GarTech
LUIS User's Guide

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The Load Box User Interface System

Introduction

Introduction

The Load Box User Interface System, LUIS, is an engine simulator used to facilitate bench top engine control system hardware and software testing.

LUIS Physical Description

The LUIS is a bench top, PC controlled load box with approximate dimensions of 18”x12”x4”.

LUIS Features

The LUIS provides the following features:

- Open and Closed Loop Engine Speed Simulation
- Integrated GarTech Arbitrary Waveform Generator
- Engine Speed (ESS), Engine Position (EPS) and up to 6 Additional Frequency Outputs
- 16 Resistive A/D Outputs
- 16 Ratiometric A/D Outputs
- 24 Active Low Switches
- 6 Individually Configurable High/Low Side Switch Outputs
- LUIS PC Application Allowing User Complete Control Over I/O Setup
- Creation of Configuration Files To Setup I/O for Specific Tests
- Control of Multiple Boxes by a single PC Application for Seamless Integration Testing of Single Engine systems with Multiple Engine Control Modules (ECM’s)
- Acceptance of CAN Commands using the J1939 Proprietary PGN
- FMET Box for Failure Mode Effects Testing

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Chapter 1 - LUIS Setup

Overview

LUIS Hardware

The LUIS has a main, parent, control module that can be connected to the PC via a CAN card or an Ethernet connection. Up to 2 additional child control modules can be added for testing a single engine system with multiple ECM's. A sidecar is also available allowing for injector loads and application specific high current loads.

This diagram illustrates the back panel of the standard LUIS.

In This Section

This table outlines the topics covered in this section.

Section 1 - Ordering Hardware

Ordering Hardware

Gartech Contact Information

All hardware can be ordered from GarTech Enterprises, Inc.

Gartech Enterprises, Inc.
3037 W. State Road 256
Austin, IN 47102
812-794-4796
www.gartechenterprises.com
info@gartechenterprises.com

GarTech Part Numbers

This table gives the part number and descriptions for the LUIS hardware.

Part Number	Description
G00391-00	LUIS PC Controller with 10” LC Monitor, Keyboard, Mouse and CAN Card
G00392-04	LUIS Main (Parent) Control Module with LED front panel
G00726-10	LUIS Sidecar with Injector Loads and LED’s
G00393-02	LUIS Child Control Module (for multiple ECM systems) with sidecar
G012191-00	FMET Box

GarTech Wiring Harnesses

A complete listing of Wiring Harnesses available can be found on the GarTech website, www.gartechenterprises.com.

Section 2 - How To Setup the LUIS

Overview

Introduction

The setup of the LUIS software is completed by downloading the software and following the installation wizard. The setup of the LUIS hardware depends on the PC connection as well as the optional equipment added to the standard control module.

In This Section

This table outlines the topics found in this section.

Setting Up a Standard LUIS

Setting Up a Standard LUIS

Introduction

The LUIS can communicate with the PC through a CAN Card or Ethernet connection. However, the basic hardware setup is the same.

Hardware Needed

To setup the LUIS, the following hardware is required.

- Standard LUIS
- PC
- Control Module
- Wiring Harness
- Control Module Power Connector
- DC Power Cable
- DC Power Supply
- AC Power Cable
- J1939 Cable

Setting Up the Hardware

This table outlines the physical connections required to setup the hardware to run a standard LUIS.

Step	Action
1	Using the J1939 cable, connect the Public J1939 port on the back of the LUIS to the right hand Public J1939 port on the back of the Sidecar.
3	Install the Control Module on the pegs located on the top of the LUIS.
4	Using the appropriate Wiring Harness, connect the Control Module to the LUIS using the ports on top of the box as well as the Injector Connector on the back of the Sidecar.
5	Using the Control Module Power Connector, connect the Control Module to the Unswitched Power Out port on the back of the LUIS.

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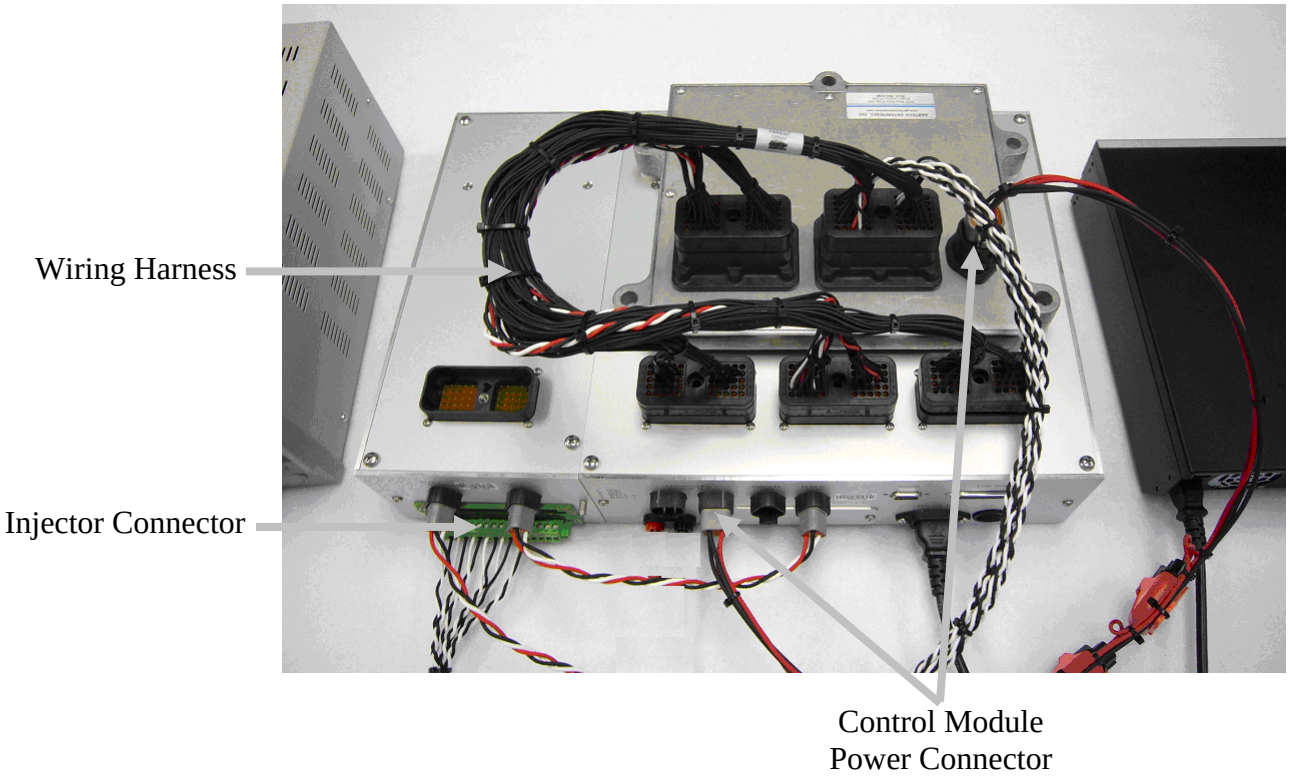
Setting Up a Standard LUIS, Continued

J1939 Cable Connections

This picture illustrates the J1939 Cable connections between the LUIS and the Sidecar.

Control Module Connections

This picture illustrates the installed Control Module with the Wiring Harness and Power Connector.



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Setting Up a Standard LUIS, Continued

Setting Up the Hardware, Continued

This table continues to outline the physical connections required to setup the hardware to run a standard LUIS.

Step	Action
6	Using the DC Power Cable, connect the LUIS to the DC Power Supply using the Unswitched Power In ports on the back of the LUIS.
7	Using the AC Power Cable, plug the LUIS in.
8	To complete the connection to the PC, please go to the appropriate setup section for CAN Card or Ethernet.

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Setting Up a Standard LUIS, Continued

DC Power Connections

This picture illustrates the DC Power connection between the LUIS and the DC power supply.

AC Power Supply

This picture illustrates the AC power connection.

AC Power Connection

Setting Up a CAN Card Connection

Setting Up a CAN Card Connection

Introduction

The LUIS can communicate with a PC via a CAN Card.

Hardware Required

To connect the LUIS with a CAN card, the following hardware is required.

- CAN Card or other Peak Adapter
- CAN Card Cable with 120 ohm terminating resistor across CAN High and CAN Low at both ends

Setting Up a CAN Card Connection

This table outlines the steps required to setup the LUIS hardware and software to run via a CAN Card connection.

Step	Action
1	After completing the setup for a standard LUIS, use the CAN Cable to connect the PC CAN Card to the left hand Public J1939 port on the Sidecar. Note: The CAN Cable must have a 120 ohm terminating resistor across CAN High and CAN Low at both ends.
2	Power up both the PC and LUIS.
3	Open the Windows **Control Panel** from the **Start** button.
4	 **DoubleClick** the **CAN Hardware** icon to view the CAN settings. Verify that the correct CAN device type is selected. Once the device type is correct, close the dialog box as well as the **Control Panel**.
5	Start the LUIS software.
6	From the **Hardware** menu, Select the ***Select Adapter*** option. The ***Peak CAN*** option should be selected. If it is not selected, from the adapter options **Select *Peak CAN***. Note: If changing the adapter type a message dialog box displays indicating that the LUIS software must be restarted for the change to take effect. **Click** <**Yes**> to restart. The user must restart LUIS.

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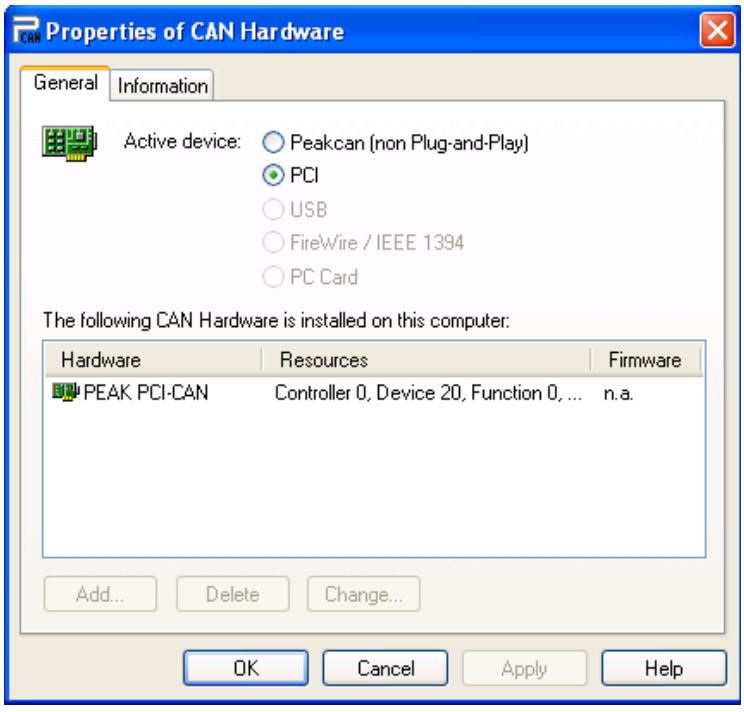
Setting Up a CAN Card Connection, Continued

CAN Card Connection

This picture illustrates the CAN Cable connection between the PC and the LUIS.

CAN Hardware Options

This is an example of the CAN Hardware options available from the Windows **Control Panel**.



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Setting Up a CAN Card Connection, Continued

Setting Up a CAN Card Connection, Continued

This table continues to outline the steps required to setup the LUIS hardware and software to run via a CAN Card connection.

Step	Action
7	From the **Hardware** menu, **Select** the ***Peak Adapter*** option. From the ***Peak Adapter*** options, **Select** ***Set Net Name***. Result: The ***Net Name*** dialog box displays.
8	The *Current Net Name* field displays the net name currently in use. If the net name is not correct, **Type** the correct name in the field and **Click** <**OK**>. Note: If changing the net name a message box displays indicating that the LUIS software must be restarted for the change to take effect. **Click** <**Yes**> to restart.
9	The LUIS hardware and software is installed and ready to run communicating through the CAN Card connection.

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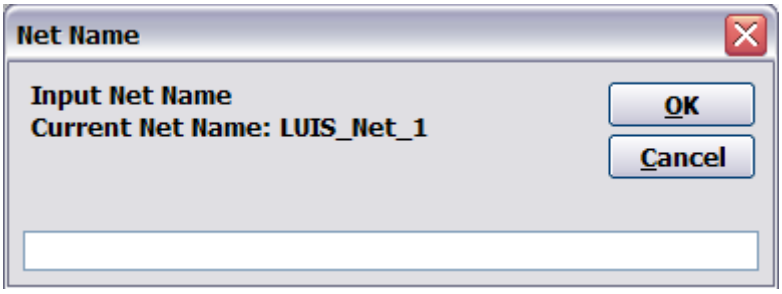
Setting Up a CAN Card Connection, Continued

Net Name Dialog Box

This is an example of the ***Net Name*** dialog box.



Setting Up an Ethernet Connection

Setting Up an Ethernet Connection

Introduction

The LUIS can communicate with the PC through an Ethernet connection.

Hardware Needed

To connect the LUIS through the Ethernet, the following hardware is required.

- Optional LUIS Ethernet Card
- Crossover Ethernet Cable or Hub and Ethernet Cables

Setting Up an Ethernet Connection

This table outlines the steps for setting up the LUIS hardware and software to run via an Ethernet connection.

Step	Action
1	After completing the setup for a standard LUIS, use the appropriate Ethernet cable to connect the PC to the LUIS. Note: To connect directly, a crossover cable must be used.
2	Power up both the PC and LUIS.
3	Start the LUIS software.
4	From the **Hardware** menu, **Select** the ***Select Adapter*** option. From the ***Adapter*** options, **Select *Ethernet***. Result: The message dialog box displays indicating that the LUIS software must be restarted for the change to take effect. **Click** <**Yes**> to restart.
5	Once LUIS has restarted, from the **Hardware** menu, **Select** the ***Ehternet*** option. From the ***Ethernet*** options, **Select *Configure***. Result: The **Ethernet Configuration** window displays.
6	In the *F/W Version* field, the current firmware version displays. Note: This firmware version applies only to the TCP/IP add-on card. It is not the same as the LUIS firmware

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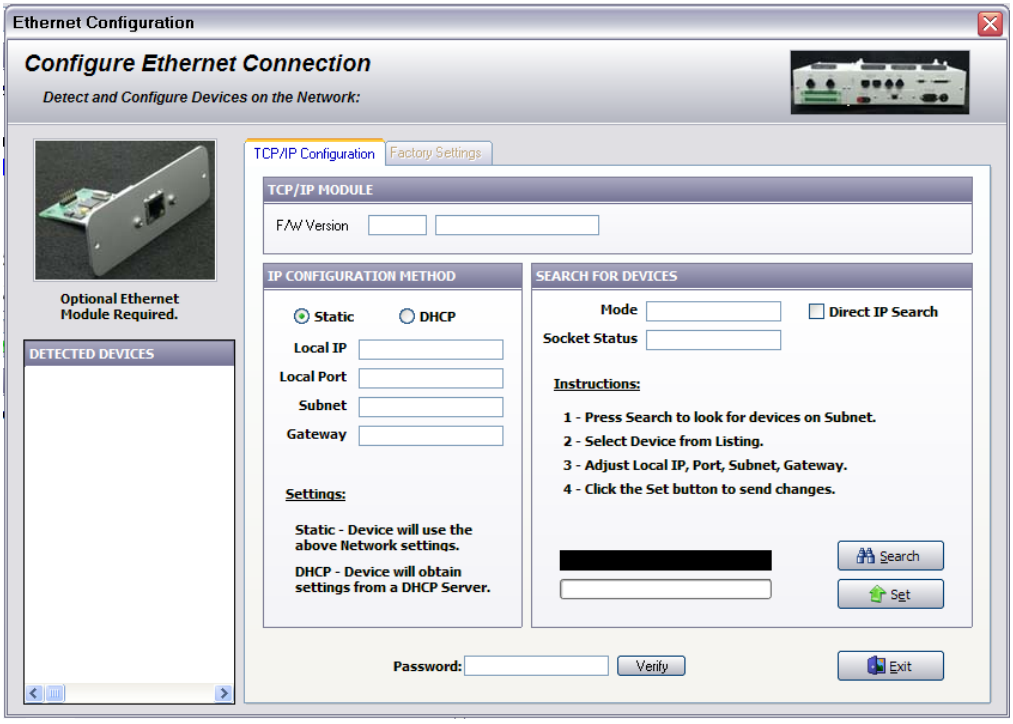
Setting Up an Ethernet Connection, Continued

Ethernet Connection

This picture illustrates the Ethernet connection between the PC and the LUIS.

Ethernet Configuration Window

This graphic is an example of the **Ethernet Configuration** window.



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Setting Up an Ethernet Connection, Continued

Setting Up an Ethernet Connection, Continued

This table continues to outline the steps for setting up the LUIS hardware and software to run via an Ethernet connection.

Step	Action
7	In the **Search for Devices** panel, **Click** the <**Search**> button. Result: The MACID Addresses for all local devices display in the *Detected Devices* field. Note: A direct IP Search can be completed to find an IP address outside the local devices by **Selecting** the *Direct IP Search* checkbox, entering the IP Address and **Clicking** <**Search**>.
8	**Select** the MACID Address for the Ethernet card in the LUIS box from the list. Note: The Ethernet card should be labeled with its MACID Address.
9	The fields on the window display the information for the selected Ethernet card.
10	Make any changes required. Note: Changes cannot be made if the card is in DHCP mode.
11	Once the Ethernet settings are correct, **Click** the <**Set**> button.
12	To close the window, **Click** the <**Exit**> button.
13	To begin communicating, from the **Hardware** menu, **Select *Ethernet*** and then the ***Connect/Disconnect*** option. Result: The LUIS hardware and software is installed and is communicating through the Ethernet connection.

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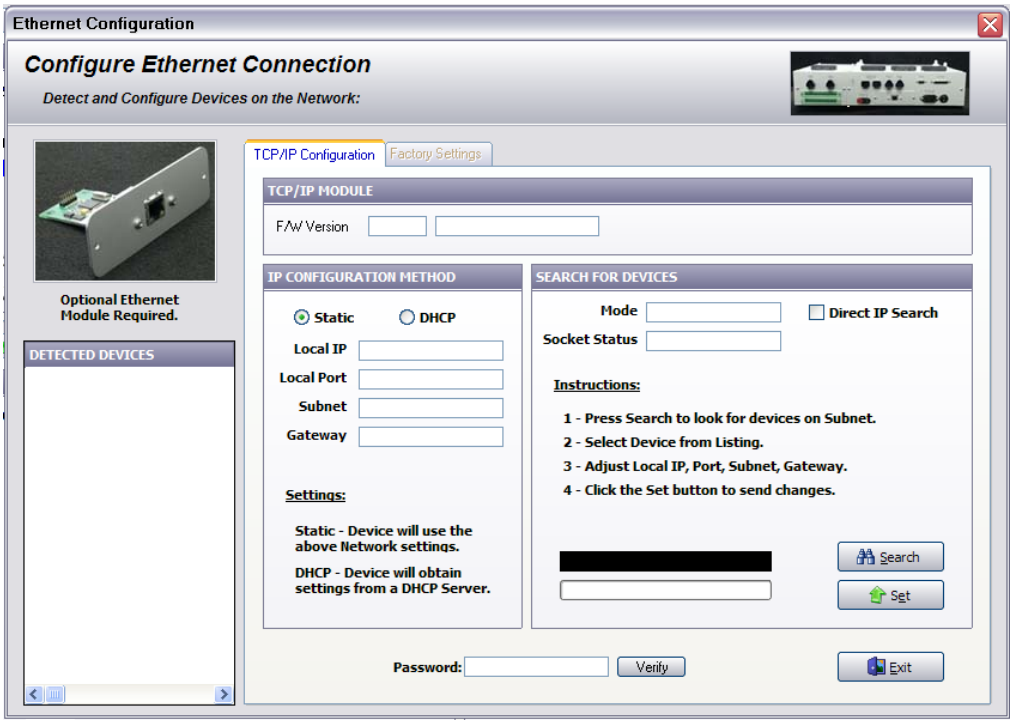
Setting Up an Ethernet Connection, Continued

Ethernet Configuration Window

This graphic is an example of the **Ethernet Configuration** window.



Changing a Sidecar

Changing a Sidecar

Introduction

Sidecars can be added to the parent LUIS to allow for injector loads and application specific high current loads. Different Sidecars are needed depending on the loads required.

Changing a Sidecar

This table outlines the steps for changing a Sidecar.

Step	Action
1	Power down the LUIS unit.
2	Disconnect all the cables connected to the back of the Sidecar.
3	Unscrew the two thumbscrews holding the Sidecar to the Load Box. Note: There is one screw on the front of the unit and one on the back.
4	Carefully pull the sidecar away from the Load Box.
5	Disconnect the internal cable between the Sidecar and the Load Box.
6	Connect the internal cable between the new Sidecar and the Load Box.
7	Carefully push the Sidecar to the load box.
8	Screw in the two thumbscrews to attach the Sidecar to the Load Box.
9	Connect all the cables to the back of the new Sidecar.
10	Power up the LUIS.
11	The new loads can now be added to the configuration file in the LUIS GUI.

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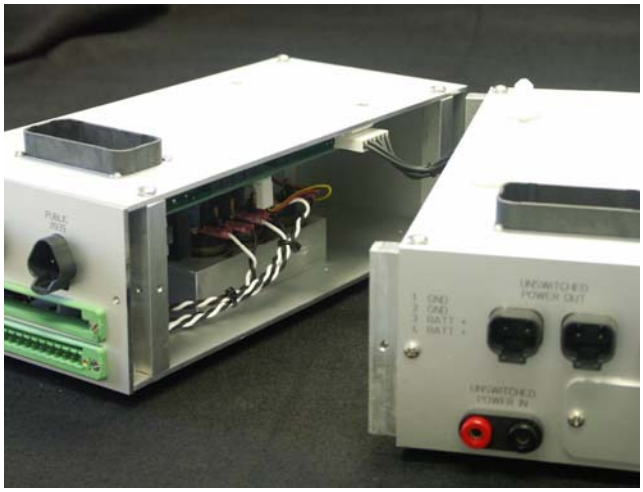
Changing a Sidecar, Continued

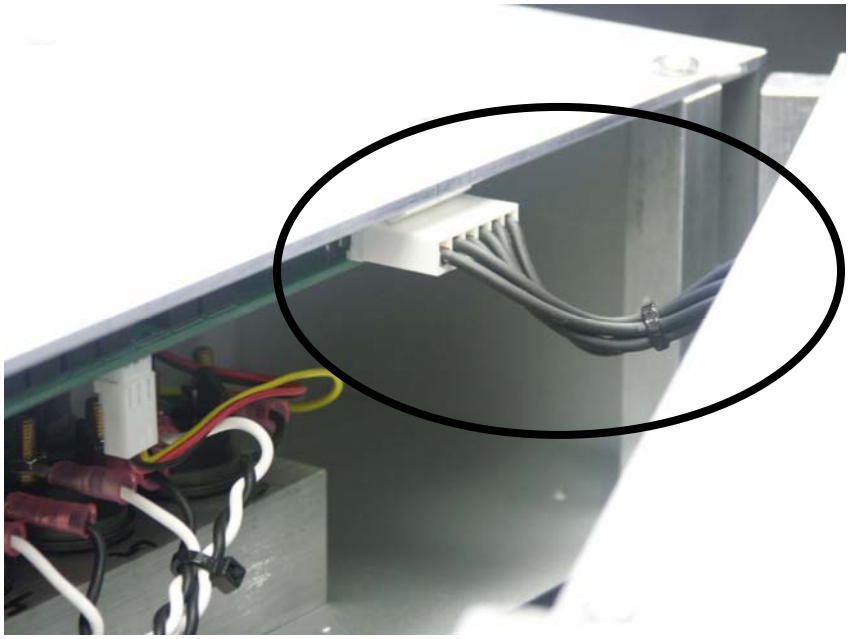
Sidecar Assembly/Disassembly

This picture illustrates the Sidecar detached from the Load Box.



Internal Connection

This picture illustrates the internal connection between the Sidecar and the Load Box.



Adding Child Modules

Adding Child Modules

Introduction

Up to two child modules can be added to the LUIS for testing a single engine system with multiple ECM's.

Hardware Required

This following hardware is required when adding a child module.

- ECM
- Child Load Box
- Parent/Child J1939 Cables
- Parent/Child Private CAN Bus Connector Cables
- Parent/Child LUIS Bus Connector Cables
- Parent/Child Control Module Power Connector

Adding Child Module

This table outlines the steps for adding child modules to the LUIS.

Note: A Parent/Child stack can be ordered directly from GarTech. This unit is shipped already stacked and connected. When this item arrives, this table can be used to ensure that all of the cables are connected as expected and nothing was loosened during shipping.

Step	Action
1	Setup the parent module as a standard LUIS. Note: For more information, see **Setting Up a Standard LUIS**.
2	Install the Control Module on the pegs located on the top of the Child Load Box.
3	Using the appropriate wiring harness, connect the Control Module to the Child Load Box using the ports on top of the box.
4	Replace the J1939 cable between the Sidecar and Parent Load Box with the Parent/Child J1939 cable. This cable plugs into the right hand Public J1939 port on the Parent Side Car and into the Public J1939 port on each Load Box in the setup.

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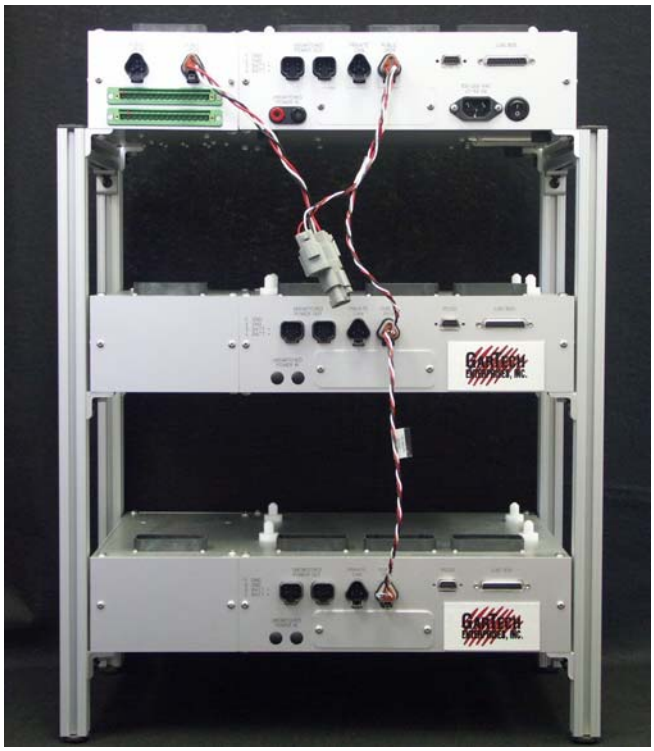
Adding Child Modules, Continued

Public CAN Connections

This picture illustrates the Public J1939 CAN Connections.



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Adding Child Modules, Continued

Adding Child Module

This table outlines the steps for adding child modules to the LUIS.

Step	Action
5	Replace the Control Module Power Connector with the Parent/Child Control Module Power Connector. Connect this cable to the Unswitched Power Out port on the back of each Load Box.
6	Make the private CAN connection by plugging the Parent/Child CAN Connector into the Private J1939 port on each Load Box in the setup.
7	Connect the LUIS Bus by plugging the Parent/Child LUIS Bus Connector into the LUIS Bus port on the back of each Load Box.

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Adding Child Modules, Continued

Control Module Power Connections

This picture illustrates the Control Module Power Connections.

Private CAN Connections

This picture illustrates the Private CAN Connections.

LUIS Bus Connections

This picture illustrates the LUIS Bus connections.

Downloading New Firmware

Downloading New Firmware

Introduction

Firmware is an instruction set stored in the ROM. Parent and Child boxes have same firmware. The Wavemaker and FMET Box have different Firmware.

Downloading Firmware

This table outlines the steps for downloading firmware.

Step	Action
1	Before downloading firmware, ensure that both the **VBatt** and **Keyswitch** are off and that **Engine Speed** is set to 0.
2	Close any datalink tools running on the PC.
3	From the **Hardware** menu, **Select** the ***Download Firmware*** option. Result: The **Firmware** window displays.
4	In the **Destination Device** section, **Select** the hardware to which the firmware will be downloaded.
5	**Click** the <**Select Binary File**> button. On the ***Open*** dialog box, **Browse** and **Select** the correct firmware file, and **Click** <**Open**>. Note: To avoid errors, the firmware to download should be resident on the local machine rather than on a network drive.
6	Once the firmware file has been selected, **Click** the <**Download**> button. Troubleshooting: If the download fails to complete or errors occur, the LUIS must be ROM booted to be able to continue. See **ROM Booting** in this section. Result: The firmware is downloaded to the selected device. As the download occurs, messages display in the *Firmware File* field.
7	Once the download is complete, **Click** the <**Exit**> button to close the dialog box. Note: If new firmware was downloaded to the Wavemaker, the power on the LUIS box must be cycled before the download will be complete.

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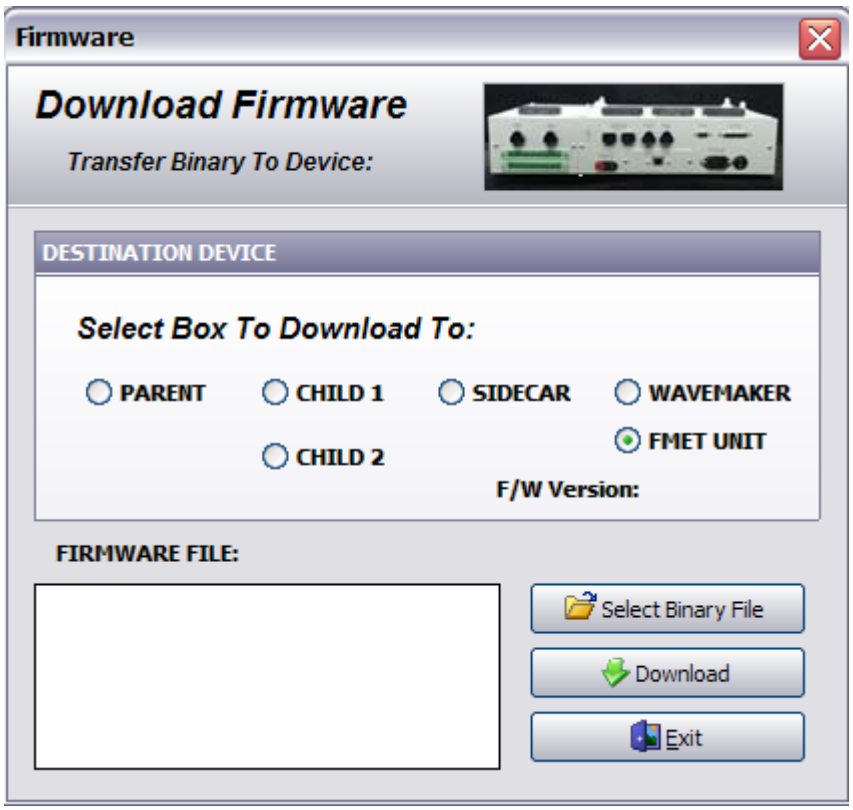
Downloading Firmware, Continued

Firmware Window

This graphic is an example of the **Firmware** window.



ROM Booting

ROM Booting

Introduction

ROM Booting is a troubleshooting process used to reset the hardware after a failed download or if communications stop between the LUIS and the PC.

ROM Booting

This table outlines the steps for ROM Booting.

Step	Action
1	Shut down the LUIS box.
2	In the LUIS software, from the **Hardware** menu **Select** the ***Download Firmware*** option. Result: The ***Firmware*** dialog box displays.
3	**Click** the <**Select Binary File**> button. On the ***Open*** dialog box, find and select the appropriate firmware file. Note: The firmware should be resident on the PC not on a network drive.
4	**Click** the <**Download**> button. Result: The "Do Not Turn Unit Off" message displays.
5	A series of messages will display. When the "Resetting Loadbox" message displays, turn the LUIS box power on. Note: The LUIS box must be powered on within about 2 seconds of the message or the ROM Boot will fail. If this happens, try again.
6	The firmware will be downloaded to all devices simultaneously except the Wavemaker. When the download is complete the "Firmware Update Complete" message displays.
7	Communication should now be restored between the PC and the LUIS Box.
8	Since the Wavemaker uses different firmware, it must be downloaded via the standard **Download Firmware** procedure earlier in this section. Until this download is complete, the firmware version will display as 99.99.

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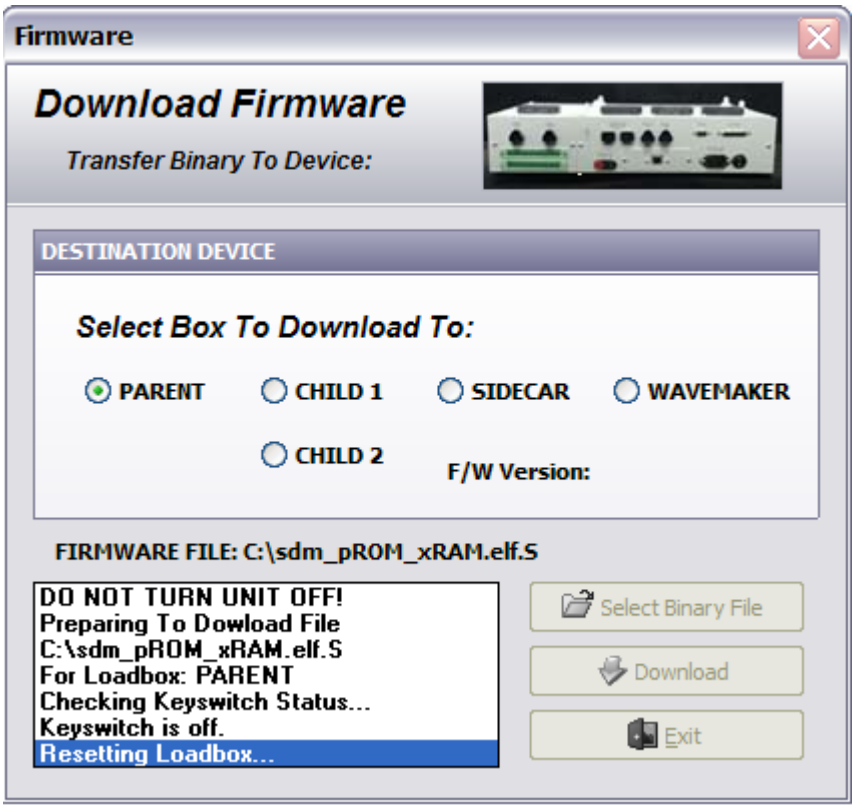
ROM Booting, Continued

Firmware Dialog Box

This graphic illustrates the “Resetting Loadbox” message on the ***Firmware*** dialog box.



Notes

Chapter 2 – The LUIS Graphical User Interface

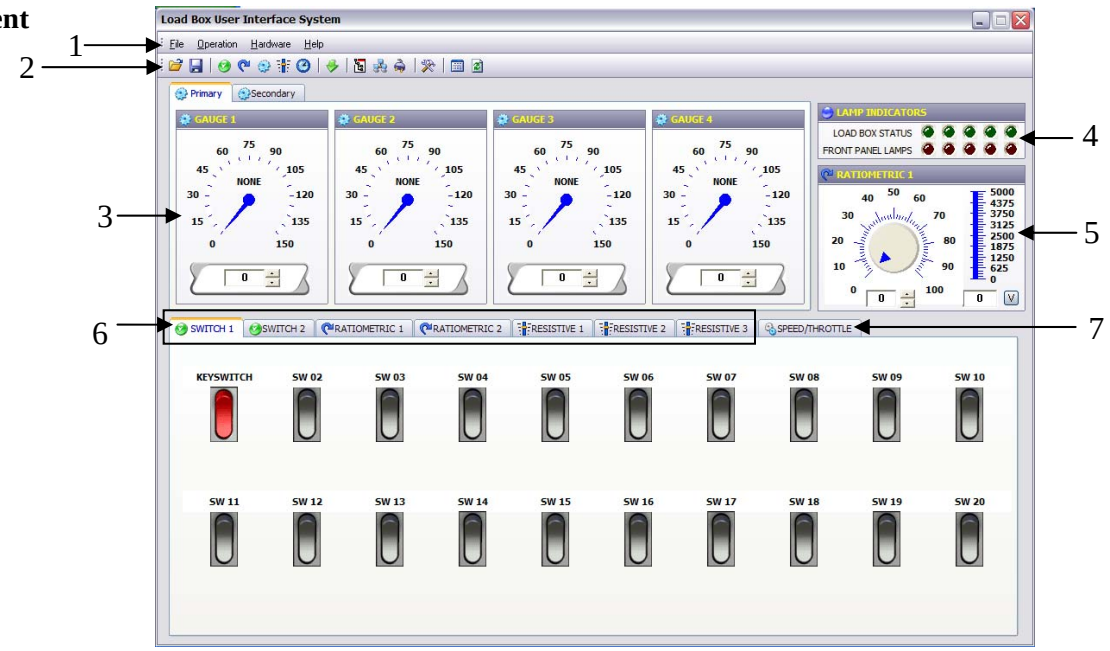
Overview

Introduction

The LUIS comes with a graphical user interface for controlling all outputs as well as for setting up closed loop controls. The LUIS GUI is made up of a menu system, toolbar, waveform gauges, lamp indicators, throttle dial, I/O controls, and closed loop controls.

LUIS GUI Basic Environment

This diagram and table describe the basic LUIS GUI environment.



	Description
1	Menu Bar
2	Toolbar
3	Waveform Gauges
4	Lamp Indicators
5	Throttle Ratiometric Dial
6	I/O Controls
7	Closed Loop Controls

Continued on next page

Overview, Continued

In This Section This table outlines the topics covered in this section.

Section 1 - Menu Bar

Menu Bar

Menus and Options

This table outlines the menus that are available as well as the options available on each menu.

Menu	*Option*	Description
File		
	Open Configuration	Opens a saved configuration and applies it to the GUI.
	Save Configuration As…	Save the current GUI configuration to be opened later.
	Exit	Exit the LUIS GUI.
Operation		
	Reset	Resets controls to their default positions.
	Front Panel Layout	Opens the ***Front Panel Functions*** dialog box where a replica of the Parent Controller front panel can be customized.
	Set Current As Defaults	Sets the current settings as the defaults for the configuration.
	Configuration Panel	Opens the **Component Configuration** window to setup the GUI.
	Data Player	Opens the **Data Player** window to configure the data player.
Hardware		
	Download Firmware	Opens the ***Firmware*** dialog box to download new firmware.
	Select Adapter	Sets the adapter type to ***Ethernet*** or ***Peak CAN***.

Menu Bar, Continued

Menus and Options, Continued

This table continues to outline the menus that are available as well as the options available on each menu.

Menu	*Option*	Description
Hardware (Continued)	***Peak Adapter***	Gives the option for setting the New Name.
	Ethernet	Allows the Ethernet to be configured or connected/disconnected.
	Calibrate	Opens the ***Calibrate Unit*** dialog box so the unit can be calibrated with the ECM for accurate temperature values.
Help		
	Contents	Opens the on-line help.
	About	Opens the ***About*** dialog box to display the version information.
	GarTech on the Web	Opens the Gartech website in the default browser.

Section 2 – Toolbar

Toolbar

Introduction

The toolbar provides quick access to many of the often used menu items.

Toolbar

This graphic and table outlines the options available from the toolbar.

Icon	Description
	Open Configuration
	Save Configuration
	Reset Switches
	Reset Ratiometrics
	Reset Gauges
	Reset Resistive
	Reset Rotary Switches
	Download Firmware
	Set Net Name
	Configure Ethernet
	Connect/Disconnect Ethernet
	Component Configuration
	Front LUIS Panel Layout
	Set Current as Default
	Reset Communication Interface
	Data Player

Section 3 - Waveform Gauges

Waveform Gauges

Introduction

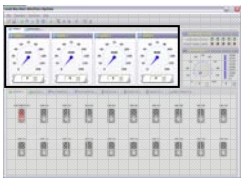
The LUIS has the GarTech Arbitrary Waveform Generator integrated into the system. The eight waveform gauges provide the ability to monitor and manipulate these waveforms.

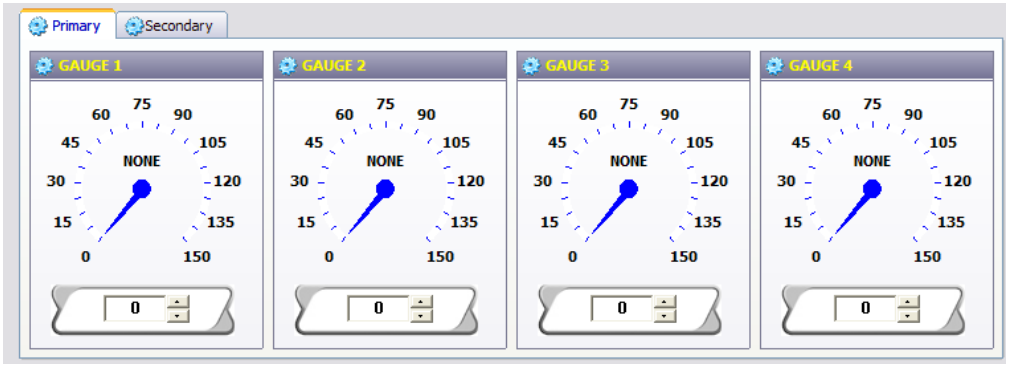
Waveform Gauges

The eight waveform gauges are found on two tabs labeled **Primary** and **Secondary**. These gauges are setup on the **Gauge** section of the **Component Configuration** window. When configuring the gauges the card type, arbitrary or digital, and input and output types must be known. The teeth per revolution, cycles per revolution, ramp rate and PWM heartbeat frequency must also be known. There is also an option to sync waveforms together, however this does nothing to the gauge.

Waveform Gauges Location

This graphic illustrates the waveform gauges and their location on the LUIS main window.





Section 4 - Lamp Indicators

Lamp Indicators

Introduction

There are two rows of lamp indicators on the LUIS GUI. The top row, Load Box Status, provides feedback on the controllers, sidecar and wavemaker. The second row, Front Panel Lamps, mirrors the lamps on the front of the Parent controller.

Load Box Status

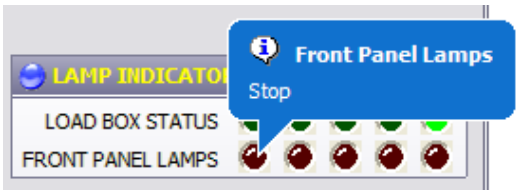
The top row of indicator lamps are labeled Load Box Status. These lamps are illuminated green to indicate that the various hardware pieces are connected and communicating. If a lamp is not illuminated green, that piece of equipment is either disconnected or not communicating.

If Load Box Status lamps indicate that communication has been lost, and communication cannot be restarted by rebooting, follow the **Rom Booting** procedure earlier in this document to recover communication.

From left to right the indicators show Parent Controller, Child 1, Child 2, Sidecar, and Wavemaker. When the cursor is held over these lamps, a pop-up displays to indicate the current state of the hardware as well as the current firmware version.

Front Panel Lamps

The second row of indicator lamps are labeled Front Panel Lamps. These lamps mirror the lamps on the front of the Parent Controller. This is particularly useful in setups where the controller is not easily in sight. These lamps can be named for easy reference using the ***Front Panel Layout*** option on the **Hardware** menu. When the cursor is held over these lamps, a pop-up displays the name given to that lamp on the ***Front Panel Layout*** dialog box.



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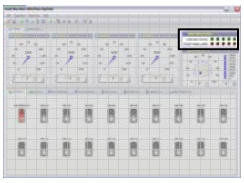
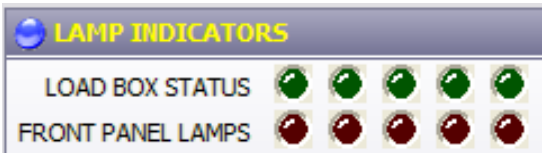
Lamp Indicators, Continued

Indicator Lamps Location

This graphic illustrates the indicator lamps and their location on the LUIS GUI.





Section 5 - Throttle Ratiometric Dial

Throttle Ratiometric Dial

Introduction

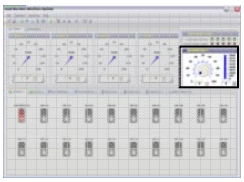
On the LUIS GUI there is one ratiometric dial on the front panel.

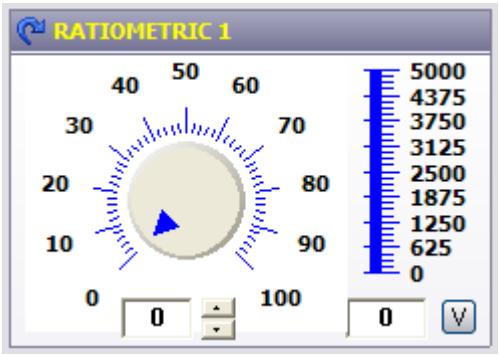
Throttle Ratiometric Dial

The ratiometric dial on the front panel is automatically configured to be Throttle. This assignment can be changed when configuring the panel. When changing, keep in mind that the Throttle is used for Auto IVS functionality, the IVS switches trigger off of their set switch point and gets its value from this pot knob.

Throttle Ratiometric Dial Location

This graphic illustrates the Throttle Ratiometric Dial and it's location on the LUIS GUI.





Section 6 - I/O Controls

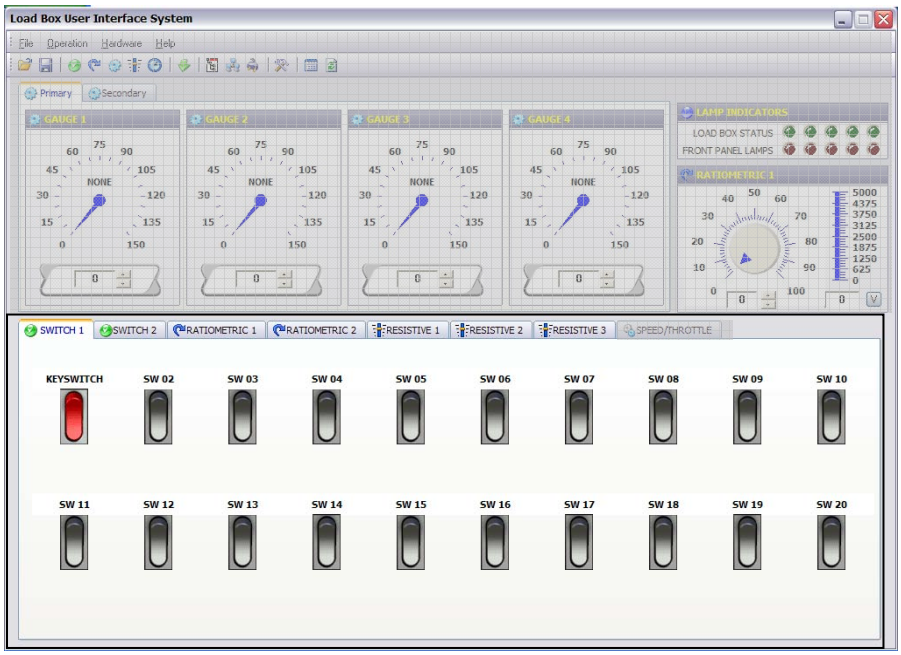
I/O Controls

Introduction

All the I/O controls are found on seven tabs categorized by control type: switch, ratiometric, and resistive. All control names, values, units, and scales are setup on the **Configuration Panel** window.

I/O Controls Location

The different I/O Controls are accessed by pressing the tabs. This diagram illustrates the I/O controls section and its location on the LUIS GUI.



In This Section

This table outlines the topics covered in this section.

Switches

Introduction

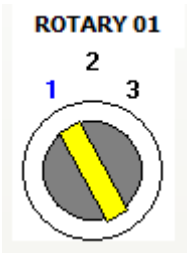
The first two tabs in the I/O controls section of the GUI provide 32 position switches and 3 rotary switches. The first switch is defaulted to Keyswitch.

Setting Positions

The two position switches are either in the ON position, which is indicated by the top of the switch being depressed and the switch name being displayed in red, or the OFF position, which is indicated by the bottom of the switch being depressed and the switch name being displayed in black.

OFF ON

The rotary switches are in one of three positions as indicated by the top of the yellow dial as well as displaying the position number in blue.



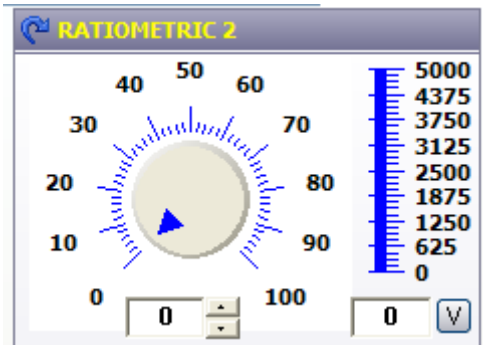
Ratiometrics

Introduction

The third and fourth tabs in the I/O controls section of the GUI provide gauges for 16 ratiometric channels.

Setting Values

The ratiometrics can be controlled by the dial, the slider, the increment/ decrement arrows, or by typing in the value field.



Ratiometric Units

Ratiometrics can be displayed in millivolts or counts. The units are controlled by the V or C button in the lower right hand corner. The unit displayed on the button is the current unit being used.

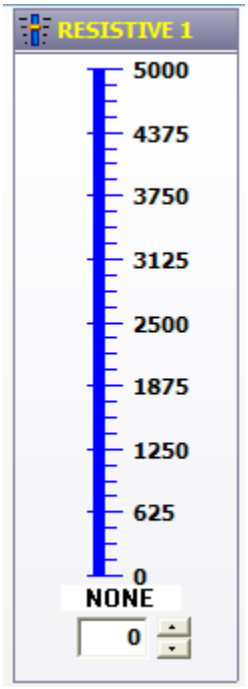
Resistives

Introduction

The fifth, sixth, and seventh tabs in the I/O Controls section of the LUIS GUI provide sliders for 24 resistive channels.

Setting Values

The resistive controls can be controlled by the slider or the increment/ decrement arrows.



Section 7 - Closed Loop Controls

Closed Loop Controls

Introduction

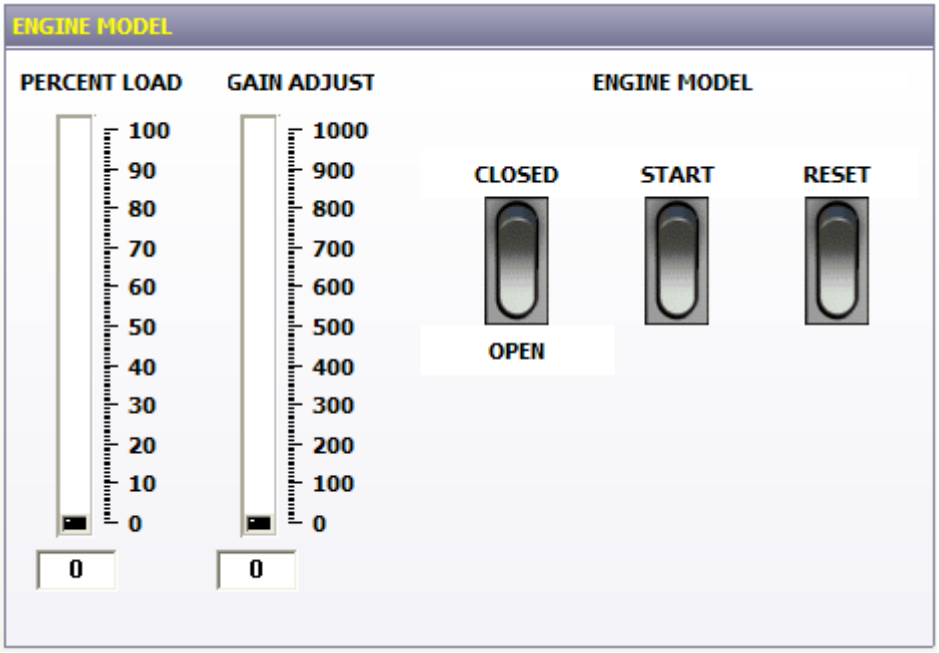
The LUIS can be set to run closed loop engine speed control. In this mode the engine speed signal generated by the load box responds similarly to an actual engine. J1939 public broadcast **must be** running in the ECM to run in closed loop mode.

Closed Loop Controls

The last tab in the I/O controls section, labeled Speed/Throttle, is the closed loop controls section. Here the engine model and throttle pedal idle validation is setup for closed loop control.

Engine Model

In the engine model section, the percent load and gain adjust are set using the sliders. The loop is set to closed using the Closed/Open switch. The start switch is used to start the closed loop control, and the reset switch set the model back to zero load/rpm.



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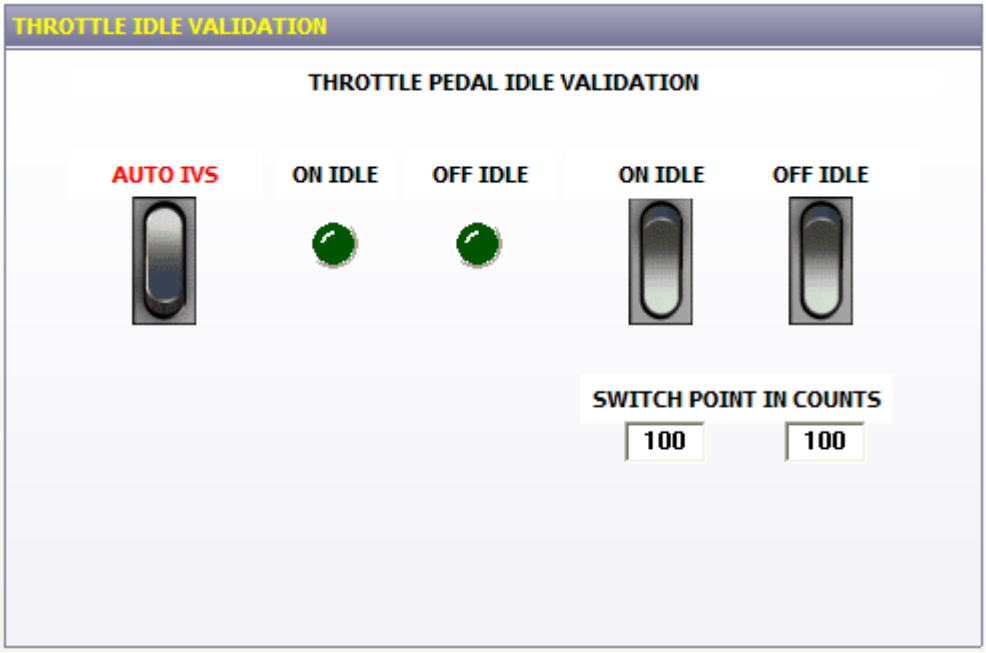
Closed Loop Controls, Continued

Throttle Idle Validation

The throttle idle validation section is used to simulate idle validation. Idle can be set to toggle automatically based on switch points in counts or manually.

When the **Auto IVS** switch is set to **On**, the **On Idle** and **Off Idle** switches turn on and off automatically based on the values entered for the *Switch Points in Counts* fields. The *Switch Point in Counts* values apply to the Throttle ratiometric. The On Idle and Off Idle lamps light to indicate the present state.

When setting the throttle pedal idle validation manually, click the **On Idle** and **Off Idle** switches when required.



Section 8 - Other Windows and Dialog Boxes

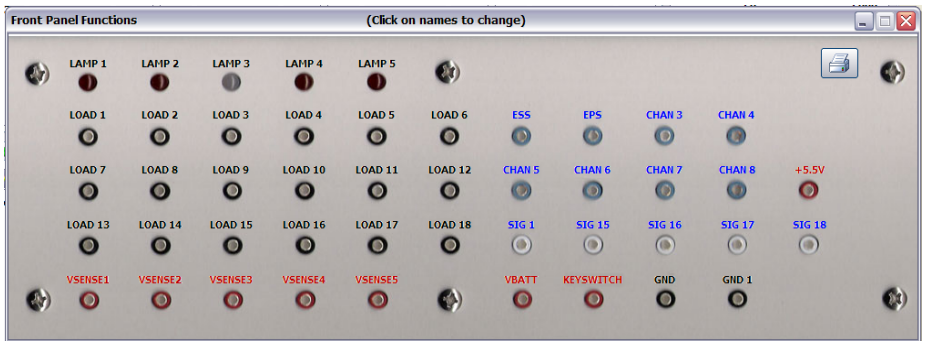
Other Windows and Dialog Boxes

Introduction

The LUIS GUI provides other windows and dialog boxes for configuring and other actions.

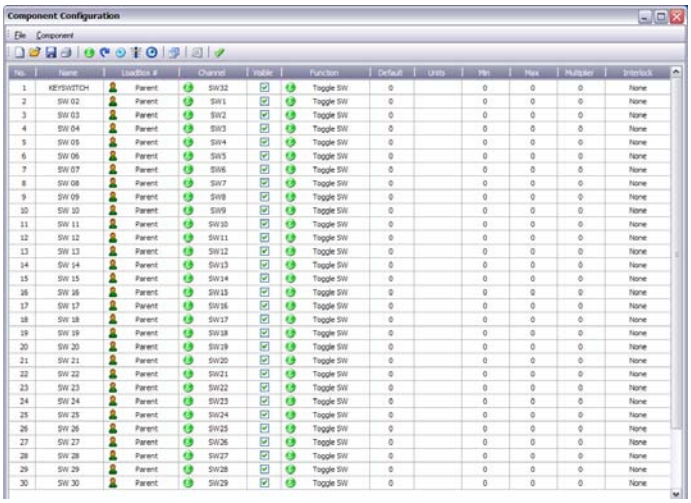
Front Panel Window

The **Front Panel** window is opened from the **Operation** menu. It displays a picture of the front of the Parent Controller. On this window, the generic labels can be replaced with meaningful names. It can be printed, by pressing the printer icon, and used as a map of the controller.



Configuration

The **Component Configuration** window is used to configure all the I/O controls on the main screen. This window is available from the **Equipment** menu.



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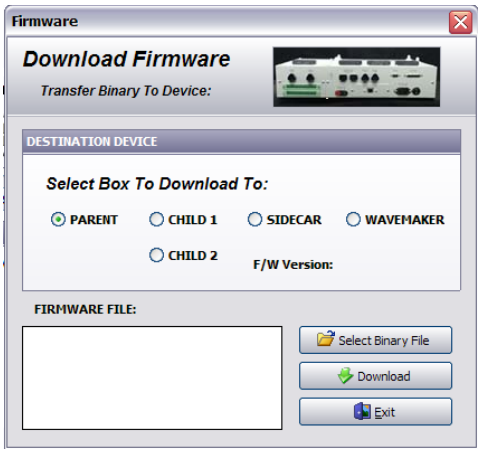
Other Windows and Dialog Boxes, Continued

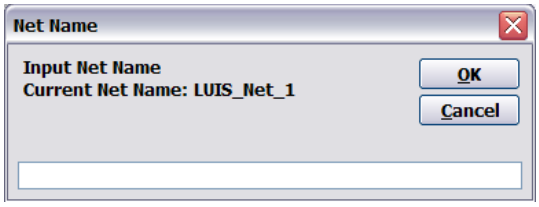
Firmware Dialog Box

This ***Firmware*** dialog box is used to download new firmware to the hardware. This dialog box is available from the **Hardware** menu.



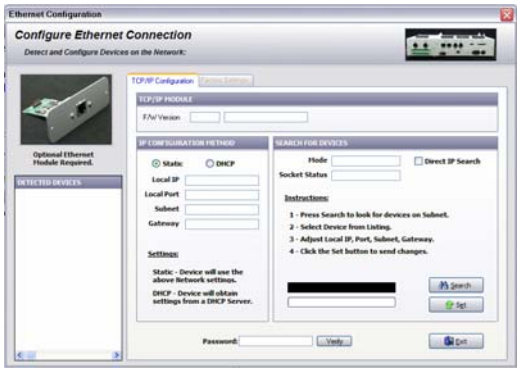
Net Name Dialog Box

The ***Net Name*** dialog box is used to set the net name for the CAN connection. This dialog box is accessed through the **Hardware** menu.



Ethernet Configuration Dialog Box

The ***Ethernet Configuration*** dialog box is used to configure the Ethernet connection. It is accessed through the **Hardware** menu.



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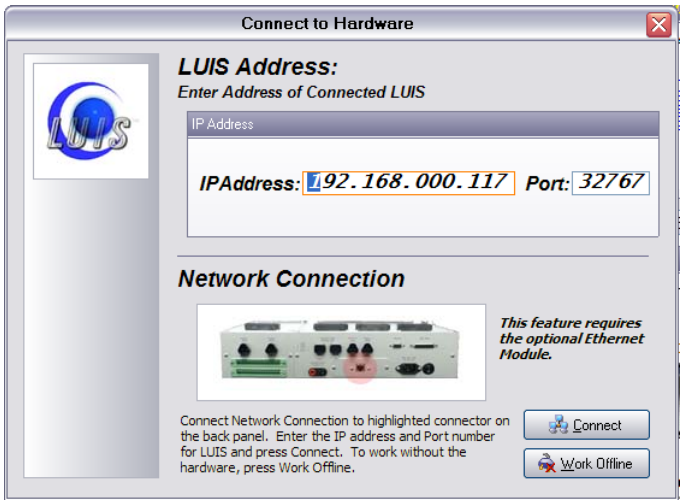
Other Windows and Dialog Boxes, Continued

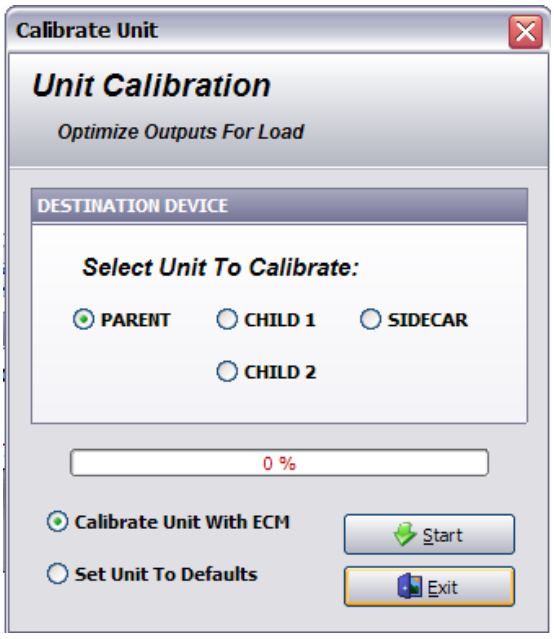
Connect to Hardware Dialog Box

The ***Connect to Hardware*** dialog box is used to connect to and disconnect from the Ethernet. This dialog box is accessed through the **Hardware** menu.



Calibrate Unit Dialog Box

The ***Calibrate Unit*** dialog box is used to calibrate hardware to the ECM to ensure accurate temperature readings. This dialog box is accessed through the **Hardware** menu.



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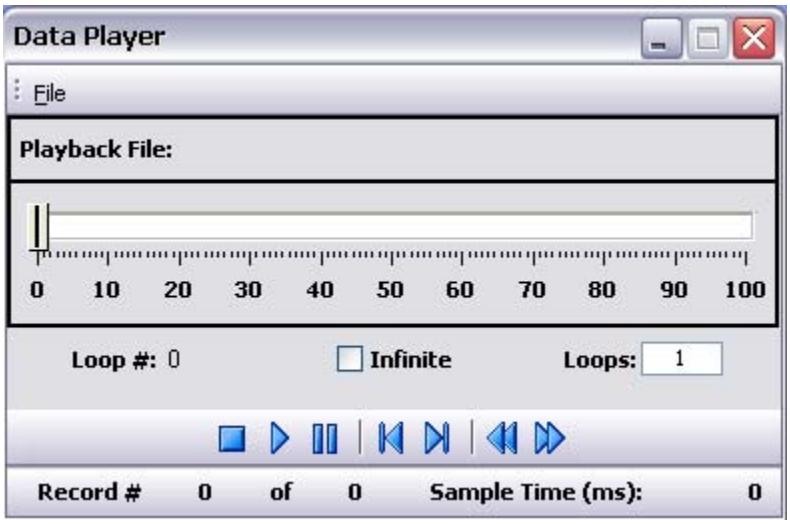
Other Windows and Dialog Boxes, Continued

Data Player Dialog Box

The ***Data Player*** dialog box is used to load and playback CSV data files. This dialog box is accessed through the **Operation** menu.



Notes

Chapter 3 – Configuring the LUIS GUI

Overview

Introduction

Each of the controls on the LUIS GUI can be configured. They can be named as well as having defaults, units, and minimum/maximum values set. They can be interlocked with other controls, and they can be removed from the display. All configuration takes place on the **Component Configuration** window.

In This Section

This table outlines the topics covered in this chapter.

Section 1 – The Component Configuration Window

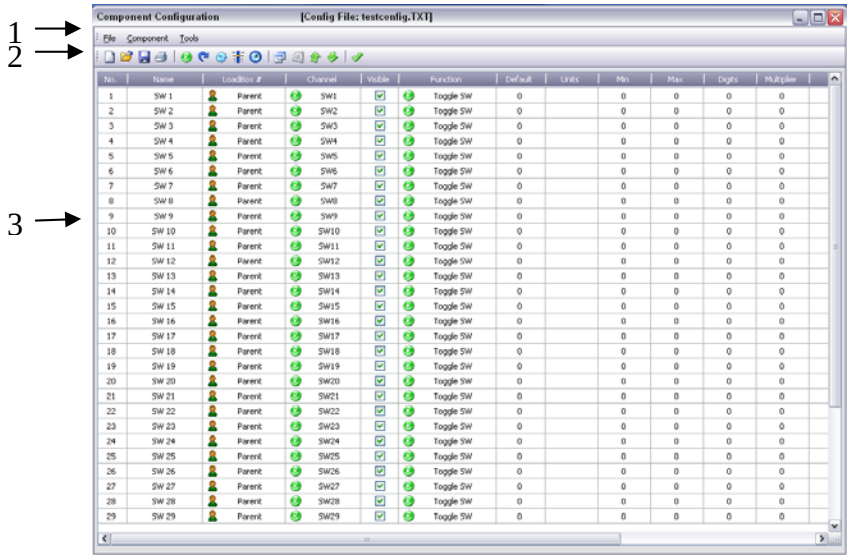
The Component Configuration Window

Introduction

The **Component Configuration** window is used to configure the LUIS GUI. The window has its own menu and toolbars unlike those on the main window.

The Component Configuration Window

This graphic and table describe the **Component Configuration** window.



	Description
1	Menu Bar
2	Toolbar
3	Panels

In This Section

This table outlines the topics covered in this section.

The Menu Bar

Menus and Options

This table outlines the menus and their options available on the **Component Configuration** window.

Menu	Option	Description
File		
	New Configuration	Resets all the fields for a new configuration.
	Open Configuration	Opens the ***Open*** dialog box where an existing configuration can be found and loaded.
	Save Configuration As	Opens the ***Save As*** dialog box so the current configuration can be saved under a new name.
	Print	Opens the **Print Preview** window from which the configuration can be printed.
	Exit	Closes the **Component Configuration** window.
Component		
	Switch	Displays the switch components in the **Panels** section of the window.
	Pot Knob	Displays the pot knob components in the **Panels** section of the window.
	Gauge	Displays the gauge components in the **Panels** section of the window.
	Slider Rotary	Displays the slider rotary components in the **Panels** section of the window.

The Menu Bar, Continued

Menu	Option	Description
Tools		
	Apply	Apply the configuration to the Main Panel.
	Tables	Opens the ***Tables*** dialog box where tables can be added or modified.
	Configuration Options	Opens the ***Options*** dialog box where Tabs and Engine Model options can be set.
	Move Up	Moves the selected entry up the list.
	Move Down	Moves the selected entry down the list.

The Toolbar

The Toolbar

This graphic and table describe the icons available on the **Component Configuration** window.

Icon	Description
	New configuration
	Open a new configuration
	Save the configuration
	Print the configuration
	Configure Switches
	Configure Pot Knobs
	Configure Gauges
	Configure Sliders
	Configure Rotary Knobs
	Interpolation Tables
	Configuration Options
	Move Entry Up
	Move Entry Down
	Apply configuration

Panels

Panels

The **Panels** portion of the **Component Configuration** window is where the configuration elements display.

The panels for switches, pot knobs, sliders, and rotary are identical except for the number of channels permitted. The panel for gauges has an upper portion identical to the other controls as well as a lower portion for configuring the waveform channels.

There is also a panel for managing interpolation tables, and one additional panel for configuration options. The **Configuration Options** panel allows the user to determine the names and visibility of the tabs on the main window.

Section 2 –Interpolation Tables

Overview

Introduction

Some of the components controlled by the LUIS require an interpolation table to match the engineering unit that is on the gauge to a counts value. For example 32 PSI is 500 counts, which is a specific voltage that LUIS outputs.

In This Section

This table outlines the topics covered in this section.

Creating an Interpolation Table

Introduction

Interpolation tables can be created from the **Table** panel in the **Component Configuration** window. The data can be entered manually, or cut and pasted from another application such as Microsoft Excel.

Creating an Interpolation Table

This table outlines the steps for creating an interpolation table.

Step	Action
1	From the **Operations** menu, **Select** the ***Configuration Panel*** option. Result: The **Component Configuration** window displays.
2	On the Menu Bar, **Click** the **Tables** icon  . Result: The **Table** panel displays in the **Component Configuration** window.
3	If any tables have already been added to the configuration, they display in the **Table Name** box. The selected table's contents display in the table on the left hand side of the panel, and its general setup information displays in the fields below the **Table Name** box.
4	To add a new table directly in the LUIS GUI, **Click** the <**Add Table**> button. Result: The ***Table Name*** dialog box displays.
5	In the *Add Table Name* field, **Type** the name of the new table, and then **Click** <**OK**>. Result: The new table name is added to the **Table Name** box.
6	With the new table name selected, fill in the *Min Volts*, *Max Volts*, *DAC Multiplier*, *Table Axis*, *and Table Notes* fields.
7	Add the table data by either **Typing** it in directly or by **Cutting** and **Pasting** from another application.
8	When the table setup is complete, **Save** the configuration before closing the **Table** panel. Note: To immediately apply the setup to the front panel, from the **File** menu **Select** the ***Apply Configuration*** option.

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Creating an Interpolation Table, Continued

Tables Panel

This graphic illustrates the **Tables** panel in the **Component Configuration** window.

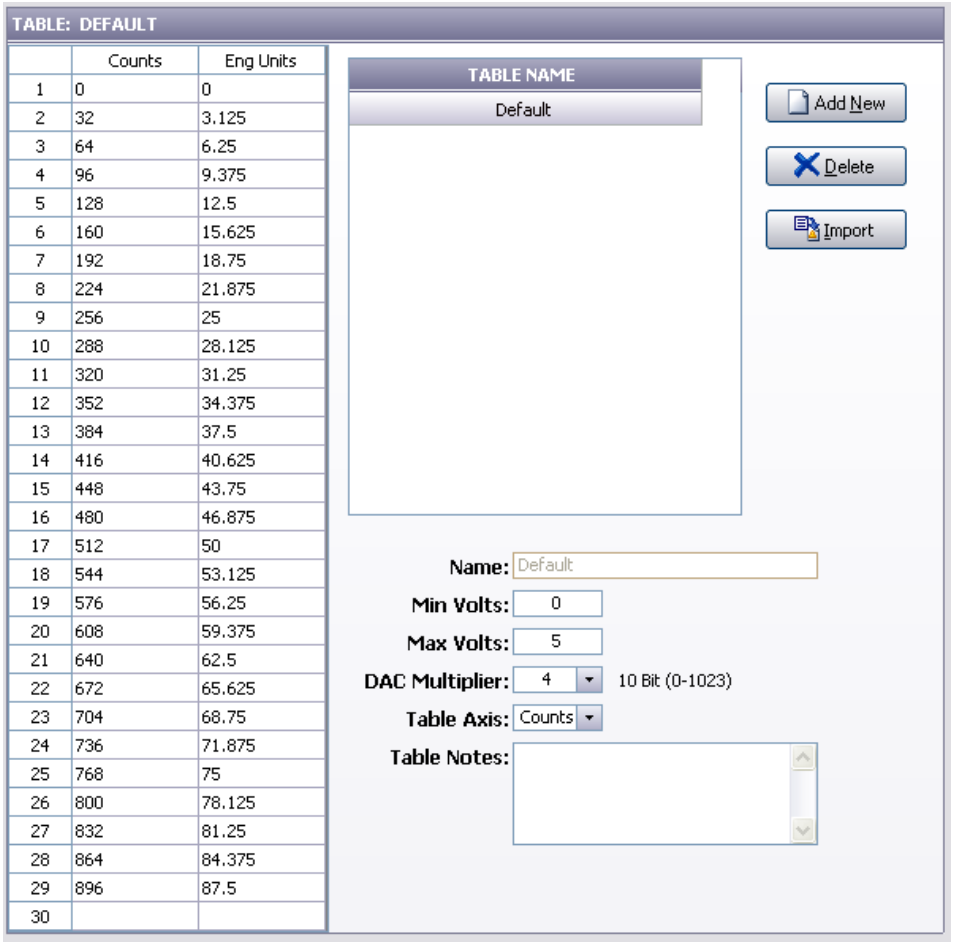
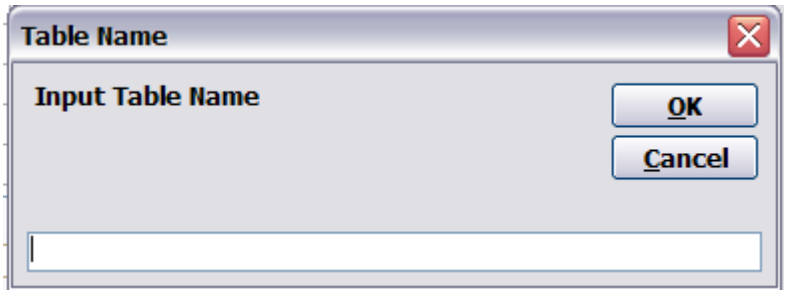


Table Name Dialog Box

This graphic illustrates the ***Table Name*** dialog box.



Importing an Interpolation Table

Introduction

Interpolation tables can be imported from other calibrations.

Importing an Interpolation Table

This table outlines the steps for importing an interpolation table.

Step	Action
1	From the **Operations** menu, **Select** the ***Configuration Panel*** option. Result: The **Component Configuration** window displays.
2	On the Menu Bar, **Click** the **Tables** icon  . Result: The **Table** panel displays in the **Component Configuration** window.
3	If any tables have already been added to the configuration, they display in the **Table Name** box. The selected table's contents display in the table on the left hand side of the panel, and its general setup information displays in the fields below the **Table Name** box.
4	To import a table, **Click** the <**Import**> button. Result: The ***Open*** dialog box displays.
5	Find the configuration file to import from, and **Click** <**Open**>. Result: The ***Import Tables*** dialog box displays.
6	On the ***Import Tables*** dialog box, **Select** the tables to import. Once all the desired tables are selected, **Click** <**Import Selected**>. Result: The table(s) is imported and added to the list of tables.
7	To edit the table, **Click** on its title to display the value on the left hand side of the panel. Make changes to the table.
8	When the table setup is complete, **Save** the configuration before closing the **Table** panel. Note: To immediately apply the setup to the front panel, from the **File** menu **Select** the ***Apply Configuration*** option.

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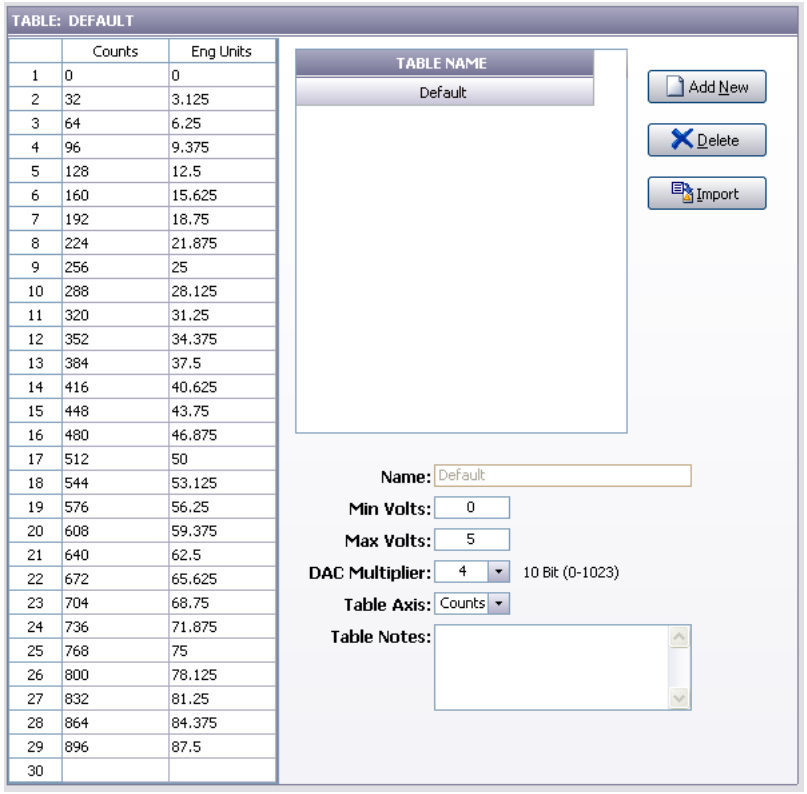
Importing an Interpolation Table, Continued

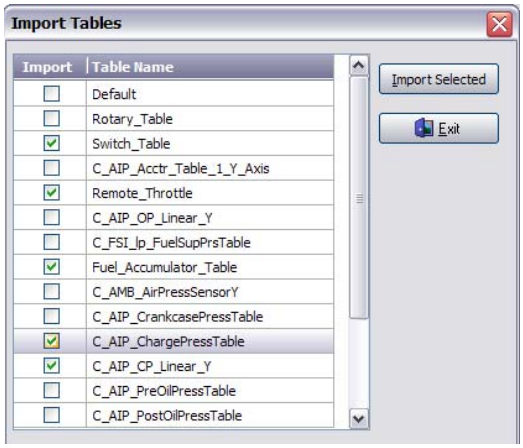
Tables Panel

This graphic illustrates the **Tables** panel in the **Component Configuration** window.



Import Tables Dialog Box

This graphic illustrates the ***Import Tables*** dialog box.



Deleting an Interpolation Table

Deleting an Interpolation Table

This table outlines the steps for deleting an interpolation table.

Step	Action
1	From the **Operations** menu, **Select** the ***Configuration Panel*** option. Result: The **Component Configuration** window displays.
2	Before a table can be deleted, any references to it by components must be removed. To remove these references, go to the component configuration panels and change the *Table* field to another table name or select ***None*** from the dropdown menu.
3	When all references to the table to be deleted have been removed, on the Menu Bar, **Click** the **Tables** icon  . Result: The **Table** panel displays in the **Component Configuration** window.
4	If any tables have already been added to the configuration, they display in the **Table Name** box. The selected table's contents display in the table on the left hand side of the panel, and its general setup information displays in the fields below the **Table Name** box.
5	On the **Table** panel **Select** the table to delete. Then **Click** the <**Delete**> button. Result: The table is deleted and is removed from the table list.
6	When the changes are complete, **Save** the configuration before closing the **Table** panel. Note: To immediately apply the setup to the front panel, from the **File** menu **Select** the ***Apply Configuration*** option.

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Deleting an Interpolation Table, Continued

Tables Panel

This graphic illustrates the **Tables** panel in the **Component Configuration** window.

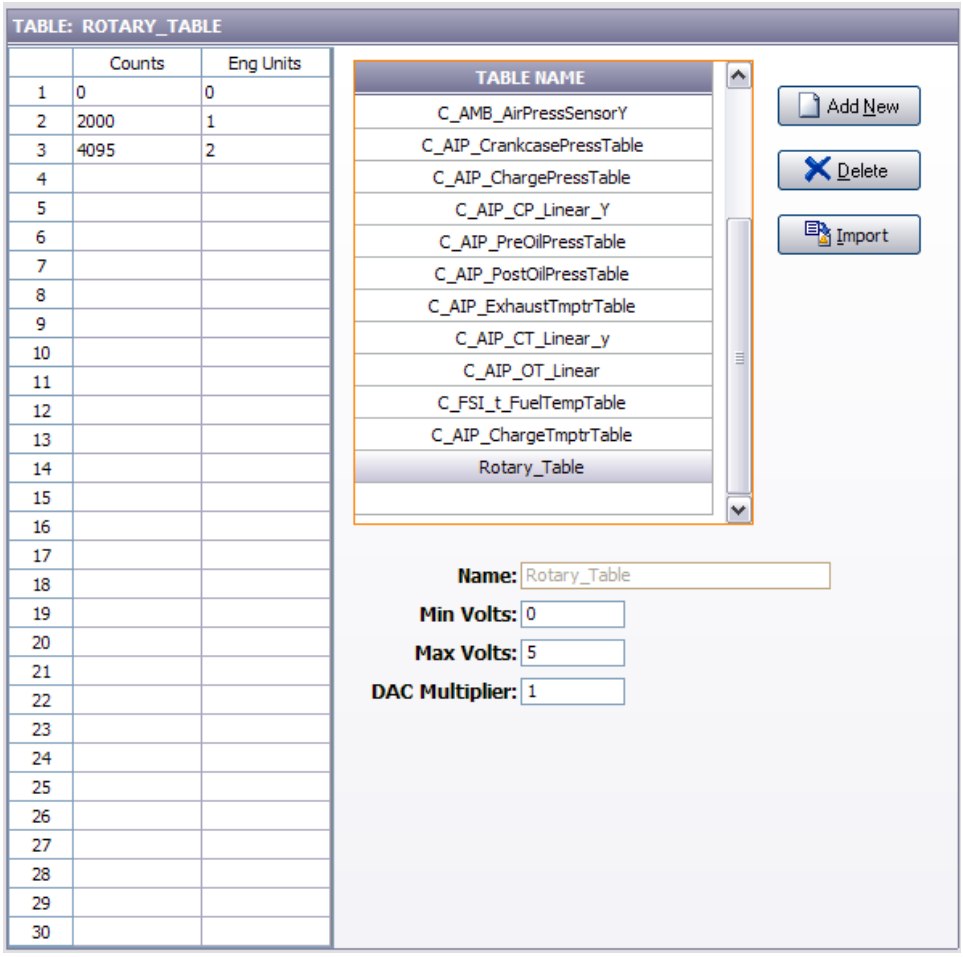
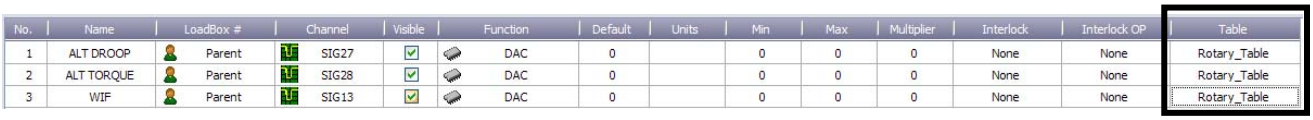


Table Reference

This graphic illustrates the table references that must be removed before deleting an interpolation table.



No.	Name	LoadBox #	Channel	Visible	Function	Default	Units	Min	Max	Multiplier	Interlock	Interlock OP	Table
1	ALT DROOP	Parent	SIG27	☑	DAC	0		0	0	0	None	None	Rotary_Table
2	ALT TORQUE	Parent	SIG28	☑	DAC	0		0	0	0	None	None	Rotary_Table
3	WIF	Parent	SIG13	☑	DAC	0		0	0	0	None	None	Rotary_Table

Section 3 – Configuring Waveform Gauges

Configuring Waveform Gauges

Introduction

The configuration for the waveform gauges, called gauges on the **Component Configuration** window, is different from all the other components as they require configuration of the waveform.

Configuring Waveform Gauges

This table outlines the steps for configuring waveform gauges.

Step	Action
1	From the **Operations** menu, **Select** the ***Configuration Panel*** option. Result: The **Component Configuration** window displays.
2	On the Menu Bar, **Click** the **Gauges** icon  . Result: The **Gauge** panel displays in the **Component Configuration** window.
3	In the top portion of the **Gauges** panel, complete the fields for each waveform gauge being used.

Field	Description
Name	**Type** in the component name.
Loadbox #	For waveform gauges, **Select** ***Wavemaker***.
Channel	**Select** the channel number from the drop down. This is the physical channel in the Wavemaker. Ensure the channel has the correct card to support the signal.
Visible	If selected, the control will display on the main window. If not selected, the control will be hidden on the main window.
Function	Select ***Freq*** for waveform gauges or DAC to control a voltage signal instead.
Default	Sets the default value for the control when the configuration is loaded or the control is reset

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Configuring Waveform Gauges, Continued

Gauge Panel

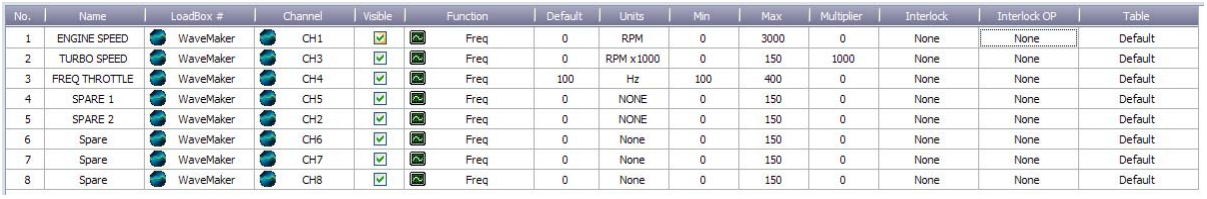
This graphic illustrates the **Gauges** panel of the **Component Configuration** window.

No.	Name	LoadBox #	Channel	Visible	Function	Default	Units	Min	Max	Multiplier	Interlock	Interlock OP	Table
1	ENGINE SPEED	WaveMaker	CH1	☑	Freq	0	RPM	0	3000	0	None	None	Default
2	TURBO SPEED	WaveMaker	CH3	☑	Freq	0	RPM x1000	0	150	1000	None	None	Default
3	FREQ THROTTLE	WaveMaker	CH4	☑	Freq	100	Hz	100	400	0	None	None	Default
4	SPARE 1	WaveMaker	CH5	☑	Freq	0	NONE	0	150	0	None	None	Default
5	SPARE 2	WaveMaker	CH2	☑	Freq	0	NONE	0	150	0	None	None	Default
6	Spare	WaveMaker	CH6	☑	Freq	0	None	0	150	0	None	None	Default
7	Spare	WaveMaker	CH7	☑	Freq	0	None	0	150	0	None	None	Default
8	Spare	WaveMaker	CH8	☑	Freq	0	None	0	150	0	None	None	Default

No.	Name	Waveform Number	Card Type	Sync	Offset	Input	Output	Teeth/Rev	Cycles/Rev	Ramp Rate	PWM HB Freq
1	ENGINE SPEED	3	Arb	Sync	0	RPM	Arb	0	2	0	0
2	TURBO SPEED	1	Dig	No Sync	0	RPM	VR	1	1	0	0
3	FREQ THROTTLE	1	Dig	No Sync	0	Freq	Hall	1	1	0	0
4	SPARE 1	1	Dig	No Sync	0	RPM	Hall	0	1	0	0
5	SPARE 2	2	Arb	Sync	0	RPM	Arb	0	2	0	0
6	Spare	1	Dig	No Sync	0	RPM	Hall	0	1	0	0
7	Spare	1	Dig	No Sync	0	RPM	Hall	0	1	0	0
8	Spare	1	Dig	No Sync	0	RPM	Hall	0	1	0	0

Top Portion of Gauges Panel

This graphic illustrates the fields in the top portion of the **Gauges** panel.



No.	Name	LoadBox #	Channel	Visible	Function	Default	Units	Min	Max	Multiplier	Interlock	Interlock OP	Table
1	ENGINE SPEED	WaveMaker	CH1	☑	Freq	0	RPM	0	3000	0	None	None	Default
2	TURBO SPEED	WaveMaker	CH3	☑	Freq	0	RPM x1000	0	150	1000	None	None	Default
3	FREQ THROTTLE	WaveMaker	CH4	☑	Freq	100	Hz	100	400	0	None	None	Default
4	SPARE 1	WaveMaker	CH5	☑	Freq	0	NONE	0	150	0	None	None	Default
5	SPARE 2	WaveMaker	CH2	☑	Freq	0	NONE	0	150	0	None	None	Default
6	Spare	WaveMaker	CH6	☑	Freq	0	None	0	150	0	None	None	Default
7	Spare	WaveMaker	CH7	☑	Freq	0	None	0	150	0	None	None	Default
8	Spare	WaveMaker	CH8	☑	Freq	0	None	0	150	0	None	None	Default

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Configuring Waveform Gauges, Continued

Configuring Waveform Gauges, Continued

This table continues to outline the steps for configuring waveform gauges.

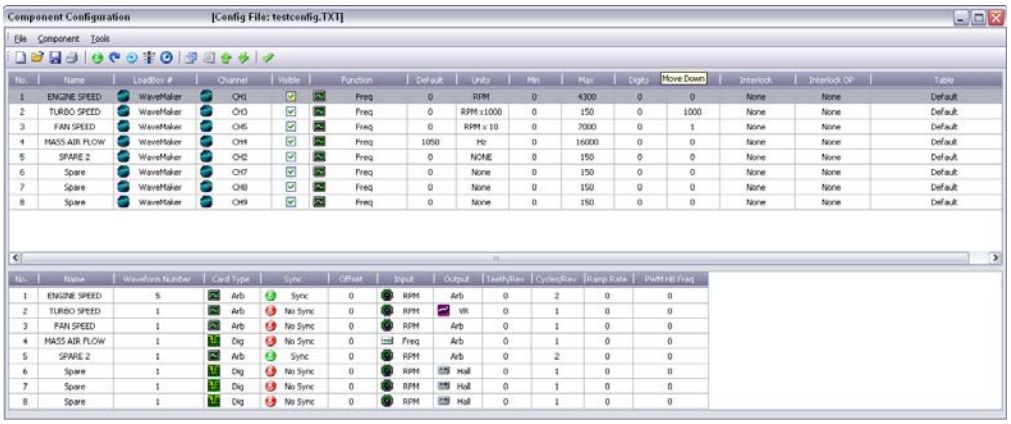
Step	Action
3	**Continued** **Field** / **Description** *Units* — **Type** in the engineering units for the component. *Min* — **Type** the minimum value for the component. This value will display on the gauge, and it must be a whole number. *Max* — **Type** the maximum value for the component. This value will display on the gauge, and it must be a whole number. *Digits* — Sets the significant digits on the displays. *Multiplier* — **Type** the multiplier to scale the component. *Interlock* — Allows component's values to be locked together. **Select** the component to which this component should be locked. *Interlock OP* — Allows the user to determine if interlocked components should be ***Non-Inverting*** or ***Inverting***. Note: This option is only used if the component is a switch. *Table* — **Sets** the interpolation table for this component. Note: This option is only used if DAQ is the selected function or a Gauge has a Hz table for its Table Axis and Freq for function.

Continued on next page

Configuring Waveform Gauges, Continued

Gauge Panel

This graphic illustrates the **Gauges** panel of the **Component Configuration** window.



Top Portion of Gauges Panel

This graphic illustrates the fields in the top portion of the **Gauges** panel.

No.	Name	LoadBox #	Channel	Visible	Function	Default	Units	Min	Max	Digits	Multiplier	Interlock	Interlock OP	Table
1	ENGINE SPEED	WaveMaker	CH1	☑	Freq	0	RPM	0	4300	0	0	None	None	Default
2	TURBO SPEED	WaveMaker	CH3	☑	Freq	0	RPM x1000	0	150	0	1000	None	None	Default
3	FAN SPEED	WaveMaker	CH5	☑	Freq	0	RPM x 10	0	7000	0	1	None	None	Default
4	MASS AIR FLOW	WaveMaker	CH4	☑	Freq	1050	Hz	0	16000	0	0	None	None	Default
5	SPARE 2	WaveMaker	CH2	☑	Freq	0	NONE	0	150	0	0	None	None	Default
6	Spare	WaveMaker	CH7	☑	Freq	0	None	0	150	0	0	None	None	Default
7	Spare	WaveMaker	CH8	☑	Freq	0	None	0	150	0	0	None	None	Default
8	Spare	WaveMaker	CH9	☑	Freq	0	None	0	150	0	0	None	None	Default

Continued on next page

Configuring Waveform Gauges, Continued

Configuring Waveform Gauges, Continued

This table continues to outline the steps for configuring waveform gauges.

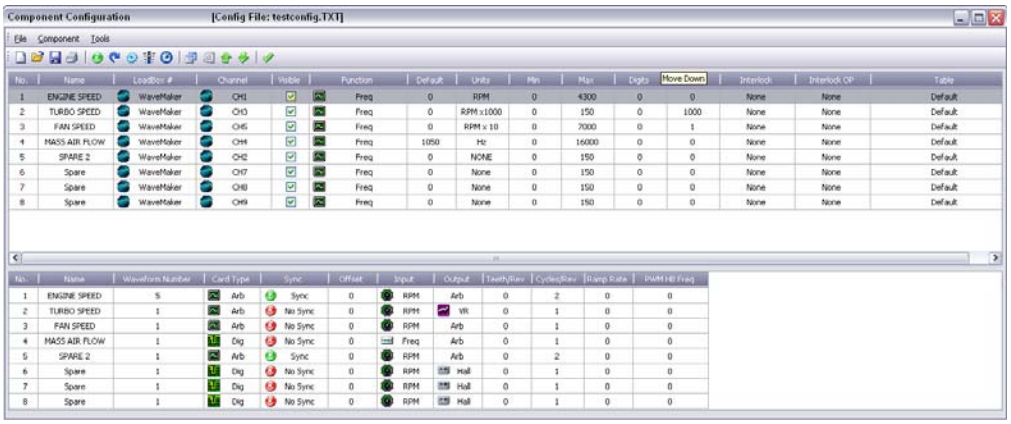
<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>4</td><td>For each waveform gauge setup, the waveform must be setup in the bottom portion of the Gauges panel.
<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>Name</td><td>The name is auto filled in from the top list.</td></tr>
<tr><td>Waveform Number</td><td>Select the waveform number that corresponds to a stored waveform. See Section 6 for current waveform number list.
Note: Contact Gartech if unsure about waveform numbers stored in the WaveMaker.</td></tr>
<tr><td>Card Type</td><td>Select the card type from Arbitrary, Digital and Digital Simulated. These are dependent on what hardware is installed. An arbitrary card can simulate a Digital card by selecting Digital Simulated.</td></tr>
<tr><td>Sync</td><td>Sets if the waveform is synchronized with other waveforms. Typically used if the signals must clock data out at the same rate.</td></tr>
<tr><td>Offset</td><td>Sets the offset of the waveform to the master clock in data points. Used to shift Arbitrary waveform data by a specific number of data points. Note: Offsets only apply to arbitrary cards.</td></tr>
<tr><td>Input</td><td>Sets the Engineering Unit for the data being sent to RPM or Frequency.</td></tr>
<tr><td>Output</td><td>Output drive signal can be Arbitrary, Hall (0 to +5v), or VR (-7v to +7v). This field should autoset to Arb if Arbitrary card is selected.</td></tr>
</table>
</td></tr>
</table>

Continued on next page

Configuring Waveform Gauges, Continued

Gauge Panel

This graphic illustrates the **Gauges** panel of the **Component Configuration** window.



Bottom Portion of Gauges Panel

This graphic illustrates the fields in the bottom portion of the **Gauges** panel used for configuring the waveforms.

No.	Name	Waveform Number	Card Type	Sync	Offset	Input	Output	Teeth/Rev	Cycles/Rev	Ramp Rate	PWM HB Freq
1	ENGINE SPEED	5	Arb	Sync	0	RPM	Arb	0	2	0	0
2	TURBO SPEED	1	Arb	No Sync	0	RPM	VR	0	1	0	0
3	FAN SPEED	1	Arb	No Sync	0	RPM	Arb	0	1	0	0
4	MASS AIR FLOW	1	Dig	No Sync	0	Freq	Arb	0	1	0	0
5	SPARE 2	1	Arb	Sync	0	RPM	Arb	0	2	0	0
6	Spare	1	Dig	No Sync	0	RPM	Hall	0	1	0	0
7	Spare	1	Dig	No Sync	0	RPM	Hall	0	1	0	0
8	Spare	1	Dig	No Sync	0	RPM	Hall	0	1	0	0

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Configuring Waveform Gauges, Continued

Configuring Waveform Gauges, Continued

This table continues to outline the steps for configuring waveform gauges.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>4</td><td>Continued
<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>Teeth/Rev</td><td>Type the teeth per revolution to use for wavemaker calculations.

Note: Applies to digital and digital simulated cards only.</td></tr>
<tr><td>Cycles/Rev</td><td>Type the cycles per revolution to use for wavemaker calculations. This is how many cycles are represented in the data that gets loaded into the Arbitrary cards. To obtain a 0.1 degree resolution, waveforms are 7200 data points which represent 2 full engine crank cycles/rev. Typically set to 2.

Note: Applies to Arbitrary cards only.</td></tr>
<tr><td>Ramp</td><td>Type the ramp rate to be used when changing values. This determines how quickly the output changes from old value to new value. Set to 0 for immediate change.</td></tr>
<tr><td>PWM HB Freq</td><td>Type the PWM heartbeat frequency if PWM output is desired. The digital card will output a constant frequency set by the PWM HB Freq and go from 0-100% duty cycle.

Note: Applies to digital cards only.</td></tr>
</table></td></tr>
<tr><td>5</td><td>When the changes are complete, Save the configuration.

Note: To immediately apply the setup to the front panel, from the File menu Select the Apply Configuration option.</td></tr>
</table>

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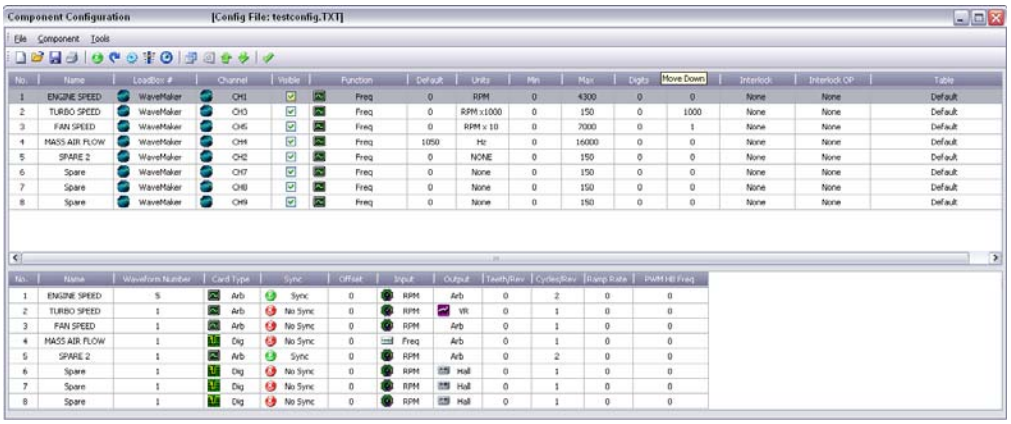
Configuring Waveform Gauges, Continued

Gauge Panel

This graphic illustrates the **Gauges** panel of the **Component Configuration** window.



Bottom Portion of Gauges Panel

This graphic illustrates the fields in the bottom portion of the **Gauges** panel used for configuring the waveforms.

No.	Name	Waveform Number	Card Type	Sync	Offset	Input	Output	Teeth/Rev	Cycles/Rev	Ramp Rate	PWM HB Freq
1	ENGINE SPEED	5	Arb	Sync	0	RPM	Arb	0	2	0	0
2	TURBO SPEED	1	Arb	No Sync	0	RPM	VR	0	1	0	0
3	FAN SPEED	1	Arb	No Sync	0	RPM	Arb	0	1	0	0
4	MASS AIR FLOW	1	Dig	No Sync	0	Freq	Arb	0	1	0	0
5	SPARE 2	1	Arb	Sync	0	RPM	Arb	0	2	0	0
6	Spare	1	Dig	No Sync	0	RPM	Hall	0	1	0	0
7	Spare	1	Dig	No Sync	0	RPM	Hall	0	1	0	0
8	Spare	1	Dig	No Sync	0	RPM	Hall	0	1	0	0

Section 4 – Configuring All Other Controls

Configuring All Other Controls

Introduction

The configuration of switches, ratiomatrics, resistives, and rotary switches is essentially the same. Some of the options in the dropdown menus will be different based on the control being configured.

Configuring All Other Controls

This table outlines the steps for configuring switches, ratiometrics, resistives, and rotary switches.

Step	Action
1	From the **Operations** menu, **Select** the ***Configuration Panel*** option. Result: The **Component Configuration** window displays.
2	On the Menu Bar, **Click** the icon for the control to setup.  Switches  POT Knob (Ratiometrics)  Sliders (Resistives)  Rotary Result: The panel for the control type displays in the **Component Configuration** window.
3	In the top portion of the component panel, complete the fields for each control being used.

Field	Description
Name	**Type** in the component name.
Loadbox #	**Select** the loadbox module for the control.
Channel	**Select** the IO Channel for the control.
Visible	**Sets** if the control is visible or not on the main window.

Continued on next page

Configuring All Other Controls, Continued

Configuration Panel

This graphic illustrates the panel for configuring other controls. This specifically illustrates a portion of the **Switches** panel.

No.	Name	LoadBox #	Channel	Visible	Function	Default	Units	Min	Max	Digits	Multiplier	Interlock	Interlock OP	Table
1	KEYSWITCH	Parent	SW32	☑	Toggle SW	1		0	0	0	0	SW#8	Non-Inverting	Default
2	KEY_Unlock	Sidecar	SW2	☑	Toggle SW	1		0	0	0	0	SW#7	Non-Inverting	Default
3	Par_SW1	Parent	SW1	☐	Toggle SW	0		0	0	0	0	None	None	Default
4	Par_SW2	Parent	SW31	☐	Toggle SW	0		0	0	0	0	None	Non-Inverting	Default
5	Par_SW3	Parent	SW3	☐	Toggle SW	0		0	0	0	0	None	None	Default
6	Par_SW4	Parent	SW4	☐	Toggle SW	0		0	0	0	0	None	None	Default
7	Par_SW5	Parent	SW5	☐	Toggle SW	0		0	0	0	0	None	None	Default
8	Par_SW6	Parent	SW6	☐	Toggle SW	0		0	0	0	0	None	None	Default
9	Par_SW7	Parent	SW7	☐	Toggle SW	0		0	0	0	0	None	None	Default
10	Par_SW8	Parent	SW8	☐	Toggle SW	0		0	0	0	0	None	None	Default
11	Brake Sw 1	Parent	SW19	☑	Toggle SW	0		0	0	0	0	SW#18	Non-Inverting	Switch_Inversion_Table
12	Brake Sw 2	Sidecar	SW1	☑	Toggle SW	0		0	0	0	0	SW#17	Non-Inverting	Switch_Inversion_Table
13	Oil Press	Parent	SW20	☑	Toggle SW	0		0	0	0	0	None	None	Switch_Inversion_Table
14	Par_SW12	Parent	SW12	☐	Toggle SW	0		0	0	0	0	None	None	Default
15	Par_SW13	Parent	SW13	☐	Toggle SW	0		0	0	0	0	None	None	Default
16	Par_SW14	Parent	SW14	☐	Toggle SW	0		0	0	0	0	None	None	Default
17	Par_SW15	Parent	SW15	☐	Toggle SW	0		0	0	0	0	None	None	Default
18	Par_SW16	Parent	SW16	☐	Toggle SW	0		0	0	0	0	None	None	Default
19	Par_SW17	Parent	SW17	☐	Toggle SW	0		0	0	0	0	None	None	Default
20	Par_SW18	Parent	SW18	☐	Toggle SW	0		0	0	0	0	None	None	Default
21	Par_SW9	Parent	SW9	☐	Toggle SW	0		0	0	0	0	None	None	Default

Continued on next page

Configuring All Other Controls, Continued

Configuring All Other Controls, Continued

This table continues to outline the steps for configuring switches, ratiometrics, resistives, and rotary switches.

Step	Action
3	**Continued** **Field** / **Description** *Function* — **Select** the function of the control. *Default* — Sets the default value for the control when the configuration is loaded or the control is reset *Min* — **Type** the minimum value for the component. This value will display on the gauge, and it must be a whole number. *Max* — **Type** the maximum value for the component. This value will display on the gauge, and it must be a whole number. *Digits* — **Select** the significant digits for the component. *Multiplier* — **Type** the multiplier to scale the component. *Interlock* — Allows component's values to be locked together. **Select** the component to which this component should be locked. *Interlock OP* — Allows the user to determine if interlocked components should be ***Non-Inverting*** or ***Inverting***. *Table* — **Sets** the interpolation table for this component.
4	When the changes are complete, **Save** the configuration. Note: To immediately apply the setup to the front panel, from the **File** menu **Select** the ***Apply Configuration*** option.

Continued on next page

Configuring All Other Controls, Continued

Configuration Panel

This graphic illustrates the panel for configuring other controls. This specifically illustrates a portion of the **Switches** panel.

No.	Name	LoadBox #	Channel	Visible	Function	Default	Units	Min	Max	Digits	Multiplier	Interlock	Interlock OP	Table
1	KEYSWITCH	Parent	SW32	☑	Toggle SW	1		0	0	0	0	SW#8	Non-Inverting	Default
2	KEY_Unlock	Sidecar	SW2	☑	Toggle SW	1		0	0	0	0	SW#7	Non-Inverting	Default
3	Par_SW1	Parent	SW1	☐	Toggle SW	0		0	0	0	0	None	None	Default
4	Par_SW2	Parent	SW31	☐	Toggle SW	0		0	0	0	0	None	Non-Inverting	Default
5	Par_SW3	Parent	SW3	☐	Toggle SW	0		0	0	0	0	None	None	Default
6	Par_SW4	Parent	SW4	☐	Toggle SW	0		0	0	0	0	None	None	Default
7	Par_SW5	Parent	SW5	☐	Toggle SW	0		0	0	0	0	None	None	Default
8	Par_SW6	Parent	SW6	☐	Toggle SW	0		0	0	0	0	None	None	Default
9	Par_SW7	Parent	SW7	☐	Toggle SW	0		0	0	0	0	None	None	Default
10	Par_SW8	Parent	SW8	☐	Toggle SW	0		0	0	0	0	None	None	Default
11	Brake Sw 1	Parent	SW19	☑	Toggle SW	0		0	0	0	0	SW#18	Non-Inverting	Switch_Inversion_Table
12	Brake Sw 2	Sidecar	SW1	☑	Toggle SW	0		0	0	0	0	SW#17	Non-Inverting	Switch_Inversion_Table
13	Oil Press	Parent	SW20	☑	Toggle SW	0		0	0	0	0	None	None	Switch_Inversion_Table
14	Par_SW12	Parent	SW12	☐	Toggle SW	0		0	0	0	0	None	None	Default
15	Par_SW13	Parent	SW13	☐	Toggle SW	0		0	0	0	0	None	None	Default
16	Par_SW14	Parent	SW14	☐	Toggle SW	0		0	0	0	0	None	None	Default
17	Par_SW15	Parent	SW15	☐	Toggle SW	0		0	0	0	0	None	None	Default
18	Par_SW16	Parent	SW16	☐	Toggle SW	0		0	0	0	0	None	None	Default
19	Par_SW17	Parent	SW17	☐	Toggle SW	0		0	0	0	0	None	None	Default
20	Par_SW18	Parent	SW18	☐	Toggle SW	0		0	0	0	0	None	None	Default
21	Par_SW9	Parent	SW9	☐	Toggle SW	0		0	0	0	0	None	None	Default

Section 5 – Configuration Options

Configuration Options

Introduction

The Configuration Options allows the user to name the tabs on the main window as well as hide tabs that are not being used.

Configuration Options

This table outlines the steps for setting the configuration options.

Step	Action
1	From the **Operations** menu, **Select** the ***Configuration Panel*** option. Result: The **Component Configuration** window displays.
2	On the Menu Bar, **Click** the **Configuration Options** icon  . Result: The **Configuration Options** panel displays in the **Component Configuration** window.
3	In the *Visibility* field, **Deselect** any tab that should be hidden on the main window.
4	In the *Tab Name* field, **Click** on a tab name to change and **Type** the new name.
5	When the changes are complete, **Save** the configuration. Note: To immediately apply the setup to the front panel, from the **File** menu **Select** the ***Apply Configuration*** option.

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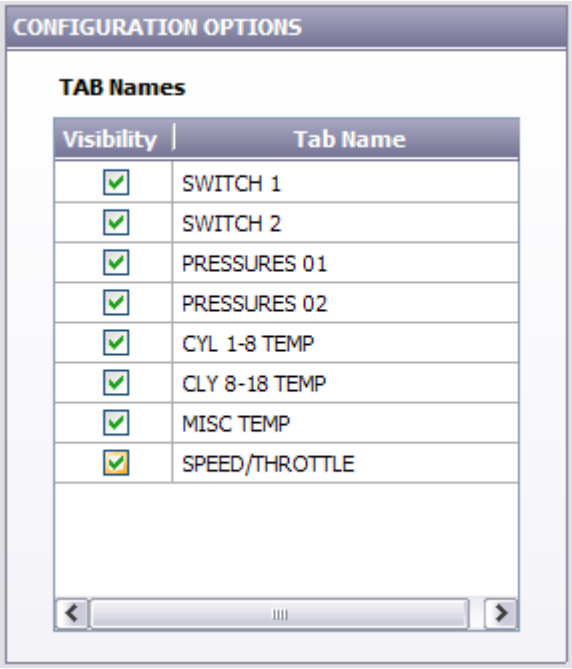
Configuration Options, Continued

Configuration Options Panel

This graphic illustrates the **Configuration Options** panel on the **Component Configuration** window.



Notes

Chapter 4 – The FMET Interface

Overview

Introduction

The Failure Mode Effects Test, FMET, is a set of actions performed during a Failure Mode Effects Analysis, FMEA. An FMEA requires the user to create specific failure situations and determine the results of those failures on multiple I/O. The GarTech FMET Box provides the ability to perform a Failure Mode Effects Test preliminarily on a bench with a LUIS as well as mounted in a system for real-world testing. It allows the user to interrupt and short ECM lines to specific fault conditions like VBATT and Ground. The GarTech FMET Interface provides a graphical user interface for communicating with the FMET box.

Physical Description

The FMET box is approximately 9”x12”x3.5”. The box can be mounted in the engine compartment to reduce wire lengths. In normal off conditions, the FMET box simply passes all of the harness signals through.

In This Chapter

This table outlines the topics covered in this chapter.

Section 1 – How To Connect an FMET Box

How To Connect an FMET Box

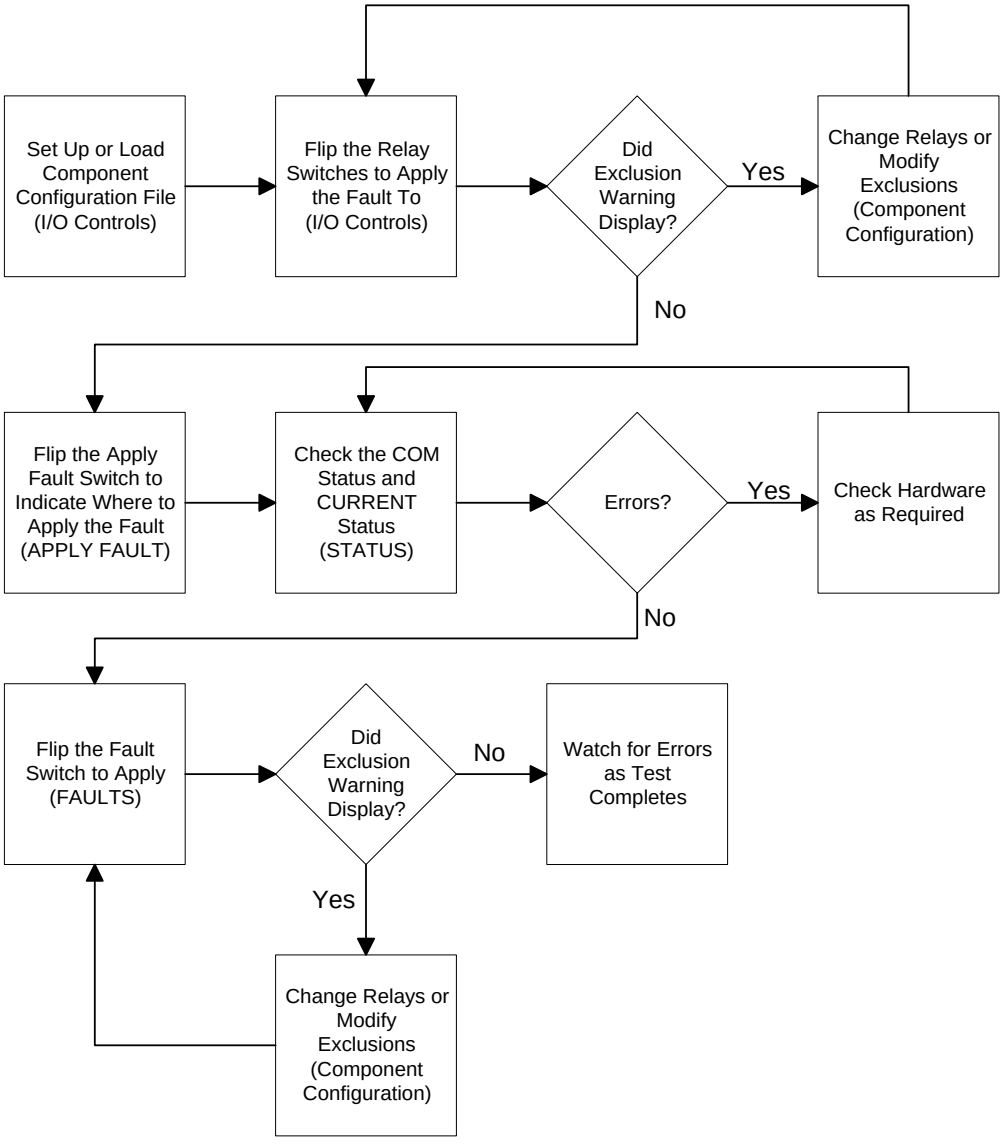
Introduction	The FMET box has a CAN interface, and only a datalink wire is required to connect the PC to the box.
Connecting the FMET Box	The FMET box is connected between the ECM and the Harness. To connect the FMET box, disconnect the wiring harness from the ECM and connect it into the FMET box cable and then back into the ECM.

Section 2 – FMET Workflow

FMET Workflow

FMET Workflow

This diagram illustrates the workflow for completing tests using the FMET Interface. This workflow assumes that all hardware is already connected.



Section 3 – The FMET Graphical Interface

Overview

Introduction

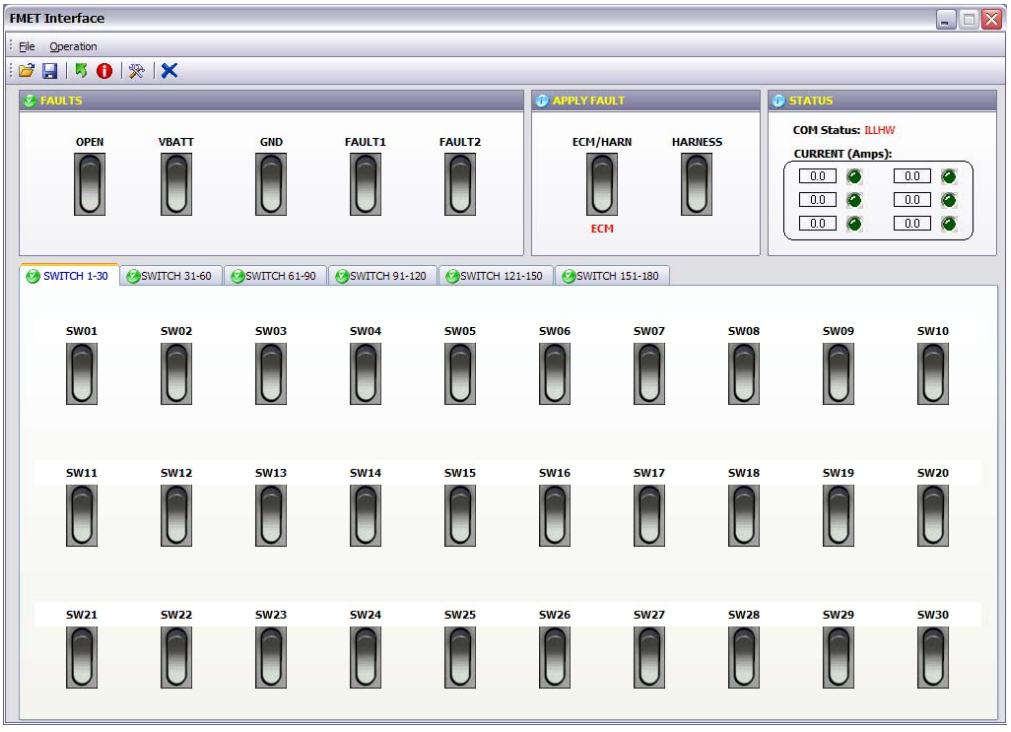
The FMET Interface provides a graphical interface for communicating with the FMET box. The FMET Interface is a part of the LUIS Graphical User Interface

How To Access the FMET Graphical Interface

To access the FMET Interface, from the LUIS Graphical Interface, **Open** the **Hardware** menu. From the **Hardware** menu, **Select** the ***FMET Unit*** option. The FMET Interface displays.

The FMET Interface

The FMET Interface is made up of six basic sections: Menu Bar, Toolbar, Faults Switches, Apply Fault Switches, Status Indicators and I/O Controls.



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Overview, Continued

In This Section This table outlines the topics covered in this section.

Menu Bar

Menus and Options

This table outlines the menus that are available as well as the options available on each menu.

Menu	*Option*	Description
File		
	Open Configuration	Opens the ***Open*** dialog box where a saved configuration can be selected and applied to the GUI
	Save Configuration As…	Opens the ***Save As*** dialog box where the current GUI configuration can be saved for later use
	Exit	Exits the FMET GUI
Operation		
	Reset -> Relays	Resets all relays
	Configuration Panel	Opens the ***Component Configuration*** window to set up the GUI
	Set Max Current	Opens the ***Relay Current*** dialog box where the maximum input current can be set in Amps to work as a fuse Note: If the Max Current is exceeded, all relays are shut off.

Toolbar

Toolbar

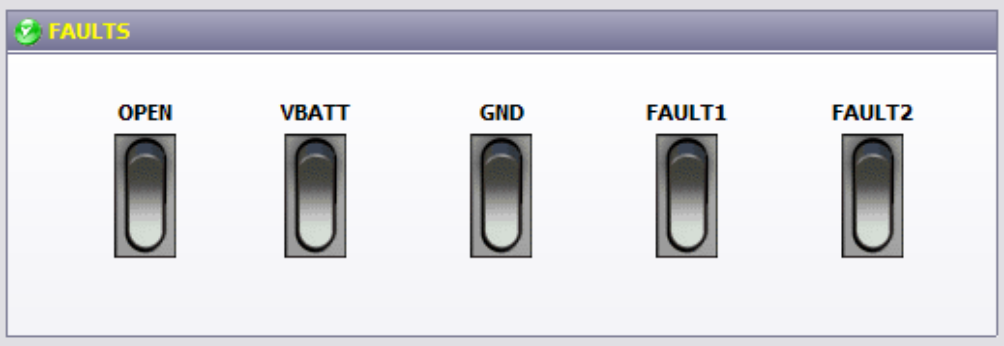
This graphic and table outlines the options available from the FMET Interface toolbar.

Icon	Description
	Open Configuration
	Save Configuration
	Reset All Relays
	Set Max Current
	Component Configuration
	Reset COM Interface

Fault Switches

Faults Switches

The Faults switches are used to apply a fault to all the selected I/O channels. The generic faults are: Open, VBATT and Ground. There are two additional customizable faults that are labeled FAULT1 and FAULT2 in the FMET Interface.



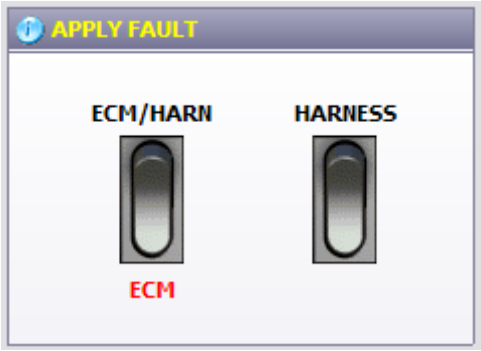
Switch Positions

The Faults switches can be in the ON or OFF position. The switch is in the ON position when the switch name is displayed in red and the top of the rocker switch is depressed. The switch is in the OFF position when the switch name is displayed in black and the bottom of the rocker switch is depressed.

Apply Fault Switches

Apply Fault Switches

The Apply Fault switches are used to set how the fault is to be applied. The appropriate Apply Fault switch should be set before flipping the Faults switch. This following table describes the possibilities.



Switch Setting	Apply Fault Through
ECM/HARN	ECM and Harness
ECM	ECM Only
HARNESS	Harness Only

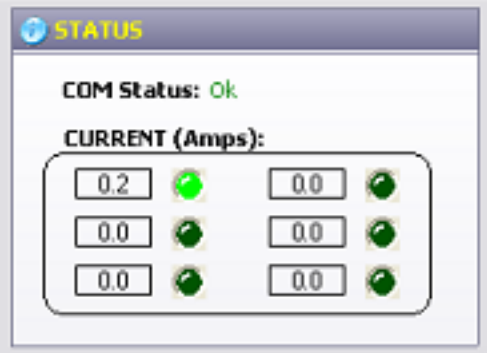
Switch Positions

The switches indicate which Apply Fault option is selected by displaying its name in red and showing the switch depressed in that direction. Clicking the Harness switch toggles between Harness being selected or ECM being selected, as the lower position of the Harness switch defaults back to ECM.

Status Indicators

Status Indicators

The status indicators section provides information on the COM Status, the current draw, in amps, through the relays on each board, as well as the status of each board.



COM Status

The COM Status indicator tells the user the current state of the hardware. This table describes the common messages.

Message	Description	Basic Troubleshooting
OK	Hardware has been found and is ready	
ILLHW	Hardware cannot be found	Check hardware connections
HWINUSE	Hardware is in use by another device	Wait until status changes to OK
BUSLIGHT	CAN Error	Reset COM Interface
BUSHEAVY	CAN Error	Reset COM Interface
BUSOFF	Can device is off	Check CAN device and then reset COM Interface

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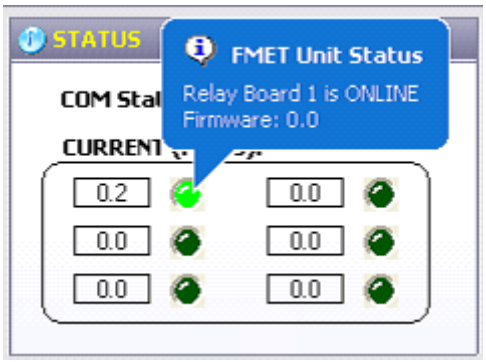
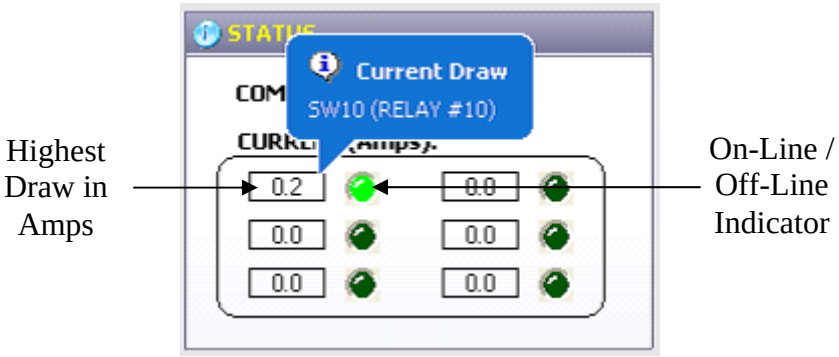
Status Indicators, Continued

Current (Amps)

The Current (Amps) section of the Status Indicators shows the status of each of the possible six boards. When a board is on-line its status light will be green, otherwise it will be black. When a board is on-line, if the cursor is held over the status light, the revision of the code that is in the mirco displays.



For each board that is on-line, the draw of all its possible 30 relays is measured and the highest draw is displayed in Amps. If the cursor is held over the Amps display, the name of the relay with the highest draw on that board will be displayed.



I/O Controls

Introduction

The I/O Control switches are divided up into tabs for each of the six possible boards. The **Component Configuration** window is used to set up the boards, the switches available as well as switch and fault exclusions.

The Component Configuration Window

The **Component Configuration** window for the FMET Interface is very similar, but not identical, to the **Component Configuration** window in the LUIS Interface. The **File** menu is the same, but the **Component** menu only offers two choices, ***Relay*** and ***Exclusion List***. The **Tools** menu does not provide a ***Table*** option, since tables are not used for FMET.

Configuring the I/O Controls

This table outlines the steps for configuring the I/O Controls.

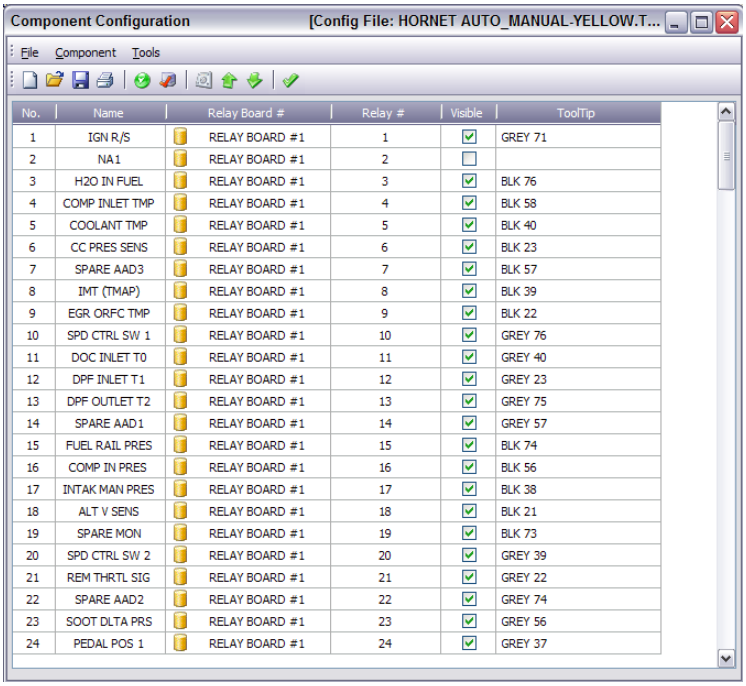
Step	Action
1	From the **Operation** menu, **Select** the ***Configuration Panel*** option. Result: The **Component Configuration** window displays
Modifying Tabs	
2	To add or remove tabs for boards, from the **Tools** menu, **Select** the ***Configuration Options*** option. Result: The ***Configuration Options*** panel displays
3	To add a tab, in the *Tab Name* field, **Type** the name of the tab, and **Click** the *Visibility* field to display a green checkmark.
4	To remove a tab, **Click** the *Visibility* tab to clear the green checkmark.
5	Once the tab names have been entered and the visibility has been set, save the configuration by **Clicking** the Save As icon on the toolbar or **Selecting** the ***Save Configuration As*** option from the **File** menu.

Continued on next page

I/O Controls, Continued

Component Configuration Window

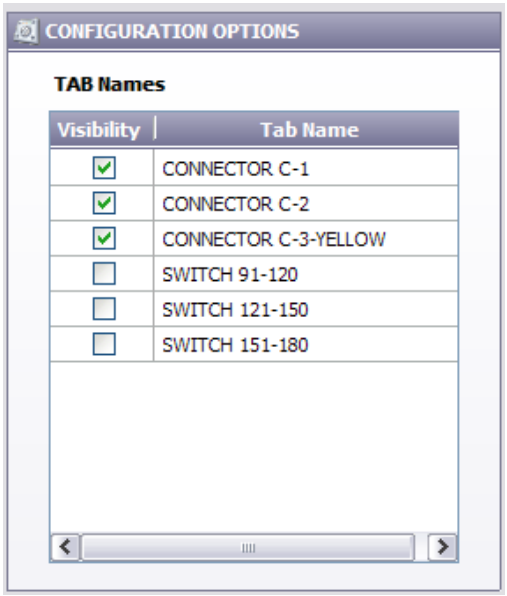
This is an example of the **Component Configuration** window.



No.	Name	Relay Board #	Relay #	Visible	ToolTip
1	IGN R/S	RELAY BOARD #1	1	☑	GREY 71
2	NA1	RELAY BOARD #1	2	☐	
3	H2O IN FUEL	RELAY BOARD #1	3	☑	BLK 76
4	COMP INLET TMP	RELAY BOARD #1	4	☑	BLK 58
5	COOLANT TMP	RELAY BOARD #1	5	☑	BLK 40
6	CC PRES SENS	RELAY BOARD #1	6	☑	BLK 23
7	SPARE AAD3	RELAY BOARD #1	7	☑	BLK 57
8	IMT (TMAP)	RELAY BOARD #1	8	☑	BLK 39
9	EGR ORFC TMP	RELAY BOARD #1	9	☑	BLK 22
10	SPD CTRL SW 1	RELAY BOARD #1	10	☑	GREY 76
11	DOC INLET T0	RELAY BOARD #1	11	☑	GREY 40
12	DPF INLET T1	RELAY BOARD #1	12	☑	GREY 23
13	DPF OUTLET T2	RELAY BOARD #1	13	☑	GREY 75
14	SPARE AAD1	RELAY BOARD #1	14	☑	GREY 57
15	FUEL RAIL PRES	RELAY BOARD #1	15	☑	BLK 74
16	COMP IN PRES	RELAY BOARD #1	16	☑	BLK 56
17	INTAK MAN PRES	RELAY BOARD #1	17	☑	BLK 38
18	ALT V SENS	RELAY BOARD #1	18	☑	BLK 21
19	SPARE MON	RELAY BOARD #1	19	☑	BLK 73
20	SPD CTRL SW 2	RELAY BOARD #1	20	☑	GREY 39
21	REM THRTL SIG	RELAY BOARD #1	21	☑	GREY 22
22	SPARE AAD2	RELAY BOARD #1	22	☑	GREY 74
23	SOOT DLTA PRS	RELAY BOARD #1	23	☑	GREY 56
24	PEDAL POS 1	RELAY BOARD #1	24	☑	GREY 37

Configuration Options Panel

This is an example of the ***Configuration Options*** panel.



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I/O Controls, Continued

Configuring the I/O Controls, Continued

This table continues to outline the steps for configuring the I/O Controls.

Step	Action
6	Once the configuration is complete and has been saved, Click the Apply icon on the toolbar or Select the Apply option from the Tools menu. Result: The Apply Configuration dialog box displays to confirm that the configuration should be applied. Click the <**Yes**> button to continue. The changes are immediately implemented.
Configuring Switches	
7	To configure the switches found on each tab, from the **Component** menu, **Select** the ***Relays*** option or **Click** the Relays icon on the toolbar. Result: The relay configuration panel displays with all possible switches listed.
8	For each switch being used, modify the fields as necessary. Note: Multiple switches can be set up for the same I/O pin. The same I/O pin can appear more than once on a single tab, or it can appear on multiple tabs.

Field	Description
Name	**Type** a name for the switch. Note: This is the name that will display on the FMET interface. It is not required.
Relay Board #	**Select** the appropriate relay board from the drowndown list.
Relay #	**Select** the correct relay # from the dropdown list.

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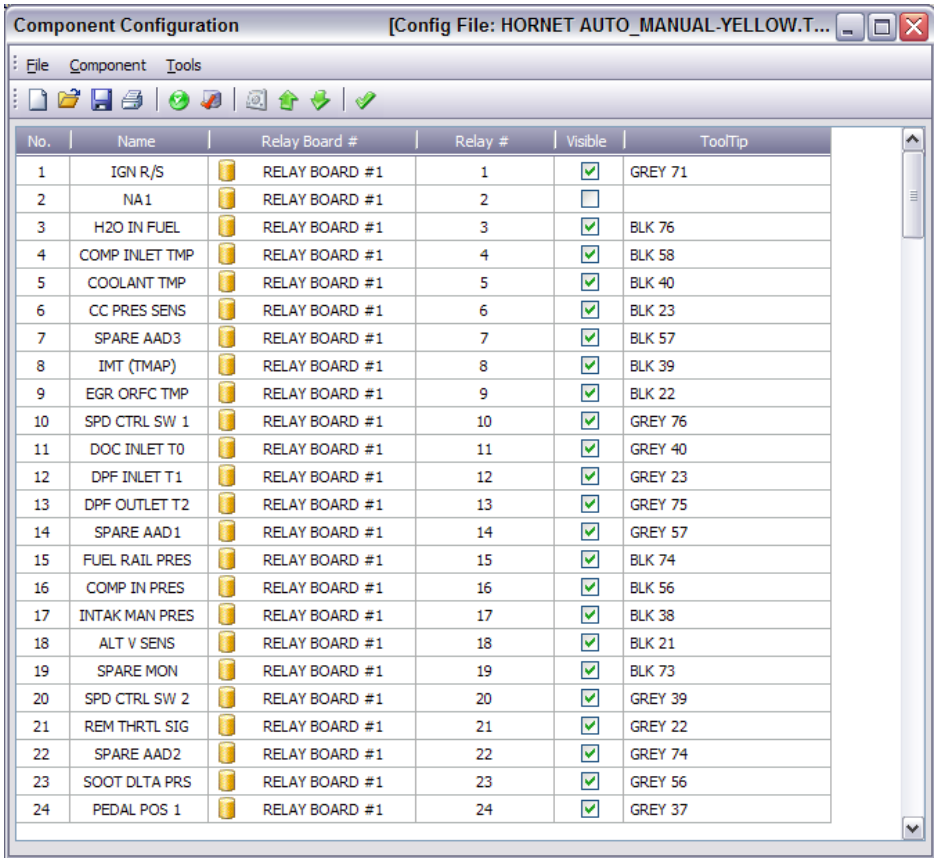
I/O Controls, Continued

Relay Configuration Panel

This is an example of the relay configuration panel.



No.	Name	Relay Board #	Relay #	Visible	ToolTip
1	IGN R/S	RELAY BOARD #1	1	☑	GREY 71
2	NA1	RELAY BOARD #1	2	☐	
3	H2O IN FUEL	RELAY BOARD #1	3	☑	BLK 76
4	COMP INLET TMP	RELAY BOARD #1	4	☑	BLK 58
5	COOLANT TMP	RELAY BOARD #1	5	☑	BLK 40
6	CC PRES SENS	RELAY BOARD #1	6	☑	BLK 23
7	SPARE AAD3	RELAY BOARD #1	7	☑	BLK 57
8	IMT (TMAP)	RELAY BOARD #1	8	☑	BLK 39
9	EGR ORFC TMP	RELAY BOARD #1	9	☑	BLK 22
10	SPD CTRL SW 1	RELAY BOARD #1	10	☑	GREY 76
11	DOC INLET T0	RELAY BOARD #1	11	☑	GREY 40
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13	DPF OUTLET T2	RELAY BOARD #1	13	☑	GREY 75
14	SPARE AAD1	RELAY BOARD #1	14	☑	GREY 57
15	FUEL RAIL PRES	RELAY BOARD #1	15	☑	BLK 74
16	COMP IN PRES	RELAY BOARD #1	16	☑	BLK 56
17	INTAK MAN PRES	RELAY BOARD #1	17	☑	BLK 38
18	ALT V SENS	RELAY BOARD #1	18	☑	BLK 21
19	SPARE MON	RELAY BOARD #1	19	☑	BLK 73
20	SPD CTRL SW 2	RELAY BOARD #1	20	☑	GREY 39
21	REM THRTL SIG	RELAY BOARD #1	21	☑	GREY 22
22	SPARE AAD2	RELAY BOARD #1	22	☑	GREY 74
23	SOOT DLTA PRS	RELAY BOARD #1	23	☑	GREY 56
24	PEDAL POS 1	RELAY BOARD #1	24	☑	GREY 37

Continued on next page

I/O Controls, Continued

Configuring the I/O Controls, Continued

This table continues to outline the steps for configuring the I/O Controls.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>8</td><td>Continued
<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>Visible</td><td>If the relay should be visible, ensure that a green checkmark displays, otherwise make sure that the field is blank.</td></tr>
<tr><td>ToolTip</td><td>Type a brief description to display if the mouse is hovered over the switch.
Note: The ToolTip is most commonly used to display Connector Numbers with Pin Number on the ECM.</td></tr>
</table></td></tr>
<tr><td>9</td><td>To rearrange switches, use the Move Up and Move Down icons on the toolbar, or the Move Up and Move Down options from the Tools menu.</td></tr>
<tr><td>10</td><td>Once the switches are all set as needed, save the configuration by Selecting the Save Configuration As option from the File menu or Clicking the Save As icon in the toolbar.
Note: The Print icon on the toolbar, or the Print option on the File menu can be used to easily review the configuration and box connections.</td></tr>
<tr><td>11</td><td>Once the configuration is complete and has been saved, Click the Apply icon on the toolbar or Select the <i>Apply</i> option from the Tools menu.
Result: The <i>Apply Configuration</i> dialog box displays to confirm that the configuration should be applied. Click the <Yes> button to continue. The changes are immediately implemented.</td></tr>
</table>

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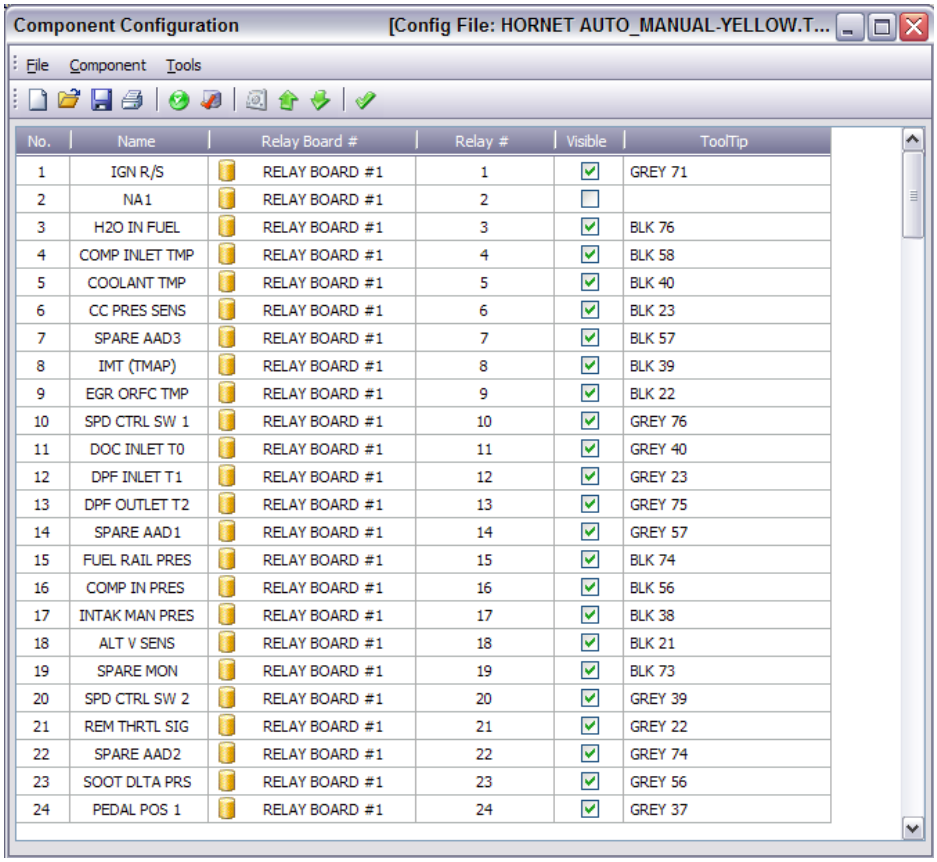
I/O Controls, Continued

Relay Configuration Panel

This is an example of the relay configuration panel.



No.	Name	Relay Board #	Relay #	Visible	ToolTip
1	IGN R/S	RELAY BOARD #1	1	☑	GREY 71
2	NA1	RELAY BOARD #1	2	☐	
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4	COMP INLET TMP	RELAY BOARD #1	4	☑	BLK 58
5	COOLANT TMP	RELAY BOARD #1	5	☑	BLK 40
6	CC PRES SENS	RELAY BOARD #1	6	☑	BLK 23
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10	SPD CTRL SW 1	RELAY BOARD #1	10	☑	GREY 76
11	DOC INLET T0	RELAY BOARD #1	11	☑	GREY 40
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14	SPARE AAD1	RELAY BOARD #1	14	☑	GREY 57
15	FUEL RAIL PRES	RELAY BOARD #1	15	☑	BLK 74
16	COMP IN PRES	RELAY BOARD #1	16	☑	BLK 56
17	INTAK MAN PRES	RELAY BOARD #1	17	☑	BLK 38
18	ALT V SENS	RELAY BOARD #1	18	☑	BLK 21
19	SPARE MON	RELAY BOARD #1	19	☑	BLK 73
20	SPD CTRL SW 2	RELAY BOARD #1	20	☑	GREY 39
21	REM THRTL SIG	RELAY BOARD #1	21	☑	GREY 22
22	SPARE AAD2	RELAY BOARD #1	22	☑	GREY 74
23	SOOT DLTA PRS	RELAY BOARD #1	23	☑	GREY 56
24	PEDAL POS 1	RELAY BOARD #1	24	☑	GREY 37

Continued on next page

I/O Controls, Continued

Configuring the I/O Controls, Continued

This table continues to outline the steps for configuring the I/O Controls.

Step	Action
Setting Exclusions	
12	Exclusions can be set to prevent relays from tripping under certain conditions. To set exclusions, **Click** the Exclusions icon on the toolbar or **Select** the ***Exclusion List*** option from the **Component** menu. Result: The ***Exclusion List*** panel displays.
13	To set an exclusion, in the first *Name* field, **Select** the appropriate relay or fault from the dropdown list. In the second *Name* field, **Select** the appropriate relay or fault from the dropdown list. Note: Exclusions are mutually exclusive. It doesn't matter which relay or fault is listed first or second. As long as one relay is switched ON the other cannot be switched ON. Result: The *Relay No.* fields are automatically populated.
14	The <**Delete**> button can be used to remove exclusions.
17	Once all the exclusions have been set, save the configuration by **Selecting** the ***Save Configuration As*** option from the **File** menu or **Clicking** the Save As icon in the toolbar.
18	Once the exclusions have been set and saved, **Click** the Apply icon on the toolbar or **Select** the ***Apply*** option from the **Tools** menu. Result: The ***Apply Configuration*** dialog box displays to confirm that the configuration should be applied. **Click** the <**Yes**> button to continue. The changes are immediately implemented.
19	Once the boards, relays and exclusions have been set, saved and applied, close the **Component Configuration** window. Note: If the FMET Interface does not reflect the changes made, the changes must not have been applied. Re-open the **Component Configuration** window, load the saved configuration files and **Apply** the changes.

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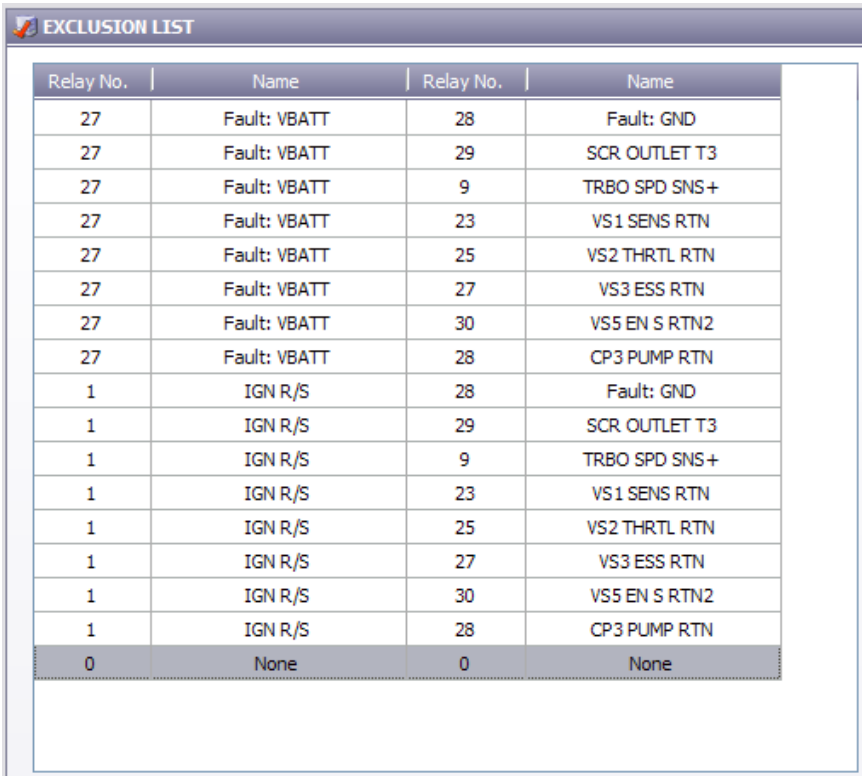
I/O Controls, Continued

Exclusion List Panel

This is an example of the ***Exclusion List*** panel.



Relay No.	Name	Relay No.	Name
27	Fault: VBATT	28	Fault: GND
27	Fault: VBATT	29	SCR OUTLET T3
27	Fault: VBATT	9	TRBO SPD SNS+
27	Fault: VBATT	23	VS1 SENS RTN
27	Fault: VBATT	25	VS2 THRTL RTN
27	Fault: VBATT	27	VS3 ESS RTN
27	Fault: VBATT	30	VS5 EN S RTN2
27	Fault: VBATT	28	CP3 PUMP RTN
1	IGN R/S	28	Fault: GND
1	IGN R/S	29	SCR OUTLET T3
1	IGN R/S	9	TRBO SPD SNS+
1	IGN R/S	23	VS1 SENS RTN
1	IGN R/S	25	VS2 THRTL RTN
1	IGN R/S	27	VS3 ESS RTN
1	IGN R/S	30	VS5 EN S RTN2
1	IGN R/S	28	CP3 PUMP RTN
0	None	0	None

Notes

Chapter 5 – Appendix

Overview

Introduction The following topics discuss some details of LUIS specifications and troubleshooting methods.

In This Section This table outlines the topics covered in this chapter.

Section 1 – Waveforms

Waveforms

Introduction

The Wavemaker inside of LUIS has built in support for specific waveform data. The user can select specific waveforms from the Configuration Screen and these will be loaded on power cycle. Only one waveform is needed to load both waveforms into the first two channels.

Waveform Data

This table describes the current support for the specific waveforms.

Waveform Number	Action
1	60-2 / 6+1 Hall (ISB)
2	24+1 / 24+1 VR
3	60-2 / 6+1 Hall (HHP)
4	24+1 / 24+1 Hall
5	60-2 / 12+1 Hall (MY07)
6	60-2 / 24+1 Hall (HHP 45/60)
7	N/A
8	N/A
9	60-2 / 12+1 Hall (MY07)
10	N/A
11	60-2 / 8+1 Hall
12	N/A
13	60-2 / 4+1 Hall
14	N/A
15	N/A

Section 2 – RS232 Interface

RS232 Interface

Introduction

The RS232 port on the rear panel of LUIS supports eight commands. The port setup is 19.2k bits per second, 8 data bits, No Parity, 1 stop bit, and No flow control.

RS232 Commands

This table describes the valid RS232 commands.

Description	Symbol	Format	Example
Rear Axle Ratio Change	A	Rear axle ratio as a floating point number. The decimal point is always the 3rd character. If less than 10, a leading zero must be included. Data range: 0 - 99.99	A05.29XXX sets the new rear axle ratio to 5.29. The vehicle speed signal will be recalculated with the new RAR value.
Waveform type change request. This parameter allows the user to select from a list of available crank and cam waveforms. The system will produce waveforms based on default settings	E	Waveform Type as a whole number. If less than 10, a leading zero must be included	E011500XX sets the new waveform to type "01" and the new engine speed request to 1500rpm
Fan speed change request	F	Fan Speed as a whole number in RPM. Leading zero(s) must be included for and speed request smaller than 1000 RPM. Data range 0 - 9999	F1234XXXX sets the new Fan Speed to 1,234 RPM
Turbo speed change request	G	Turbo speed as a floating point number in KRPM. Leading zero(s) must be included for any speed request smaller than 100 KRPM. Data range: 0 - 999.9	G012.4XXXX sets the new turbo speed to 12,400 RPM
VSS teeth per interrupt change request.	I	Number of teeth per interrupt as a whole number. If less than 10, a leading zero must be included. Data Range: 0 - 99	I16XXXXXX sets the new teeth per interrupt values. The vehicle speed signal will be recalculated with the new value.

Continued on next page

RS232 Interface, Continued

RS232 Commands, Continued

This table continues to describe the valid RS232 commands.

Description	Symbol	Format	Example
ESS/EPS change request	R	Engine speed as a whole number in RPM. Leading zeros must be added for any speed request smaller than 1000 RPM. Data range: 0 - 9999	R1234XXXX sets the new ESS/EPS speed to 1,234 RPM.
Tire size change request	T	Tire size as a whole number in revolutions per mile. If less than 100, leading zero(s) must be included.	T508XXXXX sets the new tire size to 508 rev/mile. The vehicle speed signal will be recalculated with the new value
Vehicle speed change request	V	Vehicle speed as a floating point number in MPH. If less than 100, leading zero(s) must be included. Data range: 0 - 999.99	V012.34XX sets the new vehicle speed to 12.34 MPH.

Channel Assignment

The following table lists the I/O channel assignments that must be followed when sending commands via the RS232 interface.

Analog Outputs	Channel Numbers
Parent Box	1-32
Parent Sidecar	33 - 44
Child 1 Box	45 - 76
Child 2 Box	77 - 108

Switches	Channel Numbers
Parent Box	1 - 32
Parent Sidecar	33 - 40
Child 1 Box	41 - 72
Child 2 Box	73 - 104

Section 3 – DAC Specifics

DAC Specifics

Introduction

The LUIS hardware has limitations on how accurate it can represent an Analog voltage. These limitations are based on the Digital to Analog Converters (DAC's) that are used to output the analog voltage.

DAC Limits

This table describes the DAC limitations.

Component	DAC Resolution	Reference Voltage Limit
Parent Box	12 Bits	5.5v
Parent Sidecar	Ch 1-8: 12 Bits Ch 9-12: 8 Bits	Ch 1-8: 5.5v Chan 9-12: 32v
Child 1 Box	12 Bits	5.5v
Child 2 Box	12 Bits	5.5v

Section 4 – Address Switch

Address Switch

Introduction

The LUIS hardware has a selector switch on the front panel to establish its address on the data link bus. The address determines if the box is recognized as a Parent or Child box.

Switch Settings

This table describes the switch settings

Number	Address
0	Parent
1	Child 1
2	Child 2
3-9	Do Not Use

Section 5 – Table Calibration

Table Calibration

Introduction

LUIS uses look up tables to correlate engineering units that are on the GUI interface to analog values that it outputs to the unit under test. The user can adjust these values so the engineering units on the GUI match what the unit under test calculates it to be.

Table Calibration

This table describes the table calibration procedure.

Step	Action
1	From the **Operations** menu, **Select** the ***Configuration Panel*** option. Result: The **Component Configuration** window displays.
2	On the Menu Bar, **Click** the **Tables** icon  . Result: The **Table** panel displays in the **Component Configuration** window.
3	Select the table from the list of tables that need to be calibrated.
4	The table first needs to be very simple so a full range can be achieved. This is done by setting two full range points for the sensor. In the table data on the left pane on line 1 enter 0 counts and 0 for Eng Units.
5	On line 2 enter 1023 for counts and the maximum engineering unit (i.e. 100 for 100% throttle). Delete all other entries for the table.
6	Connect a tool that can communicate with the unit under test and display the parameters that need to be calibrated.
7	Go back to the LUIS Main panel and slowly adjust the knob/slider until the tool that's communicating to the unit under test reads the lowest reading (i.e. when throttle goes from 0% to 1%). Record the LUIS value.

Continued on next page

Table Calibration, Continued

Table Calibration, Continued

This table continues to describe the table calibration procedure.

Step	Action
8	Continue slowly increasing the knob/slide on LUIS GUI until the tool that's communicating to the unit under test reads the maximum value for that sensor (i.e. when throttle is at 100%). Record the value that is on the LUIS GUI.
9	In the LUIS table for that sensor, change the first count value in row one to (1023 * LUIS first value) and in row two (1023 * LUIS second value). The table now has two valid points and is complete.

Section 6 – Troubleshooting

Troubleshooting COM Status

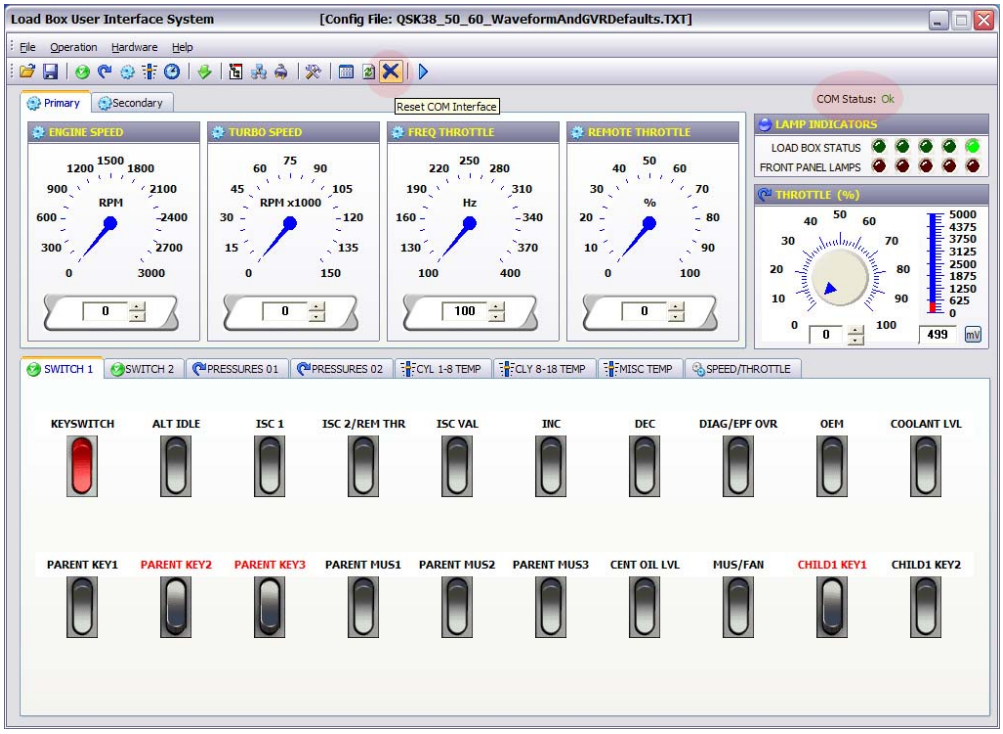
Introduction

LUIS has a number of cable connections and is a complex electronic test instrument. The items listed in this section describe the most common issues that might arise while using LUIS.

Troubleshooting COM Status

To troubleshoot the COM Status, read the COM Status on the top right of the LUIS GUI and refer to the table on the next page.

Note: After making corrections to the setup, the <**Reset COM Interface**> button may need to be clicked.



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Troubleshooting COM Status, Continued

COM Status

This table gives troubleshooting suggestions based on the COM Status on the top right of the LUIS GUI.

COM Status	Action
OK	Check the lamp indicators just below the COM Status on the LUIS GUI. If the load box light is not ON, make sure power for all the load boxes is turned ON. If your load box has a sidecar circuit, verify that the CAN cable connections in the back of the sidecar are plugged into the Parent box and your PC is connected into the sidecar CAN connector. Note: For more information, see **Section 2 - How to Setup A LUIS** in this document.
BUSHEAVY, OVERRUN	Usually caused by bad connection from the Peak adapter to LUIS or an improper amount of CAN cable termination resistors. The LUIS hardware requires a minimum of one and maximum of two 120 ohm termination resistors on the CAN bus for proper operation. For more information about how to construct a CAN node see the SAE J1939-11 specification. Also could be the result of other datalink devices on the CAN bus using an inappropriate amount of bandwidth.
BUSOFF	Check the Peak adapter settings in the NetConfig software that gets installed with LUIS by **Clicking** <**Start**> -> ***All Programs*** -> ***PCAN*** -> ***NetConfig***. After running this program, **Select** PEAK USB-CAN, (select PCI if your setup uses a PCI-to-CAN adapter), from the list and then select the Net. Edit the Net and verify that the CAN baud rate is set for 250Kbit/sec. Also see BUSHEAVY section.

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Troubleshooting COM Status, Continued

COM Status, Continued

This table continues to give troubleshooting suggestions based on the COM Status on the top right of the LUIS GUI.

COM Status	Action
ILLHW	Open up **Control Panel** in Windows and **DoubleClick** on the **CAN Hardware** icon. Select the *USB* radio button at the top of the screen and **Click** <**OK**>, (select PCI if your setup uses a PCI-to-CAN adapter). Restart LUIS. Verify that the Net name that the LUIS software is using is the connected to the hardware. In LUIS **Select Hardware->*Peak Adapter->Set Net Name***. This name must be the same as the one in NetConfig software. Run the NetConfig software by **Clicking** <**Start**> **->** ***All Programs* -> *PCAN* -> *NetConfig***. Then select the Peak adapter being used. The Nets for that device are then listed underneath and one of the Nets should match what LUIS is set for. The default Net name for LUIS is LUIS_Net_1. The bus speed must be set to 250Kbit/sec.
NOVXD	Verify that the PEAK adapter is plugged into your PC's USB port or PCI slot. If not, connect the adapter and re-start the LUIS program.
HWINUSE	Another application is using the Peak hardware and not using the same Net name that LUIS is using. Change the Net name in LUIS by selecting **Hardware->*Peak Adapter->Set Net Name*** to the same name as the other application.

Troubleshooting Closed Loop Engine Speed

Troubleshooting Closed Loop Engine Speed

These tables outline the steps for troubleshooting Closed Loop Engine Speed.

Symptom: Engine does not start, RPM gauge does not move.

Step	Action
1	Verify that the LOAD BOX STATUS indicator lamps are working correctly. Note: In most cases this means that Parent, Sidecar and Wavemaker are all Online.
2	Verify to following: • ECM wiring harness is fully connected • VBATT power supply is connected to LUIS and turned on • VBATT switch on LUIS GUI is turned ON • Key switch is turned ON • Verify correct LUIS configuration file is loaded for ECM under test • Set PERCENT LOAD slider to 0 • Set GAIN ADJUST slider to 300 • Set OPEN/CLOSED loop switch to CLOSED loop. If already in CLOSED position, toggle to OPEN and back to CLOSED loop • ECM under test supports J1939 broadcast of Percent Load and Engine Speed

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Troubleshooting COM Status, Continued

Troubleshooting Closed Loop Engine Speed, Continued

These tables continue to outline the steps for troubleshooting Closed Loop Engine Speed.

Symptom: Engine RPM dies without reaching idle RPM

Step	Action
1	Verify PERCENT LOAD slider is set to 0.
2	Increase GAIN ADJUST slider and try again.
3	Verify the ECM control software is not trying to command a shutdown.

Symptom: Engine RPM does not respond to Throttle input.

Step	Action
1	Verify there are no active ECM faults which cause fueling and/or speed derates.
2	If ECM calibration required idle validation, turn on the LUIS AUTO IVS switch. Cycle the throttle a few times to eliminate Throttle and IVS fauly codes.

Symptom: Engine RPM is unstable

Step	Action
1	Adjust GAIN ADJUST slider and PERCENT LOAD sliders until RPM becomes stable.

Section 7 – Connectors and Pinout

Connectors

Introduction

The Parent LUIS box has three 50 pin connectors on top that interface the load box to the unit under test. These interface connectors are all Deutsch 50 pin connectors. The Sidecar also has a 50 pin connector, and an additional 1 or 2 rear panel green connectors. The pinout of the green connectors may be application specific. Please consult your ECM's LUIS wiring diagram for green connector pinout information.

Connectors

This table describes the connector pinout information.

Unit	Connectors
Parent	50-01, 50-02, 50-03
Sidecar	50-04
Child 1	50-01, 50-02, 50-03
Child 2	50-01, 50-02, 50-03

Connector Pinout – Parent/Child 1/Child 2/ Pin Key 01

Parent/Child 1/ Child 2/ Pin Key 01

This table gives the connector pinout for Parent/Child 1/Child 2/Pin Key 01.

Pin	Function	I/O	Range	Notes
1	Lamp 3 low side	IN	0-VBATT	Low side driver input for front panel LED (high side = key switch)
2	Lamp 4 low side	IN	0-VBATT	Low side driver input for front panel LED (high side = key switch)
3	Lamp 5 low side	IN	0-VBATT	Low side driver input for front panel LED (high side = key switch)
4	5.5V	OUT		LUIS power supply reference output
5	AD0	IN	0-3.3v	Analog signal input with internal 10k pullup to 3.3v
6	AD1	IN	0-3.3v	Analog signal input with internal 10k pullup to 3.3v
7	Ground	OUT		Unswitched Battery Return
8	N/C			Not used
9	N/C			Not used
10	N/C			Not used
11	N/C			Not used
12	Load 8A	IN	47 ohm	Connect to driven side of Load
13	Load 1+	IN	47 ohm	High side of Load (low side = ground)
14	Load 2+	IN	47 ohm	High side of Load (low side = ground)
15	Load 3+	IN	47 ohm	High side of Load (low side = ground)
16	Load 4+	IN	47 ohm	High side of Load (low side = ground)
17	Load 5+	IN	47 ohm	High side of Load (low side = ground)
18	Load 6+	IN	47 ohm	High side of Load (low side = ground)
19	Load 7A	IN	47 ohm	Connect to driven side of load
20	Load 7B	IN	47 ohm	Connect to common side of load
21	N/C			Not used
22	Load 8B	IN	47 ohm	Connect to common side of load
23	Load 9A	IN	47 ohm	Connect to driven side of load
24	Load 9B	IN	47 ohm	Connect to common side of load
25	Ground	OUT		Unswitched Battery Return

Continued on next page

Connector Pinout – Parent/Child 1/Child 2/ Pin Key 01,
Continued

Parent/Child 1/ Child 2/ Pin Key 01, Continued

This table continues to give the connector pinout for Parent/Child 1/Child 2/Pin Key 01.

Pin	Function	I/O	Range	Notes
26	Lamp 1 low side	IN	0-VBATT	Low side driver input for front panel LED (high side = key switch)
27	Lamp 2 low side	IN	0-VBATT	Low side driver input for front panel LED (high side = key switch)
28	Load 18B	IN	10k	Connect to common side of load
29	Load 18A	IN	10k	Connect to driven side of load
30	Load 17B	IN	10k	Connect to common side of load
31	Load 17A	IN	10k	Connect to driven side of load
32	Load 16B	IN	47 ohm	Connect to common side of load
33	Load 16A	IN	47 ohm	Connect to driven side of load
34	Ground	OUT		
35	Ground	OUT		
36	Ground	OUT		
37	Ground	OUT		
38	Ground	OUT		
39	Load 15B	IN	47 ohm	Connect to common side of load
40	Load 15A	IN	47 ohm	Connect to driven side of load
41	Load 14B	IN	47 ohm	Connect to common side of load
42	Load 14A	IN	47 ohm	Connect to driven side of load
43	Load 13B	IN	47 ohm	Connect to common side of load
44	Load 13A	IN	47 ohm	Connect to driven side of load
45	Load 12B	IN	47 ohm	Connect to common side of load
46	Load 12A	IN	47 ohm	Connect to driven side of load
47	Load 11B	IN	47 ohm	Connect to common side of load
48	Load 11A	IN	47 ohm	Connect to driven side of load
49	Load 10B	IN	47 ohm	Connect to common side of load
50	Load 10A	IN	47 ohm	Connect to driven side of load

Connector Pinout – Parent/Child 1/Child 2/ 50 Pin Key 02

Parent/Child 1/ Child 2/ 50 Pin Key 02

This table gives the connector pinout for Parent/Child 1/Child 2/50 Pin Key 02.

Pin	Function	I/O	Range	Notes
1	Channel 1	OUT	0-?	Open collector output (requires external pullup)
2	Channel 2	OUT	0-?	Open collector output (requires external pullup)
3	Channel 3	OUT	0-?	Open collector output (requires external pullup)
4	Channel 4	OUT	0-?	Open collector output (requires external pullup)
5	Channel 5	OUT	0-?	Open collector output (requires external pullup)
6	Channel 6	OUT	0-?	Open collector output (requires external pullup)
7	Channel 7	OUT	0-?	Open collector output (requires external pullup)
8	Channel 8	OUT	0-?	Open collector output (requires external pullup)
9	Channel 9	OUT	0-?	Open collector output (requires external pullup)
10	Channel 10	OUT	0-?	Open collector output (requires external pullup)
11	Channel 11	OUT	0-?	Open collector output (requires external pullup)
12	Channel 12	OUT	0-?	Open collector output (requires external pullup)
13	Channel 13	OUT	0-?	Open collector output (requires external pullup)
14	Channel 14	OUT	0-?	Open collector output (requires external pullup)
15	Channel 15	OUT	0-VSENS1	Sensor output
16	Channel 16	OUT	0-VSENS1	Sensor output
17	Channel 17	OUT	0-VSENS2	Sensor output
18	Channel 18	OUT	0-VSENS2	Sensor output
19	Channel 19	OUT	0-VSENS2	Sensor output
20	Channel 20	OUT	0-VSENS2	Sensor output
21	Channel 21	OUT	0-VSENS3	Sensor output
22	Channel 22	OUT	0-VSENS3	Sensor output
23	Channel 23	OUT	0-VSENS3	Sensor output
24	Channel 24	OUT	0-VSENS3	Sensor output
25	Channel 25	OUT	0-VSENS4	Sensor output

Continued on next page

Connector Pinout – Parent/Child 1/Child 2/ 50 Pin Key 02, Continued

Parent/Child 1/ Child 2/ 50 Pin Key 02, Continued

This table continues to give the connector pinout for Parent/Child 1/Child 2/50 Pin Key 02.

Pin	Function	I/O	Range	Notes
26	Channel 26	OUT	0-VSENS4	Sensor output
27	Channel 27	OUT	0-VSENS4	Sensor output
28	Channel 28	OUT	0-VSENS4	Sensor output
29	Private CAN+	IN		No internal connection
30	Private CAN-	IN		No internal connection
31	Private CAN Shield	IN		No internal connection
32	Public J1939+	I/O		LUIS control / monitor datalink
33	Public J1939-	I/O		LUIS control / monitor datalink
34	Public J1939 Shield	IN		LUIS control / monitor datalink
35	Ground	OUT		Sensor output
36	Ground	OUT		Sensor output
37	Ground	OUT		Sensor output
38	Ground	OUT		Sensor output
39	Ground	OUT		Sensor output
40	VSENS5	IN	0-5.5v	Sensor Supply for Channel 29-32
41	VSENS4	IN	0-5.5v	Sensor Supply for Channel 25-28
42	VSENS3	IN	0-5.5v	Sensor Supply for Channel 21-24
43	VSENS2	IN	0-5.5v	Sensor Supply for Channel 17-20
44	VSENS1	IN	0-5.5v	Sensor Supply for Channel 15-16
45	Channel 16A	OUT	0-?	Open collector output (requires external pullup)
46	Channel 17A	OUT	0-?	Open collector output (requires external pullup)
47	Channel 32	OUT	0-VSENS5	
48	Channel 31	OUT	0-VSENS5	
49	Channel 30	OUT	0-VSENS5	
50	Channel 29	OUT	0-VSENS5	

Connector Pinout – Parent/Child 1/Child 2/ 50 Pin Key 03

Parent/Child 1/ Child 2/ 50 Pin Key 03

This table gives the connector pinout for Parent/Child 1/Child 2/50 Pin Key 03.

Pin	Function	I/O	Range	Notes
1	Switch 1	OUT	Open-Ground	Low Side Switch output
2	Switch 2	OUT	Open-Ground	Low Side Switch output
3	Switch 3	OUT	Open-Ground	Low Side Switch output
4	Switch 4	OUT	Open-Ground	Low Side Switch output
5	Switch 5	OUT	Open-Ground	Low Side Switch output
6	Switch 6	OUT	Open-Ground	Low Side Switch output
7	Switch 7	OUT	Open-Ground	Low Side Switch output
8	Switch 8	OUT	Open-Ground	Low Side Switch output
9	Switch 9	OUT	Open-Ground	Low Side Switch output
10	Switch 10	OUT	Open-Ground	Low Side Switch output
11	Switch 11	OUT	Open-Ground	Low Side Switch output
12	Switch 12	OUT	Open-Ground	Low Side Switch output
13	Switch 13	OUT	Open-Ground	Low Side Switch output
14	Switch 14	OUT	Open-Ground	Low Side Switch output
15	Switch 15	OUT	Open-Ground	Low Side Switch output
16	Switch 16	OUT	Open-Ground	Low Side Switch output
17	Switch 17	OUT	Open-Ground	Low Side Switch output
18	Switch 18	OUT	Open-Ground	Low Side Switch output
19	Switch 19	OUT	Open-Ground	Low Side Switch output
20	Switch 20	OUT	Open-Ground	Low Side Switch output
21	Switch 21	OUT	Open-Ground	Low Side Switch output
22	Switch 22	OUT	Open-Ground	Low Side Switch output
23	Switch 23	OUT	Open-Ground	Low Side Switch output
24	Switch 24	OUT	Open-Ground	Low Side Switch output
25	Wavemaker Ch 6+	OUT	+/- 8V	Wavemaker Freq output Channel 6 (requires optional card)
26	Switch 25 Drain	I/O	0-24v	+V for High Side Switch, SW 25 Output for Low Side Switch
27	Switch 25 Source	I/O	0-24v	GND for Low Side Switch, SW 25 Output for High Side Switch
28	Switch 26 Drain	I/O	0-24v	+V for High Side Switch, SW 26 Output for Low Side Switch

Continued on next page

Connector Pinout – Parent/Child 1/Child 2/ 50 Pin Key 03, Continued

Parent/Child 1/ Child 2/ 50 Pin Key 03, Continued

This table continues to give the connector pinout for Parent/Child 1/Child 2/50 Pin Key 03.

Pin	Function	I/O	Range	Notes
29	Switch 26 Source	I/O	0-24v	GND for Low Side Switch, SW 26 Output for High Side Switch
30	Switch 27 Drain	I/O	0-24v	+V for High Side Switch, SW 27 Output for Low Side Switch
31	Switch 27 Source	I/O	0-24v	GND for Low Side Switch, SW 27 Output for High Side Switch
32	Switch 28 Drain	I/O	0-24v	+V for High Side Switch, SW 28 Output for Low Side Switch
33	Switch 28 Source	I/O	0-24v	GND for Low Side Switch, SW 28 Output for High Side Switch
34	Switch 29 Drain	I/O	0-24v	+V for High Side Switch, SW 29 Output for Low Side Switch
35	Switch 29 Source	I/O	0-24v	GND for Low Side Switch, SW 29 Output for High Side Switch
36	Switch 30 Drain	I/O	0-24v	+V for High Side Switch, SW 30 Output for Low Side Switch
37	Switch 30 Source	I/O	0-24v	GND for Low Side Switch, SW 30 Output for High Side Switch
38	Wavemaker Ch 8+	OUT	+/- 8V	Wavemaker Freq output Channel 8 (requires optional card)
39	Wavemaker Ch 7+	OUT	+/- 8V	Wavemaker Freq output Channel 7 (requires optional card)
40	Key Switch	OUT	Open - VBATT	Key switch Output (relay contacts)
41	Engine Speed +	OUT	+/- 8V	Wavemaker Ch 1 output (arb. card)
42	Engine Speed -	OUT	Ground	
43	Engine Position +	OUT	+/- 8V	Wavemaker Ch 2 output (arb. card)
44	Engine Position -	OUT	Ground	
45	Wavemaker Ch 3+	OUT	+/- 8V	Wavemaker Ch 3 output (digital card)
46	Ground	OUT	Ground	
47	Wavemaker Ch 4+	OUT	+/- 8V	Wavemaker Ch 4 output (digital card)
48	Ground	OUT	Ground	
49	Wavemaker Ch 5+	OUT	+/- 8V	Wavemaker Ch 5 output (digital card)
50	Ground	OUT	Ground	

Connector Pinout – Sidecar 50 Pin Key 04

Sidecar 50 Pin Key 04 This table gives the connector pinout for Sidecar 50 Pin Key 04

Pin	Function	I/O	Range	Notes
1	Channel 1	OUT	0-VSENS1	Sensor output
2	Channel 2	OUT	0-VSENS1	Sensor output
3	Channel 3	OUT	0-VSENS1	Sensor output
4	Channel 4	OUT	0-VSENS1	Sensor output
5	Channel 5	OUT	0-VSENS2	Sensor output
6	Channel 6	OUT	0-VSENS2	Sensor output
7	Channel 7	OUT	0-VSENS2	Sensor output
8	Channel 8	OUT	0-VSENS2	Sensor output
9	Channel 1	OUT	0-?	Open collector output (requires external pullup)
10	Channel 2	OUT	0-?	Open collector output (requires external pullup)
11	Channel 3	OUT	0-?	Open collector output (requires external pullup)
12	Channel 4	OUT	0-?	Open collector output (requires external pullup)
13	Channel 5	OUT	0-?	Thermocouple output
14	Channel 6	OUT	0-?	Thermocouple output
15	Channel 7	OUT	0-?	Thermocouple output
16	Channel 8	OUT	0-?	Thermocouple output
17	Ref1	IN	0-32v	Sensor Supply for Channel 9
18	Ref2	IN	0-32v	Sensor Supply for Channel 10
19	Ref3	IN	0-32v	Sensor Supply for Channel 11
20	Ref4	IN	0-32v	Sensor Supply for Channel 12
21	Channel 9	OUT	0-Ref1	Sensor output
22	Channel 10	OUT	0-Ref2	Sensor output
23	Channel 11	OUT	0-Ref3	Sensor output
24	Channel 12	OUT	0-Ref4	Sensor output
25	N/C			Not used
26	SW 1 Contact	I/O	N/O	Normally Open Contact
27	SW 2 Contact	I/O	N/O	Normally Open Contact
28	SW 3 Contact	I/O	N/O	Normally Open Contact

Continued on next page

Connector Pinout – Sidecar 50 Pin Key 04, Continued

Sidecar 50 Pin Key 04, Continued

This table continues to give the connector pinout for Sidecar 50 Pin Key 04.

Pin	Function	I/O	Range	Notes
29	SW 4 Contact	I/O	N/O	Normally Open Contact
30	SW 5 Contact	I/O	N/O	Normally Open Contact
31	N/C			Not used
32	SW 7 Contact	I/O	N/O	Normally Open Contact
33	SW 8 Contact	I/O	N/O	Normally Open Contact
34	SW 1 Contact	I/O	N/C	Normally Closed Contact
35	SW 2 Contact	I/O	N/C	Normally Closed Contact
36	SW 3 Contact	I/O	N/C	Normally Closed Contact
37	SW 4 Contact	I/O	N/C	Normally Closed Contact
38	SW 5 Contact	I/O	N/C	Normally Closed Contact
39	N/C			Not used
40	SW 7 Contact	I/O	N/C	Normally Closed Contact
41	SW 8 Contact	I/O	N/C	Normally Closed Contact
42	Ground	OUT		
43	Ground	OUT		
44	Ground	OUT		
45	Ground	OUT		
46	Ground	OUT		
47	Supply	OUT	5.5V	5.5V Power Supply
48	N/C			Not used
49	VSENS2	IN	0-5.5v	Sensor Supply for Channel 5-8
50	VSENS1	IN	0-5.5v	Sensor Supply for Channel 1-4

Section 8 – CAN Protocol

CAN Protocol

Introduction

The LUIS uses special formatted CAN commands to send data from the PC to the hardware. The CAN Baud rate is 250k and the LUIS hardware has no bus terminations resistors in the box. Proper bus termination must occur on external CAN nodes for correct operation.

CAN Protocol

All CAN communications from LUIS PC to LUIS hardware use the J1939 Proprietary A message. The following is the definition for this message.

Parameter Group Name: **Proprietary A**
Definition: This proprietary PG uses the Destination Specific PDU Format allowing manufacturers to direct their proprietary communications to a specific destination node. How the data field of this message is used is up to each manufacturer. Use of proprietary messages is at the manufacturer's discretion with the constraint that significant percentages (2% or more) of vehicle network utilization must be avoided.

Transmission repetition rate: Per user requirements
Data length: 8 bytes
Data Page: 0
PDU Format: 239
PDU Specific: Destination Address:
- 0xF1 = Load Box PC Controller
- 0xF2 = Load Box Parent
- 0xF3 = Load Box Child 1
- 0xF4 = Load Box Child 2
- 0xF5 = Load Box Sidecar
- 0xF6 = Speed Board

Default priority: 6
Parameter Group Number: 61184 ($00EF00_{16}$)

Continued on next page

CAN Protocol, Continued

Command Byte

The first byte in the 8 byte data message is the Command Byte. The following table lists all of the Commands available.

Command	Description
0x01	Switch Command
0x02	DAC Command
0x04	Power Up Message
0x05	Reset
0x06	Status Request/Response
0x07	Calibration Request/Response
0x50	Change Signal Frequency
0x51	Freq Output Channel Configuration
0x59	Engine Model

Continued on next page

CAN Protocol, Continued

Switch Command

One message updates all of the switches per load box. All of the switches are mapped to a specific bit in the switch command message. The following table depicts the location of the switch bit within the switch message.

Switch Command – Defines ON/OFF state of each LUIS switch.
Data Length: Command (0x01) + 4 bytes
Resolution: 1 switch per bit (0 = OFF, 1 = ON)
Data Range: 0 to 0xFFFF FFFF
Type: Status

Switch Name	Function	Byte	Bit
SW31	Harness defined HS or LS	2	1
SW30	Harness defined HS or LS	2	2
SW29	Harness defined HS or LS	2	3
SW28	Harness defined HS or LS	2	4
SW27	Harness defined HS or LS	2	5
SW26	Harness defined HS or LS	2	6
SW25	Harness defined HS or LS	2	7
Keyswitch	Keyswitch	2	8
SW17	Switch to ground	3	1
SW18	Switch to ground	3	2
SW19	Switch to ground	3	3
SW20	Switch to ground	3	4
SW21	Switch to ground	3	5
SW22	Switch to ground	3	6
SW23	Switch to ground	3	7
SW24	Switch to ground	3	8
SW9	Switch to ground	4	1
SW10	Switch to ground	4	2
SW11	Switch to ground	4	3
SW12	Switch to ground	4	4
SW13	Switch to ground	4	5
SW14	Switch to ground	4	6
SW15	Switch to ground	4	7
SW16	Switch to ground	4	8

Continued on next page

CAN Protocol, Continued

Switch Command, Continued

The following table continues to depict the location of the switch bit within the switch message.

Switch Name	Function	Byte	Bit
SW1	Switch to ground	5	1
SW2	Switch to ground	5	2
SW3	Switch to ground	5	3
SW4	Switch to ground	5	4
SW5	Switch to ground	5	5
SW6	Switch to ground	5	6
SW7	Switch to ground	5	7
SW8	Switch to ground	5	8

CAN Protocol, Continued

DAC Command

This message updates one of the DAC channels. Byte 5 will hold the value until the Immediate update has been given or update it upon receipt.

DAC Command – Set DAC output voltage

Data Length:	Comand (0x02) + 4 bytes
Resolution:	Byte 2; 1 channel per count Bytes 3 & 4; 1 bit per count Byte 5; ON/OFF
Data Range:	Byte 2; 1-32 (SIG #) Bytes 3 & 4; 0 – 4095 counts Byte 5; 0x00 = Hold Value 0x01 = Immediate Update
Type:	Status

HW Powered

When the load box power cycles, this message is sent to inform the LUIS GUI that a new box has been powered up and it will then receive updated channel information based on the GUI settings.

HW Powered UP – Message sent from LUIS to PC after power cycle

Data Length:	1 Byte (0x04)
Resolution:	HW has just been power-cycled. No response required from PC; If PC is listening, should refresh all outputs. If key switch is ON, PC should set it to OFF before refresh & warn user that HW was power-cycled & outputs refreshed, but Key is now OFF to prevent unexpected errors.
Data Range:	0x04 only
Type:	Status

Continued on next page

CAN Protocol, Continued

Reset Command

The Reset command will reset all of the LUIS I/O and disable all of the DAC outputs.

Reset – Turn off all switches and disable all DAC outputs

Data Length:	Command (0x05) + 1 Byte
Resolution:	N/A
Data Range:	0x01 = Soft Reset (all switches off, all DAC's = 0v) 0x03 = Hard Reset (jump to bootloader)
Type:	Status

Status Request

The Status Request is derived from the PC and sent every two seconds to ping the hardware and obtain information about the hardware.

Data Length: Command (0x06) + 7 Bytes
Byte 2: 0xFF (handshake)
Byte 3: LUIS Firmware Major version (0-255)
Byte 4: LUIS Firmware Minor version (0-255)
Byte 5: Data Fresh
0x00 = No Switch or DAC commands received since last power cycle
0x01 = Switch and/or DAC commands have been executed since last power cycle
Byte 6: Lamp feedback status
1 bit per lamp, only 5 lamps to date.
0 = OFF / 1 = ON
Bits 5-7 not used, set to 0.
Bytes 7-8 not used

Status Request Example: 0x18EFF2F1 (all data bytes 2-8 set to 0xFF)
(PC asking "is Parent out there?")

Status Response Example: 0x18EFF1F2 0x06 0x01 0x02 0x00 0x00 0x00 0x00
(from Parent, firmware ver 1.2, no commands executed yet, all lamps OFF)

Continued on next page

CAN Protocol, Continued

Calibration Request

The Calibration Request message will start the calibration procedure. Typically a unit under test is installed on the load box before the command is issued.

Calibration Request – Request from PC / Response of attached LUIS devices

Data Length:	Command (0x07) + 7 Bytes
Resolution:	N/A
Data Range:	Byte 1; Calibrate option 0x01 = Calibrate all available channels 0x02 = Set calibration tables to default values (this byte set to 0xFF in Response msg) Byte 2; Calibration progress Range 0-100 indicating percentage complete Bytes 3-8 not used
Type:	Status

Change Frequency

Changes the signal output frequency or FOUT. Data values can be in Hertz or RPM depending on how the bit is set in the configuration message for that channel.

Change Frequency – Set the Frequency

Data Length:	Command (0x51) + 8 Bytes
Resolution:	Byte 3,4,5 RPM or Hz Byte 6 Ramp in RPM or Hz
Data Range:	Byte 2; Wavemaker Address Byte 3,4,5; RPM or Hz Byte 6; Ramp Rate Bytes 7-8 not used
Type:	Status

Bytes 3-5 are the Hertz or RPM values with Byte 5 representing the Low Byte.
The Ramp rate is how fast the signal transitions from its current value to its new value. A Ramp of zero will set the output frequency/RPM as fast as the WaveMaker can transition the signal.
If the Signal is setup for Frequency, all values above 2.5MHz will be ignored.

Continued on next page

CAN Protocol, Continued

Configuration Message

The Configuration messages configures each channel in the Wavemaker hardware that inside of LUIS. The Wavemaker hardware is responsible for all of the frequency signal outputs of LUIS.

Configuration Message – Sent from the PC to Wavemaker

Data Length: Command (0x51) + 8 Bytes

Resolution: N/A

Data Range:

Byte 2; Wavemaker Address
- Low Nibble Channel Number
- High Nibble Wavemaker Number

Byte 3; Waveform Number
- See Waveforms Section

Byte 4; Sync w/Master Clock
- 0x00 = No Sync with Master signal
- 0x01 = Sync with Master signal

Byte 5,6; Offset from Master

Byte 7; Signal Technology
- Low Nibble
- 1 = Hall
- 2 = VR
- High Nibble
- 1 = PWM, Bytes 5,6 HB Freq

Byte 8; Controls data bytes in command 0x50
- Low Nibble
- Number of Cycles
- High Nibble
- 1 = Frequency (Arbitrary Card)
- 2 = RPM Values (Arbitrary Card)
- 3 = Frequency (Digital Card)
- 4 = RPM (Digital card, Bytes 5-6 used to set Teeth/Rev.

Type: Status

Continued on next page

CAN Protocol, Continued

Engine Model

The Engine model commands controls the Open/Closed loop model for LUIS. If the system is in Closed loop mode, engine speed on the GUI is controlled by the unit under test and cannot be changed by the user.

Engine Model – Sent from the PC to LUIS

Data Length:	Command (0x59) + 8 Bytes
Resolution:	Byte 4-5; 1-100% Load, 0-1000 Gain
Data Range:	Byte 2; Wavemaker Address High Nibble Wavemaker Number Byte 3; Model Command 1 = Open Loop Mode 2 = Closed Loop Mode 3 = Start Engine 4 = Reset Model 5 = % Load 6 = Gain Adjust 7 = Rate Limit Byte 4-5; % Load or Gain Byte 6-8; Not Used
Type:	Status

Section 9 – Multi-Parent Setup

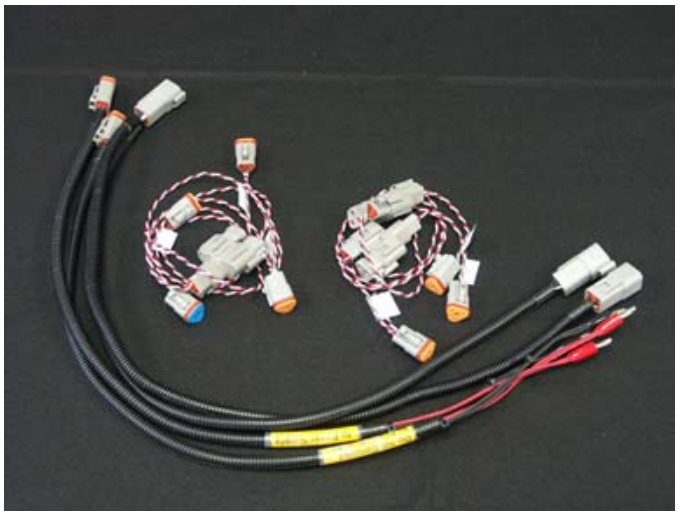
Multi-Parent Setup

Introduction

The LUIS Parent unit has a number of features that the Child boxes do not have. The Child boxes are a scaled down Parent to save costs since some of the additional I/O of the Parent is not needed for the Multi-Module setup (Wavemaker, loads, and internal power supply). The typical Multi-Module setup involves one Parent and multiple Child units. These systems are stacked into a special made rack assembly. The Parent units can be connected as Child units if special cables and LUIS configuration files are used. Since the Parent unit has addition features, having multiple Parent units will conflict with each other unless these cables are used. The following describes how to connect multiple Parents together to make a Multi-Module system.

Required Cables

A set of specialized cables (PN G01244-00) can be obtained from GarTech Enterprises Inc. to connect multiple Parents together to make a multi-module setup. The cables consist of Power, I/O rerouting, and CAN connections. The Power connections simply jumper power from one box to another. The I/O rerouting cable breaks into the I/O cables from LUIS to the ECM and makes connections that need to go to all of the LUIS boxes, for example speed signal connections and keyswitch. The CAN jumpers connect all of the CAN busses together so proper communications will occur with all of the modules. The following picture depicts the required cables:



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Multi-Parent Setup, Continued

Power Connections

The Power connections for the three Parents must be chained together. Using the power cables supplied in the kit, connect the 4 pin connector into the Parent power connector and plug the other end into Child 1's red and black banana jacks connections. Use another provided power cable and connect the 4 pin connector into the Child 1 power connection and the other end of the cable into the Child 2 red and black banana jacks. See the following figure. The Parent unit is on the left, Child 1 is in the middle, and Child 2 is on the right.

Private CAN Connections

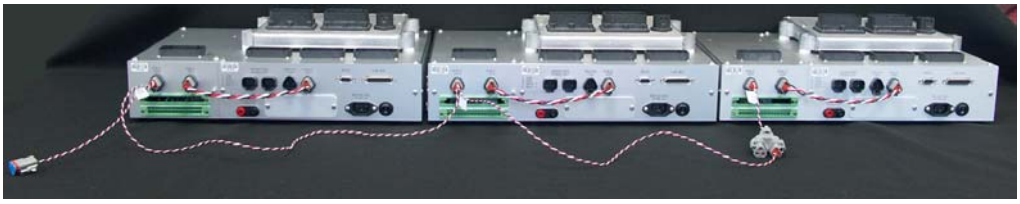
The Private CAN datalinks must be chained together so the ECM's can communicate together. Following the labels on the cable, plug all three of these connections into the load boxes. See the following figure.

Continued on next page

Multi-Parent Setup, Continued

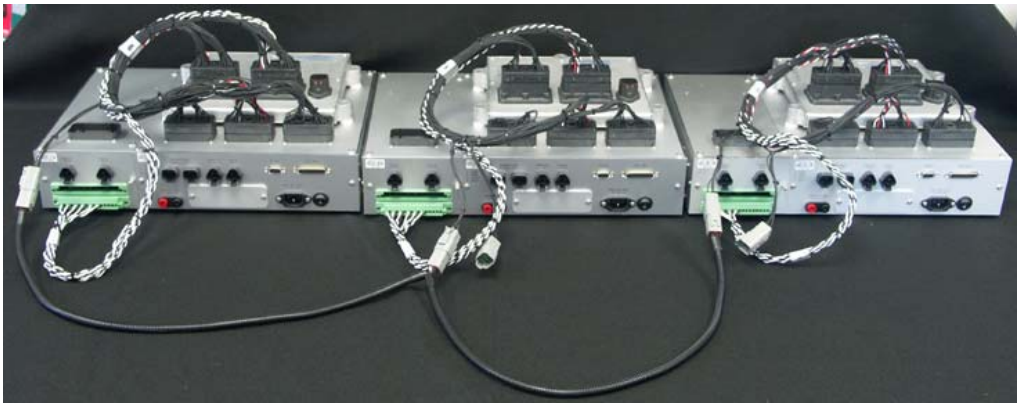
Public CAN Connections

The Public CAN datalinks must be chained together so the LUIS GUI can send data to each unit. Notice there is a loose connector on the left end of the picture which is used to connect the LUIS PC to the system. The Sidecar-to-Parent Jumpers must also be in place. Following the labels on the cables, plug all three connections in as shown.



Special I/O Connections

There are a few I/O items that need to be chained directly from the cables that connect LUIS to the ECM. These connections are clearly marked and have a 6 pin Deutsch connector to join them together. On the Child 1 and Child 2 cables, the 6 pin connector will have to be disconnected and then reconnected into the provided cables.



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Multi-Parent Setup, Continued

All Connections

The following figure shows all of the connections needed to make Parent units function for Multi-Module setups.