:03.653066 PM</td> </tr> <tr> <td></td> <td>1,990</td> <td>Slave: Response of Polling Data</td> <td>53</td> <td>1</td> <td>2/16/2011 12:09:03.653089 PM</td> </tr> <tr> <td></td> <td>1,991</td> <td>Master: Polling Data</td> <td>54</td> <td></td> <td>2/16/2011 12:09:03.653100 PM</td> </tr> <tr> <td></td> <td>1,992</td> <td>Slave: Response of Polling Data</td> <td>54</td> <td>1</td> <td>2/16/2011 12:09:03.653117 PM</td> </tr> <tr> <td></td> <td>1,993</td> <td>Master: Polling Data</td> <td>55</td> <td></td> <td>2/16/2011 12:09:03.653128 PM</td> </tr> <tr> <td></td> <td>1,994</td> <td>Slave: Response of Polling Data</td> <td>55</td> <td>1</td> <td>2/16/2011 12:09:03.653145 PM</td> </tr> </tbody> </table> <pre data-bbox="324 976 1364 1092"> Frame 1,988: (CC-Link) Len=10 Error: CC-Link - Parameter Receive: Not Received (=0) CC-Link: A 00110100 11111110 00000000 00100110 10101010 10101010 10101010 M 00101010 10101010 10101010 10101010 10101010 10101010 10101010 V 10101010 10101010 01010000 01001100 </pre>						Bookmark	Frame#	A1	A2	NO. of Stations	Timestamp		1,985	Master: Polling Data	51		2/16/2011 12:09:03.652987 PM		1,986	Slave: Response of Polling Data	51	1	2/16/2011 12:09:03.653020 PM		1,987	Master: Polling Data	52		2/16/2011 12:09:03.653032 PM		1,988	Slave: Response of Polling Data	52	1	2/16/2011 12:09:03.653054 PM		1,989	Master: Polling Data	53		2/16/2011 12:09:03.653066 PM		1,990	Slave: Response of Polling Data	53	1	2/16/2011 12:09:03.653089 PM		1,991	Master: Polling Data	54		2/16/2011 12:09:03.653100 PM		1,992	Slave: Response of Polling Data	54	1	2/16/2011 12:09:03.653117 PM		1,993	Master: Polling Data	55		2/16/2011 12:09:03.653128 PM		1,994	Slave: Response of Polling Data	55	1	2/16/2011 12:09:03.653145 PM
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	1,994	Slave: Response of Polling Data	55	1	2/16/2011 12:09:03.653145 PM																																																																			

Table 3.21 - CC-Link Devices Grid Color Codes (continued)

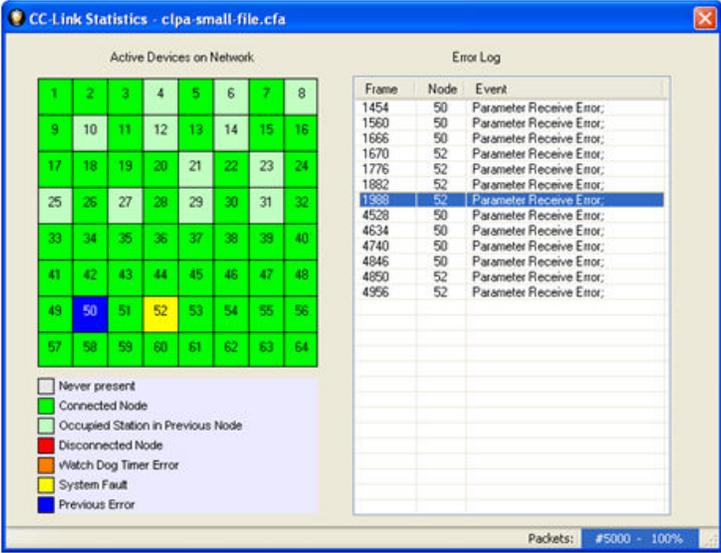
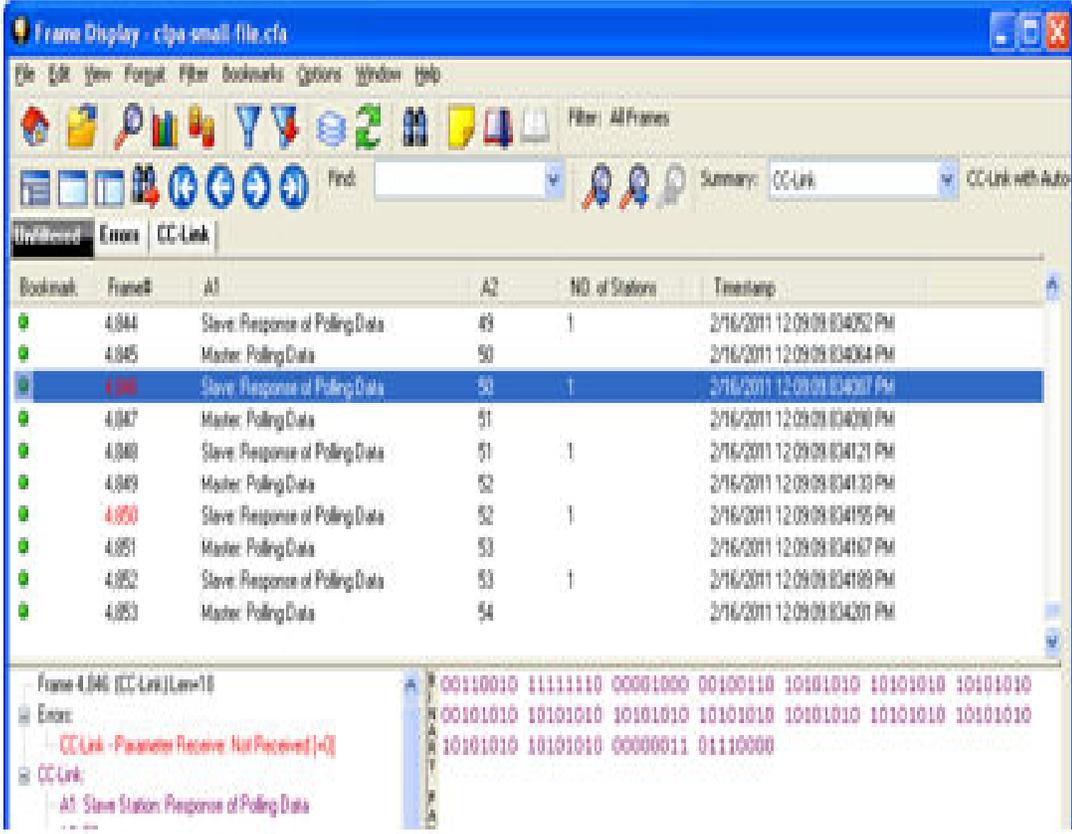
Color Code	Description
	<p>Blue: Node operating correctly but had a previous error.</p> <p>There are occasions when a node can have an error and then recover. If this occurs, the correctly operating node is first displayed in Green. When it has a System Fault, it goes to Yellow state. When the node recovers, it goes to Blue state.</p> <p>In the image below Node 50 is tagged as having a Previous Error.</p>  <p>If you look at Frame Display in the image below, you can see that Frame 4846 is the last frame where Node 50 has a Parameter Error.</p>

Table 3.21 - CC-Link Devices Grid Color Codes (continued)

Color Code	Description
	 <p>Following the example through, in the Frame Display image below you can see that in Frame 4952 the Parameter Receive Status is "Completed". Node 50 no longer has a Parameter Error. That is why Node 50 is shown as a ■ Previous Error in the Active Devices on Network grid.</p>

3.7 Introduction - Transmit

The Transmit tool is an application used to send Ethernet or Serial data to test and/or verify network integrity. On product installation, the installer creates a folder on the windows desktop labeled Frontline [Product Name].

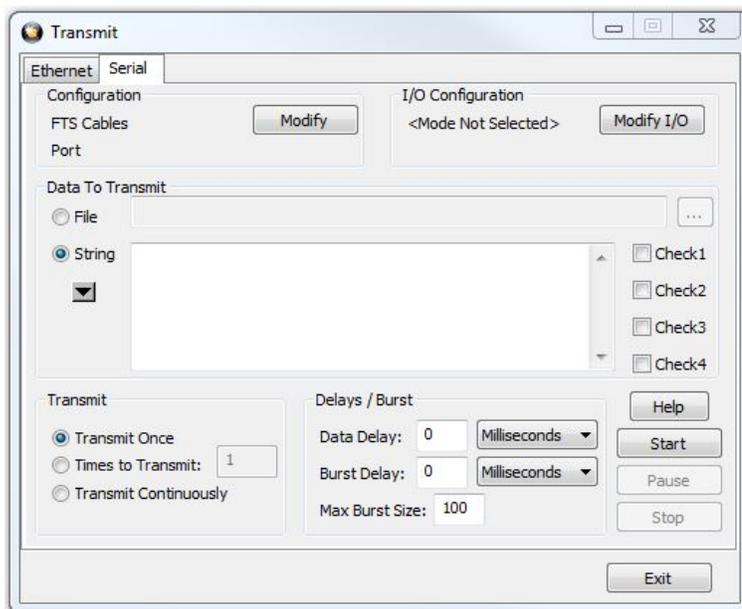
1. Double-click the Frontline [Product Name] desktop folder.

This opens a standard Windows file folder window.



Note: Note: You can also access this dialog by selecting Start > All Programs > Frontline [Product Name] (Version #) > [Product Name]

2. Double-click on Transmit Data and the application opens.

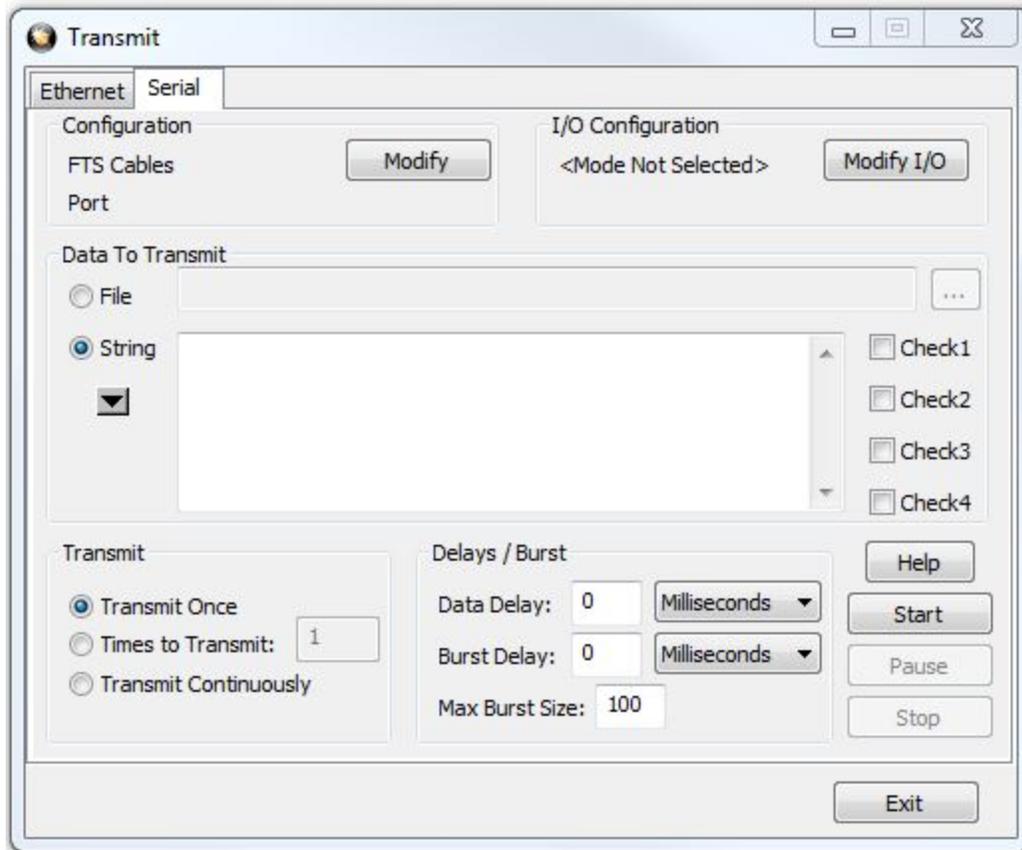


Transmit dialog

There are two options for sending the data by clicking on the tabs: [Ethernet](#) or [Serial](#).

3.7.1 Serial

The **Serial** tab in the Transmit tool is used to configure and send serial data that can be used for testing and verifying serial communication networks.



Transmit dialog with **Serial** tab active.

Configuration

The **Configuration** area displays the current cable configuration. Click here to see how to [view/change the configuration](#).

I/O Configuration

The **I/O Configuration** area displays the current I/O configuration. Click here to see how to [view/change the configuration](#).

Data to Transmit

In this section you select what type of data to transmit, either a [File](#) or a [String](#).

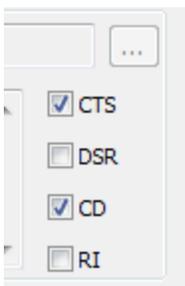
1. Select the **File** radio button.
2. Select the browse button for **File** to locate the capture file (.cfa) file that contains the data you want to send.

OR

1. Select the **String** radio button.
2. Enter a [string in the text box](#).

Note: Clicking the arrow button  displays the last 15 strings

Control Signal States



Next to the **String** text box are check boxes for changing control signal states. You are able to change control signals only for the device which you are emulating selected in the **I/O Settings Operating Mode**.

Table 3.22 - IO Settings
Operating Modes

Mode	Control States
Source DTE	RTS
	DTR
Source DCE	CTS
	DSR
	CD
	RI

To change a control signal, click on the box. A check mark means that the signal is high, while an empty box means that the signal is low.

Note: The available boxes will change depending on whether Source DTE or Source DCE is selected for the [Operating mode on the I/O Configuration](#).

Transmit

You have to select one of three options to determine how many times the data is translated.

- Select **Transmit Once** to transmit the data one time.
- Select **Times to Transmit** and enter a numeric value in the text box to transmit the data X number of times.
- Select **Transmit Continuously** to transmit the data continuously until you select the Stop button.

Delays/Bursts

Data Delay:

Data Delay inserts a delay between each transmission of a string or a file.

1. Type a value in the box to tell the analyzer how long to set the delay
2. Click on the down arrow to choose a time increment of milliseconds, seconds or minutes. A delay of 0 (zero) means that the analyzer does not insert a delay.

Example: A delay of 40 seconds causes the analyzer to transmit the string, wait 40 seconds, and transmit the string again. This pattern repeats until either the string has been transmitted the specified number of times, or the user chooses to stop transmitting.

Burst Delay

Burst Delay inserts a delay between each transmission of the transmit buffer. The [Max Burst Size on page clxviii](#) effectively sets the size of the transmit buffer. The analyzer fills the buffer with data up to the **Max Burst Size**, and sends the data. If a **Burst Delay** is set, the analyzer pauses the length of the delay, before filling up the transmit buffer again and repeating the process.

To set the Burst Delay,

1. Set the delay by typing in the length of the delay in the **Burst Delay** text box
2. Choose a time increment of milliseconds, seconds or minutes from the pull-down menu.

Example: You want to send 1000 bytes, wait 2 minutes, and repeat the pattern. Type in 1000 in the **Burst Size** text box, and set the **Data Delay** to 2 minutes. The analyzer sends 1000 bytes, using as many repetitions of the string or file as necessary to achieve the correct number of bytes, wait 2 minutes and send the string again.

Example: You want to send a 1000 byte file continuously, and insert a 5 second delay between each transmission of the file. However, you also want to send the file in increments of 400 bytes each, with a ten second delay between each group of 400 bytes. To set this up, you would set your **Max Burst Size** to 400, your **Data Delay** to 5 seconds, and your **Burst Delay** to 10 seconds.

The analyzer would send 400 bytes, wait 10 seconds, send 400 bytes, wait 10 seconds, send 200 bytes, wait 5 seconds (because the end of the file has been reached), and repeat the process until transmission was paused or stopped.

Max Burst Size

Max Burst Size allows you to control how many bytes are put into the transmit buffer at a time.

1. Type how many bytes to send in the **Max Burst Size** text box.

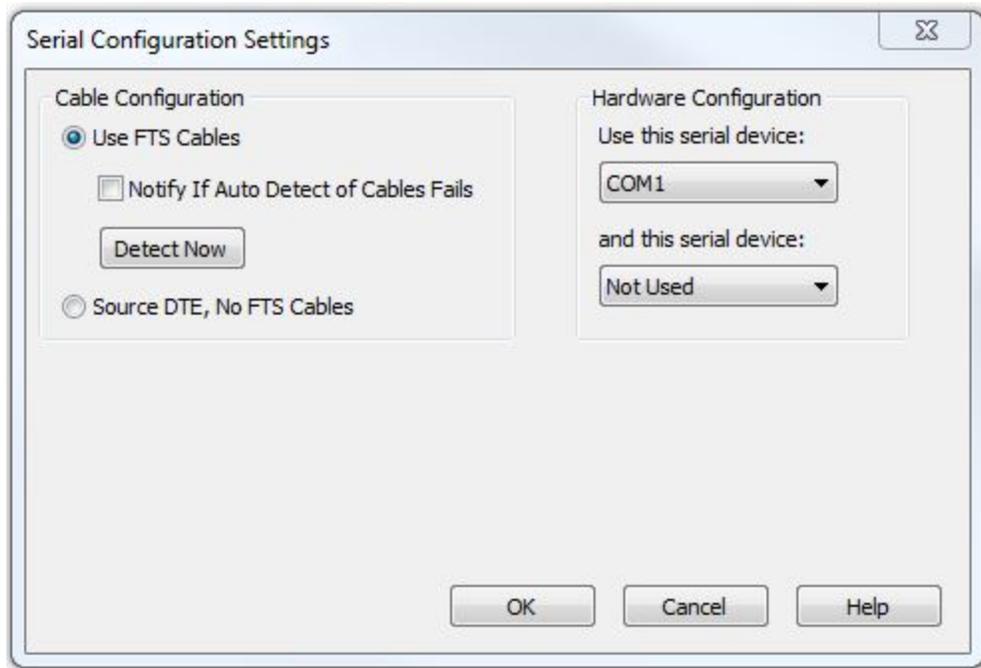
Example: Assume that the transmit buffer can hold up to 1000 bytes. If the Max Burst Size is set to 1000, the analyzer would fill up the buffer with 1000 bytes and then send the 1000 bytes. However, if you want to send only 500 bytes at one time, you would set the Max Burst Size to 500. The analyzer would put only 500 bytes into the transmit buffer before sending them, even though the buffer could hold up to 1000 bytes.

Start, Pause, or Stop

- When you are ready to send the data, select **Start**.
- Select **Pause** to stop the data transfer. Select **Pause** again to continue at the data point where the transfer was stopped.
- Select **Stop** to stop the data transfer. After you select **Stop**, selecting **Start** begins the transfer again from the beginning.

3.7.2 Serial Configuration Settings

The Configuration Settings dialog appears when you select **Modify** on the **Serial** tab. You set the cable and hardware configuration from this dialog.



Serial Configuration Settings dialog

Cable Configuration

Cable Configuration Options

Option	Description
Use FTS Cables	Select this radio button if you want to transmit the data through an FTS cable. If you select this option, you can optionally choose to activate the Notify If Auto Detect of Cables Fails . With this option selected, the tool automatically displays a message if no cable is detected. You can also select Detect Now at any time to determine if the cables are properly configured. A message box displays the status of the cables.

Cable Configuration Options (Continued)

Option	Description
Source DTE, No FTS Cables	Select this radio button if you want to transmit the data directly through a serial port connection to a PC.

Hardware Configuration

Once you select the **Cable Configuration**, you need to complete the **Hardware Configuration** settings on the right side of the dialog.

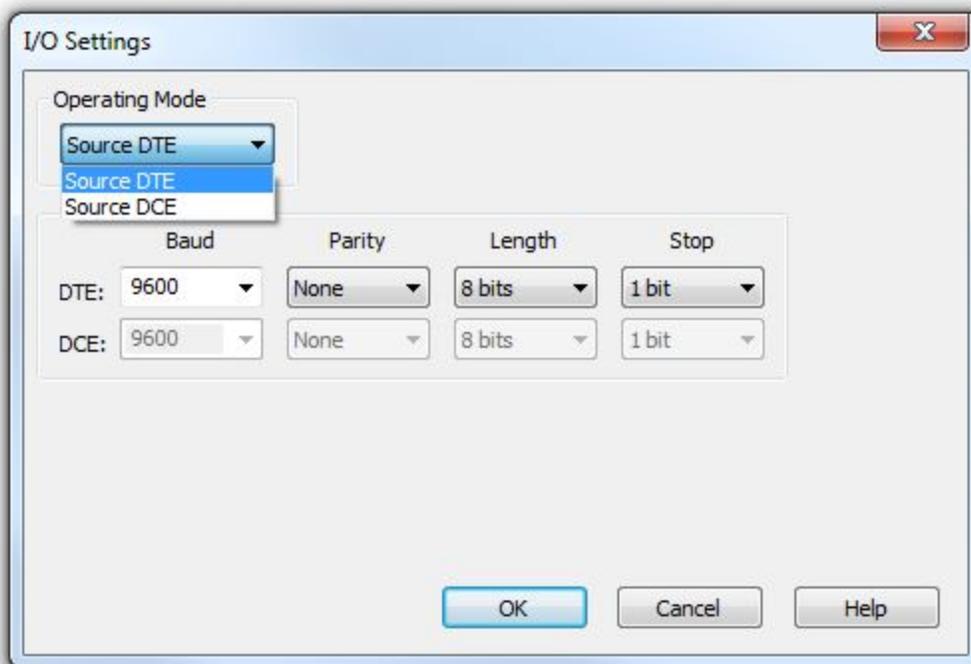
Table 3.23 - Hardware Configuration Options

Cable Configuration Setting	Available Hardware Configuration Options
Use FTS Cables	Use this serial device
Source DTE, No FTS Cables	Use this serial device
	and this serial device

Select **OK** to close the dialog.

3.7.3 I/O Settings

The I/O Settings dialog appears when you select **Modify I/O** on the **Serial** tab. You set the **Operating Mode** and communication variables from this dialog.



Serial I/O Settings dialog

Operating Mode

Select **Source DTE** or **Source DCE** from the **Operating Mode** drop-down list. Depending on the source selected either the operating parameter **DTE** or **DCE** row is activated. The operating parameters are identical for each option and are listed in the following table.

DTE/DCE Operating Mode Parameters

Parameter	Selection
Baud	300
	600
	1200
	2400
	9600 (default)
	14400
	19200
	38400
	57600
	115200
	230400
	460800
	921600
Parity	None (default)
	Odd
	Even
	Mark
	Space
Length	5 bits
	6 bits
	7 bits
	8 bits (default)
Stop	1 bit (default)
	1.5 bits
	2 bits

The parameter defaults are Baud/9600, Parity/None, Length/8 bits, and Stop/1 bit that are automatically selected when an **Operating Mode** is selected.

Once the Operating Mode and parameters are selected, click the **OK** button to close the dialog.

3.7.4 Transmitting Files

The analyzer transmits files as is. For example, if you transmit a text file, the analyzer sends the text characters, but also sends any formatting instructions such as carriage returns, tab characters, etc., as their hex equivalents.

One of the files that you can use to transmit the data is an FTS capture file. The capture file, extension .cfa, is created using the FTS application. To transmit the data in a FTS capture file, you first need to export it to a binary format. The analyzer capture files are in a special format, and if you transmit a the analyzer capture file in its native format, what you see bears no resemblance to the data you want to transmit.

If you want to transmit the data in an analyzer capture file, you need to convert the file to a generic format using the Export function in the FTS application. See [Transmitting FTS Capture Files](#) for more information.

3.7.4.1 Converting FTS Capture Files

One of the files that you can use to transmit data is a Frontline Test System (FTS) capture file. The capture file, extension .cfa, is a proprietary file type created using the FTS application.

To use a .cfa file in the Transmit tool, it first has to be converted to a binary format. You can't do this from the Transmit tool. You must open an FTS application to export and convert the .cfa file before using it with the Transmit tool.

Once you have opened the FTS application:

1. Open the capture file containing the data you want to transmit.
2. On the Control window, choose **Export Events** from the **File** menu.
3. Choose **Binary Output**.
4. In the **Available Fields** box, choose **Char/Event Name**.
5. Click the **Move One Item Right** button (looks like ">") to add it to the **Displayed Fields** box. Remove any other fields in the **Displayed Fields** box.
6. Choose a filename in the **Export** box. The default file name is the name of your capture file, followed by the word "Events" (to distinguish it from a Frame export), with a .bin extension.
7. By default the file is saved in the same directory as the original capture file. Click on the Browse button to save your file to another location.
8. If you want to transmit just DTE data or DCE data, be sure to [filter out](#) the side you do not want. Also, you probably want to filter out **Special Events**.
9. Click **Export**.

The result is a .bin file, which you can use in the Transmit tool.

3.7.5 String Formats

Note that any of the formats below can be combined. It is legal to transmit the ASCII string ABC\$65\$30, for example.

Entering Normal Text Characters

The system sends your string in whatever character set you are currently using. To change the character set, go to the Data menu in the Control Window, and choose a character set.

Examples:

To send the string "qwerty", you would type qwerty.

To send the string "hello, world", you would type hello, world.

Entering Characters in Hex

To transmit in hex, type a \$ in front of your two digit byte. The \$ symbol tells the analyzer that you are sending in hex. If you want to send more than one hex byte, you have to type the \$ symbol in front of each byte.

You must have a two digit hex number after the \$ for the analyzer to interpret the bytes as hex properly. Otherwise, the analyzer interprets the characters as if they belonged to a character set. For example, if you want to send an ASCII NUL, which is hex 00, and you type \$0, the analyzer sends hex 24 followed by hex 30. The \$ symbol is hex 24 in ASCII, and zero is hex 30. To send a hex 00, you must type \$00.

Example:

To send hex 31 00 97, you would type \$31\$00\$97.

Entering Control Characters

The ^ symbol is used to specify that what follows is a control character. You can transmit the control characters

- Ctrl-A through Ctrl-Z,
- Ctrl-@,
- Ctrl-[,
- Ctrl-\,
- Ctrl-],
- and Ctrl--.

For example, ^A sends Ctrl-A (\$01) and ^@ sends ASCII NUL (\$00).

The Escape Character

The \ is the escape character. It is used when transmitting special characters, in order to specify that the next character should be taken literally. These special characters are: \$^&*()\|. For example, to put an * in a string, enter *. To transmit a \, enter \\.

Specifying a Range of Characters

You can also send a range of characters by placing two periods between your first and last characters. For example, A..I generates the string ABCDEFGHI. It is important to note that A..I in ASCII is very different from A..I in EBCDIC. In ASCII, A..I is equivalent to \$41..\$49, while in EBCDIC A..I is equivalent to \$C1..\$C9. It is also legal to specify a descending range. For example, I..A generates IHGFEDCBA.

Sub-expressions

Sub-expressions are enclosed in (). The parentheses are not part of the sub-expression and are not transmitted. For example, (ABC) yields ABC. Sub-expressions are useful because you can specify a repeat count for them using the *. For example (ABC)*3 yields ABCABCABC.

Entering Baudot Characters

Since Baudot is only 5 bits it includes two shift characters. Shift In (\$1F) means interpret all following characters as letters; Shift Out (\$1B) means interpret all following characters as figures (punctuation, numbers, control codes, etc). When the analyzer is activated it assumes the letters mode. The shift characters are captured in the buffer just as other bytes. In source mode the analyzer automatically supplies the shift characters to the string you enter.

For example, if you are in letter mode and enter the string 12AB, the analyzer sends \$1B (Shift Out), \$17 (1), \$13 (2), \$1F (Shift In), \$03 (A), \$19 (B).

Note: When you use hex notation to input a Baudot string, the analyzer does not insert shift characters.

More Examples

Enter	To Generate
\\\$\\^\\(\\)*	\\\$^()*
\\\$.ABC.	\$.ABC.
(ABC)*3\\9	ABCABCABC9
(\$6b..\$68)*2	kjihkjih
(A(BC)*2)*3	ABCBCABCBCABCBC
Aa..iZ	Aabcdefghijklmnopqrstuvwxyz

Chapter 4 Search/Find

4.1 Find

Capturing and decoding data within the ComProbe analyzer produces a wealth of information for analysis. This mass of information by itself, however, is just that, a mass of information. There has to be ways to manage the information. ComProbe software provides a number of different methods for making the data more accessible. One of these methods is **Find**.

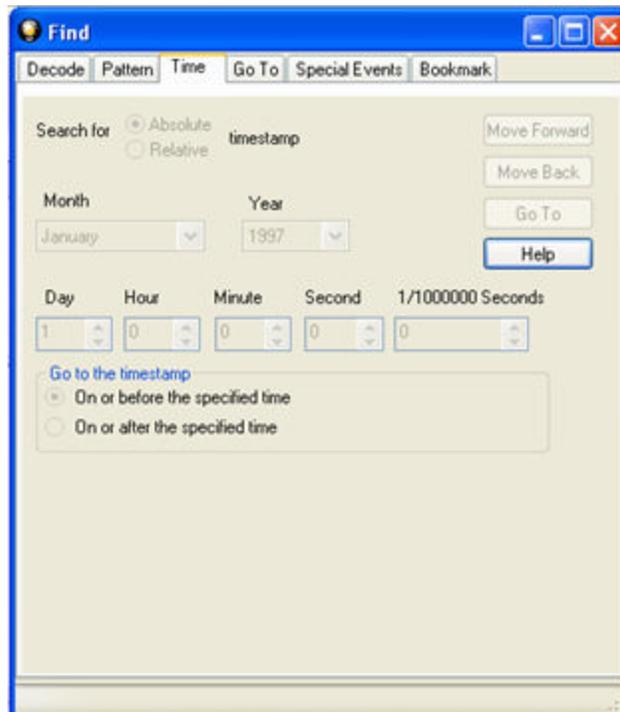


Figure 4.1 - Find Dialog

Find, as the name suggests, is a comprehensive search function that allows users to search for strings or patterns in the data or in the frame decode. You can search for errors, control signal changes, bookmarks, special events, time, and more. Once the information is located, you can easily move to every instance of the Find results.

4.1.1 Searching within Decodes

Searching within decodes lets you to do a string search on the data in the **Decode Pane** of the **Frame Display** window.

To access the search within decodes function:

1. Open a capture file, or capture some data to search.
2. Open the **Event Display**  or **Frame Display**  window.
3. Click on the **Find** icon  or choose **Find** from the **Edit** menu.
4. Click on the **Decode** tab of the **Find** dialog.

Note: The tabs displayed on the Find dialog depend on the product you are running and the content of the capture file you are viewing.

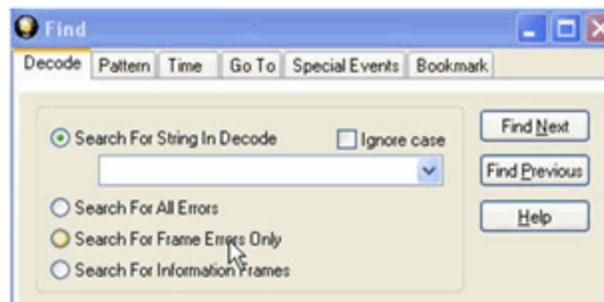


Figure 4.2 - Find Decode Tab Search for String

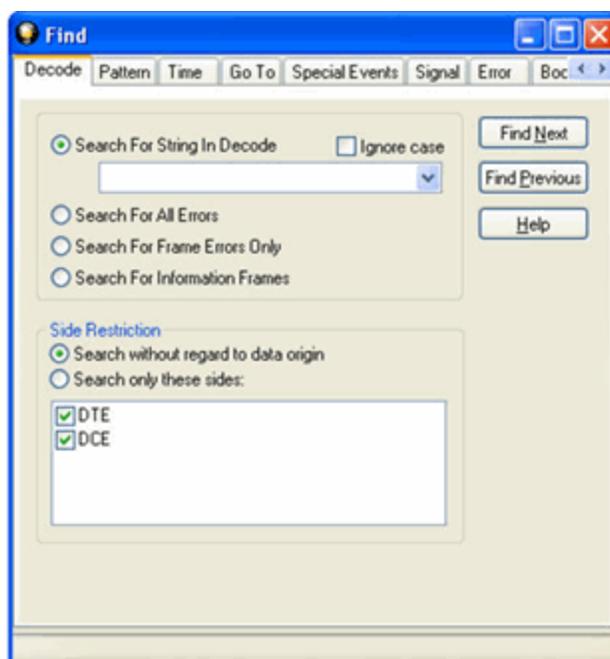


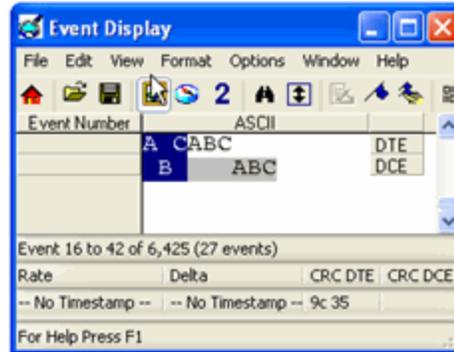
Figure 4.3 - Find Decode Tab Side Restriction

There are several options for error searching on the **Decoder** tab.

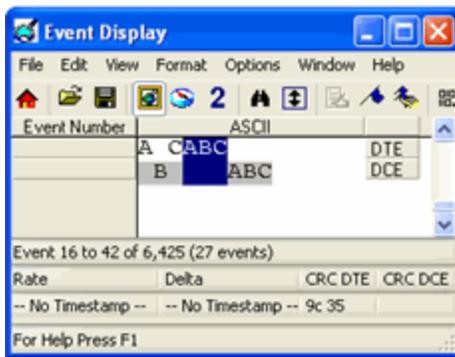
- **Search For String in Decoder** allows you to enter a string in the text box. You can use [characters](#), [hex or binary digits](#), [wildcards](#) or a combination of any of the formats when entering your string. Every time you type in a search string, the analyzer saves the search. The next time you open **Find**, the drop-down list will contain your search parameters.
- **Search for All Errors** finds frame errors as well as frames with byte-level errors (such as parity or CRC errors).
- **Search for Frame Errors Only** finds frame specific errors, such as frame check errors.
- **Search for Information Frame** only searches information frames.
 1. Enter the search string.
 2. Check **Ignore Case** to do a case-insensitive search.
 3. When you have specified the time interval you want to use, click on the **Find Next** or **Find Previous** buttons to start the search from the current event.

The result of the search is displayed in the **Decode** pane in **Frame Display**.

Side Restrictions - Side Restriction means that the analyzer looks for a pattern coming wholly from the DTE or DCE side. If you choose to search without regard for data origin, the analyzer looks for a pattern coming from one or both sides. For example, if you choose to search for the pattern ABC and you choose to search without regard for data origin, the analyzer finds all three instances of ABC shown here.



The first pattern, with the A and the C coming from the DTE device and the B coming from the DCE is a good example of how using a side restriction differs from searching without regard to data origin. While searching without regard for data origin finds all three patterns, searching using a side restriction never finds the first pattern, because it does not come wholly from one side or the other.



If you choose to search for the pattern ABC, and you restrict the search to just the DTE side, the analyzer finds the following pattern:

In this example, the analyzer finds only the second pattern (highlighted above) because we restricted the search to just the DTE side. The first pattern doesn't qualify because it is split between the DTE and DCE sides, and the third pattern, though whole, comes from just the DCE side.

If we choose both the DTE and the DCE sides in the above example, then the analyzer finds the second pattern followed by the third pattern, but not the first pattern. This is because each side has one instance in which the whole pattern can be found. The analyzer completely searches the DTE side first, followed by the DCE side.

Note: Side Restriction is available for pattern and error searching.

1. Select one of the two options.
2. Select **DTE, DCE**, or both.
3. When you made your selections, click on the **Find Next** or **Find Previous** buttons to start the search from the current event.

The result of the search is displayed in the **Decode** pane in **Frame Display**.

4.1.2 Searching by Pattern

Search by Pattern lets you perform a traditional string search. You can combine any of the formats when entering your string, and your search can include [wildcards](#). You can search one or both sides of a circuit containing interwoven data such as serial communication.

To access the search by pattern function:

1. Open a capture file, or capture some data to search.
2. Open the **Event Display**  or **Frame Display**  window.

- When you have specified the pattern you want to use, click on the **Find Next** or **Find Previous** buttons to start the search from the current event.

The result of the search is displayed in the in Frame Display and Event Display.

Refer to Searching by Decode [on page clxxviii](#) for information on **Side Restrictions**

4.1.3 Searching by Time

Searching with **Time** allows you search on timestamps on the data in **Frame Display** and **Event Display** window.

To access the search by time function:

- Open a capture file, or capture some data to search.
- Open the **Event Display**  or **Frame Display**  window.
- Click on the **Find** icon  or choose **Find** from the **Edit** menu.
- Click on the **Time** tab of the **Find** dialog.

Note: The tabs displayed on the Find dialog depend on the product you are running and the content of the capture file you are viewing.

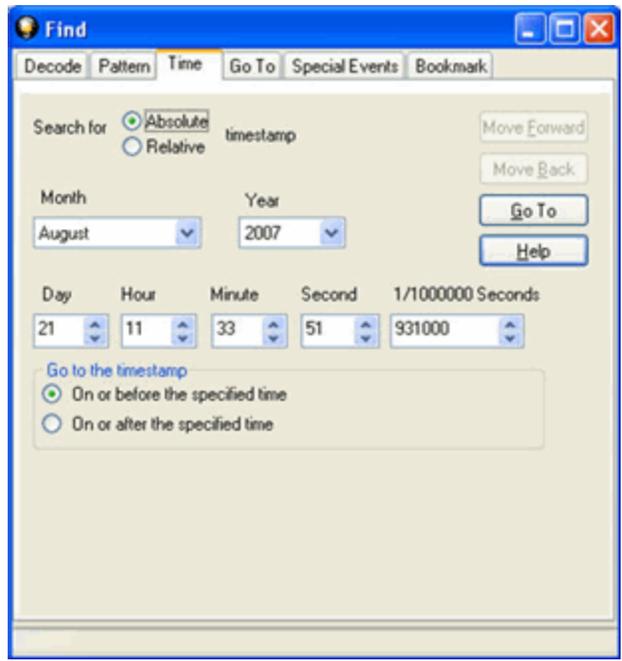


Figure 4.6 - Find by Time tab

The analyzer can search by time in several different ways.

Search for Absolute/Relative timestamp.

- [Absolute](#) - An absolute timestamp search means that the analyzer searches for an event at the exact date and time specified. If no event is found at that time, the analyzer goes to the nearest event either before or after the selected time, based on the "Go to the timestamp" selection.
- [Relative](#) - A relative search means that the analyzer begins searching from whatever event you are currently on, and search for the next event a specific amount of time away.

1. Select **Absolute** or **Relative**
2. Select the date and time using the drop-down lists for **Month, Year, Day, Hour, Minute, Second, 1/1000000**.

Note: Month and Year are not available if you select Relative.

3. When you have specified the time interval you want to use, click on the **Go To, Move Forward** or **Move Backward** buttons to start the search from the current event.

Note: When you select **Absolute** as **Search for**, **Go To** is available. When you select **Relative** as **Search for**, **Move Forward** or **Move Backward** is available.

Go to the timestamp: On or before/ On or after

The analyzer searches for an event that matches the time specified. If no event is found at the time specified, the analyzer goes to the nearest event either before or after the specified time. Choose whether to have the analyzer go to the nearest event before the specified time or after the specified time by clicking the appropriate radio button in the **Go to the timestamp** box.

If you are searching forward in the buffer, you usually want to choose the **On or After** option. If you choose the **On or Before** option, it may be that the analyzer finishes the search and not move from the current byte, if that byte happens to be the closest match.

When you select **Absolute** as **Search for**, the radio buttons are **On or before the specified time** or **On or after the specified time**. When you select **Relative** as **Search for**, the radio buttons are **On or before the specified time relative to the first selected item** or **On or after the specified time relative to the last selected item**.

1. Select **On or before the specified time** or **On or after the specified time**.
2. When you have specified the time interval you want to use, click on the **Go To, Move Forward** or **Move Backward** buttons to start the search from the current event.

When you select **Absolute** as **Search for**, **Go To** is available. When you select **Relative** as **Search for**, **Move Forward** or **Move Backward** is available.

There are a couple of other concepts to understand in respect to searching with timestamps.

- The analyzer skips some special events that do not have timestamps, such as frame markers. Data events that do not have timestamps because timestamping was turned off either before or during capture are also skipped.

- Timestamping can be turned on and off while data is being captured. As a result, the capture buffer may have some data with a timestamp, and some data without. When doing a search by timestamp, the analyzer ignores all data without a timestamp.
- The raw timestamp value is the number of 100-nanosecond intervals since the beginning of January 1, 1601. This is standard Windows time.

4.1.4 Using Go To

Searching with Go To allows you to go to a particular frame or event, or to move through the data X number of events or frames at a time. You can move either forward or backwards through the data.

To access the Go To function:

1. Open a capture file, or capture some data to search.
2. Open the **Event Display**  or **Frame Display**  window.
3. Click on the **Find** icon  or choose **Find** from the **Edit** menu.
4. Click on the **Go To** tab of the **Find** dialog.
5. The system displays the **Find** dialog with the **Go To** tab selected.

Note: The tabs displayed on the Find dialog depend on the product you are running and the content of the capture file you are viewing.

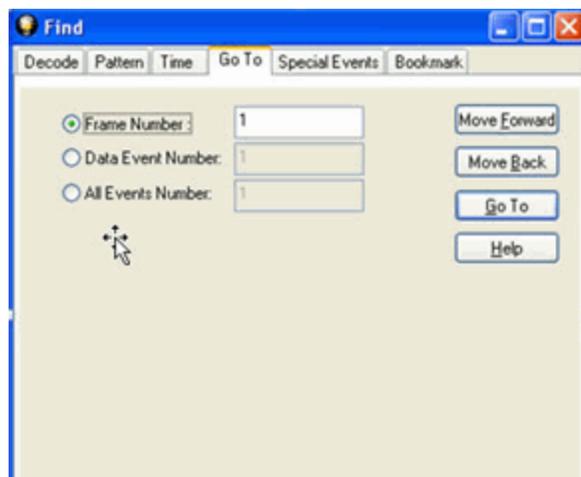


Figure 4.7 - Find Go To tab

To go to a particular frame :

1. Select the **Frame Number** radio button
2. Type the frame number in the box.
3. Click the **Go To** button.

4. To move forward or backward a set number of frames, type in the number of frames you want to move
5. Then click the **Move Forward** or **Move Back** button.

To go to a particular event :

1. Select the **Data Event Number** or **All Events Number** radio button.
2. Type the number of the event in the box.
3. Click the **Go To** button.
4. To move forward or backwards through the data, type in the number of events that you want to move each time.
5. Then click on the **Move Forward** or **Move Backward** button.
6. For example, to move forward 10 events, type the number 10 in the box, and then click on **Move Forward**. Each time you click on **Move Forward**, Frontline moves forward 10 events.

See [Event Numbering](#) for why the **Data Event Number** and **All Events Number** may be different. As a general rule, if you have the **Show All Events** icon  depressed on the **Event Display** window or **Frame**

DisplayEvent pane, choose **All Events Number**. If the **Show All Events** button is up, choose **Data Event Number**.

4.1.5 Searching for Special Events

Frontline inserts or marks events other than data bytes in the data stream. For example, the analyzer inserts start-of-frame and end-of-frame markers into framed data, marking where each frame begins and ends. If a hardware error occurs, the analyzer shows this using a special event marker. You can use Find to locate single or multiple special events.

To access the search for special events function:

1. Open a capture file, or capture some data to search.
2. Open the **Event Display**  or **Frame Display**  window.
3. Click on the **Find** icon  or choose **Find** from the **Edit** menu.
4. Click on the **Special Events** tab of the Find dialog.

Note: The tabs displayed on the Find dialog depend on the product you are running and the content of the capture file you are viewing.

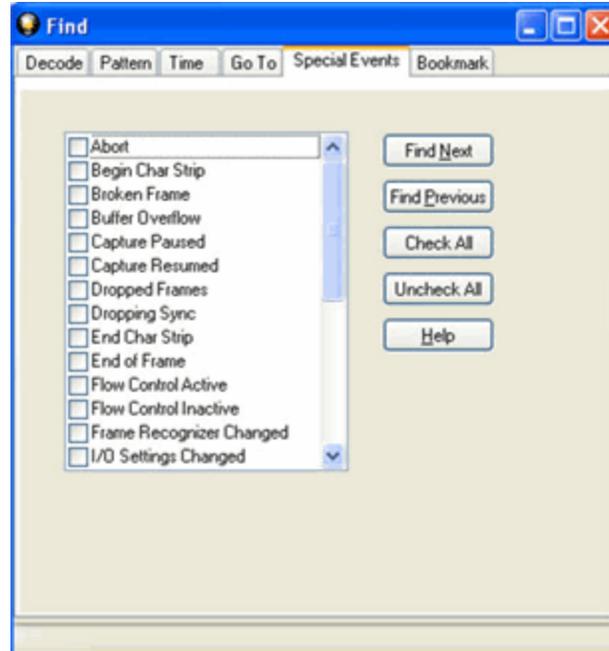


Figure 4.8 - Find Special Events tab

5. Check the event or events you want to look for in the list of special events. Use **Check All** or **Uncheck All** buttons to make your selections more efficient.
6. Click Find Next and Find Previous to move to the next instance of the event.

Not all special events are relevant to all types of data. For example, control signal changes are relevant only to serial data and not to Ethernet data.

For a list of all special events and their meanings, see [List of all Event Symbols on page 1](#).

4.1.6 Searching by Signal

Searching with Signal allows you to search for changes in control signal states for one or more control signals. You can also search for a specific state involving one or more control signals, with the option to ignore those control signals whose states you don't care about.

The analyzer takes the current selected byte as its initial condition when running searches that rely on finding events where control signals changed.

To access the search by time function:

1. Open a capture file, or capture some data to search.
2. Open the **Event Display**  or **Frame Display**  window.
3. Click on the **Find** icon  or choose **Find** from the **Edit** menu.
4. Click on the **Signal** tab of the **Find** dialog.

Note: The tabs displayed on the Find dialog depend on the product you are running and the content of the capture file you are viewing.

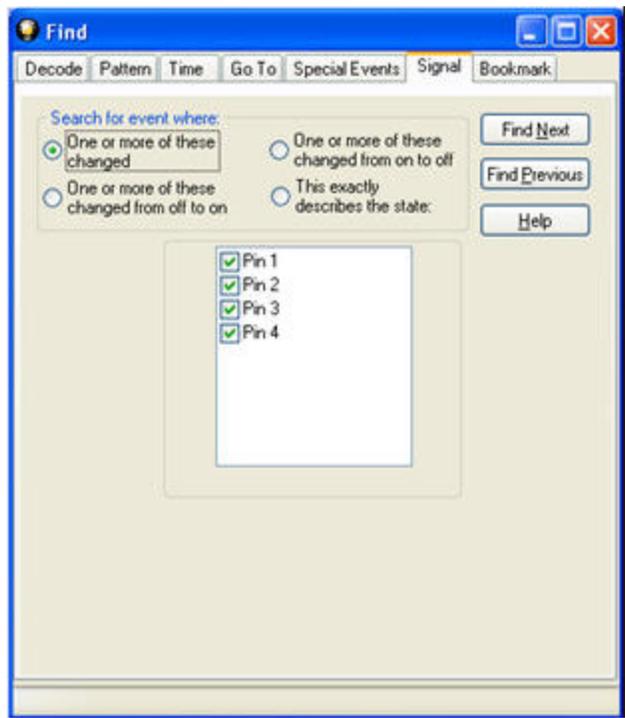


Figure 4.9 - Find Signal tab.

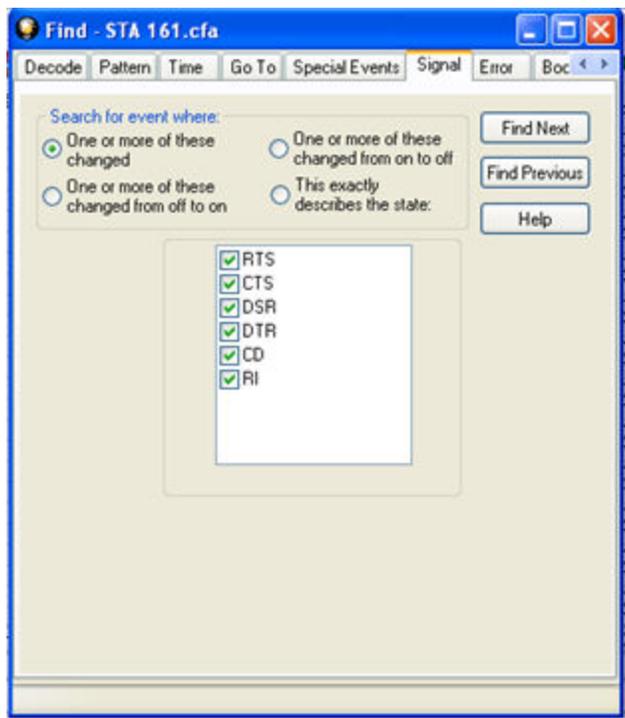


Figure 4.10 - Find Signal Tab

You will choose one qualifier—**Searching for event where**, then choose one or more control signals

Control Signals

The section with the check boxes allows you to specify which control signals the analyzer should pay attention to when doing the search. The analyzer pays attention to any control signal with a check mark.

- Click on a box to place a check mark next to a control signal
- Click again to uncheck the box
- By default, the analyzer searches all control signals, which means all boxes start out checked.

For example, if you are only interested in finding changes in **RTS** and **CTS**, you would check those two boxes and uncheck all the other boxes. This tells the analyzer to look only at the **RTS** and **CTS** lines when running the search. The other signals are ignored.

The control signals types include:

- USB - Pin 1
- USB - Pin 2
- USB - Pin 3
- USB - Pin 4

or

- RS232 - Request to Send (RTS)
- RS232 - Clear to Send (CTS)
- RS232 - Data Set Ready (DSR)
- RS232 - Data Terminal Ready (DTR)
- RS232 - Carrier Detect (CD)
- RS232 - Ring Indicator (RI).

[Click here to learn more about the Breakout Box and Pins 1 - 4.](#)

Searching for event where:

- The first three options are all fairly similar, and are described together. These options are searching for an event where:
 - One or more control signals changed
 - One or more control signals changed from off to on
 - One or more control signals changed from on to off
- Searching for an event where one or more signals changed means that the analyzer looks at every control signal that you checked, and see if any one of those signals changed state at any time.

- If you want to look at just one control signal:
 - Check the box for the signal.
 - Uncheck all the other boxes.
 - Choose to search for an event where one or more signals changed.
 - The analyzer notes the state of the selected signal at the point in the buffer where the cursor is, search the buffer, and stop when it finds an event where RTS changed state.
 - If the end of the buffer is reached before an event is found, the analyzer tells you that no matches were found.
- Searching for events where control signals changed state from off to on, or vice versa, is most useful if the signals are usually in one state, and you want to search for occasions where they changed state.

For example:

- If DTR is supposed to be on all the time but you suspect that DTR is being dropped
 - Tell the analyzer to look only at DTR by checking the DTR box and unchecking the others
 - Do a search for where one or more control signals changed from on to off.
 - The analyzer would search the DTR signal and stop at the first event where DTR dropped from on to off.
- Searching for an Exact State

To search for an exact state means that the analyzer finds events that match exactly the state of the control signals that you specify.

- First, choose to search for an event where your choices exactly describe the state.
- This changes the normal check boxes to a series of radio buttons labeled On, Off and Don't Care for each control signal.
- Choose which state you want each control signal to be in.
- Choose Don't Care to have the analyzer ignore the state of a control signal.
- When you click Find Next, the analyzer searches for an event that exactly matches the conditions selected, beginning from the currently selected event.
- If the end of the buffer is reached before a match is found, the analyzer asks you if you want to continue searching from the beginning.
- If you want to be sure to search the entire buffer, place your cursor on the first event in the buffer.
- Select one of the four radio buttons to choose the condition that must be met in the search
- Select one or more of the checkboxes for Pin 1, 2, 3, or 4.
- Click **Find Next** to locate the next occurrence of the search criteria or **Find Previous** to locate an earlier occurrence of the search criteria.

4.1.7 Searching for Data Errors

The analyzer can search for several types of data errors. Searching for data error allows you to choose which errors you want to search for and whether to search the DTE or DCE data or both. Bytes with errors are shown in red in the **Event Display** window, making it easy to find errors visually when looking through the data.

To access the search by time function:

1. Open a capture file, or capture some data to search.
2. Open the **Event Display**  or **Frame Display**  window.
3. Click on the **Find** icon  or choose **Find** from the **Edit** menu.
4. Click on the **Errors** tab of the **Find** dialog.

Note: The tabs displayed on the Find dialog depend on the product you are running and the content of the capture file you are viewing.

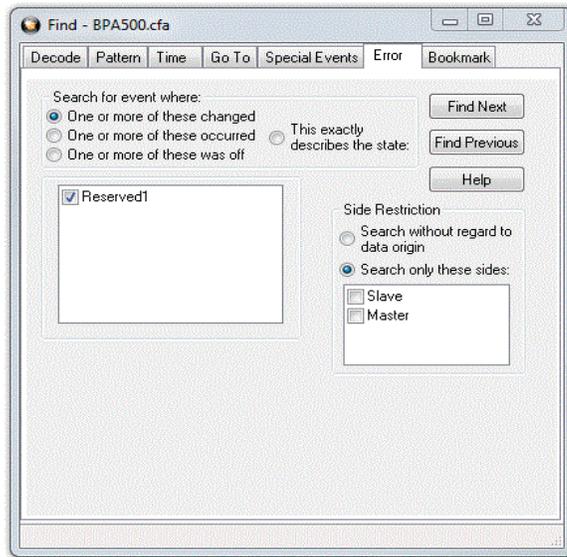


Figure 4.11 - Find Error tab.

Searching for event where

The first three options are all fairly similar, and are described together. These options are searching for an event where:

- one or more error conditions changed
- one or more error conditions occurred
- one or more error conditions were off (i.e. no errors occurred)

Selecting Which Errors to Search

The section with the check boxes allows you to choose which errors the analyzer should look for. Click on a box to check or un-check it.

If you want to search only for overrun errors

- check the box if shown
- un-check the other boxes.

To search for all types of errors

- check all boxes

The most common search is looking for a few scattered errors in otherwise clean data.

To do this type of search:

- choose to **Search for an event where** one or more error conditions occurred
- choose which errors to look for
- By default, the analyzer looks for all types of errors.

In contrast, searching for an event where one or more error conditions were off means that the analyzer looks for an event where the errors were not present.

For example, if you have data that is full of framing errors, and you know that somewhere in your 20 megabyte capture file the framing got straightened out, you could choose to search for an event where one or more error conditions were off, and choose to search only for framing. The analyzer searches the file, and finds the point at which framing errors stopped occurring.

Searching for an event where the error conditions changed means that the analyzer searches the data and stop at every point where the error condition changed from on to off, or off to on.

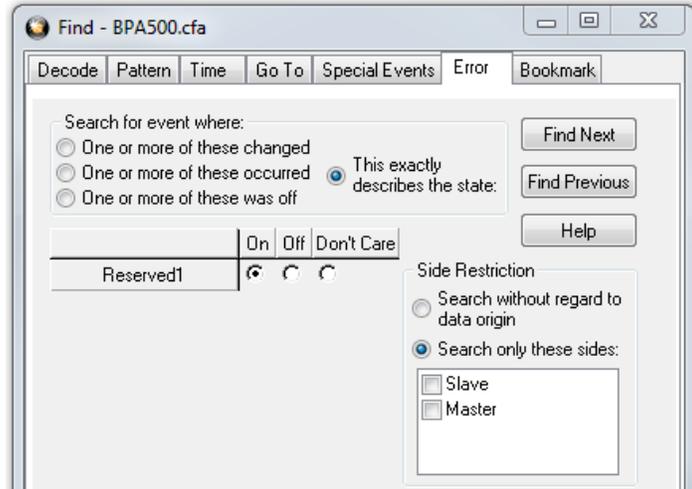
For example, if you have data where sometimes the framing is wrong and sometimes right, you would choose to search framing errors where the error condition changed. This first takes you to the point where the framing errors stopped occurring. When you click **Find Next**, the analyzer stops at the point when the errors began occurring again. Clicking **Find Previous** will search backwards from the current position.

The analyzer takes the current selected byte as its initial condition when running searches that rely on finding events where error conditions changed. The analyzer searches until it finds an event where error conditions changed or it reaches the end of the buffer, at which point the analyzer tells you that there are no more events found in the buffer. If you are searching for an exact match, the analyzer asks you if you want to continue searching from the beginning of the buffer.

Searching for Exact Error Conditions

To search for an exact state means that the analyzer finds events that exactly match the error conditions that you specify.

- Select the **This exactly describes the state** radio button.
- This changes the normal check boxes to a series of radio buttons labeled **On**, **Off** and **Don't Care** for each error.
 - **On** means that the error occurred
 - **Off** means that the error did not occur
 - **Don't Care** means that the analyzer ignores that error condition.
- Select the appropriate state for each type of error.



Example:

If you need to find an event where just an overrun error occurred, but not any other type of error, you would choose overrun error to be On, and set all other errors to Off. This causes the analyzer to look for an event where only an overrun error occurred.

If you want to look for events where overrun errors occurred, and other errors may have also occurred but it really doesn't matter if they did or not, choose overrun to be On, and set the others to Don't Care. The analyzer ignores any other type of error, and find events where overrun errors occurred.

To find the next error, click the Find Next button. To find an error that occurred earlier in the buffer to where you are, click the Find Previous button.

4.1.8 Changing Where the Search Lands

When doing a search in the analyzer, the byte or bytes matching the search criteria are highlighted in the **Event Display**. The first selected byte appears on the third line of the display.

```
[CVEventDisplay]
SelectionOffset=2
```

To change the line on which the first selected byte appears:

1. Open fts.ini (located in the C:\User\Public\Public Documents\Frontline Test Equipment\)
2. Go to the [CVEventDisplay] section
3. Change the value for SelectionOffset.
4. If you want the selection to land on the top line of the display, change the SelectionOffset to 0 (zero).

4.2 Bookmarks

Bookmarks are electronic sticky notes that you attach to frames of interest so they can be easily found later. In **Frame Display** bookmarked frames appear with a magenta triangle icon next to them.

B...	Frame#	Command	Error Code	FID	MID	FID	Source	TID	UID	Fra...	Delta	Timestamp
	1									64		12/6/2010 11:25
	2									168	00:00:00.0...	12/6/2010 11:25
E	3									124	00:00:00.3...	12/6/2010 11:25
	4									64	00:00:00.1...	12/6/2010 11:25

Figure 4.12 - Bookmarked Frame (3) in the Frame Display

00 00 00 00 00 In the **Event Display** bookmarks appear as a dashed line around the start of frame
21 M [P] 00 15 marker.

00 45 00 00 47

Bookmarks are easy to create and maintain, and are a very valuable tool for data analysis.

When you [create](#) or [modify](#) a bookmark, you have up to 84 characters to explain a problem, leave yourself a reminder, leave someone else a reminder, etc. Once you create a bookmark it will be saved with the rest of the data in the [.cfa file](#). When you open a .cfa file, the bookmarks are available to you.

Once you have created a bookmark, you can use the [Find](#) function or other navigation methods to [locate and move](#) among them.

4.2.1 Adding, Modifying or Deleting a Bookmark

You can add, modify, or delete a bookmarks from **Frame Display** and **Event Display**

Add:

1. Select the frame or event you want to bookmark.
2. There are three ways to access the **Add Bookmark** dialog.
 - a. Select **Add or Modify Bookmark** from the **Bookmarks** menu on the **Frame Display** and **Event Display**,
 - b. Select the **Add or Modify Bookmark**  icon on one of the toolbars, or
 - c. Right-click on the frame/event and choosing **Add Bookmark....**
3. In the dialog box, add a comment (up to 84 characters) in the text box to identify the bookmark.
4. Click **OK**.

Once you create a bookmark it will be saved with the rest of the data in the [.cfa file](#). When you open a .cfa file, the bookmarks are available to you.

Modify

1. Select the frame or event with the bookmark to be edited.
2. There are three ways to access the **Add/Modify Bookmark** dialog.
 - a. Select **Add or Modify Bookmark** from the **Bookmarks** menu on the **Frame Display** and **Event Display**'
 - b. Select the **Add or Modify Bookmark**  icon on one of the toolbars, or
 - c. Right-click on the frame/event and choosing **Modify Bookmark...** on the selection.
3. Change the comment in the dialog box

4. Click **OK**. The edited bookmark will be saved as a part of the [.cfa file](#).
5. You can also select **Display All Bookmarks**  from the **Frame Display** and **Event Display** toolbar or the **Bookmarks** menu. the **Find** window will open on the **Bookmark** tab. Select the bookmark you want to modify and click the **Modify...** button. Change the comment in the dialog box, and click **OK**.

Delete

1. Select the frame or event with the bookmark to be deleted.
2. There are three ways to access the **Add/Modfy Bookmark** dialog.
 - a. Select **Add or Modify Bookmark** from the **Bookmarks** menu on the **Frame Display** and **Event Display**,
 - b. Select the **Add or Modify Bookmark**  icon on one of the toolbars, or
 - c. Right-click on the frame/event and choosing **Modify Bookmark...** on the selection.
3. Click on the **Delete** button. The bookmark will be deleted.
4. You can also select **Display All Bookmarks**  from the **Frame Display** and **Event Display** toolbar or the **Bookmarks** menu. the **Find** window will open on the **Bookmark** tab. Select the bookmark you want to delete and click the **Delete** button.

4.2.2 Displaying All and Moving Between Bookmarks

There are three ways to move between bookmarks.

1. Press the F2 key to move to the next frame or event with a bookmark.
2. Select Go to Next Bookmark from the Bookmarks menu.
3. Click the Display All Bookmarks icon  . Select the bookmark you want to move to and click the Go To button, or simply double-click on the bookmark. Click the Move Forward and Move Back buttons to cycle through the bookmarks.

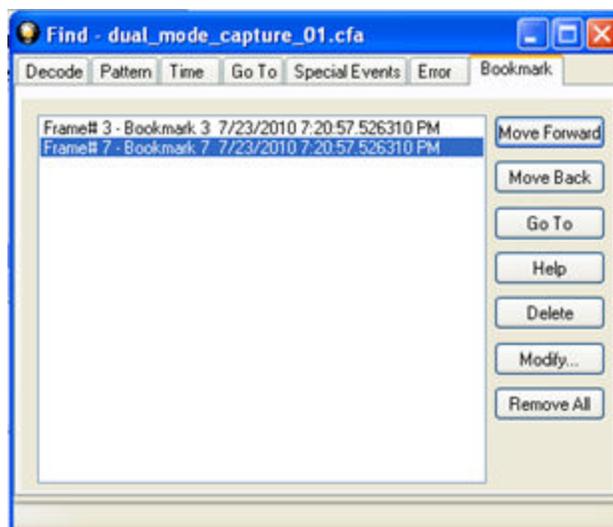


Figure 4.13 - Find Window Bookmark tab Used to Move Around With Bookmarks

To delete a bookmark, select it and click the **Delete** button.

To modify a bookmark, select it and click the **Modify** button.

Click **Remove All** to delete all the bookmarks.

Chapter 5 Save/Export

5.1 Saving Your Data

You can save all or part of the data that you have captured. You can also load a previously saved capture file, and save a portion of that file to another file. This feature is useful if someone else needs to see only a portion of the data in your capture file.

On the **Control** window toolbar you can set up to capture a single file. [Click here to see those settings.](#)

There are two ways to save portions or all of the data collected during a data capture. [Click here to see how to capture data to disk.](#)

5.1.1 Saving the Entire Capture File

This option is only available when you select **Single File** from the **Capture Mode** on **System Settings**. [Click here to learn more about selecting Save options from System Settings.](#)

1. If you are capturing data, click on the **Stop Capture**  icon to stop data capture. You cannot save data to file while it is being captured.
2. Open the **Event Display**  or **Frame Display**  window.
3. Click the **Save**  icon, or select **Save** from the **File** menu.

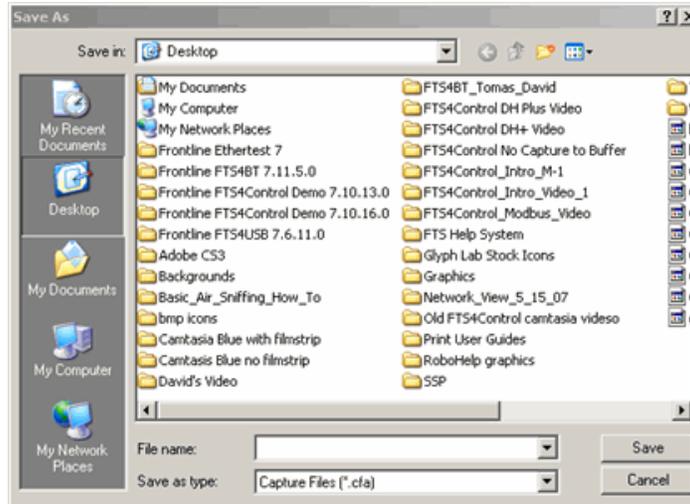
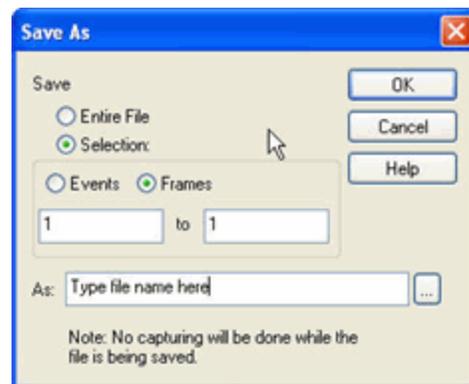


Figure 5.1 - Windows Save dialog

4. Type a file name in the **File name** box at the bottom of the screen.
5. Browse to select a specific directory. Otherwise your file is saved in the default capture file directory.
6. When you are finished, click **OK**.

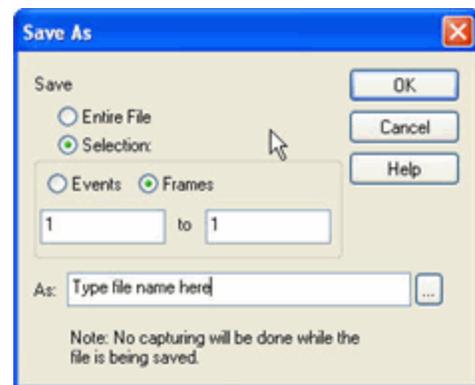
5.1.2 Saving the Entire Capture File with Save Selection

1. If you are capturing data, click on the **Stop** icon  to stop data capture. You cannot save data to file while it is being captured.
2. Open the **Event Display**  or **Frame Display**  window.
3. Right click in the data
4. Select **Save Selection** or **Save As** from the right click menu.
5. Click on the radio button labeled **Entire File**.
6. Choose to save **Events** or **Frames**. Choosing to save **Events** saves the entire contents of the capture file. Choosing to save **Frames** does not save all events in the capture file.
7. Type a file name in the **As** box at the bottom of the screen. Click the **Browse** icon to browse to a specific directory. Otherwise your file is saved in the default capture file directory.
8. When you are finished, click **OK**.



5.1.3 Saving a Portion of a Capture File

1. If you are capturing data, click on the **Stop** icon  to pause data capture. You cannot save data to a file while it is being captured.
2. Open the **Event Display**  or **Frame Display**  window, depending on whether you want to specify a range in bytes or in frames.
3. Select the portion of the data that you want to save. Click and drag to select data, or click on the first item, move to the last item and Shift+Click to select the entire range, or use the Shift key with the keyboard arrows or the navigation icons in the **Frame Display** toolbar. If the range you want to save is too large to select, note the numbers of the first and last item in the range.
4. Right click in the data
5. Select **Save Selection** or **Save As** from the right click menu
6. Click on the radio button labeled **Selection**. If you selected a range, make sure the starting and ending numbers are correct. To specify a range, type the numbers of the first and last items in the range in the boxes.
7. Select either **Events** or **Frames** to indicate whether the numbers are event or frame numbers.
8. Type a file name in the **As** box at the bottom of the screen. Click the **Browse** icon to browse to a specific directory. Otherwise your file is saved in the default capture file directory.
9. Click **OK** when you are finished.



5.2 Confirm Capture File (CFA) Changes

This dialog appears when you close a capture file after changing the [Notes](#), the protocol stack, or [bookmarks](#). The dialog lists information that was added or changed and allows you to select which information to save, and whether to save it to the current file or to a new one.

Changes made to the file appear in a list in the left pane. You can click on each item to see details in the right pane about what was changed for each item. You simply check the boxes next to the changes you want to keep. Once you decide what changes to keep, select one of the following:

- **Save To This File** – Saves the changes you have made to the current capture file.
- **Save As** – Saves the changes to a new file.
- **Cancel the Close Operation** – Closes the file and returns you back to the display. No changes are saved.
- **Discard Changes** – Closes the file without saving any of the changes made to the notes, bookmarks, or protocol stack.

5.3 Adding Comments to a Capture File

The **Notes** feature allows you to add comments to a CFA file. These comments can be used for many purposes. For example, you can list the setup used to create the capture file, record why the file is useful to keep, or include notes to another person detailing which frames to look at and why. ([Bookmarks](#) are another useful way to record information about individual frames.)

To open the **Notes** window :

1. Click the **Show Notes** icon . This icon is present on the toolbars of the **Frame Display** , as well as the **Event Display** . **Notes** can be selected from the **Edit** menu on one of these windows.
2. Type your comments in the large edit box on the **Notes** window. The **Cut, Copy, Paste** features are supported from **Edit** menu and the toolbar  when text is selected. Undo and Redo features are all supported from **Edit** menu and the toolbar  at the current cursor location.
3. Click the thumbtack icon  to keep the **Notes** window on top of any other windows.
4. When you're done adding comments, close the window.
5. When you close the capture file, you are asked to confirm the changes to the capture file. See [Confirming Capture File \(CFA\) Changes](#) for more information.

5.4 Loading and Importing Capture Files

5.4.1 Loading a Capture File

From the Control Window:

1. Go to the **File** menu.
2. Choose a file from the recently used file list.
3. If the file is not in the **File** menu list, select **Open Capture File** from the **File** menu or simply click on the **Open** icon  on the toolbar.
4. Capture files have a .cfa extension. Browse if necessary to find your capture file.
5. Click on your file, and then click **Open**.

5.4.2 Importing Capture Files

1. From the **Control** window , go to the **File** menu and select Open Capture File or click on the Open icon on the toolbar.
2. Left of the **File name** text box, select from the drop-down list **Supported File Types** box to **All Importable File Types** or **All Supported File Types (*.cfa, *.log, *.txt, *.csv, *.cap)**. Select the file and click **Open**.

The analyzer automatically converts the file to the analyzer's format while keeping the original file in its original format. You can [save the file](#) in the analyzer's format, close the file without saving it in the analyzer's format, or have the analyzer automatically save the file in the analyzer's format (see the [System Settings](#) to set this option). All of these options keep your original file untouched.

When you first open the file, the analyzer brings up the [Protocol Stack](#) window and ask you what protocol decodes, if any, you want to use. You must choose a protocol decode at this point for the analyzer to decode the data in the file. If you open a file without using any decodes, and decide later that you want to apply a decode, choose [Reframe](#) from the File menu on the Control window.

At present, the analyzer supports the following file types:

- Frontline Serialtest* Async and Serialtest ComProbe® for DOS – requires the .byt for data and the .tim for timestamps (see note on importing [DOS timestamps](#)).
- Greenleaf ViewComm* 3.0 for DOS - requires the .byt for data and the .tim for timestamps (see note on importing [DOS timestamps](#)).
- Frontline Ethertest* for DOS – requires 3 files: filename.cap, filename.ca0 and filename.ca1.
- Sniffer Type 1 – supports files with the .enc extension. Does not support Sniffer files with a .cap extension.
- Snoop or Sun Snoop – files with a .cap extension based on RFC 1761. For file format, see <http://www.faqs.org/rfcs/rfc1761.html>.
- Shomiti Surveyor files in Snoop format – files with a .cap extension. For file format, contact [Technical Support](#).
- CATC Merlin - files with a .csv extension. Files must be exported with a specific format. See [File Format for Merlin Files](#) for information.
- CATC Chief - files with a .txt extension.

5.5 Printing

5.5.1 Printing from the Frame Display/HTML Export

The **Frame Display Print** dialog and the **Frame Display HTML Export** are very similar. This topic discusses both dialogs.

Frame Display Print

The **Frame Display Print** feature provides the user with the option to print the capture buffer or the current selection. The maximum file size, however, that can be exported is 1000 frames.

When **Print Preview** is selected, the output displays in a browser print preview window, where the user can select from the standard print options. The output file format is in html, and uses the Microsoft Web Browser Control print options for background colors and images.

Print Background Colors Using Internet Explorer

1. Open the Tools menu on the browser menu bar
2. Select “Internet Options...” menu entry.
3. Click Advanced tab.

4. Check “Print background colors and images” under the Printing section
5. Click the Apply button, then click OK

Configure the Print File Range in the Frame Display Print Dialog

Selecting more than one frame in the Frame Display window defaults the radio button in the Frame Display Print dialog to Selection and allows the user to choose the All radio button. When only one frame is selected, the All radio button in the Frame Display Print dialog is selected.

How to Print Frame Display Data

1. Select **Print** or **Print Preview** from the **File** menu on the **Frame Display** window to display the **Frame Display Print** dialog. Select **Print** if you just want to print your data to your default printer. Select **Print Preview** if you want access to printer options.
2. Choose to include the **Summary** pane (check the box) in the print output. The **Summary** pane appears at the beginning of the printed output in tabular format. If you select **All layers** in the **Detail Section**, the **Data Bytes** option becomes available.
3. In the **Detail Section**, choose to exclude—**No decode section**—the decode from the **Detail** pane in the **Frame Display**, or include **All Layers** or **Selected Layers Only**. If you choose to include selected layers, then select (click on and highlight) the layers from the list box.
4. Click on selected layers in the list to de-select, or click the **Reset Selected Layers** button to de-select all selected layers.

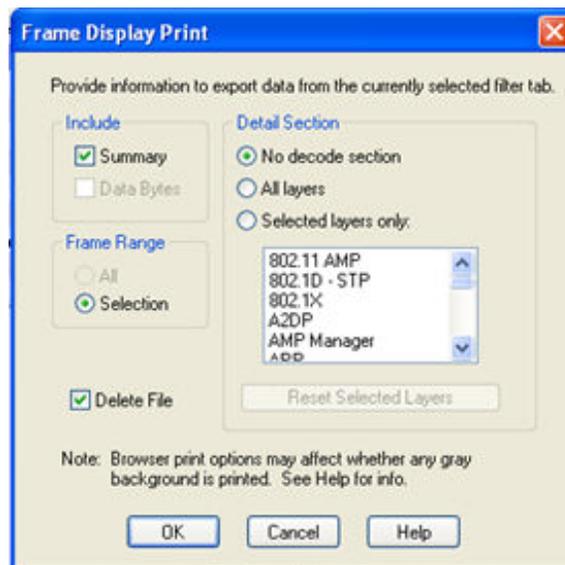


Figure 5.2 - Frame Display Print Dialog

5. Select the range of frames to include **All** or **Selection** in the **Frame Range** section of the **Frame Display Print** dialog.

Choosing **All** prints up to 1000 frames from the buffer.

Choosing **Selection** prints only the frames you select in the Frame Display window.

6. Selecting the **Delete File** deletes the temporary html file that was used during printing
7. Click the **OK** button.

Frame Display Print Preview

The **Frame DisplayPrint Preview** feature provides the user with the option to export the capture buffer to an .html file. The maximum file size, however, that can be exported is 1000 frames.

If you chose **Print Preview**, the system displays your data in a browser print preview display with options for printing such as page orientation and paper size. You can also use your Printer Preferences dialog to make some of these selections. When printing your data, the analyzer creates an html file and prints the path to the file at the bottom of the page. This file can be opened in your browser, however, it may appear different than the printed version.

1. Select **Print Preview** from the **File** menu on the **Frame Display** window to display the **Frame Display Print Preview**.

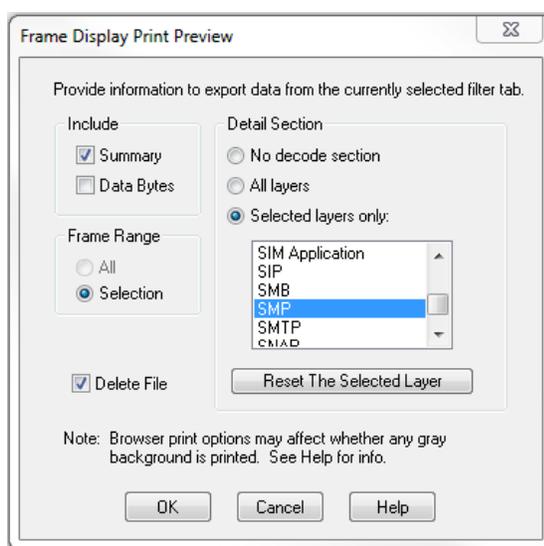


Figure 5.3 - Frame Display Print Preview Dialog

2. From this point the procedure is the same as steps 2 through 5 in "How to Print Frame Display Data" above.
3. Click the **OK** button, and after a brief wait a browser window will appear.

5.5.2 Printing from the Event Display

The Event Display Print feature provides the user with the option to print either the entire capture buffer or the current selection. When Print Preview is selected, the output displays in a browser print preview window where the user can select from the standard print options. The output file format is in html, and uses the Microsoft Web Browser Control print options for background colors and images (see below).

Print Background Colors Using Internet Explorer

1. Open the Tools menu on the browser menu bar
2. Select "Internet Options..." menu entry.
3. Click Advanced tab.
4. Check "Print background colors and images" under the Printing section
5. Click the Apply button, then click OK

The **Event Display Print** feature uses the current format of the **Event Display** as specified by the user.

See [About Event Display](#) for an explanation on formatting the **Event Display** prior to initiating the print feature.

Configure the Print File Range in the Event Display Print dialog

Selecting more than one event in the **Event Display** window defaults the radio button in the **Event Display Print** dialog to **Selection** and allows the user to choose the **All** radio button. When only one event is selected, the **All** radio button in the **Event Display Print** dialog is selected.

How to Print Event Display Data to a Browser

1. Select **Print** or **Print Preview** from the **File** menu on the **Event Display** window to display the **Event Display Print** dialog. Select **Print** if you just want to print your data to your default printer. Select **Print Preview** if you want preview the print in your browser.
2. Select the range of events to include from either **All** or **Selection** in the **Event Range** section. Choosing **All** prints all of the events in the capture file or buffer. Choosing **Selection** prints only the selected events in the Event Display window.

Note: In order to prevent a Print crash, you cannot select **All** if there are more than 100,000 events in the capture buffer.

Note: See "Configure the Print File Range in the Event Display Print Dialog" above for an explanation of these selections

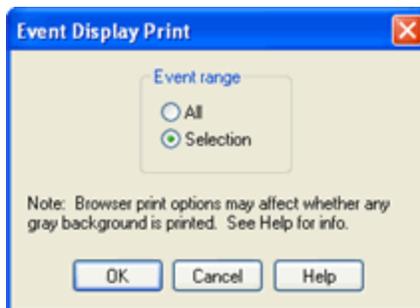


Figure 5.4 - Event Display Print Dialog

3. Click the OK button.

If you chose **Print Preview**, the system displays your data in a browser print preview display with options for printing such as page orientation and paper size. You can also use your Printer Preferences dialog to make some of these selections. When printing your data, the analyzer creates an html file and prints the path to the file at the

bottom of the page. This file can be opened in your browser, however, it may appear different than the printed version.

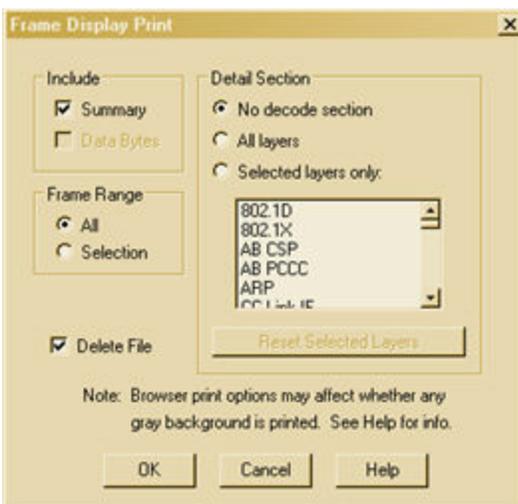
5.5.3 Print Preview

Print Preview gives a preview of how the data looks printed. You can scroll through the pages and zoom in on the data to get a closer look. The line of buttons across the top of the window controls the functions of the window.

To open the Print Preview window:

1. Choose Print Preview from the File menu in any window that supports printing.
2. Choose to include the Summary Pane (check the box) in the print output. The summary Pane appears at the beginning of the printed output in tabular format. If you select All layers in the Detail Section, the Data Bytes option becomes available.
3. In the Detail Section, choose to exclude the decode from the Detail Pane in the Frame Display, or include All Layers or Selected Layers Only. If you choose to include selected layers, then select (click on and highlight) the layers from the list box. Click on selected layers in the list to de-select, or click the Reset button to de-select all selected layers.

Note: Decode layers printout expanded regardless of the state of the Detail Pane in the Frame Display at the time of the request to print. This can produce a print output consisting of hundreds of pages or more. We recommend that you use Print Preview to determine the number of pages in your print output prior to printing.



4. Select the range of frames to include **All** or **Selection** in the **Frame Range** section of the **Frame Display Print** dialog.

Choosing **All** prints all of the frames in the capture file or buffer. If there are more than 1000 frames in the capture file or buffer, **All** will not be available.

Choosing **Selection** prints only the selected frames in the **Frame Display** window.

Note: See Configure the Print File Range in the Frame Display Print Dialog above for an explanation of these selections.

Note: Selecting the Delete File deletes the temporary html file that was used during printing..

5. Click the **OK** button.

You can print directly from the **Print Preview** window.

- **Next Page** shows you how the next page in your data looks
- **Prev Page** takes you back to the previous page.
- **Two Page** changes the display to show two pages of data. When in the **Two Page** display, the button toggles to **One Page**. Click on the **One Page** button to return to viewing one page.
- **Zoom In** and **Zoom Out** allow you to change the magnification of the pages. Click on **Zoom In** to increase the magnification, and on **Zoom Out** to decrease the magnification. When you have reached the limit in either direction, the buttons is grayed out.
- You can also zoom in and out by clicking on the page itself. When the cursor looks like a magnifying glass, you can click on the page to increase the magnification. When you have reached the top level of magnification, the cursor changes back to an arrow. Click on the page to return to normal magnification.
- Click on the **Close** button to return to the regular display.

5.6 Exporting

5.6.1 Frame Display Export

You can dump the contents of the **Summary** pane on the **Frame Display** into a Comma Separated File (.csv).

To access this feature:

1. Right click on the **Summary** pane or open the **Frame DisplayFile** menu.
2. Select the **Export...** menu item.
3. Select a storage location and enter a **File name**.
4. Select **Save**.

5.6.2 Exporting a File with Event Display Export

With the **Event Display Export** dialog you can export the contents of the **Event Display** dialog as a text (.txt), CSV (.csv), HTML (.htm), or Binary File (.bin). You also have the option of exporting the entire capture buffer or just the current selection of the Event Display dialog.

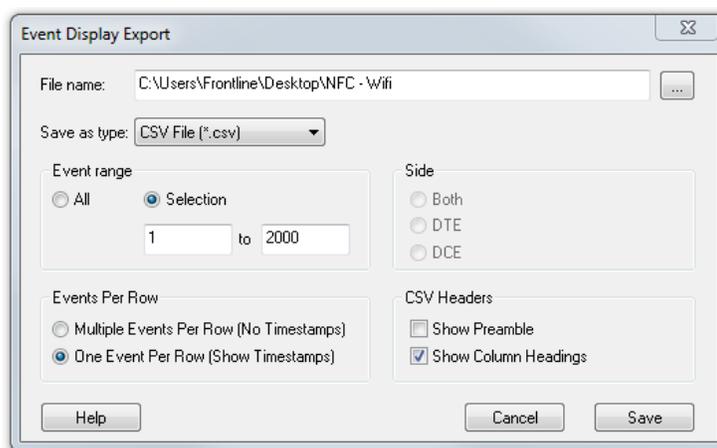


Figure 5.5 - Event Display Export Example: .csv file.

How to Export Event Display Data to a File

1. Select **Export Events** from the **File** menu on the **Event Display** window to display the **Event Display Export** dialog.
2. Enter a file path and name, or click the browser button to display the Windows **Save As** dialog and navigate to the desired storage location.
3. Select a file type from the **Save as type:** drop-down List Menu on the Event Display Export dialog. Select from among the following file formats:
 - Text File (*.txt)
 - CSV File (*.csv)
 - HTML File (*.html)
 - Binary File (*.bin)
4. Select the range of events to include in the file from either **All** or **Selection** in the **Event Range** section of the **Event Display Export** dialog.
 - Selecting more than one event in the Event Display window defaults the radio button in the Event Display Export dialog to Selection and allows the user to choose the All radio button.
 - When only one event is selected (something must be selected), the All radio button in the Event Display Export dialog is selected by default.
5. Next you need to select the Side variable for serial communications.
 - Side is used to determine whether you want to export data from Data Communications Equipment (DCE), Data Terminal Equipment (DTE) or both.
 - Side is used to determine whether you want to export data from the Host, Function/Control, or Both.
 - Choose DCE, DTEHost, Function\Control or Both to determine how you want to export the data.

5. Choose DCE, DTEHost, Function\Control or Both to determine how you want to export the data.
6. Choose whether you want to display multiple events or single events per row.

Events Per Row: You can choose to display **Multiple Events Per Row**, but this method contains no timestamps. If you select **One Event Per Row**, you can display timestamps. multiple events or single events per row.

Note: The raw timestamp value is the number of 100-nanosecond intervals since the beginning of January 1, 1601. This is standard Windows time.

Timestamp

Delta

Event Number

Byte Number

Frame Number

Type

Hex

Dec

Oct

Bin

Side

ASCII | 7-bit ASCII | EBCDIC | Baudot

RTS

CTS

DSR

DTR

CD

RI

UART Overrun

Parity Error

Framing Error

7. If you select .csv as the file type, choose whether you want to hide/display **Preambles** or **Column Headings** in the exported file
8. Click **Save**. The Event Display Export file is saved to the locations you specified in **File name**.

	A	B	C	D	E	F	G	H	I	J	K
1	Timestamp	Delta	Event Number	Byte Number	Frame Number	Type	Hex	Dec	Oct	Bin	ASCII
632	11/30/2012 12:20:02.895166 PM	0:00:00.00	631	626		3 Data	0	0	0	0	.
633	11/30/2012 12:20:02.895166 PM	0:00:00.00	632	627		3 Data	0	0	0	0	.
634	11/30/2012 12:20:02.895166 PM	0:00:00.00	633	628		3 Data	0	0	0	0	.
635	11/30/2012 12:20:02.895166 PM	0:00:00.00	634	629		3 Data	98	152	230	10011000	.
636	11/30/2012 12:20:02.895166 PM	0:00:00.00	635	630		3 Data	70	112	160	11100000	p
637	11/30/2012 12:20:02.895166 PM	0:00:00.00	636	631		3 Data	94	148	224	10010100	.
638	11/30/2012 12:20:02.895166 PM	0:00:00.00	637	632		3 Data	22	34	42	100010	"
639	11/30/2012 12:20:02.895166 PM	0:00:00.00	638	633		3 Data	21	33	41	100001	!
640	11/30/2012 12:20:02.895166 PM	0:00:00.00	639	634		3 Data	1c	28	34	11100	.
641	11/30/2012 12:20:02.895166 PM	0:00:00.00	640	635		3 Data	80	128	200	10000000	.
642	11/30/2012 12:20:02.895166 PM	0:00:00.00	641	636		3 Data	80	128	200	10000000	.
643	11/30/2012 12:20:02.895166 PM	0:00:00.00	642	637		3 Data	80	128	200	10000000	.
644	11/30/2012 12:20:02.895166 PM	0:00:00.00	643	638		3 Data	80	128	200	10000000	.

Figure 5.6 - Example: .csv Event Display Export, Excel spreadsheet

5.6.2.1 Export Filter Out

You can filter out data you don't want or need in your text file.

(This option is available only for serial data.) In the **Filter Out** box, choose which side to filter out: the DTE data, the DCE data or neither side (don't filter any data.) For example, if you choose the radio button for DTE data, the DTE data would be filtered out of your export file and the file would contain only the DCE data.

You can also filter out Special Events (which is everything that is not a data byte, such as control signal changes and Set I/O events), Non-printable characters or both. If you choose to filter out Special Events, your export file would contain only the data bytes. Filtering out the non-printable characters means that your export file would contain only special events and data bytes classified as printable. In ASCII, printable characters are those with hex values between \$20 and \$7e.

5.6.2.2 Exporting Baudot

When exporting Baudot, you need to be able to determine the state of the shift character. In a text export, the state of the shift bit can be determined by the data in the Character field. When letters is active, the character field shows letters and vice versa.

Chapter 6 Information

6.1 System Settings

Open the **System Settings** window by choosing **System Settings** from the **Options** menu on the **Control** window. To enable a setting, click in the box next to the setting to place a checkmark in the box. To disable a setting, click in the box to remove the checkmark. When viewing a capture file, settings related to data capture are grayed out.

Single File

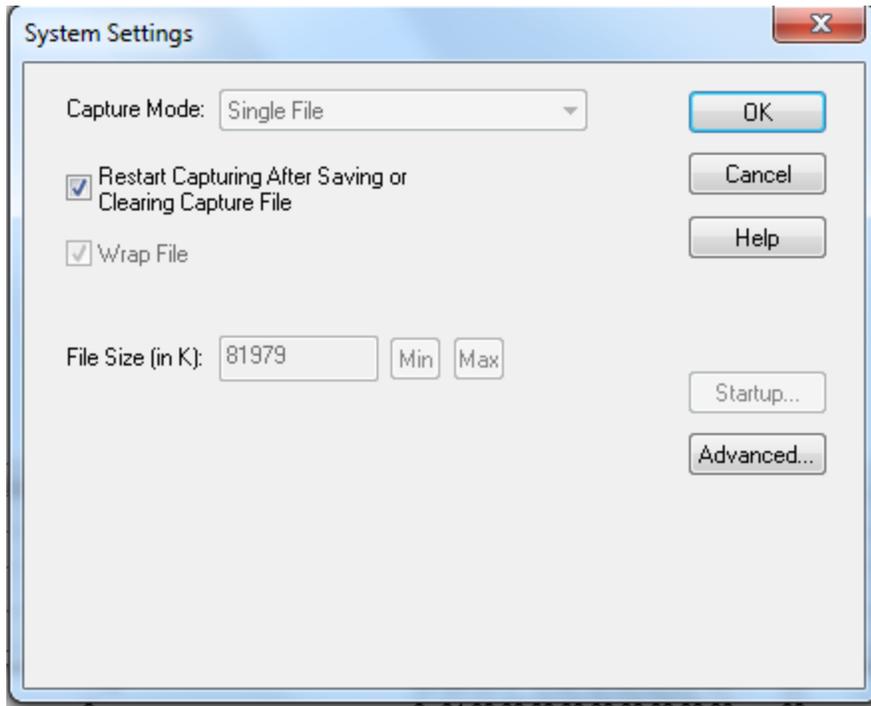


Figure 6.1 - System Settings Single File Mode

This option allows the analyzer to capture data to a file. Each time you capture the file you must provide a file name. The size of each file cannot larger than the number given in File Size (in K). The name of each file is the name you give it in the Name box followed by the date and time. The date and time are when the series was opened.

- **Restart Capturing After Saving or Clearing Capture File**

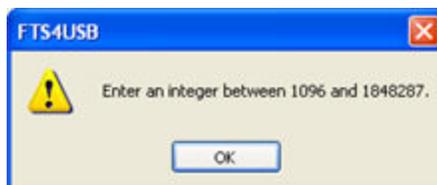
If the Automatically Restart feature is enabled, the analyzer restarts capture to the file immediately after the file is closed.

- **Wrap File**

When enabled, the analyzer wraps the file when it becomes full. The oldest events are moved out of the file to make room for new events. Any events moved out of the file are lost. When disabled, the analyzer stops capture when the file becomes full. Either reset the file or close your capture file to continue.

- **File Size:** The size of the file will depend of the available hard disk space.

1. Click the **Min** button to see/set the minimum acceptable value for the file size.
2. Click the **Max** button to see/set the maximum acceptable value for the file size.



You can accept these values, or you can enter a unique file size. But if you try to close the dialog after entering a value greater than the maximum or less than the minimum, you will see the following dialog.

- **Start up**

Opens the [Program Start up Options](#) window. **Start up** options let you choose whether to start data capture immediately on opening the analyzer.

- **Advanced**

Opens the [Advanced System Options](#) window. The Advanced Settings should only be changed on advice of technical support.

6.1.1 System Settings - Disabled/Enabled Options

Some of the **System Settings** options are disabled depending upon the status of the data capture session.

- As the default, all the options on the **System Settings** dialog are enabled.
- Once the user begins to capture data by selecting the Start Capture button, some of the options on the [System Settings](#) dialog are disabled until the user stops data capture and either saves or erases the captured data.
- The user can go into the [Startup options](#) and [Advanced system options](#) on the **System Settings** dialog and make changes to the settings at any time.

6.1.2 Changing Default File Locations

The analyzer saves user files in specific locations by default. Capture files are placed in the My Capture Files directory and configurations are put in My Configurations. These locations are set at installation.

Follow the steps below to change the default locations.

1. Choose **Directories** from the **Options** menu on the **Control** window to open the **File Locations** window.

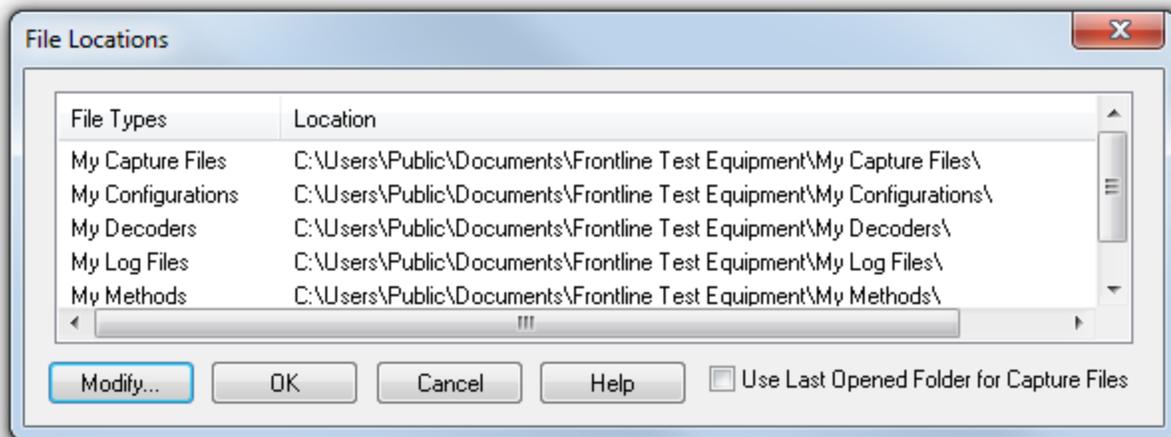


Figure 6.2 - File Locations dialog

2. Select the default location you wish to change.
3. Click **Modify**.
4. Browse to a new location.

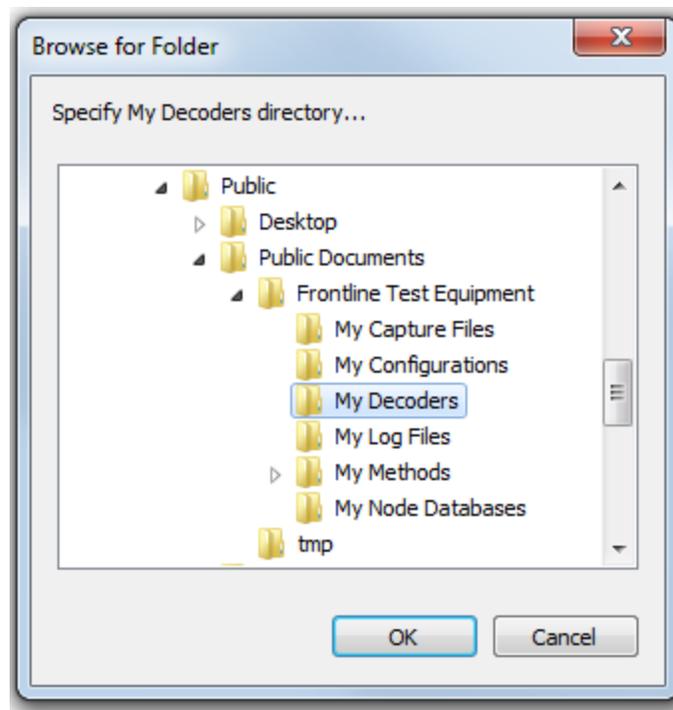


Figure 6.3 - File Locations Browse dialog

5. Click **OK**.
6. Click **OK** when finished.

If a user sets the My Decoders directory such that it is up-directory from an installation path, multiple instances of a personality entry may be detected, which causes a failure when trying to launch Frontline. For example, if an Frontline product is installed at C:\Users\Public\Public Documents\Frontline Test Equipment\My Decoders\ then "My Decoders" cannot be set to any of the following:

- C:\ My Decoders\
- C:\Users\ My Decoders\
- C:\Users\Public\My Decoders\
- C:\Users\Public\Public Documents\My Decoders\
- or to any directory that already exists in the path C:\Users\Public\Public Documents\Frontline Test Equipment\My Decoders\

Default Capture File Folder Checkbox

If the **Use Last Opened Folder for Capture Files** checkbox is checked, then the system automatically changes the default location for saving capture files each time you open a file from or save a file to a new location. For example, let's say the default location for saving capture files is Drive A > Folder A. Now you select the **Use Last Opened Folder for Capture Files** checkbox. The next time, however, you open a capture file from a different location, Folder B > Removable Flash Drive for example. Now when you save the capture file, it will be saved to Folder B > Removable Flash Drive. Also, all subsequent files will be saved to that location. This remains true until you open a file from or save a file to a different location.

There is one caveat to this scenario, however. Let's say you have selected **Use Last Opened Folder for Capture Files** and opened a file from a location other than the default directory. All subsequent capture files will be saved to that location. Suppose, however, the next time you want to save a capture file, the new file location is not available because the directory structure has changed: a folder has been moved, a drive has been reassigned, a flash drive has been disconnected, etc. In the case of a "lost" directory structure, subsequent capture files will be saved to the default location. **ComProbe software will always try to save a file to the folder where the last file was opened from or saved to, if Use Last Opened Folder for Capture Files is checked.** If, however, the location is not accessible, files are saved to the default directory that is set at installation.

If the checkbox is unchecked, then the system always defaults to the directory listed in the File Locations dialog.

6.1.3 Selecting Start Up Options

To open this window:

1. Choose **System Settings** from the **Options** menu on the Control  window.
2. On the System Settings window, click the **Start Up** button.
3. Choose one of the options to determine if the analyzer starts data capture immediately on starting up or not.

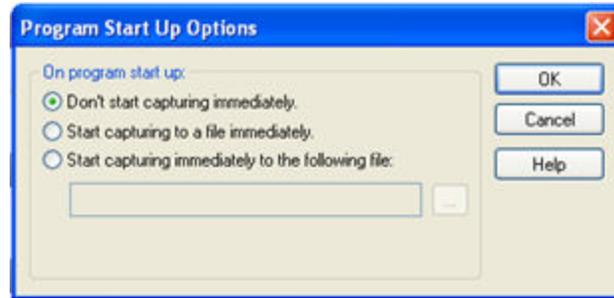


Figure 6.4 - Start Up Options dialog

- **Don't start capturing immediately** - This is the default setting. The analyzer begins monitoring data but does not begin capturing data until clicking the **Start Capture**  icon on the **Control, Event Display** or **Frame Display** windows.
- **Start capturing to a file immediately** - When the analyzer starts up, it immediately opens a capture file and begins data capture to it. This is the equivalent of clicking the **Start Capture**  icon. The file is given a name based on the settings for capturing to a file or series of files in the **System Settings** window.
- **Start capturing immediately to the following file:** - Enter a file name in the box below this option. When the analyzer starts up, it immediately begins data capture to that file. If the file already exists, the data in it is overwritten.

6.1.4 Side Names

The **Side Names** dialog is used to change the names of objects and events that appear in various displays. **The Side Names** dialog will change depending on the sniffing technology in use at the time the software was loaded. Changes to the Names are used throughout the program.

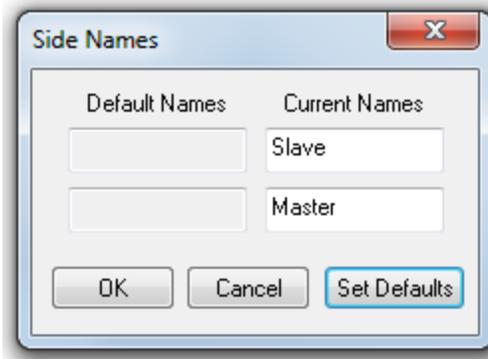


Figure 6.5 - Example: Side Names Where "Slave" and "Master" are current

1. To open the Side Names dialog, choose **Side Names...** from the **Options** menu on the **Control** window.
2. To change a name, click on the name given in the **Current Names** column, and then click again to modify the name (a slow double-click).

3. Select **OK** to initiate the changes. The changes that have been made will not fully take effect for any views already open. Closing and reopening the views will cause the name change to take effect.
4. To restore the default values, click the **Set Defaults** button.

6.1.5 Timestamping Options

The Timestamping Options window allows you to enable or disable timestamping, and change the resolution of the timestamps for both capture and display purposes.

To open this window:

Choose **Set Timestamp Format...** from the **Options** menu on the Frame Display and Event Display window or click on the **Timestamping Option**  icon in the **Event Display** toolbar. The Timestamping Options window will open.

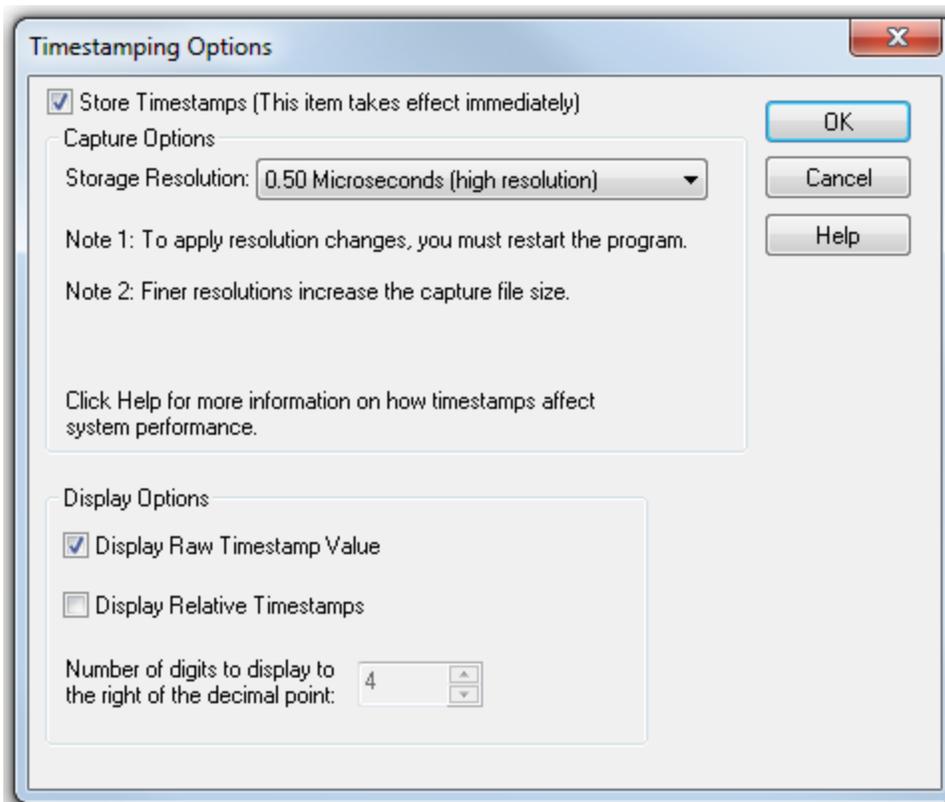


Figure 6.6 - Timestamping Options dialog

Enabling/Disabling Timestamp

To enable timestamping click to make a check appear in the check box **Store Timestamps (This time takes effect immediately)**. Removing the check will disable timestamping.

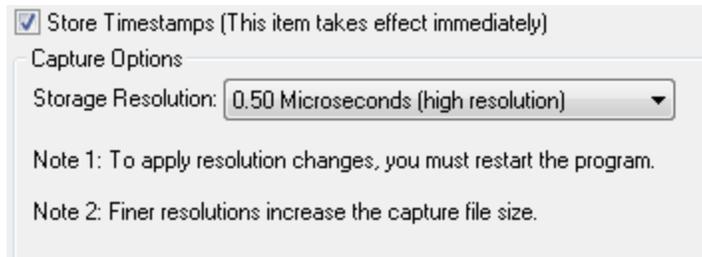
Changing the Timestamp Resolution

This option affects the resolution of the timestamp stored in the capture file. The default timestamp is 10 milliseconds. This value is determined by the operating system and is the smallest "normal" resolutions possible.

Note: The raw timestamp value is the number of 100-nanosecond intervals since the beginning of January 1, 1601. This is standard Windows time.

It is also possible to use "high resolution" timestamping. High resolution timestamp values are marked by an asterisk as high resolution in the drop down list. To change timestamping resolutions:

1. Go to the **Capture Options** section of the window.
2. Change the resolution listed in the **Storage Resolution** box.



Note: If you change the resolution, you need to exit the analyzer and restart in order for the change to take effect.

Performance Issues with High Resolution Timestamp

There are two things to be aware of when using high resolution timestamps. The first is that high resolution timestamps take up more space in the capture file because more bits are required to store the timestamp. Also, more timestamps need to be stored than at normal resolutions. The second issue is that using high resolution timestamping may affect performance on slower machines

For example, if 10 bytes of data are captured in 10 milliseconds at a rate of 1 byte per millisecond, and the timestamp resolution is 10 milliseconds, then only one timestamp needs to be stored for the 10 bytes of data. If the resolution is 1 millisecond, then 10 timestamps need to be stored, one for each byte of data. If you have two capture files, both of the same size, but one was captured using normal resolution timestamping and the other using high resolution, the normal resolution file has more data events in it, because less room is used to store timestamps.

You can increase the size of your capture file in the [System Settings](#).

Switching Between Relative and Absolute Time

With Timestamping you can choose to employ Relative Time or Absolute time.

1. Choose **System Settings** from the **Options** menu on the **Control** window, and click the **Timestamping Options** button, or click the **Timestamping Options** icon  from the **Event Display**  window.
2. Go to the **Display Options** section at the bottom of the window and find the **Display Relative Timestamps** checkbox.
3. Check the box to switch the display to relative timestamps. Remove the check to return to absolute timestamps.

Note: The options in this section affect only how the timestamps are displayed on the screen, not how the timestamps are recorded in the capture file.

- **Display Raw Timestamp Value** shows the timestamp as the total time in hundred nanoseconds from a specific point in time.
- **Display Relative Timestamps** shows the timestamp as the amount of time that has passed since the first byte was captured. It works just like a stop watch in that the timestamp for the first byte is 0:00:00.0000 and all subsequent timestamps increment from there. The timestamp is recorded as the actual time, so you can flip back and forth between relative and actual time as needed.
- Selecting both values displays the total time in nanoseconds from the start of the capture as opposed to a specific point in time.
- Selecting neither value displays the actual chronological time.

When you select **Display Relative Timestamp** you can set the number of digits to display using the up or down arrows on the numeric list.

Displaying Fractions of a Second

1. Choose **System Settings** from the **Options** menu on the **Control**  window, and click the **Timestamping Options** button, or click the **Timestamping Options** icon  from either the **Event Display**  or **Statistics**  window.
2. Go to the **Display Options** section at the bottom of the window, and find the **Number of Digits to Display** box.
3. Click on the arrows to change the number. You can display between 0 and 6 digits to the right of the decimal point.

6.1.5.1 Converting Timestamps

Serialtest for DOS uses a timebase of Pacific Standard Time during non daylight savings time hours and Pacific Daylight Time during daylight savings time hours. The analyzer always uses Greenwich Mean Time (also known as Universal Time Coordinates).

When importing a Serialtest for DOS file, the analyzer must determine if the file was recorded during daylight savings time or not before converting the timestamps. Because the rules for determining this can change, it is possible for the analyzer to convert the timestamps incorrectly, resulting in timestamps that are off by one hour.

Note: The raw timestamp value is the number of 100-nanosecond intervals since the beginning of January 1, 1601. This is standard Windows time.

6.2 Technical Information

The following information is provided to assist you in troubleshooting data capture problems.

6.2.1 Asynchronous Serial Performance Notes

As a software-based product, the speed of your computer's processor affects Frontline's performance. Overrun errors and buffer overflows are indicators that Frontline is unable to keep up with the data. The information

below describes what happens to the data as it comes in the port, what the two types of errors mean, and how various aspects of Frontline affect performance. Also included are suggestions on how to improve performance.

Data captured by the serial port first goes into the buffer of the UART chip of the serial port. The UART generates an interrupt, which tells the Frontline driver to check the port. The driver takes the data from the UART and counts each byte as they are put into the driver's own buffer. The driver tells Frontline that data is ready to be processed. Frontline takes the data from the driver's buffer and puts the data into the capture buffer.

Overrun errors occur when the data in the buffer of the UART is not retrieved before new data comes in. In this case, Frontline knows that it has lost information, but it does not know how much. Frontline indicates overrun errors in the Event Display screen by marking a byte near the overrun in red. You can search for overrun errors using the [Find](#) feature.

Driver buffer overflow errors occur when the data in the buffer of the driver is not retrieved before new data comes in. Since the driver counts the bytes as it retrieves them from the UART, it not only knows that it has lost data, it also knows how much. Buffer overflows are indicated in the Event Display screen by a plus sign within a circle. Clicking on the buffer overflow symbol shows how many events have been lost. The Statistics window is a good place to check for buffer overflow errors.

Both overrun errors and buffer overflows indicate that data is coming in too quickly for Frontline to process. There are several things that you can do to try and solve this problem.

- In the Hardware Settings window, select Use Windows Device Manager Settings. This means that Windows does not generate an interrupt every time a byte comes in, but rather waits until several bytes have accumulated in the UART buffer before telling Frontline to retrieve them. This increases performance at the cost of timestamp accuracy, since all the bytes in a group have the same timestamp regardless of when they actually arrived at the UART. Some control signal changes may also be lost.
- Frontline's number one priority is capturing data; updating windows is secondary. However, updating windows still takes a certain amount of processor time, and may cause Frontline to lose data while the window is being updated. Some windows require more processing time than others, because the information being displayed in them is constantly changing. Refrain from displaying data live in the Event Display and Frame Display windows. Try closing the Breakout Box and Statistics windows. Frontline can capture data with no windows other than the Control window open.
- Increase the value of the window refresh rate for any windows you have open while capturing data. This decreases the frequency of window updates, leaving more time for capturing data. Changing the refresh rate can be done from the Options screen in each window.
- If you suspect or know that your circuit has control signals that are changing very rapidly, go to the Hardware Settings window and choose to Disable Control Signal Interrupts. This prevents Frontline from capturing control signal changes on an interrupt basis, giving more time for capturing byte data. (You can use the counters in the Breakout Box to help determine if a control signal is changing quickly.) Frontline still notes the state of the control signals whenever a byte is captured. You must restart Frontline for this change to take effect.
- Close all other programs that are working while Frontline is running. Refrain from doing searches in the Event Display window or other processor intensive activities while Frontline is capturing data.
- Timestamping takes up processor time, primarily not in timestamping the data, but in writing the timestamp to the buffer or file. Try turning off timestamping from the [Timestamping Options](#) window.

- Change the size of the driver buffer. This value is changed from the Advanced System Settings. Go to the Control Window and choose System Settings from the Options menu. Click on the Advanced button. Find the value labeled Driver Receive Buffer Size in Operating System Pages. Take the value listed there and double it.

NOTE: This procedure might help buffer overflow errors, but does not help overrun errors.

- Slow down the speed of the communications circuit, if possible.

If you are still experiencing overruns and/or buffer overflows after trying all of the above options, then you may need to use a faster PC.

6.2.2 Progress Bars

The analyzer uses progress bars to indicate the progress of a number of different processes. Some progress bars (such as the filtering progress bar) remain visible, while others are hidden.

The title on the progress bar indicates the process underway.

6.2.3 Event Numbering

This section provides information about how events are numbered when they are first captured and how this affects the display windows in the analyzer. The information in this section applies to frame numbering as well.

When the analyzer captures an event, it gives the event a number. If the event is a data byte event, it receives a byte number in addition to an event number. There are usually more events than bytes, with the result is that a byte might be listed as Event 10 of 16 when viewing all events, and Byte 8 of 11 when viewing only the data bytes.

The numbers assigned to events that are wrapped out of the buffer are not reassigned. In other words, when event number 1 is wrapped out of the buffer, event number 2 is not renumbered to event 1. This means that the first event in the buffer may be listed as event 11520 of 16334, because events 1-11519 have been wrapped out of the buffer. Since row numbers refer to the event numbers, they work the same way. In the above example, the first row would be listed as 2d00 (which is hex for 11520.)

The advantage of not renumbering events is that you can save a portion of a capture file, send it to a colleague, and tell your colleague to look at a particular event. Since the events are not renumbered, your colleague's file use the same event numbers that your file does.

6.2.4 Ring Indicator

The following information applies when operating the analyzer in **Spy** mode or **Source DTE, No FTS Cables** mode. When using the cables supplied with the analyzer to capture or source data, Ring Indicator (RI) is routed to a different pin which generates interrupts normally.

There is a special case involving Ring Indicator and computers with 8250 UARTs or UARTs from that family where the state of RI may not be captured accurately. Normally when a control signal changes state from high to low or low to high, an interrupt is generated by the UART, and the analyzer goes to see what has changed and record it. Ring Indicator works a little differently. An interrupt is generated when RI changes from high to low, but not when RI changes from low to high. If Ring Indicator changes from low to high, the analyzer does not know that RI has changed state until another event occurs that generates an interrupt. This is simply the way the UART works, and is not a deficiency in the analyzer software.

To minimize the chance of missing a Ring Indicator change, the analyzer polls the UART every millisecond to see if RI has changed. It is still possible for the analyzer to miss a Ring Indicator change if RI and only RI changes state more than once per millisecond.

UARTs in the 8250 family include 8250s, 16450s, 16550s and 16550 variants. If you have any questions about the behavior of your UART and Ring Indicator, please [contact technical support](#).

6.2.5 RS-232 Pin-outs

Table 6.1 - 25-Pin Connector Pins

Pin	Name	Abbreviation
1	Frame Ground	FG
2	Transmit Data	TxD
3	Receive Data	RxD
4	Request To Send	RTS
5	Clear to Send	CTS
6	Data Set Ready	DSR
7	Signal Ground	GND
8	Carrier Detect	CD or DCD
20	Data Terminal Read	DTR
22	Ring Indicator	RI

Table 6.2 - 9-Pin Connector Pins

Pin	Name	Abbreviation
1	Carrier Detect	CD or DCD
2	Receive Data	RxD
3	Transmit Data	TxD
4	Data Terminal Ready	DTR
5	Signal Ground	GND
6	Data Set Ready	DSR
7	Request To Send	RTS
8	Clear To Send	CTS
9	Ring Indicator	RI

6.2.6 Useful Character Tables

6.2.6.1 ASCII Codes

hex	x0	x1	x2	x3	x4	x5	x6	x7	x8	x9	xA	xB	xC	xD	xE	xF
0x	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
1x	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
2x	SP	!	"	#	\$	%	&	'	()	*	+	,	-	.	/
3x	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4x	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5x	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_
6x	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7x	p	q	r	s	t	u	v	w	x	y	z	{		}	~	DEL

6.2.6.2 Baudot Codes

DEC	HEX	LETTERS	FIGURES
0	00	BLANK (NUL)	BLANK (NUL)
1	01	E	3
2	02	LF	LF
3	03	A	-
4	04	SP	SP
5	05	S	BEL
6	06	I	8
7	07	U	7
8	08	CR	CR
9	09	D	\$
10	0A	R	4
11	0B	J	'
12	0C	N	,
13	0D	F	!
14	0E	C	:
15	0F	K	(
16	10	T	5
17	11	Z	"
18	12	L)
19	13	W	2
20	14	H	#
21	15	Y	6
22	16	P	0
23	17	Q	1
24	18	O	9
25	19	B	?
26	1A	G	&
27	1B	FIGURES	FIGURES
28	1C	M	.
29	1D	X	/
30	1E	V	;
31	1F	LETTERS	LETTERS

6.2.6.3 EBCDIC Codes

hex	x0	x1	x2	x3	x4	x5	x6	x7	x8	x9	xA	xB	xC	xD	xE	xF
0x	NUL	SOH	STX	ETX	PF	HT	LC	DEL			SMM	VT	FF	CR	SO	SI
1x	DLE	DC1	DC2	TM	RES	NL	BS	IL	CAN	EM	CC	CU1	IFS	IGS	IRS	IUS
2x	DS	SOS	FS		BYP	LF	ETB	ESC			SM	CU2		ENQ	ACK	BEL
3x			SYN		PN	RS	UC	EOT				CU3	DC4	NAK		SUB
4x	SP											.	<	(+	
5x	&											\$	*)	:	^
6x	-	/										.	%	-	>	?
7x											:	#	@	'	=	"
8x		a	b	c	d	e	f	g	h	i						
9x		j	k	l	m	n	o	p	q	r						
Ax		~	s	t	u	v	w	x	y	z				[
Bx]		
Cx	{	A	B	C	D	E	F	G	H	I						
Dx	}	J	K	L	M	N	O	P	Q	R						
Ex	\		S	T	U	V	W	X	Y	Z						
Fx	0	1	2	3	4	5	6	7	8	9						

6.2.6.4 Communication Control Characters

Listed below in alphabetical order are the expanded text meanings for common ANSI communication control characters, and two-character system abbreviation for each one. Some abbreviations have forward slash characters between the two letters. This is to differentiate the abbreviations for a control character from a hex number. For example, the abbreviation for Form Feed is listed as F/F, to differentiate it from the hex number FF.

Table 6.3 - Communications Control Characters

Abbreviation	Control Character	Text
AK	ACK	Acknowledge
BL	BEL	Bell
BS	BS	Backspace
CN	CAN	Cancel
CR	CR	Carriage Return
D/1-4	DC1-4	Device Control 1-4
D/E	DEL	Delete
DL	DLE	Data Link Escape
EM	EM	End of Medium
EQ	ENQ	Enquiry
ET	EOT	End of Transmission
E/C	ESC	Escape
E/B	ETB	End of Transmission Block
EX	ETX	End of Text
F/F	FF	Form Feed

Table 6.3 - Communications Control Characters(continued)

Abbreviation	Control Character	Text
FS	FS	File Separator
GS	GS	Group Separator
HT	HT	Horizontal Tabulation
LF	LF	Line Feed
NK	NAK	Negative Acknowledge
NU	NUL	Null
RS	RS	Record Separator
SI	SI	Shift In
SO	SO	Shift Out
SH	SOH	Start of Heading
SX	STX	Start of Text
SB	SUB	Substitute
SY	SYN	Synchronous Idle
US	US	Unit Separator
VT	VT	Vertical Tabulation

6.3 DecoderScript Overview

The main purpose of this manual is to describe DecoderScript™, the language used in writing decoders. DecoderScript allows you to create new decoders or modify existing decoders to expand the functionality of your ComProbe protocol analyzer. DecoderScript displays protocol data, checks the values of fields, validates checksums, converts and combines field values for convenient presentation. Decoders can also be augmented with custom C++-coded functions, called "methods", to extend data formatting, validation, transformations, and so on.

A decoder defines field-by-field how a protocol message can be taken apart and displayed. The core of each "decoder" is a program that defines how the protocol data is broken up into fields and displayed in the Frame Display window of the analyzer software.

This manual provides instruction on how to create and use custom decoders. When reading the manual for the first time, we encourage you to read the chapters in sequence. The chapters are organized in such a way to introduce you to DecoderScript writing step- by- step.

Screenshots of the ComProbe protocol analyzer have been included in the manual to illustrate what you see on your own screen as you develop decoders. But you should be aware for various reasons, the examples may be slightly different from the ones that you create. The differences could be the result of configuration differences or because you are running a newer version of the program. Do not worry if an icon seems to be missing, a font is different, or even if the entire color scheme appears to have changed. The examples are still valid.

Examples of decoders, methods, and frame recognizers are included in this manual. You can cut and paste from these examples to create your own decoders.

These files are installed in the FTE directory of the system Common Files directory. The readme file in the root directory of the protocol analyzer installation contains a complete list of included files. Most files are located in My Decoders and My Methods.

We will be updating our web site with new and updated utilities, etc, on a regular basis and we urge decoder writers to check there occasionally.

Contacting Frontline Technical Support

Technical support is available in several ways. The online help system provides answers to many user related questions. Frontline's website has documentation on common problems, as well as software upgrades and utilities to use with our products.

On the Web: <http://fte.com/support/supportrequest.aspx>

Email: tech_support@fte.com

If you need to talk to a technical support representative about your NetDecoderAsync, support is available between 9 am and 5 pm, U.S. Eastern Time zone, and between 9 am and 5 pm, Pacific Time zone, on Monday through Friday. Technical support is not available on U.S. national holidays.

Phone: +1 (434) 984-4500

Fax: +1 (434) 984-4505

Instructional Videos

Teledyne LeCroy provides a series of videos to assist the user and may answer your questions. These videos can be accessed at fte.com/support/videos.aspx. On this web page use the **Video Filters** sidebar to select instructional videos for your product.