# 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<br>Description | The LUIS is a bench top, PC controlled load box with approximate dimensions of 18"x12"x4".   |
|                              |  |
|                              |  |
|                              |  |
|                              |  |
|                              | · · · · · · · · · · · · · · · · · · ·  |
|                              |  |
|                              | . 0000000000000000000000000000000000000  |
|                              |  |
|                              |  |
|                              |  |
| LUIS Features                | The LUIS provides the following features:  |
|                              |  |
|                              | • Open and Closed Loop Engine Speed Simulation   |
|                              | • Integrated Garlech 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

The LUIS has a main, parent, control module that can be connected to the PC Hardware 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.

| Торіс                 | See Page |
|-----------------------|----------|
| Ordering Hardware     | 4        |
| How To Setup the LUIS | 5        |

### Section 1 - Ordering Hardware

#### **Ordering Hardware**

| Gartech<br>Contact<br>Information | All hardware can be ordered<br>Gartech Enterprises<br>3037 W. State Road<br>Austin, IN 47102<br>812-794-4796<br>www.gartechenterp<br>info@gartechenterp | ed from GarTech Enterprises, Inc.<br>s, Inc.<br>d 256<br>prises.com<br>prises.com |
|-----------------------------------|---|---|
| GarTech Part<br>Numbers           | This table gives the part nu  | umber and descriptions for the LUIS hardware.                                     |
|                                   | Part Number   | Description   |
|                                   | G00391-00   | LUIS PC Controller with 10" LC Monitor,<br>Keyboard, Mouse and CAN Card           |
|                                   | G00392-04   | LUIS Main (Parent) Control Module with<br>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<br>Wiring<br>Harnesses    | A complete listing of Wirin<br>GarTech website, www.ga  | ng Harnesses available can be found on the rtechenterprises.com.                  |

### Section 2 - How To Setup the LUIS

#### **Overview**

| Introduction    | The setup of the LUIS software is completed by downloading the<br>and following the installation wizard. The setup of the LUIS hard<br>depends on the PC connection as well as the optional equipment<br>standard control module. | e software<br>dware<br>added to the |
|-----------------|---|-------------------------------------|
| In This Section | This table outlines the topics found in this section.   |                                     |
|                 | Торіс   | See Page                            |
|                 | Setting Up a Standard LUIS  | 5                                   |
|                 | Setting Up a CAN Card Connection  | 6                                   |
|                 | Setting Up an Ethernet Connection   | 14                                  |
|                 | Changing the Sidecar  | 18                                  |
|                 | Adding Child Control Modules  | 20                                  |
|                 | Downloading New Firmware  | 24                                  |
|                 | ROM Booting   | 26                                  |

### 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<br>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<br>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<br>Module to the LUIS using the ports on top of the box as well as<br>the Injector Connector on the back of the Sidecar. |
| 5    | Using the Control Module Power Connector, connect the Control<br>Module to the Unswitched Power Out port on the back of the<br>LUIS.   |

#### Setting Up a Standard LUIS, Continued

J1939 CableThis picture illustrates the J1939 Cable connections between the LUIS and<br/>the Sidecar.



Control ModuleThis picture illustrates the installed Control Module with the Wiring Harness<br/>and Power Connector.



Control Module Power Connector

### Setting Up a Standard LUIS, Continued

| Setting Up the<br>Hardware,<br>Continued | This tabl<br>hardware | e continues to outline the physical connections required to setup the<br>e to run a standard LUIS. |
|--|-----------------------|--|
|  | Step                  | Action   |
|  |                       |  |

| biep | Tetton   |
|------|--|
| 6    | Using the DC Power Cable, connect the LUIS to the DC Power<br>Supply using the Unswitched Power In ports on the back of the<br>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.                           |

#### Setting Up a Standard LUIS, Continued

**DC Power** This picture illustrates the DC Power connection between the LUIS and the Connections 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 LUI                     | S can communicate with a PC via a CAN Card.  |
|--|-----------------------------|--|
| Hardware<br>Required                   | To conno<br>• C<br>• C<br>a | ect the LUIS with a CAN card, the following hardware is required.<br>CAN Card or other Peak Adapter<br>CAN Card Cable with 120 ohm terminating resistor across CAN High<br>nd CAN Low at both ends                           |
| Setting Up a<br>CAN Card<br>Connection | This tabl software          | e outlines the steps required to setup the LUIS hardware and<br>to run via a CAN Card connection.  |
|  | Step                        | Action   |
|  | 1                           | After completing the setup for a standard LUIS, use the CAN<br>Cable to connect the PC CAN Card to the left hand Public J1939<br>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 <b>Control Panel</b> from the <b>Start</b> button.  |
|  | 4                           | CAN2<br>CAN Hardware<br>CAN Hardware<br>the dialog box as well as the <b>Control Panel</b> .   |
|  | 5                           | Start the LUIS software.   |
|  | 6                           | From the <b>Hardware</b> menu, Select the <i>Select Adapter</i> option. The <i>Peak CAN</i> option should be selected. If it is not selected, from the adapter options <b>Select</b> <i>Peak CAN</i> .                       |
|  |                             | <u>Note</u> : If changing the adapter type a message dialog box displays indicating that the LUIS software must be restarted for the change to take effect. <b>Click &lt;Yes&gt;</b> to restart. The user must restart LUIS. |

### Setting Up a CAN Card Connection, Continued

CAN CardThis picture illustrates the CAN Cable connection between the PC and the<br/>LUIS.



CAN HardwareThis is an example of the CAN Hardware options available from the<br/>Windows Control Panel.

| Lieneral  | Information    |   |          |
|-----------|----------------|---|----------|
| 田田<br>田田  | Active device: | ○ Peakcan (non Plug-and-Play) ● PCI               |          |
|           |                | ⊖ USB   |          |
|           |                | ○ FireWire / IEEE 1394                            |          |
|           |                | O PC Card   |          |
| The follo | wing CAN Hardw | vare is installed on this computer:               |          |
| Hardu     |                | Deserves  |          |
| naiuw     | vare           | Resources   | Firmware |
|           | AK PCI-CAN     | Controller 0, Device 20, Function 0,              | n.a.     |
|           | AK PCI-CAN     | Controller 0, Device 20, Function 0,              | n.a.     |
| B PE      | AK PCI-CAN     | Controller 0, Device 20, Function 0,              | n.a.     |
| PE/       | AK PCI-CAN     | Controller 0, Device 20, Function 0,              | n.a.     |
| PE/       | AK PCI-CAN     | Resources<br>Controller 0, Device 20, Function 0, | n.a.     |
| Add       | AK PCI-CAN     | e Change  | n.a.     |
| Add       | AK PCI-CAN     | e Change  | n.a.     |

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

### Setting Up a CAN Card Connection, Continued

| Net Name<br>Dialog Box | This is a | n example of the <i>Net Name</i> dialog box.   |                              |
|------------------------|-----------|--|------------------------------|
|                        |           | Net Name                                       |                              |
|                        |           | Input Net Name<br>Current Net Name: LUIS_Net_1 | <u>Q</u> K<br><u>C</u> ancel |
|                        |           |  |                              |

#### **Setting Up an Ethernet Connection**

#### **Setting Up an Ethernet Connection**

| Introduction                            | The LUI                | S can communicate with the PC through an Ethernet connection.  |
|---|------------------------|--|
| Hardware<br>Needed                      | To conne<br>required.  | ect the LUIS through the Ethernet, the following hardware is   |
|   | • C<br>• C             | Pptional LUIS Ethernet Card<br>Crossover Ethernet Cable or Hub and Ethernet Cables   |
| Setting Up an<br>Ethernet<br>Connection | This tabl<br>run via a | e outlines the steps for setting up the LUIS hardware and software to<br>n 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 <b>Hardware</b> menu, <b>Select</b> the <i>Select Adapter</i> option.<br>From the <i>Adapter</i> options, <b>Select</b> <i>Ethernet</i> .   |
|   |                        | <u>Result</u> : The message dialog box displays indicating that the LUIS software must be restarted for the change to take effect. <b>Click</b> < <b>Yes</b> > to restart.                     |
|   | 5                      | Once LUIS has restarted, from the <b>Hardware</b> menu, <b>Select</b> the <i>Ehternet</i> option. From the <i>Ethernet</i> options, <b>Select</b> <i>Configure</i> .                           |
|   |                        | Result: The Ethernet Configuration window displays.  |
|   | 6                      | In the <i>F/W Version</i> field, the current firmware version displays.<br><u>Note</u> : This firmware version applies only to the TCP/IP add-on card. It is not the same as the LUIS firmware |

#### 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.

| Ethernet Configuration                                    |  |   |
|---|--|---|
| <b>Configure Ethernet</b><br>Detect and Configure Devices | Connection<br>s on the Network:  |   |
| Optional Ethernet<br>Hodule Required.                     | TCP/IP Configuration       Factory Settings         TCP/IP MODULE       F/W Version         IP CONFIGURATION METHOD       IP CONFIGURATION METHOD         ID Static       DHCP         Local IP       IP         Subnet       IP | SEARCH FOR DEVICES Mode Direct IP Search Socket Status Instructions:  |
|   | Gateway  | <ol> <li>Press Search to look for devices on subject.</li> <li>Select Device from Listing.</li> <li>Adjust Local IP, Port, Subnet, Gateway.</li> <li>Click the Set button to send changes.</li> </ol>   |
|   | DHCP - Device will obtain<br>settings from a DHCP Server.<br>Password:   | Image: Section of the section of t |

#### 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 <b>Search for Devices</b> panel, <b>Click</b> the <b><search></search></b> button.  |
|      | <u>Result</u> : The MACID Addresses for all local devices display in the <i>Detected Devices</i> field.  |
|      | <u>Note</u> : A direct IP Search can be completed to find an IP address<br>outside the local devices by <b>Selecting</b> the <i>Direct IP Search</i><br>checkbox, entering the IP Address and <b>Clicking <search< b=""><b>&gt;</b>.</search<></b> |
| 8    | <b>Select</b> the MACID Address for the Ethernet card in the LUIS box from the list.   |
|      | <u>Note</u> : 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, <b>Click</b> the <b><set></set></b> button.  |
| 12   | To close the window, <b>Click</b> the <b><exit></exit></b> button.   |
| 13   | To begin communicating, from the <b>Hardware</b> menu, <b>Select</b> <i>Ethernet</i> and then the <i>Connect/Disconnect</i> option.  |
|      | <u>Result</u> : The LUIS hardware and software is installed and is communicating through the Ethernet connection.  |

#### Setting Up an Ethernet Connection, Continued



### **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. |
|--------------|--|
|              |  |

**nging a** This table outlines the steps for changing a Sidecar.

#### 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.               |
|      | <u>Note</u> : 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.      |

#### Changing a Sidecar, Continued

Sidecar This picture illustrates the Sidecar detached from the Load Box. Assembly/Disas sembly



InternalThis picture illustrates the internal connection between the Sidecar and the<br/>Load Box.



### **Adding Child Modules**

### Adding Child Modules

| Introduction           | Up to two<br>system w   | o child modules can be added to the LUIS for testing a single engine vith multiple ECM's.  |
|------------------------|---|--|
| Hardware<br>Required   | This follo<br>E<br>C<br>P<br>P<br>P<br>P<br>P                         | owing hardware is required when adding a child module.<br>CM<br>child Load Box<br>arent/Child J1939 Cables<br>arent/Child Private CAN Bus Connector Cables<br>arent/Child LUIS Bus Connector Cables<br>arent/Child LUIS Bus Connector Cables<br>arent/Child Control Module Power Connector                     |
| Adding Child<br>Module | This tabl<br><u>Note</u> : A l<br>shipped a<br>be used t<br>was loose | e outlines the steps for adding child modules to the LUIS.<br>Parent/Child stack can be ordered directly from GarTech. This unit is<br>already stacked and connected. When this item arrives, this table can<br>o ensure that all of the cables are connected as expected and nothing<br>ened during shipping. |
|                        | Step  | Action   |
|                        | 1   | Setup the parent module as 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<br>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.   |

### Adding Child Modules, Continued

**Public CAN**This picture illustrates the Public J1939 CAN Connections.**Connections** 



Continued on next page

### Adding Child Modules, Continued

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

| Step | Action   |
|------|--|
| 5    | Replace the Control Module Power Connector with the<br>Parent/Child Control Module Power Connector. Connect this cable<br>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<br>Connector into the LUIS Bus port on the back of each Load Box.   |

#### Adding Child Modules, Continued

Control Module This picture illustrates the Control Module Power Connections. Power Connections



**Private CAN** This picture illustrates the Private CAN Connections.



LUIS Bus Connections This picture illustrates the LUIS Bus connections.





#### **Downloading New Firmware**

### **Downloading New Firmware**

| Introduction            | Firmwar<br>have san<br>Firmwar | re is an instruction set stored in the ROM. Parent and Child boxes<br>ne firmware. The Wavemaker and FMET Box have different<br>re.  |
|-------------------------|--------------------------------|--|
| Downloading<br>Firmware | This tab                       | le outlines the steps for downloading firmware.  |
|                         | Step                           | Action   |
|                         | 1                              | Before downloading firmware, ensure that both the <b>VBatt</b> and <b>Keyswitch</b> are off and that <b>Engine Speed</b> is set to 0.  |
|                         | 2                              | Close any datalink tools running on the PC.  |
|                         | 3                              | From the <b>Hardware</b> menu, <b>Select</b> the <i>Download Firmware</i> option.  |
|                         |                                | Result: The Firmware window displays.  |
|                         | 4                              | In the <b>Destination Device</b> section, <b>Select</b> the hardware to which the firmware will be downloaded.   |
|                         | 5                              | Click the <b><select binary="" file=""></select></b> button. On the <i>Open</i> dialog box,<br><b>Browse</b> and <b>Select</b> the correct firmware file, and <b>Click <open></open></b> . |
|                         |                                | <u>Note</u> : 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, <b>Click</b> the <b><download></download></b> button.  |
|                         |                                | <u>Troubleshooting</u> : If the download fails to complete or errors occur, the LUIS must be ROM booted to be able to continue. See <b>ROM Booting</b> in this section.                    |
|                         |                                | <u>Result</u> : The firmware is downloaded to the selected device. As the download occurs, messages display in the <i>Firmware File</i> field.   |
|                         | 7                              | Once the download is complete, <b>Click</b> the <b><exit></exit></b> button to close the dialog box.   |
|                         |                                | <u>Note</u> : If new firmware was downloaded to the Wavemaker, the power on the LUIS box must be cycled before the download will be complete.  |

### Downloading Firmware, Continued

| Firmware<br>Window | This graphic is an example of the <b>Firmware</b> window.   |
|--------------------|---|
|                    | Firmware  |
|                    | Download Firmware<br>Transfer Binary To Device:   |
|                    | DESTINATION DEVICE  |
|                    | Select Box To Download To:  |
|                    | O PARENT O CHILD 1 O SIDECAR O WAVEMAKER  |
|                    | CHILD 2 O FMET UNIT   |
|                    | F/W Version:  |
|                    | FIRMWARE FILE:  |
|                    | Select Binary File  |
|                    | Source and |
|                    |   |
|                    |   |

#### **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 <b>Hardware</b> menu <b>Select</b> the <b>Download Firmware</b> option.  |
|      | Result: The Firmware dialog box displays.   |
| 3    | <b>Click</b> the <b>Select Binary File</b> > button. On the <i>Open</i> dialog box, find and select the appropriate firmware file.  |
|      | <u>Note</u> : The firmware should be resident on the PC not on a network drive.   |
| 4    | Click the <download> button.</download>   |
|      | 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.   |
|      | <u>Note</u> : 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<br>except the Wavemaker. When the download is complete the<br>"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<br>downloaded via the standard <b>Download Firmware</b> procedure<br>earlier in this section. Until this download is complete, the<br>firmware version will display as 99.99. |

#### ROM Booting, Continued

FirmwareThis graphic illustrates the "Resetting Loadbox" message on the FirmwareDialog Boxdialog box.

| irmware  |  |  |  |  |  |
|--|--|--|--|--|--|
| Download Firmware<br>Transfer Binary To Device:  |  |  |  |  |  |
| DESTINATION DEVICE   |  |  |  |  |  |
| Select Box To Download To:   |  |  |  |  |  |
| PARENT      CHILD 1      SIDECAR      WAVEMAKER  |  |  |  |  |  |
| CHILD 2 F/W Version:   |  |  |  |  |  |
| FIRMWARE FILE: C:\sdm_pROM_xRAM.elf.5  |  |  |  |  |  |
| DO NOT TURN UNIT OFF!<br>Preparing To Dowload File<br>C:\sdm_pROM_xRAM.elf.S<br>For Loadbox: PARENT<br>Checking Keyswitch Status<br>Keyswitch is off.<br>Resetting Loadbox |  |  |  |  |  |

#### 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.



Basic Environment

2





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

#### Overview, Continued

| Торіс                          | See Page |
|--------------------------------|----------|
| Menu Bar                       | 31       |
| Toolbar                        | 33       |
| Waveform Gauges                | 34       |
| Lamp Indicators                | 35       |
| Throttle Ratiometric Dial      | 37       |
| I/O Controls                   | 38       |
| Closed Loop Controls           | 42       |
| Other Windows and Dialog Boxes | 44       |

**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      |                           |   |
|           | <b>Open Configuration</b> | 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 <i>Front Panel</i><br><i>Functions</i> dialog box where a<br>replica of the Parent Controller<br>front panel can be customized. |
|           | Set Current As Defaults   | Sets the current settings as the defaults for the configuration.  |
|           | Configuration Panel       | Opens the <b>Component</b><br><b>Configuration</b> window to<br>setup the GUI.  |
|           | Data Player               | Opens the <b>Data Player</b><br>window to configure the data<br>player.   |
| Hardware  |                           |   |
|           | Download Firmware         | Opens the <i>Firmware</i> dialog box to download new firmware.  |
|           | Select Adapter            | Sets the adapter type to <i>Ethernet</i> or <i>Peak CAN</i> .   |

#### 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<br>(Continued) | Peak Adapter       | Gives the option for setting the New Name.  |
|                         | Ethernet           | Allows the Ethernet to be<br>configured or<br>connected/disconnected.   |
|                         | Calibrate          | Opens the <i>Calibrate Unit</i><br>dialog box so the unit can be<br>calibrated with the ECM for<br>accurate temperature values. |
| Help                    |                    |   |
|                         | Contents           | Opens the on-line help.   |
|                         | About              | Opens the <i>About</i> 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                   |
|--|-------------------------------|
| 2  | Open Configuration            |
|  | Save Configuration            |
| 0  | Reset Switches                |
| ୯  | Reset Ratiometrics            |
| ۲  | Reset Gauges                  |
| Ē  | Reset Resistive               |
| 3  | Reset Rotary Switches         |
| <  | Download Firmware             |
| in the second se | Set Net Name                  |
| -  | Configure Ethernet            |
| <b>è</b>   | Connect/Disconnect Ethernet   |
| *  | Component Configuration       |
|  | Front LUIS Panel Layout       |
| 2  | Set Current as Default        |
| ×  | Reset Communication Interface |
|  | Data Player                   |

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## **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<br>Gauges | The eight waveform gauges are found on two tabs labeled <b>Primary</b> and <b>Secondary</b> . These gauges are setup on the <b>Gauge</b> section of the <b>Component Configuration</b> 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. |
| Wavaform           | This graphic illustrates the waveform gauges and their location on the LUIS  |

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

|               |          |       |      |   | -      |         | 10.11 |                  |   |
|---------------|----------|-------|------|---|--------|---------|-------|------------------|---|
| ,             | 3        | 17    | -    | 1 | 2      | 1       | -     |                  |   |
| in            | -        | 1 14  | a li |   | 1 1    |         | 7     |                  |   |
| and so of the | cher law | (end) | (    | - | Real C | \$10010 |       |                  |   |
|               |          |       |      |   |        |         |       |                  |   |
| -             |          | 191   | 18   |   |        |         |       |                  | - |
|               | Ø        | Ē     | Ø    | B | Ö      | ē       | Ø     | Ħ                | Ē |
|               | Ē        | 8     | Ø    |   | 8      | 1       | 8     | 1<br>1<br>1<br>1 |   |



## **Section 4 - Lamp Indicators**

## **Lamp Indicators**

| Introduction         | There are two rows of lamp indicators on the LUIS GUI. The top row, Load<br>Box Status, provides feedback on the controllers, sidecar and wavemaker.<br>The second row, Front Panel Lamps, mirrors the lamps on the front of the<br>Parent controller.  |
|----------------------|---|
| Load Box<br>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 <b>Rom Booting</b> 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.  |
|                      | LAMP INDICATORS<br>LOAD BOX STATUS O O O O<br>FRONT PANEL LAMPS O O O O O   |
| Front Panel<br>Lamps | The second row of indicator lamps are labeled Front Panel Lamps. These<br>lamps mirror the lamps on the front of the Parent Controller. This is<br>particularly useful in setups where the controller is not easily in sight. These<br>lamps can be named for easy reference using the <i>Front Panel Layout</i> option<br>on the <b>Hardware</b> menu. When the cursor is held over these lamps, a pop-up<br>displays the name given to that lamp on the <i>Front Panel Layout</i> dialog box. |



## Lamp Indicators, Continued

IndicatorThis graphic illustrates the indicator lamps and their location on the LUISLampsGUI.LocationCurrent control of the control of th



## **Section 5 - Throttle Ratiometric Dial**

### **Throttle Ratiometric Dial**

| Introduction                             | On the LUIS GUI there is one ratiometric dial on the front panel.  |
|--|--|
| Throttle<br>Ratiometric<br>Dial          | The ratiometric dial on the front panel is automatically configured to be<br>Throttle. This assignment can be changed when configuring the panel. When<br>changing, keep in mind that the Throttle is used for Auto IVS functionality,<br>the IVS switches trigger off of their set switch point and gets its value from<br>this pot knob. |
| Throttle<br>Ratiometric<br>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 ControlsThe different I/O Controls are accessed by pressing the tabs. This diagramLocationillustrates the I/O controls section and its location on the LUIS GUI.



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

| Торіс        | See Page |
|--------------|----------|
| Switches     | 39       |
| Ratiometrics | 40       |
| Resistives   | 41       |

### **Switches**

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

Setting 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.



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.



RatiometricRatiometrics can be displayed in millivolts or counts. The units are controlled<br/>by the V or C button in the lower right hand corner. The unit displayed on the<br/>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 <b>must be</b> running in the ECM to run in closed loop mode.              |
|-------------------------|---|
| Closed Loop<br>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. |



### Closed Loop Controls, Continued

Throttle IdleThe throttle idle validation section is used to simulate idle validation. Idle can<br/>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 PanelThe Front Panel window is opened from the Operation menu. It displays a<br/>picture of the front of the Parent Controller. On this window, the generic<br/>labels can be replaced with meaningful names. It can be printed, by pressing<br/>the printer icon, and used as a map of the controller.

| ront Pa | inel Functio | ns      |         |         | (Click o | n names to c | hange)  |           |        |        |        | _ = [ |
|---------|--------------|---------|---------|---------|----------|--------------|---------|-----------|--------|--------|--------|-------|
| •       | LAMP 1       | LAMP 2  | LAMP 3  | LAMP 4  | LAMP 5   | Ø            |         |           |        |        | 3      | •     |
|         | LOAD 1       | LOAD 2  | LOAD 3  | LOAD 4  | LOAD 5   | LOAD 6       | ESS     | EPS       | CHAN 3 | CHAN 4 |        |       |
|         | 0            | 0       | 0       | 0       | 0        | 0            | ۲       | ۲         | 0      | 0      |        |       |
|         | LOAD 7       | LOAD 8  | LOAD 9  | LOAD 10 | LOAD 11  | LOAD 12      | CHAN 5  | CHAN 6    | CHAN 7 | CHAN 8 | +5.5V  |       |
|         | 0            | 0       | 0       | 0       | 0        | 0            | Ø       | 0         | ۲      | 0      | 0      |       |
|         | LOAD 13      | LOAD 14 | LOAD 15 | LOAD 16 | LOAD 17  | LOAD 18      | SIG 1   | SIG 15    | SIG 16 | SIG 17 | 5IG 18 |       |
|         | 0            | 0       | 0       | 0       | 0        | 0            | $\odot$ | ۲         | ۲      | ۲      | ۲      |       |
|         | VSENSE1      | VSENSE2 | VSENSE3 | VSENSE4 | VSENSE5  |              | VBATT   | KEYSWITCH | GND    | GND 1  |        |       |
|         | 0            | 0       | 0       | 0       | 0        |              | 0       | 0         | 0      | 0      |        | •     |

**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.

| Ele j | Component |   | *       | a lor | 11-2  |      | - |           |        |       |     |       |             |          |
|-------|-----------|---|---------|-------|-------|------|---|-----------|--------|-------|-----|-------|-------------|----------|
| 70. 1 | a or o    |   | 10      | 12    | - I V | Inde |   | Function  | Defait | Units | 791 | 1 New | 1 Million 1 | Internal |
| 1     | KEYSWITCH | 2 | Parent. | 0     | SW32  | 1    | 0 | Toggle SW | 0      |       | 0   | .0    | 0           | None     |
| 2     | SW 02     | 2 | Parent  | 0     | 5W1   | 1    | 0 | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 3     | SW 03     | 2 | Parent  | 0     | \$1/2 | 1    | 0 | Topple SW | 0      |       | 0   | ò     | 0           | None     |
| 4     | SW 04     | 2 | Parent. | 0     | \$1/3 | 19   | 0 | Toople SW | 0      |       | 0   | 0     | 0           | None     |
| 5     | SW 05     | 2 | Parent  | 0     | 53/4  | 1    | 0 | Topple SW | 0      |       | 0   | 0     | 0           | None     |
| 6     | SW/ 05    | 2 | Parent  | 0     | 54/5  | 1    | 0 | Topple SW | 0      |       | 0   | 0     | 0           | None     |
| 7     | SW 07     | 2 | Parent  | 0     | \$115 | 2    | 0 | Topple SW | 0      |       | ō   | 0     | 8           | None     |
| 8     | SW 08     | 2 | Parent  | 0     | SW7   |      | 0 | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 9     | SW 09     | 2 | Parent  |       | 5418  |      |   | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 10    | 5W 10     | 2 | Parent  |       | 51/9  | 1    | 0 | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 11    | SW 11     | 2 | Parent  | 0     | SW 30 | 2    | 0 | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 12    | SW 12     | 2 | Parent  |       | \$W11 | 2    |   | Topple SW | 0      |       | 0   | 0     | 0           | None     |
| 13    | SW 13     | 2 | Parent  |       | SW12  | 1    | 0 | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 24    | SW 14     | 2 | Parent  |       | SW13  | 1    | 0 | Topple SW | 0      |       | 0   | Ó     | 0           | None     |
| 15    | SW 15     | 2 | Parent  |       | SW14  | 2    |   | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 25    | SW 16     | 2 | Parent  |       | SW15  | 2    | • | Toggle SW |        |       | 0   | 0     | Q.          | None     |
| 17    | SW 17     | 1 | Parent  |       | SW 16 | 2    | 0 | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 18    | SW 18     | 2 | Parent  |       | \$W17 | 2    |   | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 19    | SW 19     | 2 | Parent  |       | SW 18 | 2    |   | Toggle SW | .0     |       | 0   | 0     | 0           | None     |
| 20    | SW 30     | 2 | Parent  |       | SW29  | 1    | 0 | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 21    | SW 21     | 2 | Parent  | ۲     | \$W20 | 2    | ۲ | Topple SW | 0      |       | 0   | 0     | 0           | None     |
| 22    | SW 22     | 2 | Parent  |       | SW21  | 2    | 0 | Toggle SW | .0     |       | 0   | 0     | 0           | None     |
| 23    | 5W 23     | 2 | Parent  |       | 5W22  | 1    | • | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 24    | 5W 24     | 2 | Parent  |       | SW23  | 2    |   | Toggle 5W | 0      |       | 0   | 0     | 0           | None     |
| 25    | SW 25     | 2 | Parent  | •     | \$W24 | P    | • | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 25    | SM 26     | 2 | Parent  | •     | \$W25 | 2    | • | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 27    | 5W 27     | 2 | Parent  |       | SW26  | 2    |   | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 28    | SW 28     | 2 | Parent  | 0     | \$W27 | 2    | • | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 29    | 5W 29     | 2 | Parent  |       | SW28  | 2    | • | Toggle SW | 0      |       | 0   | 0     | 0           | None     |
| 30    | SW 30     | 2 | Parent  |       | 5W29  |      |   | Toggle SW | 0      |       | 0   | 0     | 0           | None     |

### Other Windows and Dialog Boxes, Continued

FirmwareThis *Firmware* dialog box is used to download new firmware to the<br/>hardware. This dialog box is available from the **Hardware** menu.

| Firmware                   |                          |                |                    |
|----------------------------|--------------------------|----------------|--------------------|
| Download<br>Transfer Binar | Firmware<br>y To Device: |                |                    |
| DESTINATION DEV            | /ICE                     |                |                    |
| Select Box                 | To Download              | d To:          |                    |
| PARENT                     | CHILD 1                  | <b>SIDECAR</b> | <b>WAVEMAKER</b>   |
|                            | CHILD 2                  | F/W Version:   |                    |
| FIRMWARE FILE              | :                        |                |                    |
|                            |                          |                | Select Binary File |
|                            |                          |                | 😽 Download         |
|                            |                          |                | Exit               |
|                            |                          |                |                    |

Net NameThe Net Name dialog box is used to set the net name for the CAN connection.Dialog BoxThis dialog box is accessed through the Hardware menu.

| Net Name                                       | ×                    |
|--|----------------------|
| Input Net Name<br>Current Net Name: LUIS_Net_1 | <u>O</u> K<br>Cancel |
|  |                      |

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

| Ethernet Configuration                           |   |   |   |
|--|---|---|---|
| Configure Etherner<br>Detect and Configure Devic | t Connection<br>es os the Network:  |   |   |
| Optimal (thermet                                 | TCP/IP Configuration (Formal Temp) TCP/IP HOOKEL FAV Verses IP Configuration (Formal Temp)  | SEARCH FOR DEVICES  |   |
| Hodels Requeed.                                  | State: OHEP Local Pr Local Pr Subart Subart Getremy State: Oneor will use the adver betweet settless BHCP - Orevice will use the adver betweet settless BH | Field     Field     Field     Frees Search to book for de     Seited Device from Linking     Adjust Local By Part, Sale     Clack the Set button to sen | Cherect IP Search writes on Solmet. et, Gateway. d changes. |
| s  | Passwort  | (Nesty  | Gi Drit   |

### Other Windows and Dialog Boxes, Continued

Connect toThe Connect to Hardware dialog box is used to connect to and disconnectHardwarefrom the Ethernet. This dialog box is accessed through the Hardware menu.Dialog BoxDialog box

| Connect to Hardware 🛛 🛛 🔀   |
|---|
| LUIS Address:<br>Enter Address of Connected LUIS<br>IP Address:<br>IPAddress: 292.168.000.117 Port: 32767   |
| Network Connection This feature requires the optional Ethernet Hodule.  |
| Connect Network Connection to highlighted connector on the back panel. Enter the IP address and Port number for LUIS and press Connect. To work without the hardware, press Work Offline. |

Calibrate UnitThe Calibrate Unitdialog box is used to calibrate hardware to the ECM to<br/>ensure accurate temperature readings. This dialog box is accessed through the<br/>Hardware menu.

| alibrate Unit   |               |                 |
|-----------------|---------------|-----------------|
| Unit Calibr     | ation         |                 |
| Optimize Outpu  | uts For Load  |                 |
| DESTINATION DE  | /ICE          |                 |
| Select Un       | it To Calibra | te:             |
| PARENT          | CHILD 1       | SIDECAR         |
|                 | CHILD 2       |                 |
|                 |               |                 |
|                 | 0 %           |                 |
| 💿 Calibrate Uni | t With ECM    | 🔶 <u>S</u> tart |
| 🔘 Set Unit To D | efaults       | Exit            |
|                 |               |                 |

## Other Windows and Dialog Boxes, Continued

Data PlayerThe Data Player dialog box is used to load and playback CSV data files. This<br/>dialog box is accessed through the Operation menu.

| Data Player    |            |       |        |           |        |
|----------------|------------|-------|--------|-----------|--------|
| Eile           |            |       |        |           |        |
| Playback File: |            |       |        |           |        |
| 0 10 2         | ,p<br>0 30 | 40 50 | ) 60   | 70 80     | 90 100 |
| Loop #: 0      |            |       | finite | Loops:    | 1      |
| Record #       | 0          | of 0  | Sample | Time (ms) |        |

## Notes

## Chapter 3 – Configuring the LUIS GUI

## Overview

| Each of the controls on the LUIS GUI can be configured. They can be named<br>as well as having defaults, units, and minimum/maximum values set. They<br>can be interlocked with other controls, and they can be removed from the<br>display. All configuration takes place on the <b>Component Configuration</b><br>window. |  |  |
|---|--|--|
| 0   |  |  |
| e   |  |  |
|   |  |  |
|   |  |  |
|   |  |  |
|   |  |  |
|   |  |  |
|   |  |  |

### **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<br/>Component<br/>Configuration<br/>WindowThis graphic and table describe the Component Configuration window. $1 \rightarrow \frac{1}{2} \rightarrow \frac{1}$ 

| _   |       | e @ # @ I | 과 씨 왕 🗞 | v        |              |         |       |     |     |        |          |
|-----|-------|-----------|---------|----------|--------------|---------|-------|-----|-----|--------|----------|
| No. | Name  | Loadbox # | Channel | Visible  | Function     | Default | Units | Min | Max | Digits | Multiple |
| 1   | SW 1  | Parent    | 🧐 SW1   | <b>V</b> | O Toggle SW  | 0       |       | 0   | 0   | 0      | 0        |
| 2   | 5W 2  | Parent    | 🧐 5W2   | <b>V</b> | Toggle SW    | 0       |       | 0   | 0   | 0      | 0        |
| 3   | SW 3  | Parent    | 🥝 SW3   | <b>V</b> | O Toggle SW  | 0       |       | 0   | 0   | Ô      | 0        |
| 4   | SW 4  | Parent    | SW4     |          | O Toggle SW  | 0       |       | 0   | 0   | 0      | 0        |
| 5   | SW 5  | Parent    | 🧐 SW5   | <b>V</b> | Toggle SW    | 0       |       | 0   | 0   | 0      | 0        |
| 6   | 5W 6  | Parent    | SW6     | <b>V</b> | Toggle SW    | 0       |       | 0   | 0   | 0      | 0        |
| 7   | SW 7  | Parent    | 🥝 SW7   | <b>V</b> | O Toggle SW  | 0       |       | Û   | 0   | Û      | 0        |
|     | SW 8  | Parent    | Sw8     |          | O Toggle SW  | 0       |       | 0   | 0   | 0      | 0        |
| 2   | SW 9  | 2 Parent  | 5W9     | <b></b>  | Toggle SW    | 0       |       | 0   | 0   | 0      | 0        |
| 10  | 5W 10 | 2 Parent  | SW10    |          | Toggle SW    | 0       |       | 0   | 0   | 0      | 0        |
| 11  | SW 11 | Parent    | SW11    |          | O Toggle SW  | 0       |       | 0   | 0   | 0      | 0        |
| 12  | SW 12 | 2 Parent  | SW12    |          | O Toggle SW  | 0       |       | 0   | 0   | 0      | 0        |
| 13  | 5W 13 | 2 Parent  | SW13    |          | Toggle SW    | 0       |       | 0   | 0   | 0      | 0        |
| 14  | SW 14 | 2 Parent  | SW14    |          | Toade SW     | 0       |       | 0   | 0   | 0      |          |
| 15  | SW 15 | 2 Parent  | SW15    |          | Toode SW     | 0       |       | 0   | 0   | 0      |          |
| 16  | SW 16 | 2 Parent  | SW16    |          | Toggle SW    | 0       |       | 0   | 0   | 0      |          |
| 17  | SW 17 | R Parent  | SW17    |          | Toggle SW    | 0       |       | 0   | 0   | 0      |          |
| 18  | SW 18 | 2 Parent  | 5W18    |          | Toade SW     | 0       |       | 0   | 0   | 0      | -        |
| 19  | SW 19 | 2 Parent  | 3 SW19  |          | Coope SW     | 0       |       | 0   | 0   | 0      |          |
| 20  | SW 20 | 2 Parent  | SW20    |          | Toggle SW    | 0       |       | 0   | 0   | 0      |          |
| 21  | SW 21 | 2 Parent  | SW21    |          | Coole SW     | 0       |       | 0   | 0   | 0      | 0        |
| 22  | 5W 22 | 2 Parent  | 5W22    |          | O Togde SW   | 0       |       | 0   | 0   | 0      | 0        |
| 23  | SW 23 | 2 Parent  | 5W20    |          | Toggle SW    | 0       |       | 0   | 0   | 0      | 0        |
| 24  | SW 24 | 2 Parent  | SW24    |          | Toggle SW    | 0       |       | 0   | 0   | 0      | 0        |
| 25  | SW 25 | 2 Parent  | SW25    |          | Toggle SW    | 0       | -     | 0   | 0   | 0      | 0        |
| 26  | 5W 26 | 2 Parent  | 5W26    |          | Code SW      | 0       |       | 0   | 0   | 0      | 0        |
| 27  | SW 27 | 2 Parent  | SW27    |          | Code SW      | 0       |       | 0   | 0   | 0      | 0        |
| 28  | SW 28 | 2 Parent  | 6 SW28  |          | Coope SW     | 0       |       | 0   | 0   | 0      | 0        |
| 20  | SW 29 | Barent    | 6 SW29  |          | Togale Still | 0       |       | 0   | 0   | 0      |          |

|   | Description |  |
|---|-------------|--|
| 1 | Menu Bar    |  |
| 2 | Toolbar     |  |
| 3 | Panels      |  |

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

| Торіс        | See Page |
|--------------|----------|
| The Menu Bar | 51       |
| The Toolbar  | 52       |
| Panels       | 54       |

## 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 <i>Open</i> dialog box<br>where an existing configuration<br>can be found and loaded. |
|           | Save Configuration As | Opens the <i>Save As</i> dialog box so the current configuration can be saved under a new name. |
|           | Print                 | Opens the <b>Print Preview</b><br>window from which the<br>configuration can be printed.        |
|           | Exit                  | Closes the <b>Component</b><br><b>Configuration</b> window.                                     |
| Component |                       |   |
|           | Switch                | Displays the switch<br>components in the <b>Panels</b><br>section of the window.                |
|           | Pot Knob              | Displays the pot knob<br>components in the <b>Panels</b><br>section of the window.              |
|           | Gauge                 | Displays the gauge components<br>in the <b>Panels</b> section of the<br>window.                 |
|           | Slider Rotary         | Displays the slider rotary<br>components in the <b>Panels</b><br>section of the window.         |

## The Menu Bar, Continued

| Menu  | Option                | Description   |
|-------|-----------------------|---|
| Tools |                       |   |
|       | Apply                 | Apply the configuration to the Main Panel.  |
|       | Tables                | Opens the <i>Tables</i> dialog box where tables can be added or modified.                 |
|       | Configuration Options | Opens the <i>Options</i> dialog box<br>where Tabs and Engine Model<br>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        |
| <b>2</b>  | Open a new configuration |
|           | Save the configuration   |
| 4         | Print the configuration  |
| <b>છ</b>  | Configure Switches       |
| e         | Configure Pot Knobs      |
| ۲         | Configure Gauges         |
|           | Configure Sliders        |
| 3         | Configure Rotary Knobs   |
|           | Interpolation Tables     |
| <u>[]</u> | Configuration Options    |
| <b>\$</b> | Move Entry Up            |
| 🤣         | Move Entry Down          |
| ×1        | 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.   |          |  |  |  |
|                 | Торіс   | See Page |  |  |  |
|                 | Creating an Interpolation Table   | 56       |  |  |  |
|                 | Importing an Interpolation Table  | 58       |  |  |  |
|                 |   |          |  |  |  |

## **Creating an Interpolation Table**

| Introduction                          | Interpolation tables can be created from the <b>Table</b> panel in the <b>Component Configuration</b> window. The data can be entered manually, or cut and pasted from another application such as Microsoft Excel. |   |  |  |  |
|---------------------------------------|---|---|--|--|--|
| Creating an<br>Interpolation<br>Table | This tab  | le outlines the steps for creating an interpolation table.  |  |  |  |
|                                       | Step  | Action  |  |  |  |
|                                       | 1   | From the <b>Operations</b> menu, <b>Select</b> the <i>Configuration Panel</i> option.   |  |  |  |
|                                       |   | Result: The Component Configuration window displays.  |  |  |  |
|                                       | 2   | On the Menu Bar, Click the Tables icon  |  |  |  |
|                                       |   | <u>Result</u> : The <b>Table</b> panel displays in the <b>Component</b><br><b>Configuration</b> window.   |  |  |  |
|                                       | 3   | If any tables have already been added to the configuration, they display in the <b>Table Name</b> 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 <b>Table Name</b> box. |  |  |  |
|                                       | 4   | To add a new table directly in the LUIS GUI, <b>Click</b> the <b><add< b=""> <b>Table&gt;</b> button.</add<></b>  |  |  |  |
|                                       |   | Result: The Table Name dialog box displays.   |  |  |  |
|                                       | 5   | In the <i>Add Table Name</i> field, <b>Type</b> the name of the new table, and then <b>Click <ok< b=""><b>&gt;</b>.</ok<></b>   |  |  |  |
|                                       |   | <u>Result</u> : The new table name is added to the <b>Table Name</b> box.   |  |  |  |
|                                       | 6   | With the new table name selected, fill in the <i>Min Volts, Max Volts, DAC Multiplier, Table Axis, and Table Notes</i> fields.  |  |  |  |
|                                       | 7   | Add the table data by either <b>Typing</b> it in directly or by <b>Cutting</b> and <b>Pasting</b> from another application.   |  |  |  |
|                                       | 8   | When the table setup is complete, <b>Save</b> the configuration before closing the <b>Table</b> panel.  |  |  |  |
|                                       |   | <u>Note</u> : To immediately apply the setup to the front panel, from the <b>File</b> menu <b>Select</b> the <i>Apply Configuration</i> option.   |  |  |  |

## Creating an Interpolation Table, Continued

| Tables Panel | This graphic illustrates the Tables panel in the Component Configuration |
|--------------|--|
|              | window.  |

|      | DEFAULT |           |                                   |
|------|---------|-----------|-----------------------------------|
|      | Counts  | Eng Units |                                   |
| 1 0  | )       | 0         |                                   |
| 23   | 32      | 3.125     | Default Add New                   |
| 36   | 54      | 6.25      |                                   |
| 4 9  | 96      | 9.375     | <b>X</b> <u>D</u> elete           |
| 5 1  | 128     | 12.5      |                                   |
| 6 1  | 160     | 15.625    | Import 📑                          |
| 7 1  | 192     | 18.75     |                                   |
| 8 2  | 224     | 21.875    |                                   |
| 9 2  | 256     | 25        |                                   |
| 10 2 | 288     | 28.125    |                                   |
| 11 3 | 320     | 31.25     |                                   |
| 12 3 | 352     | 34.375    |                                   |
| 13 3 | 384     | 37.5      |                                   |
| 14 4 | 416     | 40.625    |                                   |
| 15 4 | 448     | 43.75     |                                   |
| 16 4 | 480     | 46.875    |                                   |
| 17 5 | 512     | 50        |                                   |
| 18 5 | 544     | 53.125    | Name: Default                     |
| 19 5 | 576     | 56.25     | Min Volts: 0                      |
| 20 6 | 508     | 59.375    | Max Volte: 5                      |
| 21 6 | 540     | 62.5      |                                   |
| 22 6 | 572     | 65.625    | DAC Multiplier: 4 10 Bit (0-1023) |
| 23 7 | 704     | 68.75     | Table Axis: Counts 🔹              |
| 24 7 | 736     | 71.875    | Table Notes:                      |
| 25 7 | 768     | 75        |                                   |
| 26 8 | 300     | 78.125    |                                   |
| 27 8 | 332     | 81.25     |                                   |
| 28 8 | 364     | 84.375    |                                   |
| 29 8 | 396     | 87.5      |                                   |
| 30   |         |           |                                   |

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

| Table Name       |        |
|------------------|--------|
| Input Table Name | ОК     |
|                  | Cancel |
|                  |        |
|                  |        |
|                  |        |

## Importing an Interpolation Table

| Introduction                           | Interpolation tables can be imported from other calibrations. |   |  |  |  |  |  |
|--|---|---|--|--|--|--|--|
| Importing an<br>Interpolation<br>Table | This tabl   | e outlines the steps for importing an interpolation table.  |  |  |  |  |  |
|  | Step  | Action  |  |  |  |  |  |
|  | 1   | From the <b>Operations</b> menu, <b>Select</b> the <i>Configuration Panel</i> option.   |  |  |  |  |  |
|  |   | <u>Result</u> : The <b>Component Configuration</b> window displays.   |  |  |  |  |  |
|  | 2   | On the Menu Bar, Click the Tables icon  |  |  |  |  |  |
|  |   | <u>Result</u> : The <b>Table</b> panel displays in the <b>Component</b><br><b>Configuration</b> window.   |  |  |  |  |  |
|  | 3   | If any tables have already been added to the configuration, they display in the <b>Table Name</b> 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 <b>Table Name</b> box. |  |  |  |  |  |
|  | 4   | To import a table, <b>Click</b> the <b><import< b="">&gt; button.</import<></b>   |  |  |  |  |  |
|  |   | <u>Result</u> : The <i>Open</i> dialog box displays.  |  |  |  |  |  |
|  | 5   | Find the configuration file to import from, and <b>Click <open< b="">&gt;.</open<></b>  |  |  |  |  |  |
|  |   | Result: The Import Tables dialog box displays.  |  |  |  |  |  |
|  | 6   | On the <i>Import Tables</i> dialog box, <b>Select</b> the tables to import. Once all the desired tables are selected, <b>Click</b> < <b>Import Selected</b> >.  |  |  |  |  |  |
|  |   | <u>Result</u> : 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

When the table setup is complete, Save the configuration before closing the Table panel.
<u>Note</u>: To immediately apply the setup to the front panel, from the File menu Select the *Apply Configuration* option.

## Importing an Interpolation Table, Continued

**Tables Panel**This graphic illustrates the **Tables** panel in the **Component Configuration**<br/>window.

|    | Counts | Eng Units |                                     |                 |
|----|--------|-----------|-------------------------------------|-----------------|
| 1  | 0      | 0         | TABLE NAME                          |                 |
| 2  | 32     | 3.125     | Default                             | Add <u>N</u> ew |
| 3  | 64     | 6.25      |                                     |                 |
| 4  | 96     | 9.375     |                                     | <u>X</u> elete  |
| 5  | 128    | 12.5      |                                     |                 |
| 6  | 160    | 15.625    |                                     | Import 🔤        |
| 7  | 192    | 18.75     |                                     |                 |
| 8  | 224    | 21.875    |                                     |                 |
| 9  | 256    | 25        |                                     |                 |
| 10 | 288    | 28.125    |                                     |                 |
| 11 | 320    | 31.25     |                                     |                 |
| 12 | 352    | 34.375    |                                     |                 |
| 13 | 384    | 37.5      |                                     |                 |
| 14 | 416    | 40.625    |                                     |                 |
| 15 | 448    | 43.75     |                                     |                 |
| 16 | 480    | 46.875    |                                     |                 |
| 17 | 512    | 50        | The Caulty                          |                 |
| 18 | 544    | 53.125    | Name: Derault                       |                 |
| 19 | 576    | 56.25     | Min Volts: 0                        |                 |
| 20 | 608    | 59.375    | Max Volts: 5                        |                 |
| 21 | 640    | 62.5      |                                     |                 |
| 22 | 672    | 65.625    | DAC MUITIPIIER: 4 • 10 Bit (0-1023) |                 |
| 23 | 704    | 68.75     | Table Axis: Counts 👻                |                 |
| 24 | 736    | 71.875    | Table Notes:                        | ~               |
| 25 | 768    | 75        |                                     |                 |
| 26 | 800    | 78.125    |                                     |                 |
| 27 | 832    | 81.25     |                                     | ×.              |
| 28 | 864    | 84.375    |                                     |                 |
| 29 | 896    | 87.5      |                                     |                 |

This graphic illustrates the *Import Tables* dialog box.

| mport    | Table Name                 | Import Select |
|----------|----------------------------|---------------|
|          | Default                    | Tuborcasiect  |
|          | Rotary_Table               | E Fuit        |
| <b>~</b> | Switch_Table               |               |
|          | C_AIP_Acctr_Table_1_Y_Axis |               |
| ¥        | Remote_Throttle            |               |
|          | C_AIP_OP_Linear_Y          |               |
|          | C_FSI_lp_FuelSupPrsTable   |               |
| ~        | Fuel_Accumulator_Table     |               |
|          | C_AMB_AirPressSensorY      |               |
|          | C_AIP_CrankcasePressTable  |               |
|          | C_AIP_ChargePressTable     |               |
| ~        | C_AIP_CP_Linear_Y          |               |
|          | C_AIP_PreOilPressTable     |               |
|          | C AIP PostOilPressTable    |               |

Import Tables Dialog Box

## **Deleting an Interpolation Table**

| Deleting an<br>Interpolation<br>Table | This tabl | e outlines the steps for deleting an interpolation table.                     |
|---------------------------------------|-----------|---|
|                                       | Step      | Action  |
|                                       | 1         | From the <b>Operations</b> menu, <b>Select</b> the <i>Configuration Panel</i> |

| Step | Action  |
|------|---|
| 1    | From the <b>Operations</b> menu, <b>Select</b> the <i>Configuration Panel</i> 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 <i>Table</i> field to another table name or select <i>None</i> 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 📴.   |
|      | <u>Result</u> : The <b>Table</b> panel displays in the <b>Component</b><br><b>Configuration</b> window.   |
| 4    | If any tables have already been added to the configuration, they display in the <b>Table Name</b> 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 <b>Table Name</b> box. |
| 5    | On the <b>Table</b> panel <b>Select</b> the table to delete. Then <b>Click</b> the < <b>Delete</b> > button.  |
|      | <u>Result</u> : The table is deleted and is removed from the table list.  |
| 6    | When the changes are complete, <b>Save</b> the configuration before closing the <b>Table</b> panel.   |
|      | <u>Note</u> : To immediately apply the setup to the front panel, from the <b>File</b> menu <b>Select</b> the <i>Apply Configuration</i> option.   |

## Deleting an Interpolation Table, Continued

**Tables Panel**This graphic illustrates the **Tables** panel in the **Component Configuration**<br/>window.

| TABLE | ROTARY_T | ABLE      |                           |   |           |
|-------|----------|-----------|---------------------------|---|-----------|
|       | Counts   | Eng Units |                           |   |           |
| 1     | 0        | 0         |                           |   | 🔲 Add New |
| 2     | 2000     | 1         | C_AMB_AirPressSensorY     | - |           |
| 3     | 4095     | 2         | C_AIP_CrankcasePressTable |   |           |
| 4     |          |           | C_AIP_ChargePressTable    |   |           |
| 5     |          |           | C_AIP_CP_Linear_Y         |   |           |
| 6     |          |           | C_AIP_PreOilPressTable    |   | Import    |
| 7     |          |           | C_AIP_PostOilPressTable   |   |           |
| 8     |          |           | C_AIP_ExhaustTmptrTable   |   |           |
| 9     |          |           | C_AIP_CT_Linear_y         |   |           |
| 11    |          |           | C_AIP_OT_Linear           |   |           |
| 12    |          |           | C_FSI_t_FuelTempTable     |   |           |
| 13    |          |           | C_AIP_ChargeTmptrTable    |   |           |
| 14    |          |           | Rotary_Table              |   |           |
| 15    |          |           |                           |   |           |
| 16    |          |           |                           |   |           |
| 17    |          |           |                           |   |           |
| 18    |          |           | Name: Rotary_Table        |   |           |
| 19    |          |           | Min Volts: 0              |   |           |
| 20    |          |           | Max Volts: 5              |   |           |
| 21    |          |           | DAC Multiplier: 1         |   |           |
| 22    |          |           |                           |   |           |
| 23    |          |           |                           |   |           |
| 24    |          |           |                           |   |           |
| 25    |          |           |                           |   |           |
| 20    |          |           |                           |   |           |
| 28    |          |           |                           |   |           |
| 29    |          |           |                           |   |           |
| 30    |          |           |                           |   |           |

TableThis graphic illustrates the table references that must be removed before<br/>deleting an interpolation table.

| No. | Name       | ĺι | oadBox # | 1 | Channel | Visible  | 1 | Function | Default | Units | Min | Max | Multiplier | Interlock | Interlock OP | Table        |
|-----|------------|----|----------|---|---------|----------|---|----------|---------|-------|-----|-----|------------|-----------|--------------|--------------|
| 1   | ALT DROOP  | 2  | Parent   | v | SIG27   |          | 0 | DAC      | 0       |       | 0   | 0   | 0          | None      | None         | Rotary_Table |
| 2   | ALT TORQUE | 2  | Parent   | v | SIG28   | <b>V</b> | 0 | DAC      | 0       |       | 0   | 0   | 0          | None      | None         | Rotary_Table |
| 3   | WIF        | 2  | Parent   | v | SIG13   |          |   | DAC      | 0       |       | 0   | 0   | 0          | None      | None         | Rotary_Table |

## **Section 3 – Configuring Waveform Gauges**

## **Configuring Waveform Gauges**

| Introduction                      | The cont<br><b>Configu</b><br>require c | figuration for the waveform gauges, called gauges on the <b>Component</b><br><b>ration</b> window, is different from all the other components as they<br>configuration of the waveform. |
|-----------------------------------|---|---|
| Configuring<br>Waveform<br>Gauges | This tab                                | le outlines the steps for configuring waveform gauges.  |
|                                   | Step                                    | Action  |
|                                   | 1                                       | From the <b>Operations</b> menu, <b>Select</b> the <i>Configuration Panel</i> option. <u>Result</u> : The <b>Component Configuration</b> window displays.                               |
|                                   | 2                                       | On the Menu Bar, <b>Click</b> the <b>Gauges</b> icon <b>One Result</b> : The <b>Gauge</b> panel displays in the <b>Component Configuration</b> window.                                  |

| 3 | In the top portion of the Gauges panel, complete the fields for |
|---|---|
|   | each waveform gauge being used.                                 |

| Field     | Description  |
|-----------|--|
| Name      | <b>Type</b> in the component name.   |
| Loadbox # | For waveform gauges, Select Wavemaker.   |
| Channel   | Select the channel number from the drop<br>down. This is the physical channel in the<br>Wavemaker. Ensure the channel has the<br>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 <i>Freq</i> for waveform gauges or DAC to control a voltage signal instead.   |
| Default   | Sets the default value for the control when<br>the configuration is loaded or the control is<br>reset  |

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

|               | Name  | Los    | adios F  | 1 | 2020104   | <b></b>               | 192345  | Functor   | 12    | 1.1.1.1.1.1                                   | 1 Units   | I Min  | Max  | Matpher                                       | I Interlock   | I Interlock OP | Table   |
|---------------|---|--------|--|---|---|-----------------------|---|---|-------|---|---|--|--|---|---|----------------|---------|
| 1             | ENGINE SPEED  | S w    | NaveMaker  |   | CH1   |                       |   | Fre   | q     | 0   | RPM   | 0  | 3000   | 0   | None  | None           | Default |
| 2             | TURBO SPEED   | S w    | NaveMaker  |   | CH3   |                       | 2   | Fre   | P.    | 0   | RPM x 1000  | 0  | 150  | 1000  | None  | None           | Default |
| 3             | FREQ THROTTLE   | S W    | NaveMaker  | - | 014   |                       |   | Fre   | q     | 100   | Hz  | 100  | 400  | 0   | None  | None           | Default |
| 4             | SPARE 1   | S w    | NaveMaker  |   | CH5   |                       | 9   | Fre   | q     | 0   | NONE  | 0  | 150  | 0   | None  | None           | Default |
| 5             | SPARE 2   | S w    | VaveMaker  |   | CH2   |                       | 9   | fre fre   | 4     | 0   | NONE  | 0  | 150  | 0   | None  | None           | Default |
| 6             | Spare   | 🚭 W    | NaveMaker  |   | 016   |                       |   | Fre   | q     | 0   | None  | 0  | 150  | 0   | None  | None           | Default |
| 7             | Spare   | 🔵 w    | NaveMaker  |   | CH7   |                       | 2   | Fre   | Q.    | 0   | None  | 0  | 150  | 0   | None  | None           | Default |
| 8             | Spare   | S w    | NaveMaker  | - | CHS   |                       | 9   | Fre   | q     | 0   | None  | 0  | 150  | 0   | None  | None           | Default |
|               |   |        |  |   |   |                       |   |   |       |   |   |  |  |   |   |                |         |
| 43            | Name  | 1 wave | farm Number  | 6 | od Type   |                       | Sync  | ] Offset  | 1 310 | pust 1 i                                      | Curput Teet   | hiller [Cyd                                    | les,Rav TRan   | go Ratio   Public                             | t HE Preg   |                |         |
| 1             | Name<br>BNGJE SPEED   | 1 wave | firm Namber<br>3                                   |   | rd Type<br>Arb  | 9                     | Sync  | J Officet   |       | RPM   | Cusput Teet   | h,Rev TCyc                                     | les,Rav Ram<br>2                                       | o Rate Post                                   | t inti Freeg  |                |         |
| 1 2           | Name<br>BNGNE SPEED<br>TURIKO SPEED   | 1 wave | firm Namber<br>3<br>1                              |   | nd Tirpet<br>Arb<br>Dig                                     | 9                     | Sync<br>Sync<br>No Sync   | J Officet<br>0  |       | RPM   | Arb<br>VR   | n Rev I Cyc<br>0<br>I                          | les,Rav Ram<br>2<br>1                                  | o Rate   Pud<br>0                             | t HE Pring<br>0   |                |         |
| 1 2 3         | Nore<br>BNGRS SPEED<br>TURBO SPEED<br>REQ THROTTLE                                      | J wave | rform Tilumber<br>3<br>1<br>1                      |   | id Type<br>Arb<br>Dig<br>Dig                                | <b>9</b><br>9         | Sync<br>Sync<br>No Sync<br>No Sync  | 0<br>0<br>0   |       | RPM<br>RPM<br>Freq                            | Arb<br>VR<br>Hall   | h,Eer Cyd<br>0 1                               | ies,kav Ram<br>2<br>1                                  | o Rater   Post<br>0<br>0<br>0                 | 6 HE Freq<br>0<br>0<br>0  |                |         |
| 1 2 3 4       | Name<br>ENGINE SPEED<br>TURINO SPEED<br>FREQ THROTTLE<br>SPARE 1                        | 1 wave | Par Number<br>3<br>1<br>1                          |   | id Type<br>Arb<br>Dig<br>Dig<br>Dig                         | 0<br>0<br>0<br>0      | Sync<br>Sync<br>No Sync<br>No Sync<br>No Sync                               | 00fliet<br>0<br>0<br>0                                      |       | RPM<br>RPM<br>Freq III<br>RPM III             | Arb<br>VR<br>VR<br>Hall   | N Rev Toys<br>0<br>1<br>1                      | ies,Nav Ran<br>2<br>1<br>1                             | 0 FASH 9000<br>0 0<br>0 0<br>0 0              | FHS Pring<br>0 51<br>0 0<br>0 0   |                |         |
| 1 2 3 4 5     | Norm<br>ENGINE SPEED<br>TURBO SPEED<br>FREQ THROTTLE<br>SPARE 1<br>SPARE 2              | 1 wave | Form Tilumber<br>3<br>1<br>1<br>1<br>1<br>2        |   | Arb<br>Dig<br>Dig<br>Dig<br>Arb                             |                       | Sync<br>Sync<br>No Sync<br>No Sync<br>No Sync<br>Sync                       | 0 Officet   |       | RPM<br>RPM<br>Freq III<br>RPM III<br>RPM      | Arb<br>Arb<br>VR<br>Heal<br>Heal<br>Arb   | 6 Per J Cost<br>0<br>1<br>1<br>0<br>0          | ies,Nav Ram<br>2<br>1<br>1<br>1<br>2                   | 0 Rate Ptot<br>0 0<br>0 0<br>0 0<br>0 0       | FHS Pring<br>0<br>0<br>0<br>0   |                |         |
| 1 2 3 4 5 6   | Normal<br>BYGDRE SPEED<br>TURED SPEED<br>FRAQ THROTTLE<br>SPARE 2<br>Spare<br>Spare     | 1 wave | Form 74 under<br>3<br>1<br>1<br>2<br>1             |   | Arb<br>Dig<br>Dig<br>Dig<br>Dig<br>Dig<br>Dig               | 9<br>9<br>9<br>9<br>9 | Sync<br>Sync<br>No Sync<br>No Sync<br>No Sync<br>Sync<br>No Sync            | 0 Officet<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 |       | RPM<br>RPM<br>Freq 11<br>RPM<br>RPM<br>RPM    | Arb<br>Arb<br>Hall<br>Hall<br>Hall<br>Ab  | N Per 1000<br>0<br>1<br>1<br>0<br>0<br>0       | les,Nitu Ram<br>2 1<br>1 1<br>2 1<br>1 2               | 0 FASH PAD<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0 | f id: Prog<br>0<br>0<br>0<br>0<br>0<br>0<br>0   |                |         |
| 1 2 3 4 5 6 7 | Name<br>BIGDIE SPEED<br>TURISO SPEED<br>FRADTUE<br>SPARE 1<br>SPARE 2<br>Soare<br>Spare |        | For Number<br>3<br>1<br>1<br>1<br>2<br>1<br>1<br>1 |   | Arb<br>Dig<br>Dig<br>Dig<br>Dig<br>Dig<br>Dig<br>Dig<br>Dig |                       | Sync<br>Sync<br>No Sync<br>No Sync<br>Sync<br>No Sync<br>No Sync<br>No Sync | 00500000000000000000000000000000000000                      |       | RPM<br>RPM<br>RPM<br>RPM<br>RPM<br>RPM<br>RPM | Test           Arb           VR           Hall           Hall           Hall           Hall           Hall           Hall | b Rev 1 Chi<br>0<br>1<br>1<br>0<br>0<br>0<br>0 | iei,Nav (Rat<br>2 1<br>1 1<br>2 2<br>1 1<br>1 1<br>1 1 | 0 RASe P20<br>0                               | 1         Freeg           0         0           0         0           0         0           0         0           0         0 |                |         |

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

|   | Name          | LoadBox # | Channel | Visible   | Function  | Default | Units     |     | Max  | Multiplier | Interlock | Interlock OP | Table   |
|---|---------------|-----------|---------|---|-----------|---------|-----------|-----|------|------------|-----------|--------------|---------|
| 1 | ENGINE SPEED  | WaveMaker | CH1     |   | Freq      | 0       | RPM       | 0   | 3000 | 0          | None      | None         | Default |
| 2 | TURBO SPEED   | WaveMaker | 🔵 СНЗ   |   | Freq Freq | 0       | RPM x1000 | 0   | 150  | 1000       | None      | None         | Default |
| 3 | FREQ THROTTLE | WaveMaker | 🜍 СН4   |   | Freq Freq | 100     | Hz        | 100 | 400  | 0          | None      | None         | Default |
| 4 | SPARE 1       | WaveMaker | CH5     |   | Freq Freq | 0       | NONE      | 0   | 150  | 0          | None      | None         | Default |
| 5 | SPARE 2       | WaveMaker | CH2     | <ul> <li>Image: A start of the start of</li></ul> | Freq 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 Freq | 0       | None      | 0   | 150  | 0          | None      | None         | Default |

Configuring Waveform Gauges, Continued This table continues to outline the steps for configuring waveform gauges.

| Step | Action       |  |  |  |  |  |  |  |  |  |  |
|------|--------------|--|--|--|--|--|--|--|--|--|--|
| 3    | Continued    |  |  |  |  |  |  |  |  |  |  |
|      | Field        | Description  |  |  |  |  |  |  |  |  |  |
|      | Units        | <b>Type</b> in the engineering units for the component.  |  |  |  |  |  |  |  |  |  |
|      | Min          | <b>Type</b> the minimum value for the component. This value will display on the gauge, and it must be a whole number.              |  |  |  |  |  |  |  |  |  |
|      | Max          | <b>Type</b> 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   | <b>Type</b> the multiplier to scale the component.   |  |  |  |  |  |  |  |  |  |
|      | Interlock    | Allows component's values to be locked together. <b>Select</b> the component to which this component should be locked.             |  |  |  |  |  |  |  |  |  |
|      | Interlock OP | Allows the user to determine if interlocked components should be <i>Non-Inverting</i> or <i>Inverting</i> .                        |  |  |  |  |  |  |  |  |  |
|      |              | <u>Note</u> : This option is only used if the component is a switch.   |  |  |  |  |  |  |  |  |  |
|      | Table        | <b>Sets</b> 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. |  |  |  |  |  |  |  |  |  |

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

| winds.                                       | onent Configura  | tion                     | 10 | onfig Fil   | e: testco   | nfig.T)         | (I)   |   |  |  |   |                 |  |            |              |         |
|--|--|--------------------------|----|---|---|-----------------|---|---|--|--|---|-----------------|--|------------|--------------|---------|
| Ele  | Component Loois  |                          |    |   |   |                 |   |   |  |  |   |                 |  |            |              |         |
|  | 010  | 0 1 0 9                  | 10 | 9 %   | 1   |                 |   |   |  |  |   |                 |  |            |              |         |
| No.  | Name   | Loadfor #                | 1  | Piannel   | Wattie  |                 | Function                                      | Defust  | Units  | Min  | 1 Мак   | L Digits        | Move Down                                      | Interfolds | Interlock OP | Table   |
| 1  | ENGINE SPEED   | S WaveMake               | -  | CHI   | 2   |                 | Freq  | 0   | RPM  | 0  | 4300  | 0               | 0  | None       | None         | Default |
| 2  | TURBO SPEED  | S WaveMake               |    | 013   | 1   |                 | Freq  | 0   | RPM x1000  | 0  | 150   | 0               | 1000   | None       | None         | Default |
| 3  | FAN SPEED  | S WaveMake               | -  | 06  |   |                 | Freq  | 0   | RPM x 10   | 0  | 7000  | 0               | 1  | None       | None         | Default |
| .4   | MASS AIR FLOW  | S WaveMake               | -  | OH  |   |                 | Freq  | 1050  | Hz   | 0  | 16000   | 0               | 0  | None       | None         | Default |
| 5  | SPARE 2  | WaveMake                 | -  | 042   | 2   |                 | Freq  | 0   | NONE   | 0  | 150   | 0               | 0  | None       | None         | Default |
| 6  | Spare  | S WaveMake               | -  | 017   | 9   |                 | Freq  | 0   | None   | 0  | 150   | 0               | 0  | None       | None         | Default |
| 2  | Spare  | WaveMake                 |    | OHD   |   |                 | Freq  | 0   | None   | 0  | 150   | 0               | 0  | None       | None         | Default |
|  |  |                          | _  |   |   |                 |   |   |  |  |   |                 |  |            |              |         |
| 8  | Spare  | G WaveMake               | ā  | CHS   | V   |                 | Freq  | 0   | None   | 0  | 150   | 0               | 0  | None       | None         | Defaul  |
| 8<br>()                                      | Spare  | WaveMake                 |    | CH9   |   |                 | Freq  | 0   | None   | 0  | 150   | 0               | 0  | None       | None         | Default |
| 8<br>()<br>1/5-                              | Spare<br>Norma   | WaveMake                 |    | CH9<br>rd Type  |   |                 | Freq  | 0<br>Most 1 o   | None<br>Magual Treeth  | 0<br>Rev   Cycle   | 150<br>(2247   Davip1   | 0<br>Data   PU  | 0<br>Milling                                   | None       | None         | Default |
| 8<br><<br>7/5-<br>1                          | Spare<br>Nona<br>ENGRE SPEED   | WaveMake                 |    | CH9   | 9 Sy  | ×               | Freq<br>CHut 0                                | 0<br>Sigue J o<br>RPM   | None<br>Maguat Taesthi<br>Arb 0  | 0<br>Panv   Cyclar   | 150<br>(Serv Barry 1  | 0<br>Cuta   PU  | 0<br>MMCFrag:<br>0                             | None       | None         | Default |
| 8<br>()<br>7/5-<br>1<br>2<br>2               | Spare<br>Flora<br>ENGRE SPEED<br>TURIS SPEED<br>SMI CEED                                     | WaveMake<br>WaveMore Num |    | CH9<br>cd Type<br>Arb<br>Arb                                | Sy     Sy   | IX<br>ymc       | Freq<br>Official<br>0                         | 0<br>Note C   | None<br>Arb 0<br>VR 0  | D<br>Plane Cycline<br>1  | 150<br>(See 0.000)<br>0<br>0                                      | O<br>Exte PV    | ethering:                                      | None       | None         | Default |
| 8<br>745-0<br>1<br>2<br>3                    | Spare<br>Risma<br>ENGRE SPEED<br>TURBO SPEED<br>FAN SPEED<br>Mass after Down                 | WaveHake                 |    | CH9<br>Arb<br>Arb<br>Arb                                    | Sy     Sy     No S     No S   |                 | Freq<br>Ciffut  <br>0  <br>0  <br>0           | 0<br>RPM 0<br>RPM 0<br>RPM 0<br>RPM   | None<br>None<br>Arb 0<br>VR 0<br>Arb 0<br>Arb 0                                      | 0<br>Flanv Cycles  | 150<br>(2000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0                    | O<br>Exta    PV | 0<br>MHRDFreeg<br>0<br>0                       | None       | None         | Default |
| 8<br>()<br>1<br>2<br>3<br>4<br>6             | Spare<br>Hons<br>ENGINE SPEED<br>TURIED SPEED<br>FAN SPEED<br>MASS ALR FLOW<br>Sobre 2       | WaveHday                 |    | CH9<br>ed Type<br>Arb<br>Arb<br>Dig<br>arb                  | Sym     S | x<br>ync<br>ync | Freq<br>offfat                                | 0<br>RPM<br>RPM<br>RPM<br>RPM<br>Freq<br>Down                                     | None<br>None<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0                            | 0<br>Planv Cycler  | 150<br>(244) (0.647) (<br>0<br>0<br>0<br>0<br>0                   | O<br>Data   PV  | 0<br>01100 //weq<br>0<br>0<br>0<br>0           | None       | None         | Default |
| 8<br>745-<br>1<br>2<br>3<br>4<br>5<br>6      | Spare<br>Hono<br>ENGDE SPEED<br>TURBO SPEED<br>FAN SPEED<br>MASS AIR FLOW<br>SPARE 2<br>Some | WaveHok                  |    | CH9<br>cH9<br>Arb<br>Arb<br>Arb<br>Dig<br>Arb<br>Dig<br>Dig |   |                 | Preq<br>0.00000000000000000000000000000000000 | D<br>RPM<br>PPM<br>PPM<br>PPM<br>PPM<br>RPM<br>RPM                                | None<br>None<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0 | 0<br>Parv   Cythe  | 150<br>(244) (0.647)<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0      | 0<br>Code    PU | 0<br>04128 /reaq<br>0<br>0<br>0<br>0           | None       | None         | Default |
| 8<br>7/05<br>1<br>2<br>3<br>4<br>5<br>6<br>7 | Spine<br>Horse<br>ENGRE SPEED<br>TURIO SPEED<br>HASS AIR FLOW<br>SPARE 2<br>Spine<br>Sown    | WaveHold                 |    | CH9<br>Arb<br>Arb<br>Dig<br>Arb<br>Dig<br>Dig<br>Dig        |   |                 | Preq  | D<br>Rpos<br>Rpos<br>Rpos<br>Rpos<br>Preq<br>Rpos<br>Rpos<br>Rpos<br>Rpos<br>Rpos | None<br>Arb 00<br>Arb 0<br>Arb 0<br>Arb 0<br>Hol 0                                   | 0<br>(Prov.   Cycles<br>  1<br>  1<br>  1<br>  1<br>  1<br>  1<br>  1<br>  1<br>  1<br>  1 | 150<br>150<br>100<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00 | 0               | 0<br>44140 /reeq<br>0<br>0<br>0<br>0<br>0<br>0 | None       | None         | Default |

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

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

| <b>Configuring</b><br><b>Waveform</b><br><b>Gauges,</b><br>Continued | This tabl | le continues to          | outline the steps for configuring waveform gauges.                                    |
|--|-----------|--------------------------|---|
|  | Step      |                          | Action  |
|  | 4         | For each wa the bottom p | veform gauge setup, the waveform must be setup in portion of the <b>Gauges</b> panel. |

| Field              | Description   |
|--------------------|---|
| Name               | The name is auto filled in from the top list.   |
| Waveform<br>Number | Select the waveform number that<br>corresponds to a stored waveform. See<br><i>Section 6</i> for current waveform number list<br>Note: Contact Gartech if unsure about  |
|                    | waveform numbers stored in the WaveMaker.   |
| Card Type          | Select the card type from <i>Arbitrary, Digital</i><br>and <i>Digital Simulated</i> . These are<br>dependent on what hardware is installed.<br>An arbitrary card can simulate a Digital<br>card by selecting <i>Digital Simulated</i> . |
| Sync               | <b>Sets</b> if the waveform is synchronized with other waveforms. Typically used if the signals must clock data out at the same rate  |
| Offset             | 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. <u>Note</u> : Offsets only apply to arbitrary cards.                                     |
| Input              | <b>Sets</b> the Engineering Unit for the data being sent to <i>RPM</i> or <i>Frequency</i> .  |
| Output             | 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.  |

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

| omp                                  | ment Configura  | tion       |   | 10   | onfig Fi   | ile: te  | stconf   | ig.TX  | η   |     |  |  |                   |   |           |   |           |              |         |
|--------------------------------------|---|------------|---|------|--|--|--|--------|---|-----|--|--|-------------------|---|-----------|---|-----------|--------------|---------|
| Ele                                  | Component Loois   |            |   |      |  |  |  |        |   |     |  |  |                   |   |           |   |           |              |         |
|                                      |   | (* o 1     | 0   | 0    | + +  | 1  |  |        |   |     |  |  |                   |   |           |   |           |              |         |
| No.                                  | Name  | l 1.005    | atorr≠  |      | hannel   |  | 11610  |        | Function  |     | Detast   | Units  | Min               | И Мак   | Digits    | Move Down                                     | Interlock | Interlock CP | Table   |
| 1                                    | ENGINE SPEED  | S Wa       | aveMaker  | 9    | OHI  |  |  |        | Freq  |     | 0  | RPM  | 0                 | 4300  | 0         | 0   | None      | None         | Default |
| 2                                    | TURBO SPEED   | S Wa       | aveMaker  | •    | 010  |  | 1  | $\sim$ | Freq  |     | 0  | RPM x1000  | 0                 | 150   | 0         | 1000  | None      | None         | Default |
| 3                                    | FAN SPEED   | S Wa       | aveMaker  |      | 06   |  |  | 2      | Freq  |     | 0  | RPM × 10   | 0                 | 2000  | 0         | 1   | None      | None         | Default |
| 4                                    | MASS AIR FLOW   | S Wa       | aveMaker  | 9    | OH   |  |  |        | Freq  |     | 1050   | Hz   | 0                 | 16000   | 0         | 0   | None      | None         | Default |
| 5                                    | SPARE 2   | S Wa       | aveMaker  | •    | OH2  |  | 2  |        | Freq  |     | 0  | NONE   | 0                 | 150   | 0         | 0   | None      | None         | Default |
| 6                                    | Spare   | S Wa       | aveMaker  | 9    | 017  |  | 2  |        | Freq  |     | 0  | None   | 0                 | 150   | 0         | 0   | None      | None         | Default |
| 7                                    | Spare   | S Wa       | aveMaker  | •    | OH0  |  | 9  | 2      | Freq  |     | 0  | None   | 0                 | 150   | 0         | 0   | None      | None         | Default |
| .8                                   | Spare   | S Wa       | augustainer   | -    | 049  |  |  | 100    | Free  |     | 0  | Aluma  |                   | 100   |           |   |           | 40000        | Def. b  |
|                                      |   |            |   | -    | 410  |  |  |        | , red   |     | ų  | 1414   | U                 | 190   | 0         | 0   | NOTE      | NUTR         | Derau   |
| <                                    |   |            |   |      |  |  |  |        | Title   |     |  |  | U                 | 150   | Ū         |   | N/TW      | None         | Umau    |
| < [<br>745-                          | Filme   | 1 warm     | orn Number  | 1 64 | d Type   |  | Sync   |        | offeet  | 1 2 | veit 1 o   | Negut Tauth  | U<br>Rev   Cycle  | (Dev  Damp  | Rata   P  | AMINETING                                     |           | succe        | Lerau   |
| <  <br>1                             | FLORA<br>ENGINE SPEED   | Warver     | orn Number<br>S   |      | d Type<br>Arb                                    | 0  | Sync<br>Sync   |        | offset<br>0                                       |     | φu≉ I α<br>RPM   | Act 0  | U<br>Rav   Gycle  | 0,0000   0.000p<br>2   0  | RAVA   P  | With the Fried                                | 1014      | oune         | Lerau   |
| ¢]<br>1455<br>1<br>2                 | Numa<br>ENGRAE SPEED<br>TURBO SPEED   | Warnete    | om Nuniter<br>S   |      | d Type<br>Arb<br>Arb                             | 0  | Sync<br>Synx<br>Nao Syn  |        | offut<br>0<br>0                                   | 0   | RPM RPM  | Arth Contraction Contraction   | 0<br>RAVE   67/08 | (190<br>(1947   83m)<br>2 (1  | D.MA   P  | AM1HE Fried<br>0<br>0                         |           | - NOTE       | Derau   |
| ¢  <br>145-<br>1<br>2<br>3           | ENGINE SPEED<br>TURBO SPEED<br>FAN SPEED  | U Warved e | om falsoder<br>S<br>I<br>I                              |      | d Trpe<br>Arb<br>Arb<br>Arb                      | 9  | Sync<br>Sync<br>No Syn<br>No Syn                               |        | ciffaet<br>0<br>0                                 | 000 | RPM RPM  | Arb 0<br>Arb 0<br>Arb 0<br>Arb 0   | U<br>Rav   Cycle  | 190<br>1924 (Romp<br>2 (<br>1 (<br>1 (                              | Exes   P  | 0<br>0<br>0<br>0                              |           | ovcre        | U TAR   |
| <1<br>1<br>2<br>3<br>4               | HUMA<br>ENGINE SPEED<br>TURBO SPEED<br>FAN SPEED<br>MASS AIR FLOW                             | 1 wardt    | orn filmdee<br>S<br>I<br>I<br>I                         |      | d Type<br>Arb<br>Arb<br>Arb<br>Dig               | 00000  | Sync<br>Sync<br>No Syn<br>No Syn<br>No Syn                     |        | offeet<br>0<br>0<br>0                             |     | RPM<br>RPM<br>Freq   | Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0                                | Barr   Gycle      | 190<br>1040 (0.649)<br>2 (0<br>1 (0<br>1 (0<br>1 (0                 | EARA   F  | 0<br>0<br>0<br>0                              | NUCE      | nore         | Derau   |
| ¢  <br>1<br>2<br>3<br>4<br>5         | TURNA<br>ENGRAE SPEED<br>TURBO SPEED<br>FAN SPEED<br>MASS AIR FLOW<br>SPARE 2                 | Utawate    | sen funder<br>S<br>I<br>I<br>I<br>I<br>I                |      | d Trav<br>Arb<br>Arb<br>Arb<br>Dig<br>Arb        | 000000000000000000000000000000000000000        | Sync<br>Sync<br>No Syn<br>No Syn<br>Sync                       |        | 0<br>0<br>0<br>0<br>0<br>0                        |     | RPM<br>RPM<br>Freq<br>RPM                                  | Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0                       |                   | 190<br>2 0<br>1 0<br>1 0<br>2 0<br>1 0<br>2 0                       |           | 0<br>0<br>0<br>0<br>0<br>0                    | NUCE      | nore         | Let all |
| ¢<br>1<br>2<br>3<br>4<br>5<br>6      | Prove<br>Engres SPEED<br>Turbo SPEED<br>FAN SPEED<br>MASS AIR FLOW<br>SPARE 2<br>Spare        | U Warwir   | sen funder<br>S<br>I<br>I<br>I<br>I<br>I<br>I<br>I<br>I |      | d Trave<br>Arb<br>Arb<br>Dig<br>Arb<br>Dig       | 9<br>9<br>9<br>9                               | Sync<br>Sync<br>No Syn<br>No Syn<br>Sync<br>No Syn             |        | 0<br>0<br>0<br>0<br>0<br>0<br>0                   |     | RPM<br>RPM<br>RPM<br>Freq<br>RPM<br>RPM                    | Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0              | U<br>Siev   Cythe | 190<br>2 0<br>1 0<br>1 0<br>2 0<br>1 0<br>2 0<br>1 0                | Exten   P | 0<br>0<br>0<br>0<br>0<br>0<br>0<br>0          | NUCE      | nore         | Derac   |
| <<br>1<br>2<br>3<br>4<br>5<br>6<br>7 | Huma<br>EMGRE SPEED<br>TURBO SPEED<br>FAN SPEED<br>MASS ALR FLOW<br>SPARE 2<br>Spare<br>Spare | Utawar     | orn familier<br>S<br>1<br>1<br>1<br>1<br>1<br>1         |      | d Trpe<br>Arb<br>Arb<br>Arb<br>Dig<br>Dig<br>Dig | 9<br>9<br>9<br>9<br>9<br>9<br>9<br>9<br>9<br>9 | Sync<br>Sync<br>No Syn<br>No Syn<br>No Syn<br>No Syn<br>No Syn |        | CH44<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 |     | Quit I Q<br>RPM<br>RPM<br>RPM<br>Freq<br>RPM<br>RPM<br>RPM | Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>Arb 0<br>I Hal 0<br>I Hal 0 | U<br>Rev   Cycle  | 190<br>1000<br>1 0<br>1 0<br>1 0<br>1 0<br>1 0<br>1 0<br>1 0<br>1 0 | Exten   P | AM1HE Freq<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | NUCLEY    | , pore       | Derau   |

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           |

Configuring Waveform Gauges, Continued This table continues to outline the steps for configuring waveform gauges.

| Step | Action   |   |  |  |  |  |  |  |  |  |  |  |
|------|--|---|--|--|--|--|--|--|--|--|--|--|
| 4    | Continued  |   |  |  |  |  |  |  |  |  |  |  |
|      | Field  | Description   |  |  |  |  |  |  |  |  |  |  |
|      | Teeth/Rev  | <b>Type</b> the teeth per revolution to use for wavemaker calculations.   |  |  |  |  |  |  |  |  |  |  |
|      |  | <u>Note</u> : Applies to digital and digital simulated cards only.  |  |  |  |  |  |  |  |  |  |  |
|      | Cycles/Rev   | <b>Type</b> the cycles per revolution to use for<br>wavemaker calculations. This is how many<br>cycles are represented in the data that gets<br>loaded into the Arbitrary cards. To obtain a<br>0.1 degree resolution, waveforms are 7200<br>data points which represent 2 full engine<br>crank cycles/rev. Typically set to 2. |  |  |  |  |  |  |  |  |  |  |
|      |  | Note: Applies to Arbitrary cards only.  |  |  |  |  |  |  |  |  |  |  |
|      | Ramp   | <b>Type</b> the ramp rate to be used when<br>changing values. This determines how<br>quickly the output changes from old value<br>to new value. Set to 0 for immediate<br>change.   |  |  |  |  |  |  |  |  |  |  |
|      | PWM HB Freq  | <b>Type</b> the PWM heartbeat frequency if<br>PWM output is desired. The digital card<br>will output a constant frequency set by the<br>PWM HB Freq and go from 0-100% duty<br>cycle.   |  |  |  |  |  |  |  |  |  |  |
|      |  | Note: Applies to digital cards only.  |  |  |  |  |  |  |  |  |  |  |
| 5    | When the changes are complete, Save the configuration. |   |  |  |  |  |  |  |  |  |  |  |
|      | Note: To immedia<br>File menu Select t                 | tely apply the setup to the front panel, from the he <i>Apply Configuration</i> option.   |  |  |  |  |  |  |  |  |  |  |
#### Configuring Waveform Gauges, Continued

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

|                                      | onent Configura   | tion       |  | 10   | onfig Fil   | le: testo | onfig.T  | хŋ   |   |  |                    |  |                     |  |           |              |         |
|--------------------------------------|---|------------|--|------|---|-----------|--|--|---|--|--------------------|--|---------------------|--|-----------|--------------|---------|
| Ele                                  | Component Tools   |            |  |      |   |           |  |  |   |  |                    |  |                     |  |           |              |         |
|                                      |   | ( O )      | 101  | 101  | ++1   | 1         |  |  |   |  |                    |  |                     |  |           |              |         |
| No.                                  | Name  | l Los      | adler #  |      | hannel  | 1 Wate    | 81   | Function   | l Deta.   | r í unra   | Min                | Мак  | Digits              | Move Down  | Interfock | Interlock OP | Table   |
| 1                                    | ENGINE SPEED  | 3 W        | NaveMaker  | 9    | OHI   |           |  | Freq   | 0   | RPM  | 0                  | 4300   | 0                   | 0  | None      | None         | Default |
| 2                                    | TURBO SPEED   | S 14       | WaveMoker  | •    | 010   |           |  | Freq   | 0   | RPM ×1000  | 0                  | 150  | 0                   | 1000   | None      | None         | Default |
| 3                                    | FAN SPEED   | S 14       | NaveMaker  |      | 06  |           |  | Freq   | 0   | RPM x 10   | 0                  | 7000   | 0                   | 1  | None      | None         | Default |
| 4                                    | MASS AIR FLOW   | S 11       | NaveMaker  | 9    | OH  | R         |  | Freq   | 1050  | Hz   | 0                  | 16000  | 0                   | 0  | None      | None         | Default |
| 5                                    | SPARE 2   | <b>9</b> W | WaveMaker  | •    | CH2   | 2         |  | Freq   | 0   | NONE   | 0                  | 150  | 0                   | 0  | None      | None         | Default |
| 6                                    | Spare   | <b>S</b> 4 | <b>WaveMaker</b>   | 9    | 017   |           |  | Freq   | 0   | None   | 0                  | 150  | 0                   | 0  | None      | None         | Default |
| 7                                    | Spare   | S 4        | NaveMaker  |      | OH0   | 2         |  | Freq   | 0   | None   | 0                  | 150  | 0                   | 0  | None      | None         | Default |
|                                      | Serve .   |            |  | -    |   |           |  |  |   |  |                    |  |                     |  |           |              |         |
|                                      | 34.84   |            | WaveMaker  |      | CHS   |           |  | Freq   | Q   | None   | 0                  | 150  | 0                   | 0  | None      | None         | Default |
| ¢1                                   | ALCON.  | 1          | WaveMaker<br>doors taxetee   | 1 68 | CH9   |           |  | Freq   | best 1  | Output Teet  | 0<br>Dave   Gyrtle | 150<br>(Raw   Rampi  | D D                 | 0<br>Millifreq   | None      | None         | Default |
| ¢<br>1                               | Numa<br>ENGINE SPEED  | - ward     | WaveMaker<br>doorstaantee<br>S   |      | CH9<br>d Lipe<br>Arb                                    |           |  | Preq<br>Ciffset<br>0   | Signat I  | None<br>None<br>Notgut Twent<br>Arb 0  | D<br>Pare   Gyrte  | 150<br>c(0.ev (0.evp)<br>2 0   | D<br>Rute   PU      | 0<br>M1HFreq<br>0  | None      | None         | Default |
| ¢ <br>145-<br>2                      | ALVINA<br>ENGINE SPEED<br>TURBO SPEED   |            | dooro falondoso<br>5   |      | CH9<br>d Lupe<br>Arb<br>Arb                             |           | iyek<br>Synk   | Preq<br>Official<br>0<br>0                                       | Signific<br>Big RPM<br>C RPM  | None<br>Adgust Taest<br>Arb C<br>VR C  | 0<br>Sinv Cycle    | 150<br>(200 [03mp1<br>2 0<br>1 0   | Rate   PU           | 0<br>MHEFreq<br>0<br>0                                   | None      | None         | Default |
| <<br>145-<br>1<br>2<br>3             | Nona<br>ENGRE SPEED<br>TURBO SPEED<br>FAN SPEED   |            | dom fander<br>S<br>1   |      | CH9<br>d Type<br>Arb<br>Arb<br>Arb                      |           | lync<br>Sync   | Preq<br>Ciffuet<br>0<br>0  | Digut J<br>Digut J<br>Di | Ach C<br>Arb C<br>Arb C  | 0<br>Sime   Gyrte  | 150<br>2 0<br>1 0<br>1 0   | D RAMA   PV         | 0<br>5110 Freq<br>0<br>0<br>0                            | None      | None         | Default |
| <<br>7451-0<br>1<br>2<br>3<br>4      | ENGINE SPEED<br>TURBO SPEED<br>FAN SPEED<br>MASS AIR FLOW                                     | www.       | Vavehäker<br>S<br>1<br>1<br>1  |      | CH9<br>d Type<br>Arb<br>Arb<br>Dig                      |           | iyac<br>Sync<br>Sync   | Preq<br>Officient<br>O<br>O<br>O<br>O                            | Nquit<br>RPM<br>RPM<br>RPM<br>RPM<br>III<br>Preq  | None<br>Output Tant<br>Arb ()<br>Arb ()<br>Arb ()  | 0<br>Films   Gypte | 150<br>c,Rav (Bany)<br>2 0<br>1 0<br>1 0<br>1 0  | Rate   PU           | 0<br>0<br>0<br>0<br>0<br>0                               | None      | None         | Default |
| <<br>1<br>2<br>3<br>4<br>5           | Risma<br>ENGRE SPEED<br>TURBO SPEED<br>FAN SPEED<br>MASS AIR FLOW<br>SPARE 2                  |            | Vavehaker<br>S<br>1<br>1<br>1<br>1   |      | CH9<br>d Type<br>Arb<br>Arb<br>Dig<br>Arb               |           | Ne livera<br>Syme<br>Syme<br>Syme                            | Preq<br>Officiel<br>0<br>0<br>0<br>0<br>0                        | RPM<br>RPM<br>RPM<br>RPM<br>RPM<br>RPM<br>RPM   | Ach Contract Teach Ach Contract Teach Contract Teac | D<br>Plane   Gypta | 150<br>(Ray Ray)<br>2 0<br>1 0<br>2 0  | Rate Pro            | 0<br>011/07/reg<br>0<br>0<br>0<br>0<br>0<br>0            | None      | None         | Default |
| ¢<br>1<br>2<br>3<br>4<br>5<br>6      | Hone<br>ENGINE SPEED<br>TURIO SPEED<br>FAIN SPEED<br>MASS AIR FLOW<br>SPARE 2<br>Spare        |            | Vavehicker<br>Sinn Namber<br>S<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1 |      | CH9<br>d Type<br>Arb<br>Arb<br>Dig<br>Arb<br>Dig<br>Dig |           | lync<br>Sync<br>Sync<br>Sync<br>Sync<br>Sync<br>Sync         | Preq<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0                     | RPM     RPM     RPM     RPM     RPM     RPM     RPM     RPM     RPM   | Acb C<br>Arb C<br>Arb C<br>Arb C<br>Arb C<br>Arb C<br>Arb C  | Direct Capital     | 150<br>c State (flore)<br>2 0<br>1 0<br>1 0<br>2 0<br>1 0<br>1 0<br>1 0<br>1 0<br>1 0<br>1 0<br>1 0<br>1 | 2 0                 | 0<br>41 kii Fraq<br>0<br>0<br>0<br>0<br>0<br>0           | None      | None         | Default |
| <<br>1<br>2<br>3<br>4<br>5<br>6<br>7 | Hons<br>ENGRE SPEED<br>TURBO SPEED<br>FAN SPEED<br>MASS AIR FLOW<br>SPARE 2<br>Spare<br>Spare |            | Vavehlaker<br>Sorm Namber<br>S<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1           |      | CH9<br>d Type<br>Arb<br>Arb<br>Dig<br>Dig<br>Dig        |           | lync<br>Sync<br>Sync<br>Sync<br>Sync<br>Sync<br>Sync<br>Sync | Preq<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | RPM   | Arb C<br>Arb C<br>Arb C<br>Arb C<br>Arb C<br>Arb C<br>Arb C<br>Arb C<br>C<br>Arb C<br>C<br>Arb C<br>C<br>C<br>Arb C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C  | 0                  | 150<br>c Edu (fi orgs)<br>2 0<br>1 0<br>2 0<br>1 0<br>1 0<br>1 0<br>1 0<br>1 0<br>1 0<br>1 0<br>1        | 0<br>Exta   DV<br>1 | 0<br>55 kt Fixed<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | None      | None         | Default |

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<br/>Other ControlsThis table outlines the steps for configuring switches, ratiometrics, resistives,<br/>and rotary switches.

| Step |   | Action   |  |  |  |  |  |  |  |
|------|---|--|--|--|--|--|--|--|--|
| 1    | From the <b>Operations</b> menu, <b>Select</b> the <i>Configuration Panel</i> option. |  |  |  |  |  |  |  |  |
|      | Result: The Component Configuration window displays.                                  |  |  |  |  |  |  |  |  |
| 2    | On the Menu Bar, <b>Click</b> the icon for the control to setup.                      |  |  |  |  |  |  |  |  |
|      | 🥝 Switches  |  |  |  |  |  |  |  |  |
|      | POT Knob (F   | Ratiometrics)  |  |  |  |  |  |  |  |
|      | Sliders (Resis  | stives)  |  |  |  |  |  |  |  |
|      | O Rotary  |  |  |  |  |  |  |  |  |
|      | Result: The panel f<br>Configuration with   | for the control type displays in the <b>Component</b> ndow.      |  |  |  |  |  |  |  |
| 3    | In the top portion of each control being  | of the component panel, complete the fields for used.            |  |  |  |  |  |  |  |
|      | Field   | Description  |  |  |  |  |  |  |  |
|      | Name  | <b>Type</b> in the component name.                               |  |  |  |  |  |  |  |
|      | Loadbox #   | Select the loadbox module for the control.                       |  |  |  |  |  |  |  |
|      | Channel   | Select the IO Channel for the control.                           |  |  |  |  |  |  |  |
|      | Visible   | <b>Sets</b> if the control is visible or not on the main window. |  |  |  |  |  |  |  |
|      |   |  |  |  |  |  |  |  |  |

## Configuring All Other Controls, Continued

| Configuration | This graphic illustrates the panel for configuring other controls. This |
|---------------|---|
| Panel         | 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    | 🧐 5W32  | ~       | 🎯 Toggle SW   | 1       |       | 0   | 0   | 0      | 0          | SW#8      | Non-Inverting | Default                |
| 2   | KEY_Unlock | j Sidecar | 🧐 5W2   |         | 🌝 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    | 🧐 5W3   |         | 🧐 Toggle SW   | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 6   | Par_SW4    | arent 2   | 🧐 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    | arent 2   | 🧐 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    | arent 2   | 🧐 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 | j Sidecar | 🧐 SW1   | ¥       | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | SW#17     | Non-Inverting | Switch_Inversion_Table |
| 13  | Oil Press  | 2 Parent  | 🧐 SW20  | ~       | 🤣 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Switch_Inversion_Table |
| 14  | Par_SW12   | 2 Parent  | 🧐 SW12  |         | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 15  | Par_SW13   | 2 Parent  | 🧐 SW13  |         | 🤣 Toggle SW   | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 16  | Par_SW14   | arent 2   | 🧐 SW14  | 100     | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 17  | Par_SW15   | 2 Parent  | 🧐 SW15  |         | 🤣 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 18  | Par_SW16   | 2 Parent  | 🧐 SW16  |         | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 19  | Par_SW17   | 2 Parent  | 🧐 SW17  |         | 🤣 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 20  | Par_SW18   | arent 2   | 🧐 SW18  | 1       | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 21  | Par_SW9    | 2 Parent  | 🧐 SW9   |         | 🧐 Toggle SW   | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |

#### Configuring All Other Controls, Continued

**Configuring All** This table continues to outline the steps for configuring switches, other Controls, 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<br>the configuration is loaded or the control is<br>reset  |  |  |  |  |  |  |  |  |  |
|      | Min  | <b>Type</b> the minimum value for the component. This value will display on the gauge, and it must be a whole number.                          |  |  |  |  |  |  |  |  |  |
|      | Max  | <b>Type</b> the maximum value for the component. This value will display on the gauge, and it must be a whole number.                          |  |  |  |  |  |  |  |  |  |
|      | Digits   | <b>Select</b> the significant digits for the component.  |  |  |  |  |  |  |  |  |  |
|      | Multiplier   | <b>Type</b> the multiplier to scale the component.   |  |  |  |  |  |  |  |  |  |
|      | Interlock  | Allows component's values to be locked together. <b>Select</b> the component to which this component should be locked.                         |  |  |  |  |  |  |  |  |  |
|      | Interlock OP   | Allows the user to determine if interlocked components should be <i>Non-Inverting</i> or <i>Inverting</i> .                                    |  |  |  |  |  |  |  |  |  |
|      | Table  | <b>Sets</b> the interpolation table for this component.  |  |  |  |  |  |  |  |  |  |
| 4    | When the changes<br><u>Note</u> : To immedia<br><b>File</b> menu <b>Select</b> | s are complete, <b>Save</b> the configuration.<br>ttely apply the setup to the front panel, from the<br>the <i>Apply Configuration</i> option. |  |  |  |  |  |  |  |  |  |

## Configuring All Other Controls, Continued

| Configuration | This graphic illustrates the panel for configuring other controls. This |
|---------------|---|
| Panel         | 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    | 🧐 5W32  | ~        | 🧐 Toggle SW   | 1       |       | 0   | 0   | 0      | 0          | SW#8      | Non-Inverting | Default                |
| 2   | KEY_Unlock | j Sidecar | 🧐 5W2   | <b>v</b> | 🎯 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    | arent 2   | 🧐 SW31  |          | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | Non-Inverting | Default                |
| 5   | Par_SW3    | Parent    | 🥝 5W3   |          | 🧐 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 6   | Par_SW4    | arent 2   | 🧐 SW4   |          | 🎯 Toggle SW   | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 7   | Par_SW5    | 2 Parent  | 🥝 SW5   |          | 🤣 Toggle SW   | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 8   | Par_SW6    | arent 2   | 🧐 SW6   | 1957     | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 9   | Par_SW7    | 2 Parent  | 🥝 SW7   |          | 🤣 Toggle SW   | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 10  | Par_SW8    | 2 Parent  | 🧐 SW8   | 100      | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 11  | Brake Sw 1 | 2 Parent  | 🥝 SW19  | <b>v</b> | 🤣 Toggle SW   | 0       |       | 0   | 0   | 0      | 0          | SW#18     | Non-Inverting | Switch_Inversion_Table |
| 12  | Brake Sw 2 | j Sidecar | 🧐 SW1   | <b>v</b> | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | SW#17     | Non-Inverting | Switch_Inversion_Table |
| 13  | Oil Press  | 2 Parent  | 🥝 SW20  | <b>v</b> | 🤣 Toggle SW   | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Switch_Inversion_Table |
| 14  | Par_SW12   | 2 Parent  | 🧐 SW12  | 1        | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 15  | Par_SW13   | 2 Parent  | 🧐 SW13  |          | 🍪 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 16  | Par_SW14   | 2 Parent  | 🧐 SW14  | 1        | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 17  | Par_SW15   | 2 Parent  | 🧐 SW15  |          | 🤣 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 18  | Par_SW16   | 2 Parent  | 🧐 SW16  | . 201    | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 19  | Par_SW17   | 2 Parent  | 🥝 SW17  |          | 🤣 Toggle SW   | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 20  | Par_SW18   | 2 Parent  | 🧐 SW18  | 100      | 🎯 🛛 Toggle SW | 0       |       | 0   | 0   | 0      | 0          | None      | None          | Default                |
| 21  | Par_SW9    | 2 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<br>Options | This tabl   | e outlines the steps for setting the configuration options.   |  |  |  |  |  |  |
|                          | Step  | Action  |  |  |  |  |  |  |
|                          | 1   | From the <b>Operations</b> menu, <b>Select</b> the <i>Configuration Panel</i> option.   |  |  |  |  |  |  |
|                          |   | Result: The Component Configuration window displays.  |  |  |  |  |  |  |
|                          | 2   | On the Menu Bar, Click the Configuration Options icon 2.  |  |  |  |  |  |  |
|                          |   | <u>Result</u> : The <b>Configuration Options</b> panel displays in the <b>Component Configuration</b> window.                                   |  |  |  |  |  |  |
|                          | 3   | In the <i>Visibility</i> field, <b>Deselect</b> any tab that should be hidden on the main window.   |  |  |  |  |  |  |
|                          | 4   | In the <i>Tab Name</i> field, <b>Click</b> on a tab name to change and <b>Type</b> the new name.  |  |  |  |  |  |  |
|                          | 5   | When the changes are complete, <b>Save</b> the configuration.   |  |  |  |  |  |  |
|                          |   | <u>Note</u> : To immediately apply the setup to the front panel, from the <b>File</b> menu <b>Select</b> the <i>Apply Configuration</i> option. |  |  |  |  |  |  |

#### Configuration Options, Continued

ConfigurationThis graphic illustrates the Configuration Options panel on the ComponentOptions PanelConfiguration window.

| <b>V</b>  | SWITCH 1       |
|---|----------------|
| <b>~</b>  | SWITCH 2       |
| <b>~</b>  | PRESSURES 01   |
| <ul> <li>Image: A set of the set of the</li></ul> | PRESSURES 02   |
| <b>~</b>  | CYL 1-8 TEMP   |
| <b>~</b>  | CLY 8-18 TEMP  |
| <b>~</b>  | MISC TEMP      |
| $\checkmark$  | SPEED/THROTTLE |

#### 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<br>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.

| Торіс                        | See Page |
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| FMET Workflow                | 79       |
| The FMET Graphical Interface | 70       |

#### **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<br>FMET Box | The FMET box is connected between the ECM and the Harness. To connect<br>the FMET box, disconnect the wiring harness from the ECM and connect it<br>into the FMET box cable and then back into the ECM. |

#### Section 2 – FMET Workflow

#### **FMET Workflow**



#### **Section 3 – The FMET Graphical Interface**

#### **Overview**

| Introduction  | The FMET Interface provides a graphical interface for communicating with<br>the FMET box. The FMET Interface is a part of the LUIS Graphical User<br>Interface  |
|---|---|
| How To Access<br>the FMET<br>Graphical<br>Interface | To access the FMET Interface, from the LUIS Graphical Interface, <b>Open</b> the <b>Hardware</b> menu. From the <b>Hardware</b> menu, <b>Select</b> the <i>FMET Unit</i> option. The FMET Interface displays. |
| The FMET<br>Interface                               | The FMET Interface is made up of six basic sections: Menu Bar, Toolbar,<br>Faults Switches, Apply Fault Switches, Status Indicators and I/O Controls.   |



#### Overview, Continued

| Торіс                | See Page |
|----------------------|----------|
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| Status Indicators    | 86       |
| I/O Controls         | 88       |

**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 <i>Open</i> dialog box<br>where a saved configuration<br>can be selected and applied to<br>the GUI            |
|           | Save Configuration As | Opens the <i>Save As</i> dialog box<br>where the current GUI<br>configuration can be saved for<br>later use             |
|           | Exit                  | Exits the FMET GUI  |
| Operation |                       |   |
|           | Reset -> Relays       | Resets all relays   |
|           | Configuration Panel   | Opens the <i>Component</i><br><i>Configuration</i> window to set<br>up the GUI  |
|           | Set Max Current       | Opens the <i>Relay Current</i><br>dialog box where the<br>maximum input current can be<br>set in Amps to work as a fuse |
|           |                       | <u>Note</u> : 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             |
|------|-------------------------|
| 2    | Open Configuration      |
|      | Save Configuration      |
| 5    | Reset All Relays        |
| 0    | 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.



# SwitchThe Faults switches can be in the ON or OFF position. The switch is in thePositionsON position when the switch name is displayed in red and the top of the<br/>rocker switch is depressed. The switch is in the OFF position when the switch<br/>name is displayed in black and the bottom of the rocker switch is depressed.

#### **Apply Fault Switches**

Apply FaultThe Apply Fault switches are used to set how the fault is to be applied. The<br/>appropriate Apply Fault switch should be set before flipping the Faults<br/>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.

| 🕐 STATUS       |     |
|----------------|-----|
| COM Status: Ok |     |
| CURRENT (Amp   | s): |
| 0.2            | 0.0 |
| 0.0            | 0.0 |
| 0.0            | 0.0 |
|                |     |

**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                               |
|----------|--------------------------------------|---|
| ОК       | 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<br>then reset COM<br>Interface |

#### 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 <b>Component Configuration</b> window is used to set up the boards, the switches available as well as switch and fault exclusions.  |
|---|--|
| The<br>Component<br>Configuration<br>Window | The <b>Component Configuration</b> window for the FMET Interface is very similar, but not identical, to the <b>Component Configuration</b> window in the LUIS Interface. The <b>File</b> menu is the same, but the <b>Component</b> menu only offers two choices, <i>Relay</i> and <i>Exclusion List</i> . The <b>Tools</b> menu does not provide a <i>Table</i> option, since tables are not used for FMET. |
| Configuring the                             | This table outlines the stars for configuring the I/O Controls   |

#### **I/O Controls**

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

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

| Component     | This is an example of the <b>Component Configuration</b> window. |                                |      |                |                    | v.       |                   |       |
|---------------|--|--------------------------------|------|----------------|--------------------|----------|-------------------|-------|
| Configuration |  | -                              |      | -              |                    |          |                   |       |
| Window        | Com  | ponent Configura               | tion | [C             | Config File: HORNI | ET AUT   | D_MANUAL-YELLOW.T | _ 🗆 🛛 |
|               | i <u>Fi</u> le   | <u>Component</u> <u>T</u> ools |      |                |                    |          |                   |       |
|               | I 🗋  | 🖻 🔒 🕘 4                        | 0    | 2 🔮 🤣 🛷        |                    |          |                   |       |
|               | No.  | Name                           | 1    | Relay Board #  | Relay #            | Visible  | ToolTip           | ~     |
|               | 1  | IGN R/S                        | 1    | RELAY BOARD #1 | 1                  | <b>v</b> | GREY 71           |       |
|               | 2  | NA1                            |      | RELAY BOARD #1 | 2                  |          |                   | ≡     |
|               | 3  | H2O IN FUEL                    |      | RELAY BOARD #1 | 3                  | <b>~</b> | BLK 76            |       |
|               | 4  | COMP INLET TMP                 |      | RELAY BOARD #1 | 4                  | <b>~</b> | BLK 58            |       |
|               | 5  | COOLANT TMP                    | 1    | RELAY BOARD #1 | 5                  | <b>v</b> | BLK 40            |       |
|               | 6  | CC PRES SENS                   |      | RELAY BOARD #1 | 6                  | <b>~</b> | BLK 23            |       |
|               | 7  | SPARE AAD3                     |      | RELAY BOARD #1 | 7                  | <b>V</b> | BLK 57            |       |
|               | 8  | IMT (TMAP)                     |      | RELAY BOARD #1 | 8                  | <b>~</b> | BLK 39            |       |
|               | 9  | EGR ORFC TMP                   |      | RELAY BOARD #1 | 9                  | ✓        | BLK 22            |       |
|               | 10   | SPD CTRL SW 1                  |      | RELAY BOARD #1 | 10                 | <b>~</b> | GREY 76           |       |
|               | 11   | DOC INLET TO                   |      | RELAY BOARD #1 | 11                 | <b>V</b> | GREY 40           |       |
|               | 12   | DPF INLET T1                   |      | RELAY BOARD #1 | 12                 | <b>V</b> | GREY 23           |       |
|               | 13   | DPF OUTLET T2                  |      | RELAY BOARD #1 | 13                 | <b>~</b> | GREY 75           |       |
|               | 14   | SPARE AAD1                     |      | RELAY BOARD #1 | 14                 | <b>~</b> | 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                 | <b>v</b> | BLK 38            |       |
|               | 18   | ALT V SENS                     |      | RELAY BOARD #1 | 18                 | <b>v</b> | BLK 21            |       |
|               | 19   | SPARE MON                      |      | RELAY BOARD #1 | 19                 | <b>v</b> | BLK 73            |       |
|               | 20   | SPD CTRL SW 2                  |      | RELAY BOARD #1 | 20                 | <b>~</b> | GREY 39           |       |

RELAY BOARD #1

RELAY BOARD #1

RELAY BOARD #1

RELAY BOARD #1

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

REM THRTL SIG

SPARE AAD2

SPARE AAD2

PEDAL POS 1

21

22

23

24

| TAB Name   | TAB Names            |  |
|------------|----------------------|--|
| Visibility | Tab Name             |  |
| <b>~</b>   | CONNECTOR C-1        |  |
| <b>~</b>   | CONNECTOR C-2        |  |
| <b>V</b>   | CONNECTOR C-3-YELLOW |  |
|            | SWITCH 91-120        |  |
|            | SWITCH 121-150       |  |
|            | SWITCH 151-180       |  |
|            |                      |  |

**V** GREY 22

**V** 

**V** GREY 56

**V** GREY 37

GREY 74

21

22

23

24

| Configuring the | This table continues to outline the steps for configuring the I/O Controls. |
|-----------------|---|
| I/O Controls,   |   |
| Continued       |   |
|                 |   |

| Step    |  | Action  |  |  |  |  |  |
|---------|--|---|--|--|--|--|--|
| 6       | Once the configuration is complete and has been saved, Click the<br>Apply icon on the toolbar or Select the Apply option from the<br>Tools menu.   |   |  |  |  |  |  |
|         | <u>Result</u> : The Apply Configuration dialog box displays to confirm that the configuration should be applied. Click the <b><yes></yes></b> button to continue. The changes are immediately implemented. |   |  |  |  |  |  |
| Configi | uring Switches   |   |  |  |  |  |  |
| 7       | To configure the sy<br><b>Component</b> menu,<br>icon on the toolbar   | To configure the switches found on each tab, from the <b>Component</b> menu, <b>Select</b> the <i>Relays</i> option or <b>Click</b> the Relays icon on the toolbar. |  |  |  |  |  |
|         | Result: The relay c switches listed.   | onfiguration panel displays with all possible   |  |  |  |  |  |
| 8       | For each switch being used, modify the fields as necessary.  |   |  |  |  |  |  |
|         | <u>Note</u> : Multiple swi<br>same I/O pin can aj<br>appear on multiple  | tches can be set up for the same I/O pin. The ppear more than once on a single tab, or it can tabs.   |  |  |  |  |  |
|         | Field  | Description   |  |  |  |  |  |
|         | Name   | <b>Type</b> a name for the switch.  |  |  |  |  |  |
|         |  | <u>Note</u> : This is the name that will display on the FMET interface. It is not required.   |  |  |  |  |  |
|         | Relay Board #  | <b>Select</b> the appropriate relay board from the drowndown list.  |  |  |  |  |  |
|         | Relay #  | Select the correct relay # from the dropdown list.  |  |  |  |  |  |
|         |  |   |  |  |  |  |  |

Relay Configuration Panel

| This is an exam | ple of the relay | configuration panel.  |  |
|-----------------|------------------|-----------------------|--|
|                 |                  | e oninger attor paner |  |

| 0  | Component Configuration [Config File: HORNET AUTO_MANUAL-YELLOW.T 💶 🗖 |   |         |                |        |                |      |
|--|---|---|---------|----------------|--------|----------------|------|
| : <u>Fi</u> le <u>C</u> omponent <u>T</u> ools |   |   |         |                |        |                |      |
|  |   |   |         |                |        |                |      |
|  | TeelTie   | Maible  | Delev # | Delau Deced #  |        | Name           | Ne   |
|  |   | VISIDIE   | Relay # | Relay board #  |        | I Name         | INO. |
| -  | GREY /1   |   | 1       | RELAY BOARD #1 |        | IGN R/S        | 1    |
| -  |   |   | 2       | RELAY BOARD #1 |        | NA1            | 2    |
| _  | BLK 76  |   | 3       | RELAY BOARD #1 | :L 🧾   | H2O IN FUEL    | 3    |
| _  | BLK 58  |   | 4       | RELAY BOARD #1 | IMP    | COMP INLET TMP | 4    |
| _  | BLK 40  |   | 5       | RELAY BOARD #1 | MP 🚺   | COOLANT TMP    | 5    |
| _  | BLK 23  |   | 6       | RELAY BOARD #1 | vs 📒   | CC PRES SENS   | 6    |
| _  | BLK 57  | <ul> <li>Image: A start of the start of</li></ul> | 7       | RELAY BOARD #1 | 3 🔰    | SPARE AAD3     | 7    |
| _  | BLK 39  | Image: A start of the start          | 8       | RELAY BOARD #1 | ) 🔰    | IMT (TMAP)     | 8    |
| _  | BLK 22  |   | 9       | RELAY BOARD #1 | MP 🔰   | EGR ORFC TMP   | 9    |
| _  | GREY 76   | <ul> <li>Image: A start of the start of</li></ul> | 10      | RELAY BOARD #1 | V 1 🧻  | SPD CTRL SW 1  | 10   |
|  | GREY 40   | <b>~</b>  | 11      | RELAY BOARD #1 | то 🔋 🧃 | DOC INLET TO   | 11   |
|  | GREY 23   | <b>V</b>  | 12      | RELAY BOARD #1 | 1 🧻    | DPF INLET T1   | 12   |
|  | GREY 75   | <ul> <li>Image: A set of the set of the</li></ul> | 13      | RELAY BOARD #1 | т2 🤋   | DPF OUTLET T2  | 13   |
|  | GREY 57   | <ul> <li>Image: A set of the set of the</li></ul> | 14      | RELAY BOARD #1 | 1      | SPARE AAD1     | 14   |
|  | BLK 74  | <ul> <li>Image: A set of the set of the</li></ul> | 15      | RELAY BOARD #1 | RES 🔋  | FUEL RAIL PRES | 15   |
|  | BLK 56  | <ul> <li>Image: A set of the set of the</li></ul> | 16      | RELAY BOARD #1 | ES 🧃   | COMP IN PRES   | 16   |
|  | BLK 38  |   | 17      | RELAY BOARD #1 | RES 🥫  | INTAK MAN PRES | 17   |
|  | BLK 21  |   | 18      | RELAY BOARD #1 | s 🧻    | ALT V SENS     | 18   |
| -  | BLK 73  |   | 19      | RELAY BOARD #1 | N 🔋    | SPARE MON      | 19   |
|  | GREY 39   | Image: A start of the start          | 20      | RELAY BOARD #1 | V 2 📔  | SPD CTRL SW 2  | 20   |
| -  | GREY 22   |   | 21      | RELAY BOARD #1 | SIG 📔  | REM THRTL SIG  | 21   |
| -  | GREY 74   |   | 22      | RELAY BOARD #1 | 2      | SPARE AAD2     | 22   |
| -  | GREY 56   |   | 23      | RELAY BOARD #1 | RS 🣔   | SOOT DLTA PRS  | 23   |
| -  | GREY 37   |   | 24      | RELAY BOARD #1 | 1      | PEDAL POS 1    | 24   |
|  | GREY 37   |   | 24      | RELAY BOARD #1 | 1      | PEDAL POS 1    | 24   |

**Configuring the** This table continues to outline the steps for configuring the I/O Controls. **I/O Controls,** Continued

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

Relay Configuration Panel This is an example of the relay configuration panel.

| mp                                   | onent Configurat | tion | [Co            | onfig File: HOR | NET AUTO   | D_MANUAL-YELLOW.T. | - L_ (C |
|--------------------------------------|------------------|------|----------------|-----------------|--|--------------------|---------|
| Eile <u>C</u> omponent <u>T</u> ools |                  |      |                |                 |  |                    |         |
| 🗋 🚰 🛃 🥝 😺 🗐 🗐 🛊 🔶 🛷                  |                  |      |                |                 |  |                    |         |
| No.                                  | Name             |      | Relay Board #  | Relay #         | Visible  | ToolTip            | -       |
| 1                                    | IGN R/S          |      | RELAY BOARD #1 | 1               | <ul> <li>Image: A start of the start of</li></ul>  | GREY 71            |         |
| 2                                    | NA1              |      | RELAY BOARD #1 | 2               |  |                    |         |
| 3                                    | H2O IN FUEL      |      | RELAY BOARD #1 | 3               | <b>~</b>   | BLK 76             |         |
| 4                                    | COMP INLET TMP   |      | RELAY BOARD #1 | 4               | <ul> <li>Image: A set of the set of the</li></ul>  | BLK 58             |         |
| 5                                    | COOLANT TMP      |      | RELAY BOARD #1 | 5               | <b>~</b>   | BLK 40             |         |
| 6                                    | CC PRES SENS     |      | RELAY BOARD #1 | 6               | <b>~</b>   | BLK 23             |         |
| 7                                    | SPARE AAD3       |      | RELAY BOARD #1 | 7               | <b>~</b>   | BLK 57             |         |
| 8                                    | IMT (TMAP)       |      | RELAY BOARD #1 | 8               | <ul> <li>Image: A set of the set of the</li></ul>  | BLK 39             |         |
| 9                                    | EGR ORFC TMP     |      | RELAY BOARD #1 | 9               | <ul> <li>Image: A set of the set of the</li></ul>  | BLK 22             |         |
| 10                                   | SPD CTRL SW 1    |      | RELAY BOARD #1 | 10              | <ul> <li>Image: A set of the set of the</li></ul>  | GREY 76            |         |
| 11                                   | DOC INLET TO     |      | RELAY BOARD #1 | 11              | <ul> <li>Image: A second s</li></ul> | GREY 40            |         |
| 12                                   | DPF INLET T1     |      | RELAY BOARD #1 | 12              | <ul> <li>Image: A set of the set of the</li></ul>  | GREY 23            |         |
| 13                                   | DPF OUTLET T2    |      | RELAY BOARD #1 | 13              | Image: A start of the start           | GREY 75            |         |
| 14                                   | SPARE AAD1       |      | RELAY BOARD #1 | 14              | <ul> <li>Image: A set of the set of the</li></ul>  | GREY 57            |         |
| 15                                   | FUEL RAIL PRES   |      | RELAY BOARD #1 | 15              | <ul> <li>Image: A start of the start of</li></ul>  | BLK 74             |         |
| 16                                   | COMP IN PRES     |      | RELAY BOARD #1 | 16              | <ul> <li>Image: A set of the set of the</li></ul>  | BLK 56             |         |
| 17                                   | INTAK MAN PRES   |      | RELAY BOARD #1 | 17              | <b>~</b>   | BLK 38             |         |
| 18                                   | ALT V SENS       |      | RELAY BOARD #1 | 18              | <b>~</b>   | BLK 21             |         |
| 19                                   | SPARE MON        |      | RELAY BOARD #1 | 19              | <b>~</b>   | BLK 73             |         |
| 20                                   | SPD CTRL SW 2    |      | RELAY BOARD #1 | 20              | <b>~</b>   | GREY 39            |         |
| 21                                   | REM THRTL SIG    |      | RELAY BOARD #1 | 21              | <b>~</b>   | GREY 22            |         |
| 22                                   | SPARE AAD2       |      | RELAY BOARD #1 | 22              | <b>~</b>   | GREY 74            |         |
| 23                                   | SOOT DLTA PRS    |      | RELAY BOARD #1 | 23              | <b>~</b>   | GREY 56            |         |
| 24                                   | PEDAL POS 1      |      | RELAY BOARD #1 | 24              | <b>V</b>   | GREY 37            |         |

**Configuring the** This table continues to outline the steps for configuring the I/O Controls. **I/O Controls,** Continued

| Step    | Action   |
|---------|--|
| Setting | Exclusions   |
| 12      | Exclusions can be set to prevent relays from tripping under certain conditions. To set exclusions, <b>Click</b> the Exclusions icon on the toolbar or <b>Select</b> the <i>Exclusion List</i> option from the <b>Component</b> menu. |
|         | Result: The Exclusion List panel displays.   |
| 13      | To set an exclusion, in the first <i>Name</i> field, <b>Select</b> the appropriate relay or fault from the dropdown list. In the second <i>Name</i> field, <b>Select</b> the appropriate relay or fault from the dropdown list.      |
|         | <u>Note</u> : 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 <b><delete< b="">&gt; button can be used to remove exclusions.</delete<></b>   |
| 17      | Once all the exclusions have been set, save the configuration by <b>Selecting</b> the <i>Save Configuration As</i> option from the <b>File</b> menu or <b>Clicking</b> the Save As icon in the toolbar.                              |
| 18      | Once the exclusions have been set and saved, <b>Click</b> the Apply icon on the toolbar or <b>Select</b> the <i>Apply</i> option from the <b>Tools</b> menu.   |
|         | <u>Result</u> : The <i>Apply Configuration</i> dialog box displays to confirm that the configuration should be applied. <b>Click</b> the <b><yes></yes></b> button to continue. The changes are immediately implemented.             |
| 19      | Once the boards, relays and exclusions have been set, saved and applied, close the <b>Component Configuration</b> window.  |
|         | Note: If the FMET Interface does not reflect the changes made, the changes must not have been applied. Re-open the <b>Component Configuration</b> window, load the saved configuration files and <b>Apply</b> the changes.           |

| Exclusion List | This is an example of the <i>Exclusion List</i> panel. |
|----------------|--|
| Panel          |  |

| 27 | Eault: VBATT | 28 | Fault: GND     |
|----|--------------|----|----------------|
| 27 | Fault: VBATT | 20 | SCR OLITIET 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. This table outlines the topics covered in this chapter. |          |  |  |
|-----------------|---|----------|--|--|
| In This Section |   |          |  |  |
|                 | Торіс   | See Page |  |  |
|                 | Waveforms   | 98       |  |  |
|                 | RS232 Interface   | 99       |  |  |
|                 | DAC Specifics   | 101      |  |  |
|                 | Address Switch  | 102      |  |  |
|                 | Table Calibration   | 103      |  |  |
|                 | Troubleshooting   | 105      |  |  |
|                 | Connectors and Pinout   | 110      |  |  |
|                 | CAN Protocol  | 119      |  |  |
|                 | Multi-Parent Setup  | 128      |  |  |

#### 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 This table describes the current support for the specific waveforms.

#### Data

| 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.

#### This table describes the valid RS232 commands.

#### **RS232** Commands

| Description   | Symbol | Format   | Example   |
|---|--------|--|---|
| Rear Axle Ratio Change  | A      | Rear axle ratio as a floating<br>point number. The decimal<br>point is always the 3rd<br>character. If less than 10, a<br>leading zero must be<br>included. Data range: 0 -<br>99.99 | A05.29XXX sets the new<br>rear axle ratio to 5.29.<br>The vehicle speed signal<br>will be recalculated with<br>the new RAR value. |
| Waveform type change request.<br>This parameter allows the user to<br>select from a list of available crank<br>and cam waveforms. The system<br>will produce waveforms based on<br>default settings | E      | Waveform Type as a whole<br>number. If less than 10, a<br>leading zero must be<br>included   | E011500XX sets the new<br>waveform to type "01" and<br>the new engine speed<br>request to 1500rpm                                 |
| Fan speed change request  | F      | Fan Speed as a whole number<br>in RPM. Leading zero(s)<br>must be included for and<br>speed request smaller than<br>1000 RPM. Data range 0 -<br>9999                                 | F1234XXXX sets the new<br>Fan Speed to 1,234 RPM  |
| Turbo speed change request  | G      | Turbo speed as a floating<br>point number in KRPM.<br>Leading zero(s) must be<br>included for any speed<br>request smaller than 100<br>KRPM. Data range: 0 -<br>999.9                | G012.4XXXX sets the<br>new turbo speed to 12,400<br>RPM   |
| VSS teeth per interrupt change request.   | I      | Number of teeth per interrupt<br>as a whole number. If less<br>than 10, a leading zero must<br>be included. Data Range: 0 -<br>99  | I16XXXXX sets the new teeth per interrupt values.<br>The vehicle speed signal will be recalculated with the new value.            |

#### RS232 Interface, Continued

**RS232** Commands. This table continues to describe the valid RS232 commands.

| Description                  | Symbol | Format  | Example   |
|------------------------------|--------|---|---|
| ESS/EPS change request       | R      | Engine speed as a whole<br>number in RPM. Leading<br>zeros must be added for any<br>speed request smaller than<br>1000 RPM. Data range: 0 -<br>9999 | R1234XXXX sets the new<br>ESS/EPS speed to 1,234<br>RPM.  |
| Tire size change request     | Т      | Tire size as a whole number<br>in revolutions per mile. If<br>less than 100, leading zero(s)<br>must be included.                                   | T508XXXXX sets the<br>new tire size to 508<br>rev/mile. The vehicle<br>speed signal will be<br>recalculated with the new<br>value |
| Vehicle speed change request | V      | Vehicle speed as a floating<br>point number in MPH. If less<br>than 100, leading zero(s)<br>must be included. Data<br>range: 0 - 999.99             | V012.34XX sets the new<br>vehicle speed to 12.34<br>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       | <b>Channel Numbers</b> |
|----------------|------------------------|
| Parent Box     | 1 - 32                 |
| Parent Sidecar | 33 - 40                |
| Child 1 Box    | 41 - 72                |
| Child 2 Box    | 73 - 104               |
|                |                        |

#### **Section 3 – DAC Specifics**

#### **DAC Specifics**

IntroductionThe LUIS hardware has limitations on how accurate it can represent an<br/>Analog voltage. These limitations are based on the Digital to Analog<br/>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 1-8: 5.5v            |
|                | Ch 9-12: 8 Bits | 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<br>Table<br>Calibration | LUIS use<br>interface<br>adjust th<br>under tes<br>This tabl | es look up tables to correlate engineering units that are on the GUI<br>to analog values that it outputs to the unit under test. The user can<br>ese values so the engineering units on the GUI match what the unit<br>st calculates it to be. |
|--------------------------------------|--|--|
|                                      | Step   | Action   |
|                                      | 1  | From the <b>Operations</b> menu, <b>Select</b> the <i>Configuration Panel</i> option.  |
|                                      |  | Result: The Component Configuration window displays.   |
|                                      | 2  | On the Menu Bar, Click the Tables icon   |
|                                      |  | <u>Result</u> : The <b>Table</b> panel displays in the <b>Component Configuration</b> 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<br>until the tool that's communicating to the unit under test reads the<br>lowest reading (i.e. when throttle goes from 0% to 1%). Record the<br>LUIS value.                  |

## Table Calibration, Continued

| Table<br>Calibration,<br>Continued | This tabl | This table continues to describe the table calibration procedure. |  |  |
|------------------------------------|-----------|---|--|--|
|                                    | Step      | Action  |  |  |
|                                    | 0         |   |  |  |

| 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<br>one to (1023 * LUIS first value) and in row two (1023 * LUIS<br>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<br/>COM StatusTo troubleshoot the COM Status, read the COM Status on the top right of the<br/>LUIS GUI and refer to the table on the next page.

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



Continued on next page

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

#### Troubleshooting COM Status, Continued

| COM Status | Action  |  |  |
|------------|---|--|--|
| ILLHW      | Open up <b>Control Panel</b> in Windows and<br><b>DoubleClick</b> on the <b>CAN Hardware</b> icon. Select<br>the <i>USB</i> radio button at the top of the screen and<br><b>Click <ok></ok></b> , (select PCI if your setup uses a PCI-<br>to-CAN adapter). Restart LUIS.   |  |  |
|            | <ul> <li>Verify that the Net name that the LUIS software is using is the connected to the hardware. In LUIS</li> <li>Select Hardware-&gt;Peak Adapter-&gt;Set Net Name.</li> <li>This name must be the same as the one in</li> <li>NetConfig software. Run the NetConfig software by Clicking <start> -&gt; All Programs -&gt; PCAN -&gt;</start></li> <li>NetConfig. Then select the Peak adapter being used.</li> <li>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</li> <li>LUIS_Net_1. The bus speed must be set to 250Kbit/sec.</li> </ul> |  |  |
| 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<br>and not using the same Net name that LUIS is<br>using. Change the Net name in LUIS by selecting<br><b>Hardware</b> -> <i>Peak Adapter</i> -> <i>Set Net Name</i> to the same<br>name as the other application.  |  |  |

#### COM Status, Continued

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

#### **Troubleshooting Closed Loop Engine Speed**

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

| 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  |  |  |  |  |  |  |

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

#### 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<br>AUTO IVS switch. Cycle the throttle a few times to eliminate<br>Throttle and IVS fauly codes. |

#### **Symptom:** Engine RPM is unstable

| St | tep | Action  |
|----|-----|---|
|    | 1   | Adjust GAIN ADJUST slider and PERCENT LOAD sliders until<br>RPM becomes stable. |
|    |     | N W becomes studie.   |

#### 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. |                     |  |  |  |
|--|---|---------------------|--|--|--|
| <b>Connectors</b> 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/ This table gives the connector pinout for Parent/Child 1/Child 2/Pin Key 01. 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  |

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

Continued

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

Continued

| 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/This table gives the connector pinout for Parent/Child 1/Child 2/50 Pin Key<br/>02.Child 2/ 50 Pin<br/>Key 0202.

| 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                                    |

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

Parent/Child 1/<br/>Child 2/ 50 PinThis table continues to give the connector pinout for Parent/Child 1/Child<br/>2/50 Pin Key 02.Key 02,<br/>Continued2/50 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/This table gives the connector pinout for Parent/Child 1/Child 2/50 Pin Key<br/>03.Child 2/ 50 Pin03.Key 0303.

| 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<br>Side Switch  |
| 27  | Switch 25 Source | I/O | 0-24v       | GND for Low Side Switch, SW 25 Output for<br>High Side Switch |
| 28  | Switch 26 Drain  | I/O | 0-24v       | +V for High Side Switch, SW 26 Output for Low<br>Side Switch  |

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

Parent/Child 1/<br/>Child 2/ 50 PinThis table continues to give the connector pinout for Parent/Child 1/Child<br/>2/50 Pin Key 03.Key 03,Continues

Continued

| Pin | Function          | I/O | Range        | Notes   |
|-----|-------------------|-----|--------------|---|
| 29  | Switch 26 Source  | I/O | 0-24v        | GND for Low Side Switch, SW 26 Output for                     |
| 30  | Switch 27 Drain   | I/O | 0-24v        | +V for High Side Switch SW 27 Output for Low                  |
| 50  | Switch 27 Diam    | 1/0 | 0 247        | Side Switch   |
| 31  | Switch 27 Source  | I/O | 0-24v        | GND for Low Side Switch, SW 27 Output for<br>High Side Switch |
| 32  | Switch 28 Drain   | I/O | 0-24v        | +V for High Side Switch, SW 28 Output for Low<br>Side Switch  |
| 33  | Switch 28 Source  | I/O | 0-24v        | GND for Low Side Switch, SW 28 Output for<br>High Side Switch |
| 34  | Switch 29 Drain   | I/O | 0-24v        | +V for High Side Switch, SW 29 Output for Low<br>Side Switch  |
| 35  | Switch 29 Source  | I/O | 0-24v        | GND for Low Side Switch, SW 29 Output for<br>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<br>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 | This table gives the connector pinout for Sidecar 50 Pin Key 04 |
|----------------|---|
| 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                            |

#### Connector Pinout - Sidecar 50 Pin Key 04, Continued

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

| 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         |
| 50  | SW S Contact | 1/0 | 10/0   | Normany 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 | 1/0 | N/C    | Normally Closed Contact       |
| 36  | SW 3 Contact | I/O | N/C    | Normally Closed Contact       |
|     |              |     |        |                               |
| 37  | SW 4 Contact | 1/0 | 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 the hardware. The CAN Baud rate is 250k and the LUIS hardware has no but terminations resistors in the box. Proper bus termination must occur on external CAN nodes for correct operation.  |          |  |  |  |
|-----------------|---|----------|--|--|--|
| CAN<br>Protocol | All CAN communications from LUIS PC to LUIS hardware use the J1939<br>Proprietary A message. The following is the definition for this message.<br>Parameter Group Name: <b>Proprietary A</b><br>Definition: This proprietary PG uses the Destination Specific<br>PDU Format allowing manufacturers to direct their proprietary communications to a specific<br>destination node. How the data field of this message is used is up to each manufacturer. Use of<br>proprietary messages is at the manufacturer's discretion with the constraint that significant<br>percentages (2% or more) of vehicle network utilization must be avoided. |          |  |  |  |
|                 |   |          |  |  |  |
|                 | Transmission repetition rate: Per user requi<br>Data length: 8 bytes<br>Data Page: 0<br>PDU Format: 230   | irements |  |  |  |
|                 | PDU Specific: Destination Address:<br>0xF1 = Load Box PC Controller<br>0xF2 = Load Box Parent<br>0xF3 = Load Box Child 1<br>0xF4 = Load Box Child 2<br>0xF5 = Load Box Sidecar<br>0xF6 = Speed Board  |          |  |  |  |
|                 | Default priority: 6   |          |  |  |  |
|                 | Parameter Group Number: 61184 (00EF0016)  |          |  |  |  |
|                 |   |          |  |  |  |

**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                      |

#### 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   |

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   |

| DAC<br>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 D  | AC 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<br>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. |  |  |  |
|                | <b>HW Powered UP</b> – Message sent from LUIS to PC after power cycle  |  |  |  |
|                | Data Length  | 1 Byte $(0x04)$                                    |  |  |
|                | Resolution:  | HW has just been power-cycled                      |  |  |
|                | Resolution.  | No response required from PC:                      |  |  |
|                |  | If PC is listening, should refresh all outputs. If |  |  |
|                |  | kev 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  |  |  |
|                | Туре:  | Status   |  |  |
|                |  |  |  |  |

| The Reset command will reset all of the LUIS I/O and disable all of the DAC outputs.   |  |  |
|--|--|--|
| <b>Reset</b> – Turn off all switc<br>Data Length:<br>Resolution:<br>Data Range:<br>Type:   | hes and disable all DAC outputs<br>Command (0x05) + 1 Byte<br>N/A<br>0x01 = Soft Reset (all switches off, all DAC's = 0v)<br>0x03 = Hard Reset (jump to bootloader)<br>Status  |  |
| 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 $(0x06) + 7$ BytesByte 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 cycleByte 6: Lamp feedback status1 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 |  |  |
| <b>Status Request Example: 0x18EFF2F1</b> (all data bytes 2-8 set to 0xFF) (PC asking "is Parent out there?")  |  |  |
| <b>Status Response Examp</b><br>0x00<br>(from Parent_firmware ve   | <b>le: 0x18EFF1F2</b> 0x06 0x01 0x02 0x00 0x00 0x00<br>er 1.2. no commands executed vet. all lamps OFF)  |  |
|  | The Reset command will<br>outputs.<br><b>Reset</b> – Turn off all switce<br>Data Length:<br>Resolution:<br>Data Range:<br>Type:<br>The Status Request is der<br>the hardware and obtain is<br>Data Length:<br>Byte 2: 0xFF (handshake)<br>Byte 3: LUIS Firmware M<br>Byte 4: LUIS Firmware M<br>Byte 5: Data Fresh<br>0x00 = No Switch<br>0x01 = Switch and<br>power cycle<br>Byte 6: Lamp feedback st<br>1 bit per lamp, onl<br>0 = OFF / 1 = ON<br>Bits 5-7 not used,<br>Bytes 7-8 not used<br><b>Status Request Example</b><br>(PC asking "is Parent out<br><b>Status Response Examp</b><br>0x00<br>(from Parent, firmware ve |  |

| Calibration<br>Request | The Calibration Request message will start the calibration procedure.<br>Typically a unit under test is installed on the load box before the command is issued.  |   |  |
|------------------------|--|---|--|
|                        | Calibration Request – D<br>Data Length:<br>Resolution:<br>Data Range:  | Request from PC / Response of attached LUIS devices<br>Command (0x07) + 7 Bytes<br>N/A<br>Byte 1; Calibrate option<br>0x01 = Calibrate all available channels<br>0x02 = Set calibration tables to default values<br>(this byte set to 0xFF in Response msg)<br>Byte 2; Calibration progress<br>Range 0-100 indicating percentage complete<br>Bytes 3-8 not used |  |
|                        | Type:  | Status  |  |
| Change<br>Frequency    | Changes the signal output frequency or FOUT. Data values can be in Hertz<br>or RPM depending on how the bit is set in the configuration message for that<br>channel.   |   |  |
|                        |  |   |  |
|                        | 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<br>Byte.<br>The Ramp rate is how fast the signal transitions from its current value to its<br>new value. A Ramp of zero will set the output frequency/RPM as fast as the<br>WaveMaker can transition the signal.<br>If the Signal is setup for Frequency, all values above 2.5MHz will be<br>ignored. |   |  |

| Configuration<br>Message | The Configuration messages configures each channel in the Wavemaker<br>hardware that inside of LUIS. The Wavemaker hardware is responsible for<br>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 /; Signal lechnology                    |  |
|                          |  | Low Niddle $1 - 11^{11}$                     |  |
|                          |  | 1 = Hall<br>2 = VP                           |  |
|                          |  | 2 - VK<br>High Nibble                        |  |
|                          |  | 1 - DWM Bytes 5.6 HB Free                    |  |
|                          |  | 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                                       |  |

Engine The Engine model commands controls the Open/Closed loop model for LUIS. Model 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 Byte 2; Wavemaker Address Data Range: High Nibble Wavemaker Number Byte 3; Model Command 1 = Open Loop Mode 2 =Closed Loop Mode 3 =Start Engine 4 = Reset Model5 = % Load 6 = Gain Adjust 7 = Rate LimitByte 4-5; % Load or Gain Byte 6-8; Not Used Status Type:

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



#### Multi-Parent Setup, Continued

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



## Private CANThe Private CAN datalinks must be chained together so the ECM's canConnectionscommunicate together. Following the labels on the cable, plug all three of<br/>these connections into the load boxes. See the following figure.



#### Multi-Parent Setup, Continued

Public CANThe Public CAN datalinks must be chained together so the LUIS GUI canConnectionssend data to each unit. Notice there is a loose connector on the left end of the<br/>picture which is used to connect the LUIS PC to the system. The Sidecar-to-<br/>Parent Jumpers must also be in place. Following the labels on the cables, plug<br/>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.



#### Multi-Parent Setup, Continued

All

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

