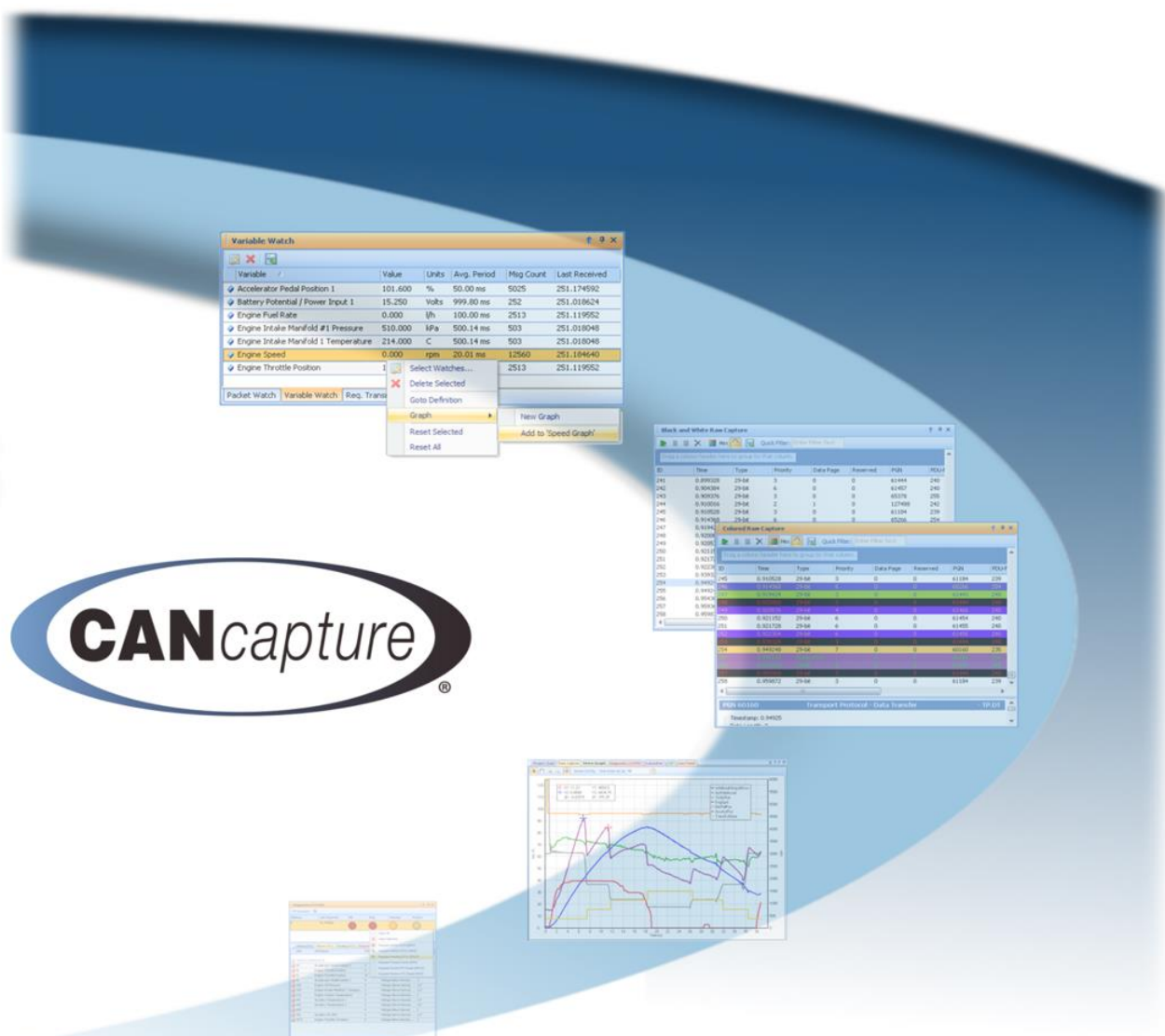


CANcapture[®]

Advanced CAN Diagnostic Software



www.cancapture.com

User Manual

Document Number ER000088_00



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CHANGE RECORD

REV	ORIG	APPR. 1	APPR. 2	APPR. 3	SEC./ PG.	DESCRIPTION	DATE
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1 INTRODUCTION

Thank you for purchasing CANCapture from EControls. CANCapture is the complete Controller Area Network (CAN) solution that offers every feature one would expect from a CAN diagnostic and analysis tool and more.

To start using CANCapture you will first need to install the software. Please refer to the Section 3 for software installation steps; CANCapture user instructions begin in Section 4.

NOTE: This manual replaces the following legacy documents:

- EPC0061 (CANCapture Installation Procedure)
- ERC0016 (CANCapture User Manual)

CANCapture is supplied with a custom ECOM cable that is enabled to run your new CANCapture software. The ECOM cable is a USB2.0 High-Speed device that allows Controller Area Network (CAN) traffic to be transmitted and received using a computer or laptop. You may distribute the software to as many target machines that you like; however, the software will only operate with the CANCapture enabled ECOM device.



2 ACRONYM / ABBREVIATION DEFINITIONS

The following acronyms/abbreviations are found within the manual sections that follow:

ACRONYM/ ABBREVIATION	DESCRIPTION
ASCII	American Standard Code for Information Interchange – character encoding standard
CAN	Controller Area Network
CCP	CAN Calibration Protocol
CSV	Comma-Separated Variable
DBC	Visual FoxPro database file extension
DTC	Diagnostic Trouble Code
ECOM	EControls COMMunication Interface
HEX	HEXadecimal
IEEE	Institute of Electrical and Electronics Engineers
J1939	SAE standard – recommended practice used for communication and diagnostics among vehicle components
NMEA	National Marine Electronics Association
PGN	Parameter Group Number
SPN	Suspect Parameter Number

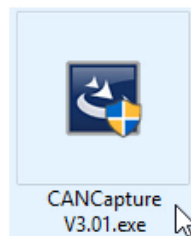
3 SOFTWARE INSTALLATION

To start using CANCapture you will first need to install the software. Please refer to the steps in this section for software installation instructions.

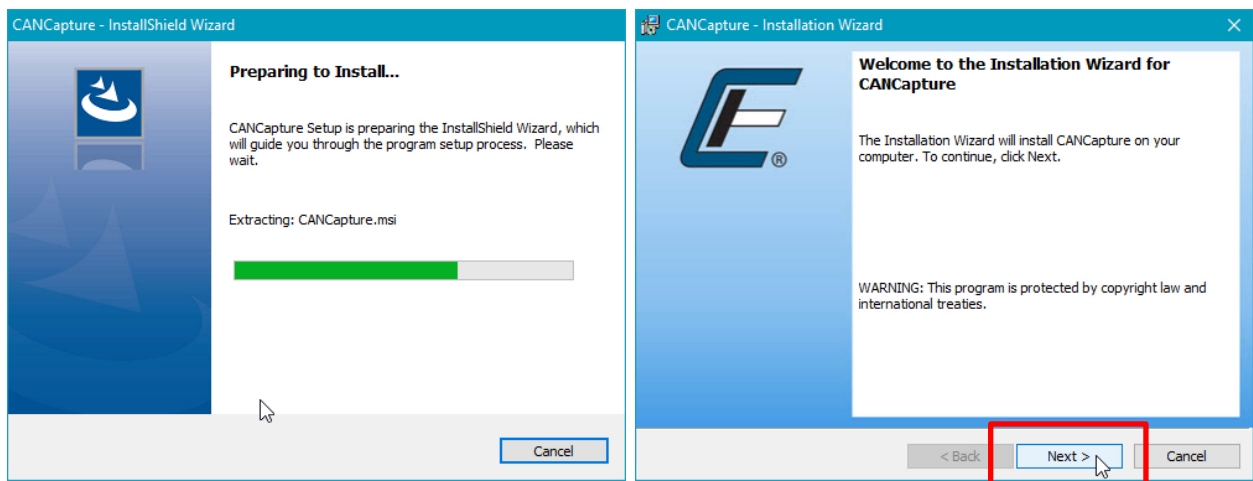
- 1) Locate the CANCapture installer file CANCapInstaller_Vx.x.exe.

NOTE: (x.x) will be a decimal number value representing the most recent revision of the software.

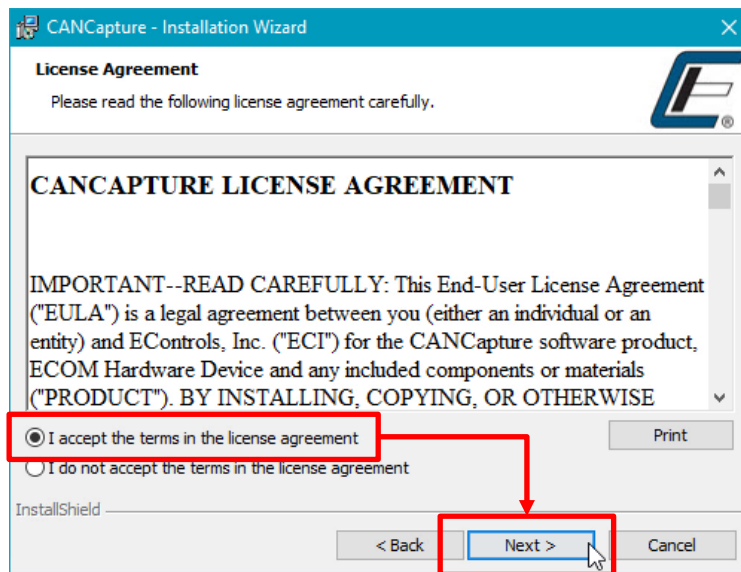
- 2) Right-click the file name or installer icon and select 'Run as Admin' from the context-specific dropdown.



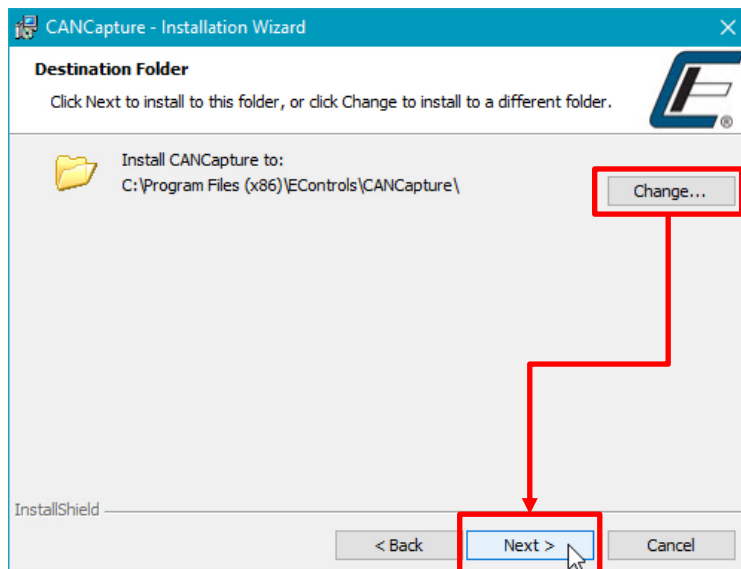
- 3) Select **[Yes]** to the Windows system message asking for authorization to make changes to the PC or device.
- 4) After a **Preparing to Install** window appears briefly, select **[Next >]** at the CANCapture installer **Welcome** window:



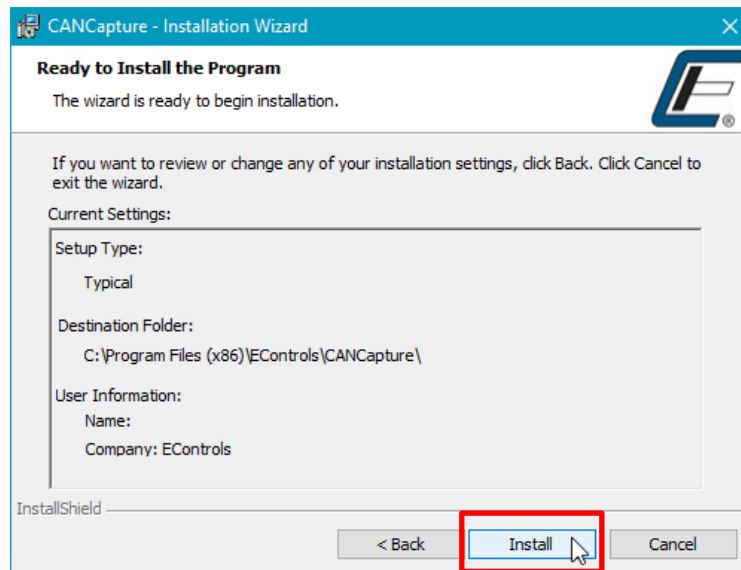
- 5) At the **License Agreement** window, click to Accept the license agreement terms, then select **[Next >]**.



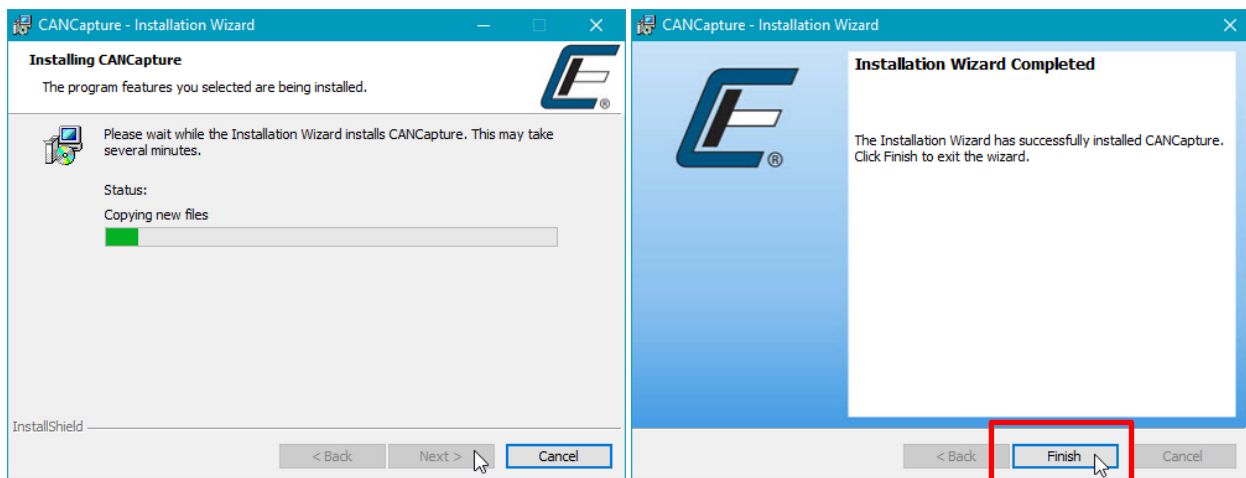
- 6) At the **Destination Folder** window, select **[Change...]** to modify the default installation folder as needed, then select **[Next >]**.



- 7) At the **Ready to Install the Program** window, review the setup type, destination folder and user information, and go [**<Back**] to make any changes as needed. If no changes are required, select [**Install**].



- 8) The **Installing CANCapture** window will show installation progress before transitioning to the **Installation Wizard Completed** window. Select [**Finish**] to finalize the installation and close the installer.

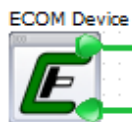


You are now ready to start using **CANCapture**!

4 GRAPHICAL WORKSPACE AND DATA FLOWCHART

CANCapture uses a graphical data work space flow chart as its centralized location for managing and controlling the program's behavior. The flow chart is used to visually control the flow of CAN traffic in and out of various function blocks which can each handle, interpret, and react to data in unique ways. The flow chart is highly flexible, allowing one to freely manipulate function blocks and draw interconnects at any time (before or during a "live" capture) and in any way.

- The interface is completely flexible - add unlimited function blocks anywhere on the grid and join them with interconnect lines that can be branched and connected in any way. Interconnect lines turn green to easily identify when they are properly connected.
- The flow chart can be manipulated during a "live" capture and will immediately respond to changes. There's no need to stop a session just to change the data flow.
- Each block corresponds to its respective window (or panel), which can be renamed, disabled, focused, or removed all from the chart.
- Cut, copy, and paste functionality is supported as well as an import and export feature for saving and sharing configurations with others. For example, you can easily export your list of transmit messages or a custom packet filter to share with a colleague.



The ECOM block is typically the source of all messages throughout the CANCapture flow chart. Using the flexible nature of CANCapture's flow chart, one can easily wire and route the messages received on the CAN bus in an unlimited number of ways. For example, the output port of one ECOM block can be routed to the input port of another to create a simple bridge between two CAN buses. Alternately, a packet filter or custom script can be placed between the two so that only specific messages will be forwarded - the possibilities are virtually endless.

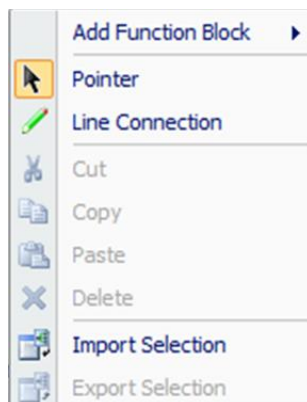
Every message that is received by the ECOM block contains a hardware timestamp that is accurate within microseconds. The ECOM is capable of capturing CAN 2.0A (11-bit), CAN 2.0B (29-bit) messages, and all CAN error frames. All messages are fully supported throughout the CANCapture data base and software.

J1939 multi-packet and NMEA-2000 Fast Packet messages are seamlessly supported by the ECOM block. Immediately after the final packet of the J1939 connection management session is received, the reassembled multi-packet message will be injected into the stream (unless disabled in the ECOM block properties). All other blocks that receive this message will treat it like a normal packet. This means that a packet-watch can monitor the packet's statistics; additionally user panels, graphs, and variable-watches can all access each variable of the multi-packet message.

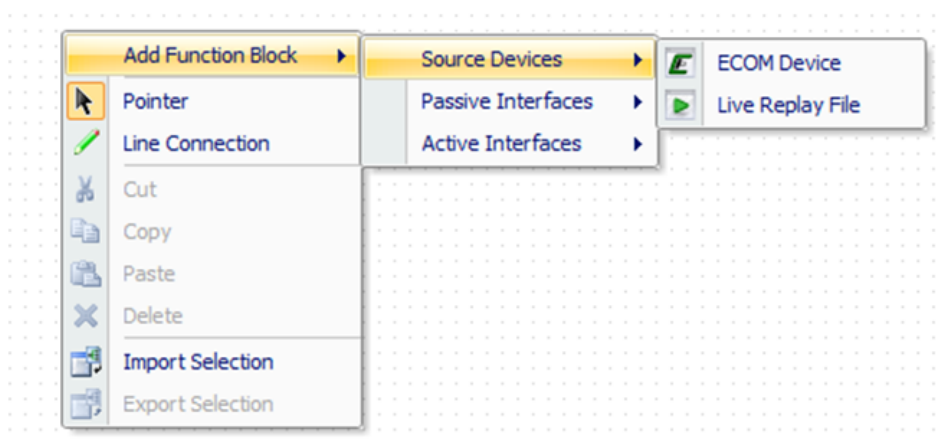
If more than one ECOM device needs to be used in a CANCapture flow chart, the properties of each block can be manually configured to assign a specific device serial number to each. In addition specific CAN error frames and J1939 multi-packet support can be enabled or disabled in the properties.

4.1 Adding Function Blocks

To add a function block to the Graphical Data Flowchart simply click the right-hand mouse button to display the valid choices.



You may add a CAN message Source Device by selecting **[Add Function Block → Source Devices]**. The following will be displayed:



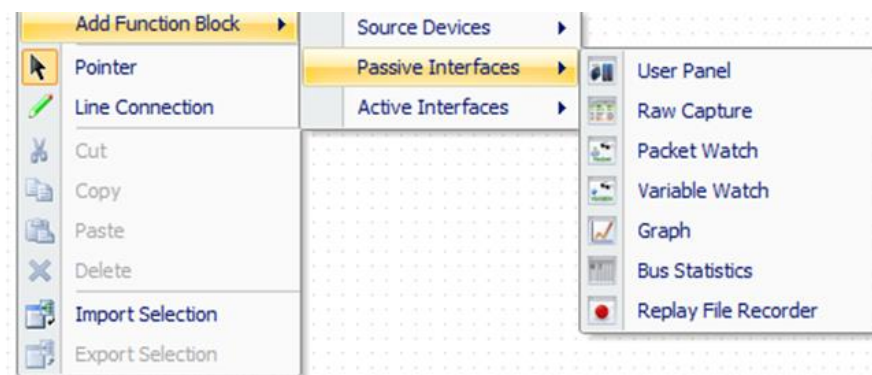
Source Device selections are:

ECOM Device - The **ECOM Device** function block is used to represent an ECOM device physically connected to the local computer. As each message (or error frame) is received from the CAN bus, it is sent to the output port of the block. If a trace is connected to the input port of the ECOM block, each incoming message that is received will be transmitted on the respective CAN bus.

Live Replay File - The **Live Replay File** function block is used to playback CAN sessions previously captured and saved using a Recorder Block. The recorder simply saves every received CAN message to a user specified file so that it can be replayed at a later time. The live replay allows real-time playback, preserving all original timestamps in the process. An entire saved session can be perfectly replayed for repeated analysis; furthermore, rate of playback can be changed anywhere from 1/10th to 100x the original speed.

4.1.1 Passive Interface Function Blocks

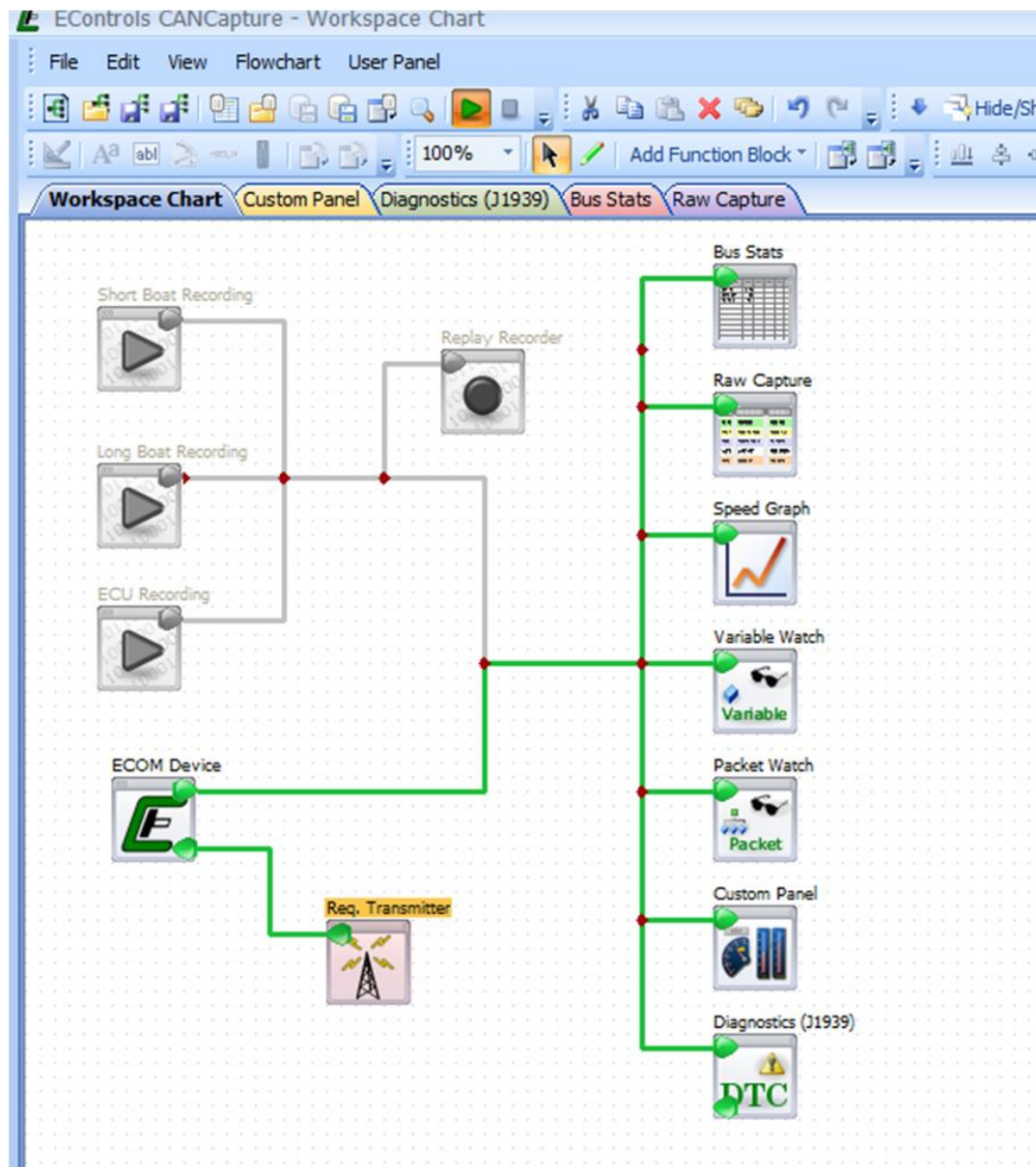
You may add a passive function block by left-clicking the mouse on the specific selection in the drop down menu as illustrated below.



The selections are:

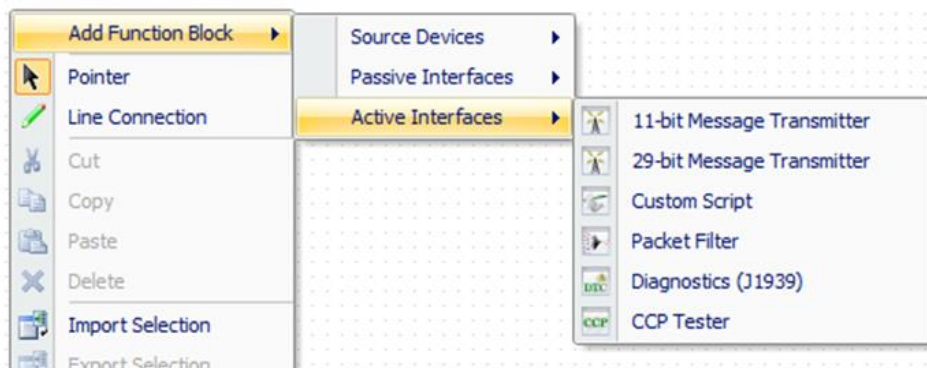
- User Panel** - The **User Panel** block is designed specifically to display and monitor real-time data using a variety of fully customizable gauges, thermostats, number sliders, and text labels. The panel consists of a simple form editor that allows gauge items to be added and linked to any variable in the CAN database. Every aspect of the items can be configured to create a unique appearance; custom and pre-designed themes are also available.
- Raw Capture** – The **Raw Capture** block displays a real-time list of every CAN message (or error message) that is received by its input port. Aside from showing all the relevant information, if an incoming packet is defined in the current CAN database, the packet will be highlighted using the assigned color-code. The block also provides "live" text filtering based on all displayed columns, advanced hierarchical column sorting, locked/unlocked automatic scrolling, exporting to excel for post-analysis, full integration with the active CAN database, an advanced details view for each packet, and the ability to display all relevant fields in either decimal or hexadecimal.
- Packet Watch** - The **Packet Watch** block is used to monitor the statistics of individual packets received on the CAN network. It can be used to measure the average period, total message count, message rate, maximum period, minimum period, and last time received for any message type. All measurements are high-precision due to the utilization of hardware timestamps from the ECOM device are used.
- Variable Watch** - The **Variable Watch** block is used to monitor the value and stats of individual CAN variables. The watch list reports the current value as well as the average received period, total count, and last received timestamp for each chosen variable. The block also supports exporting all variables to a Microsoft Excel CSV file for easy post-analysis.
- Graph** - The **Graph** block is used to plot any variable in the CAN database; as each variable is received, it is plotted in real-time in the graph window. The graph was developed from scratch with the purpose of being able to handle streaming data with a moving time axis. Due to its tuned development efforts and focus on performance, there is no graphing tool available that is better suited for real-time streaming data – response and display time is instantaneous.

- **Bus Statistics** - The **Bus Statistics** block is used to report statistics for all CAN messages that are received. It displays information about the total packet counts, error counts, multi-packet counts, data transmission rates, bus loading, capture time, and the capture state.
- **Replay File Recorder** - The **Replay File Recorder** saves every received CAN message to a user specified file so that it can be replayed at a later time. The live replay allows real-time playback, preserving all original timestamps in the process. An entire saved session can be perfectly replayed for repeated analysis; furthermore, the rate of playback can be changed anywhere from 1/10th to 100x the original speed.



4.1.2 Active Interface Function Blocks

To add active function blocks, select **Active Interfaces** as illustrated below:

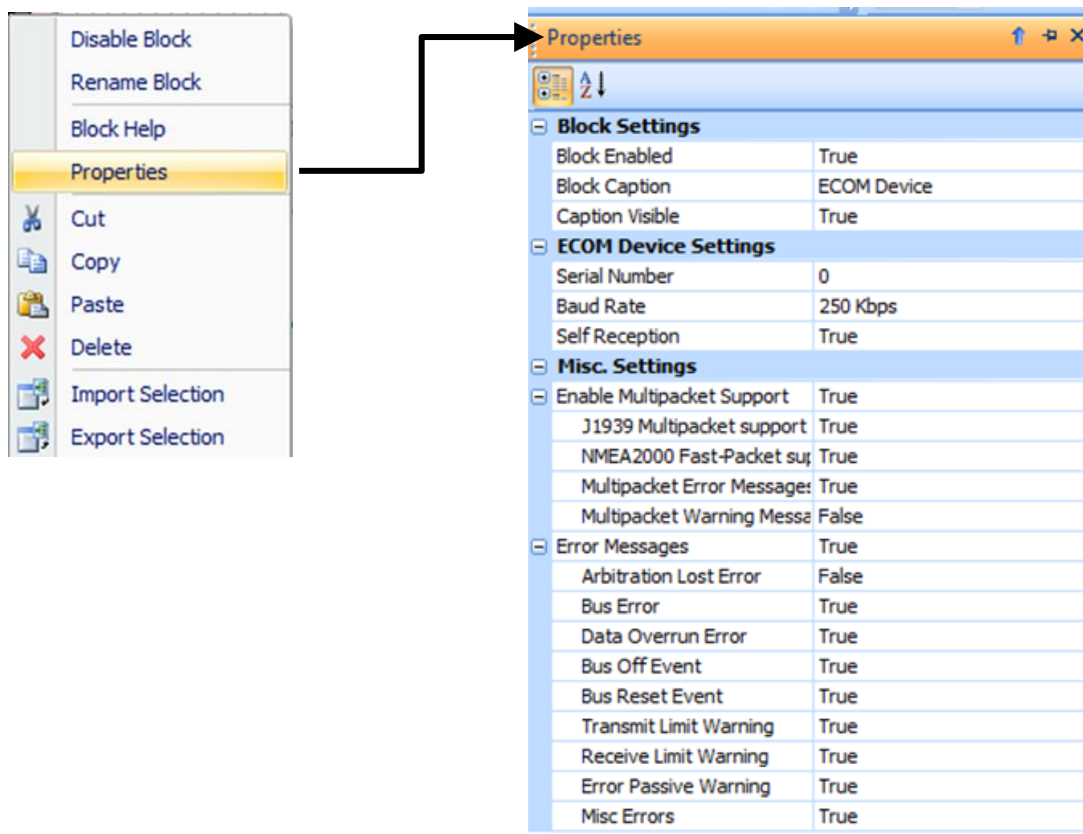


The selections are:

- **11-bit Message Transmitter/29-bit Message Transmitter** - The 11-bit and 29-bit Transmitter blocks are used to generate messages on the CAN network. Each transmitter can be configured to send pre-defined messages after a certain time offset, at a recurring interval, or after a hot-key is pressed by the user. Standard CAN and J1939 packets are both supported along with all relevant fields.
- **Custom Script** - The **Custom Script** block is used to write customized code that can interact with incoming and outgoing packets. The C/C++-like syntax can be easily learned – even by non-programmers – based on the many examples and documentation that is available. If a special function is needed and none of the other blocks can do it, the scripting will be able to fill the gap. Easily implement advanced filters, triggered responses, data encryption/decryption, end-of-line testing procedures, node emulators, etc.
- **Packet Filter** - The **Packet Filter** block is used to selectively forward incoming CAN packets to the block's output port. Each filter can be configured as either a "Pass Filter," where only matching packets get forwarded, or as a "Reject Filter," where all messages are forwarded except those that match. Packets can be added, removed, enabled, or disabled, all while the capture is still "live".
- **Diagnostics (J1939)** - The **Diagnostics (J1939)** block is used to display diagnostic trouble codes (DTCs) and other fault-code information for J1939 based systems. The diagnostic window displays the Malfunction Indicator Lamp (MIL), Red Stop Lamp, Amber Warning Lamp, and Protect Lamp states for all systems on the CAN network. It also has the ability to display an interactive list of all active, pending, and historic DTCs as well as freeze frame data and information.
- **CCP Tester** - The **CCP Tester** block is used to test and diagnose a CAN Calibration Protocol (CCP) implementation. The block supports all the fundamental CCP commands: CONNECT, GET_CCP_VERSION, EXCHANGE_ID, GET_SEED, UNLOCK (CAL resource), SET_MTA, DOWNLOAD, UPLOAD, and DISCONNECT. It allows the user to enter a simple script to perform the custom GET_SEED/UNLOCK sequence and provides support for reading and writing arbitrary memory addresses in an ECU.

4.2 Configuring Function Blocks

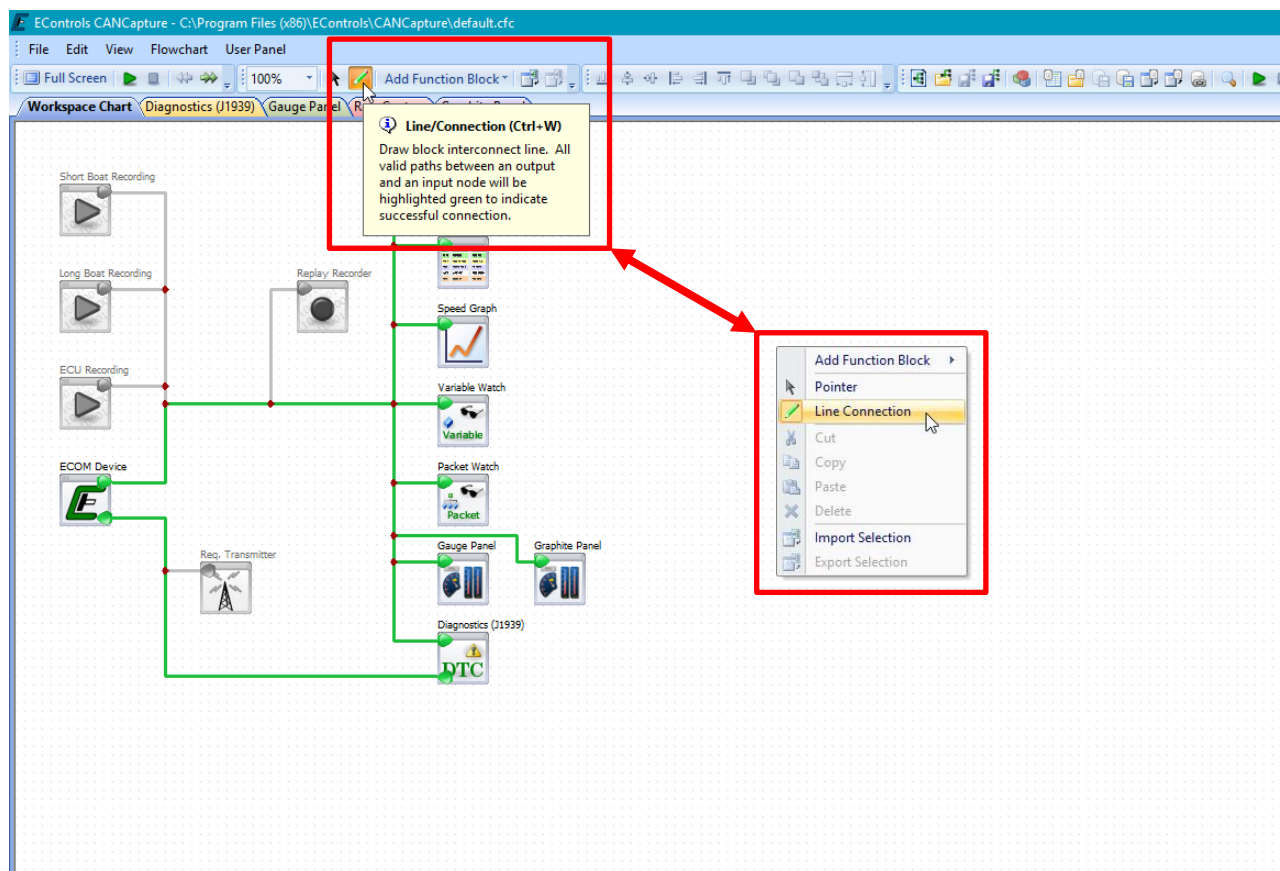
Each function block may be configured by selecting the desired function block, right-clicking the mouse button, then selecting **[Properties]** from the drop down menu and left-clicking the mouse on the selection as illustrated below. The **Properties** window will indicate the parameters of the selected function block:



Any of the parameters may be modified by simply left-clicking on the parameter you wish to modify. Parameters that have boundaries on their values have a drop down menu for the selection of the valid choices for that particular parameter.

4.3 Connecting the Function Blocks

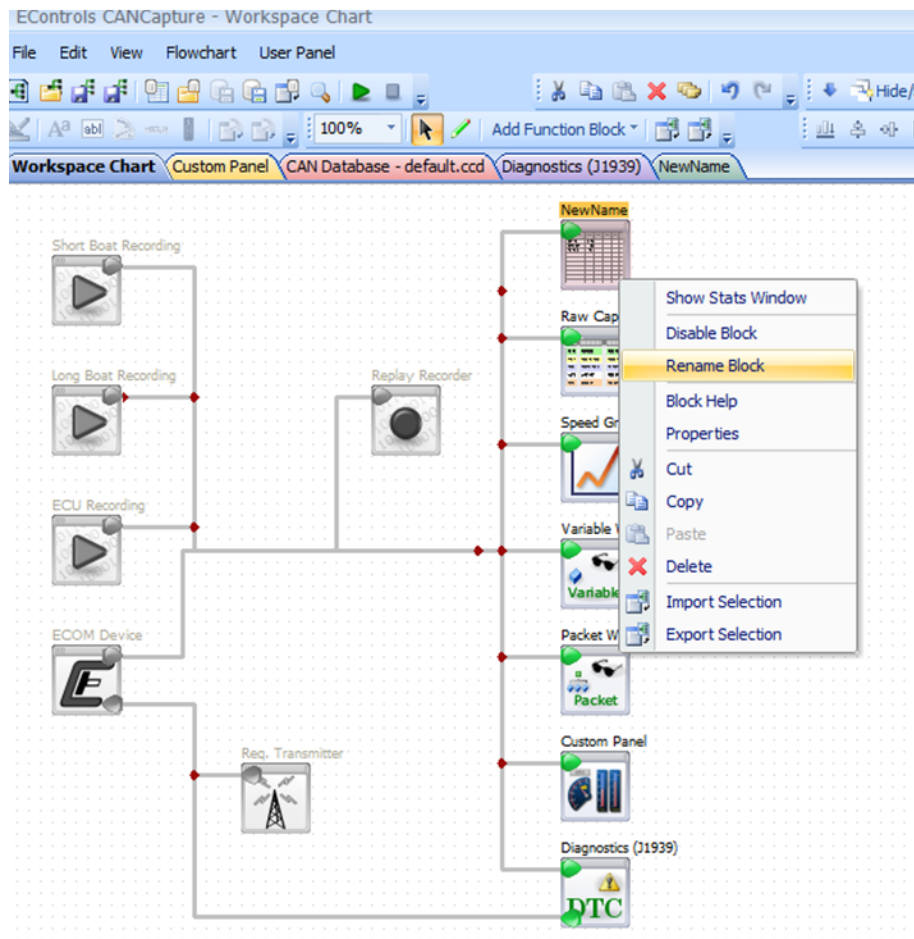
To connect the respective function block to the output of an ECOM, Replay Recorder or any other block, you simply right-click on the workspace and select **[Line Connection]**. Alternately, select the **Line/Connection (Ctrl+W)** icon on the **Graphical Workspace Toolbar** menu and connect to the input of the function block you wish to receive the CAN messages, as illustrated below:



The **Drawing Pen** will now appear. You may now connect the function blocks as you please. When you have completed the connection of the function blocks you may exit the **Line Connection** function by depressing the **[ESC]** key on the keyboard or select the **[Pointer]** option from the drop down menu.

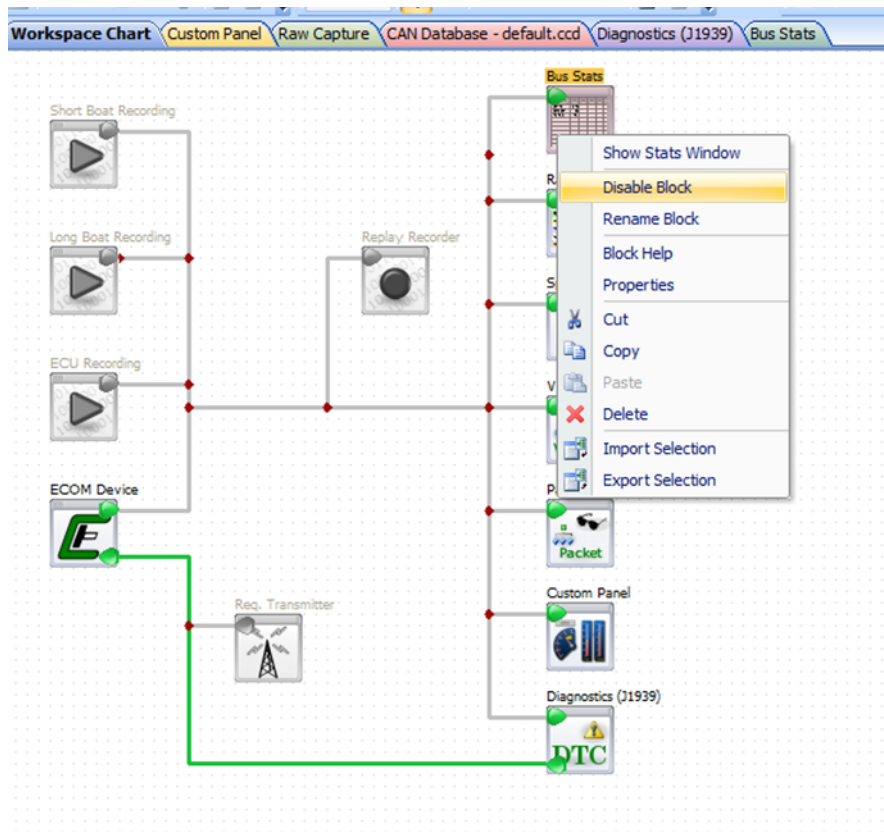
4.4 Renaming Function Blocks

You may rename the function blocks by right-clicking on the function blocks that you want to rename and selecting **[Rename Block]** by left-clicking on the selection and typing in a unique name of your choice as illustrated below. Alternatively, you may depress the **[F2]** Key on the keyboard with the function block selected.



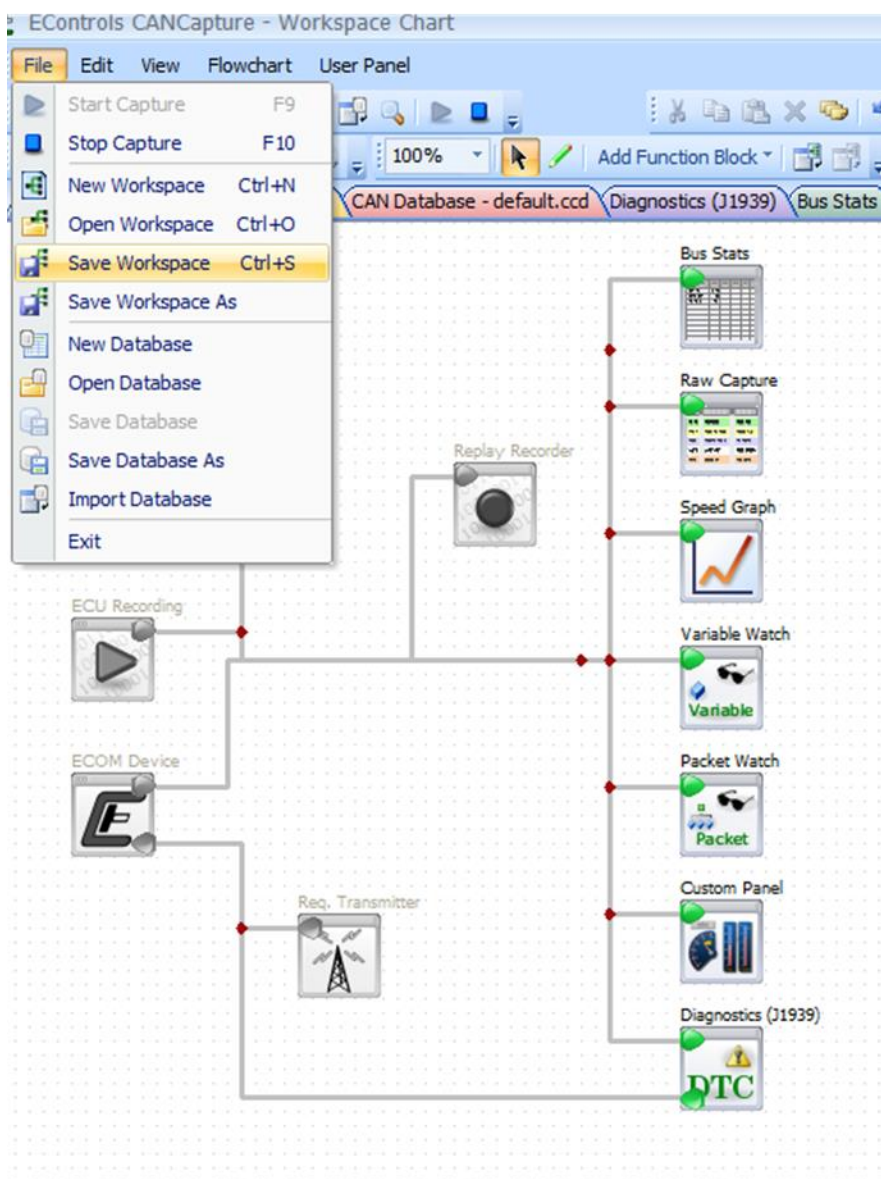
4.5 Enabling / Disabling Function Blocks

You may **Enable** or **Disable** a function block – either active or passive – by left-clicking on the function block you wish to effect and selecting either **[Disable Block]** or **[Enable Block]** from the drop down menu by left-clicking the mouse on the selection as illustrated below.



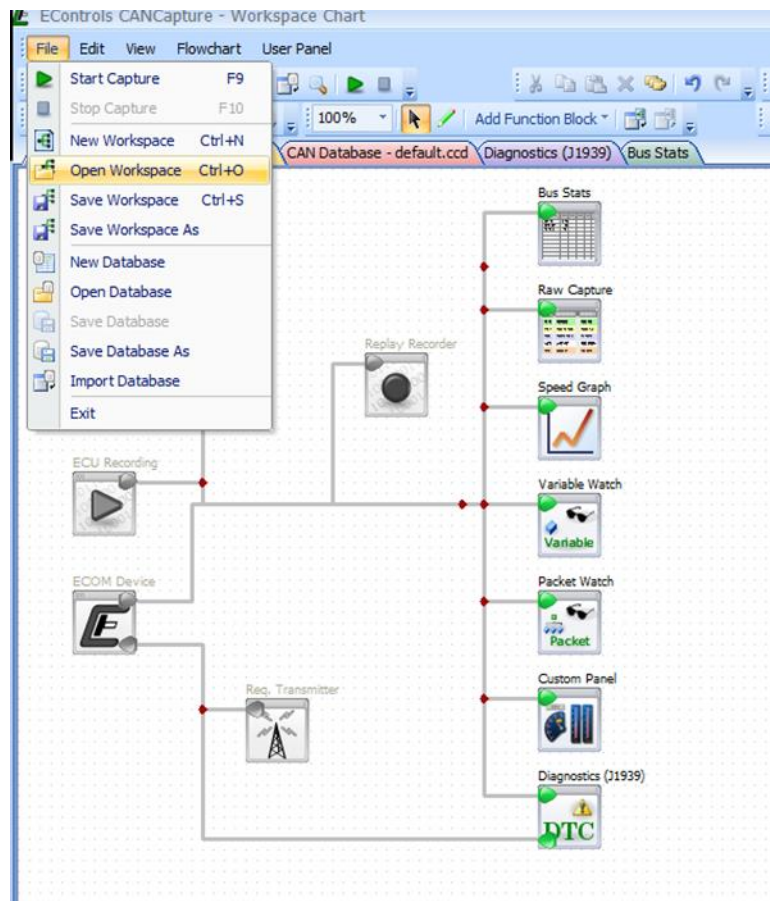
4.6 Saving Your Workspace Chart

You may save your **Workspace Chart** to a location of your choice by selecting [**File**] on the upper tool bar menu and then [**Save Workspace As**] or [**Save Workspace Ctrl+S**] from the drop down menu by left-clicking the mouse on the selection. Select the location where you want to save the **Workplace Chart** and double click on the [**Save**] button as illustrated below.



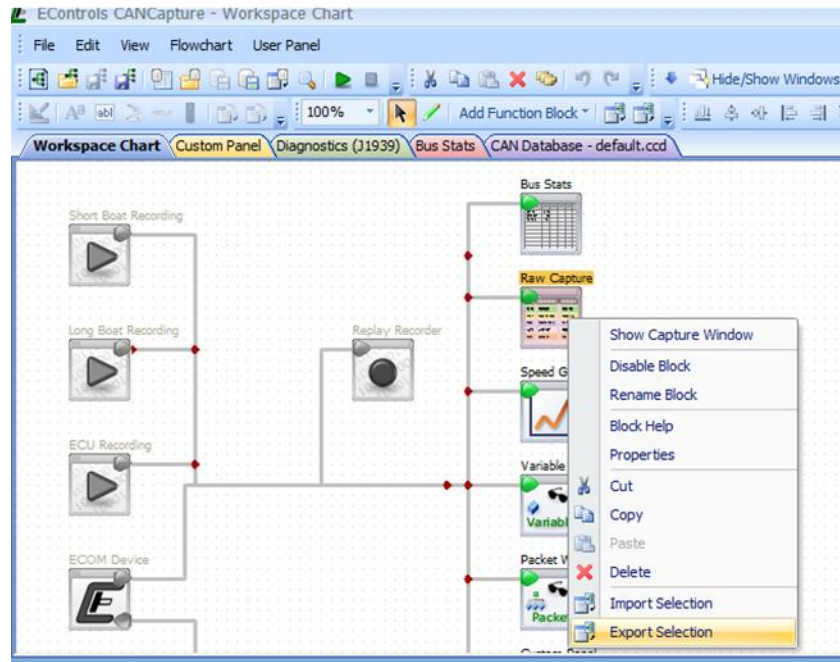
4.7 Retrieving a Saved Workspace

You may **Retrieve** a saved **Workspace Chart** by selecting [**File**] on the **Tool Bar Menu** and then selecting [**Open Workspace Ctrl+O**]. When the window opens, select the location of the saved **Workspace Chart** that you want to retrieve and select it by double-clicking with the left-hand mouse button as illustrated below.



4.8 Exporting a Function Block to a File

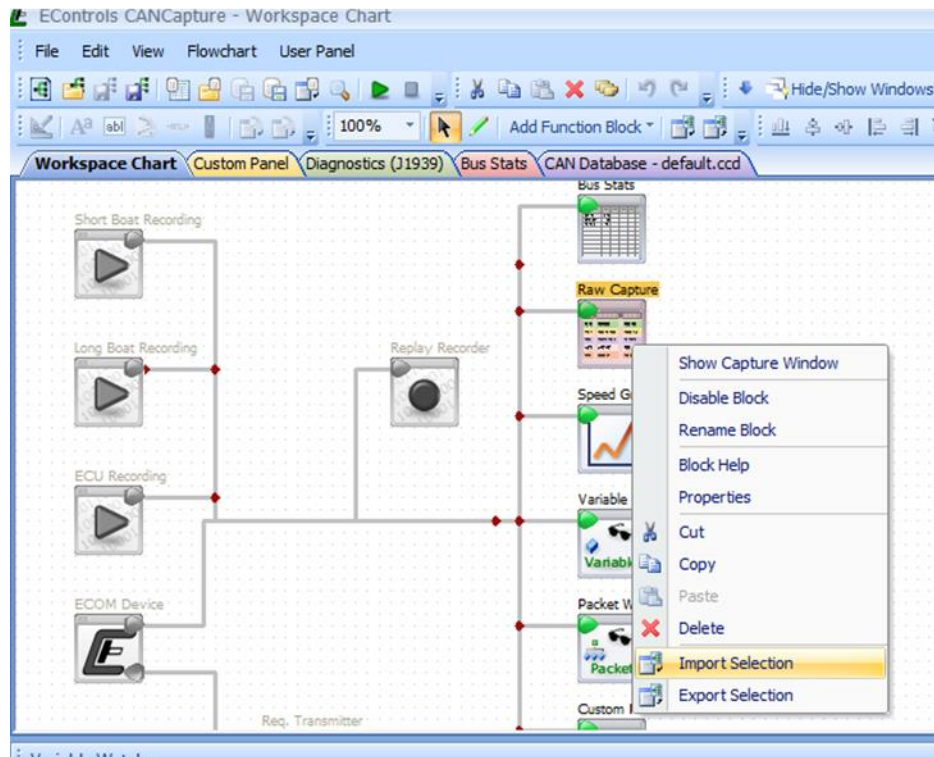
You may save a function blocks with all the settings you have selected to a file of your choice. To save a function block, right-click the mouse on the function block and select **[Export Selection]** by left-clicking on the selection as illustrated below.



You may now select the location on your computer where you wish to save the function blocks for importing at a later time. You may give the file a name of your choice and select **[Save]**.

4.9 Importing a Saved Function Block

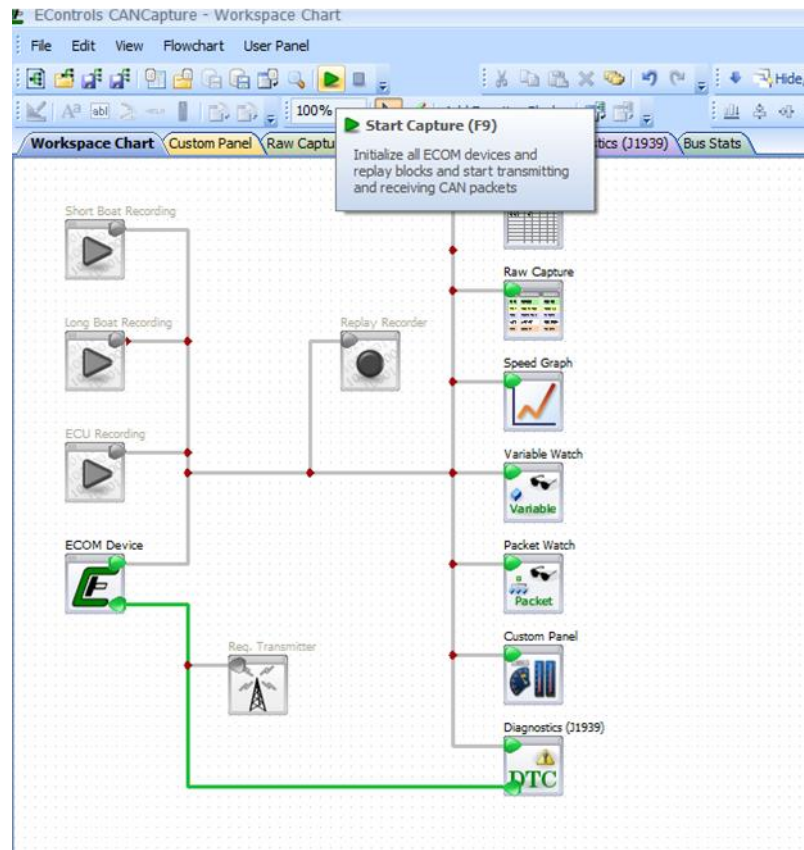
You may import a saved function block to your workspace flowchart by right-clicking on a workspace and selecting **[Import Selection]** from the drop down menu by left-clicking the mouse on the selection as illustrated below.



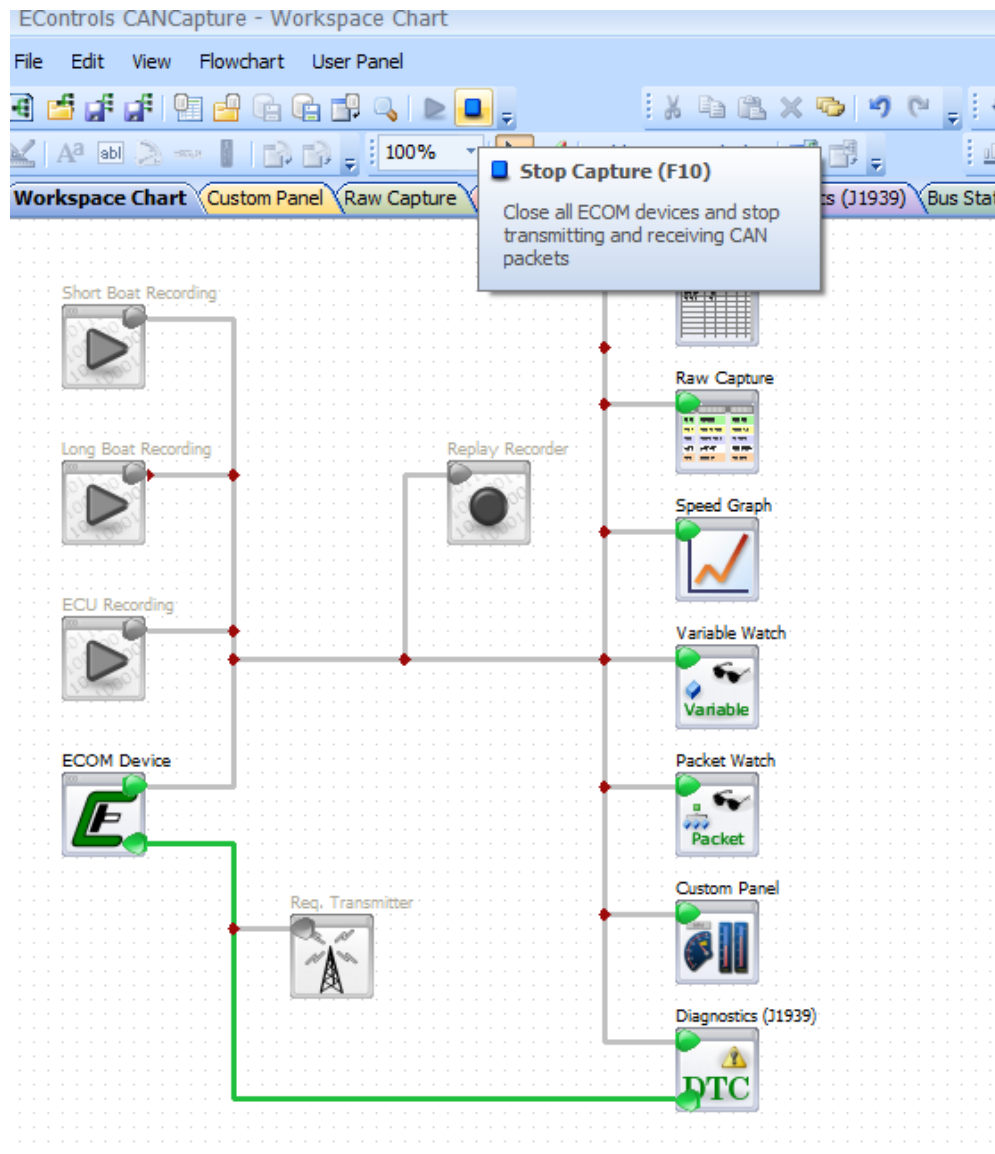
You may now navigate to the file name that you exported the function block properties to and select **[Open]**.

4.10 Starting and Stopping CANCapture

To initialize **CANCapture** select the green arrow [▶] in the toolbar or depress [F9] on the keyboard as illustrated below. This will enable all **ECOM** devices and **Replay** blocks and begin transmitting and receiving CAN messages.



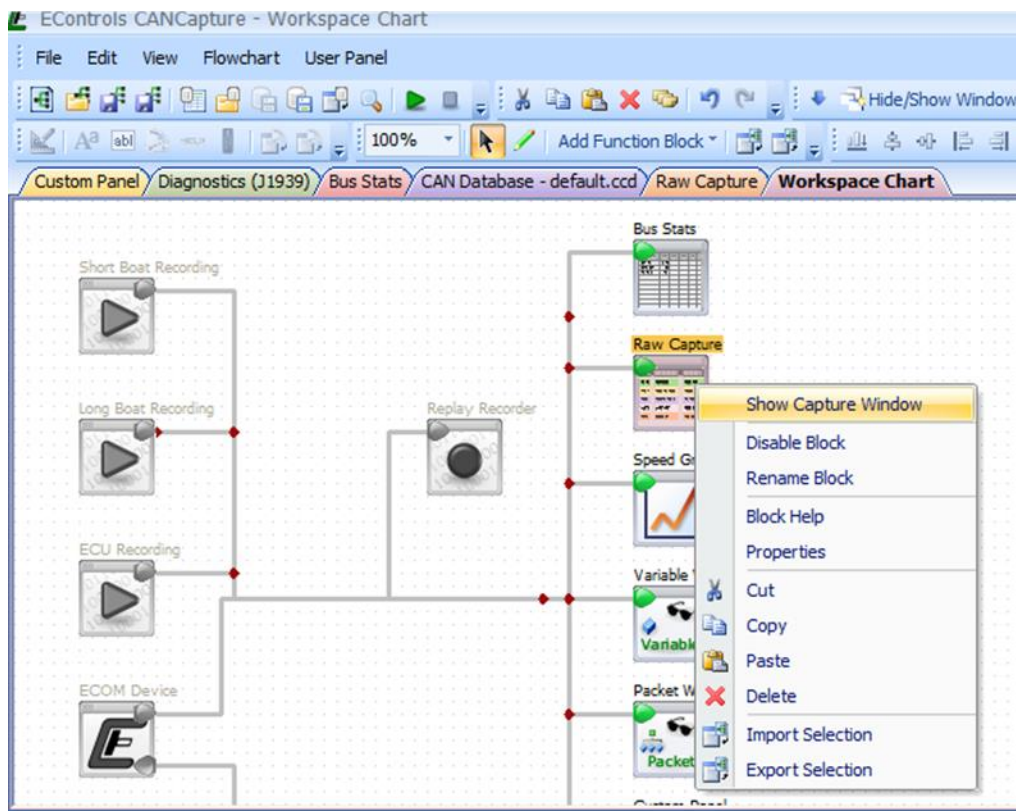
To **Stop** CANCapture select the blue square [■] to the right of the start icon by clicking the left-hand mouse button on the **Stop Capture** icon or depressing [F10] on the keyboard. This will disable all **ECOM** devices and **Replay Recorders** and stop transmitting and receiving CAN messages.



5 RAW CAPTURE FUNCTION BLOCK

5.1 Displaying the Raw Capture Window

You may display a capture window by right-clicking on the specific function block you want to display and selecting **Show Capture Window** by left-clicking the mouse on the selection as illustrated below.



CANCapture will now display the data associated with the selected function block on the display window. An example of a **Raw Capture** Window is illustrated below.

EControls CANCapture - Raw Capture

File Edit View Flowchart User Panel

Custom Panel Diagnostics (11939) Bus Stats CAN Database - default.ccd Raw Capture Workspace Chart

Quick Filter: Enter Filter Text

Drag a column header here to group by that column.

ID	Time	Type	Priority	Data Page	Reserved	PDU-F	PDU-S	Source Add...	PGN	PID	Data Length	Data
1490	9.840200	29-bit	3	0	0	240	4	0	61444	217056256	8	25...
1491	9.848256	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0
1492	9.858240	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0
1493	9.862232	29-bit	3	0	0	240	4	0	61444	217056256	8	25...
1494	9.868224	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0
1495	9.878208	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0
1496	9.883200	29-bit	3	0	0	240	4	0	61444	217056256	8	25...
1497	9.888256	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0
1498	9.898240	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0
1499	9.902232	29-bit	3	0	0	240	4	0	61444	217056256	8	25...
1500	9.908224	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0
1501	9.918208	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0
1502	9.923200	29-bit	3	0	0	240	4	0	61444	217056256	8	25...
1503	9.928256	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0
1504	9.938240	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0
1505	9.943168	29-bit	3	0	0	240	4	0	61444	217056256	8	25...
1506	9.948224	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0

Variable Watch

You may **Start**, **Pause**, or **Stop** the capture from the tool bar menu on the **RAW Capture** window.

EControls CANCapture - Raw Capture

File Edit View Flowchart User Panel

Workspace Chart Custom Panel Diagnostics (11939) CAN Database - default.ccd Properties Bus Stats Raw Capture

Quick Filter: Enter Filter Text

Start Capture

Initialize all ECOM devices and replay blocks and start transmitting and receiving CAN packets

ID	Time	Type	Priority	Data Page	Reserved	PDU-F	PDU-S	Source Add...	PGN	PID	Data Length	Data
211	13.880128	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
212	13.888704	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
213	13.898112	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
214	13.906720	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
215	13.915328	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
216	13.923936	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...

EControls CANCapture - Raw Capture

File Edit View Flowchart User Panel

Workspace Chart Custom Panel Diagnostics (11939) CAN Database - default.ccd Properties Bus Stats Raw Capture

Quick Filter: Enter Filter Text

Pause Capture

This will prevent the current capture list from receiving any packets while the pause is active.

ID	Time	Type	Priority	Data Page	Reserved	PDU-F	PDU-S	Source Add...	PGN	PID	Data Length	Data
217	13.880128	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
218	13.888704	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
219	13.898112	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
220	13.906720	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
221	13.915328	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
222	13.923936	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...

EControls CANCapture - Raw Capture

File Edit View Flowchart User Panel

Workspace Chart Custom Panel Diagnostics (11939) CAN Database - default.ccd Properties Bus Stats Raw Capture

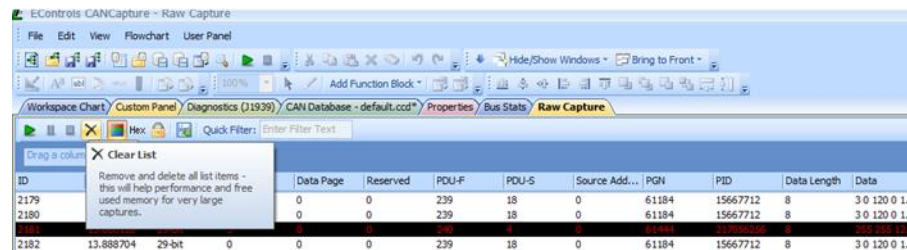
Quick Filter: Enter Filter Text

Stop Capture

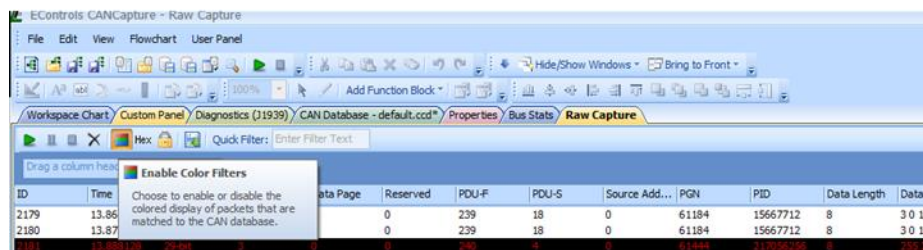
Close all ECOM devices and stop transmitting and receiving CAN packets

ID	Time	Type	Priority	Data Page	Reserved	PDU-F	PDU-S	Source Add...	PGN	PID	Data Length	Data
217	13.880128	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
218	13.888704	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
219	13.898112	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
220	13.906720	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
221	13.915328	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...
222	13.923936	29-bit	0	0	0	239	18	0	61184	15667712	8	3 0 120 0 1...

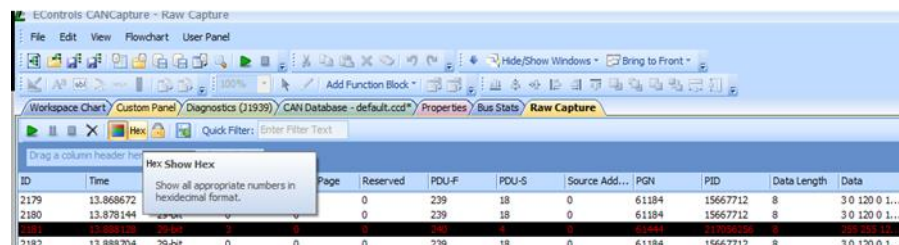
You may clear the **Raw Capture** list by selecting the **Clear List** Icon located on the **Raw Capture** tool bar:



You can enable or disable the **Color filter** by selecting the **Enable Color Filters** icon located on the **Raw Capture** tool bar menu:



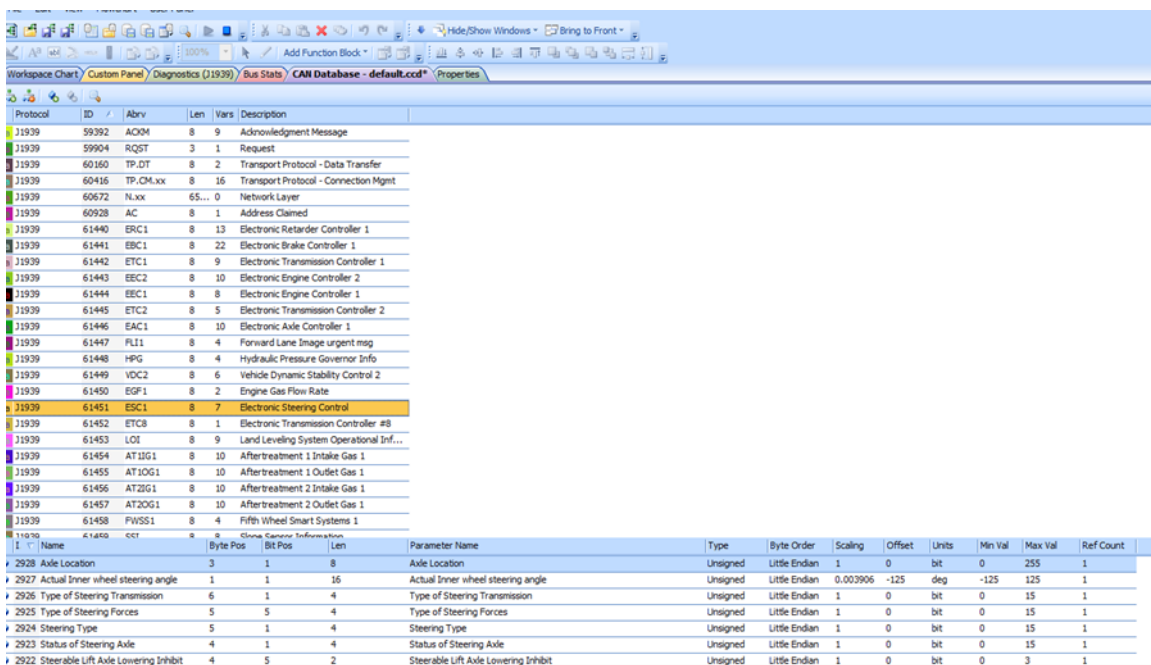
The display can be in either hexadecimal or decimal by selecting the **HEX** icon from the **Raw Capture** tool bar menu:



6 CAN DATABASE

The CAN database is used to identify every packet that is received on the CAN network and passed within the graphical flow chart. Packets are broken into individual variables, and each variable can be assigned a unique conversion formula, operational range, unit, and name. The CANCapture database supports the standard features one would expect from a CAN database, along with many other features:

- The database is integrated into the application, so you can easily add new definitions, jump to existing, add new graphs or variable watches, and manage all variables from one convenient location.
- Support for all variations of CAN protocols - SAE J1939, CAN bus, NMEA-2000, and other proprietary specifications. Includes full J1939 database and natively supports PGN and SPN identifiers.
- Supports importing of other existing .DBC databases.
- Assign color codes to each packet to help easily identify each message type in the "Raw Capture" list.
- Signed, unsigned, IEEE float, IEEE double, and ASCII variable types along with big or little (Motorola or Intel) byte ordering.
- Includes support for the NMEA-2000 Fast Packets and the J1939 transport protocol, including J1939 multi-packet messages, variable length ASCII SPNs, and diagnostic messages and diagnostic trouble codes.
- Integrated "hot-filter" search functionality allows quick and easy access to all variables.

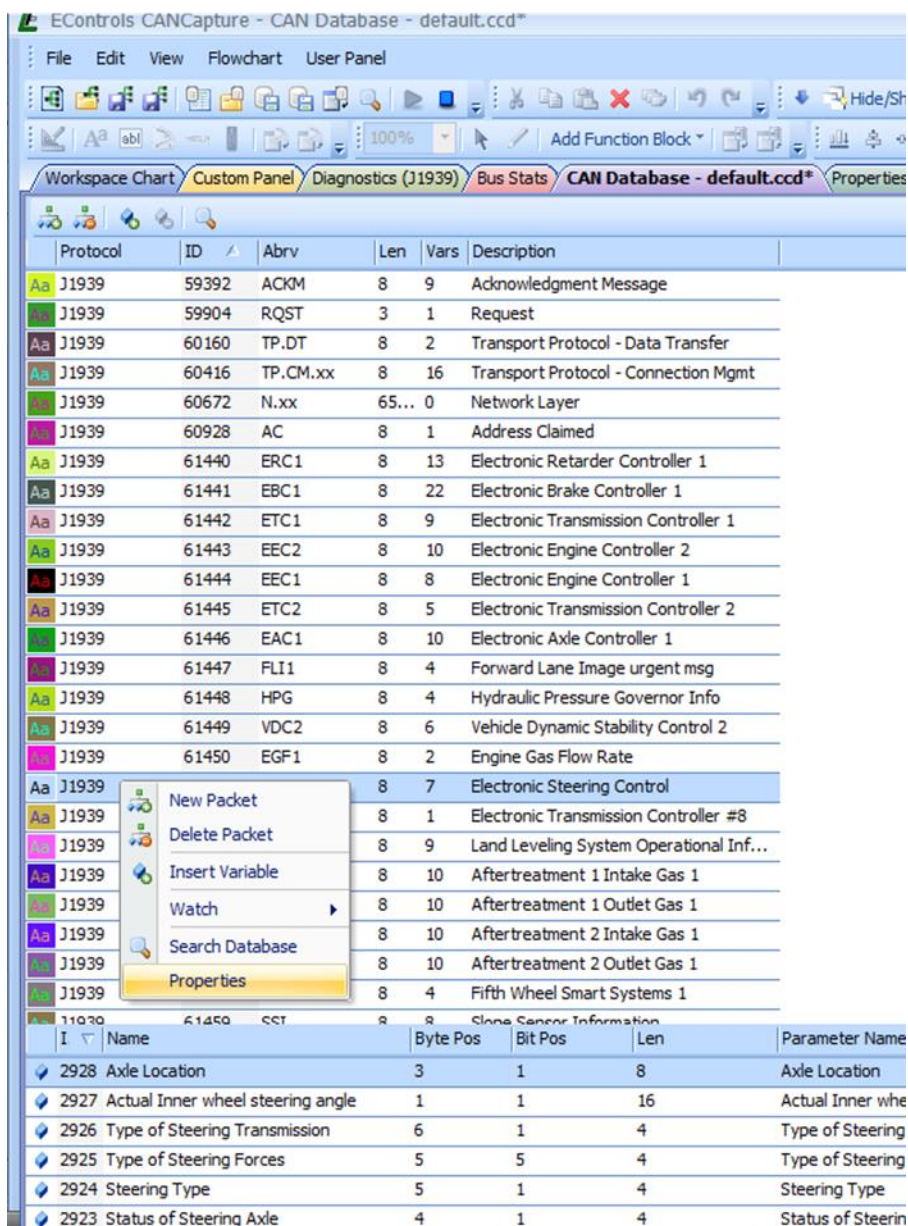


Protocol	ID	Abbr	Len	Vars	Description
J1939	59392	AOM	8	9	Acknowledgment Message
J1939	59904	RQST	3	1	Request
J1939	60160	TP_DT	8	2	Transport Protocol - Data Transfer
J1939	60416	TP_CM_xx	8	16	Transport Protocol - Connection Mgmt
J1939	60672	N_xx	65...	0	Network Layer
J1939	60928	AC	8	1	Address Claimed
J1939	61440	ERC1	8	13	Electronic Retarder Controller 1
J1939	61441	EB1	8	22	Electronic Brake Controller 1
J1939	61442	ETC1	8	9	Electronic Transmission Controller 1
J1939	61443	EEC2	8	10	Electronic Engine Controller 2
J1939	61444	EEC1	8	8	Electronic Engine Controller 1
J1939	61445	ETC2	8	5	Electronic Transmission Controller 2
J1939	61446	EAC1	8	10	Electronic Axle Controller 1
J1939	61447	FLI1	8	4	Forward Lane Image urgent msg
J1939	61448	HPG	8	4	Hydraulic Pressure Governor Info
J1939	61449	VDC2	8	6	Vehicle Dynamic Stability Control 2
J1939	61450	EGF1	8	2	Engine Gas Flow Rate
J1939	61451	ESC1	8	7	Electronic Steering Control
J1939	61452	ETC8	8	1	Electronic Transmission Controller #8
J1939	61453	LOI	8	9	Land Leveling System Operational Inf...
J1939	61454	AT1G1	8	10	Aftertreatment 1 Intake Gas 1
J1939	61455	AT1OG1	8	10	Aftertreatment 1 Outlet Gas 1
J1939	61456	AT2G1	8	10	Aftertreatment 2 Intake Gas 1
J1939	61457	AT2OG1	8	10	Aftertreatment 2 Outlet Gas 1
J1939	61458	FWSS1	8	4	Fifth Wheel Smart Systems 1
J1939	61459	CC1	8	8	Class 8 Camera Information

ID	Name	Byte Pos	Bit Pos	Len	Parameter Name	Type	Byte Order	Scaling	Offset	Units	Min Val	Max Val	Ref Count
2928	Axle Location	3	1	8	Axle Location	Unsigned	Little Endian	1	0	bit	0	255	1
2927	Actual Inner wheel steering angle	1	1	16	Actual Inner wheel steering angle	Unsigned	Little Endian	0.003906	-125	deg	-125	125	1
2926	Type of Steering Transmission	6	1	4	Type of Steering Transmission	Unsigned	Little Endian	1	0	bit	0	15	1
2925	Type of Steering Forces	5	5	4	Type of Steering Forces	Unsigned	Little Endian	1	0	bit	0	15	1
2924	Steering Type	5	1	4	Steering Type	Unsigned	Little Endian	1	0	bit	0	15	1
2923	Status of Steering Axle	4	1	4	Status of Steering Axle	Unsigned	Little Endian	1	0	bit	0	15	1
2922	Steerable Lift Axle Lowering Inhibit	4	5	2	Steerable Lift Axle Lowering Inhibit	Unsigned	Little Endian	1	0	bit	0	3	1

6.1 Modifying Packet Properties

To modify packet properties simply right-click on the packet and select **[Properties]** on the drop down menu by left-clicking the mouse on the selection as illustrated below.



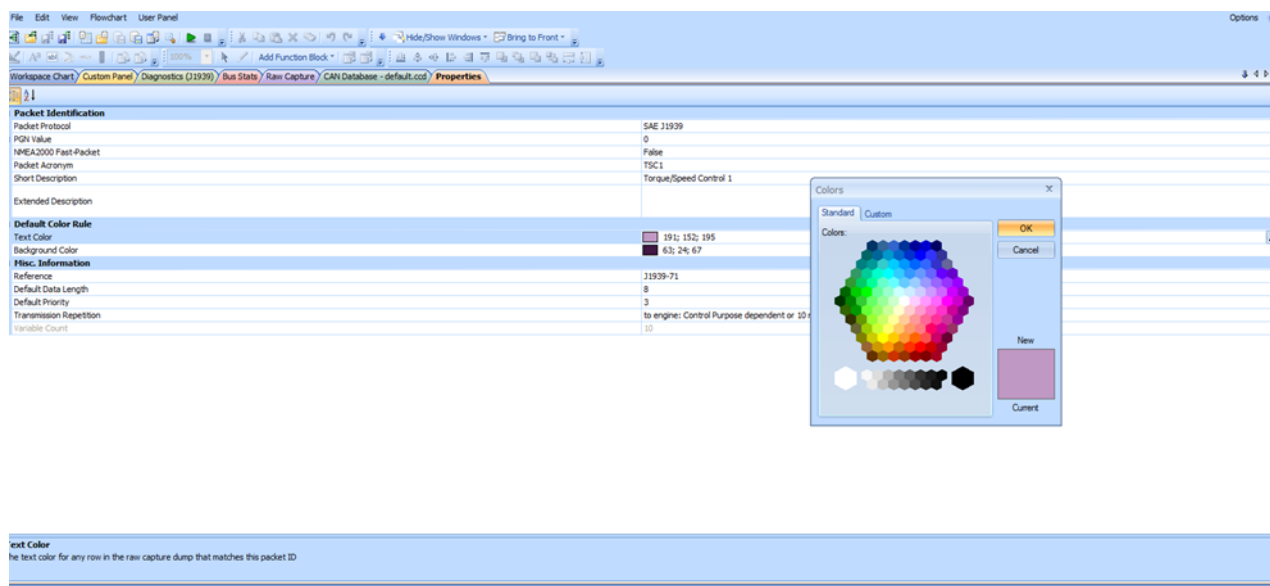
The screenshot shows the EControls CANCapture interface. The 'Custom Panel' tab is selected, displaying a table of CAN packets. A right-click context menu is open over the packet with ID 61450 (Electronic Steering Control), and the 'Properties' option is highlighted.

Protocol	ID	Abv	Len	Vars	Description
J1939	59392	ACKM	8	9	Acknowledgment Message
J1939	59904	RQST	3	1	Request
J1939	60160	TP.DT	8	2	Transport Protocol - Data Transfer
J1939	60416	TP.CM.xx	8	16	Transport Protocol - Connection Mgmt
J1939	60672	N.xx	65...	0	Network Layer
J1939	60928	AC	8	1	Address Claimed
J1939	61440	ERC1	8	13	Electronic Retarder Controller 1
J1939	61441	EBC1	8	22	Electronic Brake Controller 1
J1939	61442	ETC1	8	9	Electronic Transmission Controller 1
J1939	61443	EEC2	8	10	Electronic Engine Controller 2
J1939	61444	EEC1	8	8	Electronic Engine Controller 1
J1939	61445	ETC2	8	5	Electronic Transmission Controller 2
J1939	61446	EAC1	8	10	Electronic Axle Controller 1
J1939	61447	FLI1	8	4	Forward Lane Image urgent msg
J1939	61448	HPG	8	4	Hydraulic Pressure Governor Info
J1939	61449	VDC2	8	6	Vehicle Dynamic Stability Control 2
J1939	61450	EGF1	8	2	Engine Gas Flow Rate
J1939	61450	ESC	8	7	Electronic Steering Control
J1939	61450	ESC	8	1	Electronic Transmission Controller #8
J1939	61450	ESC	8	9	Land Leveling System Operational Inf...
J1939	61450	ESC	8	10	Aftertreatment 1 Intake Gas 1
J1939	61450	ESC	8	10	Aftertreatment 1 Outlet Gas 1
J1939	61450	ESC	8	10	Aftertreatment 2 Intake Gas 1
J1939	61450	ESC	8	10	Aftertreatment 2 Outlet Gas 1
J1939	61450	ESC	8	4	Fifth Wheel Smart Systems 1
J1939	61450	ESC	8	8	Slope Sensor Information

I	Name	Byte Pos	Bit Pos	Len	Parameter Name
2928	Axle Location	3	1	8	Axle Location
2927	Actual Inner wheel steering angle	1	1	16	Actual Inner whe
2926	Type of Steering Transmission	6	1	4	Type of Steering
2925	Type of Steering Forces	5	5	4	Type of Steering
2924	Steering Type	5	1	4	Steering Type
2923	Status of Steering Axle	4	1	4	Status of Steerin

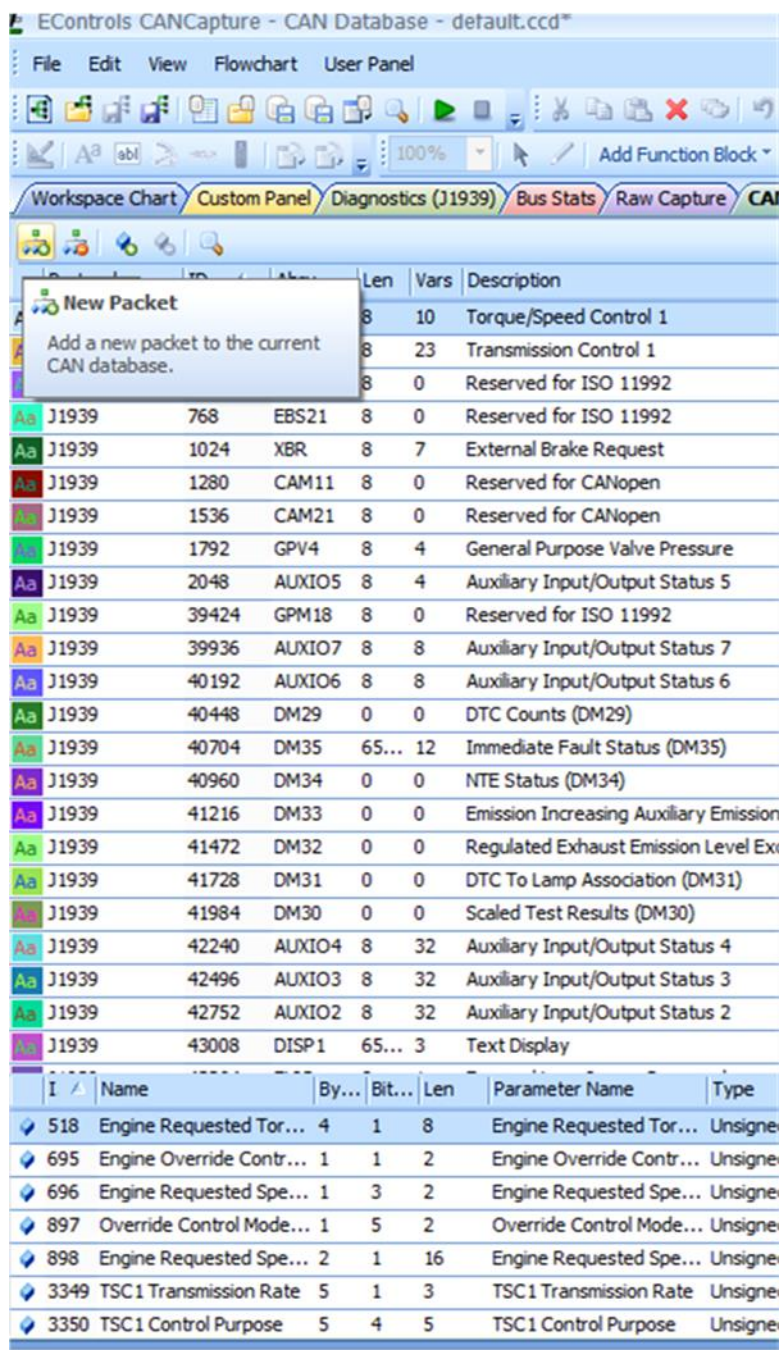
The **Packet Properties** window will now open, displaying the details of the packet. You may customize the packet by changing the color of the **Text** and **Background** by highlighting your selection (by left-clicking on either **Text** or **Background**) and then left-clicking on the **[...]** button at the end of the **Color Properties** bar and selecting a color from the **Standard** or **Custom** color pallet as illustrated below. This is extremely helpful when one is trying to identify a packet when viewing a raw capture of all packets being transmitted on the CAN bus.

When you are satisfied with the color choice left-click the mouse on the **[OK]** button to accept it. If you want to discard your changes and return to the previous menu left-click on the **[Cancel]** button.



6.2 Adding a new Packet to the Database

You may add a new packet to the database by simply left-clicking on the **New Packet** icon on the tool bar menu as illustrated below.

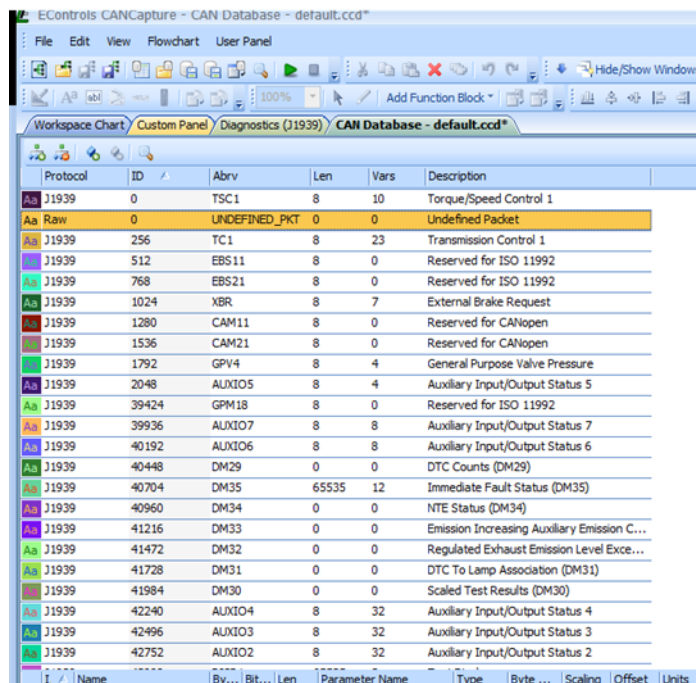


The screenshot shows the EControls CANCapture interface. A 'New Packet' dialog box is open, displaying the text: 'Add a new packet to the current CAN database.' Below the dialog box, a table lists various CAN packets. The table has columns for 'Len', 'Vars', and 'Description'. The packets are listed with their IDs, names, and parameters.

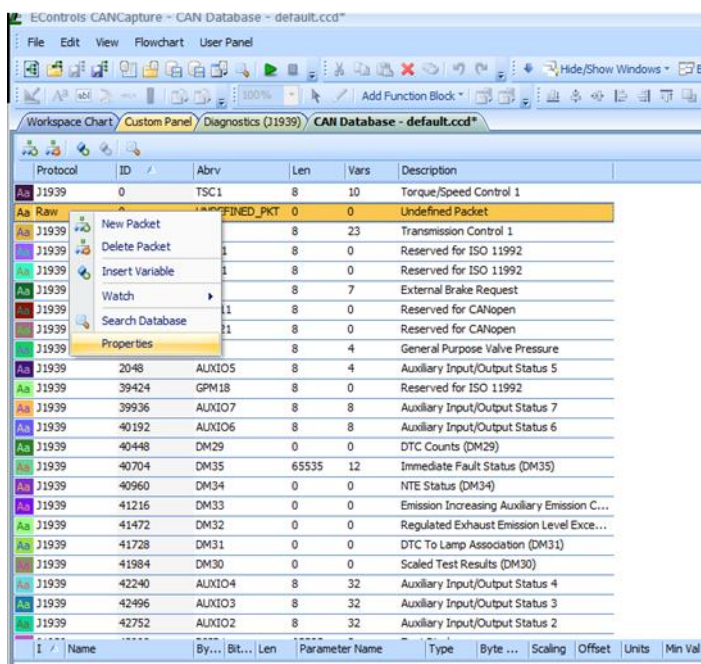
Len	Vars	Description
8	10	Torque/Speed Control 1
8	23	Transmission Control 1
8	0	Reserved for ISO 11992
8	0	Reserved for ISO 11992
8	7	External Brake Request
8	0	Reserved for CANopen
8	0	Reserved for CANopen
8	4	General Purpose Valve Pressure
8	4	Auxiliary Input/Output Status 5
8	0	Reserved for ISO 11992
8	8	Auxiliary Input/Output Status 7
8	8	Auxiliary Input/Output Status 6
0	0	DTC Counts (DM29)
65...	12	Immediate Fault Status (DM35)
0	0	NTE Status (DM34)
0	0	Emission Increasing Auxiliary Emission
0	0	Regulated Exhaust Emission Level Ex
0	0	DTC To Lamp Association (DM31)
0	0	Scaled Test Results (DM30)
8	32	Auxiliary Input/Output Status 4
8	32	Auxiliary Input/Output Status 3
8	32	Auxiliary Input/Output Status 2
65...	3	Text Display

I	Name	By...	Bit...	Len	Parameter Name	Type
518	Engine Requested Tor...	4	1	8	Engine Requested Tor...	Unsigne
695	Engine Override Contr...	1	1	2	Engine Override Contr...	Unsigne
696	Engine Requested Spe...	1	3	2	Engine Requested Spe...	Unsigne
897	Override Control Mode...	1	5	2	Override Control Mode...	Unsigne
898	Engine Requested Spe...	2	1	16	Engine Requested Spe...	Unsigne
3349	TSC1 Transmission Rate	5	1	3	TSC1 Transmission Rate	Unsigne
3350	TSC1 Control Purpose	5	4	5	TSC1 Control Purpose	Unsigne

A new line with your new packet will be automatically inserted. You may now edit the properties of your new packet by right-clicking on the new packet and then selecting **[Properties]** on the drop down menu by left-clicking the mouse on the selection as illustrated below.

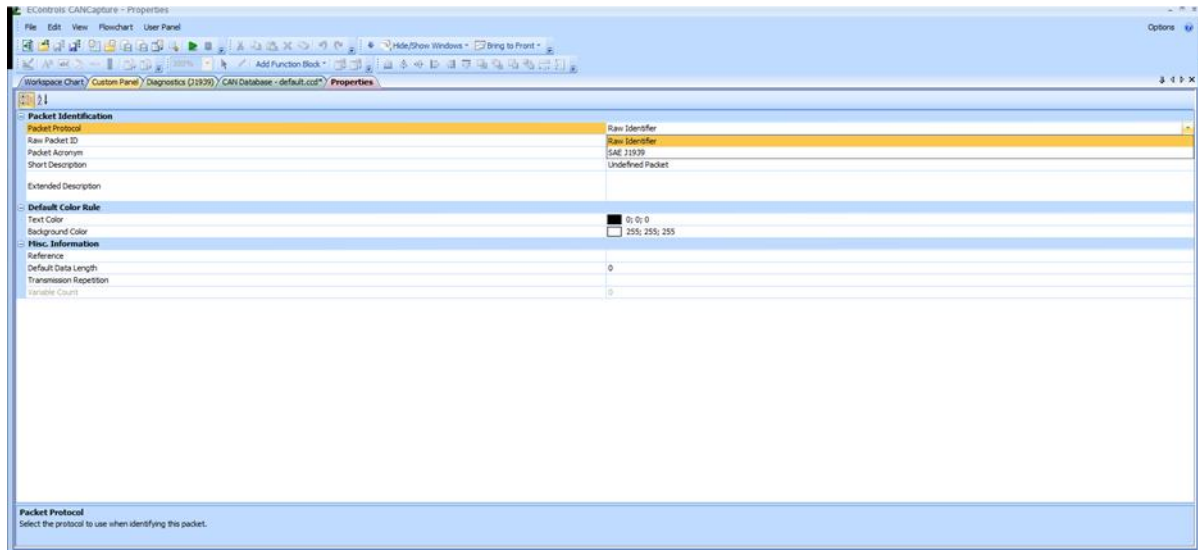


Protocol	ID	Abv	Len	Vars	Description
J1939	0	TSC1	8	10	Torque/Speed Control 1
Raw	0	UNDEFINED_PKT	0	0	Undefined Packet
J1939	256	TC1	8	23	Transmission Control 1
J1939	512	EB511	8	0	Reserved for ISO 11992
J1939	768	EB521	8	0	Reserved for ISO 11992
J1939	1024	XBR	8	7	External Brake Request
J1939	1280	CAM11	8	0	Reserved for CANopen
J1939	1536	CAM21	8	0	Reserved for CANopen
J1939	1792	GPV4	8	4	General Purpose Valve Pressure
J1939	2048	AUXIO5	8	4	Auxiliary Input/Output Status 5
J1939	39424	GPM18	8	0	Reserved for ISO 11992
J1939	39936	AUXIO7	8	8	Auxiliary Input/Output Status 7
J1939	40192	AUXIO6	8	8	Auxiliary Input/Output Status 6
J1939	40448	DM29	0	0	DTC Counts (DM29)
J1939	40704	DM35	65535	12	Immediate Fault Status (DM35)
J1939	40960	DM34	0	0	NTE Status (DM34)
J1939	41216	DM33	0	0	Emission Increasing Auxiliary Emission C...
J1939	41472	DM32	0	0	Regulated Exhaust Emission Level Exce...
J1939	41728	DM31	0	0	DTC To Lamp Association (DM31)
J1939	41984	DM30	0	0	Scaled Test Results (DM30)
J1939	42240	AUXIO4	8	32	Auxiliary Input/Output Status 4
J1939	42496	AUXIO3	8	32	Auxiliary Input/Output Status 3
J1939	42752	AUXIO2	8	32	Auxiliary Input/Output Status 2



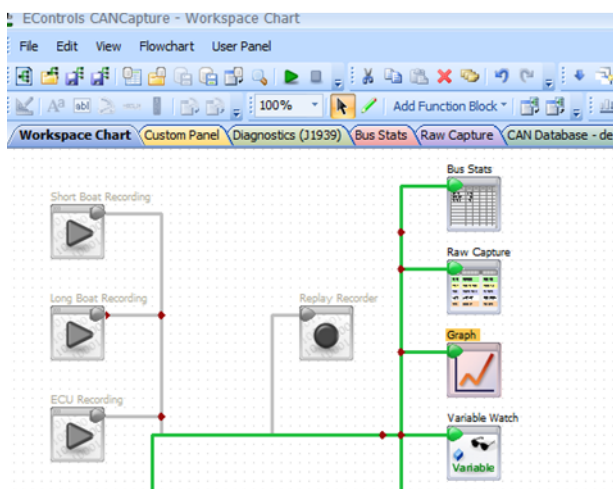
Protocol	ID	Abv	Len	Vars	Description
J1939	0	TSC1	8	10	Torque/Speed Control 1
Raw	0	UNDEFINED_PKT	0	0	Undefined Packet
J1939	256	TC1	8	23	Transmission Control 1
J1939	512	EB511	8	0	Reserved for ISO 11992
J1939	768	EB521	8	0	Reserved for ISO 11992
J1939	1024	XBR	8	7	External Brake Request
J1939	1280	CAM11	8	0	Reserved for CANopen
J1939	1536	CAM21	8	0	Reserved for CANopen
J1939	1792	GPV4	8	4	General Purpose Valve Pressure
J1939	2048	AUXIO5	8	4	Auxiliary Input/Output Status 5
J1939	39424	GPM18	8	0	Reserved for ISO 11992
J1939	39936	AUXIO7	8	8	Auxiliary Input/Output Status 7
J1939	40192	AUXIO6	8	8	Auxiliary Input/Output Status 6
J1939	40448	DM29	0	0	DTC Counts (DM29)
J1939	40704	DM35	65535	12	Immediate Fault Status (DM35)
J1939	40960	DM34	0	0	NTE Status (DM34)
J1939	41216	DM33	0	0	Emission Increasing Auxiliary Emission C...
J1939	41472	DM32	0	0	Regulated Exhaust Emission Level Exce...
J1939	41728	DM31	0	0	DTC To Lamp Association (DM31)
J1939	41984	DM30	0	0	Scaled Test Results (DM30)
J1939	42240	AUXIO4	8	32	Auxiliary Input/Output Status 4
J1939	42496	AUXIO3	8	32	Auxiliary Input/Output Status 3
J1939	42752	AUXIO2	8	32	Auxiliary Input/Output Status 2

You may edit the various properties of your new packet such as selecting **Raw Identifier** or **J1939** by left-clicking on the [▼] **Packet Protocol** bar and then left-clicking again on the selection as illustrated below.

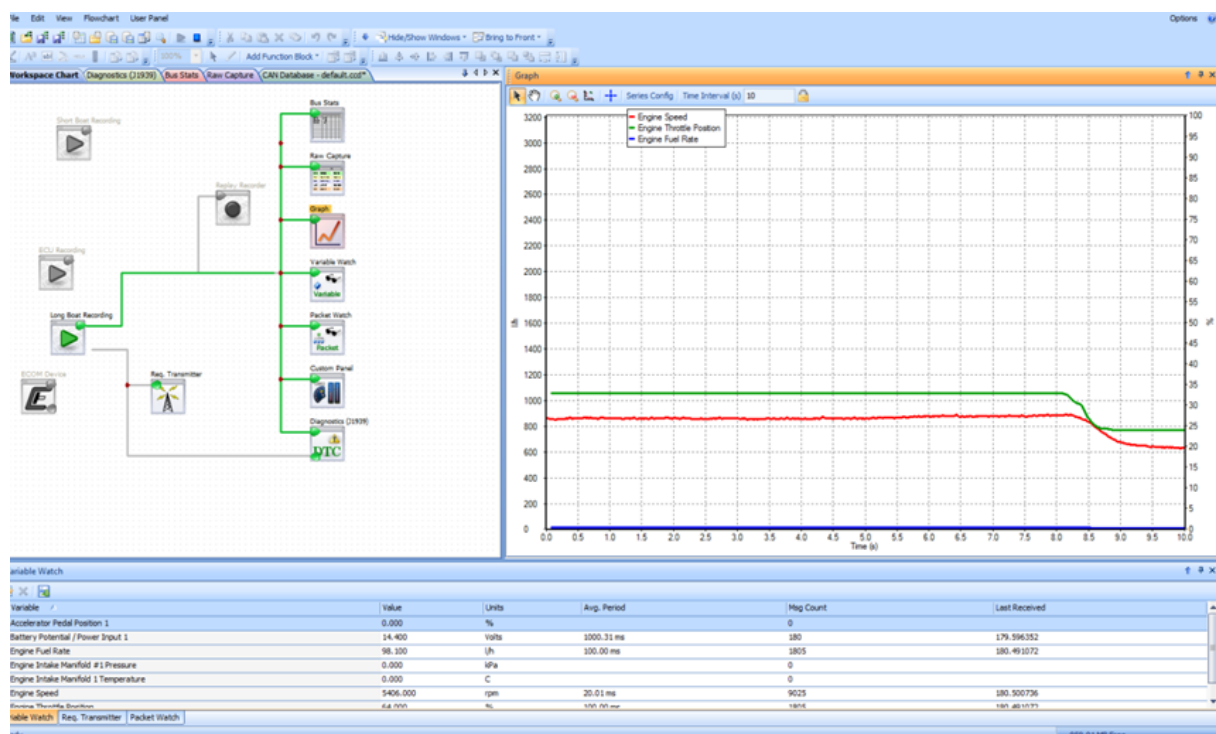


7 GRAPH FUNCTION BLOCK

To enable the graphing function, left-click on the **Graph** function block as illustrated below. CANCapture is capable of graphing data in real time as it is captured or from a previously recorded data session.

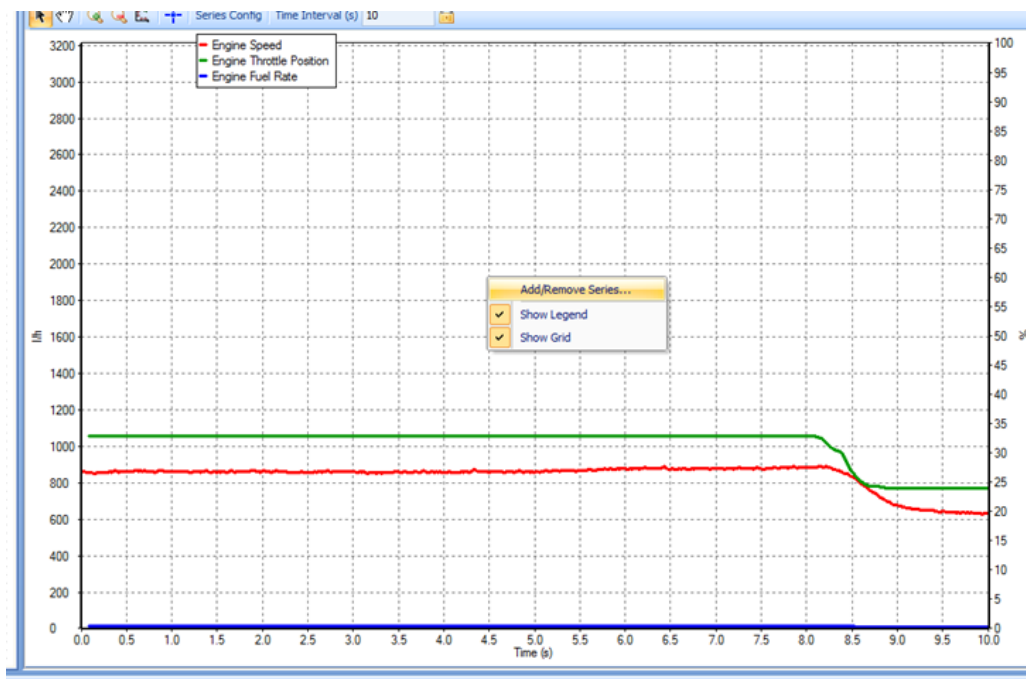


The **Graph** window will now appear.



7.1 Adding or removing a series to your graph

You may **Add** or **Remove** a data series to your graph by either right-clicking on the graph and selecting **[Add/Remove Series...]** from the drop down menu by left-clicking the mouse on the selection or by selecting **[Series Config]** from the **Graph** window tool bar menu as illustrated below.

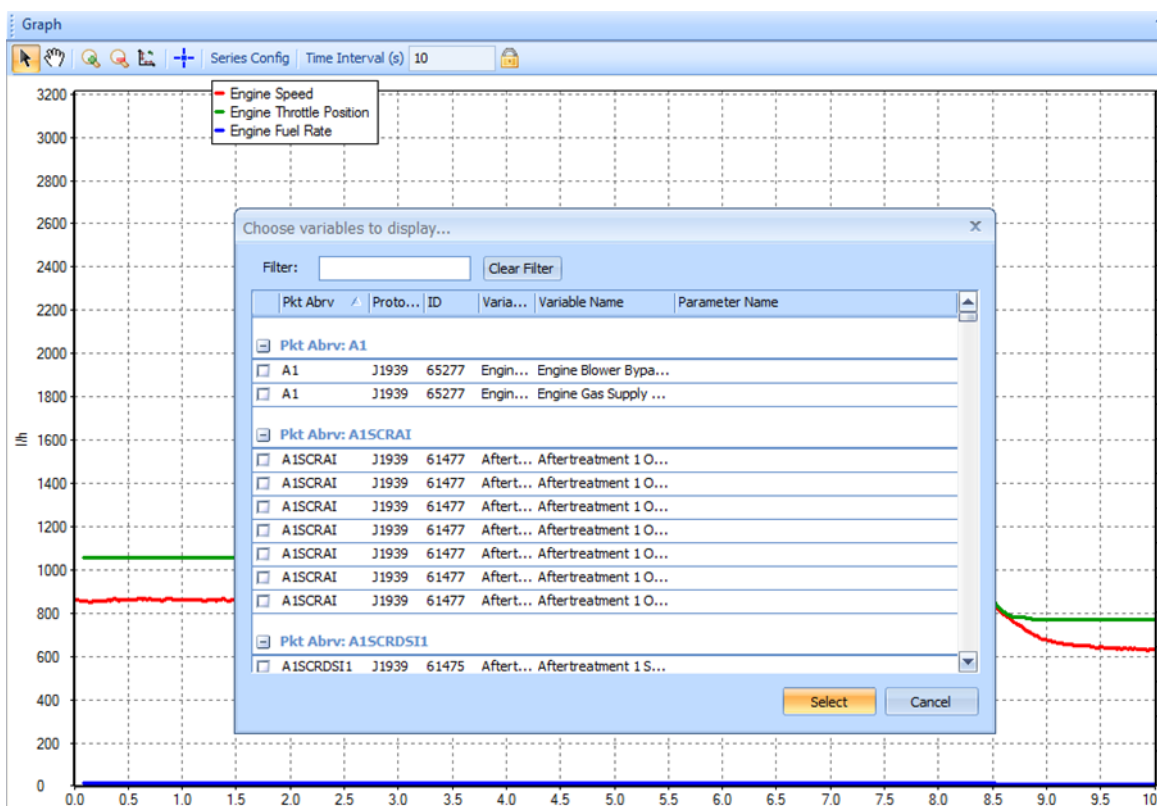


7.2 Selecting Variable(s) on Graph

You may now select the **Variable(s)** you wish to display on the graph from the list that is displayed by left-clicking on the selection box to the left of the **Variable** you wish to display.

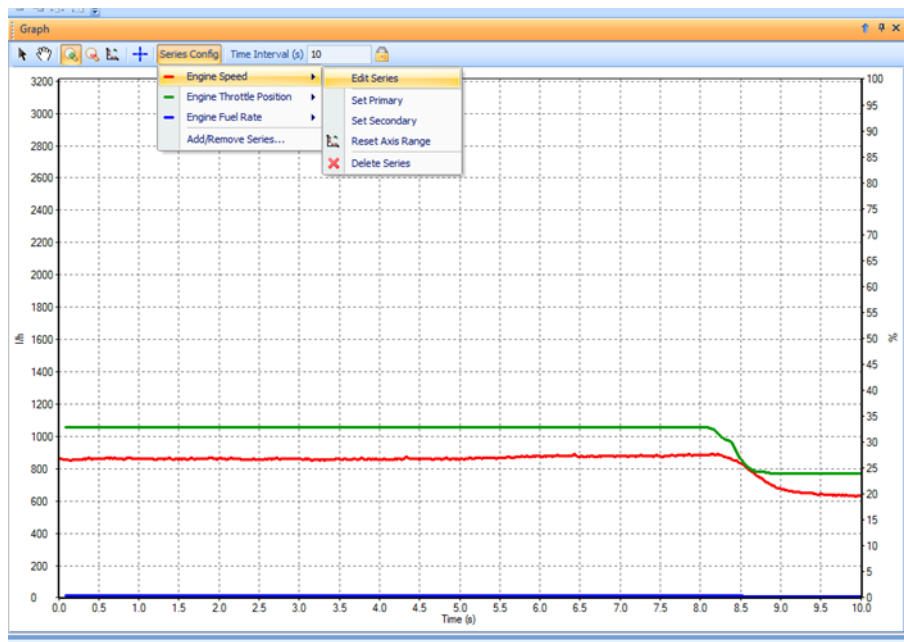
To remove a **Variable** from the graph left-click on the box to remove the selection check mark [v] from the box.

When you have completed selecting the **Variable(s)** you wish to display on the graph, left-click on the **[Select]** button. If you wish to cancel this process and return to the graph window, left-click on the **[Cancel]** button.



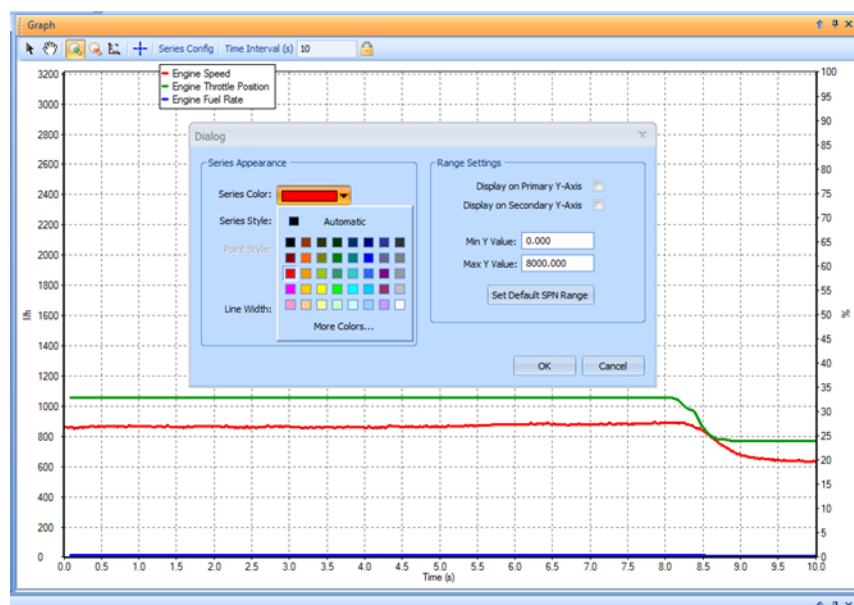
7.3 Editing a Series for Graphing

You may edit a data series on the graph by selecting the **[Series Config]** from the **Graph** toolbar menu, selecting the data series you wish to edit and selecting **[Edit Series]** as illustrated below.



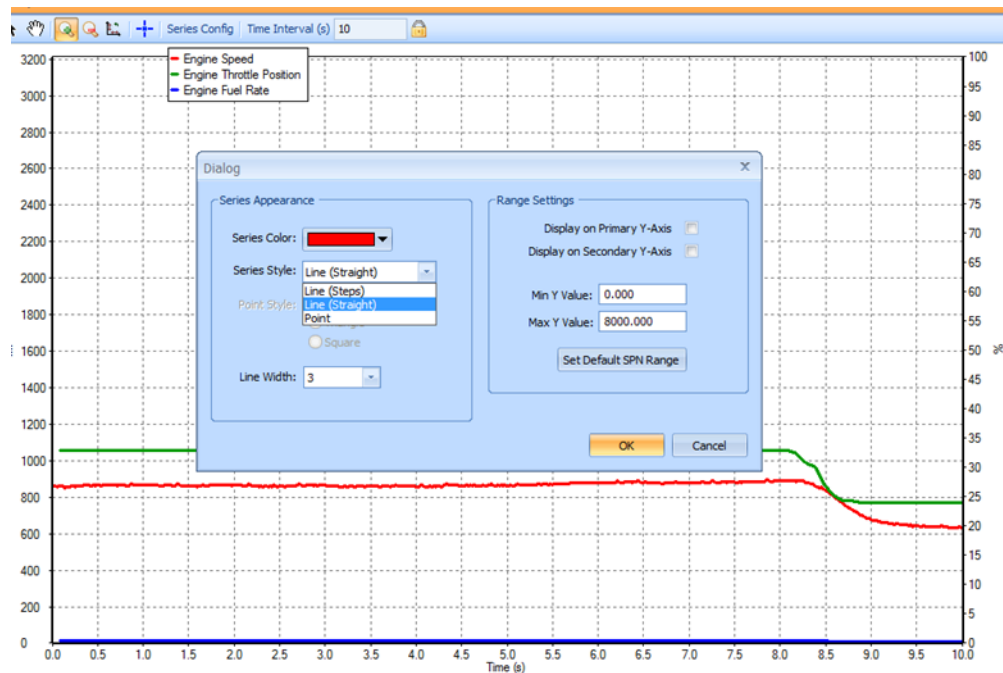
7.4 Setting the Data Series Display Color

You may set the color you wish the data series to be displayed in on the graph by selecting the specific color from the drop down menus on the **Series Color:** selection on the **Dialog** window under **Series Appearance** as illustrated below.



7.5 Selecting Line Style for the Graph

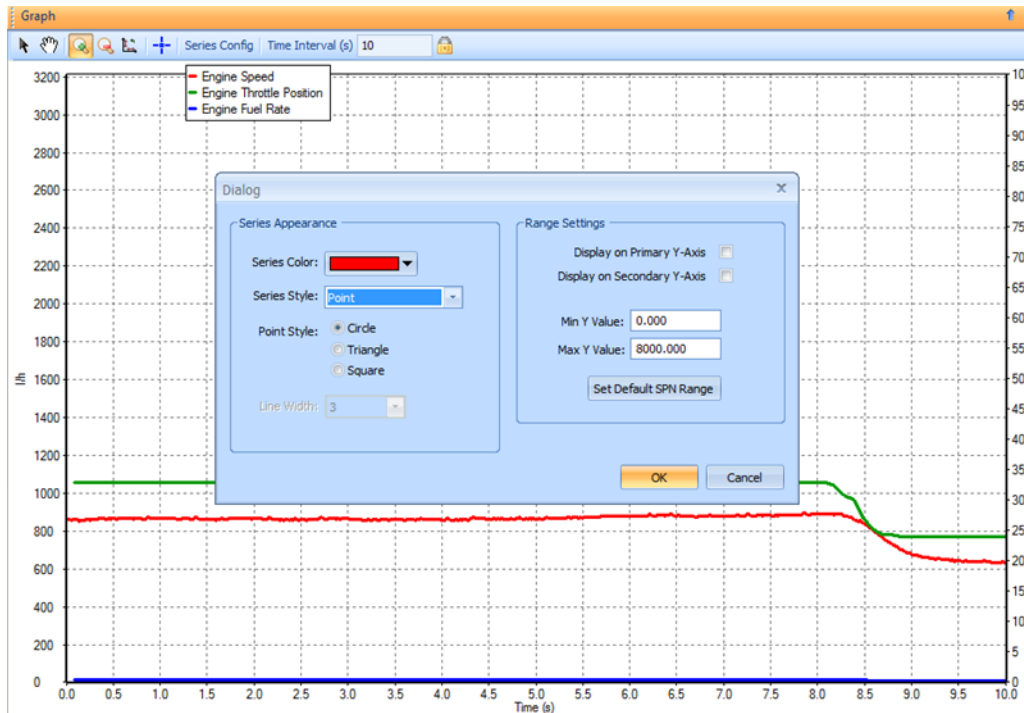
You may select the line style you wish to display the data series on the plot by selecting **Series Style:** from the drop down menu on the **Dialog** window under **Series Appearance** as illustrated below. The choices are **Line (Steps)**, **Line (Straight)**, or **Point**.



When you are satisfied with your choices, left-click on the **[OK]** button to accept them. If you want to discard your changes and return to the previous menu, left-click on the **[Cancel]** button.

7.6 Selecting a Point Style Graph

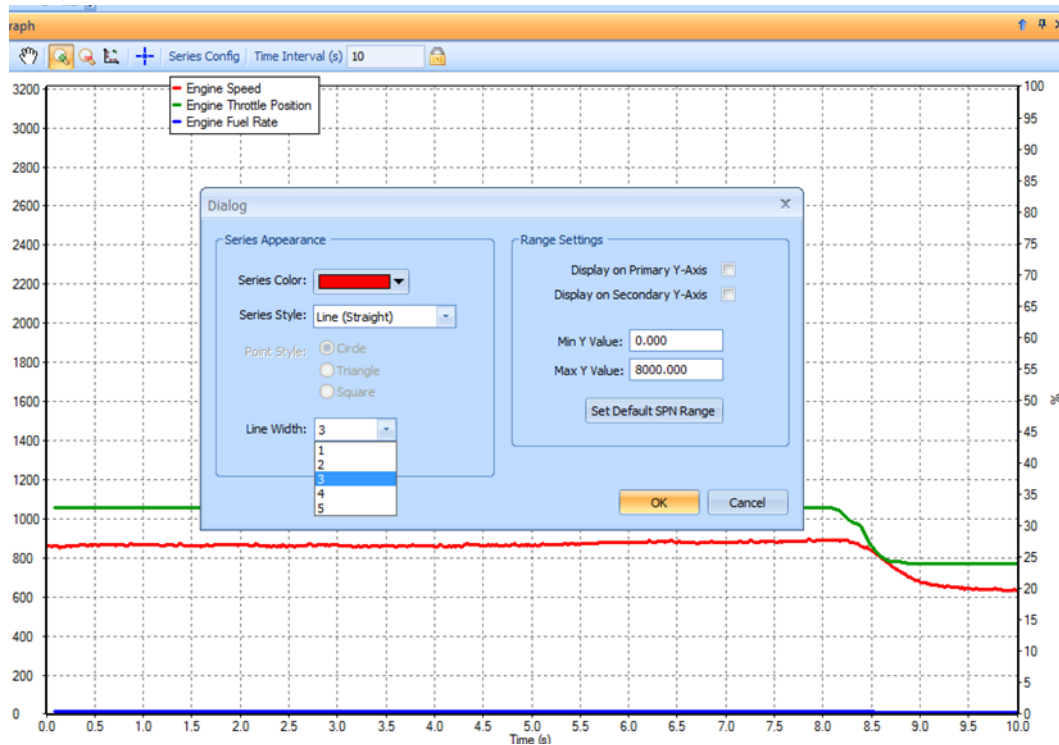
You may select the **Point Style** you wish to display by selecting it from the drop down menu on **Point Style:** on the **Dialog** window as illustrated below. The points may be displayed as **Circles**, **Triangles** or **Squares**.



When you are satisfied with your choices, left-click on the **[OK]** button to accept them. If you want to discard your changes and return to the previous menu, left-click on the **[Cancel]** button.

7.7 Selecting the Line Width for a series displayed as a Line Graph

You may select the **Line Width** for a data series that is being displayed as a line graph by selecting the relative line size from the drop down menu on the **Dialog** window as illustrated below. The choices are from **1** to **5**.

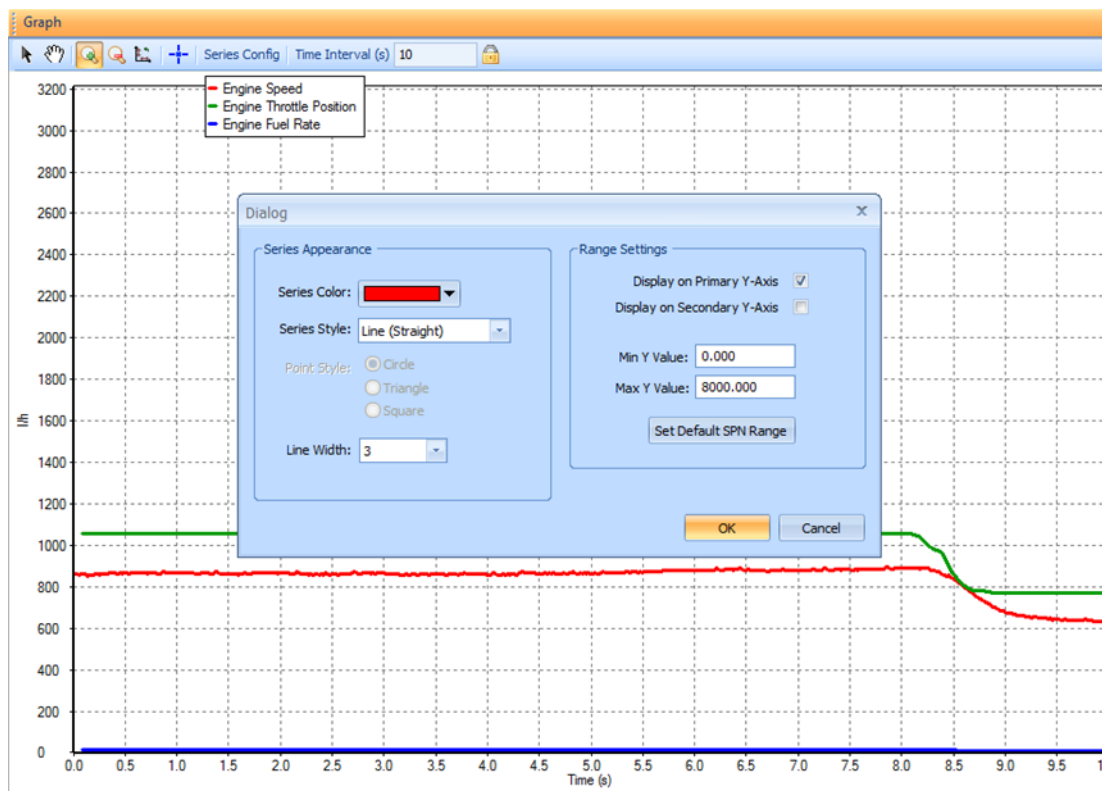


When you are satisfied with your choices, left-click on the **[OK]** button to accept them. If you want to discard your changes and return to the previous menu, left-click on the **[Cancel]** button.

7.8 Selecting the Range Setting for the Data Series

You may select the various **Range Settings** for the data series by making your selections under the **Range Settings** of the **Dialog** window.

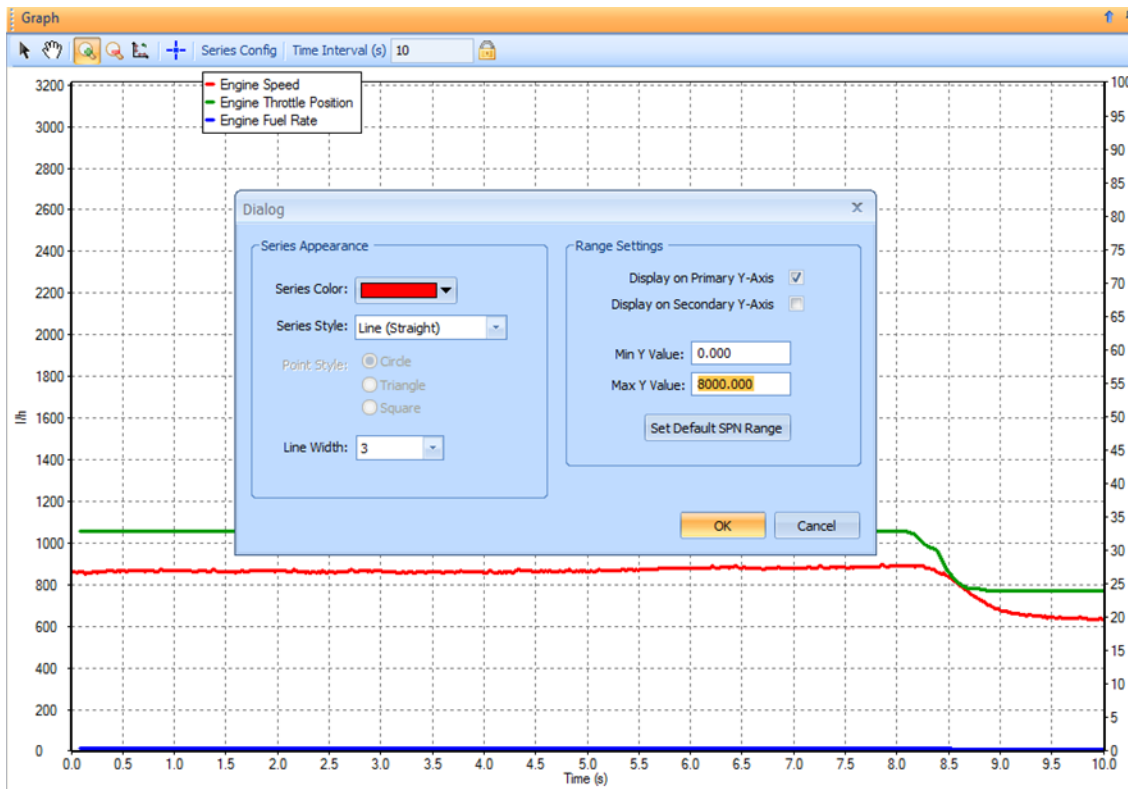
You may choose to display the range for the data series on the **Primary Y-Axis** or the **Secondary Y-Axis** by left-clicking on the selection circle following the choice. A check mark [v] will appear in the selection box upon selection acceptance as illustrated below.



When you are satisfied with your choices, left-click on the **[OK]** button to accept them. If you want to discard your changes and return to the previous menu, left-click on the **[Cancel]** button.

7.9 Setting the Minimum and Maximum Range Values for a Data Series

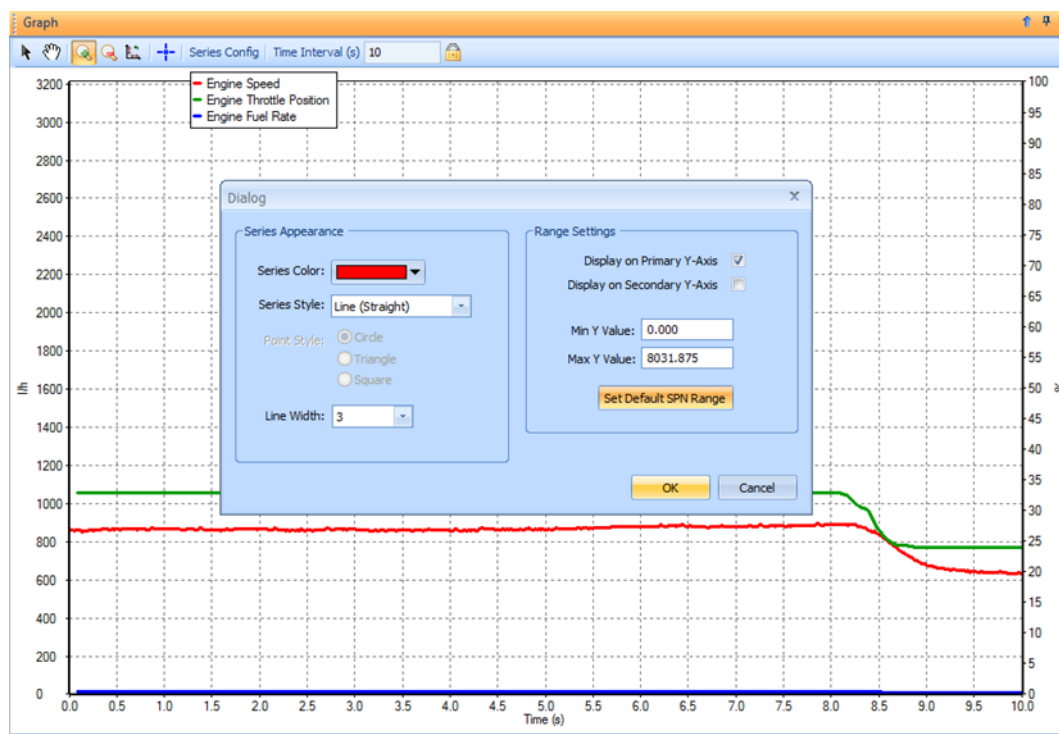
You may set the **Minimum** and **Maximum** values for the data series that is being displayed on the graph by entering the values on the **Dialog** window under the **Range Settings** in the **Min Y Value:** and **Max Y value:** fields, as illustrated below:



When you are satisfied with your settings, you may left-click the mouse on the **[OK]** button. If you want to discard your changes and return to the previous window, left-click the mouse on the **[Cancel]** button.

7.10 Selecting the Default SPN Range Value

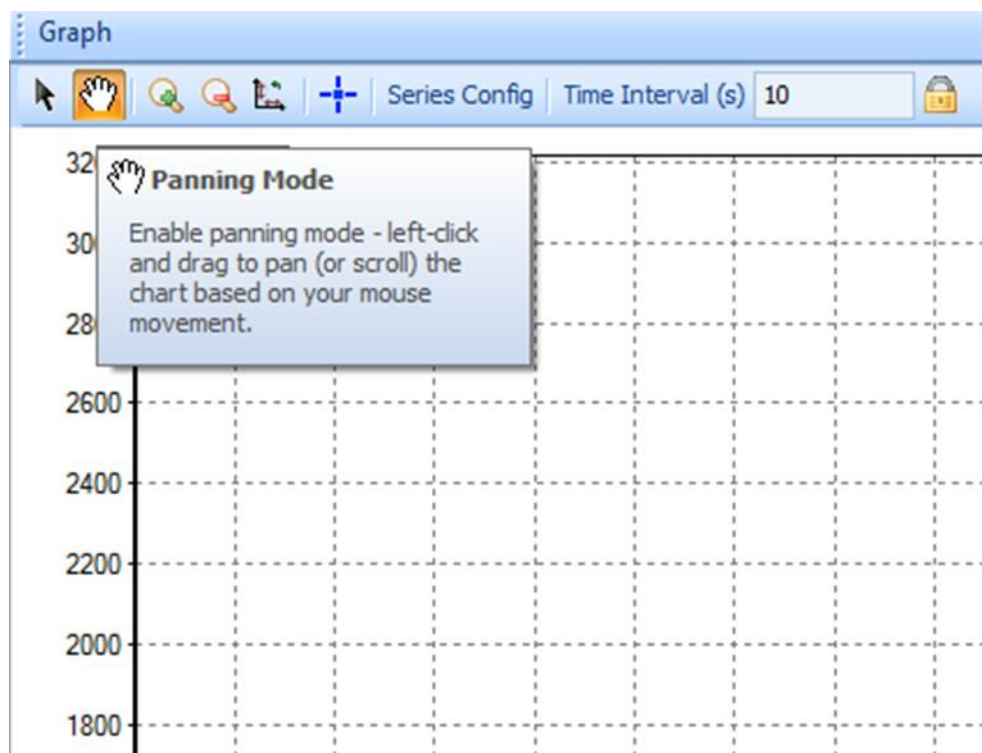
Alternatively, you can select to use the default SPN range values by selecting the **[Set Default SPN Range]** selection button on the **Dialog** window under **Range Settings**. The **Default SPN Range** is retrieved from the CAN database for the respective SPN.



After you have completed selecting all the display parameters for the data series, you may accept the selections and exit the **Dialog** window by left-clicking on the **[OK]** button. If you wish to discard your entries and exit the **Dialog** window, left-click on **[Cancel]** button.

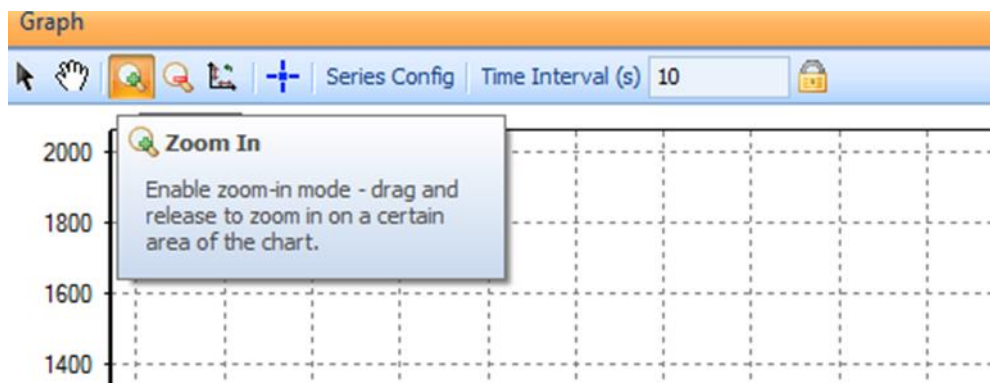
7.11 Using the Panning Tool on the Graph Window

You may enable the **Panning Tool** by selecting the **Panning Mode** icon from the **Graph** window toolbar and left-clicking and holding down the left mouse button while scrolling through the graph as illustrated below.



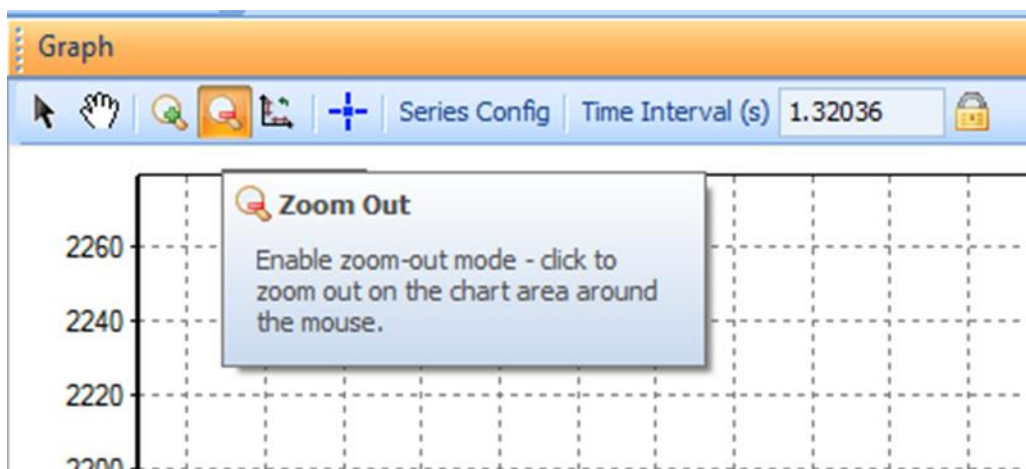
7.12 Zooming in on a specific area of the graph

You may zoom in on a specific area of the graph by selecting the green **Zoom In** icon on the **Graph** window tool bar and then selecting an area you wish to zoom by clicking and dragging the left mouse button as illustrated below.



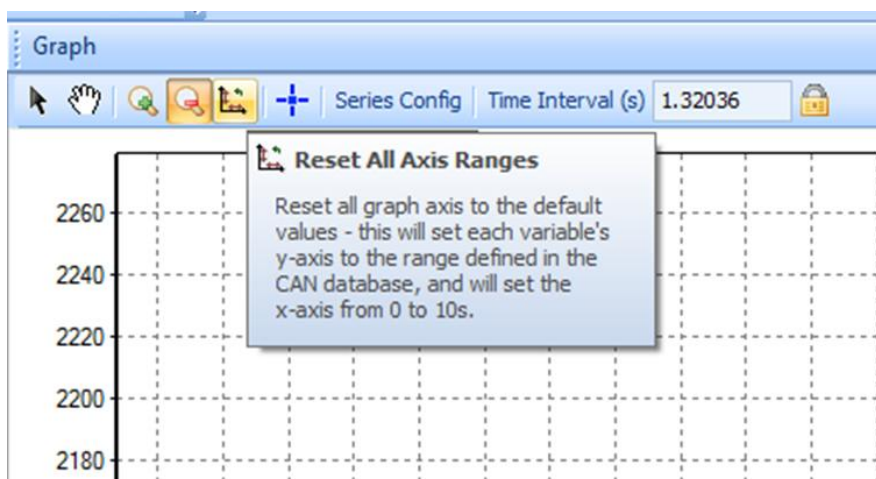
7.13 Zooming Out

You may zoom out on the graph by selecting the red **Zoom Out** icon on the **Graph** window tool bar menu and left-clicking on the graph as illustrated below.



7.14 Resetting All Graph Ranges to Default Values

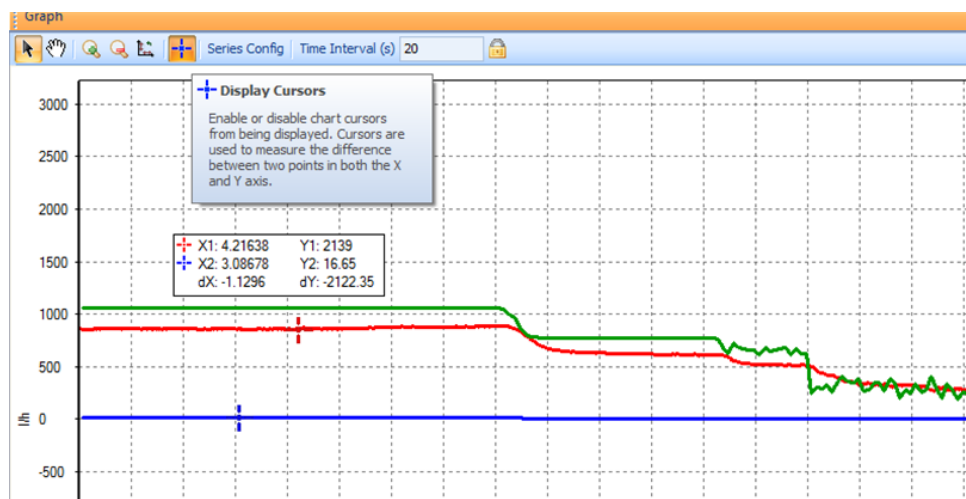
You may reset all graph ranges to default values by selecting the **Reset All Axis Ranges** icon on the **Graph** window tool bar menu as illustrated below. All graph axes will be reset to the default values defined in the CAN database.



7.15 Enabling and Locating Display Cursors

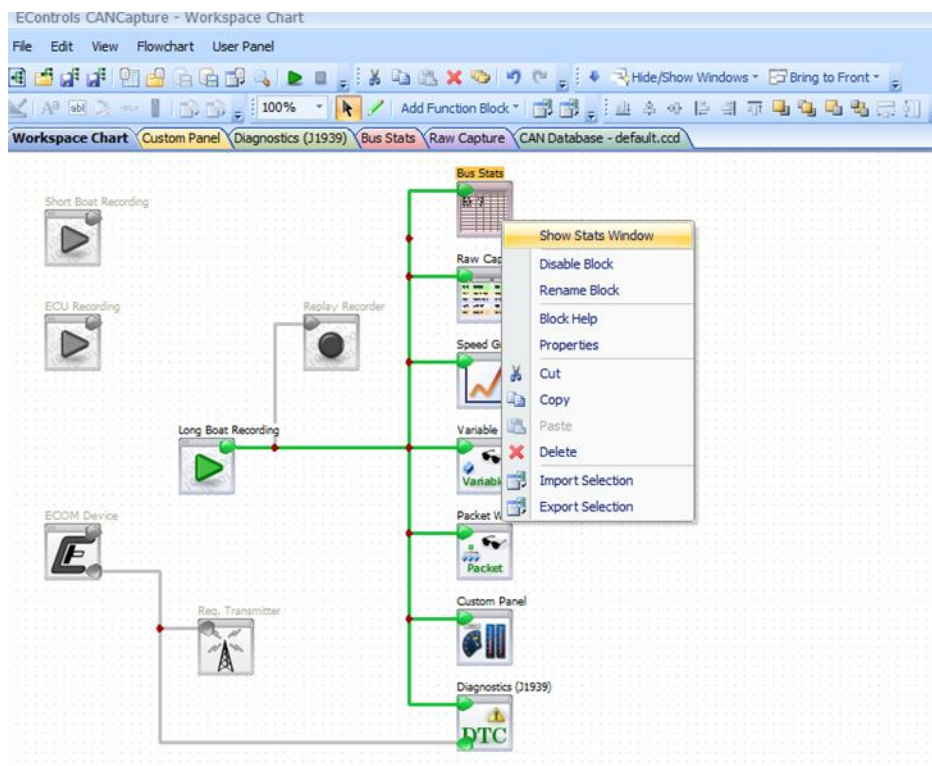
You may enable display cursors to aid in the measurement of any two points on the graph either in the **X** or **Y** axis by selecting the **[+] Display Cursors** icon from the **Graph** window tool bar menu as illustrated below. After enabling, you may locate the cursors using the right mouse button. The cursor window that appears will display the absolute values of each cursor as well as the difference between the two cursors in both the X and Y axis illustrated as **dX** and **dY**.

NOTE: The pointer icon must be selected in order to drag and move the cursors.



7.16 Bus Statistics Function Block

You may display the CAN bus statistics (**Bus Stats**) window by right-clicking on the **Bus Stats** function block on the **Workspace Chart** window and selecting [**Show Stats Window**] by left-clicking on the selection as illustrated below, or by simply double-clicking the left mouse button on the **Bus Stats** function block.

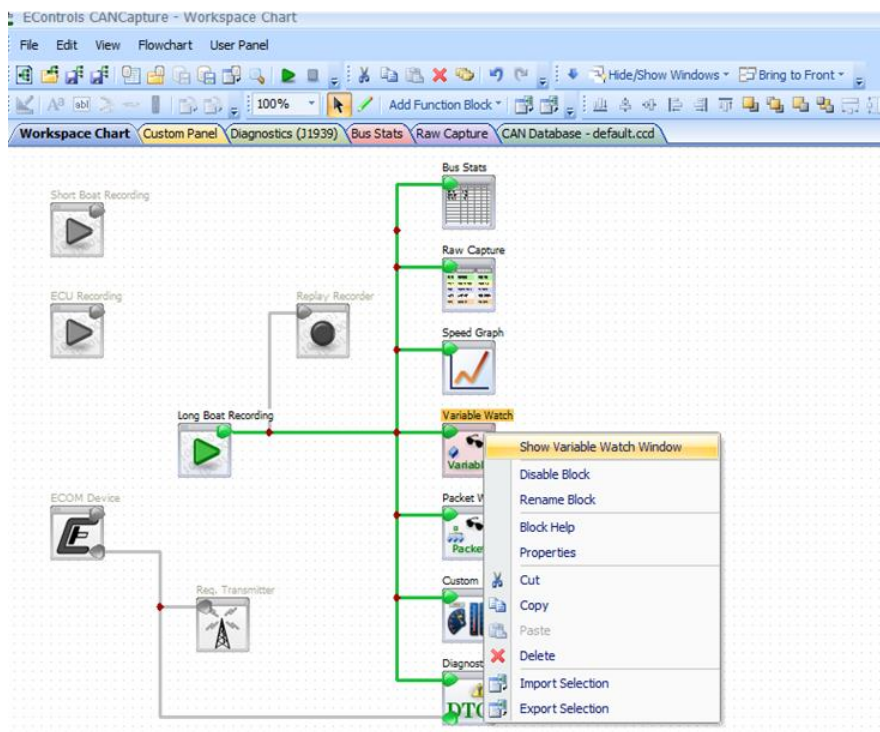


The **Bus Stats** window will now open, displaying the current statistics of the CAN Bus.

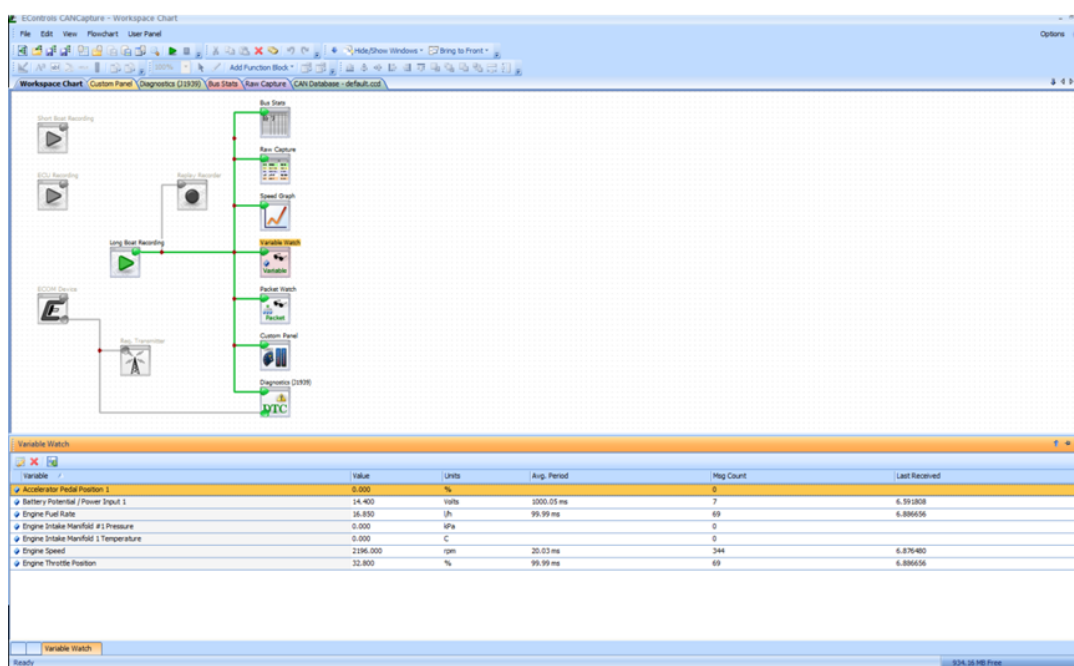
Statistic	Value
Capture State	Active
Capture Time	2.6 s
Message Count	2773 msg
Byte Count	40716 bytes
Avg. Msg. Size	14.7 bytes
Msg/s	1091.57 msg/s
KByte/s	16.03 KB/s
Bus Load (250k)	51.30%
Multipacket Count	2
Error Count	0

7.17 Variable Watch Function Block

You may open the **Variable Watch** window by right-clicking on the **Variable Watch** function block and selecting **[Show Variable Watch Window]** by left-clicking the mouse on the selection as illustrated below, or by simply double-clicking the **Variable Watch** function block with the left mouse button:

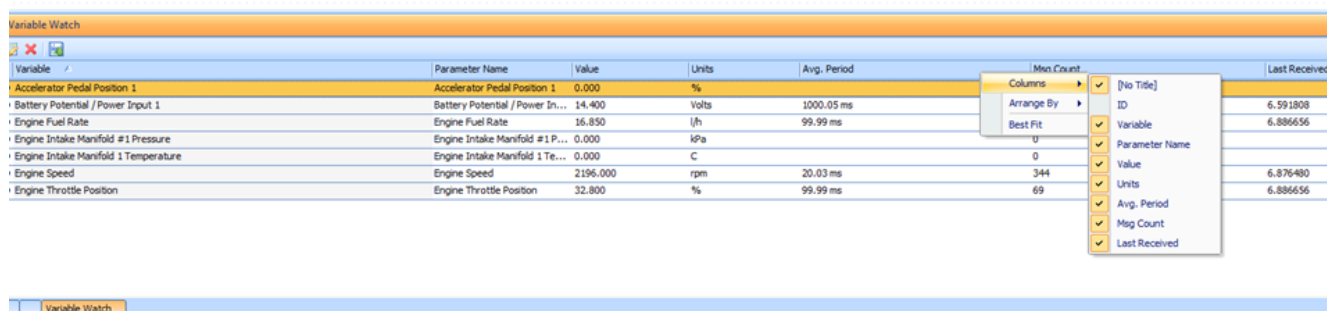


The **Variable Watch** window will now appear and be selected.



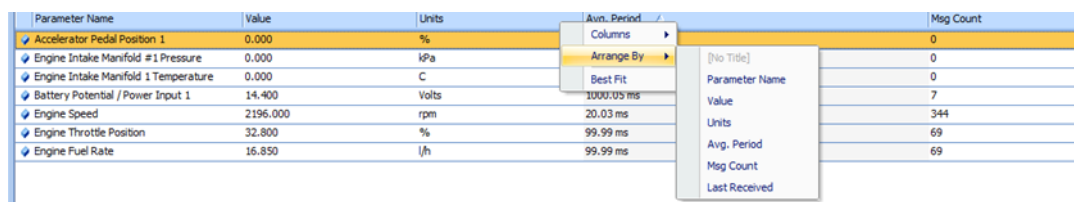
7.18 The Variable Watch Display Column Options

You may select the columns to display by right-clicking on the display column headings and selecting **Columns** from the drop down menu by left-clicking the mouse on the selection. The, simply check or un-check the items you wish to display from the menu as illustrated below:



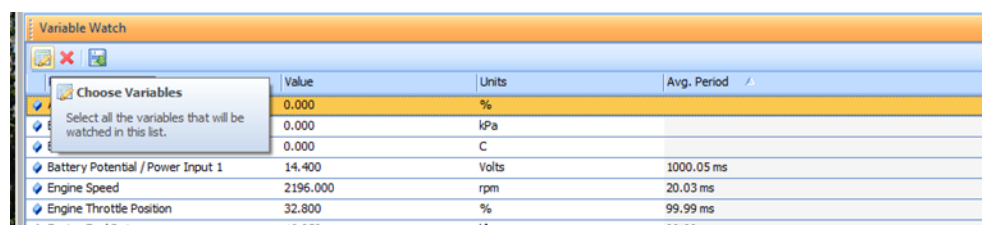
7.19 Selecting the Arrangement the Variable Watch Columns

You may select the **Arrangement** of the display columns by left-clicking on the headings and selecting **[Arrange by ►]** from the drop down menu, followed by the column you wish to sort as illustrated below:

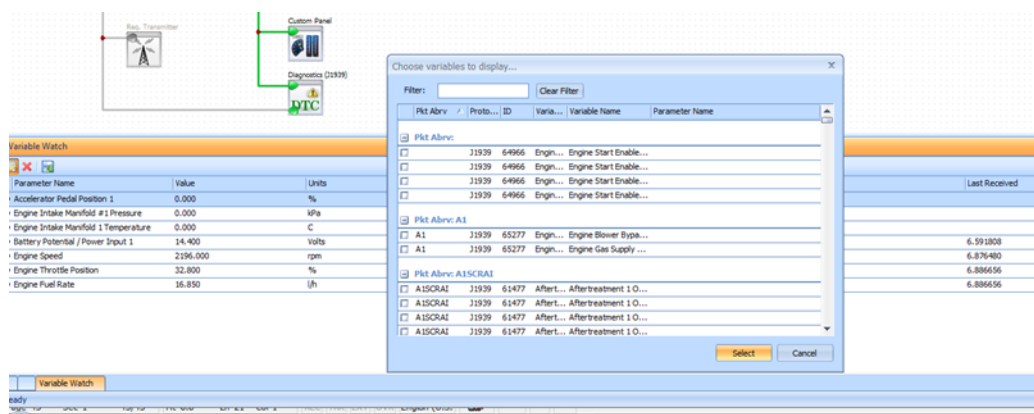


7.20 Selecting the Desired Variable to Display on Variable Watch

You may select the variable you wish to display on the **Variable Watch** window by double clicking on the **Choose Variables** icon on the **Variable Watch** widow tool bar as illustrated below:



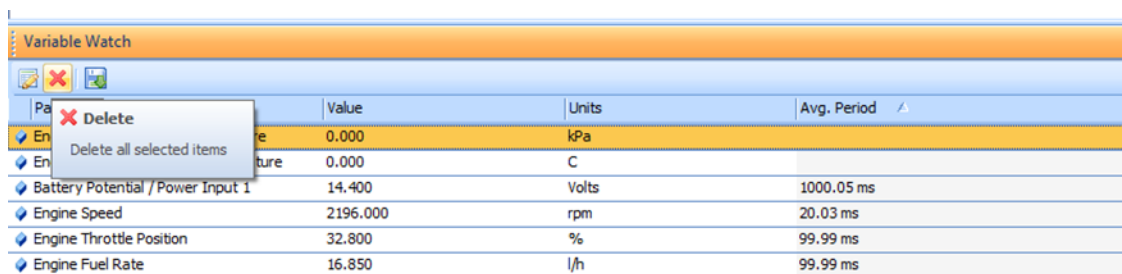
The following window will open, allowing you to select the variables you wish to display on the **Variable Watch** window:



You may now select or deselect the particular variable you wish to display by adding or removing a check mark [v] on the selection box to the left of the variable and left-clicking with the mouse button while the cursor is over the selection box. Once you are satisfied with your selections, left-click on the **[Select]** button to complete. If you wish to discard your selections and return to the **Variable Watch** window simply left-click on the **[Cancel]** button.

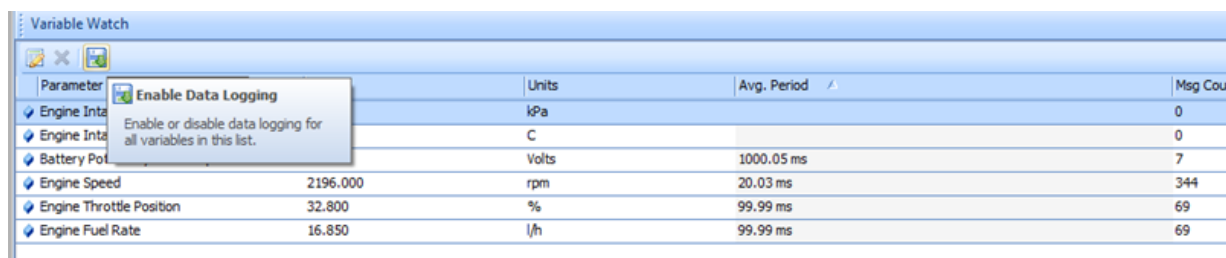
7.21 Deleting Selected Items from the Variable Watch Window

If you wish to delete items from the **Variable Watch** window, you may highlight the item by right-clicking the particular item and either clicking the **[X] Delete Selected Items** icon from the **Variable Watch** window tool bar (as illustrated below) or by depressing the **[Delete]** key on the keyboard.



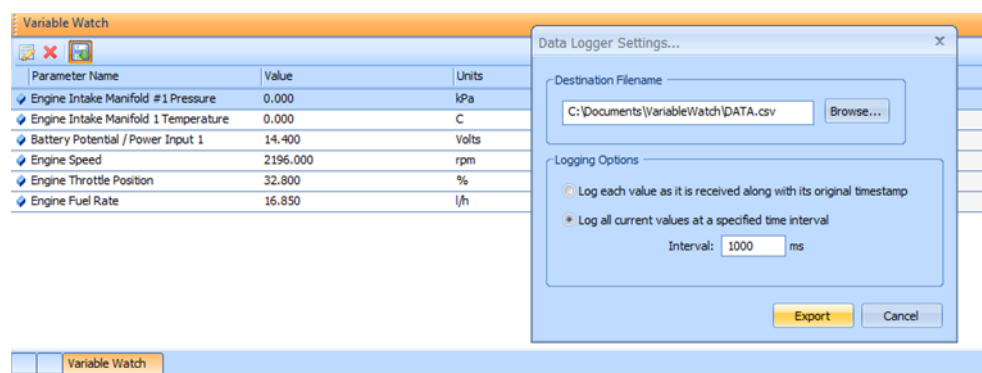
7.22 Enabling Data Logging from the Variable Watch Window

You may enable the data logging feature to save the data to a file of your choice by selecting the **Enable Data Logging** icon from the **Variable Watch** window toolbar as illustrated below. This will log the incoming data for all variables on the **Variable Watch** window list to the file that you select.



7.23 Selecting the Destination File for Data Logging

After enabling data logging the following window will open, allowing you to select the file where you wish to save the data. The destination file should be entered in the format as illustrated below:



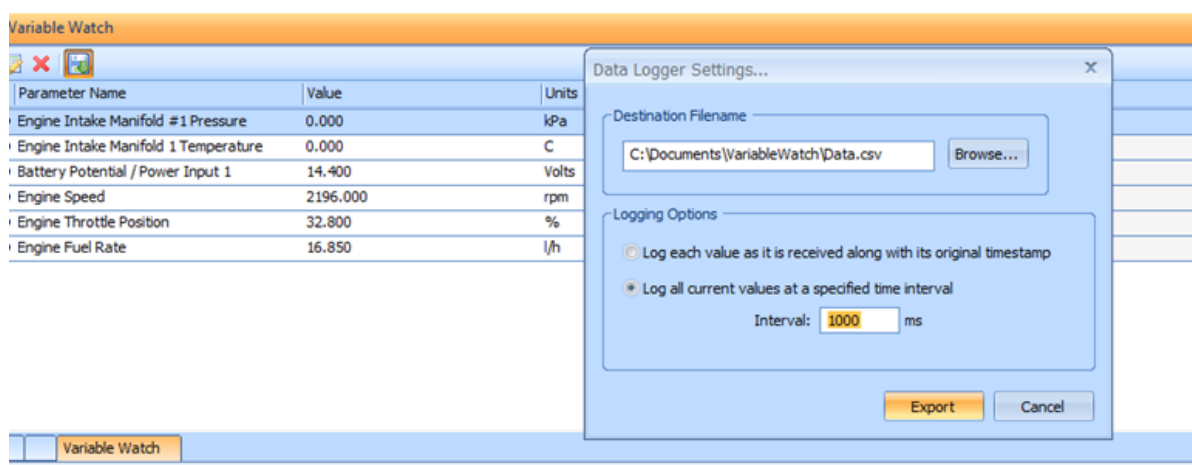
You may now enter the file name in the **Destination Filename** window on the **Data Logger Settings...** window, or select **[Browse...]** to locate a file you wish to save the data to. If you select **[Browse...]**, the software will take you to your computer storage options, allowing you to select the folder and select a unique filename for your data file (if desired). The data will be saved as a (*.csv) file. When you are satisfied with your settings, left-click on **[Export]**. If you want to discard your changes and return to the previous menu, left-click on the **[Cancel]** button.

7.24 Variable Watch Data Logging Options

You may select the Data Logging Options from the **Data Logger Settings** window. The options are:

- 1) **Log each value as it is received along with its original timestamp**
- 2) **Log all values at a specified time interval**

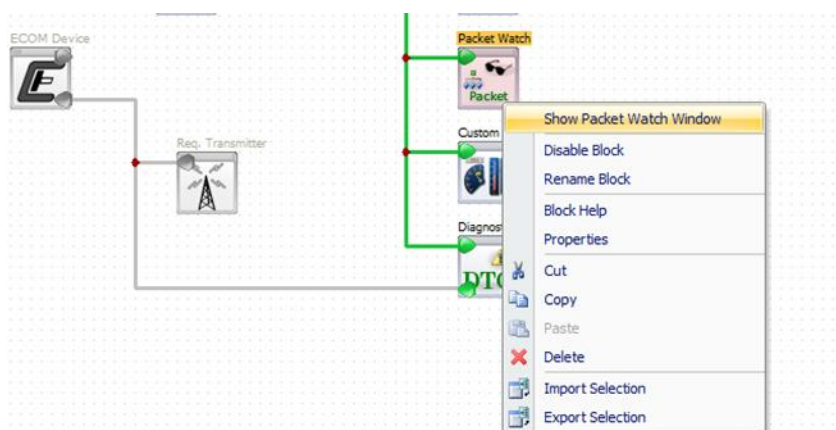
If you select **Log all values at a specified time interval** you may select the time interval in milliseconds by entering the value in the **Interval** field of the **Data Logging Options** window as illustrated below.



When you are satisfied with the location and options, you may select the **[Export]** button to start logging your data. If you want to discard all of your selections and return to the **Variable Watch** window, you may select the **[Cancel]** button by clicking with the left mouse button.

8 PACKET WATCH FUNCTION BLOCK

To display the **Packet Watch** window, you may either right-click on the **Packet Watch** function block and select **[Show Packet Watch Window]** from the drop down menu, as illustrated below, or simply double-left-click on the **Packet Watch** function block.

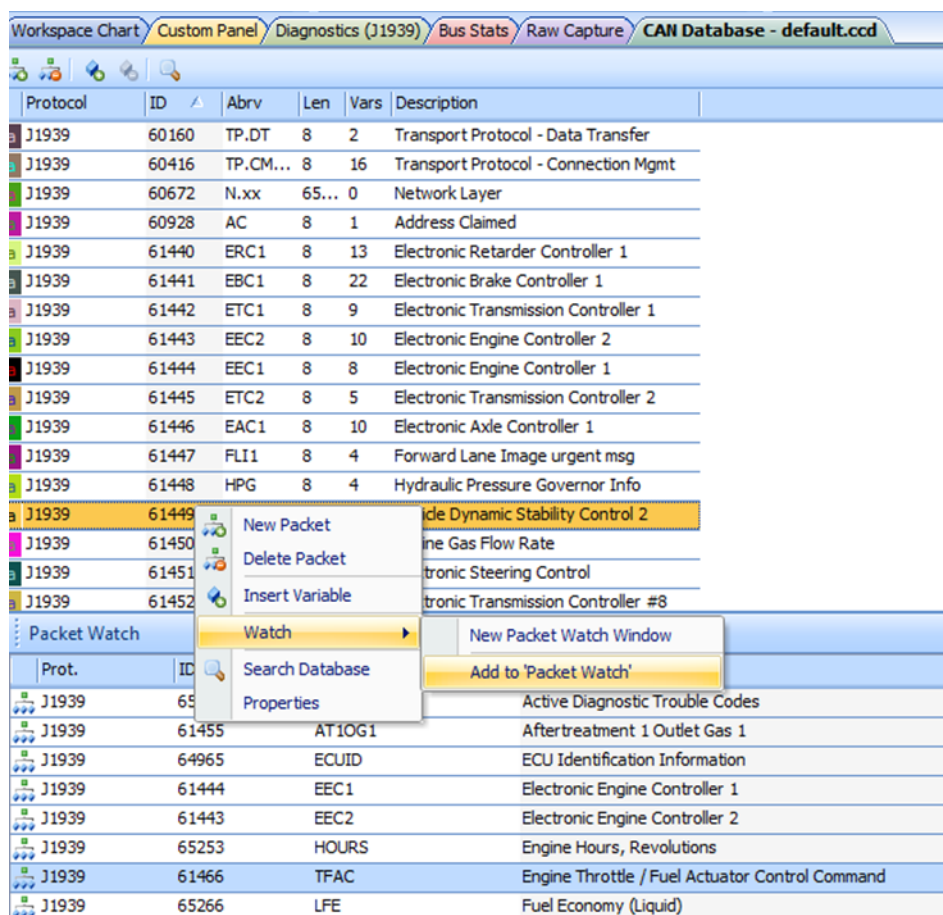


The **Packet Watch** window will now open at the bottom of the screen as illustrated below.

Prot.	ID	Abbreviation	Description	Avg. Period	Msg Count	Msg/s	Max Period	Min Period	Last Received
11939	65226	DM01	Active Diagnostic Trouble Codes	1000.01 ms	7	1.00	1000.26 ms	999.81 ms	6.26323
11939	61455	AT10G1	Aftertreatment 1 Outlet Gas 1		0				
11939	64965	ECUID	ECU Identification Information		0				
11939	61444	EEC1	Electronic Engine Controller 1	20.03 ms	344	49.93	21.18 ms	18.82 ms	6.87648
11939	61443	EEC2	Electronic Engine Controller 2		0				
11939	65253	HOURS	Engine Hours, Revolutions	2000.06 ms	3	0.50	2000.06 ms	2000.06 ms	5.57216
11939	61466	TFAC	Engine Throttle / Fuel Actuator Control Command		0				
11939	65266	LFE	Fuel Economy (Liquid)	99.99 ms	69	10.00	100.61 ms	99.26 ms	6.88666

8.1 Adding New Packets to the Packet Watch Window

You may add new packets to the **Packet Watch** window by opening the **CAN Database** window and right-clicking on the packet you wish to add to the **Packet Watch** window and select **[Watch ►]** and then select **[Add to 'Packet Watch']** on the drop down menu by as illustrated below.

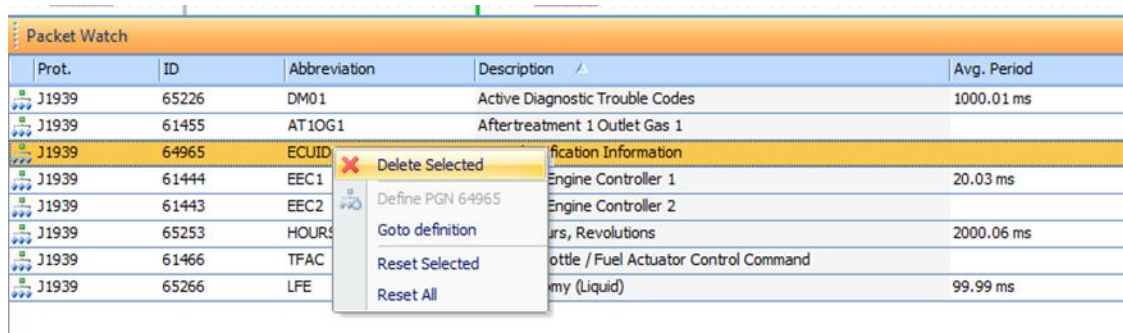


Protocol	ID	Abbrv	Len	Vars	Description
J1939	60160	TP.DT	8	2	Transport Protocol - Data Transfer
J1939	60416	TP.CM...	8	16	Transport Protocol - Connection Mgmt
J1939	60672	N.xx	65...	0	Network Layer
J1939	60928	AC	8	1	Address Claimed
J1939	61440	ERC1	8	13	Electronic Retarder Controller 1
J1939	61441	EBC1	8	22	Electronic Brake Controller 1
J1939	61442	ETC1	8	9	Electronic Transmission Controller 1
J1939	61443	EEC2	8	10	Electronic Engine Controller 2
J1939	61444	EEC1	8	8	Electronic Engine Controller 1
J1939	61445	ETC2	8	5	Electronic Transmission Controller 2
J1939	61446	EAC1	8	10	Electronic Axle Controller 1
J1939	61447	FLI1	8	4	Forward Lane Image urgent msg
J1939	61448	HPG	8	4	Hydraulic Pressure Governor Info
J1939	61449				Electronic Dynamic Stability Control 2
J1939	61450				Engine Gas Flow Rate
J1939	61451				Electronic Steering Control
J1939	61452				Electronic Transmission Controller #8

Prot.	ID	Description
J1939	65...	Active Diagnostic Trouble Codes
J1939	61455	Aftertreatment 1 Outlet Gas 1
J1939	64965	ECU Identification Information
J1939	61444	Electronic Engine Controller 1
J1939	61443	Electronic Engine Controller 2
J1939	65253	Engine Hours, Revolutions
J1939	61466	Engine Throttle / Fuel Actuator Control Command
J1939	65266	Fuel Economy (Liquid)

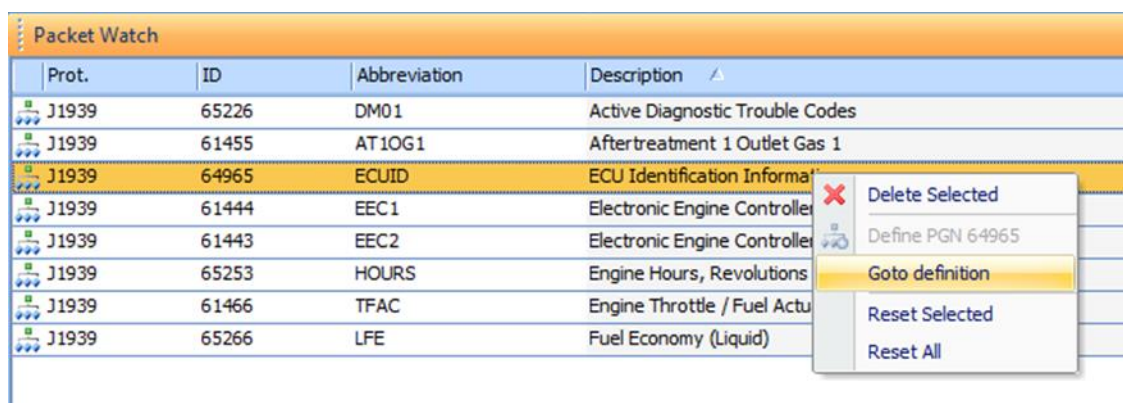
8.2 Deleting Packets from the Packet Watch Window

You may delete packets from the **Packet Watch** window by highlighting the particular variable by positioning the cursor over the variable you wish to delete, right-clicking with the mouse and selecting [**X Delete Selected**] from the drop down menu by left-clicking the mouse as illustrated below:



8.3 Finding the Packet Definition

You may obtain the packet definition by right-clicking the desired packet and selecting [**Goto definition**] from the drop down menu as illustrated below:



The **CAN Database** will now open allowing you to obtain the definition for the specific packet.

8.4 Resetting Packets

You may reset the data of a specific packet or reset the data for all packets on the **Packet Watch** window by right-clicking the mouse on the desired packet and selecting either **[Reset Selected]** or **[Reset All]** from the drop down menu by left-clicking on the selection as illustrated below.

8.4.1 Reset Selected

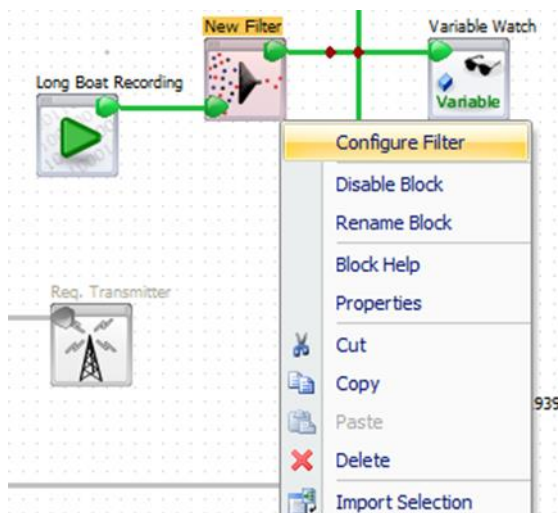
Packet Watch					
Prot.	ID	Abbreviation	Description	Avg. Period	
J1939	65226	DM01	Active Diagnostic Trouble Codes	1000.01 ms	
J1939	61455	AT1OG1	Aftertreatment 1 Outlet Gas 1		
J1939	64965	ECUID	ECU Identification Information		
J1939	61444	EEC1	Electronic Engine Controller 1	20.03 ms	
J1939	61443	EEC2	Electronic Engine Controller 2		
J1939	65253	HOURS	Engine Hours, Revolutions	2000.06 ms	
J1939	61466	TFAC	Engine Throttle / Fuel Actuator Control Command		
J1939	65266	LFE	Fuel Economy (Liquid)	99.99 ms	

8.4.2 Reset All

Packet Watch					
Prot.	ID	Abbreviation	Description		
J1939	65226	DM01	Active Diagnostic Trouble Codes		
J1939	61455	AT1OG1	Aftertreatment 1 Outlet Gas 1		
J1939	64965	ECUID	ECU Identification Information		
J1939	61444	EEC1	Electronic Engine Controller 1		
J1939	61443	EEC2	Electronic Engine Controller 2		
J1939	65253	HOURS	Engine Hours, Revolutions		
J1939	61466	TFAC	Engine Throttle / Fuel Actuator Control Command		
J1939	65266	LFE	Fuel Economy (Liquid)		

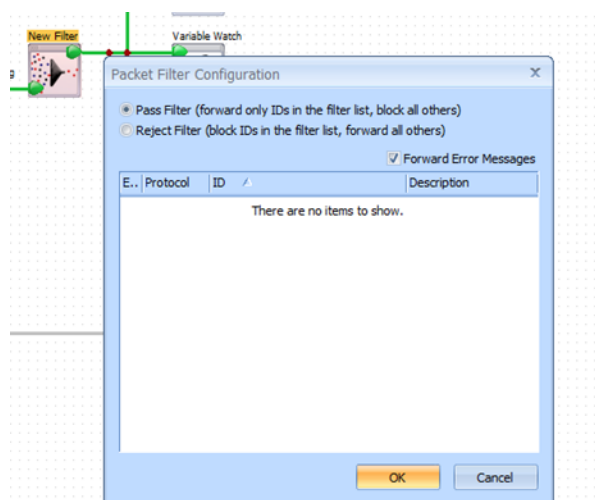
9 PACKET FILTER FUNCTION BLOCK

You may place a **Packet Filter** function block between a source device, such as an **ECOM** or **Recorder** block, and a passive interface, such as the **Graphing** function block. The **Packet Filter** block may be either a **Pass Filter** or a **Reject Filter**. A **Packet Filter** function block may be configured by right-clicking on the **Packet Filter** function block and selecting [**Configure Filter**] from the drop down menu by left-clicking the mouse on the selection as illustrated below.



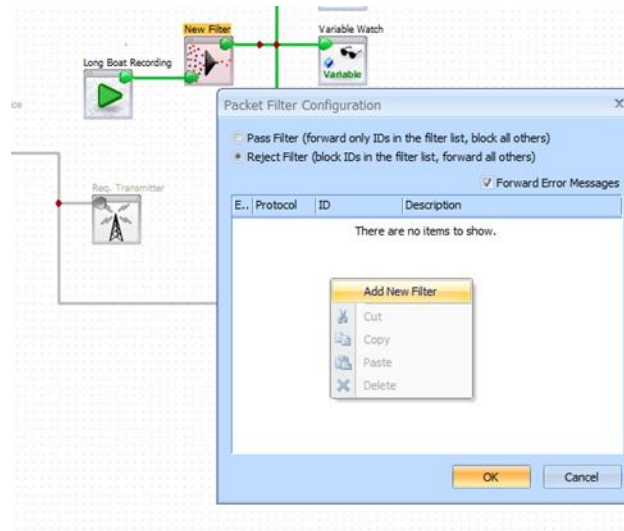
The **Packet Filter Configuration** window will now open as illustrated below. From this menu you may select the type of filter you desire:

- **Pass Filter** – forward only IDs in the filter list and block all others
- **Reject Filter** – block IDs in the filter list and forward all others

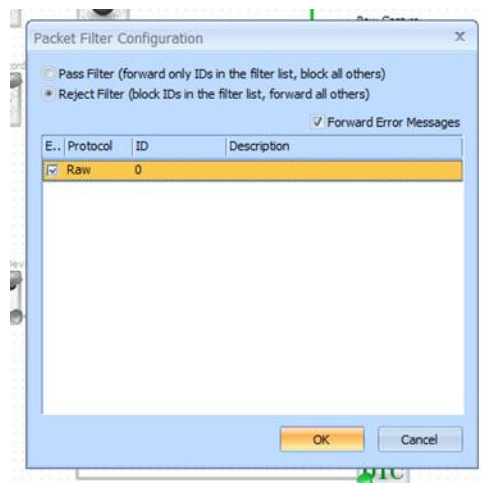


9.1 Adding a New Packet Filter

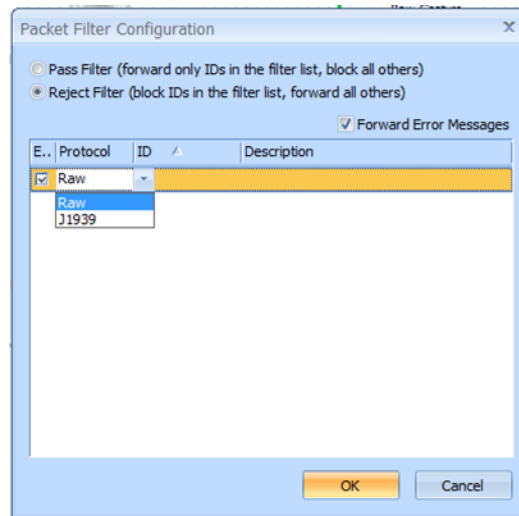
You may add a new filter to the **Packet Filter** window by right-clicking on the **Packet Filter** window and selecting **[Add New Filter]** by left-clicking the mouse on the selection as illustrated below:



The new filter will appear on the **Packet Filter Configuration** window as illustrated below:

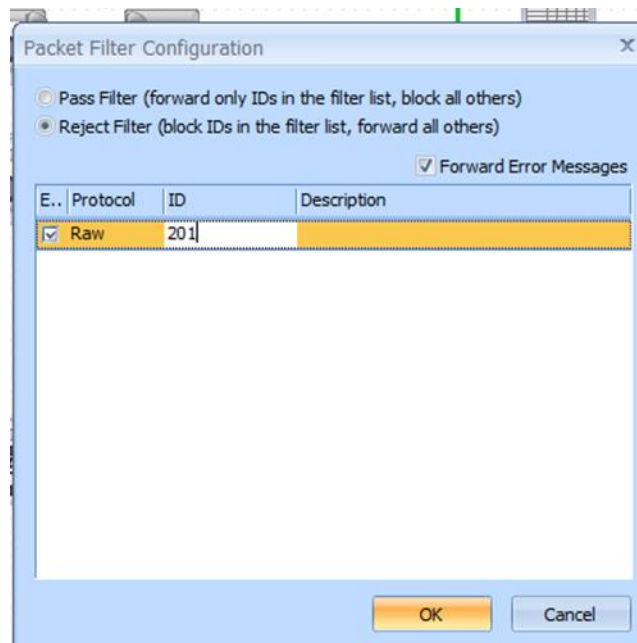


You may now select the message protocol from either **[RAW]** or **[J1939]** by double clicking the **Protocol** column and selecting from the drop down menu as illustrated below.

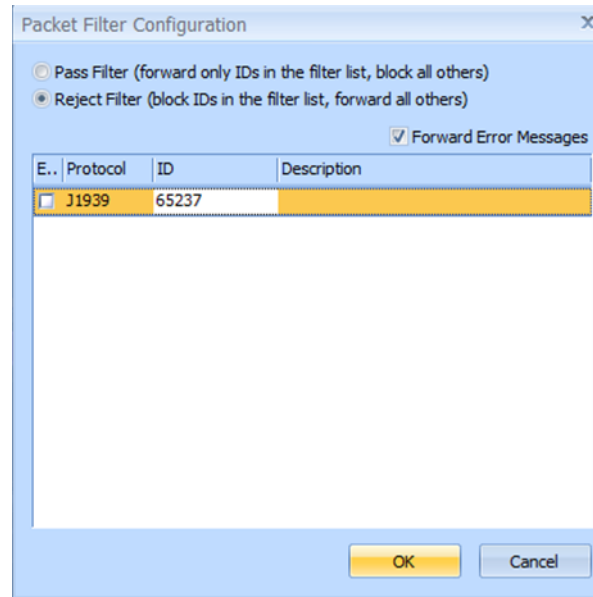


To enter the message ID that you want to filter, double click under the **ID** column and enter the message identifier as follows:

- For a Raw Protocol Message enter the RAW Identifier (11-bit or 29-bit):



- For a J1939 Protocol Message enter the PGN identifier:



Packet Filter Configuration

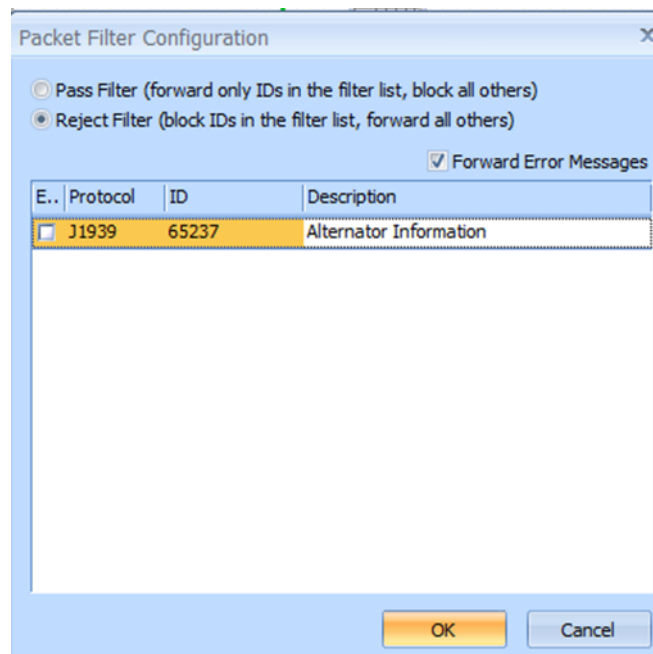
☐ Pass Filter (forward only IDs in the filter list, block all others)
☒ Reject Filter (block IDs in the filter list, forward all others)

☒ Forward Error Messages

E..	Protocol	ID	Description
<input type="checkbox"/>	J1939	65237	

OK Cancel

You may enter a message description by double-clicking under the **Description** column and entering a description of your choice as illustrated below:



Packet Filter Configuration

☐ Pass Filter (forward only IDs in the filter list, block all others)
☒ Reject Filter (block IDs in the filter list, forward all others)

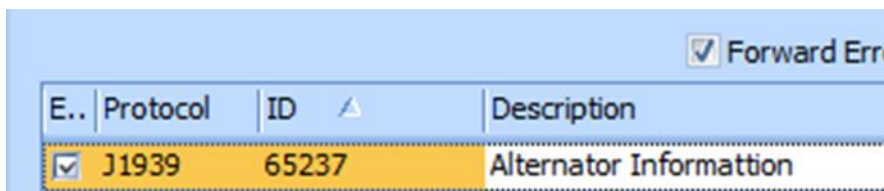
☒ Forward Error Messages

E..	Protocol	ID	Description
<input type="checkbox"/>	J1939	65237	Alternator Information

OK Cancel

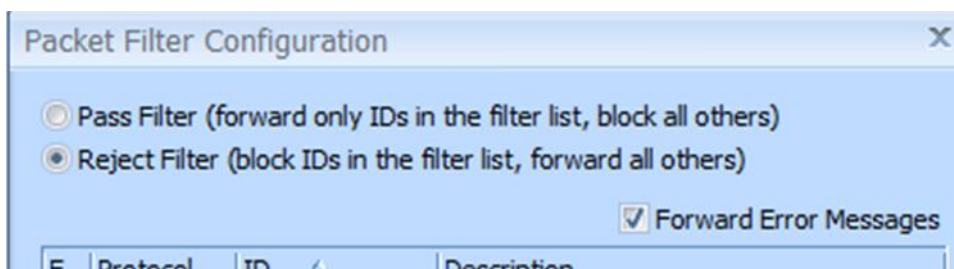
9.2 Enabling / Disabling a Packet Filter

You may enable or disable a packet filter by adding or removing the check mark [✓] in the enable box under the [E.] (enable) column heading by left-clicking the mouse when the mouse cursor is over the selection box as illustrated below.



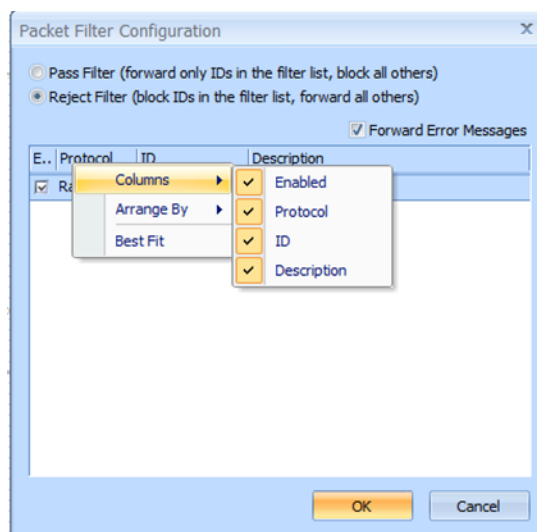
9.3 Forwarding Error Messages

You may forward all error messages independent of the packet filter settings by selecting the **Forward Error Messages** selection box and adding a check mark [✓] by left-clicking the mouse with the cursor over the selection box. To disable error message forwarding, remove the check mark [✓] from the selection box by left-clicking the mouse with the mouse cursor over the selection box as illustrated below:



9.4 Selecting the Packet Filter Message Columns to be Displayed

You may select the information columns that will be displayed on the **Packet Filter Configuration** window by right-clicking on the column headings and selecting **[Columns ►]** as illustrated below. You may select information columns that you want to display by adding a check mark **[v]** by clicking the left mouse button while the cursor is over the selection box to the left of the column heading on the drop down menu. To remove a selection, simply left-click the selection box that you want to remove until the check mark **[v]** is not visible.

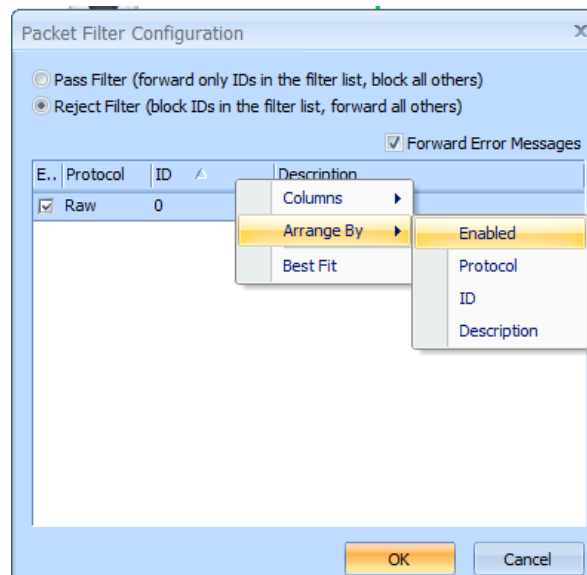


9.5 Selecting how the Packet Filter Display is Arranged

You may modify the order in which the packet filters are displayed on the **Packet Filter Configuration** screen by selecting [**Arrange by** ►] selection on the drop down menu as illustrated below or merely right-clicking on the column heading.

The choices are:

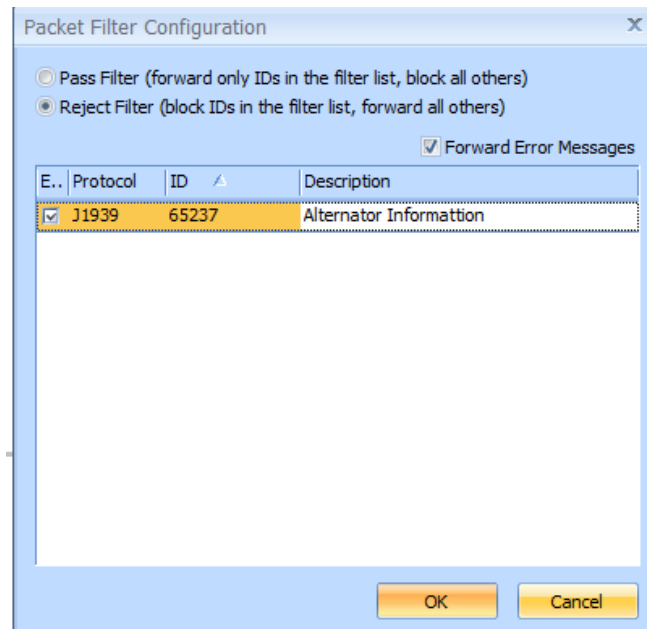
- Enabled
- Protocol
- ID
- Description



You may also choose to let **CANCapture** decide how to display the **Packet Filter Configuration** screen by selecting [**Best Fit** ►] on the selection screen.

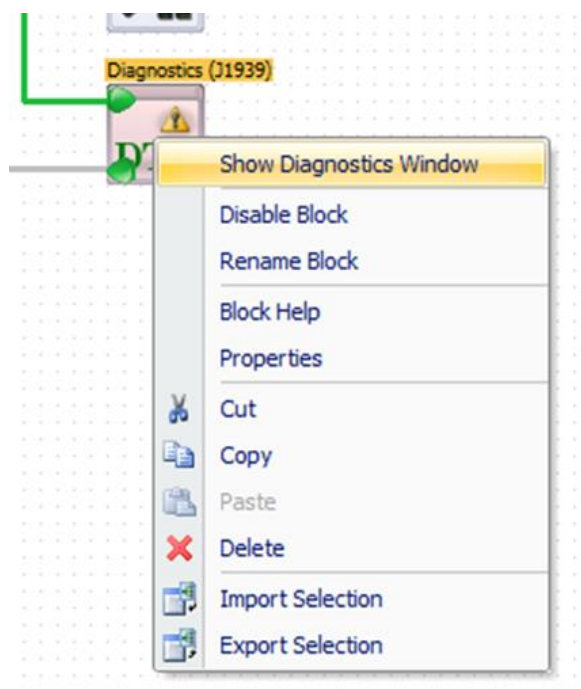
9.6 Completing the Packet Filter Configuration

When you are satisfied with the configuration of the **Packet Filters**, click on the **[OK]** button to accept all changes and return to the main window. If you want to discard your changes, right-click on the **[Cancel]** button as illustrated below:



10 J1939 DIAGNOSTICS FUNCTION BLOCK

You may display the **Diagnostics (J1939)** function block window by right-clicking the mouse button on the **Diagnostics (J1939)** function block and selecting [**Show Diagnostics Window**] by left-clicking the mouse button on the selection (as illustrated below), or by simply double-clicking the left mouse button on the **Diagnostics (J1939)** function block.



The following window will appear, displaying the **Diagnostics (J1939)** information.

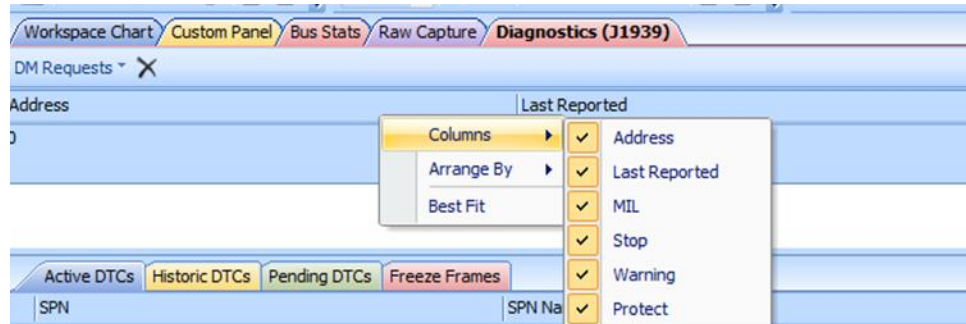
Workspace Chart / Custom Panel / Bus Stats / Raw Capture / Diagnostics (J1939)					
DM Requests X					
Address	Last Reported	ML	Stop	Warning	Protect
0	26.549824	●	●	●	●
Active DTCs / Historic DTCs / Pending DTCs / Freeze Frames					
SPN	SPN Name	FMI	FMI Description	OC	
Source Address: 0					
110	Engine Coolant Temperature	3	Voltage Above Normal, Or Shorted To High Source	2	
105	Engine Intake Manifold 1 Temperature	3	Voltage Above Normal, Or Shorted To High Source	127	
51	Engine Throttle Position	4	Voltage Below Normal, Or Shorted To Low Source	3	
3673	Engine Throttle 2 Position	4	Voltage Below Normal, Or Shorted To Low Source	3	
91	Accelerator Pedal Position 1	4	Voltage Below Normal, Or Shorted To Low Source	3	
29	Accelerator Pedal Position 2	3	Voltage Above Normal, Or Shorted To High Source	3	
701	Auxiliary I/O #01	3	Voltage Above Normal, Or Shorted To High Source	127	
100	Engine Oil Pressure	3	Voltage Above Normal, Or Shorted To High Source	127	
645		4	Voltage Below Normal, Or Shorted To Low Source	2	
51	Engine Throttle Position	31	Condition Exists	3	
441	Auxiliary Temperature 1	3	Voltage Above Normal, Or Shorted To High Source	127	
442	Auxiliary Temperature 2	3	Voltage Above Normal, Or Shorted To High Source	127	

10.1 Selecting the Display Columns for the Diagnostics (J1939) Window

You may select the information columns to be displayed on the **Diagnostics (J1939)** window by right-clicking on the column headings and selecting from the drop down menu as illustrated below.

The choices are:

- Address
- Last Reported
- MIL
- Stop
- Warning
- Protect



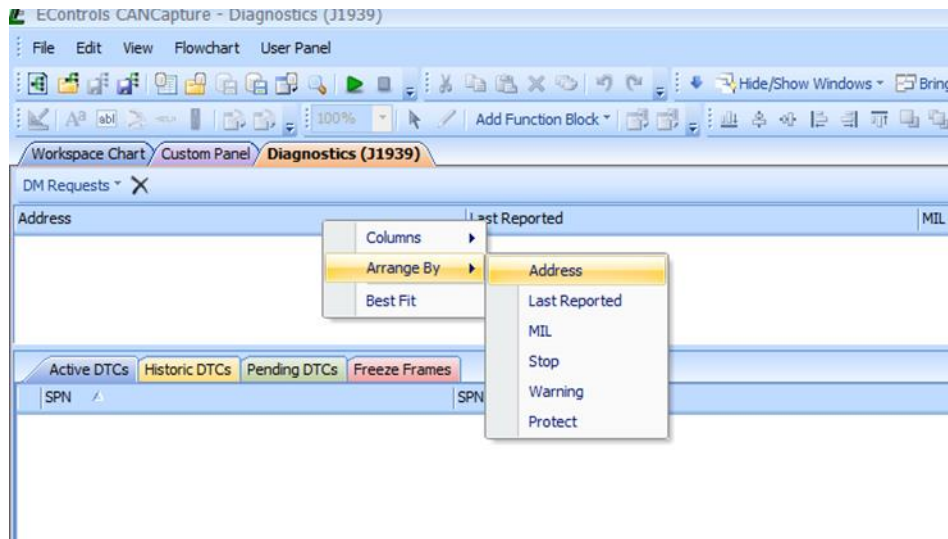
To select the columns that you want to display add a check mark [v] in the selection box preceding the selection by left-clicking the mouse with the cursor over the selection box. To remove an information column from the display, remove the check mark [v] from the selection box by left-clicking the mouse with the cursor over the selection box.

10.2 Changing the Arrangement on the Diagnostics (J1939) Window

You may change the arrangement of the indicators on the **Diagnostics (J1939)** window by right-clicking the mouse button on the column headings and selecting **[Arrange By ►]** from the drop down menu as illustrated below.

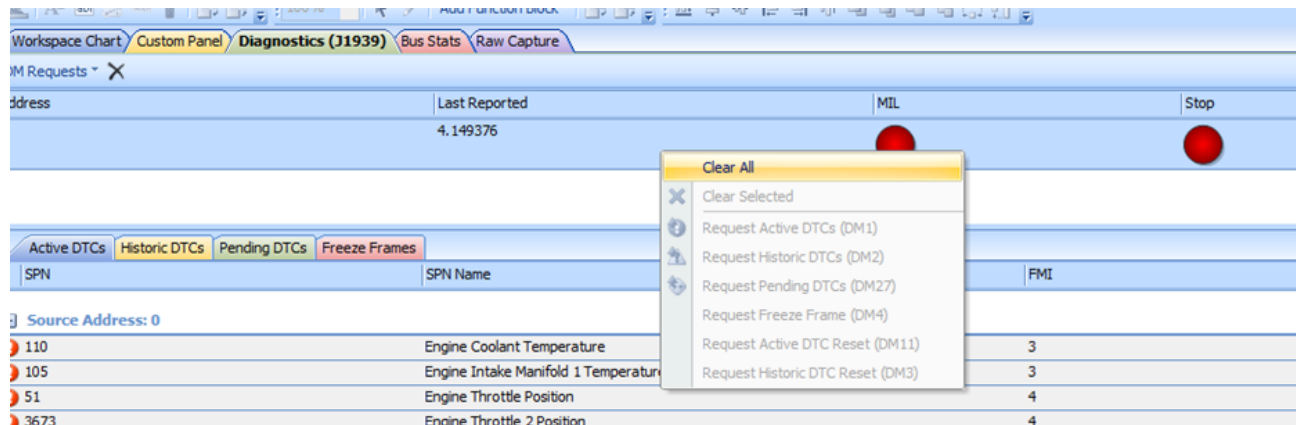
The choices are:

- **Address**
- **Last Reported**
- **MIL**
- **Stop**
- **Warning**
- **Protect**



10.3 Clearing the Diagnostics (J1939) Indicators

You may clear all **Diagnostics (J1939)** indicators by right-clicking the mouse on the indicator window and left-clicking the mouse and selecting **[Clear All]** as illustrated below:

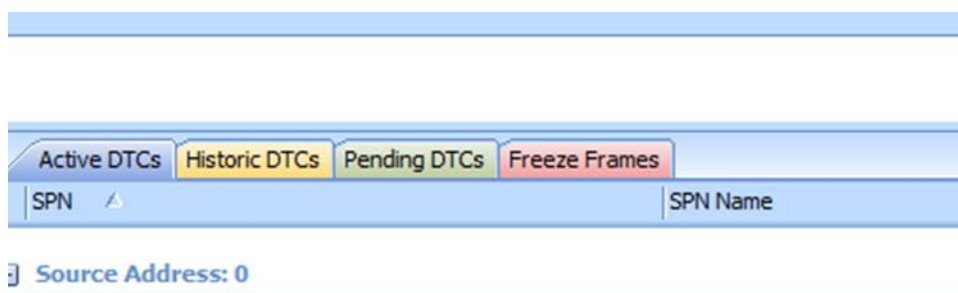


10.4 Diagnostics (J1939) Tabs

There are four tabs on the **Diagnostics (J1939)** window as illustrated below.

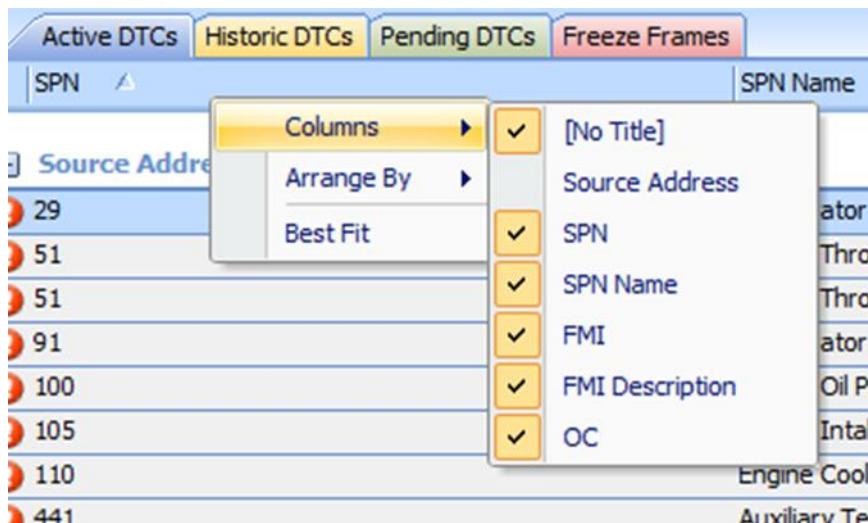
These are:

- Active DTCs
- Historic DTCs
- Pending DTCs
- Freeze Frames



10.5 Selecting Columns to Display on the Diagnostics (J1939) Window

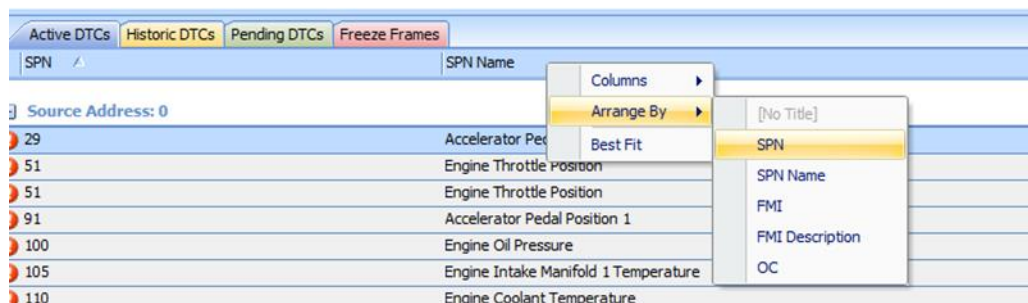
You may select the columns you want to display by right-clicking on the column headings and selecting **[Columns ►]** by left-clicking the mouse on the selection as illustrated below.



You may now select the **[Column ►]** to display by adding a check mark **[v]** to the selection box preceding the column definition by left-clicking the mouse with the mouse cursor on the selection box. To remove a column from the display, you need to remove the check mark **[v]** from the selection box by left-clicking the mouse with the cursor on the selection box.

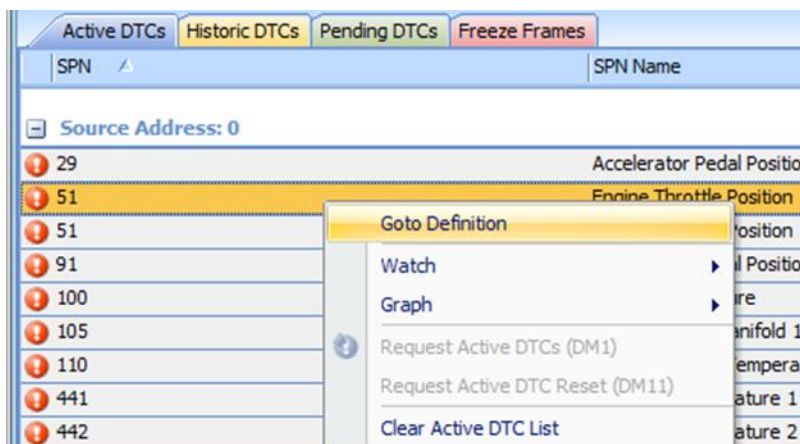
10.6 Selecting the Column Arrangement on the J1939 Diagnostic Window

You may arrange the columns on the **Diagnostics (J1939)** window by right-clicking on the desired column heading and selecting **[Arrange By ►]** from the drop down menu as illustrated below, or by merely left-clicking on the desired column heading.



10.7 Options on the Diagnostics (J1939) Window

You may select the options for the various DTCs by right-clicking on the desired **DTC** and selecting from the drop down by left-clicking the mouse on the selection menu as illustrated below.

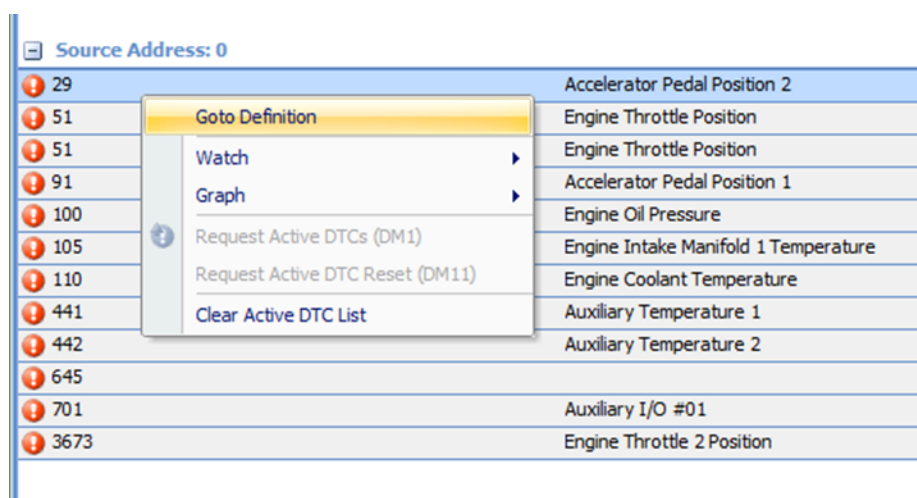


The options are:

- **Goto Definition**
- **Watch**
- **Clear Active DTC list**

10.8 DTC Options

You may employ the various options on an individual DTC by right-clicking the mouse on the specific DTC and selecting the option you desire from the drop down menu by left-clicking on the selection as illustrated below:

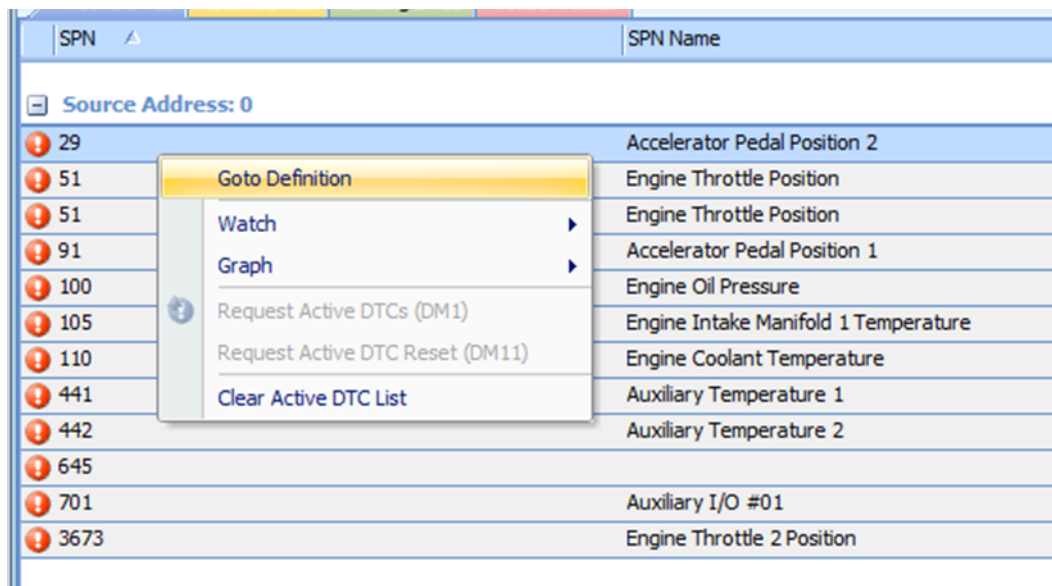


The choices are:

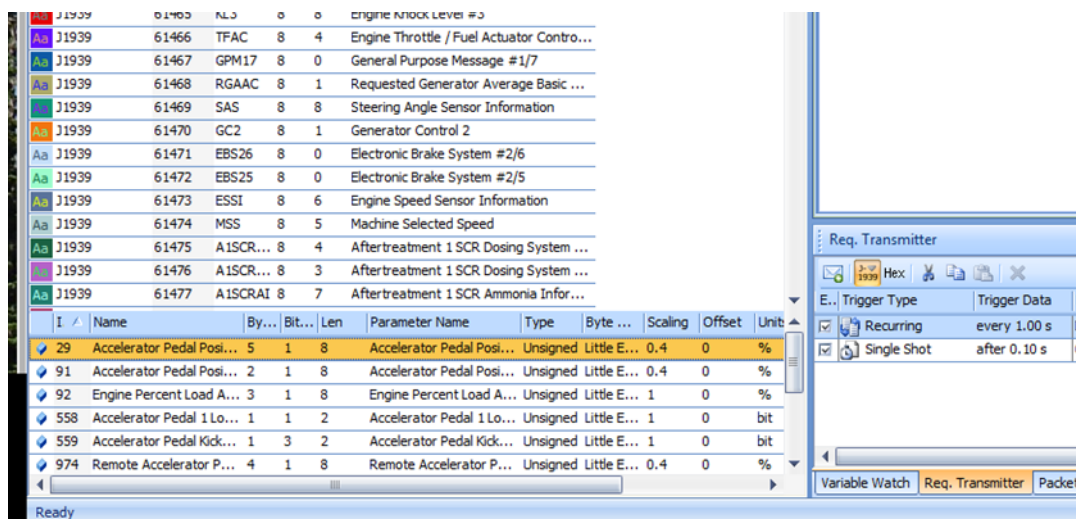
- **Goto Definition**
- **Watch**
- **Graph**
- **Request Active DTCs (DM1)**
- **Request Active DTC Request (DM11)**
- **Clear Active DTC List**

10.9 Selecting Goto Definition on the DTC Options Menu

You may select the **Goto Definition** option on the drop down menu by left-clicking the mouse on the [**Goto Definition**] Selection as illustrated below.

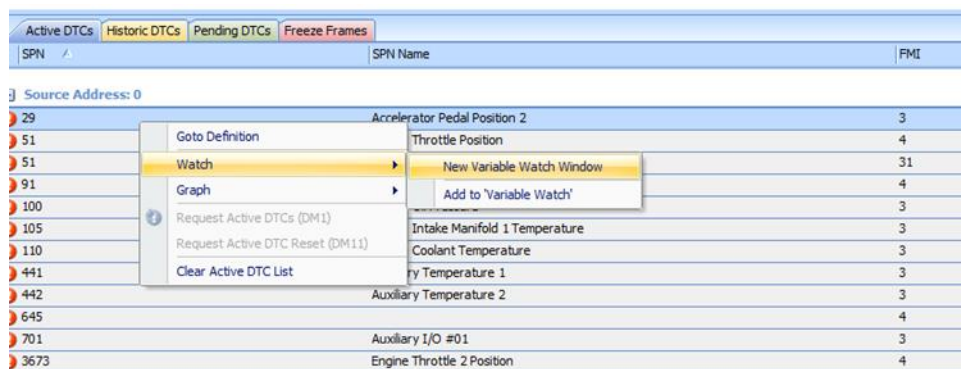


The **CAN Database** window will now open showing the definition for the DTC that is highlighted.

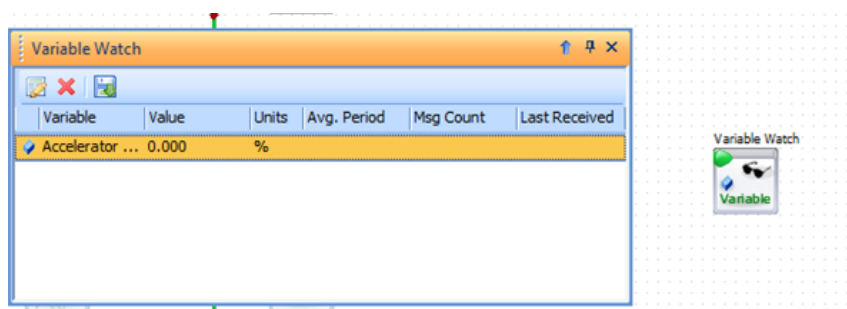


10.10 Adding a New Variable Watch Window for the DTC

You may add a new **Variable Watch** window for a DTC by right-clicking on the specific DTC you wish to affect and selecting [**Watch** ►] and then [**New Variable Watch Window**] by left-clicking the mouse on the selection as illustrated below:



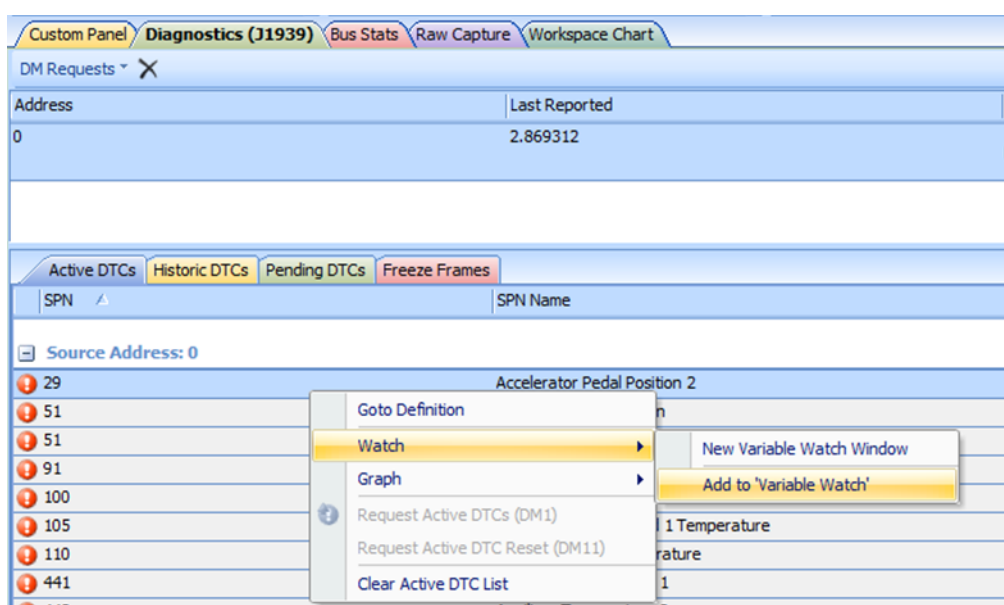
The new **Variable Watch** window will open, displaying a new **Variable Watch** function block. The same new **Variable Watch** function block will appear on the **Graphical Workspace Flowchart**.



To configure the DTC in the **Variable Watch** window, follow the instructions for the **Variable Watch** window described earlier in this manual. You will need to connect the new **Variable Watch** function block to your system as desired on the **Graphical Workspace Flowchart** using the **Line Connector** described earlier in this document.

10.11 Adding a DTC to a Variable Watch Window

You may add a DTC to a **Variable Watch** window by right-clicking on the specific DTC and selecting **[Watch ►]** and then **[Add to 'Specific Name']** from the drop down menu by left-clicking the mouse on the selection as illustrated below:

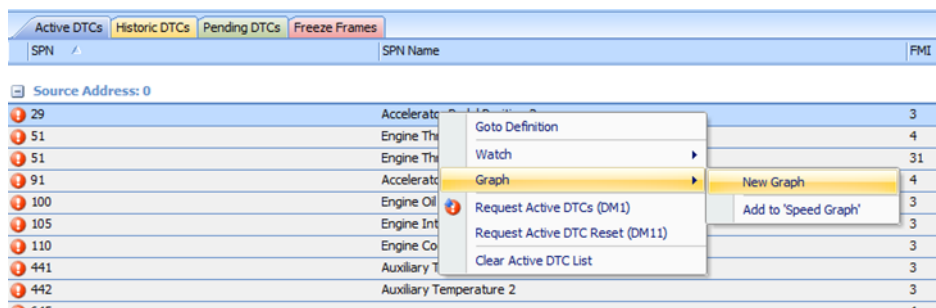


The DTC will be added to the **Variable Watch** window as illustrated below.

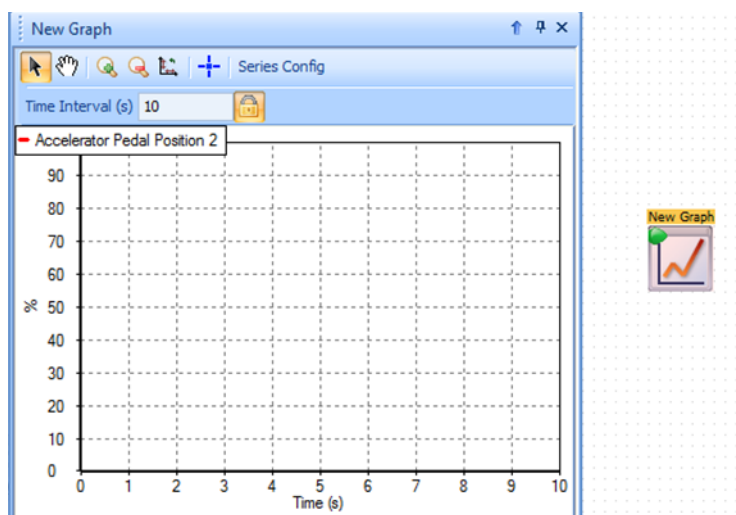
Active DTCs					
Historic DTCs					
Pending DTCs					
Freeze Frames					
SPN	SPN Name	FMI	FMI Description	OC	
Source Address: 0					
29	Accelerator Pedal Position 2	3	voltage Above Normal, Or Shorted To High Source	3	
51	Engine Throttle Position	4	voltage Below Normal, Or Shorted To Low Source	3	
51	Engine Throttle Position	31	Condition Exists	3	
Variable Watch					
Variable	Value	Units	Avg. Period	Mag Count	Last Received
Accelerator Pedal Position 2	0.000	%	499.68 ms	7	3.012864
Engine Intake Manifold 1 Temperature	214.000	C	19.54 ms	158	3.139392
Engine Speed	0.000	rpm	81.11 ms	33	3.114368
Engine Throttle Position	101.600	%			

10.12 Adding the DTC(s) to a Graph Window

You may add DTCs to a **New Graph** window by right-clicking on the specific DTC and selecting [**Graph** ►] and then [**New Graph**] from the drop down menu by left-clicking the mouse on the selection as illustrated below:



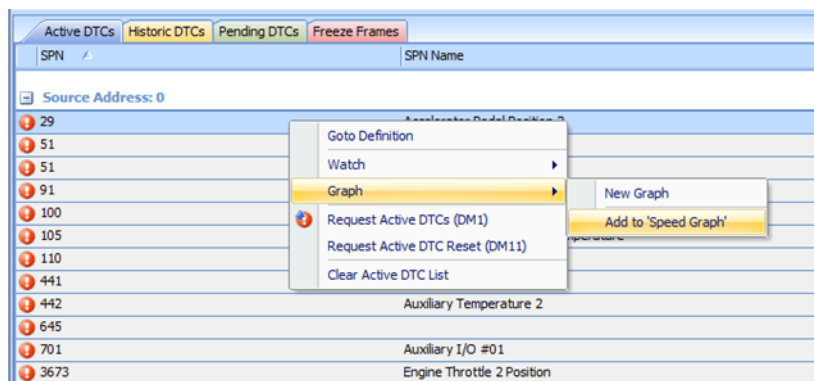
A **New Graph** window and a **Graph** function block will appear on the **Graphical Workspace Flowchart** as illustrated below:



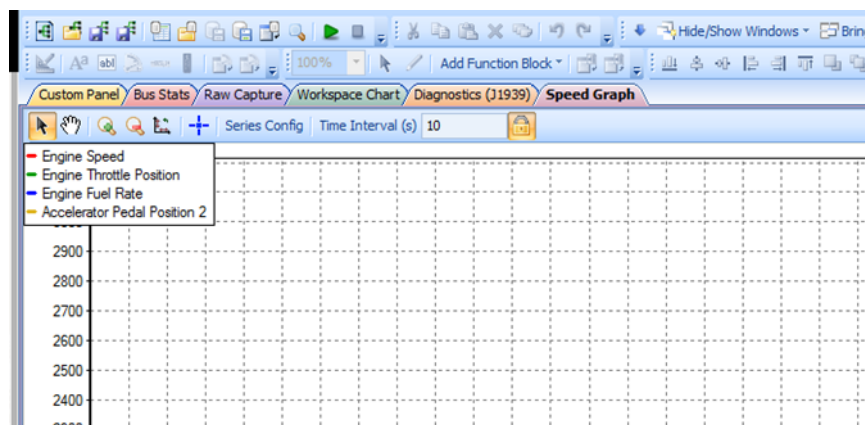
You may now configure the **New Graph** by referring to the **Graph Window Configuration** setting section described earlier in this manual. In addition you will need to connect the new **Graph** function block to the system using the **Drawing Pen** as described earlier in this document.

10.13 Adding DTCs to an Existing Graph Window

You may add a DTCs to an existing **Graph** window by right-clicking on the specific DTC and selecting **[Graph ►]** and **[Add to '(specific name)' Graph]** from the drop down menu by left-clicking on the **[Add to '(specific name) Graph']** as illustrated below.



The existing **Graph** window will now open showing the addition of your specific DTC(s) included to the graph.



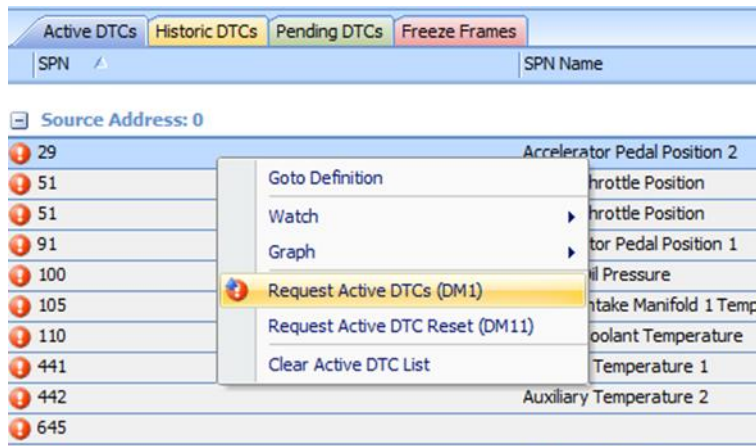
You may now configure the **Graph** to your needs by referring to the **Configuring the Graph** window section presented earlier in this document.

10.14 Requesting Active DTCs

You may request Active DTCs by selecting right-clicking on the **DTC** list and selecting **[Request Active DTCs (DM1)]** from the drop down menu by left-clicking the mouse on the selection as illustrated below.

NOTES:

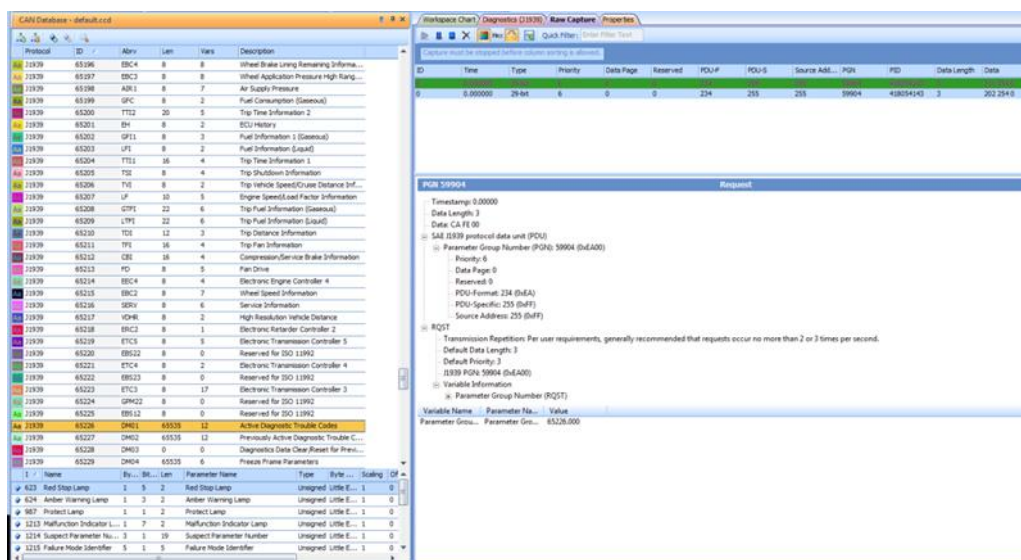
1. CANCapture must be running in order for these options to be available
2. This is only necessary if the ECU is not already broadcasting the Active DTCs.



This will send a request out of the output port on the **J1939 Diagnostic** function block to the CAN bus.

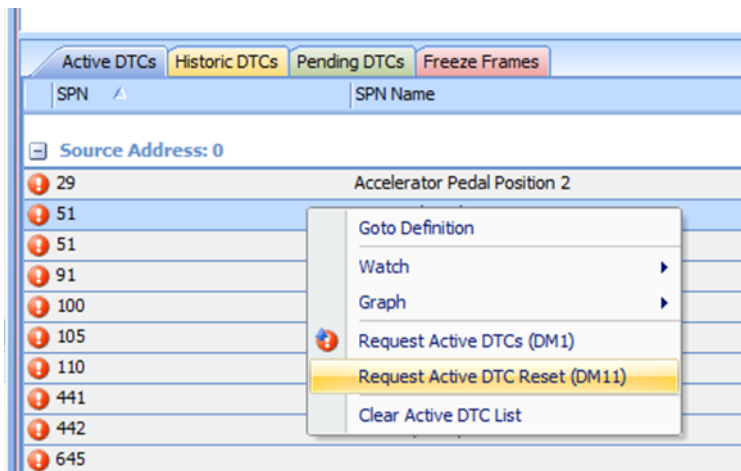
NOTE: The output port must be connected for this to operate properly.

The following Message will be sent out **65226 Active Diagnostic Trouble Codes** per the J1939 protocol



10.15 Requesting an Active DTC Reset (DM11)

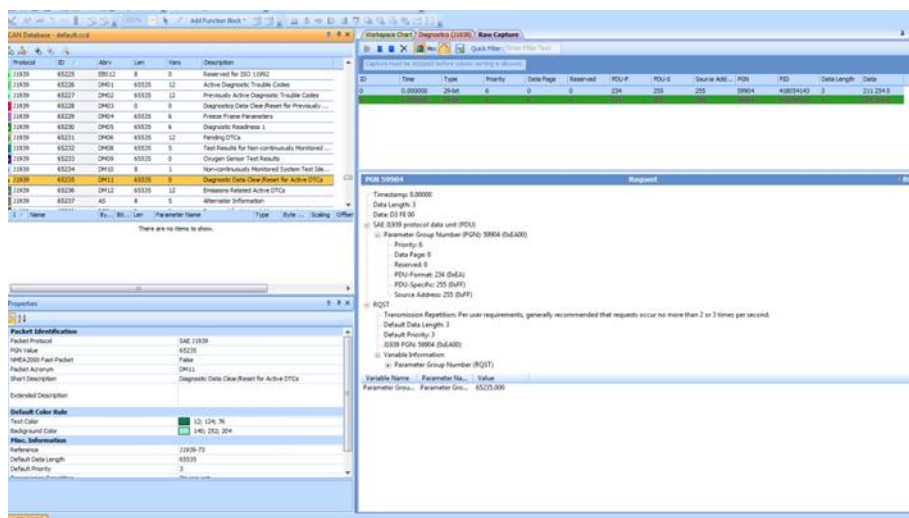
You may request an **Active DTC Reset (DM11)** by right-clicking on the DTC list and selecting **[Request Active DTC Reset (DM11)]** by left-clicking the mouse on the selection as illustrated below.



This will send the request out of the output port of the **J1939 Diagnostic** function block.

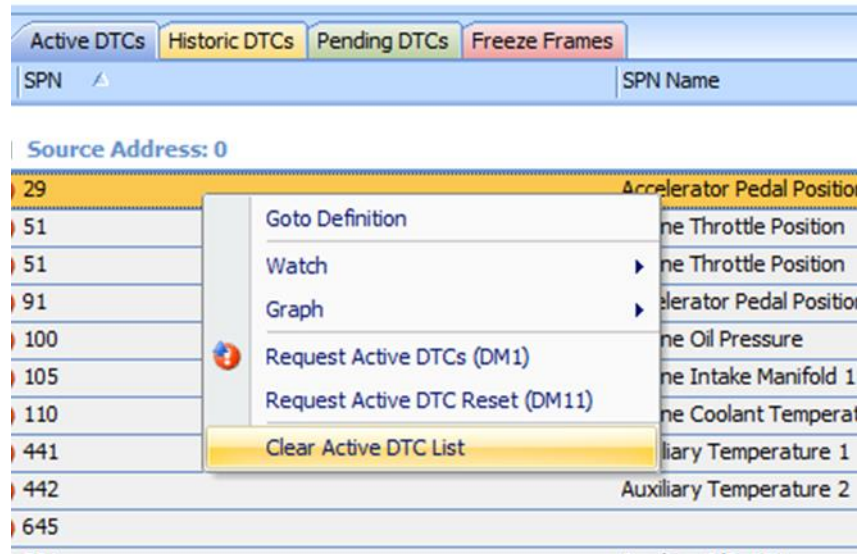
NOTE: You must have the output port of the **J1939 Diagnostic** function block connected to the system.

The following will be sent out **65235 Diagnostic Data Clear Reset for Active DTCs** per the J1939 protocol



10.16 Clearing the Active DTC List

You may **Clear the Active DTC List** by right-clicking on any of the DTCs on the list and select **[Clear Active DTC List]** from the drop down menu by left-clicking the mouse on the **[Clear Active DTC List]** selection as illustrated below.

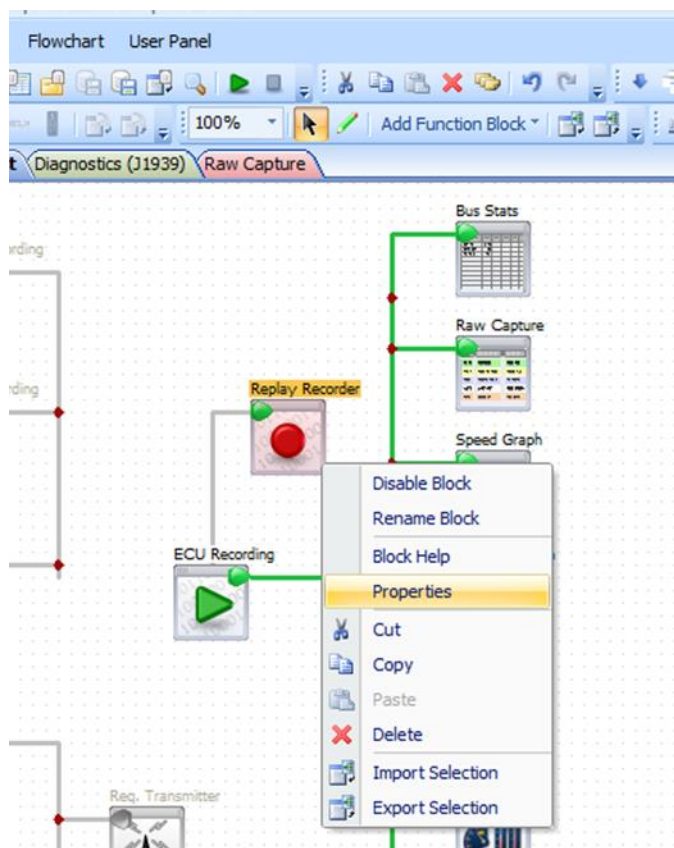


All active DTCs will now be cleared from the list.

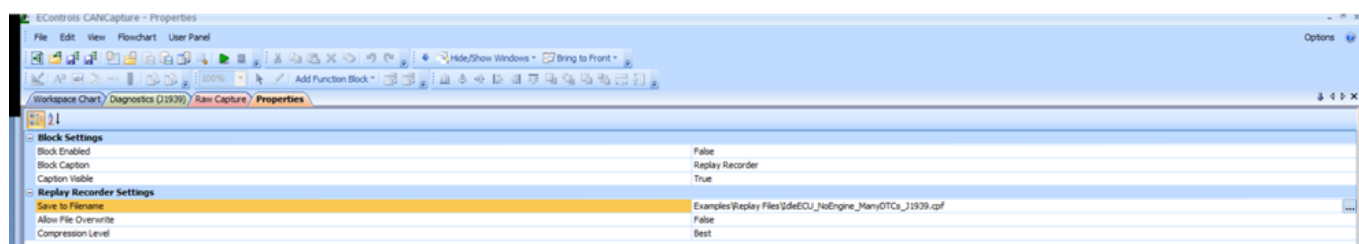
NOTE: This does not send a CAN message to clear or reset DTCs. It simply clears the items from the list.

11 REPLAY RECORDER FUNCTION BLOCK

You may set up the replay recorder by either right-clicking on the mouse on the **Replay Recorder** function block and selecting **[Properties]** in the drop down menu by left-clicking on the selection as illustrated below or simply double clicking the left mouse button on the **Replay Recorder** function block.

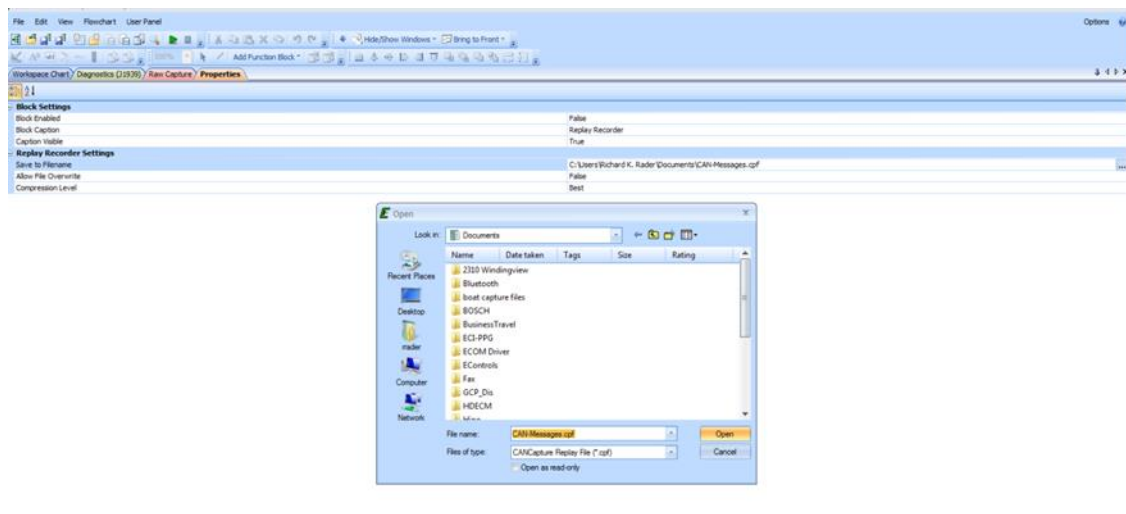


The **Properties** window will now open displaying all the settings for the recorder block.



11.1 Saving Can Message Data

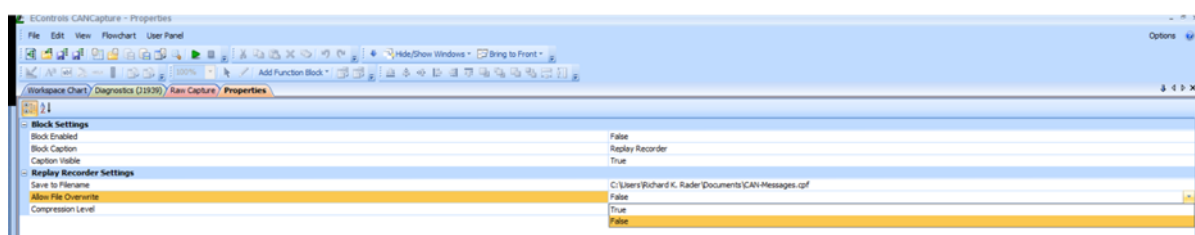
You may now select the file you wish to save the CAN message data to by selecting the [...] icon at the far right-hand side of the **Save to Filename** setting as illustrated below:



You may now select the file you wish to save your data to from the window illustrated above. The file will be stored in the *.cpf (Can Playback File) format.

11.2 Selecting the file Overwrite option

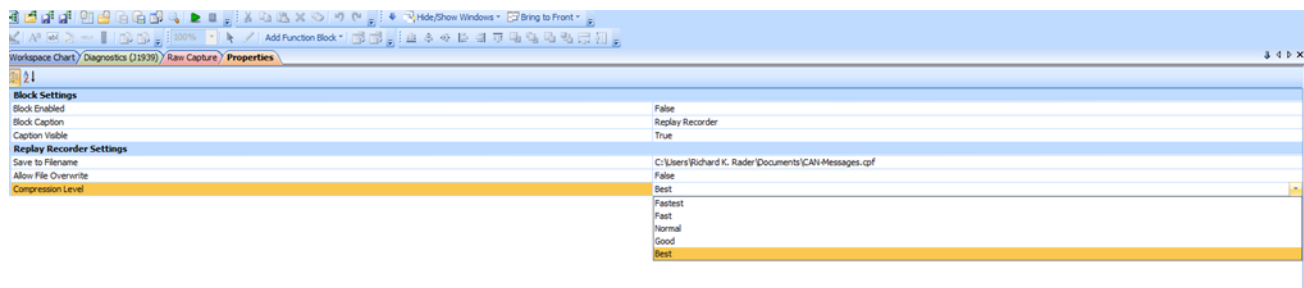
You may select the **Allow File Overwrite** option by left-clicking the mouse on the [▼] icon on the far right hand side of the **Allow File Overwrite** option selection as illustrated below:



You may now select either **True** or **False** from the drop down menu by right-clicking on the selection. If you select **False** the data file will be protected from being overwritten at a later date. If you select **True**, the file may be overwritten and you will lose all previously recorded data every time a new capture is started.

11.3 Setting the Level of Compression of the Data File

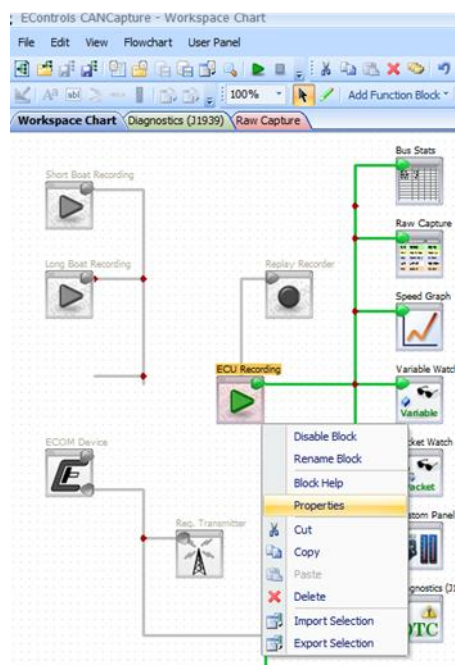
You may set the level of compression of the data of your file by right-clicking the mouse on the [▼] on the far right-hand side of the **Compression Level** selection as illustrated below:



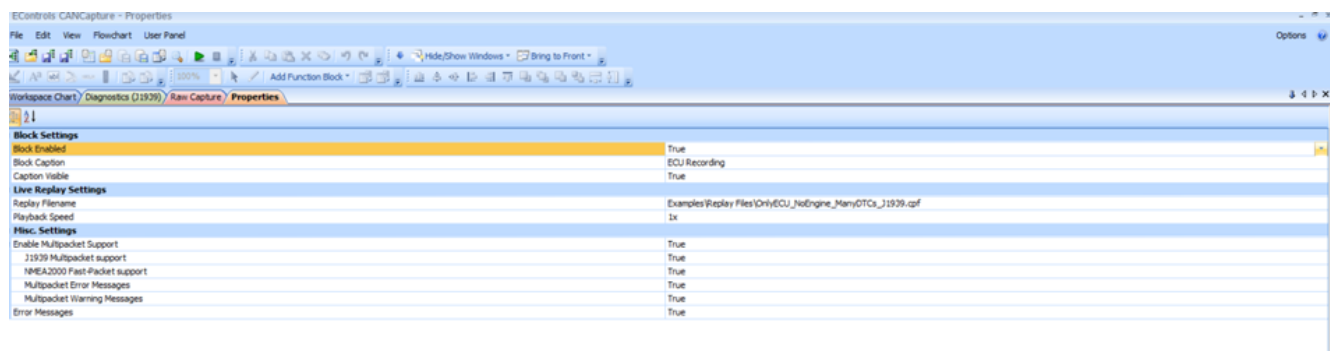
You may now select the amount of data compression you want from the drop down menu by left-clicking your selection with the mouse. The **Fastest** selection will provide the best performance but the least amount of compression, while the **Best** selection will provide the highest amount of compression. All other selections are somewhere in between these settings.

12 LIVE REPLAY FUNCTION BLOCK

You may configure the parameters of the file replay block by right-clicking the mouse button on the **Replay** function block and selecting **[Properties]** from the drop down menu by left-clicking on the **[Properties]** selection as illustrated below or simply double clicking on the **Replay** function block.

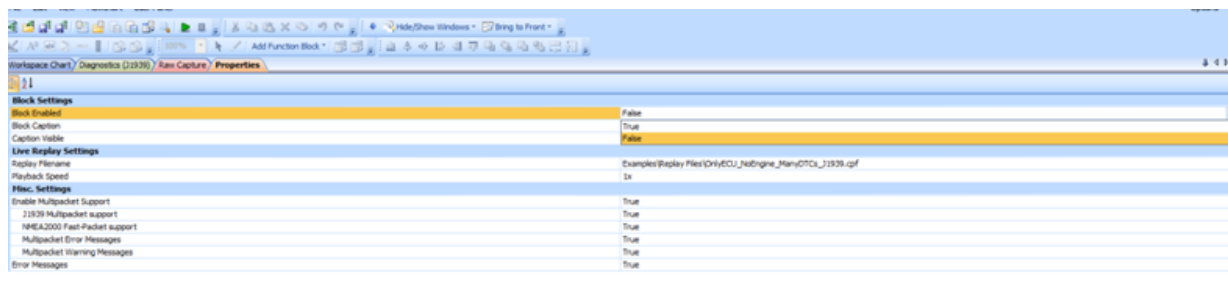


The following window will now open:



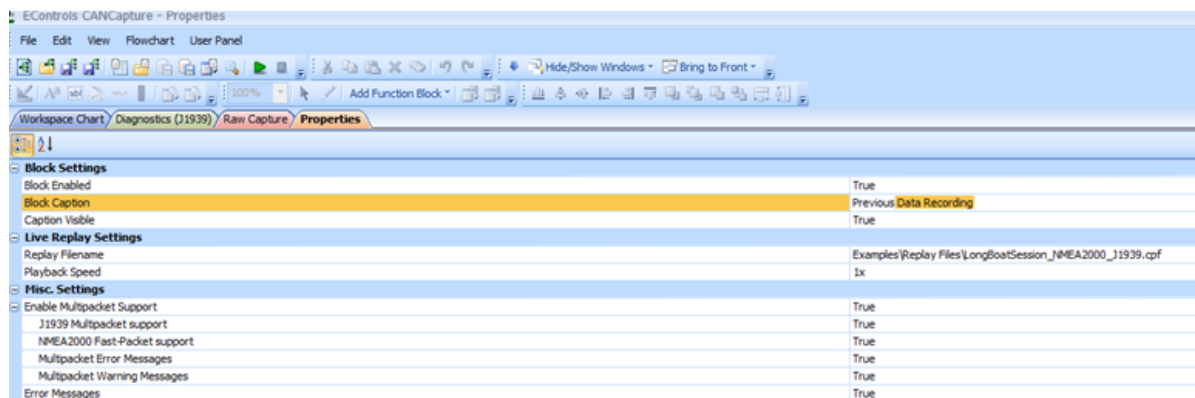
12.1 Enabling / Disabling the Live Replay Function Block

You may Enable or Disable the **Live Replay** function block from this window by selecting the **Block Enabled** line and left-clicking on the [▼] icon on the far right-hand side of the line and selecting either **True** or **False** from the drop down menu as illustrated below:



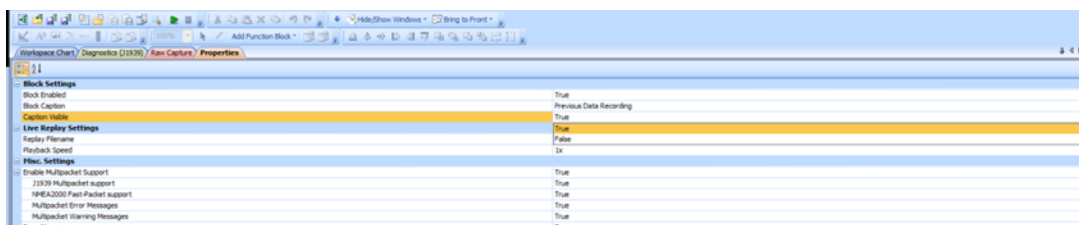
12.2 Modifying the Replay Block Caption

You may modify the **Live Replay** function block caption by selecting **Block Caption**, then hold down the left-hand mouse button while cursoring over the portion of the caption (or the entire caption) that you wish to modify to highlight it, then enter the caption content that you desire to display on the flowchart as illustrated below.



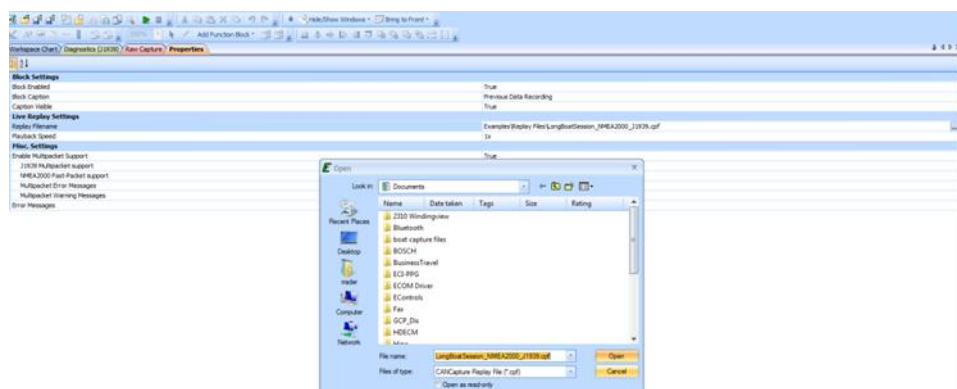
12.3 Selecting if the Caption is Visible

You may select if the **Caption** is visible or not by selecting the **Caption Visible** option under **Block Settings** and left-clicking on the [▼] icon at the far right-hand side of the **Caption Visible** line. Then, select from the drop down menu either **True** to make the Caption visible or **False** to make the caption invisible on the flowchart as illustrated below:



12.4 Selecting the Data File to Playback

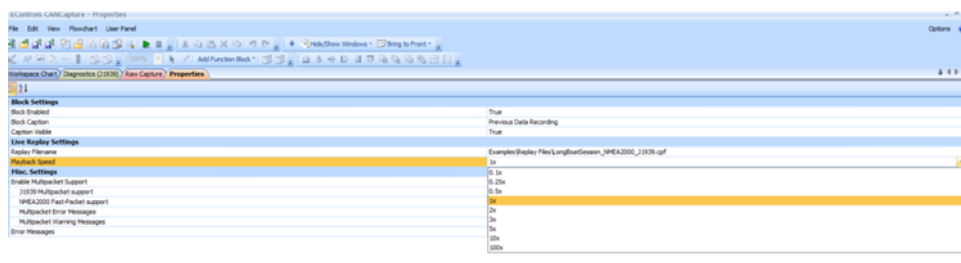
To select the data file that you have previously recorded for playback select the [...] icon on the far right-hand side of the **Replay Filename** line under **Replay Settings** by left-clicking with the mouse as illustrated below:



You may then browse your computer storage for the file that you wish to replay and select open by right-clicking the mouse on the **[Open]** icon.

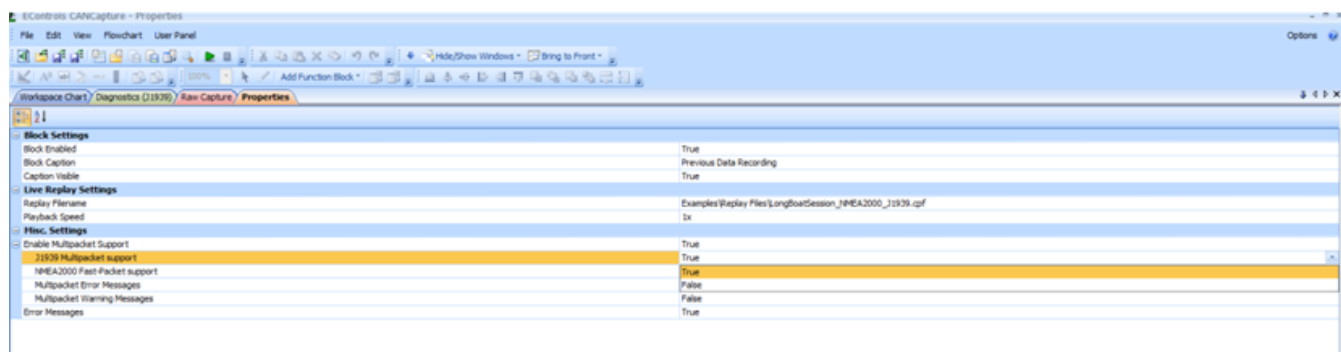
12.5 Setting the Playback Speed

You may select the desired playback speed of your data by selecting **Playback Speed** under **Live Replay Settings** and left-clicking on the [▼] on the far right-hand side of the window and selecting the desired **Playback Speed** from the drop down menu as illustrated below or by double clicking on the **Playback Speed** to cycle through the various choices.



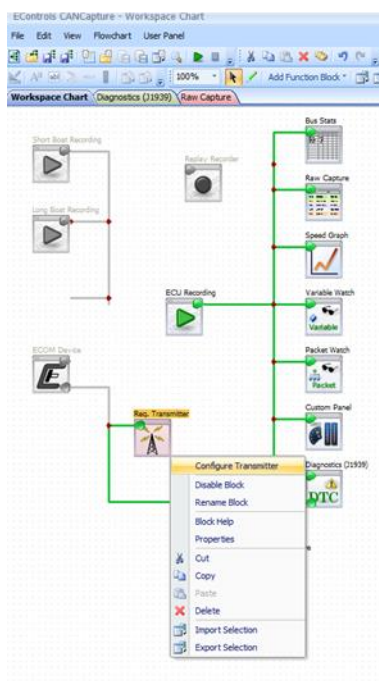
12.6 Miscellaneous Settings for the Playback Block

You may choose which **Miscellaneous Setting** you wish enabled or disabled by selecting the [▼] icon at the far right-hand side of the selection and selecting either **True** or **False** from the drop down menu by left-clicking the mouse on the selection as illustrated below this will toggle the selection between **True** and **False** each time you double click. You may also double-click the option to toggle between **True** and **False**.

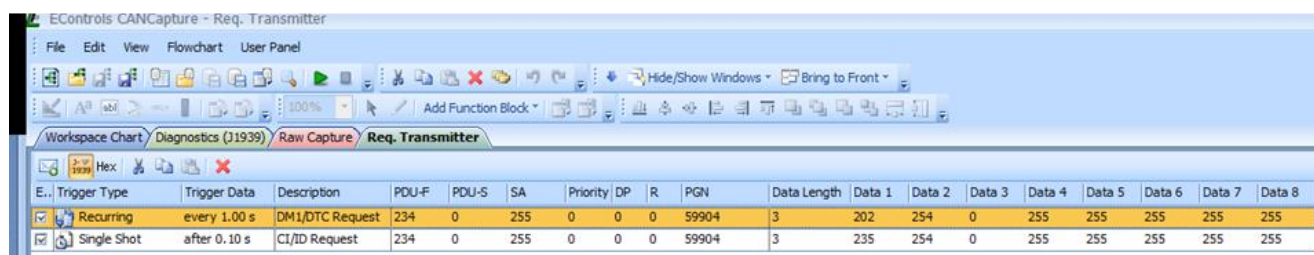


13 11-BIT AND 29-BIT MESSAGE TRANSMITTER FUNCTION BLOCKS

You may configure the various parameters of the **Message Transmitter** function blocks by right-clicking the mouse on the function block and selecting **[Configure Transmitter]** from the drop down menu as illustrated below, or by simply double clicking on the **Message Transmitter** function block.

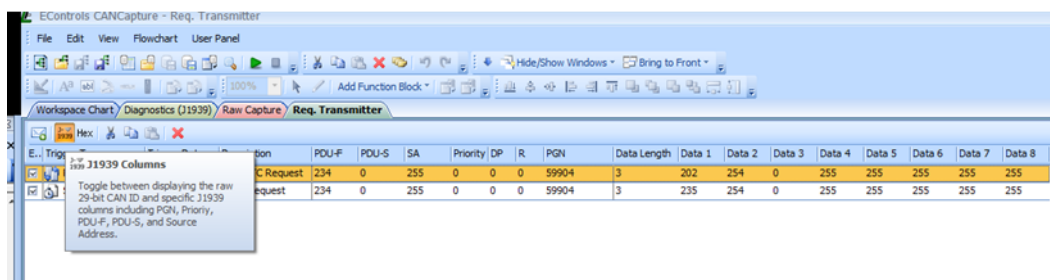


The following window will open, displaying the configuration parameters of the **Message Transmitter** function block.



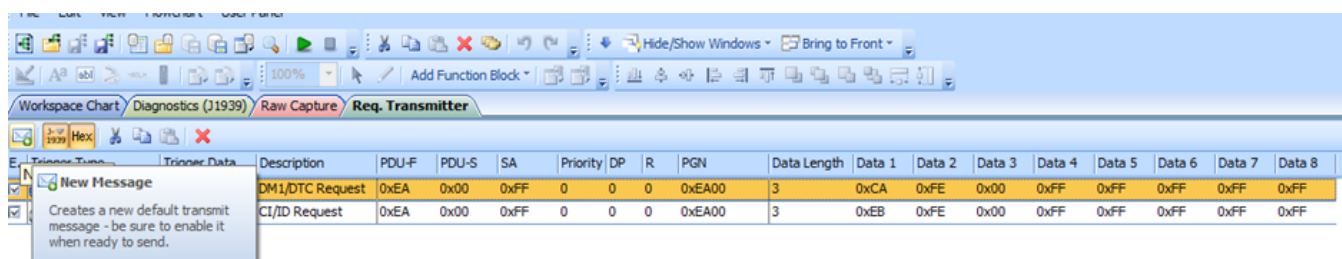
13.1 Selecting the CAN Data Column Display Format (29-bit Only)

You may toggle the display format for your CAN data in the columns by left-clicking the mouse on the **J1939 Columns** selection on the toolbar of the **Message Transmitter** window as illustrated below. The data display format will toggle between **J1939** and **Raw 29-bit identifier** each time you click on the selection.



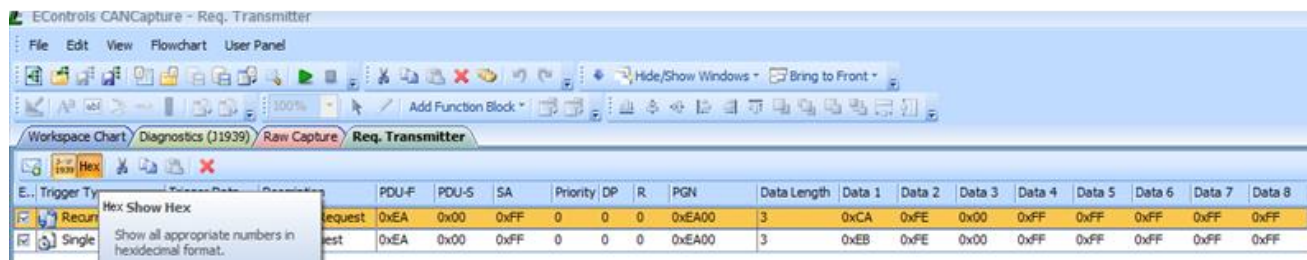
13.2 Adding a New Transmit Message

You may add a **New Transmit Message** by left-clicking the mouse on the **envelope** icon in the **Transmitter** window toolbar as illustrated below.



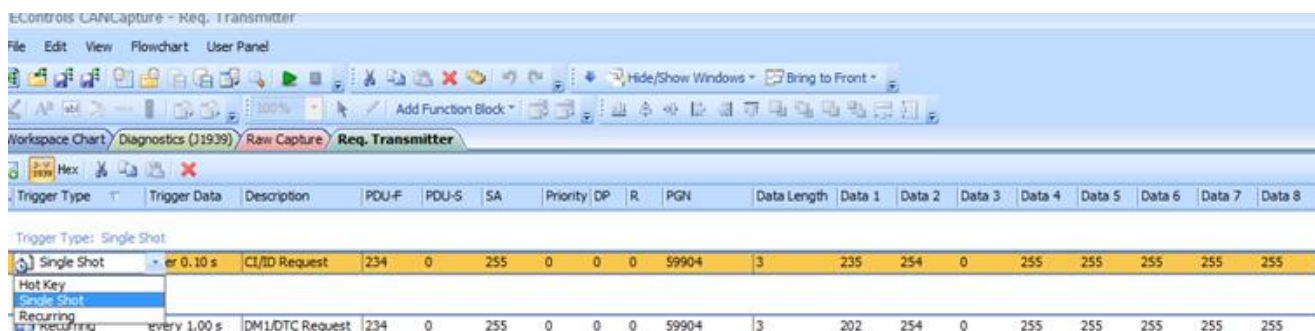
13.3 Displaying the Data in Hexadecimal

You may display the CAN Data in hexadecimal by left-clicking the mouse on the **[Hex]** selection in the **Message Transmitter** window toolbar as illustrated below. The display will toggle between **decimal** and **hexadecimal** each time you left-click the mouse on the selection.



13.4 Setting the Trigger Type

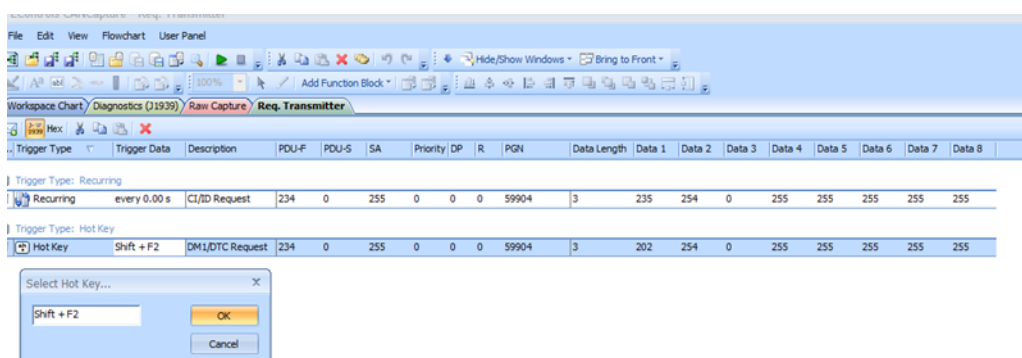
You may set the type of trigger for your request transmitter by double-clicking on the trigger type window and then left-clicking on the [▼] icon to and selecting the trigger type from the drop down menu as illustrated below:



The choices are **Hot Key**, **Single Shot**, or **Recurring**.

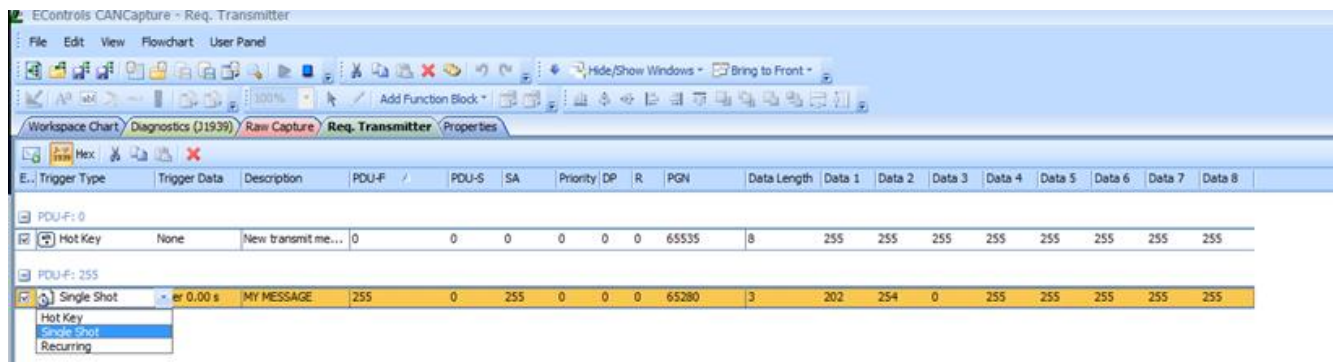
13.5 Selecting the Hot Key for Triggering the Message Transmitter

To select the specific **Hot Key** for triggering the **Message Transmitter**, double click on the **Hot Key** option. When the **Select Hot Key...** window opens, depress the specific keyboard key(s) you wish to be the **Hot Key(s)**, as illustrated below. When you are satisfied with your selection, left-click on the **[OK]** button. If you want to discard your changes and return to the Message **Transmitter** configuration window, left-click on the **[Cancel]** button.



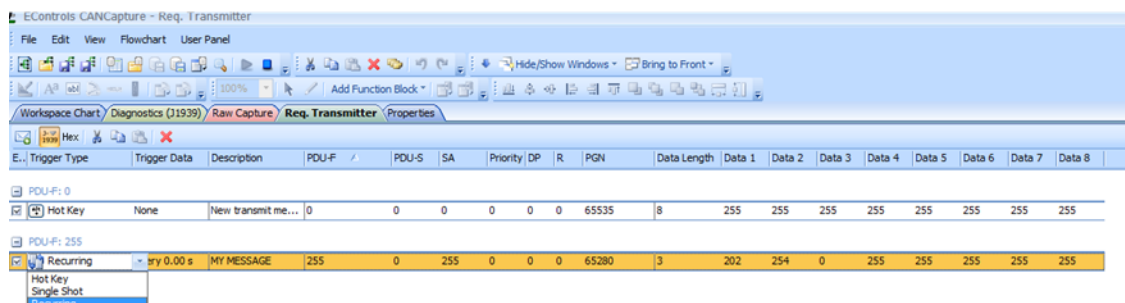
13.6 Selecting a Single Shot Trigger

You may select a **Single Shot** by double clicking on the **Trigger Type** option and selecting the [▼] icon and selecting **[Single Shot]** from the drop down menu as illustrated below:



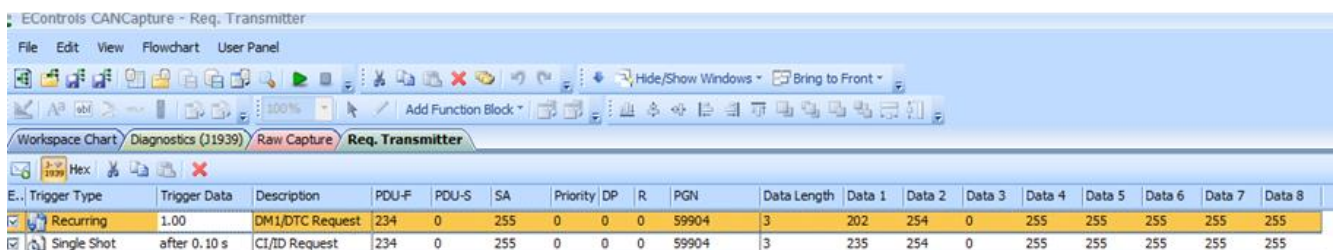
13.7 Selecting a Recurring Trigger

You may select a **Recurring Trigger** by double clicking on the **Trigger Type** window and then left-clicking on the [▼] icon and then selecting **[Recurring]** as illustrated below.



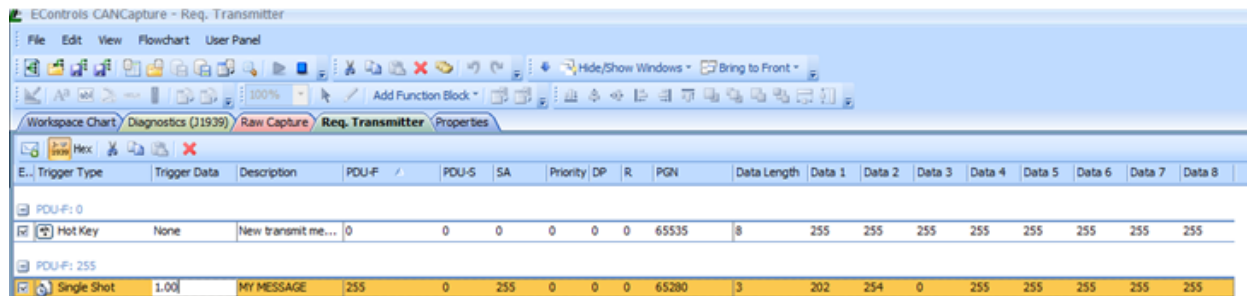
13.8 Setting the Time Interval for a Recurring Message

You may set the time interval of the reoccurring message by double clicking the **Trigger option** window by left-clicking the mouse and entering the time interval in seconds.



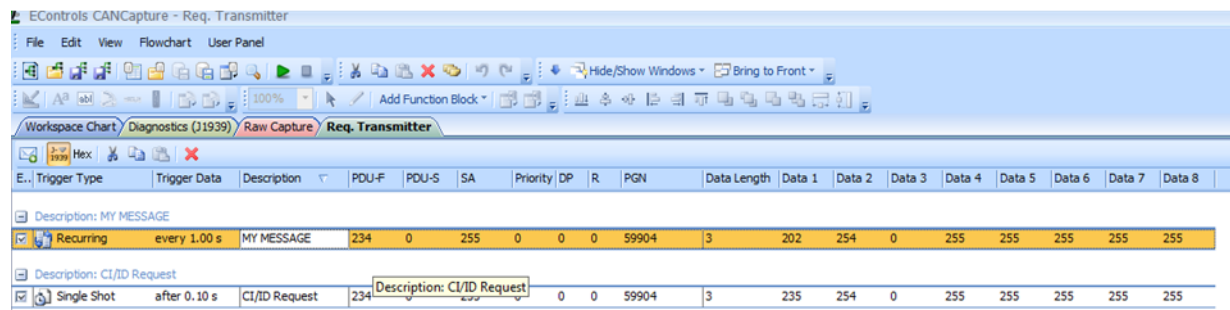
13.9 Setting the Time Delay for a Single Shot Trigger

You may set up the time delay for the **Single Shot Trigger** by double clicking on the **Trigger Data** option and entering the **time delay** in seconds as illustrated below. The **time delay** is from the start of the capture.



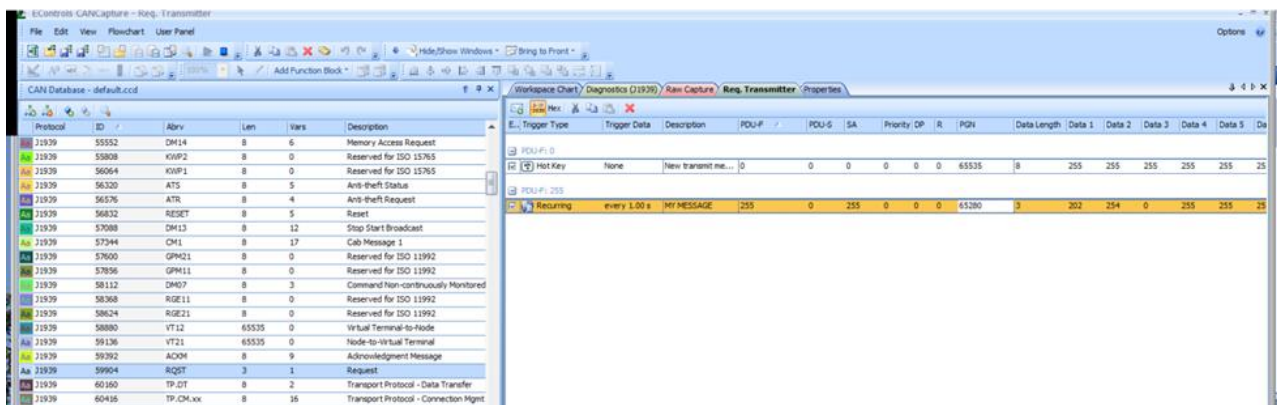
13.10 Entering the Message Description

You may enter a **Message Description** by left-clicking on the **Description** window and typing in a description of your choice as illustrated below.



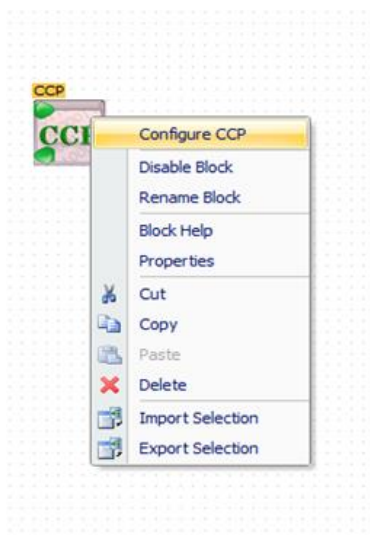
13.11 Entering the Message Data

You may enter the **Transmit Message** data by clicking on the specific window and typing in the data from the CAN database as illustrated below.

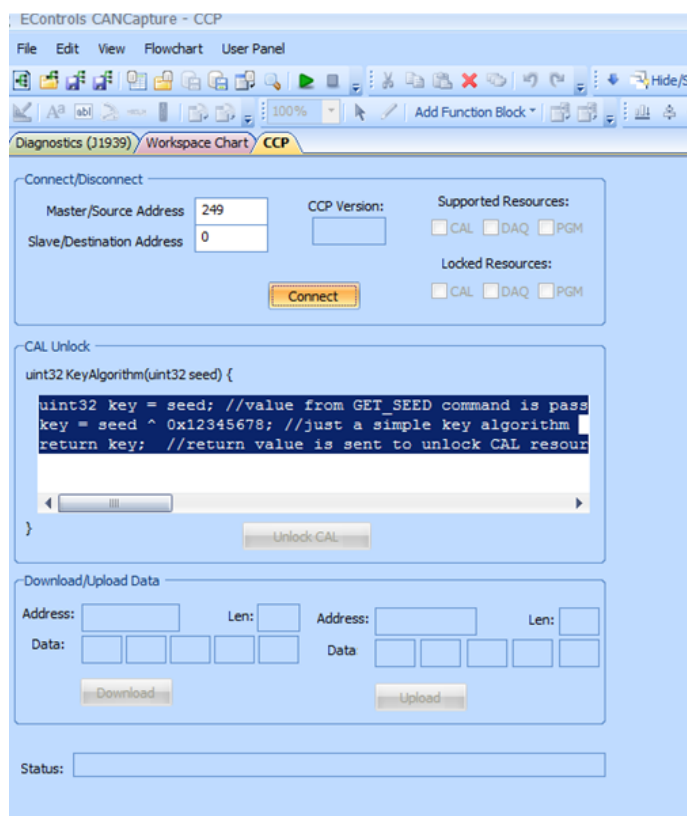


14 CCP TESTER FUNCTION BLOCK (ADVANCED USERS)

You can configure the **CCP Tester** block by left-clicking on the block and selecting **[Configure CCP]** from the drop down menu as illustrated below. Alternately, you may double click the block to pull up the configuration window.

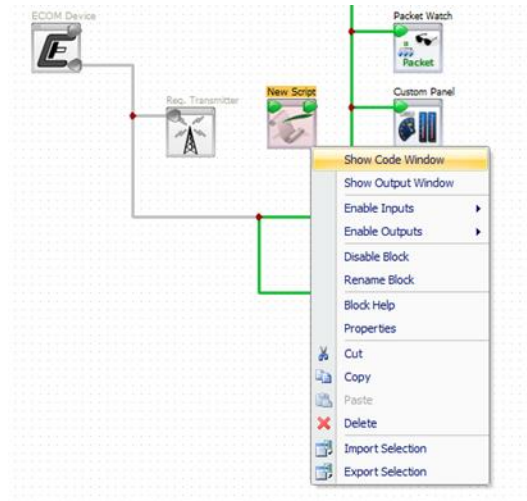


The following window will open.



15 CUSTOM SCRIPT FUNCTION BLOCK (ADVANCED USERS)

To edit a **Custom Script**, right-click the mouse on the **Custom Script** function block and select [**Show Code Window**] from the drop down menu by left-clicking on the selection as illustrated below.



The following window will open showing examples of the various **Custom Script** function block functions. The scripting uses a C / C++ style syntax. The script editor also includes an “auto complete” and “intellitip” feature which will help to show the available variables and functions as well as the parameters and syntax required. Simply type the variable name followed by a ‘.’ to show all variable options.

```

EControls CANCapture - New Script
File Edit View Flowchart User Panel
100% Add Function Block
Diagnostics (11939) Workspace Chart CCP New Script

//This function is called when a new capture is started
//"block" holds an object representing the current script block on the flowchart
//Type "block." for a list of available functions for use in the script
void OnStartCapture(ScriptBlock block)
{
    block.ClearOutputText(); //Clear this script's output window
    block.PrintOutputText("Capture started\n", false, false, false, false); //Print to the output window
}

//This function is called when a capture is stopped
//"block" holds an object representing the current script block on the flowchart
void OnStopCapture(ScriptBlock block)
{
    block.ClearOutputText(); //Clear this script's output window
    block.PrintOutputText("Capture stopped\n", false, false, false, false); //Print to the output window
}

//This function is called everytime a message is received on an input port
//"inPort" will hold the port the message was received by (1, 2, or 3)
//"block" holds an object representing the current script block on the flowchart
//"msg" holds an object representing the message received
//Type "block." or "msg." to see a list of available parameters and functions
void OnReceiveMessage(uint8 inPort, ScriptBlock block, Message &msg)
{
    uint8 outPort = inPort; //Setup the outgoing port to be the same as inputs

    //Trivial example... if message pgn is 61444, then print message
    if (msg.GetPGN() == 61444)
    {
        string outputString = ""; //The standard C++ "string" type is supported
        outputString = "Received PGN " + msg.GetPGN() + " - SA:" + msg.GetSA() + "\n\t";

        //retrieve data length
        uint8 dataLength = msg.GetDataLength();
        outputString += "Length: " + dataLength + " - ";

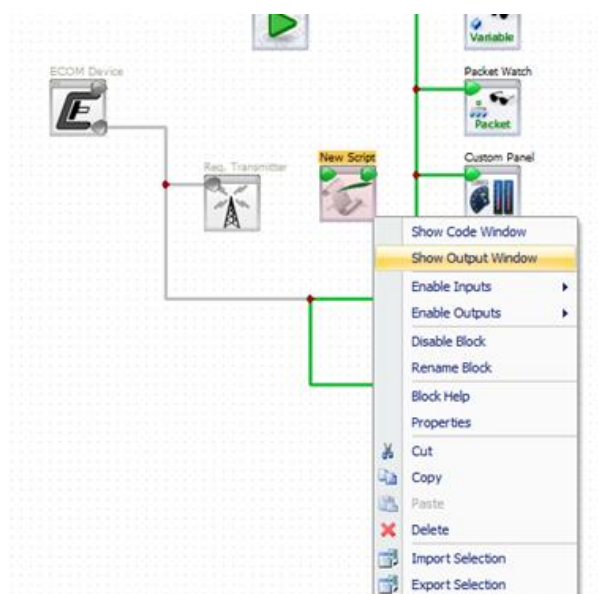
        //Now retrieve all the data
        for (int i = 0; i < dataLength; ++i)
            outputString += msg.GetData(i) + " ";
        outputString += "\n";

        //Now print message to the output window in red
        block.PrintOutputText(outputString, true, false, false, false);
    }

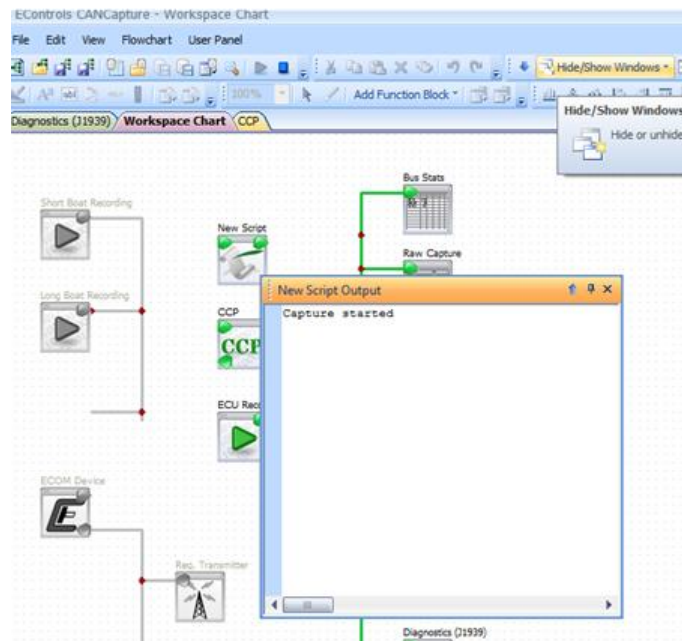
    //Now send message to the output port directly across from the received input
    block.SendMessage(outPort, msg);
}
    
```

15.1 Displaying the Custom Script Output Window

To display the **Custom Script Output Block** window right-click with the mouse on the **Custom Script** function block and select **[Show Output Window]** from the drop down menu by left-clicking on the selection as illustrated below.



The following window will open, displaying the output from the **Custom Script** function block. This window can be used by the script code to provide visual feedback to the end user.



15.2 Displaying Custom Script Function Block Help

To display the help feature for the **Custom Script** function block right-click on the **Custom Script** function block and select **[Block Help]** from the drop down menu by left-clicking the mouse on the selection as illustrated below.

NOTE: This **Block Help** feature is available for all function blocks.

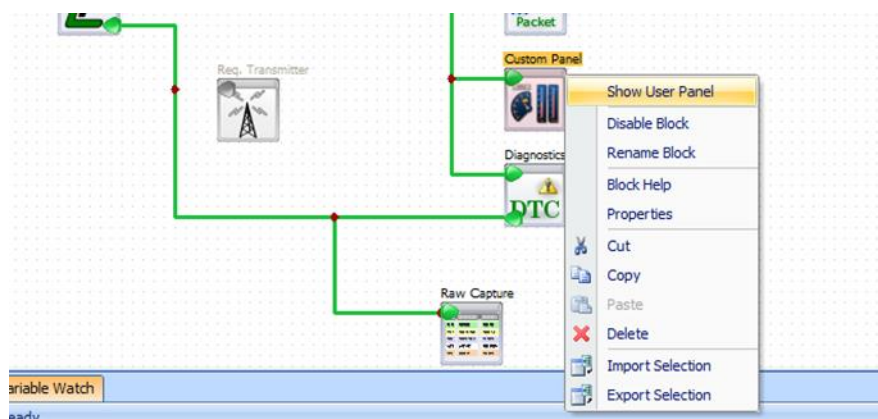


The following window will open:



16 USER PANEL FUNCTION BLOCK

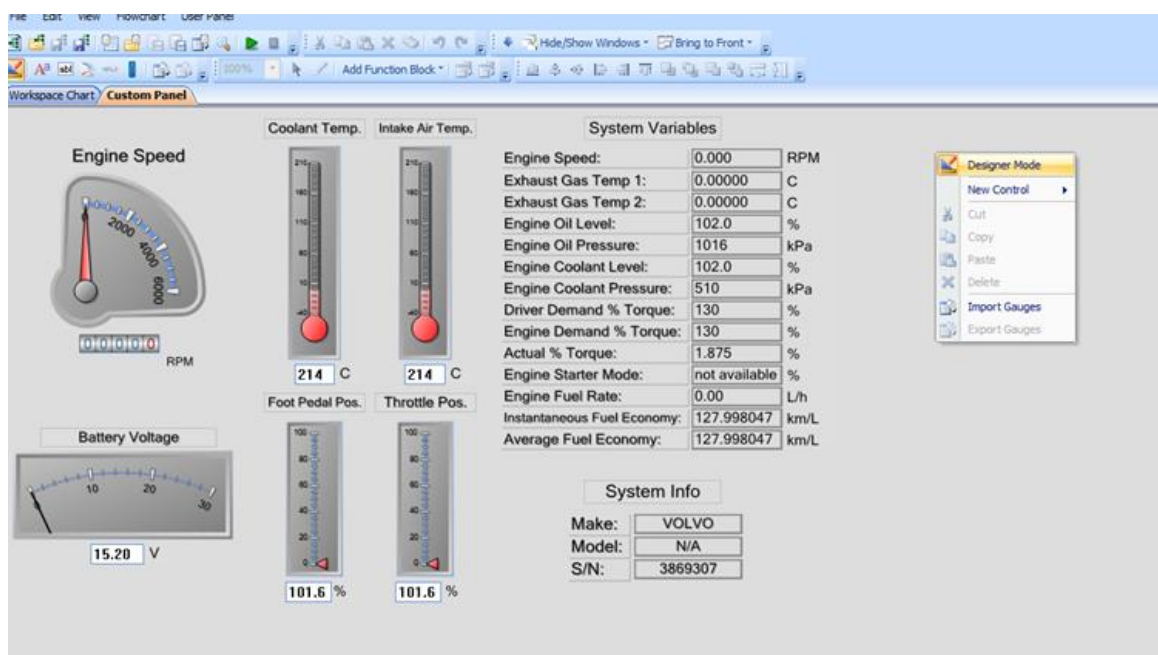
You may open the **Custom Panel** by right-clicking on the **Custom Panel** function block and selecting [**Show User Panel**] by left-clicking the mouse on the selection. Alternately, simply double click on the **Custom Panel** function block.



16.1 Invoking the Designer Mode

You may invoke the **Designer Mode** to create your own custom gauge by right-clicking the mouse on the **Custom Panel Screen** and selecting [**Designer Mode**] from the drop down menu by left-clicking the mouse on the selection as illustrated below:

NOTE: The capture must be stopped in order to enable this option.

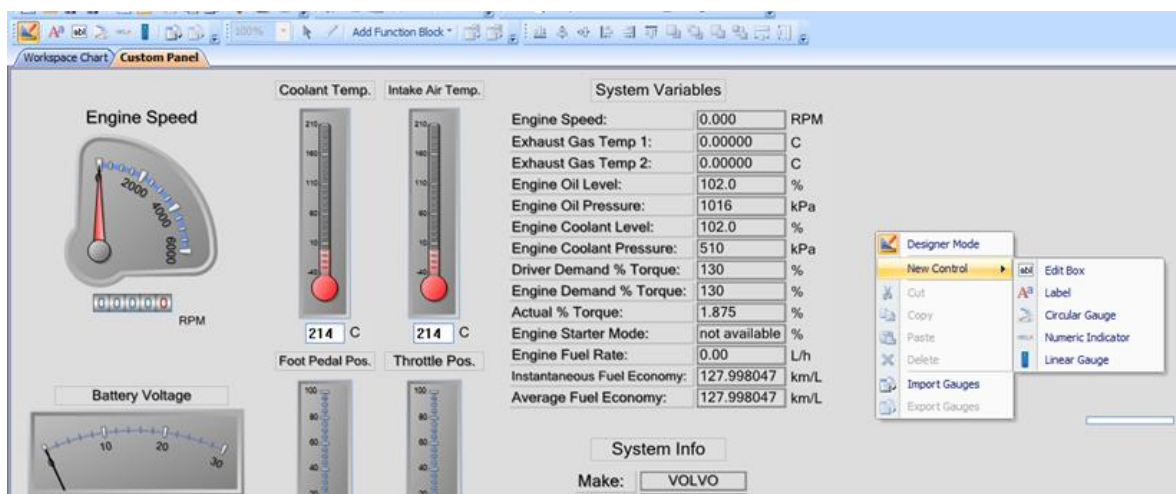


16.2 Adding a New Custom Gauge

After selecting the **Designer Mode** you can create a new gauge by right-clicking on the **Custom Panel Screen** and selecting **[New Control]** from the drop down menu as illustrated below. The 5 options for **Control Types** are:

- Edit Box
- Label
- Circular Gauge
- Numeric Indicator
- Linear Gauge

Each option will be described in the following sections.



16.3 Adding an Edit Box or Label Control

After choosing to add an **Edit Box** or **Label Control** from the **[New Control]** menu, you will be prompted with a special mouse cursor signifying which control is about to be created. While this cursor is showing, simply drag and release a square area in the **Custom Panel** workspace to create an **Edit Box** or **Label** with the respective size. The newly created **Label** will say “Text” – various properties of the label, including the actual text, can be changed by following the instructions in the **Overview of the Gauge Container** section below.

- Examples of **Edit Boxes** are the two controls that show “214” in the above image.
- Examples of **Label Controls** are the “Engine Speed”, “Battery Voltage”, and “Coolant Temp” displays in the above image.

16.4 Adding a Circular Gauge, Numeric Indicator, or Linear Gauge

After choosing to add a **Circular Gauge**, **Numeric Indicator**, or **Linear Gauge** from the **[New Control]** popup menu, you will be presented with a screen similar to the image below. From this window, you may choose the type of control by selecting one of the options from the **Gauge Type** dropdown menu. For each type of control, you can select from a variety of appearance themes by selecting an option from the **Gauge Theme** dropdown menu.

NOTE – ADVANCED USERS: You can create your own custom themes by adding or editing the XML files in the **AppearanceThemes** folder. The default location of this directory is:

C:\Program Files\EControls\CANCapture\Gauge Templates\AppearanceThemes



When you have found your desired gauge, double-click on it, and you will be prompted with a special mouse cursor signifying that a gauge control is about to be created. While this cursor is showing, simply drag and release a square area in the **Custom Panel** workspace to create a **Gauge Control** with the respective size.

16.5 Overview of the Gauge Container

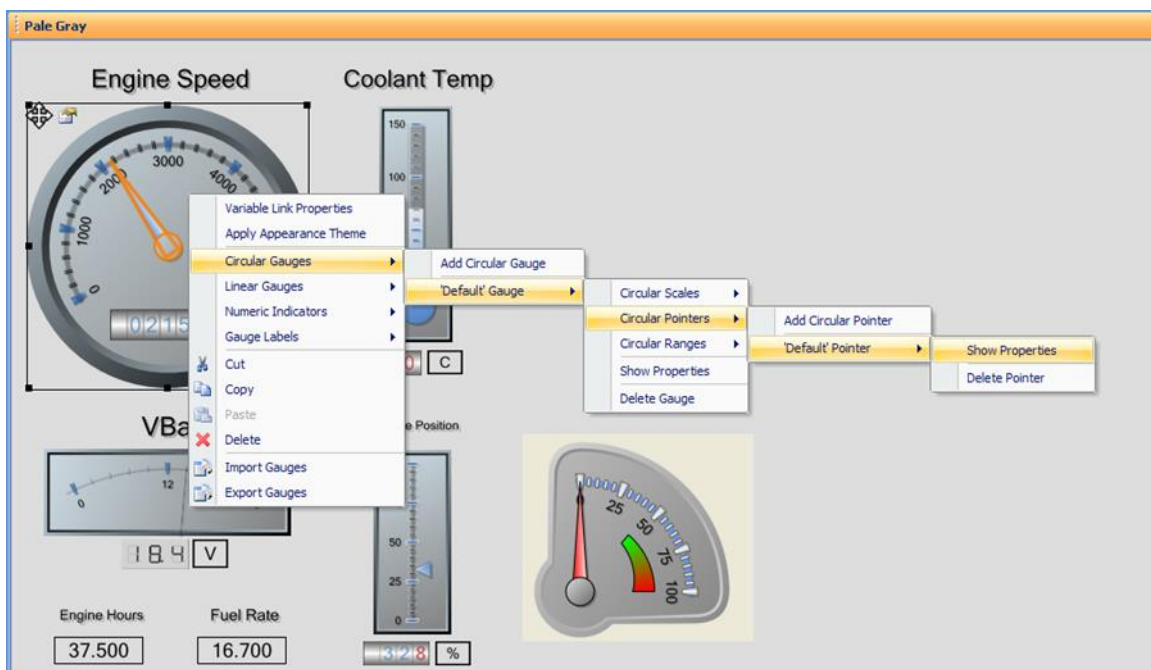
The gauge controls are completely customizable with an infinite number of configurations. Each set of **Circular Gauges**, **Numeric Indicators**, **Linear Gauges**, and **Labels** are contained within a **Gauge Container**, and each **Gauge Container** can contain any number and combinations of these gauge elements.

Each **Circular Gauge** can have various **Circular Scales**, **Circular Pointers**, and **Circular Ranges**:

- **Circular Scales** – The round portion of the gauge containing the tick marks and the numeric labels. For example, the blue bar ranging from 0 to 100 in the gauge at the bottom-right of the image below.
- **Circular Pointers** – The pointer of each gauge that is used to indicate the value the gauge is showing. This can be a pointer style (as highlighted in orange below), a marker style, or a bar style.
- **Circular Ranges** – This is the visual range such as the “red-line” that is commonly shown on tachometers. An example of this is the green-to-red gradient in the gauge on the bottom-right of the below image.

Each **Linear Gauge** can have any number of **Linear Scales**, **Linear Pointers**, and **Linear Ranges**, which are identical to those of the **Circular Gauge**, but for the respective **Linear Gauge**.

In addition, the **Linear Pointers** also have a “**Thermometer**” style which can be used to indicate the gauge value in a fashion similar to that of a thermometer, as seen in the **Coolant Temp** gauge below.

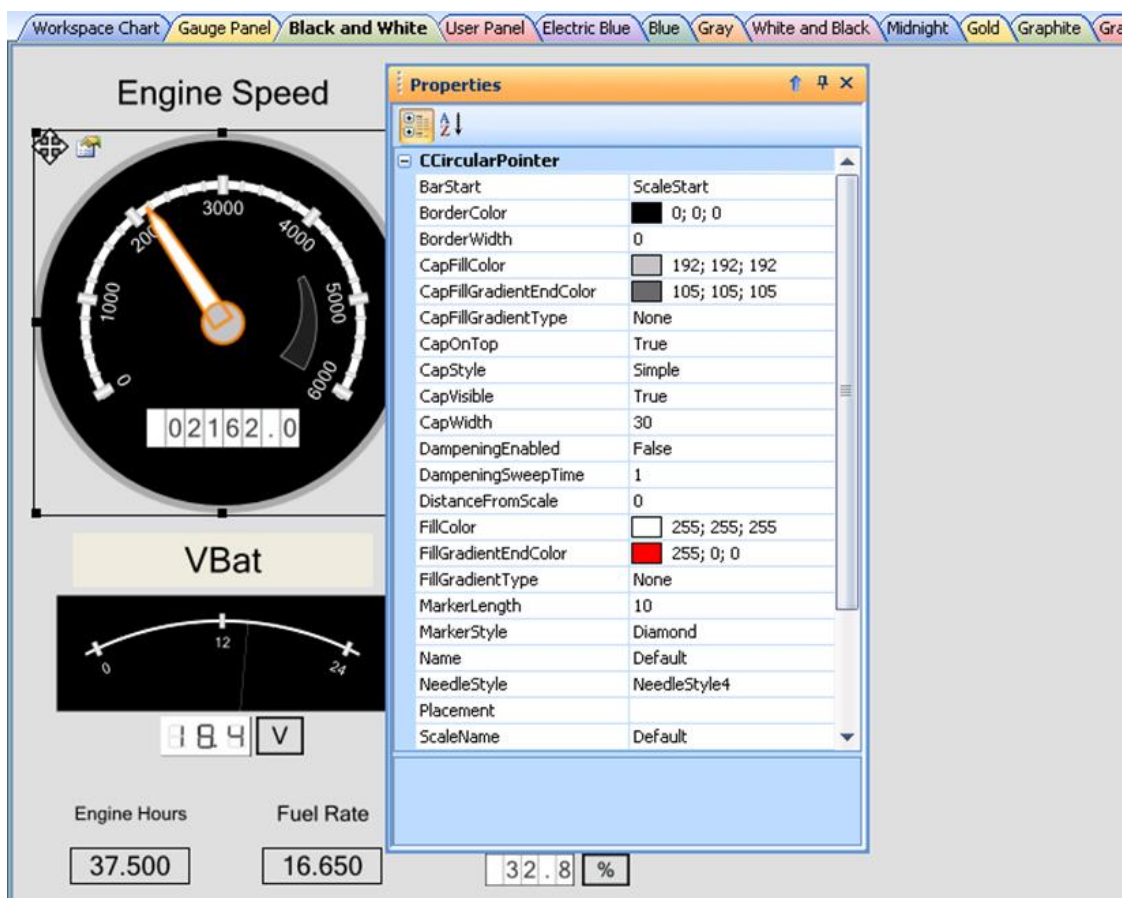


16.6 Edit Properties of a Gauge Element

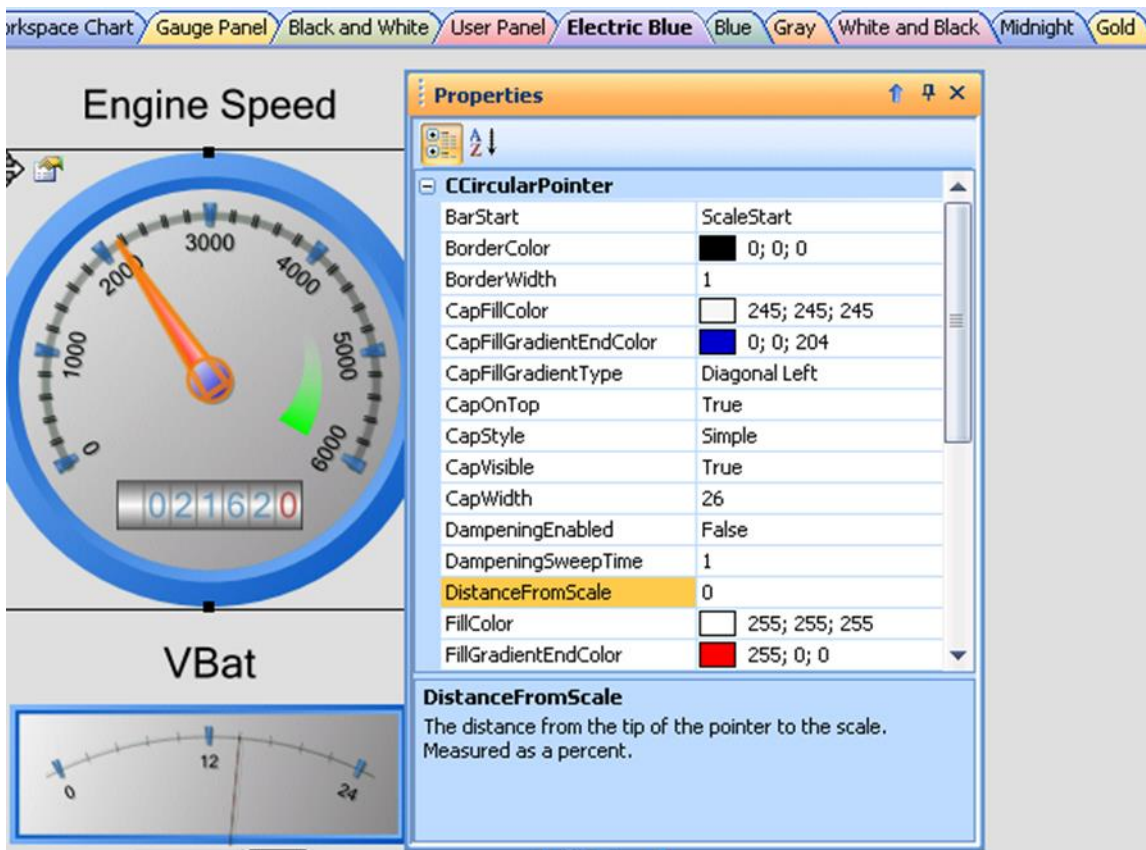
Method 1: To list and edit the properties of any **Gauge Element** within the **Gauge Container**, right-click on the **Gauge Container** and follow the sub-menus beneath the **Circular Gauges**, **Linear Gauges**, **Numeric Indicators**, and **Gauge Labels** menus. As you highlight each menu option, the respective gauge element will be outlined and highlighted in orange, as seen in the image on the previous page. To edit a gauge element, select the **[Show Properties]** option for the respective gauge element; this will cause the item's properties to be displayed in the **Properties** window as seen in the image below.

Method 2: You can also show the properties of a **Gauge Element** by left-clicking on the item while in **Designer Mode**. When the element is selected, it will be highlighted in orange and the element's properties and settings will be visible in the **Properties** window. An example of this can be seen in the below image.

NOTE: It is recommended that you have the **Properties** window visible in a separate window or docking pane while editing the gauge elements.

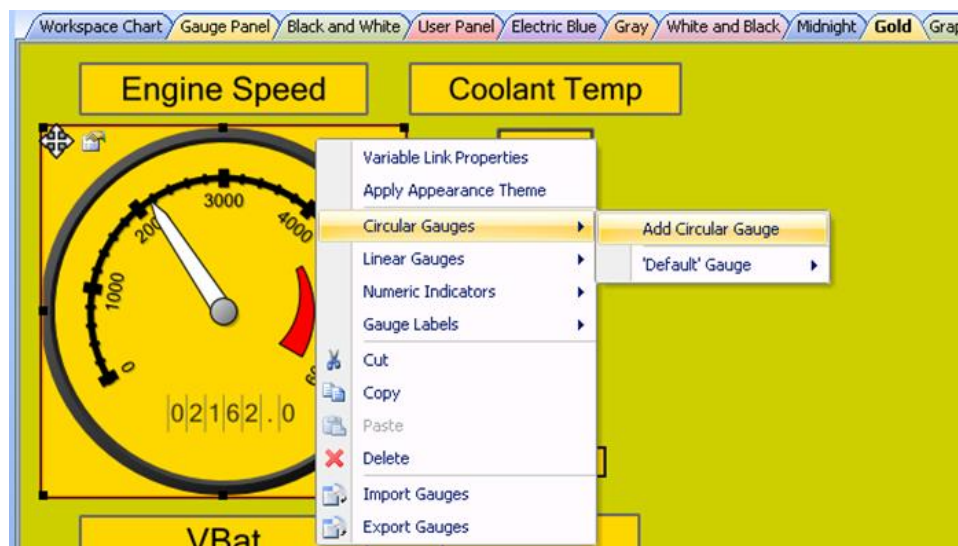


There are many properties and settings for each gauge element, ranging from location, size, and width to color, gradients, styles, and fonts. Rather than describing each property in this manual, a brief description for each property can be displayed by highlighting the property and reading the **Integrated Help Panel** located at the bottom of the **Properties** window. An example of this integrated help can be seen in the description of the **DistanceFromScale** property in the image below.

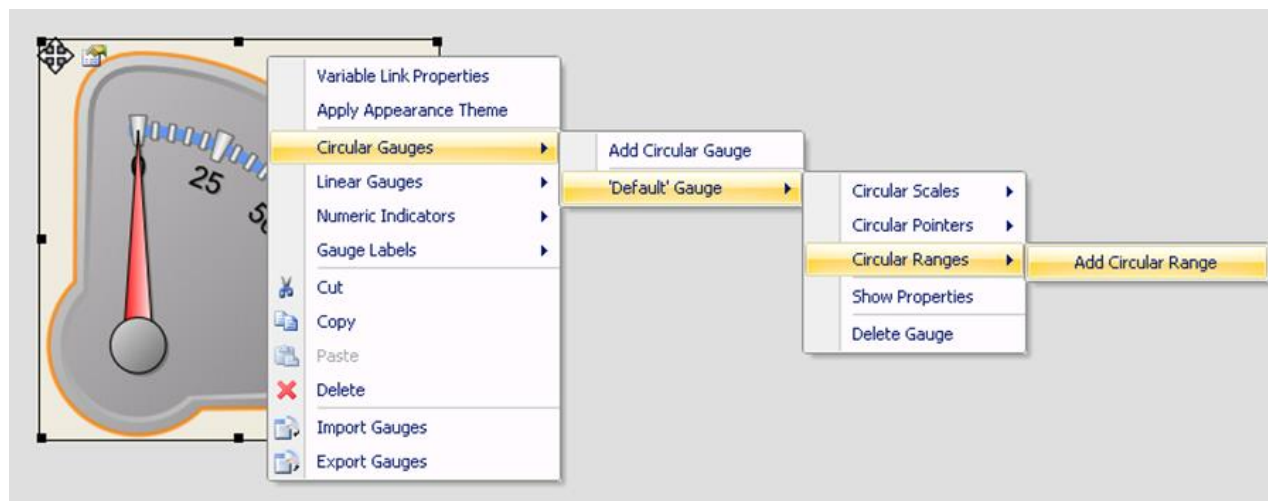


16.7 Add Gauge Element to Existing Gauge Container

You can add a **Gauge Element** (i.e. Linear Gauge, Circular Scale, Numeric Indicator, Label, etc.) to an existing **Gauge Container** by right-clicking on the **Gauge Container** and following either the **Circular Gauges**, **Linear Gauges**, **Numeric Indicator**, or **Gauge Labels** sub-menus and clicking on the respective **[Add (Element Name)]** option as illustrated below.

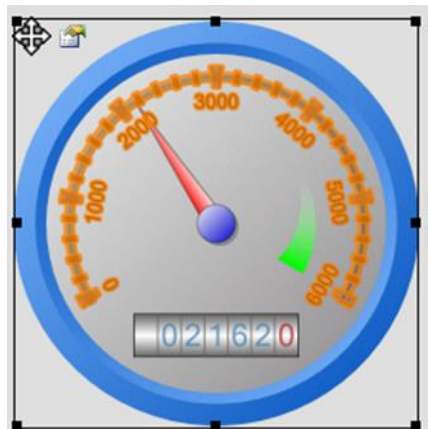


Circular Scales, **Circular Pointers**, and **Circular Ranges** can only be added to existing **Circular Gauges**, and similarly, **Linear Scales**, **Linear Pointers**, and **Linear Ranges** can only be added to existing **Linear Gauges**. An example showing how to add a **Circular Range** to the 'Default' Circular Gauge can be seen in the image below.

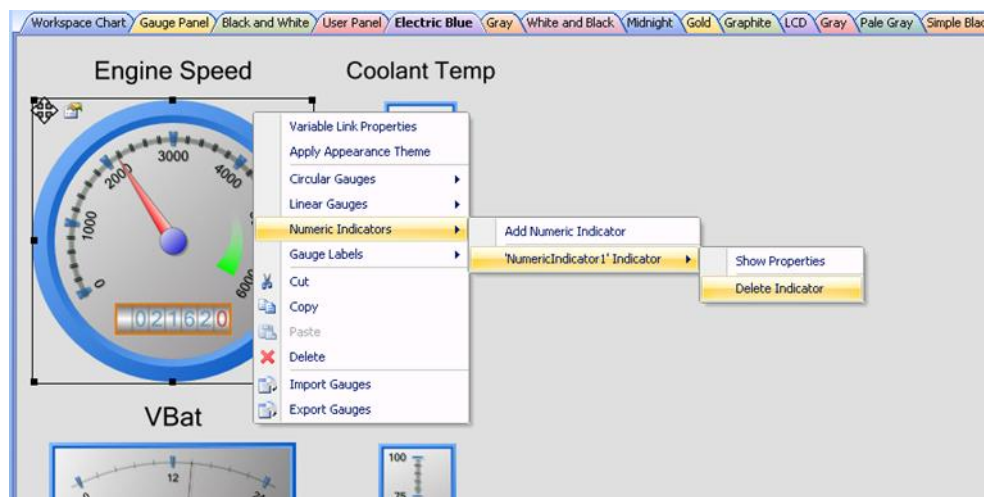


16.8 Delete Gauge Element from a Gauge Container

Method 1: You can delete a **Gauge Element** (i.e. Circular Gauge, Linear Pointer, Circular Range, Label, etc.) from an existing **Gauge Container** by left-clicking on the element so that it is selected and highlighted in orange. When the **Gauge Element** is selected you can delete it by now pressing the **Delete Key** on your keyboard. In the example image below, the circular scale that is selected in orange would be deleted after pressing the **Delete Key**.



Method 2: If a **Gauge Element** is not visible or off the screen (and therefore you cannot click on it to select it), you can also delete it by right-clicking on the **Gauge Container** and following either the **Circular Gauges**, **Linear Gauges**, **Numeric Indicator**, or **Gauge Labels** sub-menus and clicking on the respective **[Delete (Element Name)]**. As your mouse moves over the menu items for each **Gauge Element**, the item will automatically be highlighted so that you can see which item is going to be deleted. The image below shows an example of how to delete a **Numeric Indicator**; notice that the numeric indicator that will be deleted is highlighted in orange.

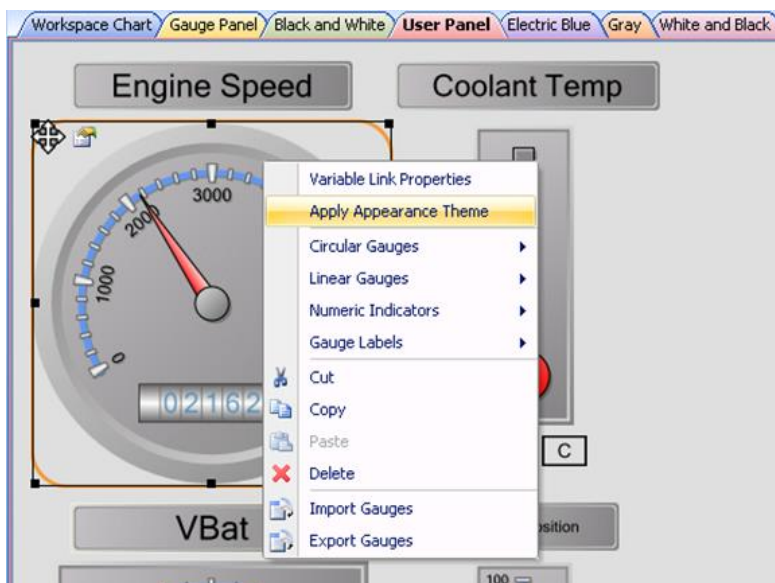


16.9 Apply Gauge Appearance Theme

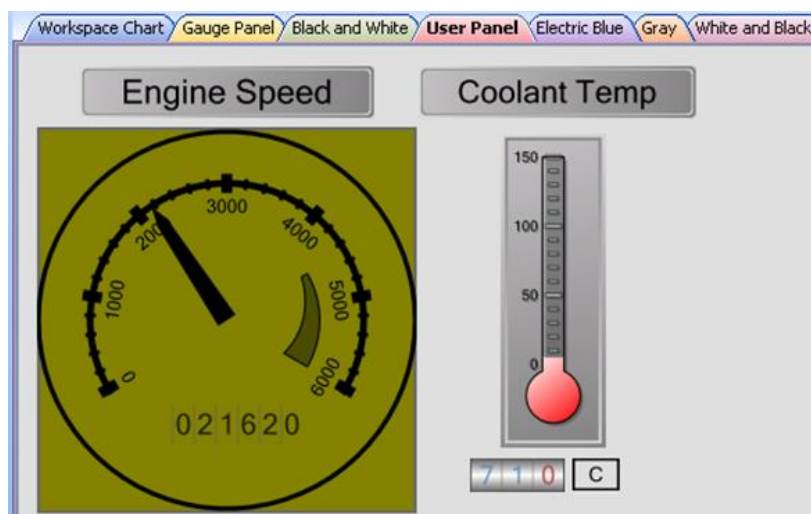
An appearance theme can be applied to any **Gauge Container** by right-clicking on the control and selecting **[Apply Appearance Theme]**. After selecting this option, a **File Select Dialog** will be displayed asking for the Appearance Theme XML file to apply to the **Gauge Container**.

A set of pre-defined **Appearance Themes** can be found in

C:\Program Files\EControls\CANCapture\Gauge Templates\AppearanceThemes

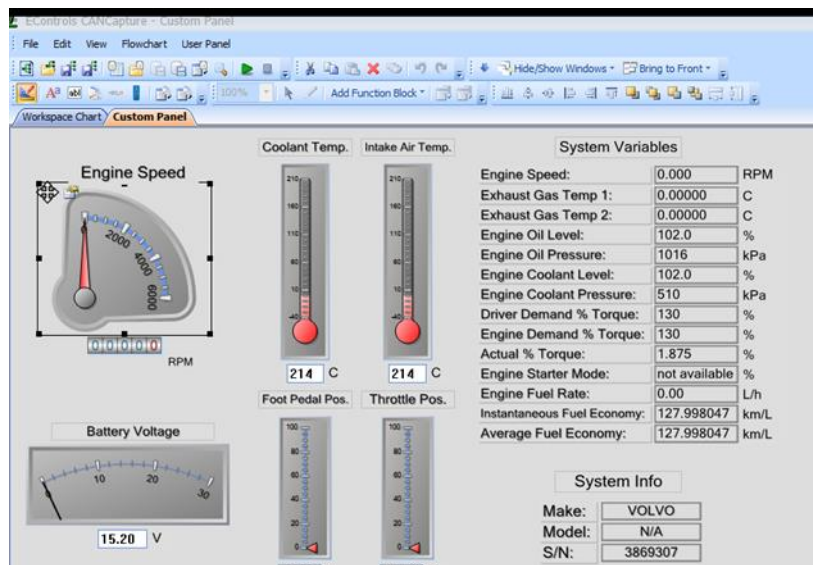


After selecting the **Appearance Theme** file, all the properties defined within the theme will be applied and the **Gauge** will display the new appearance. An example of the **LCD Appearance Theme** applied to the above gauge is shown in the image below.



16.10 Repositioning the Custom Gauge Container

You may reposition the gauge by holding the left mouse button down on the crosshairs icon to move the position in the vertical and horizontal axis as illustrated below.

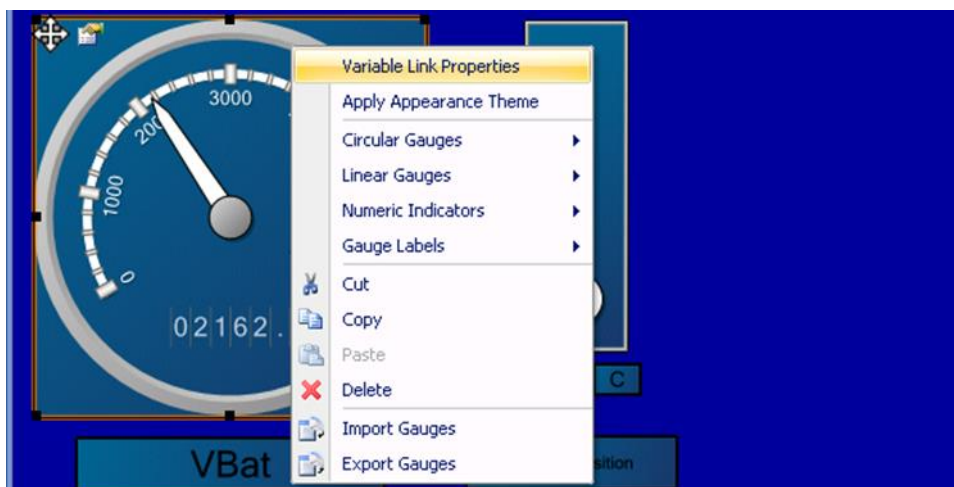


16.11 Linking a CAN Variable to a Gauge Element

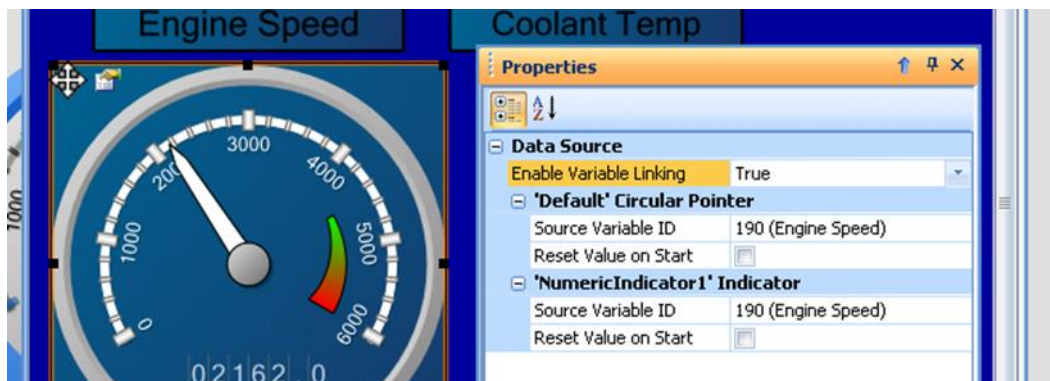
Gauge Elements and **Edit Boxes** can be linked to CAN variables that are defined within the current **CAN Database**. As each CAN variable is received by the **User Panel**, all controls that are linked to the respective variable will be updated in real-time.

To link a variable to a **Gauge Element**, first right-click on the desired **Gauge Container** and select **[Variable Link Properties]** from the drop down menu as illustrated below.

Alternately you can click on the small **Variable Link Properties Icon** in the top left corner of the **Gauge Container** next to the **Move Icon**.

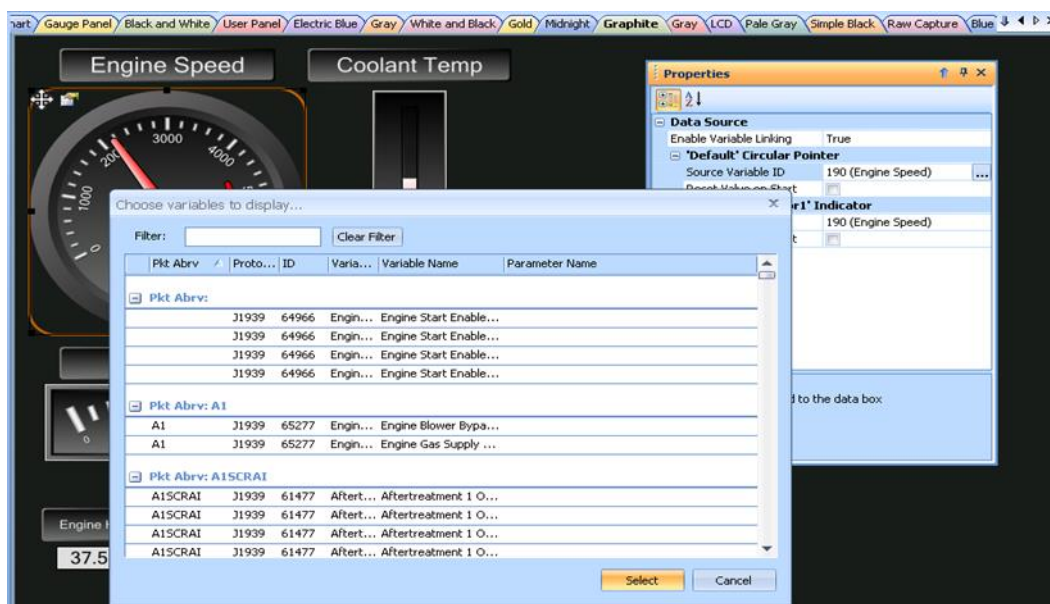


The **Variable Linking** options will now be displayed in the **Properties** window as illustrated below. If not already enabled, set the **Enable Variable Linking** option to **True**, and you should then see options for each **Circular Pointer**, **Linear Pointer**, **Numeric Indicator**, **Label**, or **Edit Box** that is in the **Gauge Container**.

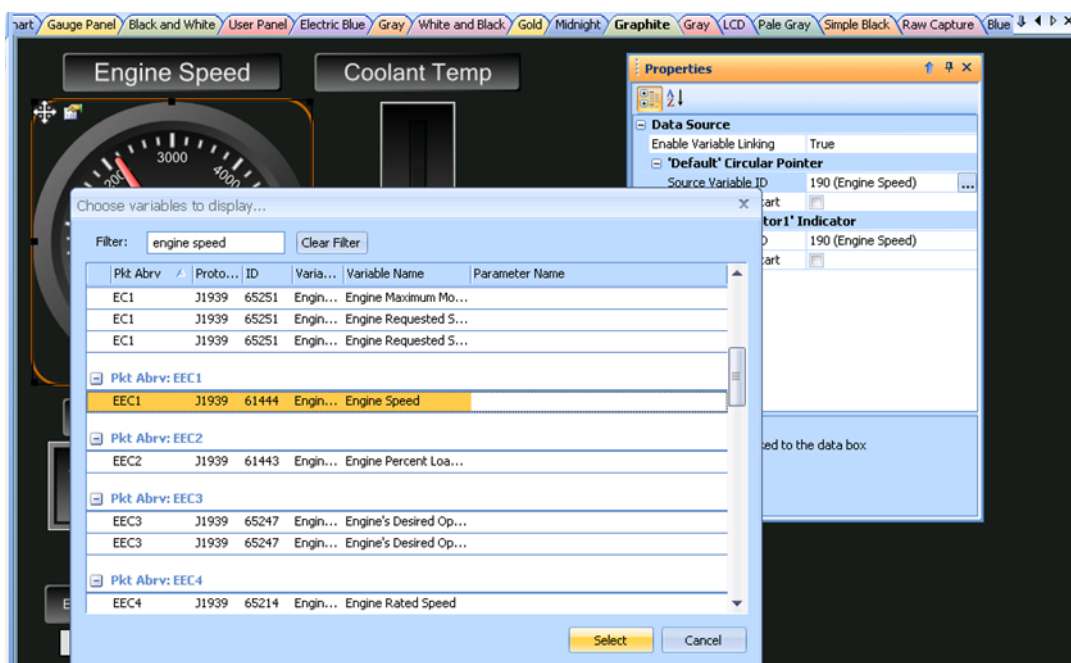


16.12 Linking and Setting the Source Variable

You may select the **Source Variable** that you want the respective **Gauge Element** to be linked to by clicking the mouse on the [...] Icon on the far right-hand side of the **Source Variable ID** line. You should then receive the **Choose Variable to Display Dialog** as seen in the image below.

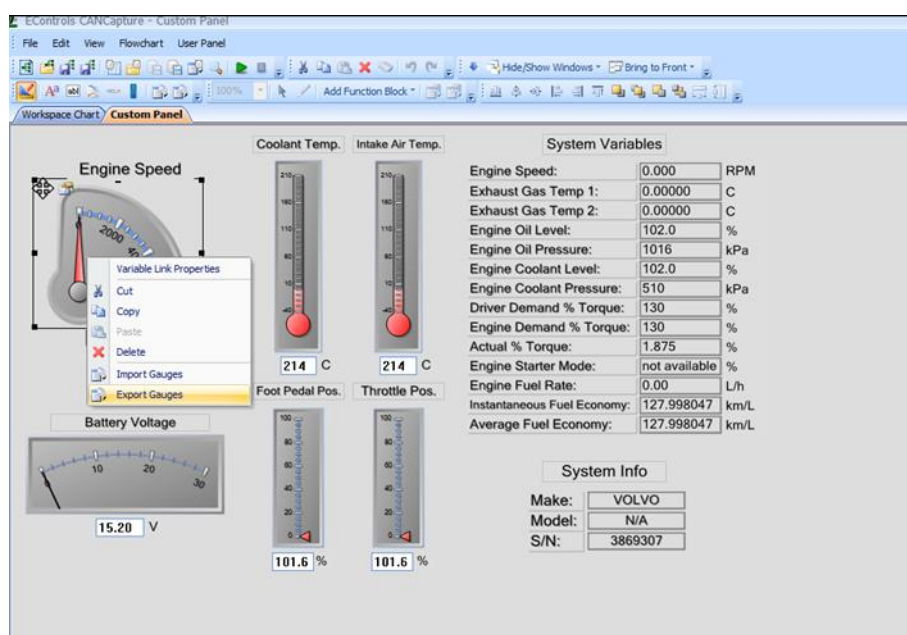


To choose a variable, search for and highlight the desired parameter and then click on the **[Select]** button or simply double click the selection as illustrated below:

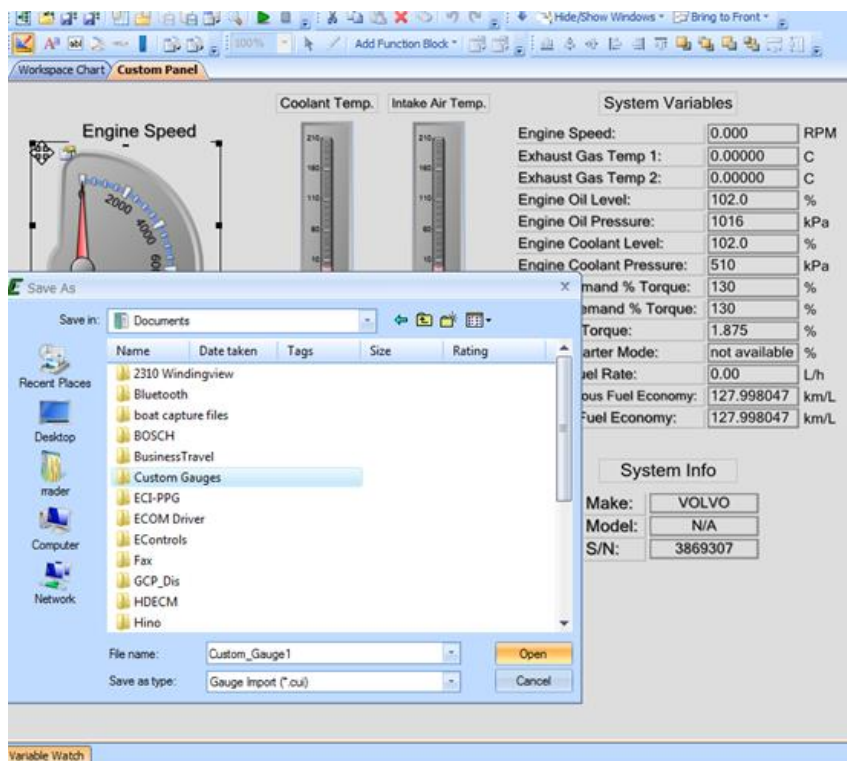


16.13 Saving a Custom Gauge Design

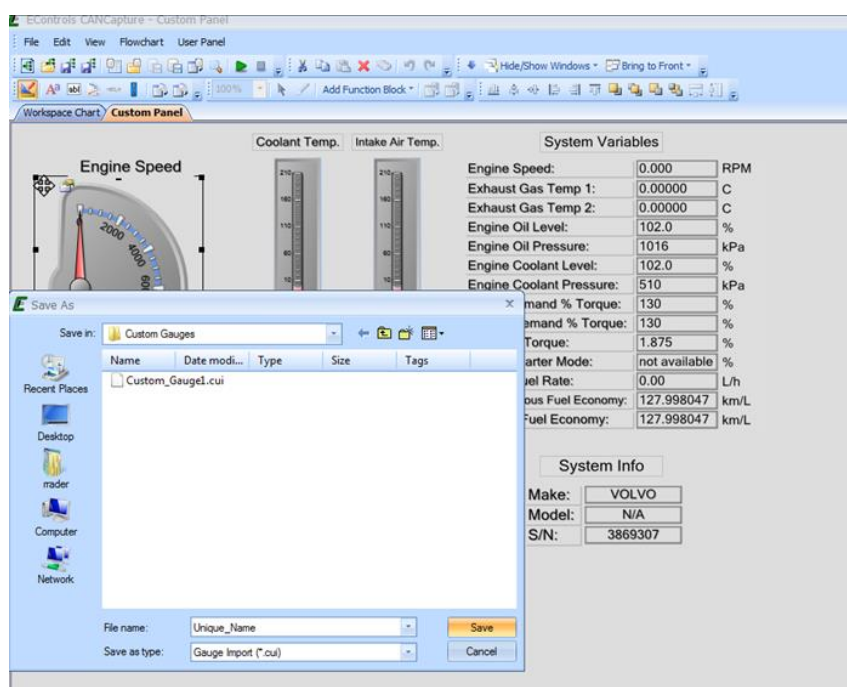
You may save a **Custom Gauge** by right-clicking the mouse on the gauge you want to save and selecting **[Export Gauges]** from the drop down menu by left-clicking the selection as illustrated below.



The following window will open:

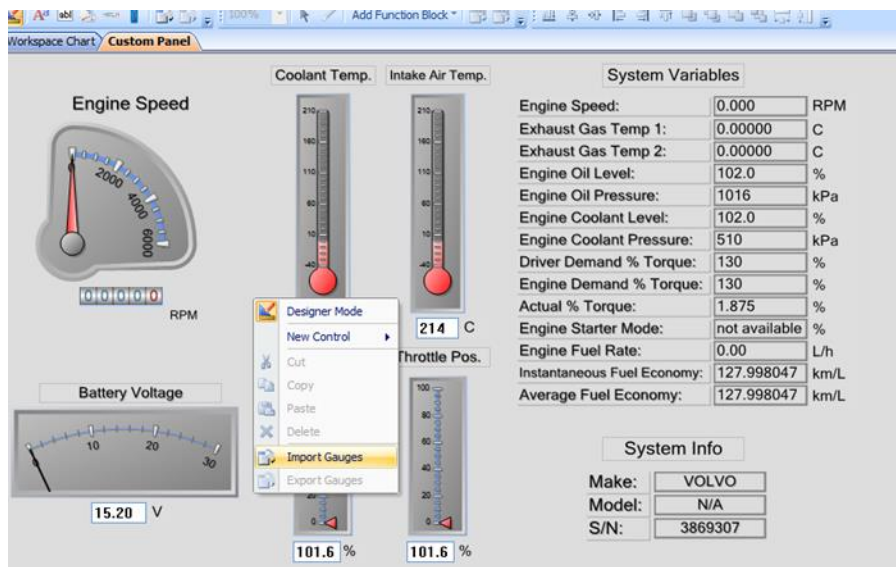


After selecting the destination where you want to save your **Custom Gauge**, you can give your gauge file a unique name and save the gauge by left-clicking on **[Save]** as illustrated below. The gauge will be saved in the *.cui format. To discard your changes and return to the previous window select **[Cancel]** by left-clicking the mouse on the selection.

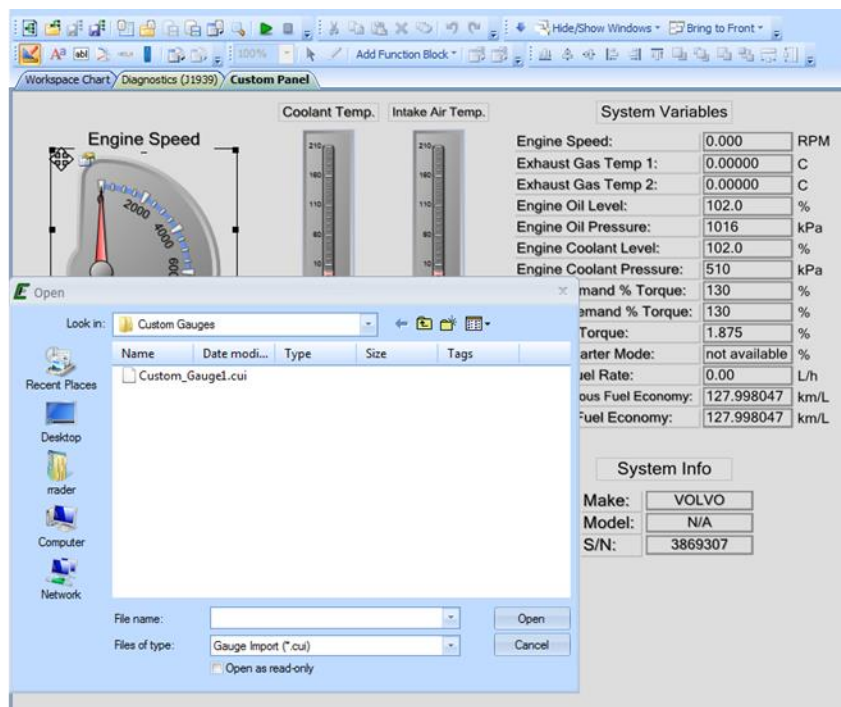


16.14 Importing Saved Gauges

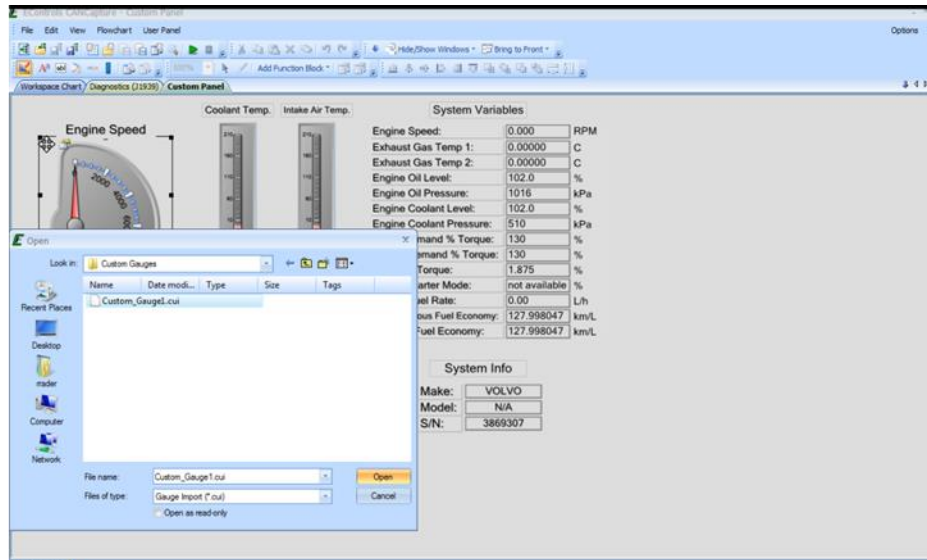
You may import or retrieve saved gauges to your **Custom Panel** by right-clicking on the **Custom Panel** workspace and selecting **[Import Gauges]** by left-clicking the mouse on the selection.



The following window will open:



You may now browse your computer storage for the gauge that you would like to import. When located, you may select the file by double clicking on the file name and then import it by left-clicking the mouse on the **[Open]** as illustrated below.



If you want to abort the **Custom Gauge** importing function and return to the previous menu, left-click on the **[Cancel]** button.