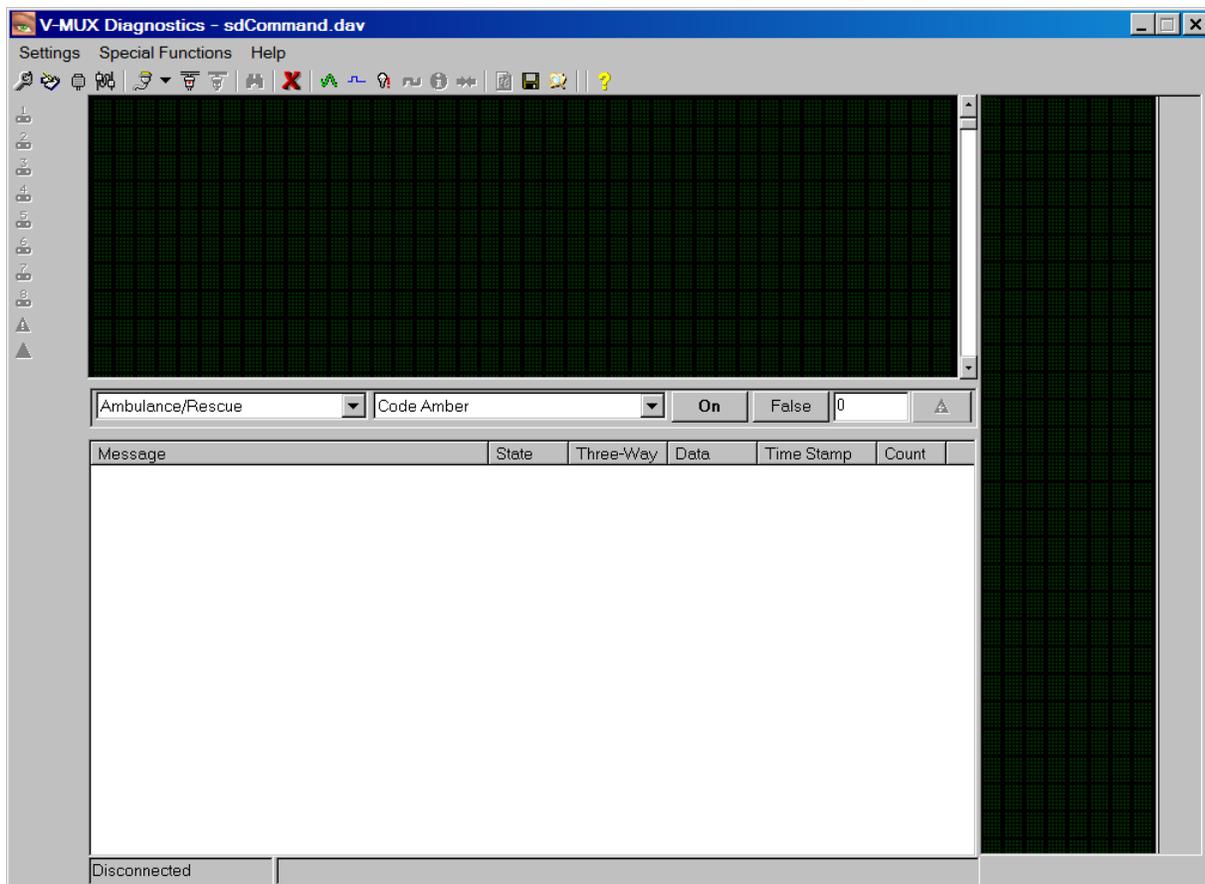




**WELDON**  
A DIVISION OF AKRON BRASS



# V-MUX<sup>®</sup> Diagnostics

User Manual , September 2012

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## **General Computer Requirements:**

A Microsoft Windows® based computer host. Non-Windows computers are not supported.

Computer Operating System: Microsoft Windows 2000®, XP®, Vista, Windows 7.

NOTE: V-MUX® Diagnostics may be incompatible with the Windows 95, 98, ME, or Windows NT computer operating systems due to USB hardware support issues. These versions are not recommended.

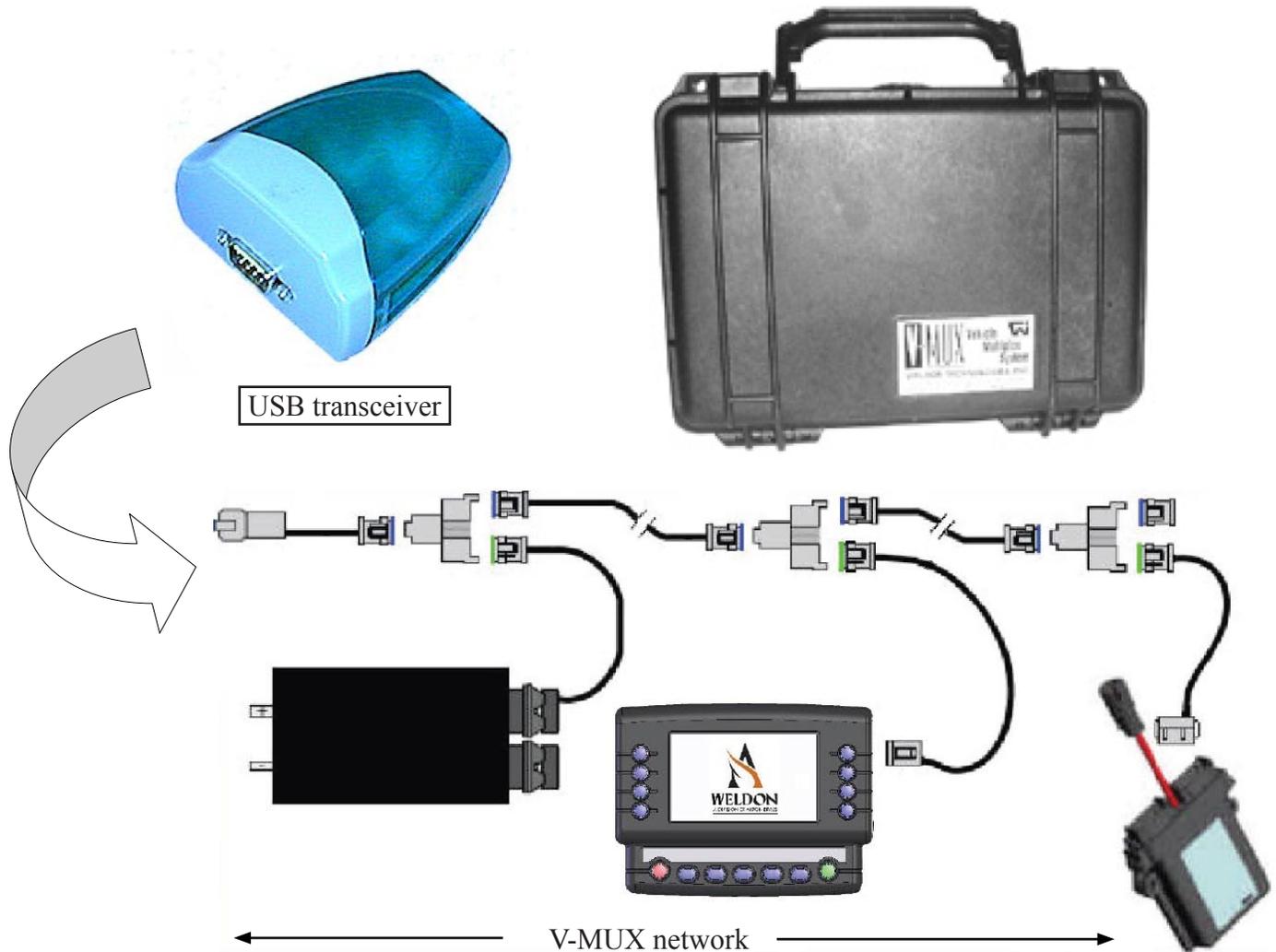
Computer hardware requirements (minimums):

- 900 MHz processor speed.
- 512 MByte RAM memory.
- 100 MByte free hard drive space.
- USB port.

## #6131 V-MUX Diagnostics and Downloader Kit:

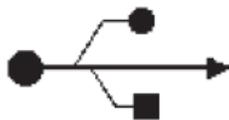
The full V-MUX kit includes USB transceiver, USB cable (to computer), hook-up cable (to vehicle), direct adapters for individual V-MUX nodes, tools, software, and carry case.

All earlier kits using an RS-232 serial port plug-in are obsolete. Contact Weldon for upgrade if necessary.



### USB Transceiver software set-up:

A one-time USB driver set-up is required to operate this kit with a computer. See page 8.



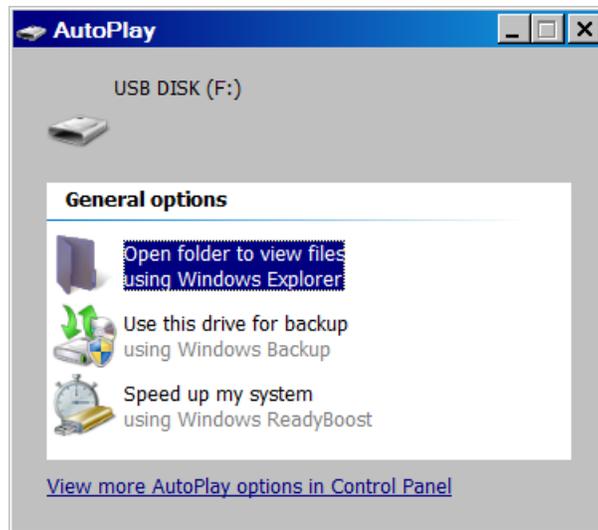
TIP: Look for the official USB logo to identify and locate the USB port on the computer.

## Installing V-MUX Diagnostics software:

### Installing the Diagnostics software from the 6131 kit USB memory stick:

Insert the included software memory stick drive into the computer's USB port. Windows will assign to it a "removable storage" drive letter of "E:", "F:", ...

Once the memory stick is recognized by the computer and assigned a drive letter, a pop-up window will allow a selection of "Open folder to view files". Open the folder and then the top-level folder (named "0S90-2118-00" or similar).



The Diagnostics installation program is located in a sub-folder named "Diagnostics" or similar:

VMUXDiagnostics142\_Install.exe

This file is the automated software installer for current version 1.4.2.

The Windows Installation Wizard will begin. Follow all prompts.

Once Diagnostics is installed, Windows will assign it an icon link on the Start Menu

**Start ➔ All Programs ➔ V-MUX Software ➔ V-MUX Diagnostics**

The installed path to the Diagnostics program is by default:

**C:\Program Files\V-MUX Software\V-Mux Diagnostics\V-MUX Diagnostics.exe**

It is best to keep this path as is.

## Where to find V-MUX Diagnostics software:

V-MUX software updates are available for free from Akron Brass/Weldon's on-line V-MUX support page:

<http://www.akronbrass.com/weldon-v-mux-downloads>

also from the Weldon homepage at  
[www.weldoninc.com](http://www.weldoninc.com) or [www.v-mux.com](http://www.v-mux.com)

1. Select the tabbed link "Vehicle Electronics"
2. In the pop-up window select "Resources: V-MUX Software Updates"

The screenshot shows the Weldon website navigation bar with links for Home, About Us, Customer Support, Application Solutions, English, My Account, and My Cart. The Weldon logo is on the left, and a LIVE CHAT button with the phone number 1.800.228.1161 is on the right. Below the navigation bar is a search bar with a SEARCH button. A horizontal menu contains categories: Nozzles, Monitors, Valves, Lighting, Vehicle Electronics, Reels, and More Products. The 'Vehicle Electronics - V-Mux' category is selected, leading to a page titled 'V-MUX Software Updates & Downloads'. The page content includes a sub-header 'Node Operating System Files' and a note: 'Note: V-MUX Downloader v6.2.3 now uses My Documents/V-MUX as default path for OS files.' Below this is a table with columns: File, Version, Updated, and Description.

File	Version	Updated	Description
<a href="#">vmii.bin</a>	v2.09	05/03/2012	Hercules Operating System <a href="#">Release Notes</a>
<a href="#">vm6030.bin</a>	v1.03	03/14/2011	8x16 Operating System <a href="#">Release Notes</a>
<a href="#">vmmii.bin</a>	v2.09	04/12/2010	Mini 4x12 Operating System <a href="#">Release Notes</a>

"V-MUX PC Software" will be the fourth category down from the top of the support page.

The screenshot shows the 'V-MUX PC Software' page. The title 'V-MUX PC Software' is circled in black with a callout line pointing to the text above. Below the title is a table with columns: File, Version, Updated, and Description.

File	Version	Updated	Description
<a href="#">VMUXDiagnostics142_Install.exe</a>	v1.4.2	07/14/2010	V-MUX Diagnostics Software <a href="#">Release Notes</a>
<a href="#">VMUXDownloader623_Install.exe</a>	v6.2.3	05/24/2011	V-MUX Downloader v6.2.3 *OS Files not included* <a href="#">Release Notes</a>
<a href="#">VMuxDownloader.zip</a>	v5.05	05/24/2004	V-MUX Downloader For 98 Trucks *OS Files not included*

## Installing V-MUX Diagnostics software:

### First-time only USB driver set-up:



The first time the V-MUX USB transceiver box is plugged into the computer, the Windows Hardware Wizard will recognize it as a new device and install the necessary USB driver software. Appendix A of this manual reviews the driver installation process.

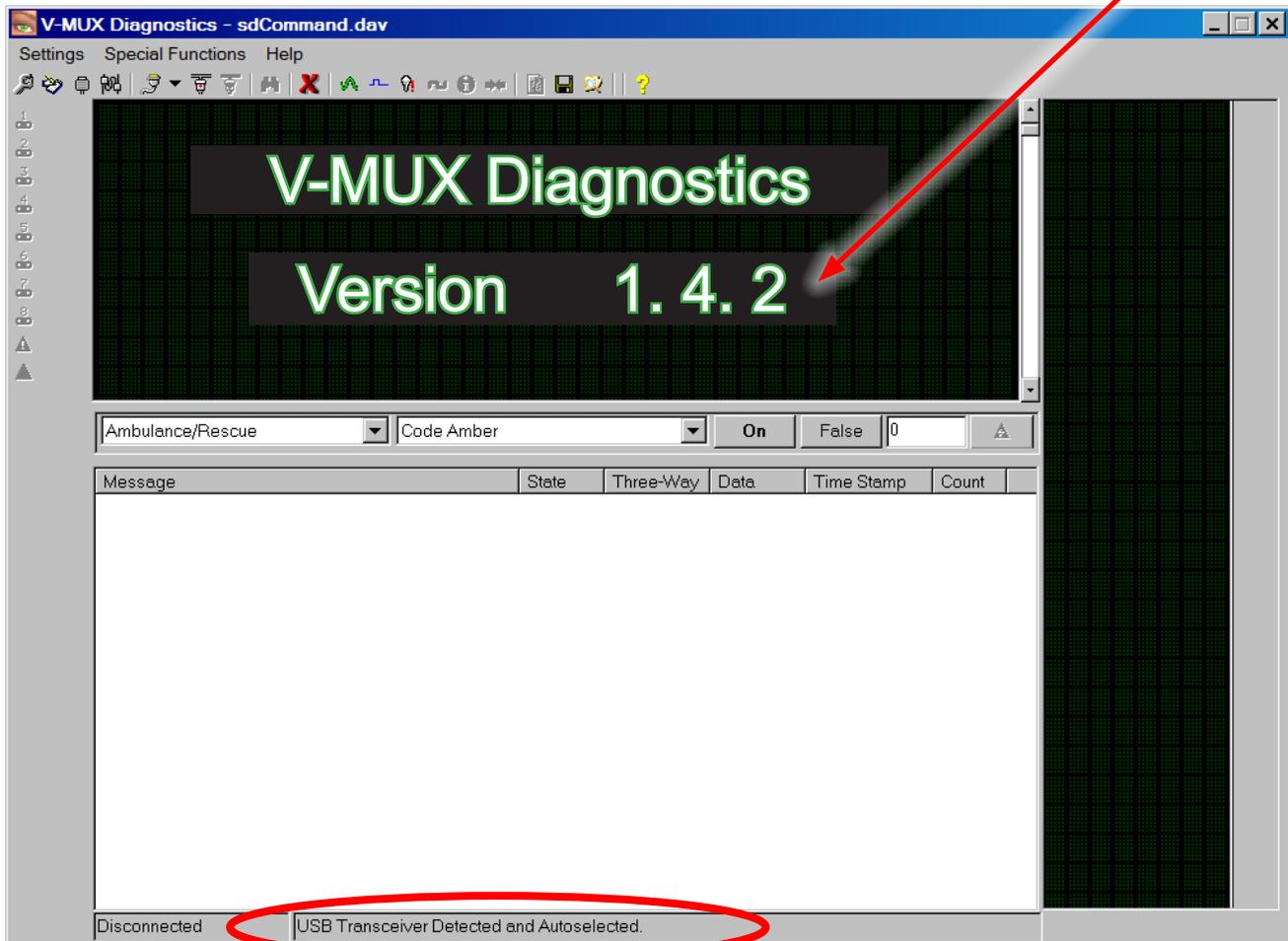
Additionally, the document “**USB Transceiver Setup.pdf**” covers driver installation in even greater detail. It is available on the install medium (disk or USB memory stick) and also from the Weldon on-line V-MUX support page in the “Manuals” section.

### Verifying the USB driver installation:

- 1) Plug the provided USB cable into both the V-MUX transceiver and the computer’s USB port
- 2) Start the V-MUX Diagnostics program (after the transceiver is plugged in) from the standard Start button path:

**Start - All Programs - V-MUX Software - V-MUX Diagnostics:**

- 3) Diagnostics will open as a compact dialogue interface. The interface window is not resizable. The latest software version is 1.4.2.



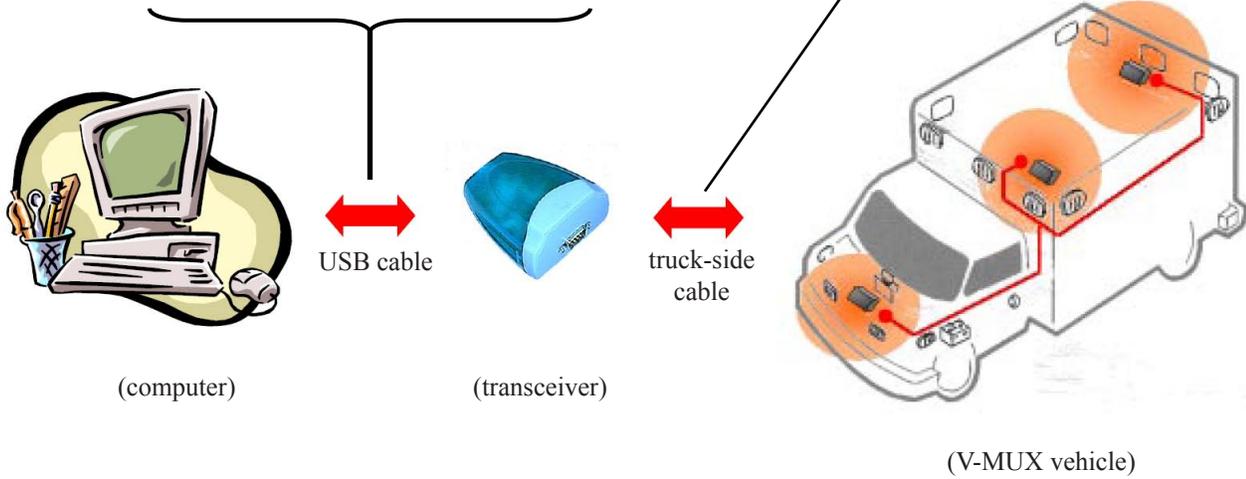
- 4) Verify that “**USB Transceiver Detected and Autoselected**” is indicated at bottom.

If the USB transceiver is not detected, exit the Diagnostics program completely, unplug the USB cable and repeat from step 1. Review “**USB Transceiver Setup.pdf**” for step-by-step troubleshooting help.

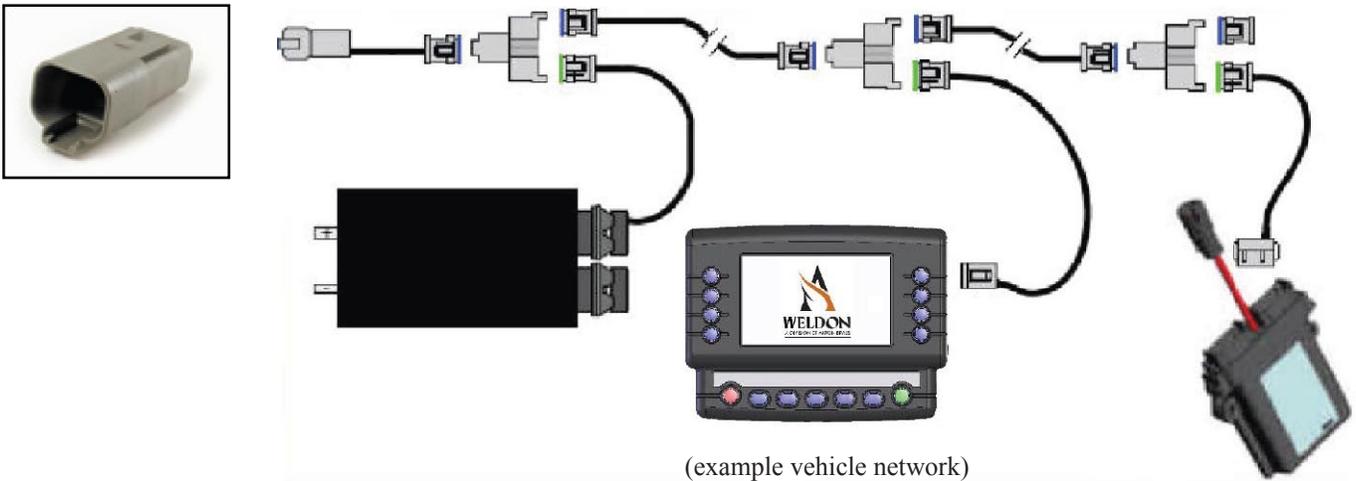
## Connecting V-MUX Diagnostics:

Connect the V-MUX truck-side cable. The 9-pin end of the cable connects into the transceiver box. The 4-pin end of the cable connects to the vehicle network port. See vehicle OEM instructions for the network port location.

Connect the V-MUX transceiver box and USB cable into the computer's USB port.



(vehicle network tap)



## Screen Layout --

## Overall View

The Diagnostics interface window is divided into six specialized working areas:

- 1) The **Settings and Toolbar area** -- connection tools and optional features are accessed here.
- 2) The **Active Node list** -- enables Diagnostics to focus its resources on particular V-MUX nodes in a 1-32 node network.
- 3) The **Primary Information area** -- detailed V-MUX information from nodes and sensors is presented here.
- 4) The **Command editor** -- enables Diagnostics to send virtual V-MUX messages into an active network. ("Action Area")
- 5) The **Active Message list** -- shows in real-time all active messages on the V-MUX system network.
- 6) The **Secondary Information area** -- shows additional V-MUX activity being reported on the network

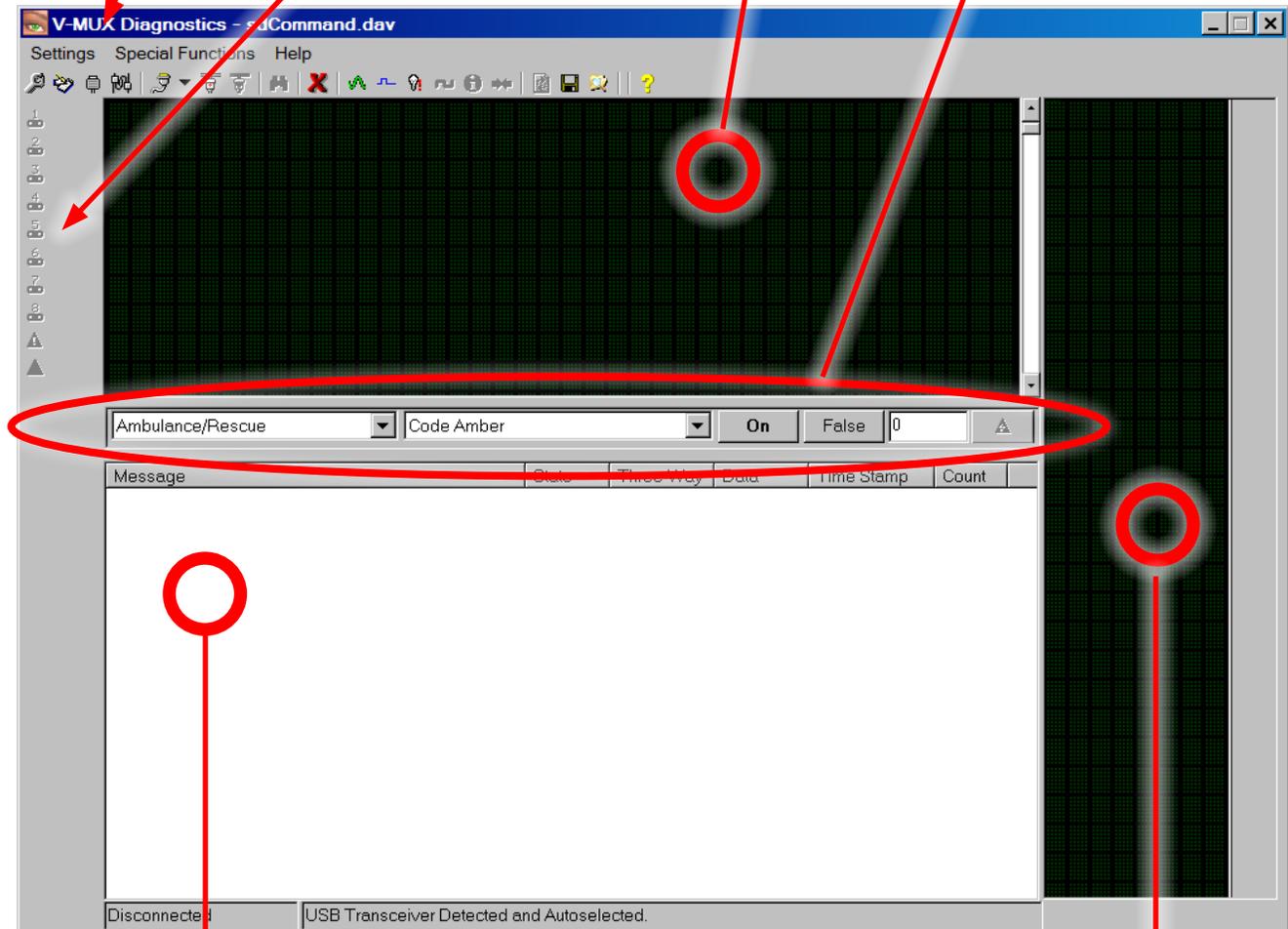
### 3) Primary Information

- Sensor data
- Node program memory listings
- Node Input/Output listing

### 1) Settings and Toolbar area

### 2) Active node list (1-32)

### 4) Command editor "Action Area"



### 5) Active Message list

### 6) Secondary information

- V-MUX Sync flag
- Communications health
- Load shed report

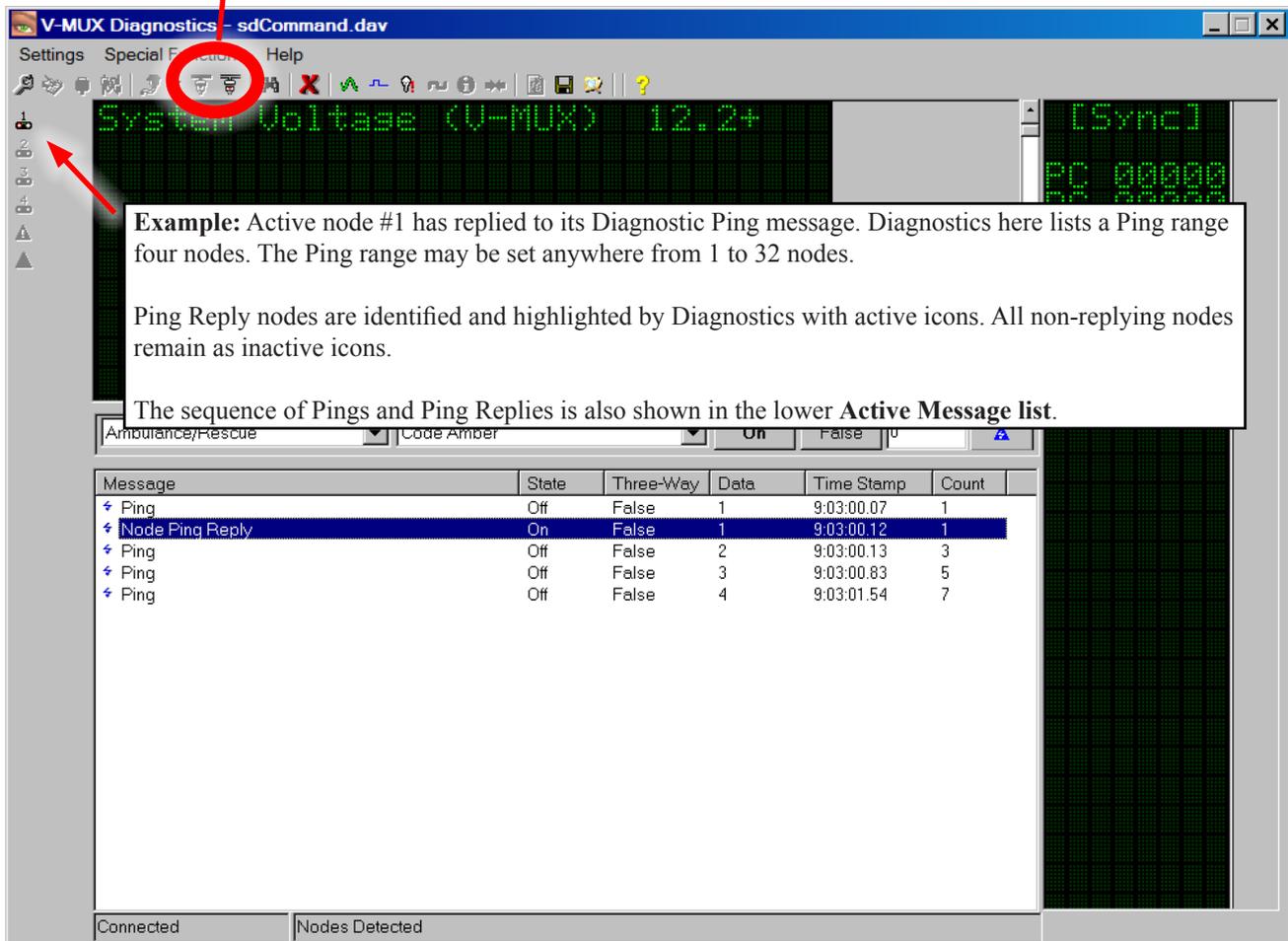
## Screen Layout --

## Connect to a live V-MUX System

Click on the “Connect”  toolbar icon. This is the sixth tool from the left.

**TIP:** If the mouse cursor is allowed to hover over each icon, a brief description of the tool function will appear in a text box. All toolbar functions are defined in the Toolbar section of this manual (Page 20)

Upon connection, nodes in the live V-MUX system will be recognized by Diagnostics through a series of automatic **Pings** and **Node Ping Replies**. All nodes which Diagnostics identifies as having replied to their Pings will be listed with an active icon in the **Active node list** along the left side.



**Example:** Active node #1 has replied to its Diagnostic Ping message. Diagnostics here lists a Ping range four nodes. The Ping range may be set anywhere from 1 to 32 nodes.

Ping Reply nodes are identified and highlighted by Diagnostics with active icons. All non-replying nodes remain as inactive icons.

The sequence of Pings and Ping Replies is also shown in the lower **Active Message list**.

Message	State	Three-Way	Data	Time Stamp	Count
⚡ Ping	Off	False	1	9:03:00.07	1
⚡ Node Ping Reply	On	False	1	9:03:00.12	1
⚡ Ping	Off	False	2	9:03:00.13	3
⚡ Ping	Off	False	3	9:03:00.83	5
⚡ Ping	Off	False	4	9:03:01.54	7

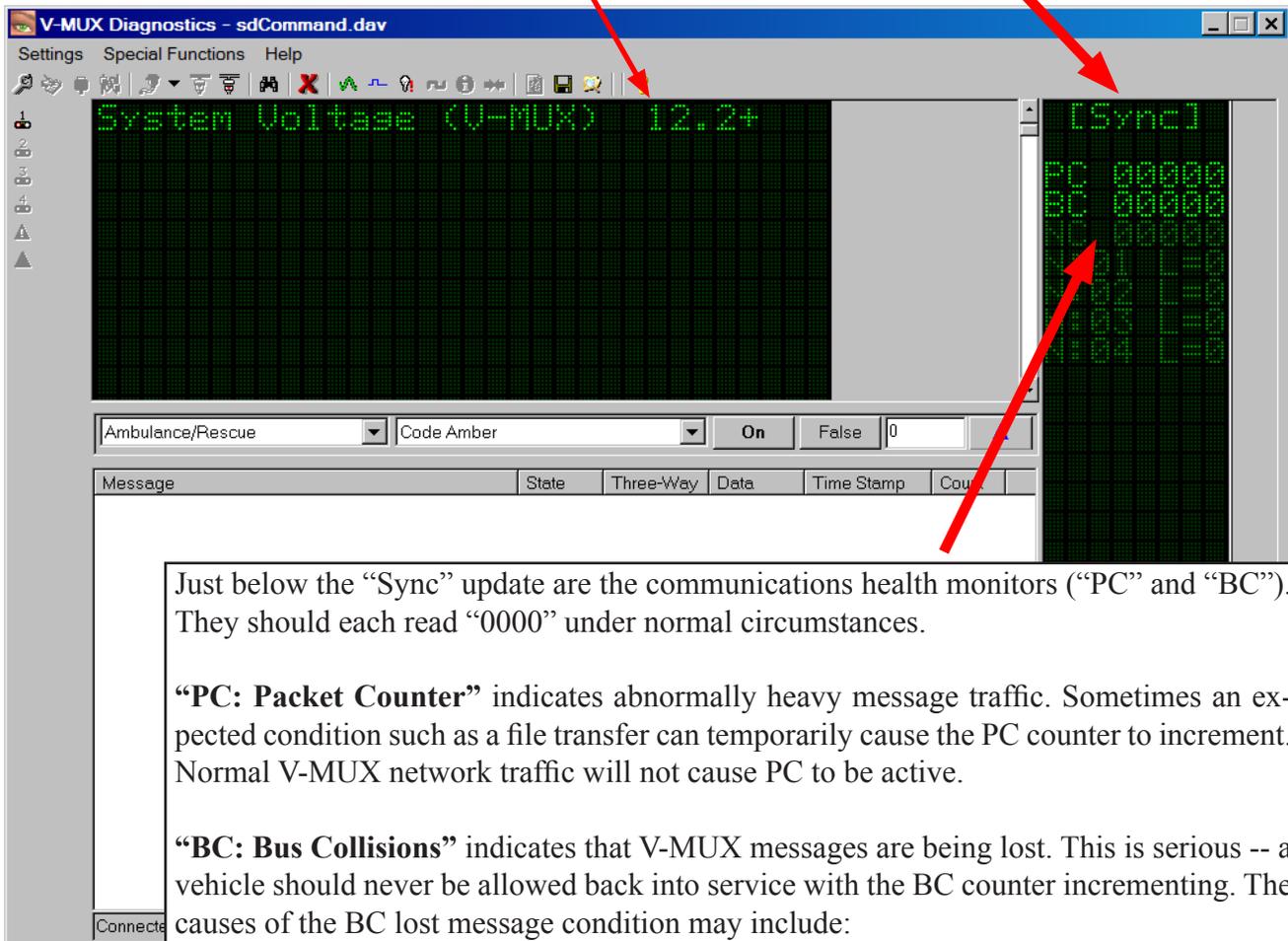
If no replies are seen, try manually pinging the live System with the “Detect Active Nodes”  icon (Tool 8). If nothing still happens, check the physical cable hook-up and the USB port selection.

The Primary information area initially displays sensor data from all nodes in the vehicle. If any node uses a sensor analog input, that data will report in here. The sensor data is continuously updated in real-time as the nodes collect new measurements -- usually every several seconds, but sometimes as fast as twice a second. The System Voltage is always sent from node #1 in a V-MUX network.

Node 1 generates a “Synchronize” [SYNC] message and repeats it continuously about every 4 seconds. The purpose of the synchronize command is twofold:

- 1) It coordinates warning light flash patterns between separate nodes so that alternating ON/OFF lights are precisely synchronized with each other.
- 2) It indicates that network data traffic is transmitting normally. If any node fails to hear the “SYNC” it will repeatedly transmit a distress message: “VM\_OUT\_OF\_NETWORK”.

“Synchronize” message  
(from Node 1)



Just below the “Sync” update are the communications health monitors (“PC” and “BC”). They should each read “0000” under normal circumstances.

“PC: Packet Counter” indicates abnormally heavy message traffic. Sometimes an expected condition such as a file transfer can temporarily cause the PC counter to increment. Normal V-MUX network traffic will not cause PC to be active.

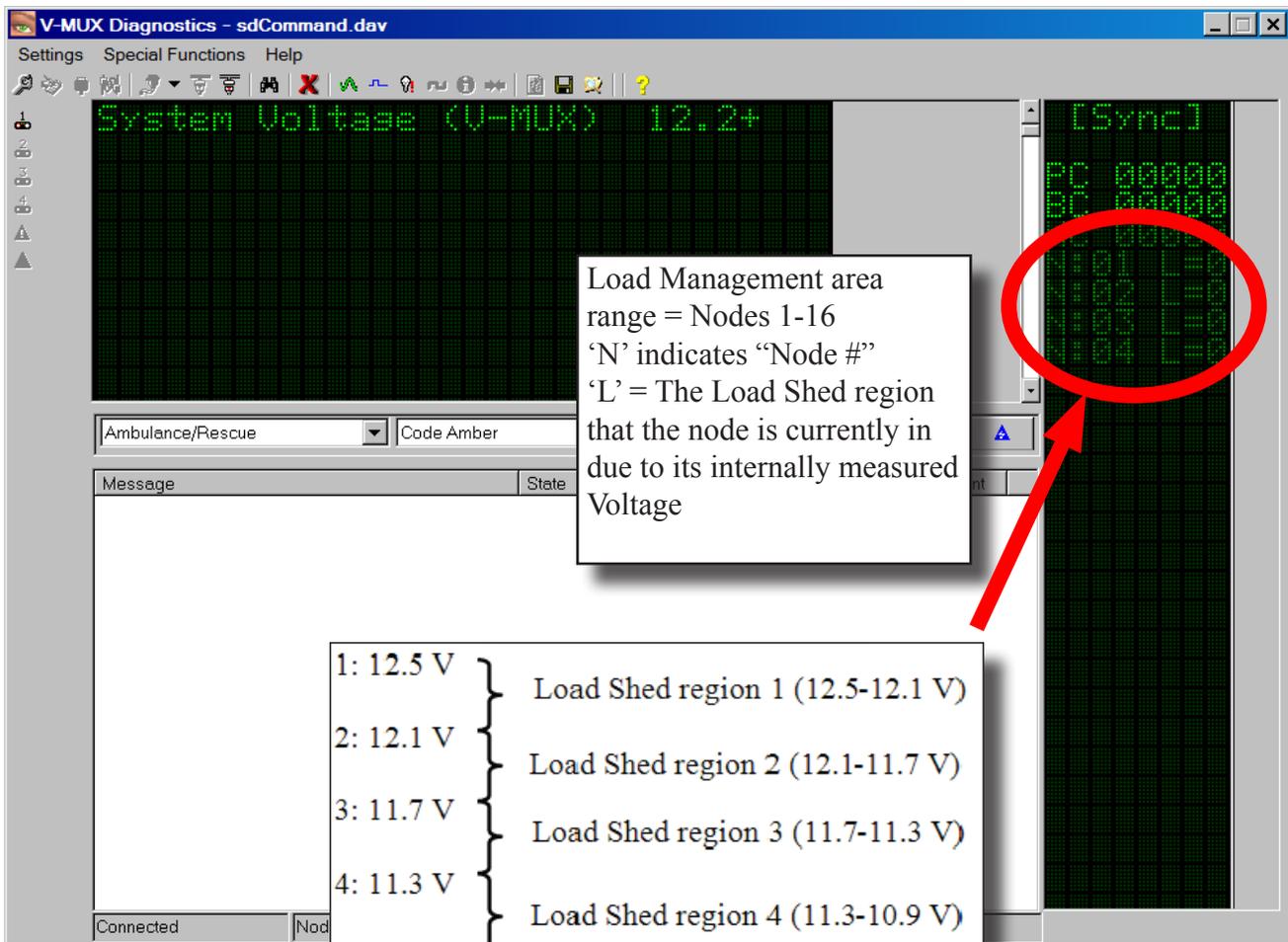
“BC: Bus Collisions” indicates that V-MUX messages are being lost. This is serious -- a vehicle should never be allowed back into service with the BC counter incrementing. The causes of the BC lost message condition may include:

- Water in the communications line, especially the network junctions.
- A loose connection within the twisted-pair network cable assembly
- A reversed hook-up at one of the twisted-pair links.
- A wire fault such as a short to ground or to another wire.

The vehicle designer is able to set Load Management, also known as Load Shedding, for each node's output channels individually. The basis of load management is the internally measured voltage at the particular node; in other words, the node that is controlling the output channel.

Load Shedding voltage thresholds begin at 12.5 Volts and continue downwards in increments of 0.4 Volts (12.1 Volts, 11.7 Volts, etc...). Each threshold is numbered (1-8) and defines a Load Shed region 0.4 Volts wide. If a node continues to lose voltage it will enter each of the eight defined regions, as shown below. The node reports to the network each time it passes a voltage threshold. This threshold number is what is indicated in the Load Management area of Diagnostics with "L=\_ " for each node.

An indication of L=0 means that the node voltage level is above the 12.5 V threshold or that no load shed message has yet been sent from the node.



Load Management area  
range = Nodes 1-16  
'N' indicates "Node #"  
'L' = The Load Shed region  
that the node is currently in  
due to its internally measured  
Voltage

1: 12.5 V	}	Load Shed region 1 (12.5-12.1 V)
2: 12.1 V		
3: 11.7 V	}	Load Shed region 2 (12.1-11.7 V)
4: 11.3 V		
5: 10.9 V	}	Load Shed region 3 (11.7-11.3 V)
6: 10.5 V		
7: 10.1 V	}	Load Shed region 4 (11.3-10.9 V)
8: 9.7 V		
	}	Load Shed region 5 (10.9-10.5 V)
	}	Load Shed region 6 (10.5-10.1 V)
	}	Load Shed region 7 (10.1-9.7 V)

## Screen Layout –

## The Message List area

All V-MUX network activity is listed in the lower Active Message List area. By default all messages are displayed from top-down as they are received.

In the example shown here, we see that the switch message from **Door Cab Left** has turned ON and OFF. The current switch state is always shown on the lowest line.

Message	State	Three-Way	Data	Time Stamp	Count
↔ Ping	Off	False	1	9:03:00.07	1
↔ Node Ping Reply	On	False	1	9:03:00.12	1
↔ Ping	Off	False	2	9:03:00.13	3
↔ Ping	Off	False	3	9:03:00.83	5
↔ Ping	Off	False	4	9:03:01.54	7
🚗 Door Cab Left	On	False	1	10:10:19.51	1
🚗 Door Cab Left	Off	False	1	10:10:23.46	3

The real-time ON/OFF state is indicated two ways -- with icons ( 🚗, 🚗 ) to the immediate left of any switch message and also with the text “On”/”Off” listed in the **State** column to the immediate right of any switch message. In some messages, like the Pings shown above, the switch state is not meaningful and so the State column can be ignored. Notice that the icons to the left of the Ping/Reply messages are System ( ↔ ) icons. They do not indicate ON/OFF.

The **Three-Way** column is available in case two independent switches are both programmed to issue the same Command. This would be the case, for example, if a vehicle light were to operate from both a forward and a rear switch. Any change in state of either switch would toggle the state of the light. To keep track of the two switches, the Three-Way flag (True/False) becomes necessary. Most of the time such a set-up is not used and so the Three-Way column “True”/”False” is ignored. “False” is the default.

## Screen Layout –

## The Message List area

In the Active Message List area, the first four columns (**Message**, **State**, **Three-Way**, **Data**) show information that is carried within each V-MUX message packet on the network. The last two columns, **Time Stamp** and **Count**, only show information put onto the screen by the Diagnostics program after the message has been read.

**Time Stamp** shows the Diagnostics clock reading associated with the arrival of the message (based on the start of the computer clock's day at midnight). **Count** keeps a tally of each change in a messages state since the Diagnostics program started.

Message	State	Three-Way	Data	Time Stamp	Count
🚗 Door Cab Left front	On	False	1	8:53:03.72	1
🚗 Door Cab Right front	On	False	1	8:53:12.59	1
🚗 Scene Left	On	False	2	8:53:59.72	1

The **Data** column usually indicates a V-MUX node number.

Data column can carry information beyond a simple node number, as shown below:

Message	State	Three-Way	Data	Time Stamp	Count
🚗 E Emergency Master	On	False	1	14:35:51.69	1
🚗 E Front Light Bar	On	False	0	14:35:56.13	1
🚗 E Grill Lights	On	False	0	14:36:05.43	1
🚗 E Front Intersection	On	False	0	14:36:23.87	1
🚗 E Warning Lts Front	On	False	0	14:36:58.43	1
🚗 E Warning Lts Rear	On	False	0	14:37:04.98	1
🚗 E Emergency Master	Off	False	0	14:37:13.50	3
🚗 E Front Light Bar	Off	False	0	14:37:18.57	3
🚗 E Grill Lights	Off	False	0	14:37:28.49	3
🚗 E Warning Lts Front	Off	False	0	14:37:35.06	3
🚗 E Warning Lts Rear	Off	False	0	14:37:41.39	3

### Example -- Command Sets and Free Commands in the Message List:

The Emergency Master switch is wired into node 1 as indicated in the Data column. In turn, an Emergency Master On/Off state triggers a Command Set from the same node 1 which sends out five more On/Off Commands:

	State	Data
• E Emergency Master	[On]	[1] ← '1' from node 1 Input
• E Front Light Bar	[On]	[0] ← '0' from node 1 Command Set
• E Grill Lights	[On]	[0]
• E Front Intersection	[On]	[0]
• E Warning Lights Front	[On]	[0]
• E Warning Lights Rear	[On]	[0]

For items originating from a node **Command Set** or a **Free Command** the Data column always indicates "0", no matter which node issues the Command.

Data

Door Switches	Door Cab Left	Off	False	0		
Message	State	Three-Way	Data	Time Stamp	Count	
Door Cab Left	On	False	1	14:46:35.88	1	
Door Cab Left	Off	False	1	14:47:09.49	3	
Door Cab Left	On	False	0	14:47:13.59	5	
Door Cab Left	Off	False	0	14:47:15.44	7	

**Example -- virtual Commands that originate from the Diagnostics program**

The Command “Door Cab Left” is first shown On and Off by way of node 1, as seen by the Data column “1”. The very same Command is again indicated On and Off but the Data column indicates “0”. This is because in this case the Message was sent from Diagnostics as a virtual Command. The value of “0” comes directly from the Data field in the Message editing area. Sending virtual Messages is described on the next page.

V-MUX Diagnostics - sdCommand.dav

Settings Special Functions Help

Four types of V-MUX messages display in the Active Message List:

- 1. Switched events** – A switch or button has changed state (ex: <Rear Scene> ON/OFF)
- 2. Logically triggered events** -- From Command Sets or Free Commands (ex: Emergency Master)
- 3. System events** – Requests and transfers of system information (ex: Ping)
- 4. Sensor triggers** – A sensor has passed some warning threshold (ex: “Low Voltage” warning)

It is possible to also display analog sensor data traffic and other messages in the Active Message List. Right-click in the Active Message List area to invoke a Message Options pop-up window. Check the “Show all messages” option for sensor data to be listed.

right-click to bring up this menu

Show all messages

Don't display duplicate commands

Display message data in Hex

**Message Options:** (3 options)

1) “Show all messages” – Shows sensor data in the Active Message List area. Not checked by default.

2) “Don't display duplicate messages” – Places Messages of the same Command to overlay the previous Message. Checked by default

3) “Display message data in Hex” – Switches the display of message Data so as to be shown in hexadecimal (base-16) instead of decimal (base-10). Hex format is used when interpreting error codes. Not checked by default

Disconnected USB Transceiver Detected and Autoselected

## Screen Layout –

## The Command Editor area

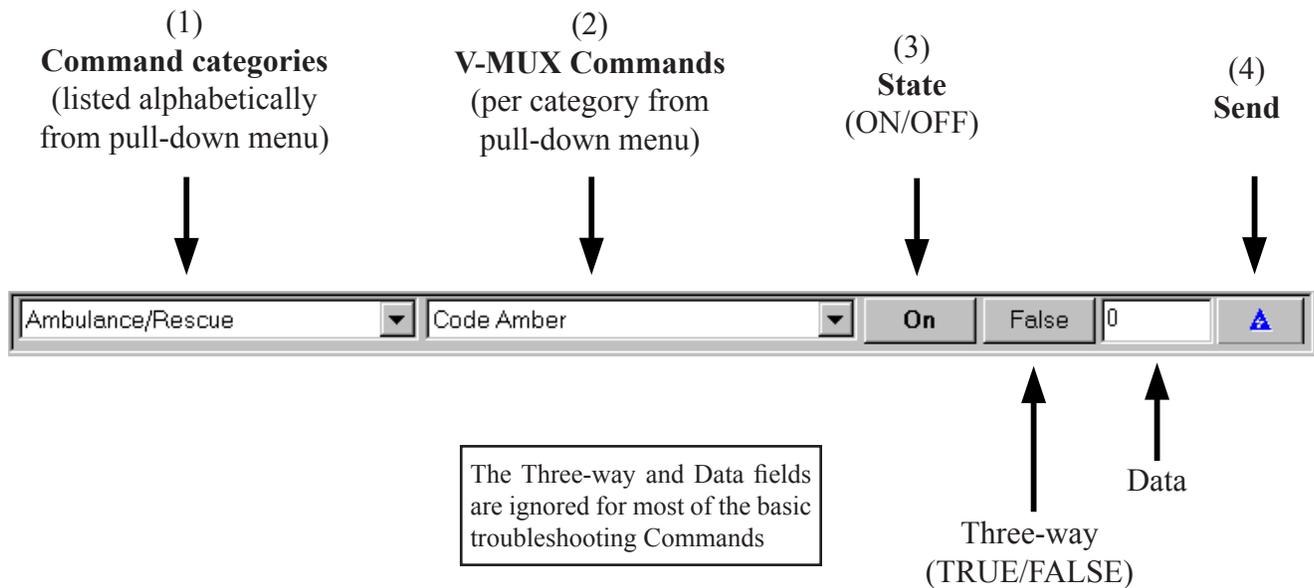
The Diagnostics Command Editor allows a V-MUX Command to be created and sent into a live system as a virtual command. The virtual command will act exactly as a normal command. Before sending virtual commands, make sure that the vehicle network is powered and Diagnostics is connected to it.

### To edit a message:

- 1) Select the Command Category (left pull-down menu)
- 2) Select the V-MUX Command (middle pull-down menu).
- 3) Set the state to ON or OFF as needed.

### To Send a message:

- 4) Click the blue triangle icon at the far right to Send the V-MUX message.



### Advanced message options -- **Three-way** and **Data**:

- When troubleshooting devices that operate from more than one switch, set the **Three-Way** field to 'True'. (Normally this field is ignored and may be left as 'False' .)
- Some tests will require that a **Data** field value be set. (Normally this field is ignored and may be left as '0')

Example -- We wish to test changes in brightness of a Vacuum Fluorescent (VFD) Display:

Send [Category = V-MUX, Command = VFD Luminance, State = ON, Three-Way FALSE, Data = 75]  
to dim the VFD two-line display to a 75% brightness level.

Send [Category = V-MUX, Command = VFD Luminance, State = ON, Three-Way FALSE, Data = 50]  
to dim the VFD two-line display to a 50% brightness level.

Send [Category = V-MUX, Command = VFD Luminance, State = ON, Three-Way FALSE, Data = 25]  
to dim the VFD two-line display to a 25% brightness level.

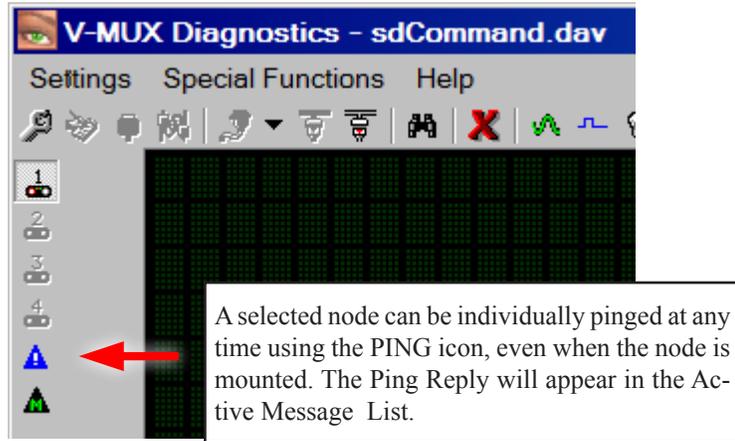
## Selecting and Mounting Nodes:

## Method 1

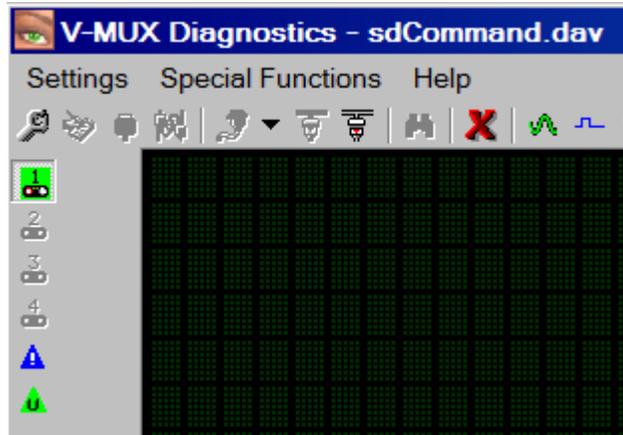
“Mounting” a V-MUX node allows Diagnostics to monitor and retrieve information from that specific node. In general the node should be selected and mounted as shown in steps 1 and 2.

1) Select the desired node from the live status bar on the left side.

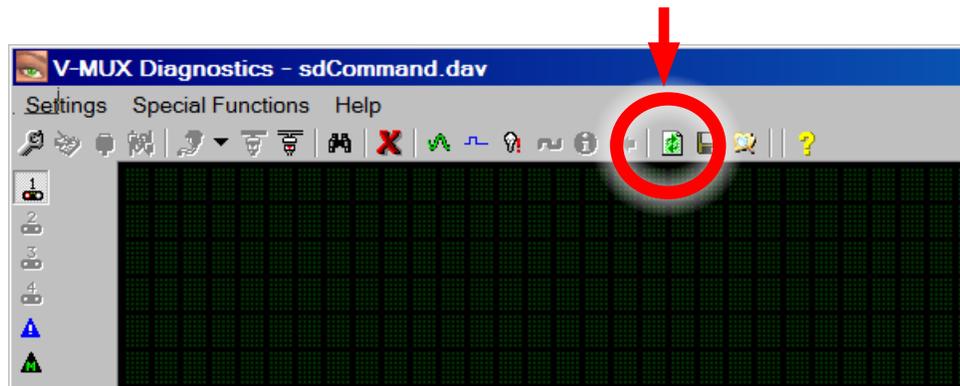
2) Click the **Mount** node icon at the bottom of the node status bar.



Once a node is mounted the icons for both the selected node and the Mount function turn GREEN. The M inside the lower icon becomes a U because the next time that icon is clicked, it will **Unmount** the selected node.



3) Click the “Retrieve Node Information” tool.



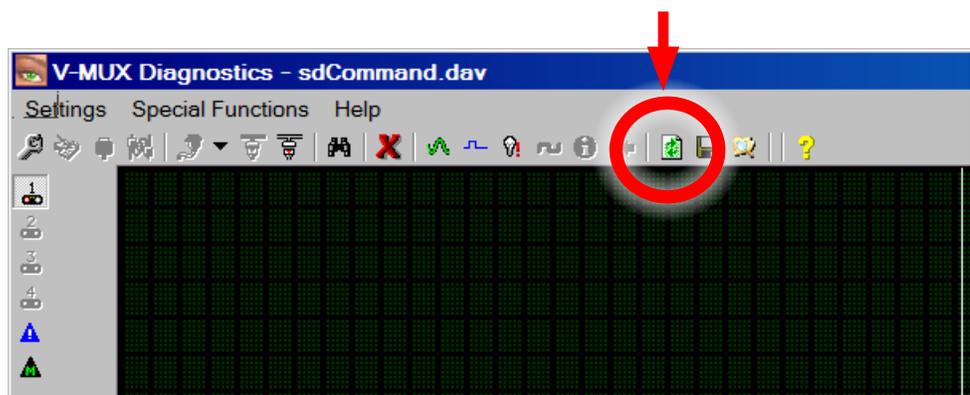
## Selecting and Mounting Nodes:

## Method 2

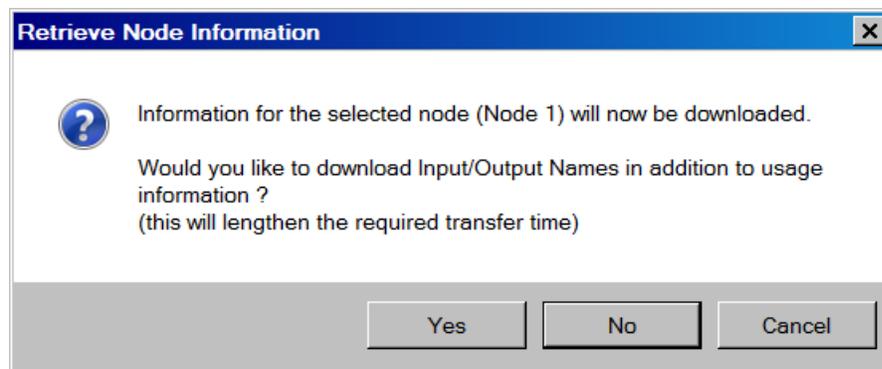
Shown below is an alternate retrieval method that saves a step:

1) Select the desired node from the live status bar on the left side.

2) Click the “Retrieve Node Information” tool.



3) A pop-up box will ask to download information from the selected node’s memory. Click “yes”



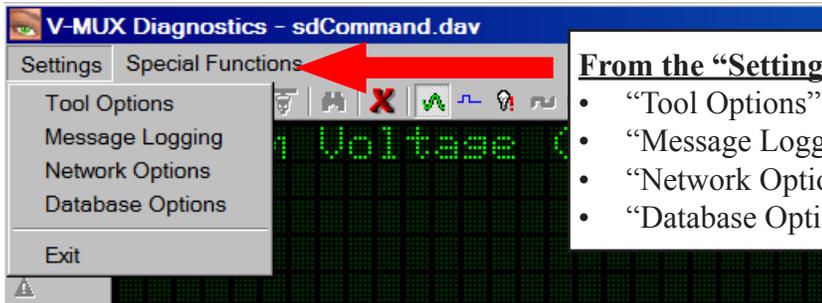
4) While retrieving the node’s program memory the progress bar at the lower right of Diagnostics will provide a visual indication of the transfer.



Some of the toolbar icons only become active when a node has been selected and/or mounted. These tools will enable information about node operation and programming to be monitored. Each of these icons is discussed in detail in the TOOLBAR section of this manual.

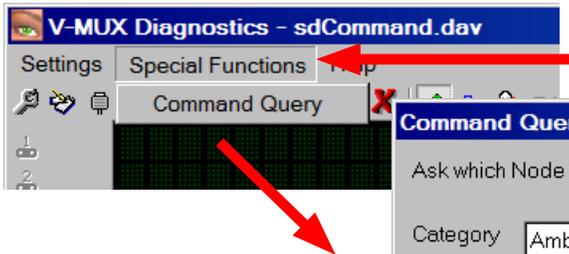


## Top-Level Tool pull-down Menus -- Settings, Special Functions, and Help



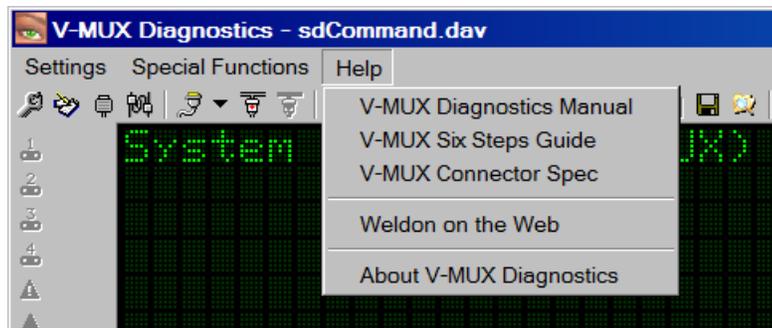
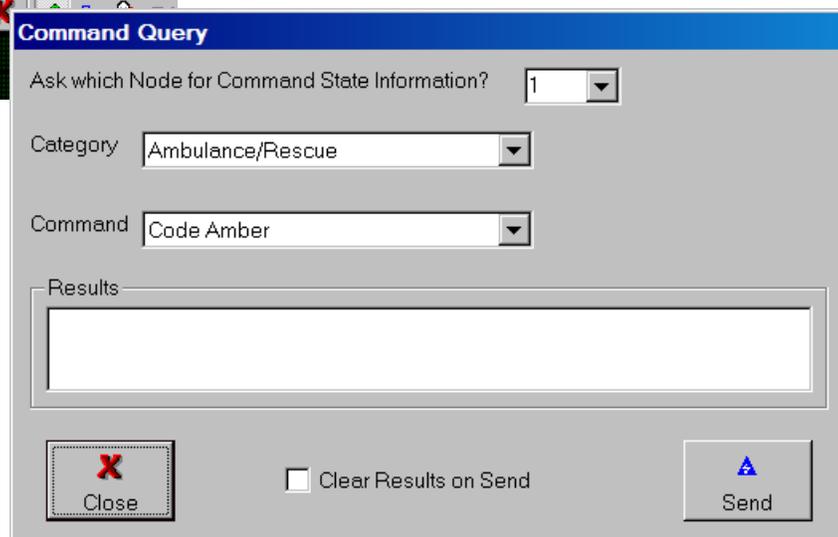
### From the “Settings” pull-down menu:

- “Tool Options” duplicates the function of Tool 1 
- “Message Logging” duplicates the function of Tool 2 
- “Network Options” duplicates the function of Tool 3 
- “Database Options” duplicates the function of Tool 4 



### From the “Special Functions” pull-down menu:

- “Command Query” allows the user to ask a node what it believes the current On/Off state of a Command is.



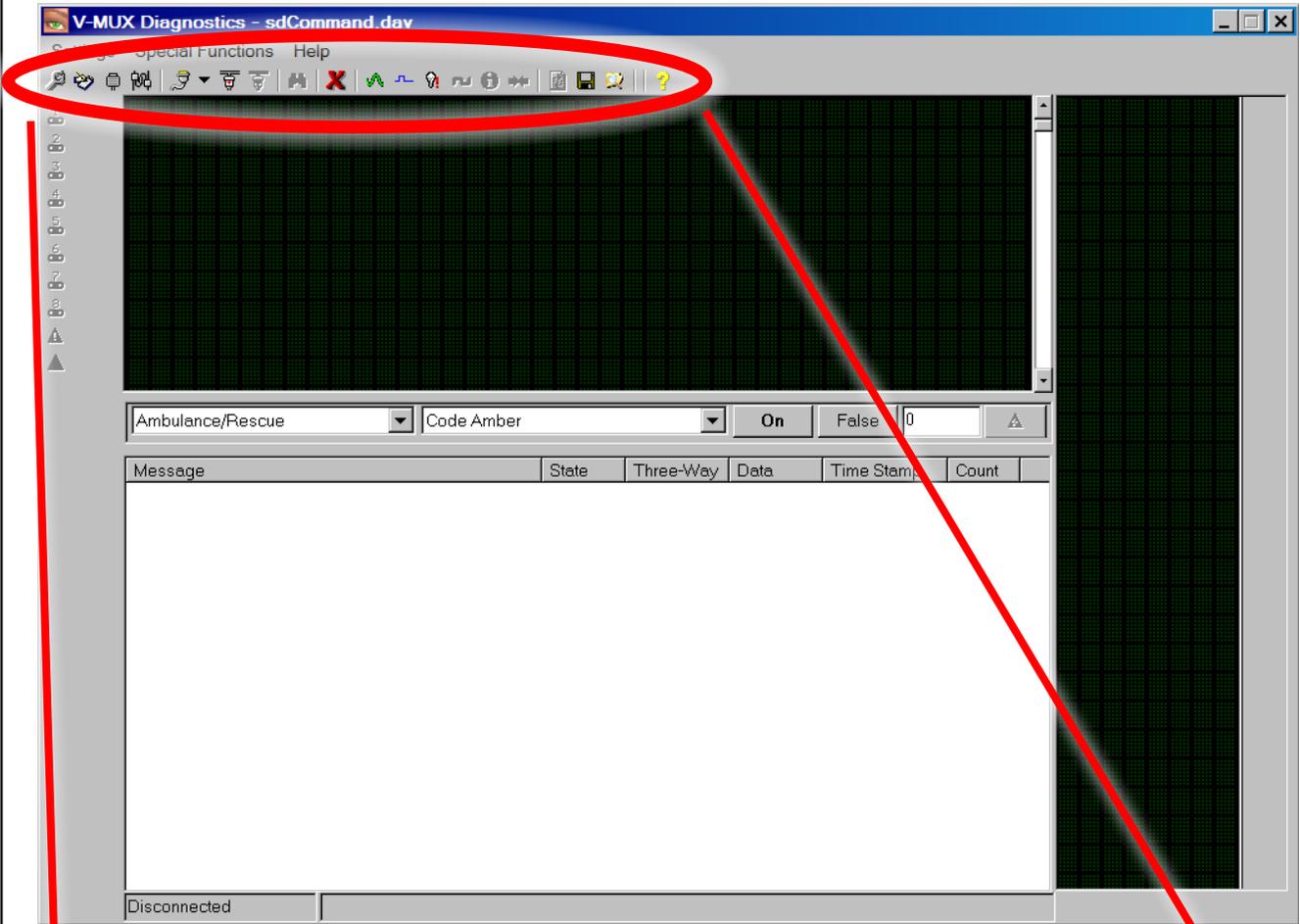
### From the Help pull-down menu:

--- All documents are in Adobe .pdf format ---

- “V-MUX Diagnostics Manual” ( this user manual)
- “V-MUX Six Steps Guide” ( a quick troubleshooting guide)
- “V-MUX Connector Spec” ( a reference to all V-MUX components)
- “Weldon on the Web” ( an online link to [www.v-mux.com](http://www.v-mux.com); NOTE: the computer must be online with the world wide web for this link to work)
- About V-MUX Diagnostics (duplicates the function of Tool 19  )

## The Diagnostics TOOLBAR:

How to use Tools 1-19 to change settings, gather V-MUX data, and use advanced features:



Toolbar icons (itemized: see pages 21 - 40)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19



pg 21 pg 22 pg 23 pg 26 pg 28 pg 29 pg 30 pg 30 pg 31 pg 32 pg 33 pg 34 pg 35 pg 36 pg 37 pg 38 pg 39 pg 40

**Tool 1)**  **“Tool Options”** -- Invokes a pop-up window to indicate various Diagnostics program options:

- **On Connect** -- behavior upon connection to a V-MUX node or network
- **Message Options** -- how messages are displayed in the Active Message List area
- **Current Message Database** -- indicates which set of V-MUX Commands will be used by Diagnostics



**On Connect:** (1 option)

Sets Diagnostics to automatically Ping for live nodes (“Detect nodes”) upon each V-MUX network connect. Checked by default.

**Message Options:** (3 options)

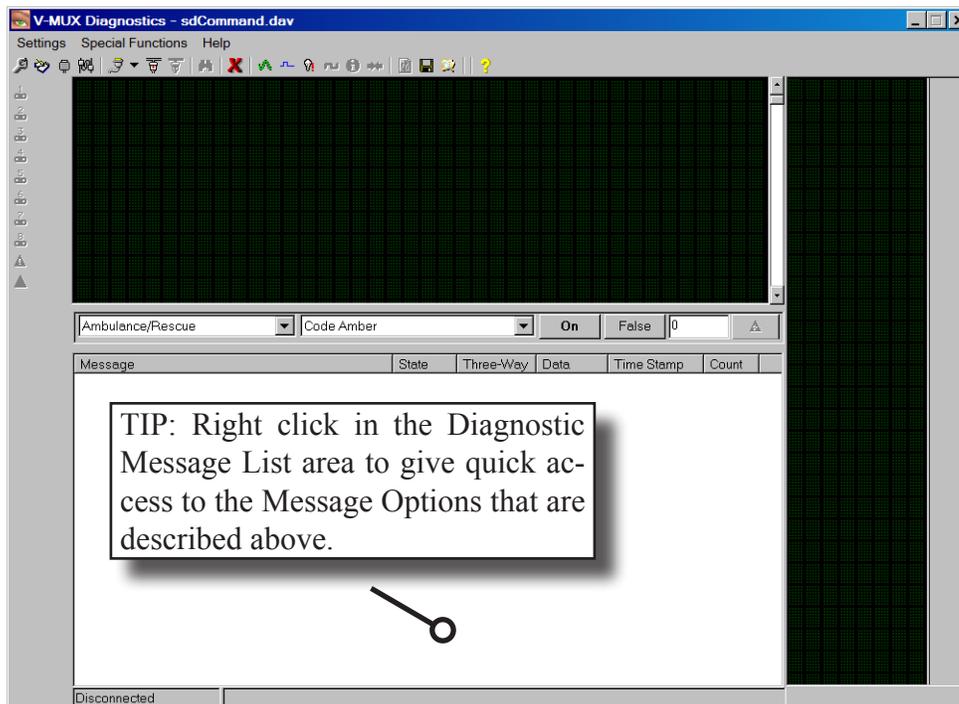
1) “Show all messages” – Shows sensor data in the Active Message List area. Not checked by default.

2) “Don’t display duplicate messages” – Places Messages of the same Command to overlay the previous Message. Checked by default

3) “Display message data in Hex” – Switches the display of message Data so as to be shown in hexadecimal (base-16) instead of decimal (base-10). Hex format is used when interpreting error codes. Not checked by default

**Current Message Database**

Shows the database file which associates V-MUX message codes with readable text Commands. For example, message code 4 = “Reverse” because the database matches the two. The default V-MUX Diagnostics database file is **sdCommands.dav**. Other databases may be chosen by use of Icon 4, “Database Options”. (see pg 26)

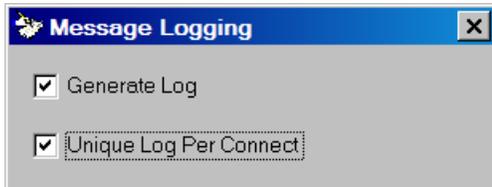


Tool 2)  “Message Logging” -- Enable a Diagnostics session log file report:

NOTE: Diagnostics must be disconnected from V-MUX for this tool to be available.



A pop-up box will appear with options to enable message logs and also to create a unique log for each Diagnostic session.



The log file may be accessed by clicking on Tool 18 to “**Explore Diagnostic’s Log Directory**”.

The log folder “**diaglogs**” is located at:

C:\ProgramData\Weldon\V-MUX\Diagnostics\diaglogs

**Log files are named in the following syntax:**

**Example** -- 2012-08-04\_03-25-02P.txt

The file format is as follows:

2012-08-04 means this file was created on August 4, 2012

03-25-02P means the timestamp of file creation was 3:25:02 PM.

Each log file will get a unique date and time for the name. The log file is simple text and can be opened with Windows Notepad or any other text editor.

The log file is useful for situations in which it is necessary to capture a time-stamped record of a V-MUX event (or non-event).

**Example:** The vehicle door ajar beacon operates haphazardly and it is suspected that one or more magnetic door switches are faulty or mis-aligned. A logged V-MUX Diagnostics session while the vehicle is driven can capture each door switch event and write it to the log file for later investigation.

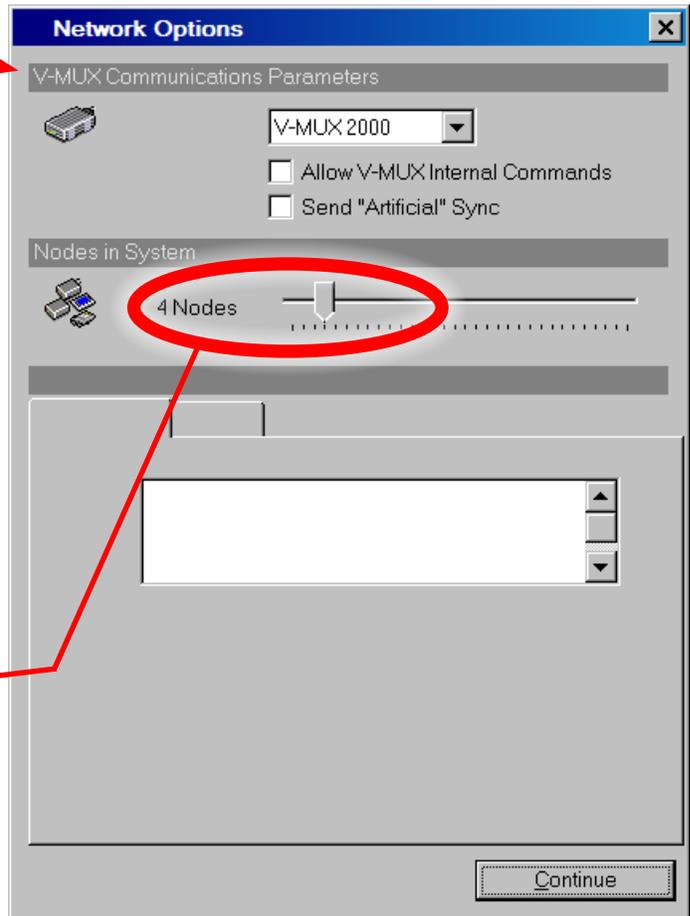
Tool 3)  “Network Options” -- Invokes a pop-up window of options about the V-MUX network:



NOTE: Diagnostics must be disconnected (Tools 6/7) from the V-MUX system for this tool to be available.

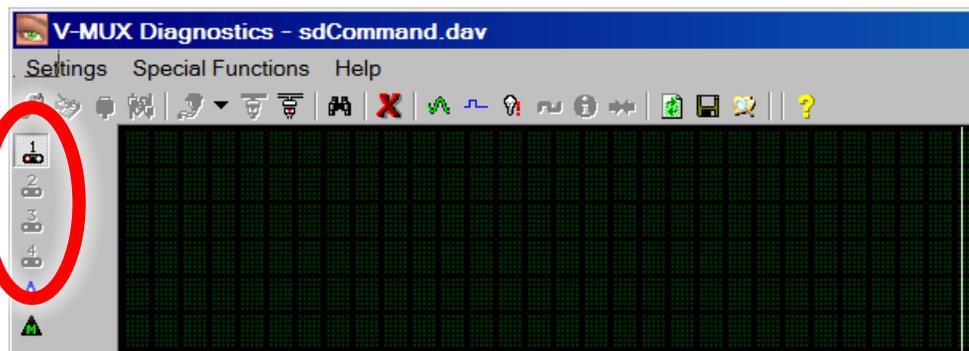
### “V-MUX Communications Parameters”

- V-MUX 2000 (default) or V-MUX 98:  
All V-MUXed vehicles produced since the year 2000 are of type “V-MUX 2000”. Do not select V-MUX 98 unless told to do so by Weldon.
- “Allow V-MUX Internal Commands”  
V-MUX commands that relate to basic system utilities and memory access. These are listed in Appendix B. WARNING: Certain internal commands can erase the memory of a V-MUX node. Contact Weldon before using this feature.
- “Send ‘Artificial’ Sync”:  
Causes Diagnostics to issue the V-MUX network SYNC message every several seconds. Used when Node #1, which usually issues the SYNC, is not available. (Example: On a test stand)



### “Nodes in System”

This slide control sets the number of nodes (1-32) Diagnostics will make available on the side node list. This is also the number of nodes that Diagnostics will automatically Ping for upon each connection.



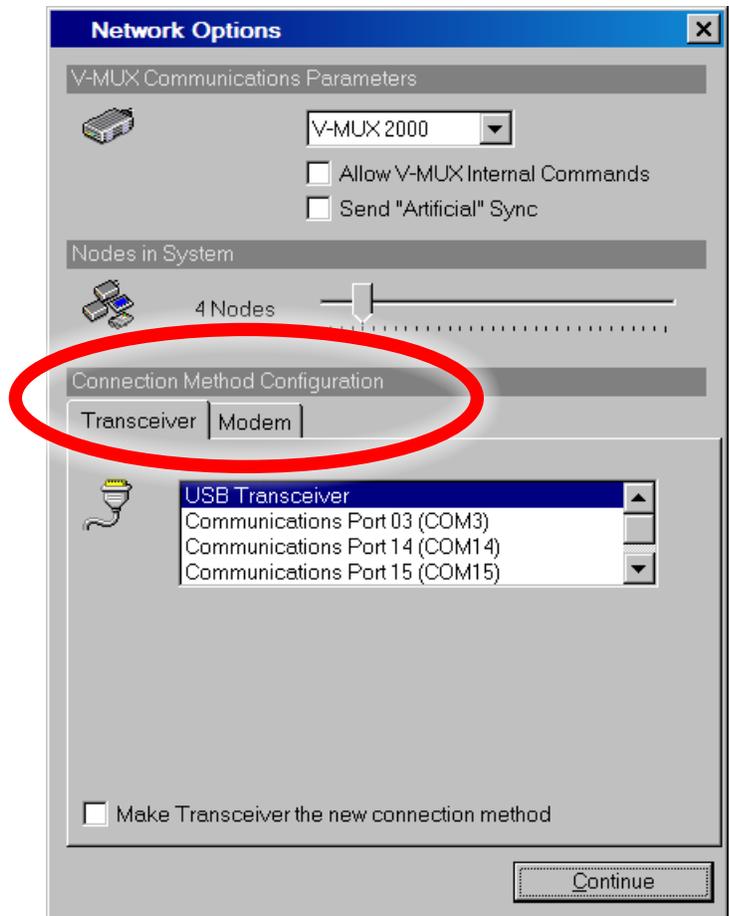
Tool 3)  “Network Options” -- Invokes a pop-up window of options about the network:



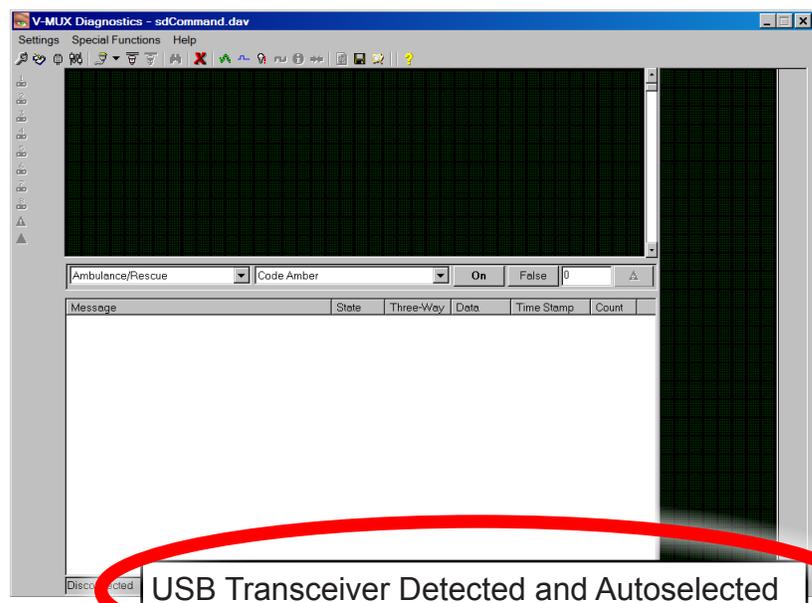
### “Connection Method Configuration” (TAB = Transceiver)

When the USB device drivers are properly installed and the V-MUX transceiver is plugged into the USB port prior to starting Diagnostics, this field will auto-select “USB Transceiver”.

The standard Communications Ports (COM1 etc...) are a legacy from when Diagnostics communicated from a 9-pin serial port connection (RS232).



Another way to see that the USB Transceiver is properly installed is that upon startup, (with the USB Transceiver already plugged in), Diagnostics will indicate along its bottom frame the message: “USB Transceiver Detected and Autoselected”



Tool 3)  “Network Options” -- Invokes a pop-up window of options about the network:



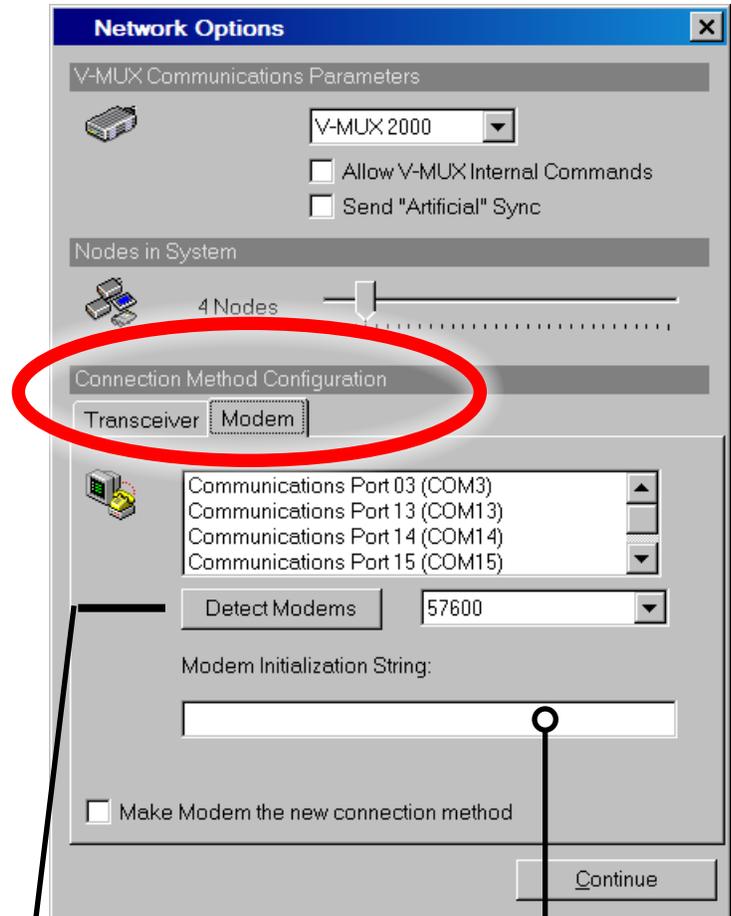
### “Connection Method Configuration” (TAB = Modem)

Diagnostics is able to remotely access V-MUX systems that are connected to a Weldon type 6120 modem module at the vehicle. This also requires that the computer running Diagnostics be itself connected to a local modem and phone line.

Although many computers have built-in modems, Weldon has determined that the best results in terms of data stability are obtained when the computer uses an external modem.

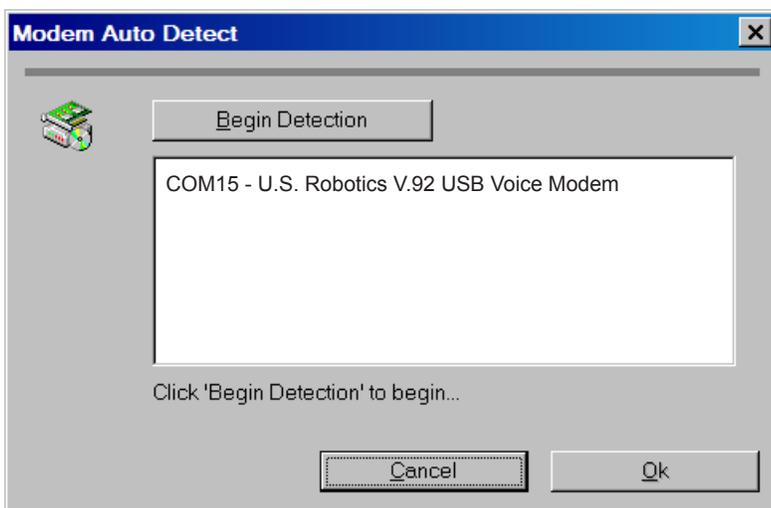
A Weldon recommended device is the US Robotics Model USR5637 56K\* fax/modem.

With the modem attached to the computer, Diagnostics must first detect it as an available device. Click on the “**Detect Modems**” button to invoke the “Modem Auto Detect” window. Click on on the “Begin Detection” button. Once the modem has been detected it may be used for dial-up, as described in the Tools 5,6,7 sections.



#### “Modem Initialization String:”

Most modern modems do not require an initialization string and so this field may be left blank. In the rare case that a value is needed here, the setup instructions for the modem device will specify what to enter.



Tool 4)  “Database Options” -- Select a vehicle specific Diagnostics database



↑ NOTE: Diagnostics must be disconnected (Tool 7 OFF) from the V-MUX system for Tool 4 to be available.

### Current Message Database (the file that holds the V-MUX Commands)

The name of the general database file common to all of V-MUX is “sdCommand.dav”. This common database allows V-MUX Diagnostics to tap into any V-MUXed vehicle and troubleshoot it.

A disadvantage in this approach is that a common database is inflexible when showing Commands related to a particular vehicle, because most of the listed Commands do not apply to those V-MUX nodes.

One solution is to have the V-MUX designer give to the Diagnostics troubleshooter a vehicle specific database, which contains only those Commands that apply to the particular system.

Another solution is to allow Diagnostics to extract from the V-MUX nodes in network a database file specific to that vehicle. This file can then be saved for future use alongside other vehicle files. Tools 16/17 are used to extract and save V-MUX files from nodes.

### Available V-MUX Systems:

“sdCommands.dav” is the default database. Use the selection window to use a previously saved database file.

### System Information:

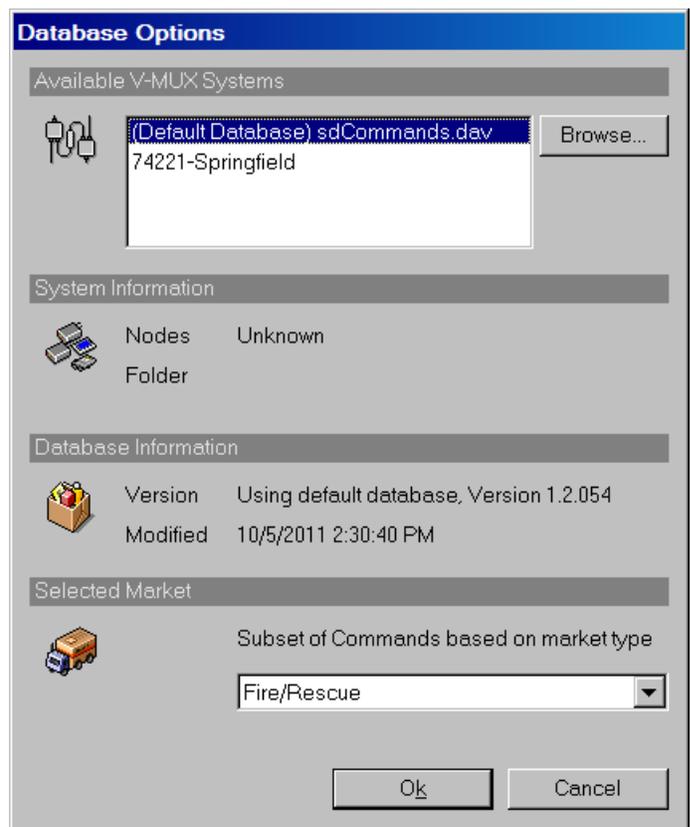
Shows node count and file path in the V-MUXed vehicle system.

### Database Information:

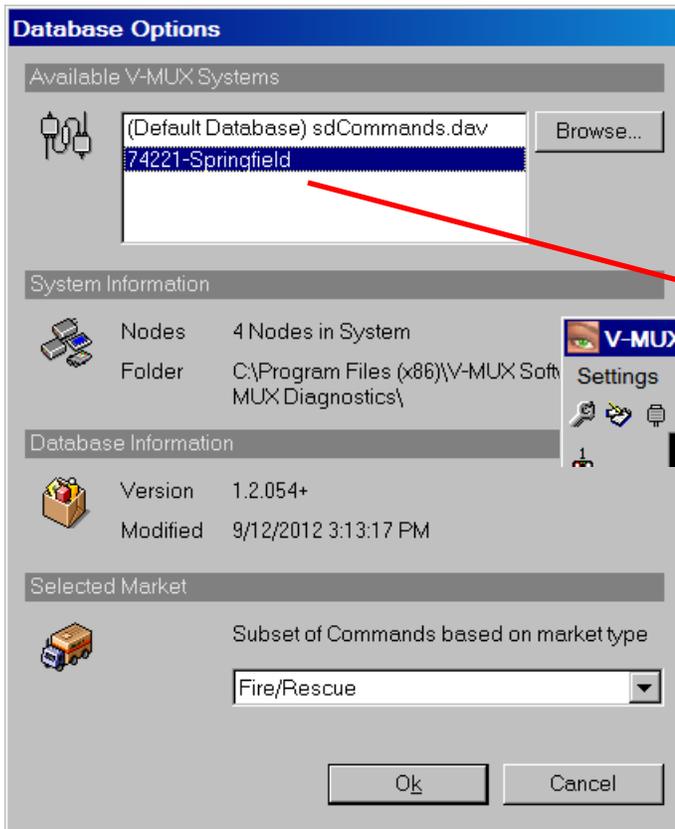
Shows the version number of the database and when it was last modified.

### Selected Market:

Different database files can be created with Commands that match the type of vehicle they are used with. (For example the “RV “ Recreational Vehicle market.) The Fire/Rescue market is the default.



Tool 4)  “Database Options” -- Select a vehicle specific Diagnostics database



**Example:** From the Database Options window we change the database file to vehicle **74221-Springfield**. The change in database is indicated at the top of the main Diagnostics window for the rest of the session.



The fields for **System Information** and **Database Information** will automatically update to match the selected database.

## Special Commands

There is an additional database not shown by the Database Options window. The file **SpecialCommands.dav** adds extra troubleshooting related messages to Diagnostics. Unlike sdCommand.dav, this extra database is not required and if it is missing from the folder, Diagnostics will still run, but without the extra messages.

Each of the following messages from SpecialCommands.dav will include the Node number and the channel number involved:

- Fault detected on \_\_\_\_\_
- Short detected on \_\_\_\_\_
- Open detected on \_\_\_\_\_
- Overcurrent detected on \_\_\_\_\_
- Direct PWM at \_\_\_\_\_

The following messages will include the node number in the data column of the Active Message List

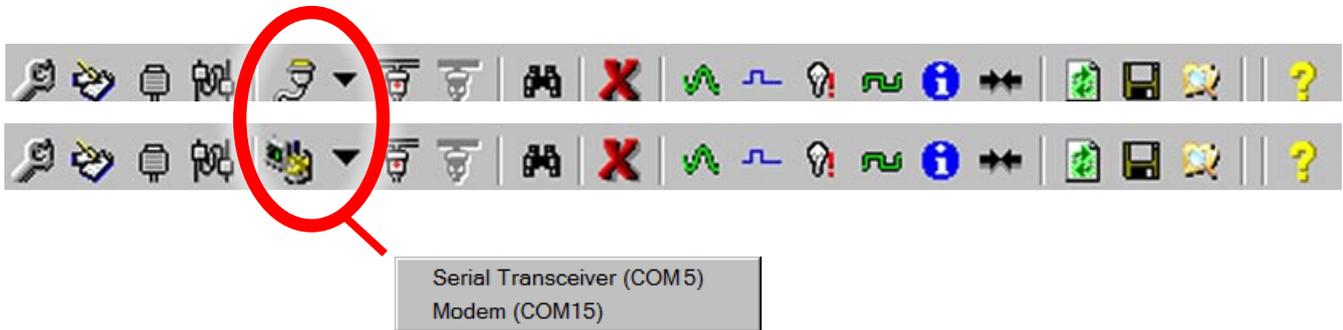
### Errors

- Bad Hercules Node Binary
- Bad Vista Node Binary
- Bad Gateway Node Binary
- Bad Mini Node Binary
- PIC Not Responding

### Info

- PIC Reply Timeout

**Tools 5) “Connect Using”** -- To select either the USB Transceiver or the Modem for communications.



Tool 5 “Connect Using” sets up Diagnostics to use one of two ports

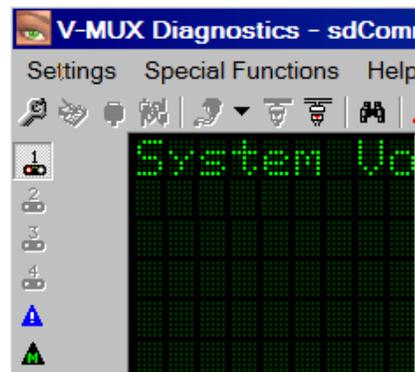
- the USB Transceiver virtual COM Port (“Serial Transceiver”)
- the detected Modem COM Port (“Modem”)
- 

NOTE: The modem must first be detected by use of the “Network Options” Tool 3 at the tabbed “Modem” section of Connection Method

If a V-MUX network is detected one or more nodes will reply to PING Commands. Diagnostics will activate the vertical node status bar and highlight all nodes that PING REPLY, up to the limit of 16. (Nodes may also be manually pinged with the “**Detect Active Nodes**” Tool 8 -- see pg 29.)

**Example:** Here we see that Node 1 has replied to its Ping message from Diagnostics. Its icon becomes available and we can see that it is distinctly highlighted. →

Nodes 2, 3, and 4 have not replied to their Ping messages and so their icons remain ghosted and unavailable.



Tools 6,7)  “Connect/Disconnect” -- To start or end a communications session with V-MUX



Tools 6/7 “Connect/Disconnect” are mutually exclusive -- when one is ON the other is OFF.

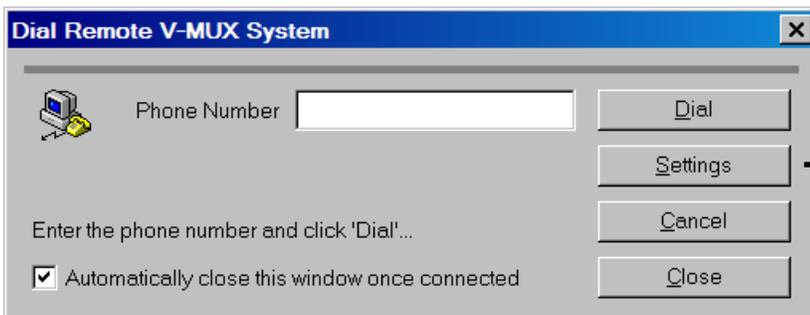
Click on Tool 6 to “**Connect**”. Diagnostics opens the selected port (Modem or USB as set by Tool 5). Upon connection Tool 6 passes control over to Tool 7 = “Disconnect”.

When finished click on Tool 7 to “**Disconnect**” and end the session.

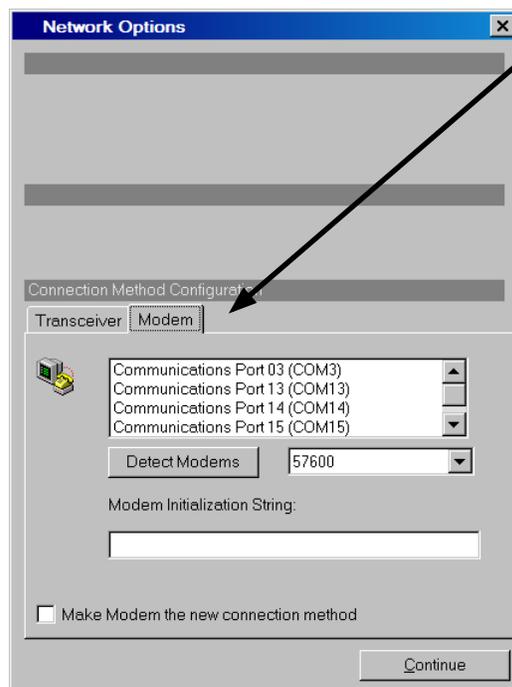
If the Connection uses the Modem port a dialogue window “Dial Remote V-MUX System” will appear and prompt for the appropriate “Phone Number”.

Modem dial-up procedure:

- Verify that the remote vehicle is connected at the V-MUX network tap to a Weldon type 6120 modem.
- Verify that the 6120 modem is plugged into an analog phone line with the Weldon 0L40-2677-00 adapter.
- Verify that the remote V-MUX system is powered and active.
- Enter the phone number of the remote V-MUX system.
- Click the “Dial” button.

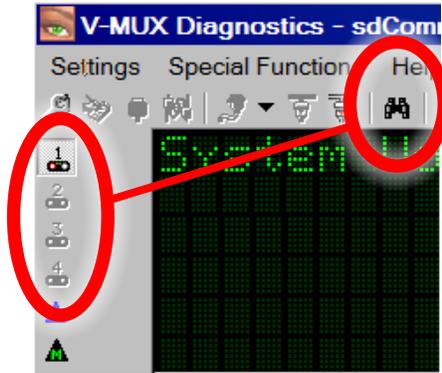


→ To “Detect Modems”:  
Click on the “Settings” button to invoke the “Modem” section of Network Options. This is the same feature that Tool 3 provides (page 25).



Modem note:  
Upon modem connection Diagnostics acts the same way with the remote V-MUX system as it does with the USB Transceiver on a local V-MUX system.

Tool 8)  “Detect Active Nodes” -- To manually Ping V-MUX nodes up to the limit set on the node list



Tool 9)  Clear Message List -- Clears the upper and lower message areas, Diagnostics remains connected:



Upper message area

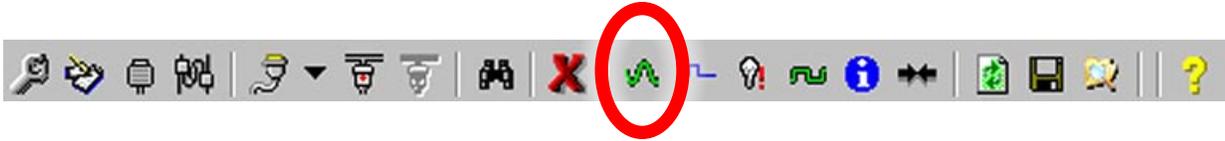
As new sensor data arrives, the upper message area will quickly fill again with analog information

Message	State	Three-Way	Data	Time Stamp	Count
Door Cab Left front	On	False	1	15:40:57.69	1
Door Cab Right front	On	False	1	15:41:02.46	1

Activity in the right side window remains unaffected by the Clear Message List tool.

After being cleared of existing messages the lower message area will refill with V-MUX messages as they are received. This generally happens when Input switches change state.

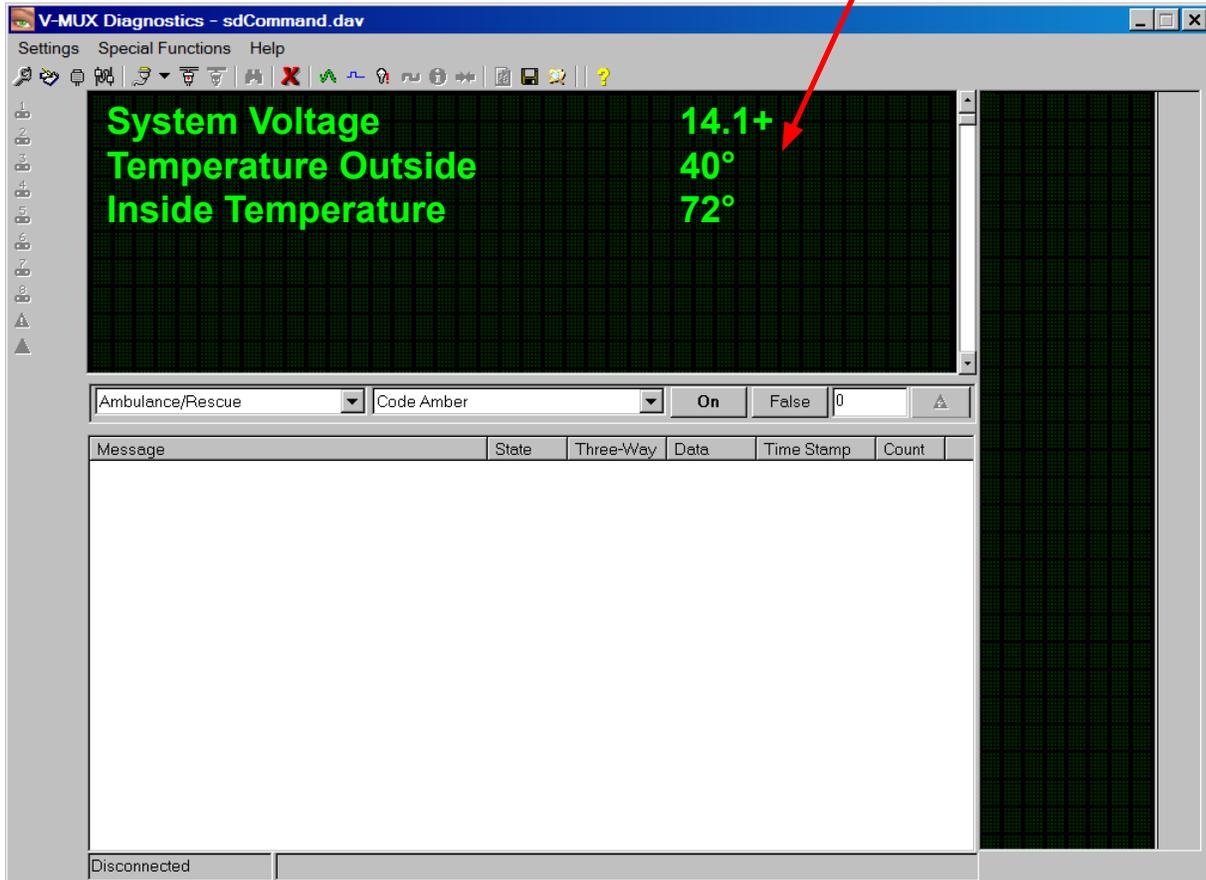
**Tool 10)**  “Display Analog Data” -- Sets the upper viewing area to display analog Sensor Data:



By default the Diagnostic window shows analog sensor data in the upper viewing area upon each Connect. If during a session the display has been changed to indicate other types of information, Tool 10 will return the view to analog sensor data.

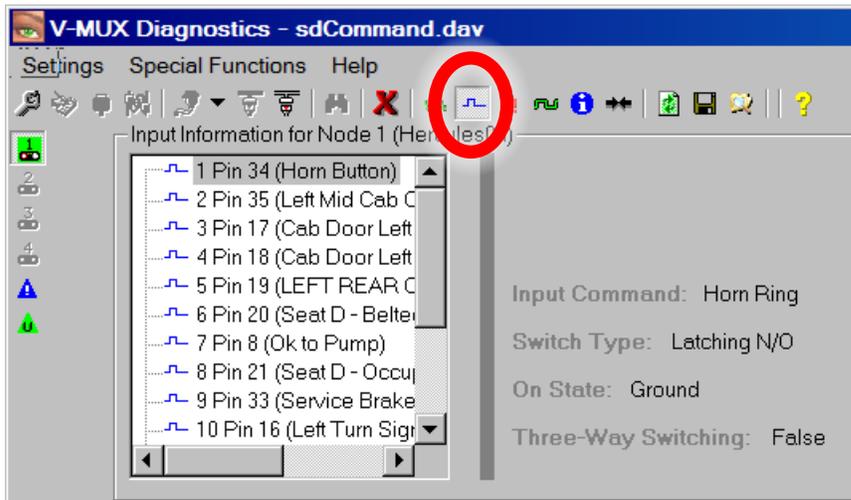
V-MUX nodes transmit their sensor data (Voltage, Amps, Temperatures, etc...) with periodic updates for each measurement. Data refresh rates can be as fast as once every half second to as slow as once every 10 seconds. The sensor data is displayed line-by-line from top down as the data comes into Diagnostics.

Analog Sensor Data  
from all nodes



**Tool 11)**  **“Input Diagnostics”** -- Lists the programmed Input channels of a selected node:

The Input List comes from the node’s program memory by use of Tool 16 (Retrieve). Once the program information has been retrieved, it can be saved in database form available for future Diagnostics use with the V-MUXed vehicle.

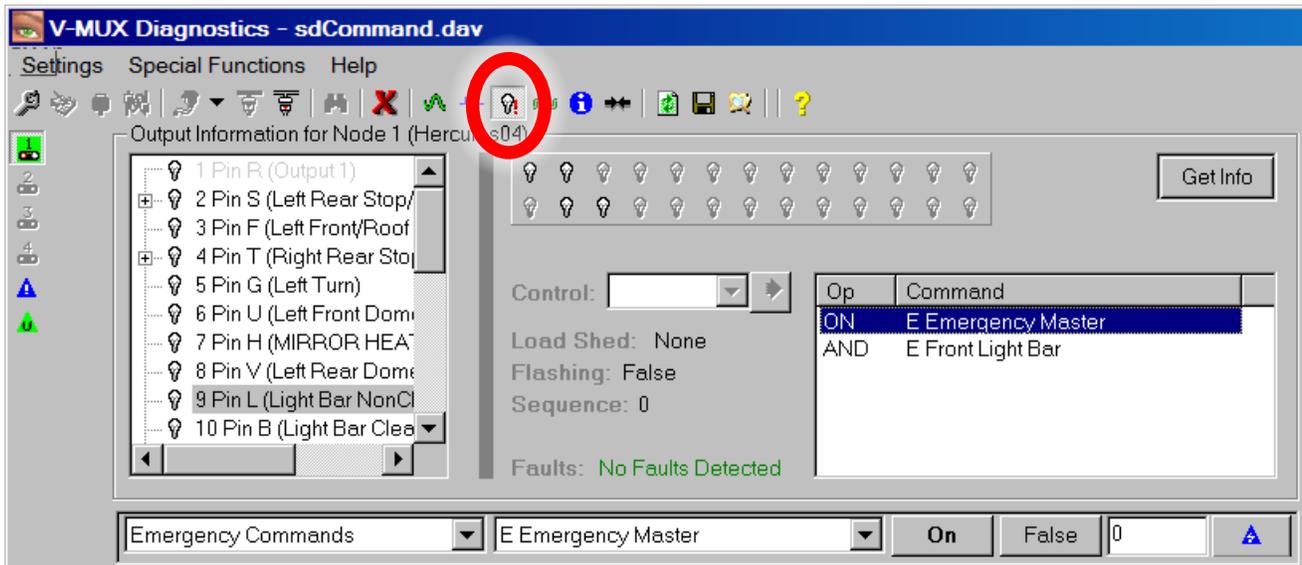


In the example shown here:

- the selected Node 1 is a **Hercules** node
- the OEM has assigned the name **“Bat Comp Sw”** to Input Channel 8 which is at pin 21 (**i8-p21**)
- the actual V-MUX Input Command that turns On and Off with the switch state is **“Comp Sw 0”**
- the switch type is **Latching - Normally Open**
- the ON state of the input channel can be triggered by either a **+VBatt** or a **Ground** signal (bi-directional)
- the switch is not used for any **Three-Way** output channel.

**Tool 12)**  “Output Diagnostics” -- Lists the Output channels of a selected node:

The Output Diagnostics list is pulled from a node’s program memory by use of Tool 16 (Retrieve).



The Output Manager enables Diagnostics to control Output channels by two methods:

**METHOD 1:** The “direct control” light bulb icons (located towards the top) allow PWM capable channels to be directly forced ON/OFF by clicking on the corresponding icon. When the mouse cursor hovers over a channel lightbulb icon, a small description text box will appear. Hercules PWM output channels = 1, 2, 15, 16. The 8x16 and Mini 4x12 nodes allow all of their output channels to be direct forced.

- The PWM Control  at the center allows you to change the level of modulation of the selected channel by using a pull-down menu control. First select the desired output channel using the upper control. Next select the PWM percentage from the PWM Control then click on the arrow tool icon to send the PWM message for that channel. The “Release” option returns the output to its non-PWM state.

**METHOD 2:** Each output channel listed at the left has corresponding Command Logic listed at the right. For example, if channel 9 Pin L is selected at the left, the V-MUX Commands that turn on the device are listed in the right window:

ON <E Emergency Master>  
AND <E Front Light Bar>

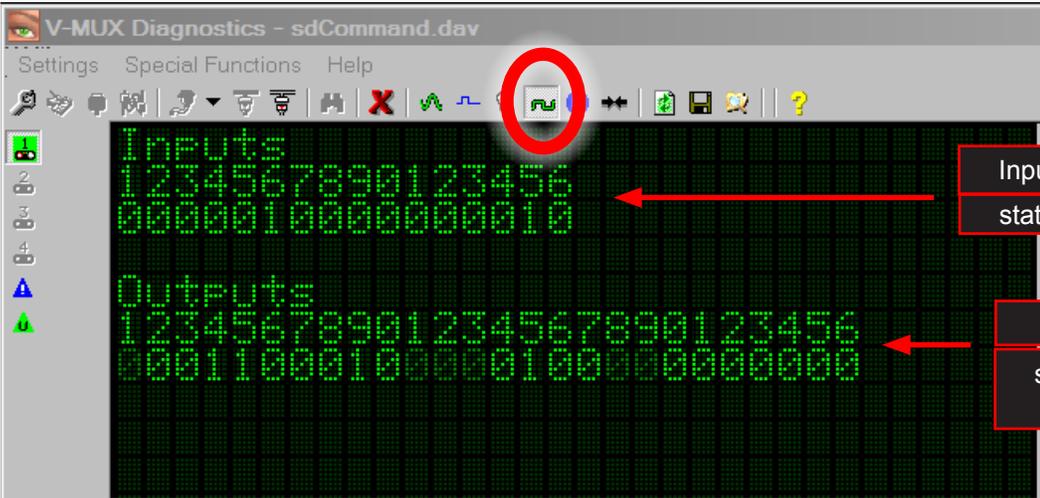
To control outputs by use of the Command Logic window, double-click each of the Commands (ex: E Emergency Master). The selected command is placed in the action area of Diagnostics, and can be issued onto the network by use of the Send button at the right . All Command Logic must be Sent before the channel will turn On.

Additionally as seen in the middle area of the example shown above

- the output will not **Load Shed** at any voltage (“Load Shed = None”)
- the output will not **Flash** with any pattern (“Flashing = False”)
- the output will not **Sequence** with any ON/OFF delay (“Sequence = 0”)
- No undercurrent or overcurrent **Faults** have been detected on this output DURING OPERATION.

Tool 13)  “Monitor Inputs and Outputs” -- Displays active state of Inputs/Outputs for the mounted node

### Hercules node



The screenshot shows the V-MUX Diagnostics interface for the Hercules node. The 'Inputs' section displays 16 channels (1-16) with a state of 0000010000000010. The 'Outputs' section displays 26 channels (1-26) with a state of 000110001000001000000000. A red circle highlights the 'Monitor Inputs and Outputs' icon in the toolbar. Red arrows point from callout boxes to the input and output data.

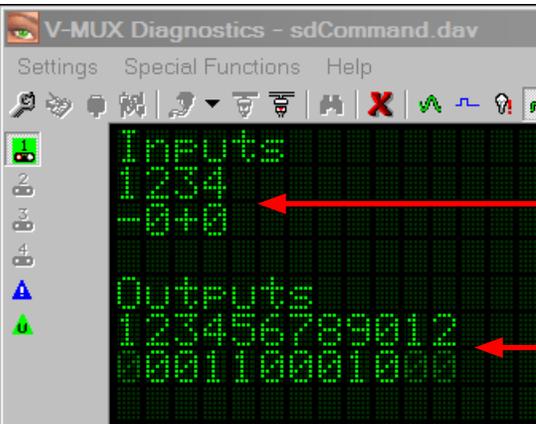
Input channels (1-16)  
 state (1=ON, 0=OFF)

Output channels (1-26)  
 state (“1”=ON, “0”=OFF)  
 (dim “0” = not used)

There are actually six programmable electrical conditions that can trigger the ON state:

- +Batt
- Ground
- +Batt or Ground [bipolar]
- NOT +Batt
- NOT Ground
- Floating [physical open = logical ON]

### Mini 4x12 node



The screenshot shows the V-MUX Diagnostics interface for the Mini 4x12 node. The 'Inputs' section displays 4 channels (1-4) with a state of 1234 -0+0. The 'Outputs' section displays 12 channels (1-12) with a state of 000110001000. Red arrows point from callout boxes to the input and output data.

Input channels (1-4)  
 electrical state: “+”= +Batt,  
 “-” = Ground,  
 “0” = open

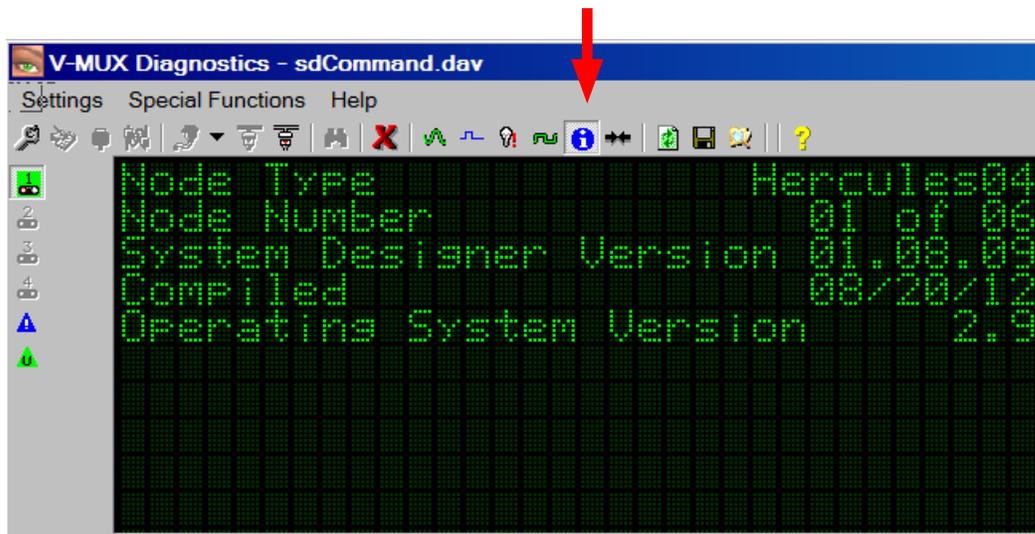
Output channels (1-12)  
 state (1=ON, 0=OFF)  
 (dim “0” = not used)

Mini 4x12 and Mini 16x0 nodes report on the electrically polar of their inputs, as indicated by one of three symbols.

Electrically by symbol:

- Switch open = “0”
- +Batt = “+”
- Ground = “-”

Tool 14)  “Flash Information” -- Displays the top-level contents of the node’s Flash memory.



In the example shown here:

- the selected **Node Type** is a Hercules04  
(The '04' suffix means that the Hercules is 4th generation. It has no relation to the Node Number (1 of 6))
- **Node Number** “01 of 06” indicates that the selected node is identified within a six node network as being at the #1 spot. There are a maximum of 32 nodes possible in a V-MUX network.
- The node design file was created with V-MUX **System Designer Version 1.8.9**
- The node application file was created (“**Compiled**”) on August 20, 2012
- The onboard node **Operating System file version** is 2.9

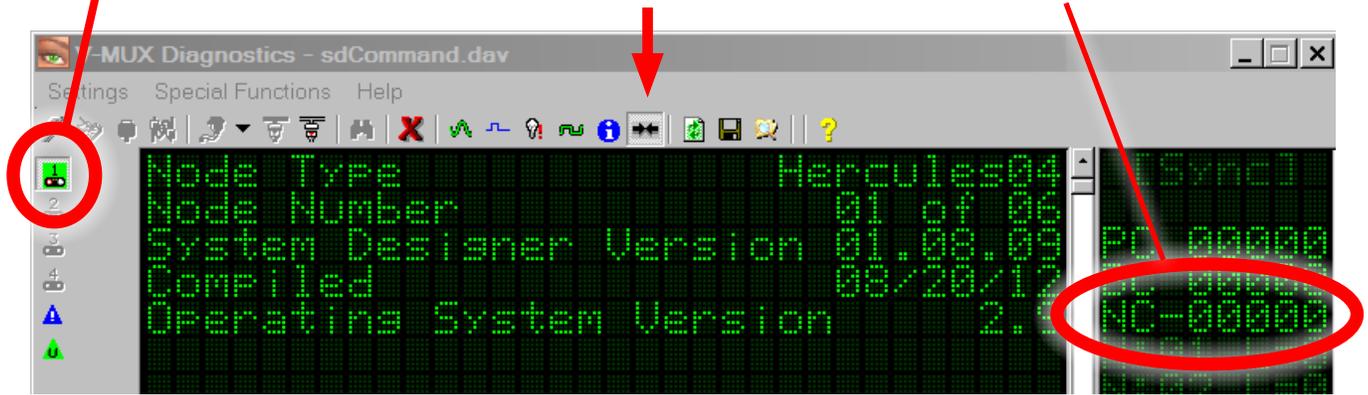
Mini 4x12 only -- There is a secondary controller on the node called a PIC processor with its own Operating System. The secondary operating system indicates its presence with “**PIC Code Version**”. (The latest version is 6.)

Tool 15)  “Monitor Node Collisions” -- Monitors loss of data reported by the mounted node.



Example: Node 1 is the mounted node.

While the Node Collisions monitor is active there is a small rotating pipe symbol ( -- | ) to the right of “NC”.



V-MUX nodes listen to their own messages ( the “local echo”) as they transmit on the communications line. If a node fails to hear its own messages it attempts to re-transmit them and also keeps track of exactly how many messages have failed. These failed messages are referred to as “Collisions”, though they may fail for various reasons.

### **The three Collisions counters:**

**NC** -- Diagnostics asks the mounted node to report how many failed messages it has noted.

**BC** -- The totality of collisions on the entire network.

**PC** -- The number of messages that exceed a network traffic limit of a certain set limit of messages per second.

A small number of PC counts during a Diagnostics session is acceptable as long as the counter completely stops after heavy Diagnostic activity, for example -- extracting node information.

A consistently incrementing counter for PC, BC, or NC is an indication of a serious failure of the communications link to carry data. It **MUST** be investigated and fixed or the loss of data will get worse over time.

### **Some common causes of collision activity:**

- Water in the communications links
- Mis-pinned communications links
- Improper node grounds
- Heavy flyback from inductive loads

Toolset 16,17) --  "Retrieve",  "Save"

Tool 16,  "Retrieve Node Information", becomes active when any node is selected from the left side list. This tool allows for the program memory of the node to be retrieved.

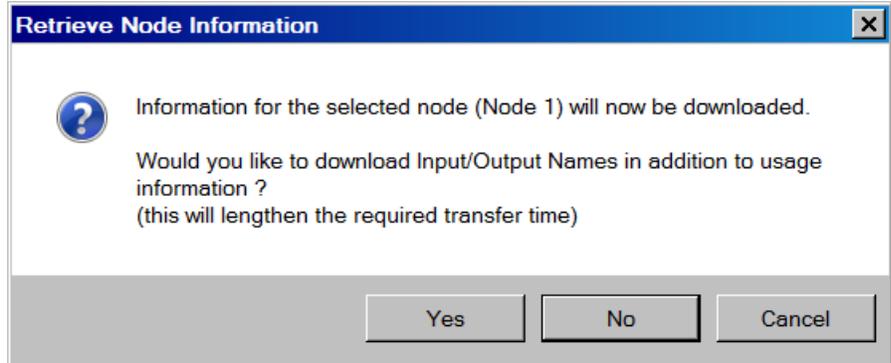
1) Select the desired node from the live status bar on the left side.



2) Click the "Retrieve Node Information" icon.

"Retrieve Node Information" is a necessary step whenever the Input/Output programming of the node needs to be examined. If the selected node is not already mounted, this tool will do the mount procedure automatically, saving a step.

3) A pop-up box will ask to download information from the selected node's memory. Click "yes"



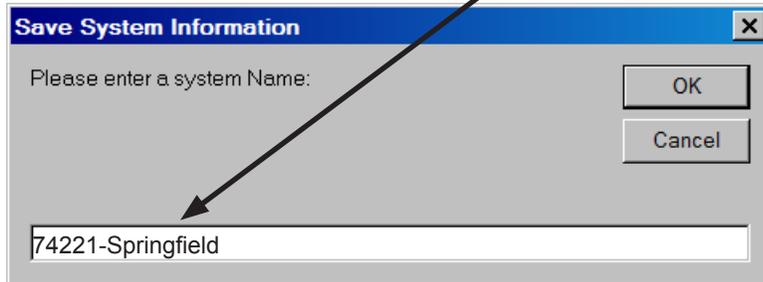
4) While retrieving the node's program memory the progress bar at the lower right of Diagnostics will provide a visual indication of the transfer.



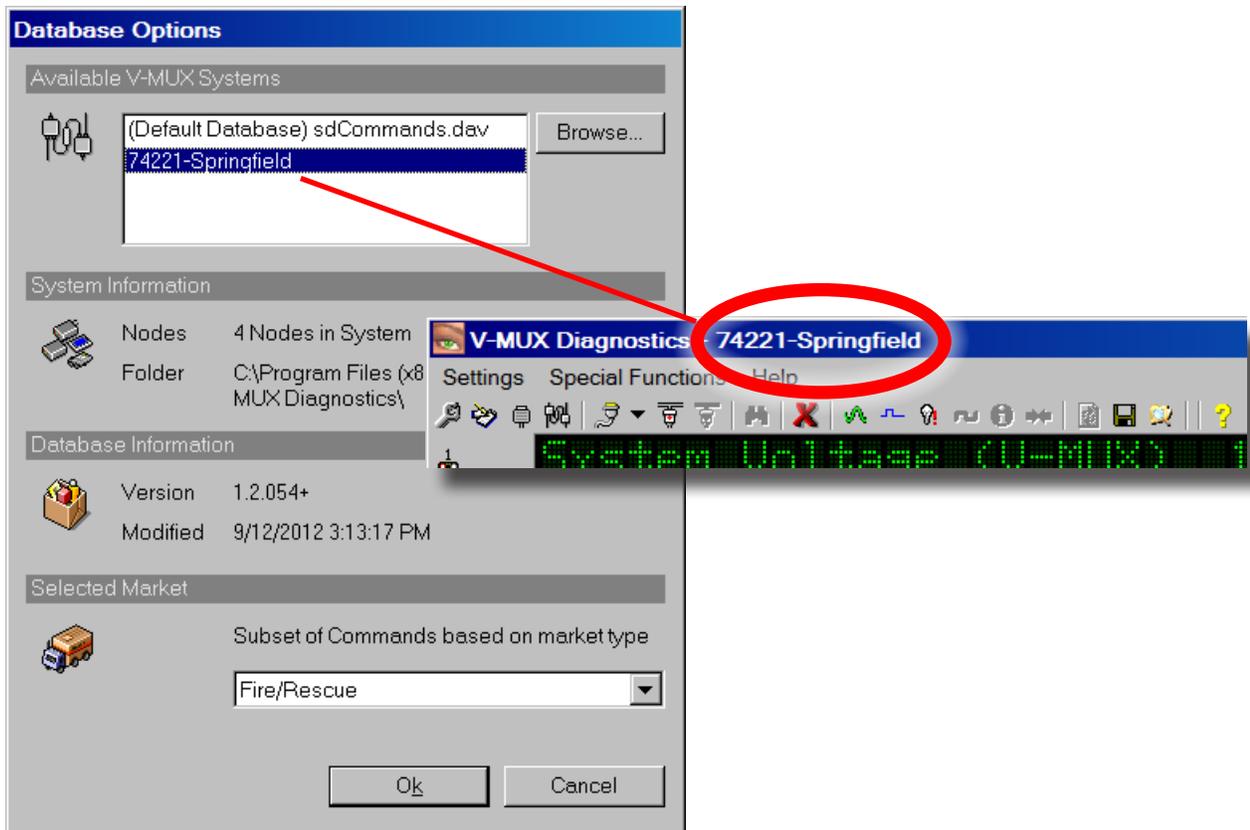
Tool 17,  “Save Current System” -- save the retrieved node information as a single V-MUX database file



Enter a vehicle identifier name for the file. It will be saved to the local directory with a \*.dav file type. Example: “74221-Springfield” will be stored with filename “74221-Springfield.dav”



The file “74221-Springfield.dav” can be accessed with the “Database Options” (Tool 4). Once selected it is the database for that session of Diagnostics.



**Tool 18)**  “Explore Diagnostics Log Directory” -- The folder that holds all of the Dignostics log files.

Log files are enabled from “Message Logging” Tool 2 .  The folder is named “diaglogs”

The path to the Diagnostics session log files, shown in the view window, is:

C:\ProgramData\Weldon\V-MUX\Diagnostics\diaglogs



**Log files are named in the following syntax:**

**Example** -- 2012-08-04\_03-25-02P.txt

The file format is as follows:

2012-08-04 means this file was created on August 4, 2012

03-25-02P means the timestamp of file creation was 3:25:02 PM.

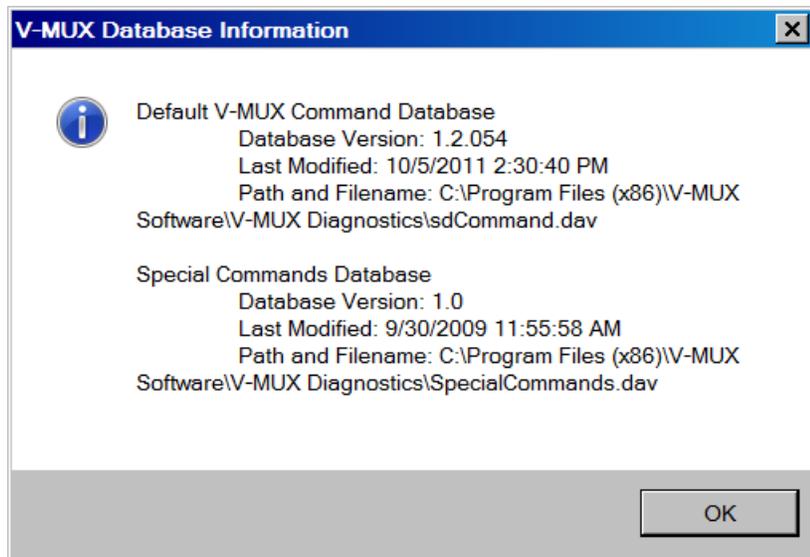
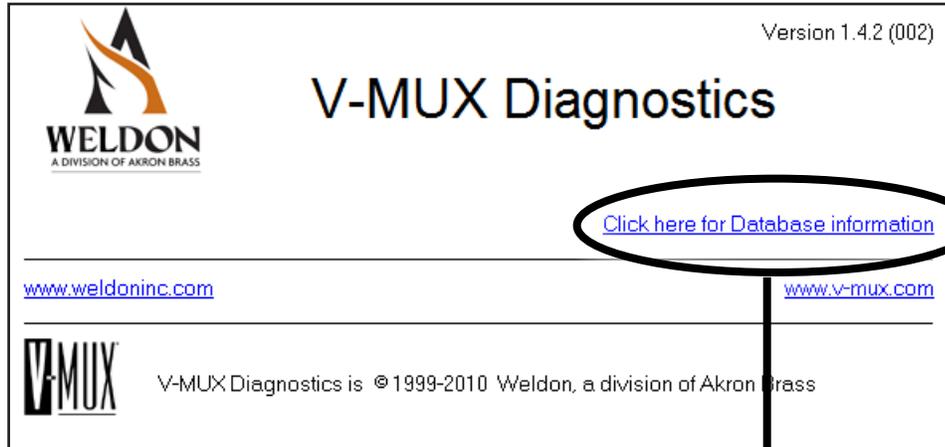
Each log file will get a unique date and time for the name. The log file is simple text and can be opened with any text editor program.

The log file is useful for situations in which it is necessary to capture a time-stamped record of a V-MUX event (or non-event).

**Example:** The vehicle door ajar beacon operates haphazardly and it is suspected that one or more magnetic door switches are faulty or mis-aligned. A logged V-MUX Diagnostics session while the vehicle is driven can capture each door switch event and write it to the log file for later investigation.

Tool 19)  “About” -- Invokes version and database related information

- The version (build) of the Diagnostics program. Current version is 1.4.2
- Shows the default database file “sdCommand.dav” installed version
- On-line website links: [www.weldoninc.com](http://www.weldoninc.com) and [www.v-mux.com](http://www.v-mux.com) (see page 6)



## V-MUX System Report Documents --

The entire V-MUX electrical design as created by the vehicle OEM can be put into document form for reference. The Microsoft Excel® spreadsheet program is used to create these documents. Two main reference documents will be created for you to use:

- 1) **The Input/Output Nodal Specification**
- 2) **The Nodal Relationships Specification**

Document 2, the Relationships Spec, is the more useful of the two for troubleshooting Command Logic.

**Inputs:** Both Digital (switches = ON/OFF) and Analog (sensors = 0-5VDC range) are listed.

**Node:** The live node number associated with this page is shown.

**Location:** Indicates where in the vehicle the node is located.

**Ch#:** The Weldon V-MUX channel number.

**Pin #:** The harness pin assignment on the terminating Deutsch end connector.

**OEM Wire:** The harness wire identifier.

**Command:** The V-MUX message command that will be issued when the switch is thrown.

**Qty:** NOT CURRENTLY USED. Will always be blank.

**Type:** Switch type; momentary, latching, normally open, normally closed.

**Comments:** Anything of importance the OEM designer wants you to know.

**Example:** Mini4x12 -- 4 switch inputs, 1 analog sensor input, 1 internal System Voltage.

Digital Inputs			Node 1	Location: Right-Mid		
Ch #	Pin #	OEM Wire	Command	Qty	Type	Comments
1	3		E Emergency Master		Latching N/O	
2	2		E Primary		Latching N/O	
3	10		E Secondary		Latching N/O	
4	4		Turn Signal Right		Latching N/O	
<b>Analog Inputs</b>						
Ch #	Pin #	OEM Wire	Command	Value Range		Comments
1	N/A		Unassigned	0	188	
2	1		Unassigned	0	255	

## V-MUX System Report Documents (continued) --

**Outputs:** Hercules node (High capacity = +12 VDC, 10.5 Amp/channel, channels 1-16  
 Low capacity = +12 VDC, 2 Amp/channel, channels 14-24  
 Low ground = GND , 2 Amp/channel, channels 25, 26)

Mini4x12 node (Medium capacity = +12 VDC, 7.5 Amp/channel)

**Priority Shedding:** Indicates the voltage level this output channel will Load Manage OFF at.

**Relationships:** Indicates the logical relationship a set of one or more input commands must have to cause the output channel to turn ON.

High Capacity Outputs			Node 1		Location: Center-Front
CH #	Pin #	OEM Wire	Name	Priority Shedding	Relationships
1	R		Output 1	No Shed	(None)
2	S		Output 2	No Shed	(None)
3	F	LHF/SP380	HIGH IDLE	No Shed	<ON> Auto Throttle <AND> Park Brake <AND> Ignition <AND> <NOT> PTO Switch (Hot Shift) <AND> <NOT> Service Brake
4	T	LHT	L SIDE DC SCENE	2 (12.1 V)	<ON> Ignition <AND> Scene Left <AND> Park Brake
5	G	LHG	R SIDE DC SCENE	2 (12.1 V)	<ON> Ignition <AND> Park Brake <AND> Scene Right
6	U		Output 6	No Shed	(None)
7	H	LHH/WT118	PTO REQUEST	No Shed	<ON> PTO Switch (Hot Shift) <AND> Ignition <AND> Park Brake <AND> Park/Neutral
8	V	LHV	WARN FRONT ROCKERS	No Shed	<ON> E Emergency Master
9	L	LHL/SP323/SF	L LT BAR RED RELAY	No Shed	<ON> E Emergency Master <AND> E Front Lightbar Red
10	B	LHB/SP324/SF	R LT BAR RED RELAY	No Shed	<ON> E Emergency Master <AND> E Front Lightbar Red
11	M	LHM/SP325/SF	PTO ENGAGE SOLENOID	No Shed	<ON> PTO Switch (Hot Shift) <AND> Park Brake <AND> Park/Neutral <AND> Ignition
12	C	LHC/SP326/SF	REAR DIRECTIONAL LIGHTS	2 (12.1 V)	<ON> E Emergency Master <AND> Park Brake
13	N	LHN/SP327/SF	LT BAR CLEAR RELAY	No Shed	<ON> E Emergency Master <AND> E Front Lightbar Red <AND> <NOT> Park Brake
14	D	LHD/SP328/SF	MARS LIGHTS RELAY	0 (No Load)	<ON> E Grill Lights <AND> <NOT> Park Brake
15	O		Output 15	No Shed	(None)
16	P		Output 16	No Shed	<ON> E Emergency Master <AND> E Strobes Low
<b>Low Capacity Outputs</b>					
CH #	Pin #	OEM Wire	Name	Priority Shedding	Relationships
17	Q	LHO/SP329/SF	OPTICOM RELAY	No Shed	<ON> E Emergency Master <AND> E Front Lightbar Red <AND> <NOT> Park Brake
18	E	LHP/SP330/SF	WW STROBE SUPPLY	No Shed	<ON> E Emergency Master <AND> E Strobes Low
19	A	LLA	AC LOAD MGT RELAY	1 (12.5 V)	<ON> Ignition
20	J		Output 20	No Shed	(None)
21	W		Output 21	No Shed	(None)
22	X		Output 20	No Shed	(None)
23	K		Output 23	No Shed	(None)
24	7		Output 24	No Shed	(None)

## Appendix A: USB Driver Installation:

### **Driver installation instructions: V-MUX® Transceiver for USB**

Included with your USB transceiver kit:

- (1) USB to V-MUX transceiver box.
- (1) USB cable. Connects USB side of transceiver to user's computer.
- (1) V-MUX cable. Connects V-MUX side of transceiver to Diagnostics tap in vehicle.
- (2) Deutsch pin extractor tools -- red and blue plastic
- (3) Hook-up adapter tools for Hercules node, Mini-nodes, and CAN Gateway node.
- (2) Jumper wire tools -- red and black.
- (1) USB memory stick ("thumb drive") -- includes Diagnostics, Downloader, and USB device drivers software.

**NOTE:** The USB device drivers are only tested for Windows 2000, XP.

-----

#### **The included USB cable has two molded ends, each distinctly shaped.**

Plug the square-shaped end into the USB transceiver box.

Plug the rectangular end into the computer's USB port.

**NOTE:** there is a connection icon on the flat end to aid in the proper orientation of the cable into the USB port. The icon usually must point upward at the USB port, or match a corresponding icon printed at the port if sideways.

#### **First time users:**

Windows should auto-detect the first new USB hardware item. (There will be two altogether.) "Found new hardware: USB TO RS-422/485 ADAPTER"

The Found New Hardware Wizard should pop up.

#### **Do you have your USB transceiver drivers on the included USB memory stick?**

--- Place your USB memory stick in an available computer USB port.

--- Select "Install the software automatically (Recommended)".

--- Click "Next>". Windows will scan for the correct files and auto-install them.

OR

#### **Are your USB drivers in a different sub-directory because they were saved or downloaded to there?**

Windows may not be able to find them automatically.

--- Select "Install from a list or specific location (Advanced)".

--- Click "Next>".

--- Select "Search for the best driver in these locations."

---Are your USB drivers saved somewhere on your own A:\ floppy or CD-ROM disk?

----- Select "Search removable media (floppy, CD-ROM...)" Windows will search all.

---Do you know the correct path (maybe on the hard drive) to where your USB drivers are saved?

-----Select "Include this location in the search:" Use the Browse button to navigate to the correct directory.

-----When Windows sees the USB drivers' directory it will auto-install them.

Windows should next auto-detect the second new USB hardware item.

"Found new hardware: USB Serial Port"

The Found New Hardware Wizard should pop up for the second install.

Repeat the above procedure as before.

After the initial installation the driver settings should remain permanent.

If you have any problems with this setup please call **Weldon, A Division of Akron Brass**  
(800) 989-2718 -- V-MUX® support on extensions x9509, x9510

## Appendix B: V-MUX Internal Commands:

**Ack** – Acknowledge to clear Load shed, Analog Warnings and Diagnostic errors on the VFD.

**Download Code** – \*\*DANGER\*\* Tells a mounted node to INVALIDATE its current program for new programming.

**Download Data** – NOT USED , OBSOLETE

**Invalidate** – NOT USED, OBSOLETE

**Mount** – Puts selected node into a one-on-one state, this will allow you to extract certain types of information from the node. MOUNT must precede the DOWNLOAD CODE command.

**Set Load Level** – Use this command with a mounted node to set the Load shed level to any desired value – even though the actual voltage level is ok. Type the desired load level into the Data Byte click the send to set the load level.

**Pause System** – Pauses the system so that it will not send commands.

**Resume System** – Resumes the system after pause.

**PC Random Send** – Test command used for purposely creating collisions. Disabled in production code so it will not do anything if you use it.

-----  
Commands that begin with “Get” require you to mount the node you want to extract information from. The Node the Data Field of the Data Transport Command.

**Get Command Array** –Returns the value of all commands that are turned ON in the system. The command array is an internal array of all the commands available to the system. The value that returns will be a sum of all the positions. Value range is 0-1024.

**Get Input Array** – Extracts the status of the input array for the node you are mounted to. The value will be the sum of all the inputs turned on for that node.

**Get Output Array** – Returns the sum off all the outputs that are turned on for the node you are mounted to.

**Get Flash Data** – Returns the flash information in the data field. The Flash Information Icon 14  on the top tool bar is recommended; this will return information in the upper window that is already formatted.

**Get Protocol Errors** – NOT USED

**Get Collisions** – Retrieves the total number of collisions that have occurred on the network.

**Get Buffer High** – Retrieves the highest position that the receive buffer has reached. The buffer has 20 positions. If the number returned in the data filed is 20 you should check the buffer overflows. Use GET ALL MAIL STATS for more information.

**Get Buffer Overflows** – If the Buffer High position reaches 20 then you can expect to see a number returned in this request. If the Buffer High is below 20 you should not see any value other than 0 returned.

**Get Command Checksum** – This command will return the checksum value of the command array.

## Appendix B: V-MUX Internal Commands (Continued):

**Get Analog Channel** – To obtain the raw value of the analog channel use this command. Enter the channel number of the request in the data field

**Get Voltage** – Returns the local voltage from any node (System Voltage is from node 1) .

**Get Load Level** – Returns the load-shed level from the node you have mounted.

**Get Embedded Version** – Returns the embedded code (operating system) version a node is running.

**Get All Mail Stats** – Using this command while mounted to a node will receive the network stats for that node. The request will go out to the node and the node will transport the network information back Via the Data Transport command. The network information will be in the following order with values for each item in the data byte:

Inbox high: The inbox has 20 positions; a value >20 usually means a network problem. Inbox overflows: This represents the number of times Inbox high has exceeded 20. Outbox high: This also has 20 positions and should always be a value lower than 20. Outbox overflows: This represents the number of time the Outbox has exceeded 20. Messages received: A running total of the number of messages that have been received. Messages sent: A running total of the number of messages that have been sent.
---

**Get TP and Set TP** – For Weldon use only. Used for debugging problems with Weldon test code; TP = Test Point.

----- Nodes transmit inter-System information to one another using the following commands. -----

**Data Transport** – This is the command that a node uses to transport data; for instance, a node uses this command to reply answers to your “Get” requests. Using this command from the PC will do nothing.

**VM Sync** – This command syncs all the nodes together; the nodes are synced in order to maintain patterns for flashing lights. Node 1 sends the Sync command every few seconds, if the other nodes on the network do not hear a Sync command they will start broadcasting an “Out of Network Message. You can observe this in the Diagnostics lower window.

**VM Load Shed** – This command is used for the nodes when transmitting the load shed values to each other. It is updated on the right side of the Diagnostics software

**VM Request for Command Checksum** -- A node that has been out of network or has had protocol errors will use this internal command.

**VM Diagnostics** – The nodes to transmit their diagnostic messages use this command.