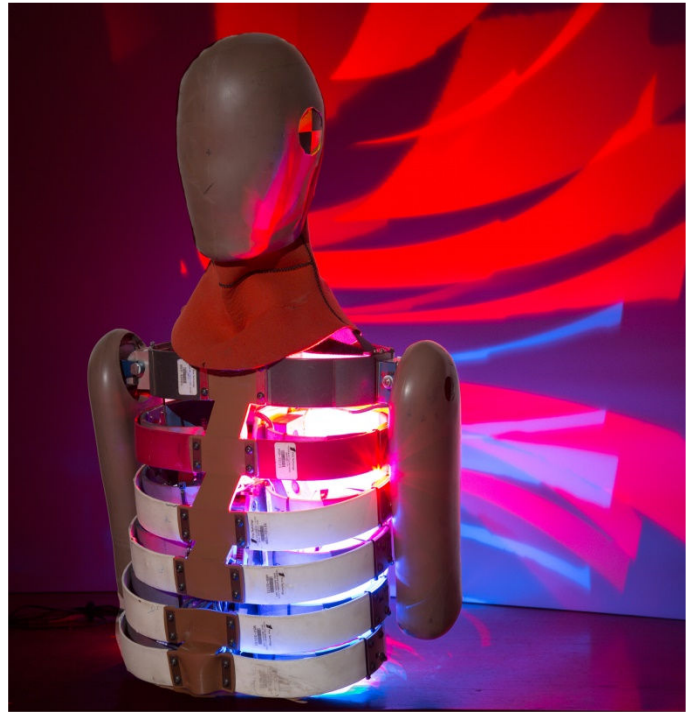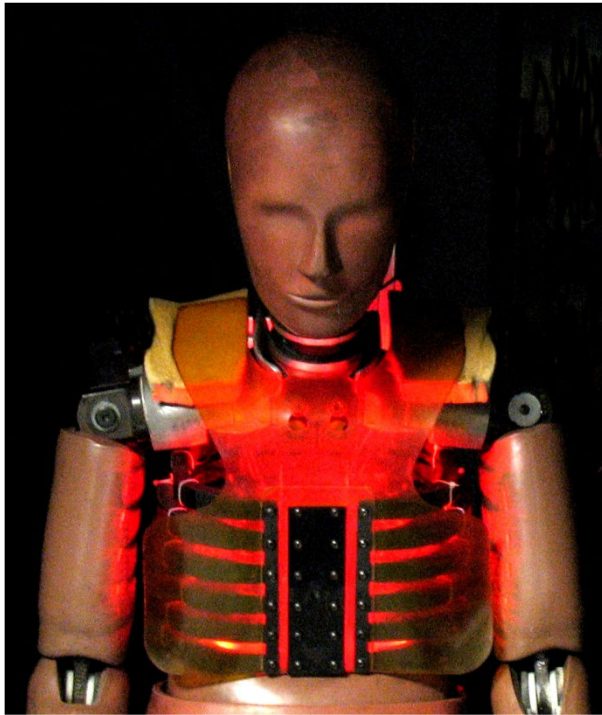# BOXBORO
s y s t e m s

RibEye™ Multi-Point Deflection Measurement System Software User Manual (Version 8.1)

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**RibEye™ Multi-Point Deflection Measurement System
Software User Manual (Version 8.1)**

1.0   RibEye Control Software Description

The RibEye control software is used to set up the RibEye for a test, download the data from the RibEye, view the data, and export the data for crash test analysis. The RibEye software works with all Boxboro Systems RibEye models. When the software connects to a RibEye, it adapts the screens according to the features and capabilities of the connected RibEye.

1.1   Computer Requirements

The RibEye Control software works on PCs running Windows 7 (SP2), Windows 10, and Windows 11.

1.2   Software Installation

First, insert the RibEye USB thumb drive into a USB port. Using Windows Explorer, open the "RibEye Installer" directory and run the "install.exe" program. Then follow the instructions on the screen. This program installs the RibEye control software and the National Instruments LabWindows/CVI Run-Time Engine. The RibEye program is installed in the C:\Program Files(x86)\RibEye_8_1 directory and will not overwrite previous versions of RibEye software. The installer creates shortcuts on your Desktop and Start Menu.

The Boxboro Systems website has the latest version of the RibEye software; you can download the software from the website's RibEye page: www.boxborosystems.com/ribeye.html.

1.3   Software Configuration

This version of RibEye software uses an initialization file, RibEye_8_0.ini, which is stored in the RibEye installation directory, typically C:\Program Files(x86)\RibEye_8_1. The initialization (INI) file lets you configure things like ISO codes for channel names and default values for most controls. Items that can be set in the INI file are discussed below in the sections that relate to them.

Instructions on how to configure your software by editing the INI file are presented in Appendix A. You can edit the INI file with any text editor such as Notepad. When editing the file, be sure to follow the format presented in the appendix. If the INI file is accidently corrupted while editing it, a spare copy is installed in the installation directory. You can make a copy of the spare INI file, and change the copy's name to RibEye_8_0.ini to start with a fresh version.

If you have made changes from the defaults in the RibEye_8_0.ini file for running version 8.0, you can copy of the 8_0.ini file from the C:\Program Files(x86)\RibEye_8_0 directory to the C:\Program Files(x86)\RibEye_8_1 directory.

If the last version of the RibEy software you have installed is version 7.0, and you made changes to the INI file that you want to preserve, you can copy the RibEye_7_0.ini file from C:\Program Files(x86)\RibEye_7_0 directory, rename it RibEye 8_0.ini, and put it in the C:\Program Files(x86)\RibEye_8_1 directory. You will have to add the following lines to the INI file to make it compatible to the RibEye_8_0.in file:

[LegacySoftwareFilterClassCode]
; use LegacySWUnfiltCode = 0 for standard unfiltered ISO filter code = 0
; use LegacySWUnfiltCode = 1 for unfiltered ISO filter code = P
LegacySWUnfiltCode = 0

2.0   RibEye Control Software Operation

The main screen upon start-up of the RibEye control software is shown in Figure 1. Note that most of the controls are grayed out, and only the "Connect/Setup", "Plot", and "Export" tabs are visible. Without connecting to a RibEye, the software can be used only to re-plot existing data sets and to export them. The "Status" box shows the current state of the RibEye (disconnected).

Figure 1. RibEye control software main screen upon start-up

2.1   Connecting to the RibEye

The control software can communicate to RibEyes via Ethernet over a Local Area Network (LAN). The "Connect to RibEye via:" drop-down menu has the option for connecting via RS232 Serial for special configurations.

Typically you connect the RibEye to the same local area network (LAN) that your PC is connected to. The RibEye can be connected to a router on the vehicle or via special cables to some data acquisition systems. You can also connect your PC directly to a RibEye with an Ethernet cable. For older PCs that do not have an auto-sensing Ethernet port, you need a crossover Ethernet cable.

Select Ethernet in the "Connect to RibEye via:" drop-down menu. Next, select the IP address for your RibEye in the "IP Address" box. You can also type an IP address into the box. RibEyes are shipped from the factory with a default IP address of **192.168.0.240**. If your network IP addresses do not begin with **192.168.0**, you must change the RibEye IP address to match your network in order for the software to communicate with it. For example, if your network address starts with **175.22.49**, then the RibEye IP address must be changed to **175.22.49.xxx**. (Please refer to section 2.2 below to change the IP address and to view the IP address of your network.) The last three digits of the RibEye IP address must not be the same as another device on your network. Ask your system administrator to tell you what unused address to use. The last three digits of the RibEye IP address can be any number between 002 and 254.

2.1.1 Communication Port

Communications between the RibEye and the PC is via TCP protocol, and uses port #3000. If you are having trouble communicating with the RibEye, make sure that your firewall is not blocking port 3000.

2.2   Finding RibEyes on Your LAN and Changing a RibEye IP Address

The "Find RibEyes" button is used to search for all RibEyes that are currently connected to your LAN and powered up (Figure 2). RibEyes that are not turned on will not be found, and the software will display a message box saying that no RibEyes were found on the network (Figure 3).

Figure 2. "Find RibEyes" screen
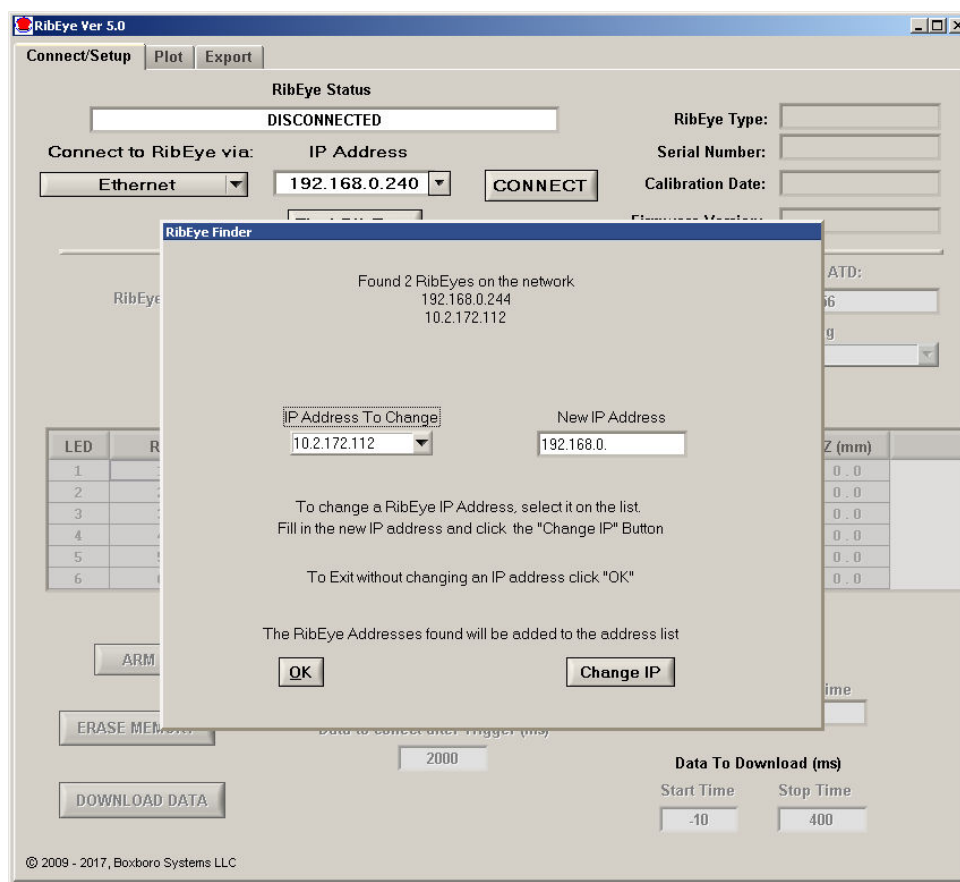
Figure 3. "Find RibEyes" screen when no RibEyes found
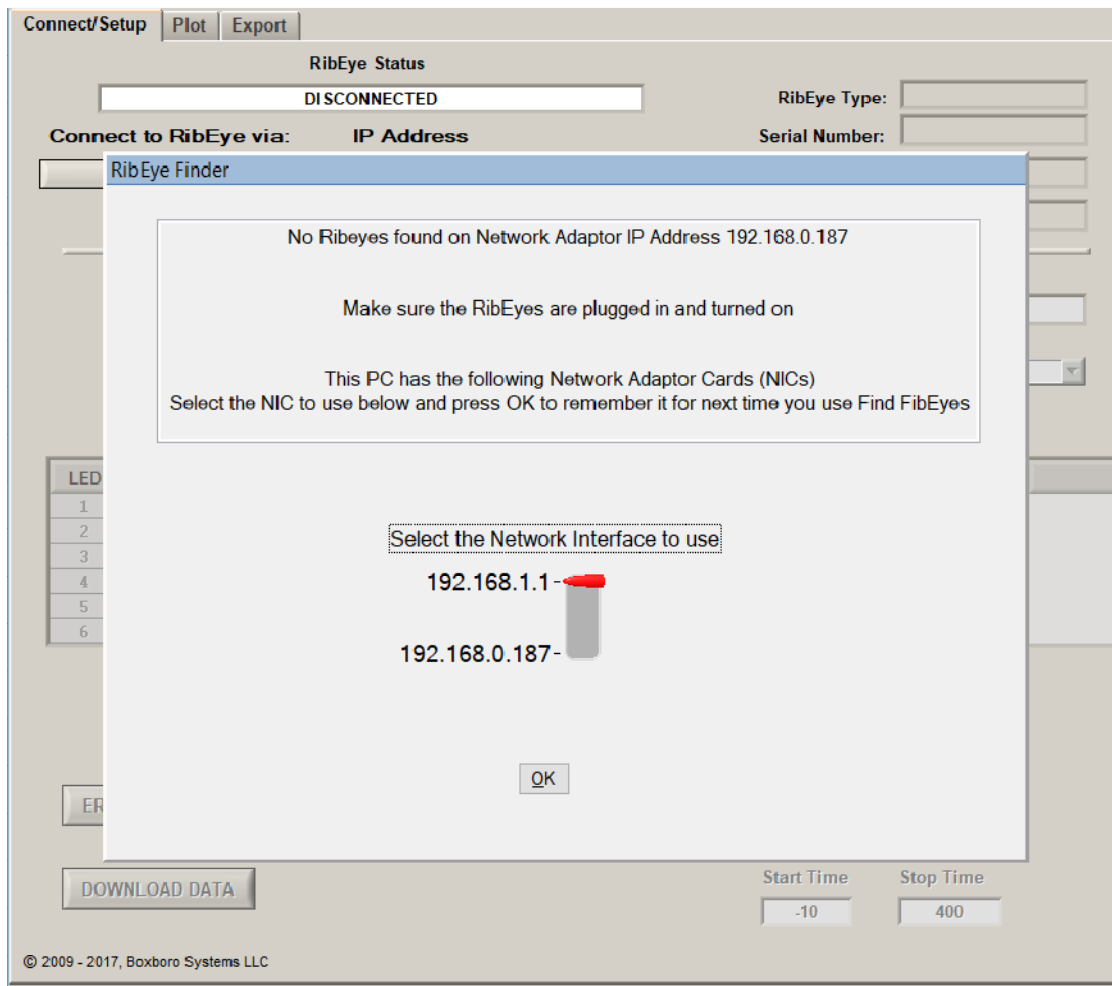
When you click on the "Find RibEyes" button, a UDP Broadcast message is sent out of your LAN port requesting that RibEyes respond. Note that the first time you run the program after installation, your firewall might block the UDP message and display an information box asking if the program should be allowed. When the RibEyes have been found, they are displayed in the pop-up screen (top center). If you press the OK button, the RibEye IP addresses are automatically added to the "IP Address" drop-down menu on the main RibEye screen.

When no RibEyes are found on the network, even though they are powered on and connected, it might be because your computer has multiple Network Interface Cards (NICs), and the Find RibEye commands are being sent to the wrong Ethernet port. In this case, as shown above in Figure 3, the Find RibEyes software will display more than one Network Interface to use. Select the Ethernet port for the network that the RibEye is connected to, and click the OK button. The software will store the correct Ethernet adaptor to use when you click on the "Find RibEyes" button again.

2.2.1 How Finding RibEyes Works

For older RibEyes, with two cables from the Trunk Box to the controller, the software listens to port 1020 for a UDP protocol broadcast message from the RibEyes. Each RibEye sends out a UDP broadcast packet every 10 seconds.

For newer RibEyes, with a single cable from the Trunk Box to the controller, and for WorldSID RibEyes, the software sends a UDP protocol broadcast message out on port 30718. Each RibEye on the network responds with its IP address.

Note that some network routers and most firewalls block UDP broadcast packets. See your system administrator if this feature doesn't work, and tell your administrator what ports need to be allowed (1020 and/or 30718). The Windows firewall can be told to allow messages on these ports.

Changing the RibEye IP address (see section 2.2.2 below) also uses the UDP protocol and the UDP broadcast address to communicate with the RibEyes, even if they are not on the same network subnet.

The newer model RibEyes have a web interface that can be used to adjust other network parameters if needed. However, these other network parameters should be changed only by your system administrator. The second-generation WorldSID RibEye's IP address can only be changed via the "Find RibEyes" button in the software.

2.2.2 Changing a RibEye IP Address

Depending on your LAN configuration, you might have to change the RibEye IP address in order to communicate with it. Typically, as noted above, the RibEyes have to be on the same subnet (the network address, minus the final 3 digits) for proper communications.

To change a RibEye IP Address, select the RibEye address you want to change in the drop-down box labeled "IP Address To Change". Enter your selected RibEye's desired new address in the "New IP Address" box. Note that the software automatically shows the subnet address of your PC, but you can over-ride the address assigned by the computer – click on the "Change IP" button and enter your RibEye's IP address. If you do not need to change any addresses, click on the "OK" button.

When you click on the "Change IP" button, if the change is successful, you will get a message that the program is waiting for the RibEye to re-boot. This takes about 10 seconds.

If the new RibEye address is the same as another device on your network, you will get an error message as shown below. Pick another address to use for the RibEye.

IP Available Check

Another device on the network is using the same IP Address, pick another address to use

OK
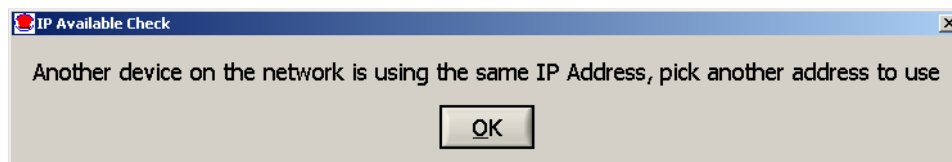
If the new RibEye address is the same as another RibEye on your network, you will get an error message as shown below. Pick another address to use for the RibEye.

IP Address Conflict

The new IP Address is the same as another RibEye on the network
Select another address

OK
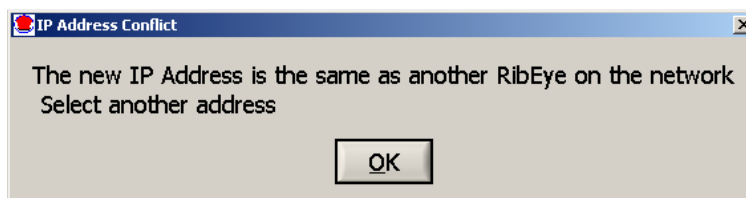
In rare circumstances, another device on your network uses the same protocol to change its IP address as the RibEye does. If this occurs, you will get the error message shown below. To prevent changing the address on the other device that uses the same protocol, you should remove the RibEye from your network and connect the RibEye directly to a PC and change its address. Then you can put the RibEye back on the network.

Protocol Conflict

There is another device on the network that is responding to the protocol.
The IP address cannot be changed without affecting the other device
Connect this RibEye directly to a PC to change its IP address

OK

INI File Note: If you have an older RibEye – Hybrid III RibEye with two cables from the controller to the trunk box, or a WorldSID RibEye with a serial number below 100 – these RibEyes have an older style Ethernet adaptor that uses a different protocol for finding RibEyes. The older style systems require that you wait 15 seconds for the RibEyes to respond. To enable the protocol for the older style RibEyes, you must edit the INI file. Go to the [webwidget] section and set the Widget Type = 0. This setting finds both the older and newer RibEyes.

2.2.3 Issues Communicating with RibEyes

The RibEye software always uses the default Ethernet port on your PC to try to communicate with a RibEye. The following are some potential problems and work-arounds. To determine what LAN connections your PC has, open a DOS command prompt window and type: ipconfig/all. This shows you the LAN connections on your PC.

2.2.3.1 Your PC Has Multiple NICs

If your PC has multiple Network Interface Cards (NICs), unplug the Ethernet cables from the NICs connecting to LANs that the RibEye is *not* connected to. Try to communicate with the RibEye again. Once communication is established with the RibEye, you can plug the other Ethernet cables back in. The PC should now remember, via its routing table, which NIC to use to send command to the RibEye. Note that instead of unplugging the ethernet cables from the NICs not used for the RibEye, you can disable the NICs using the Windows control panel.

2.2.3.2 Your Laptop Has Wired and Wi-Fi Connections

If your laptop has both wired and wireless (Wi-Fi) Ethernet connections, it connects to one LAN via wireless and a second LAN via the wired Ethernet port. To connect with the RibEye, turn off the Wi-Fi port and establish communications via the wired port. After communications have been established with the RibEye, you should be able to turn your Wi-Fi port back on and still be able to connect to your RibEye.

According to one customer, to make their laptop communicate to the RibEye on the wired Ethernet port while the Wi-Fi was enabled, they had to –

- Right-click on their wired Local Area connection
- Select Properties
- Select Advanced
- Go to the Speed and Duplex setting
- Set it to Auto-negotiate

Then they were able to connect to the RibEye with the wired port while leaving the Wi-Fi port enabled.

2.3   Main Screen After Connecting to the RibEye

After you have selected the correct IP address, click on the "Connect" button to connect to the RibEye. When the software connects to the RibEye, it retrieves the following data and fills it in on the screen: RibEye Type, Serial Number, Calibration Date, and Firmware Version. The software also retrieves and fills in the "RibEye Installed in ATD" text field. For most RibEye models, the RibEye trigger setting is also retrieved and displayed. Figure 4 shows the main screen after the software has connected to the RibEye. Note that "Live Display tab is now visible, and the various control buttons are activated.

Figure 4. RibEye control software main screen after connecting to RibEye

2.4   Text Field Under "RibEye Installed in ATD"

This text field can be used for any purpose, but it is typically used for dummy identification, so that if multiple RibEyes are being used, you can verify that you are connected to the right one. The user can change this text field, and the software stores the data in the RibEye's flash memory.

After you change the text in this field, either press the "Enter" key on your keyboard or click outside the text box on the screen. The software then writes the updated information to the RibEye, and a confirmation box pops up as shown in Figure 5. Click on "OK" to close the box.

**Figure 5. Confirmation of updated data
under "RibEye Installed in ATD"**
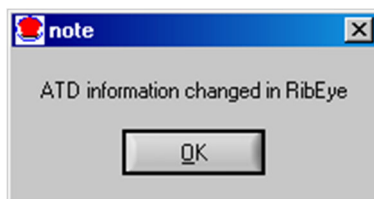
2.5   Trigger Setting

The "Trigger Setting" drop-down menu is used to select the trigger signal type and polarity. The RibEye trigger setting is stored in the RibEye's flash memory. If you change the setting, the new setting is written to the RibEye. The two options are –

- Rising Edge – when you want to trigger on a rising voltage at the trigger input
- Falling Edge – when you want to trigger on a falling voltage at the trigger input

Some RibEye models show two additional options for differential-type trigger signals –

- Differential – Rising Edge
- Differential – Falling Edge

Refer to the Hardware User Manual for your RibEye for more information on Trigger connections.

Some versions of the RibEye do not show the "Trigger Setting" menu because they are designed to be directly connected to a specific data acquisition system, and the trigger setting is fixed to operate with that system. Refer to your RibEye Hardware User Manual for more information.

The trigger settings are shown in all output data formats using the codes shown in Table 1. In addition, starting with this version of the software , if the manual trigger button is used to force a trigger, the code has a 4 added to it.

Table 1. Trigger codes in data files

Trigger Setting	Trigger code
Rising Edge	0
Falling edge	1
Differential Rising edge	2
Differential Falling Edge	3

Rising Edge – Manual Trigger Button Used for Trigger	4
Rising Edge – Manual Trigger Button Used for Trigger	5
Rising Edge – Manual Trigger Button Used for Trigger	6
Rising Edge – Manual Trigger Button Used for Trigger	7

2.6 "RibEye Pointed Toward Dummy" Field

The drop-down menu for "RibEye Pointed Toward Dummy" is shown only for side-impact dummies. The selections for impact direction, Left Side or Right Side, are used to convert data from the RibEye coordinate system to the dummy coordinate system. For the SID-IIs and the WorldSID, changing the direction changes the signs of the X and Y data. For the Polar Left or Right settings, the RibEye coordinate system is rotated about the Z-axis of the dummy by plus-or-minus 41 degrees.

For first-generation WorldSID RibEyes, "RibEye Pointed Toward Dummy" also loads a new calibration file into the RibEye. The RibEye uses different calibration files for left-side and right-side impact. If you switch the RibEye from one side of the dummy to the other, use this control to load the appropriate calibration file. For a second-generation WorldSID RibEye that has been calibrated for both left- and right-side impacts, both calibration files are already stored in the RibEye, and the correct file is loaded into memory.

If the RibEye has only been calibrated for one side impact (left or right) and you try to change the "RibEye Pointed to Dummy" field, the software will not let you make the change.

The direction selection is checked whenever data is read from the RibEye, and the coordinate conversions are applied to the data.

2.7 ISO Code Settings

The drop-down menus for "ISO Test Object" and "ISO Position" (Figure 6) are used to generate the standard ISO channel naming codes as shown in the table on the screen in Figure 6. When you change any of the values in the drop-down menus, you will see the changes reflected in the ISO codes in the table. The ISO codes are used as channel headers in the exported data files. The channel codes are not stored in the RibEye. The "Rib" and "Position" entries for each LED in the table cannot be changed by the user. When data is downloaded, the ISO codes are read from the table and are used to name the channels in the data files. For the formal definitions of the channel codes, see ISO/TS 13499 RED B 2020 E (Version 1.6.2), Road vehicles – Multimedia data exchange format for impact tests.

Figure 6. ISO code settings

LED	RIB	POSITION	ISO CODES	X (mm)	Y (mm)	Z (mm)
1	1	REAR	1 1 SHRI LE RE WS DS XYZ	0.0	0.0	0.0
2	1	MIDDLE	1 1 SHRI LE MI WS DS XYZ	0.0	0.0	0.0
3	1	FRONT	1 1 SHRI LE FR WS DS XYZ	0.0	0.0	0.0
4	2	REAR	1 1 TRRI LU RE WS DS XYZ	0.0	0.0	0.0
5	2	MIDDLE	1 1 TRRI LU MI WS DS XYZ	0.0	0.0	0.0
6	2	FRONT	1 1 TRRI LU FR WS DS XYZ	0.0	0.0	0.0

RibEye Pointed Toward Dummy: Left Side
RibEye Installed in ATD: tested at proxy 03-07-2018
ISO Test Object: 1 - Vehicle 1
Trigger Setting: Rising Edge
ISO Position: 1 - Front Left
Show Current XYZ's

Appendix D contains special setup instructions for the Hybrid III 50th Male 2-axis adjustable-LED RibEye, which allows LEDs to be placed on any rib or on the sternum. Please contact Boxboro Systems for the special firmware needed to convert a standard RibEye to an adjustable-LED model.

The ISO codes used in the RibEyes are shown in Table 2. The format is –

A B CCCC DD EE FF GG H I

Table 2. ISO codes used in RibEyes

Letters	ISO Definition	Options

A	Test Object	Can be defined by the user, typically:
		    1 = vehicle 1
		    2 = vehicle 2
		    3 = vehicle 3
		    S = sled
		    etc.

B	Position	Standard seating positions 0–9

CCCC	Main Location	Typically the rib name or sternum
		For frontal dummies:
		    RIBS or STRN for sternum
		For side-impact dummies:
		    SHRI = shoulder rib
		    TRRI = thoracic rib
		    ABRI = abdominal rib

DD	Fine Position 1	The rib number such as 01, 02, 03
		Or a position code such as:
		    UP = upper; MI = middle; LO = lower
		    LU = left upper; RU = right upper
		    LM = left middle; RM = right middle
		    LL = left lower; RL = right lower

EE	Fine Position 2	A position code such as:
		    UP = upper; MI = middle; LO = lower;
		    LE = left; RI = right;
		    OU = outer; FR = front; RE = rear

FF	Fine Position 3	The dummy type such as:
		    S2 = SID-IIs
		    WS = WorldSID 50th Male
		    W5 = WorldSID 5th Female
		    H3 = Hybrid III 50th Male
		    HF = Hybrid III 5th Female
		    PE = Polar
		    BA = Ballistic SID-IIs for vest/weapons testing

GG	Dimension	Always DS for displacement
H	Direction	X, Y, or Z
I	Filter Class	0 = unfiltered A = CFC 1000 B = CFC 600 C = CFC 180 D = CFC 60

INI File Note: You can change the ISO codes for the Main Location, Fine Position 1, and Fine Position 2 for WorldSIDs and Hybrid III dummies by editing the INI file. Two sections of the INI file, [WorldSIDleft] and [WorldSIDright], apply to WorldSID 5th and 50th dummies. A third section, [HybridIII], applies to Hybrid III 5th and 50th dummies. These sections are described in more detail in Appendix A.

The previous version of RibEye software (version 5.3, released in October 2017) used the same ISO codes for a WorldSID RibEye mounted on either side of the dummy. If you want to continue using this existing channel-naming convention, copy the 5.3 INI file WorldSID ISO codes to the [WorldSIDleft] and [WorldSIDright] sections in the INI file for version 8.1.

2.7.1 ISO Codes for Ambient Light Channels

The ambient light channels have special ISO codes. The ambient light data is always unfiltered, and the units are 16-bit counts (0-65,535). 0 is for no ambient light, and 65,535 is a full-scale reading. The values are proportional to the ambient light power, but the data is not calibrated to standard optical power units such as lumens.

The ISO codes for the Test Object and Seating Position are the same as the standard ISO codes. The ISO codes for the other locations are shown in Table 3.

Table 3. ISO codes for ambient light

Letters	ISO Definition	2-Axis RibEyes	3-Axis RibEyes	WorldSID
CCCC	Main Location	SENS	SENS	SENS
DD	Fine Location 1	LE for left sensor RI for right sensor	LE for left sensor RI for right sensor MI for middle sensor TO for top sensor BO for bottom sensor	MI for middle sensor TO for top sensor BO for bottom sensor
EE	Fine Location 2	99	99	RE for red (upper ribs) BL for blue (lower ribs)
FF	Fine Location 3	99	99	99
GG	Dimension	PO	PO	PO
H	Direction	0	0	0
I	Filter	0	0	0

2.7.2 "ISO Test Object" Menu

The "ISO Test Object" drop-down menu sets the first character of the ISO codes shown in Table 2 above. Typically this is used to indicate the vehicle that the RibEye dummy is in. This list of options can be modified by right-clicking your mouse inside the drop-down menu box. This pulls up a screen where you can enter additional test objects as shown in Figure 7. The "ISO Test Object" list is stored in a text file located in the RibEye software installation directory; the default directory is:

C:\Program Files(x86)\RibEye_8_1\isotestobject.txt

You can directly edit this file to delete or add entries. The file is read at program startup to populate the drop-down menu list.

Figure 7. Adding to "ISO Test Object" list

2.7.3 "ISO Position" Menu

The "ISO Position" drop-down menu lets you choose the standard dummy positions in a vehicle. The "ISO Position" sets the second character of the ISO codes shown in Table 2 above. Figure 8 lists the options for dummy positions.

Figure 8. "ISO Position" list of options
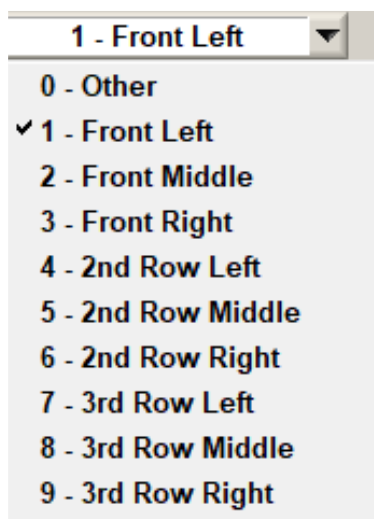
2.8 "Show Current XYZ's" Button

The "Show Current XYZ's" button turns on the LEDs briefly and report the current positions in the dummy coordinate system based on the Left or Right setting in the "RibEye Pointed Toward Dummy" field. For 2-axis systems, the button is labeled "Show Current XY's". The current positions displayed are the average of 2000 points collected by the RibEye.

Note that you can copy the current positions into a spreadsheet by highlighting the entries with your mouse and pressing CTRL-C to copy the data to the windows clipboard. Then you can paste the data into a spreadsheet. Some users find this to be a convenient way to track the rib's initial positions from test to test.

2.9 Data Collection Setup, Arm, and Download Controls

Figure 9 illustrates these controls, which are described in the following sections.

Figure 9. Data collection setup, arm, and download controls
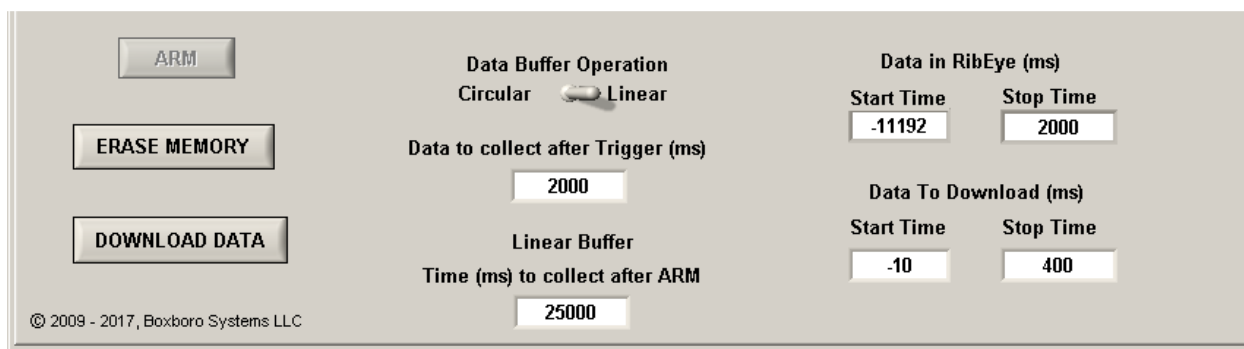
2.9.1 Data Buffer Operation

RibEyes collect data into a dynamic RAM data buffer. The size of the data buffers for each RibEye model is shown in Table 4. The buffer can be configured as a Circular or Linear buffer. If the "Data Buffer Operation" switch is set to Circular, only the "Data to collect after Trigger" box is shown (see Figure 10). In this mode, when the RibEye is armed, it begins collecting data to a circular buffer. It continues to collect data to the circular buffer until it receives a trigger signal (see section 2.9.4 "Arm/Disarm" and "Trigger" Buttons). After a trigger is received, RibEye continues to collect data for the number of milliseconds entered in the "Data to Collect after Trigger" box.

If the "Data to collect after Trigger" value is set to the maximum data buffer size, then *no pre-trigger data will be available*. We recommend that you set the "Data to collect after Trigger" value to no more than the maximum buffer size – 100 milliseconds (ms) – so that you will have 100 ms of pre-trigger data available and, thus, data relative to the pre-trigger data can be viewed and exported. If you set the "Data to collect after Trigger" value to a number *greater than* the maximum buffer size -100 ms, the software will notify you that it is out of range (see Figure 10) but will allow you to continue with your selection.

Table 4. RibEye dynamic memory data buffer size

RibEye Model	Data Buffer Size (ms)
All Hybrid III, SID2S, Polar, and Ballistic	30,000
First-Generation WorldSID	25,000
Second-Generation WorldSID	180,000

Figure 10. Data buffer operation switch
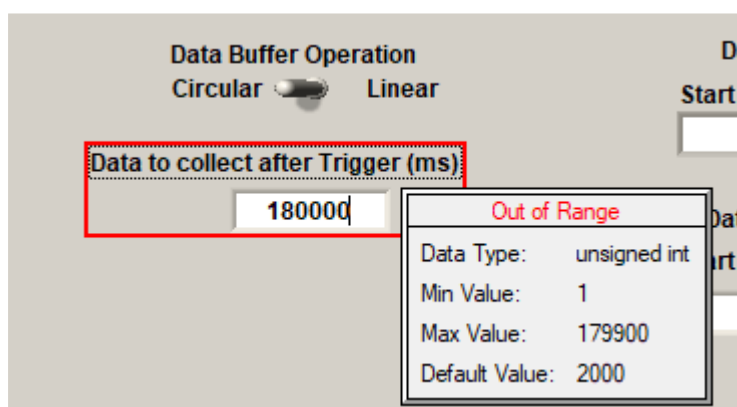
When the data buffer is set to "Linear", the RibEye collects up to "Time to collect after ARM", starting from when it is armed. If a trigger is received, it continues to collect data until it has either collected the amount of data set in the "Data to Collect after Trigger" box, or until the "Time (ms) to collect after ARM" is reached, whichever happens first. If no trigger is received, the RibEye stops collecting data after the time period specified in "Time (ms) to collect after ARM". If a trigger is detected, the time the trigger occurs is set to 0 ms. Table 5 shows some examples.

Table 5. Linear buffer operation examples

Data to collect after Trigger (ms)	Time (ms) to collect after ARM	Trigger occurs (ms after ARM)	Data Stored in RAM Buffer	
			Start Time	Stop Time
2,000	30,000	10,000	−10,000	2,000
2,000	30,000	29,000	−29,000	1,000
2,000	30,000	No Trigger	0	30,000

INI File Note: By editing the INI file, you can set the default values for 1) the Circular/Linear Buffer Switch and 2) the Data to collect after Trigger. See Appendix A for more details.

2.9.2 Flash Memory Data Storage

Immediately after data collection stops, data is copied from the RAM buffer to non-volatile flash memory for the Hybrid III, SID2S, Polar, and Ballistic RibEyes. The flash memory holds 2 seconds of data. If the RibEye is powered down after it writes to flash memory, only 2 seconds of data will be available to download. If a trigger occurred during the test, the flash holds data from –500 to 1,500 ms, where Time 0 is the time the trigger occurred. If no trigger occurred, the RibEye stores the last 2 seconds of data acquired in flash memory. Note that if power is interrupted while the RibEye is writing data to flash memory, then when the RibEye is rebooted, it will report the data in flash as –

$$\text{Start Time} = –29, 999 \text{ ms}$$
$$\text{Stop Time} = 27,999 \text{ ms}$$

There might or might not be any good data in flash memory, but the data can be downloaded and inspected.

WorldSID RibEyes will store the full amount of data collected into the dynamic RAM data buffer into non-volatile flash memory. The second-generation WorldSID RibEye writes data to flash memory as it is collecting data to the dynamic RAM data buffer, instead of waiting for the test to be complete to write data to flash like the first-generation RibEye. The second generation WorldSID RibEye stores up to 3 minutes of data in flash memory.

All WorldSID RibEyes have a battery backup which allows them to complete data acquisition and storage to flash memory, even if the main power fails during a test. When operating on battery power, once the data is stored in flash memeort, the battery will be turned off. If the main power is still disconnected when the battery turns off, the RibEye will turn off. To download the data you will have to restore the main power.

2.9.3 "Erase Memory" Button

The "Erase Memory" button erases the RibEye RAM and flash memory. This typically takes about 1 second for a second-generation WorldSID RibEye and 10–14 seconds for other RibEye models. A pop-up box appears asking you to confirm that you want to erase the memory. After the first pop-up box is acknowledged, a second pop-up box appears asking you to confirm a second time, with the YES and NO button positions swapped. The RibEye "Status" box displays "Erasing RibEye Flash Memory", and a progress bar appears.

2.9.4 "Arm/Disarm" and "Trigger" Buttons

Clicking on the "Arm" button (see Figure 9 above) starts the RibEye collecting data. Note that if memory is not erased as described above, the "Arm" button is inactive. When you click the "Arm" button, the RibEye will turn on the LEDs briefly and check that all LEDs are reporting good data. If one or more LEDs is reporting an error code, a message box will appear as shown in Figure 11. You have the choice to "continue to ARM" or to stop and determine why the LED is reporting an error code. See section 2.9.6 for more information on error codes.

For a second-generation WorldSID RibEye, the battery will also be checked after clicking on the "Arm" button. See Section 2.9.7 for more information on the battery and error messages that may occur.

Figure 11. Error code notification when arming the RibEye
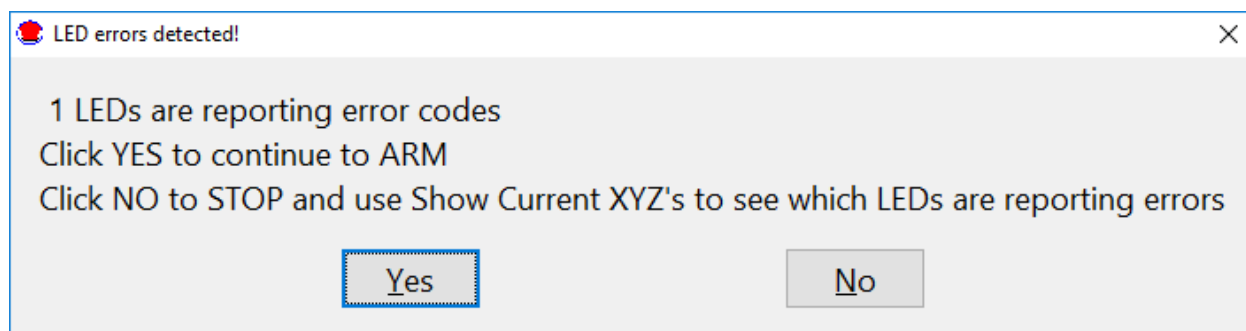
If there are no error codes, or if you decide to continue even though there are error codes, the ARM button label changes to "Disarm", and a "Trigger" button appears as shown in Figure 12.

Figure 12. "Disarm" and "Trigger" buttons that appear after arming

20
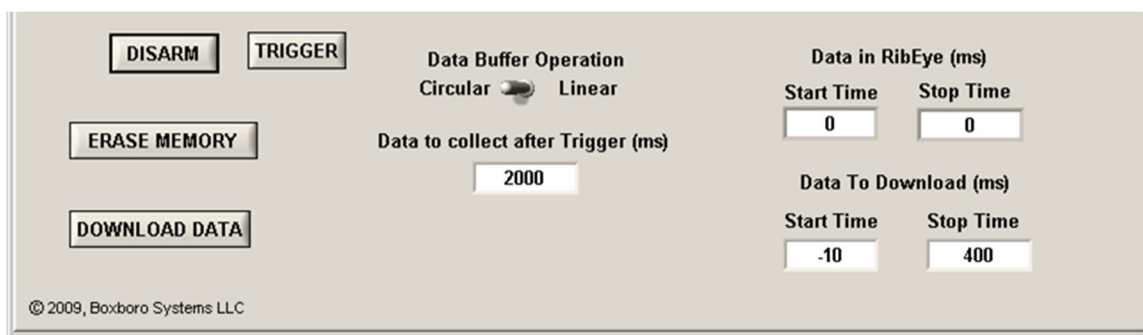
Then the RibEye Status box displays "Collecting Pre-Trigger Data", and a message pops up (Figure 13) asking if you plan to disconnect the Ethernet cable to the RibEye.

Figure 13. Message pop-up after arming
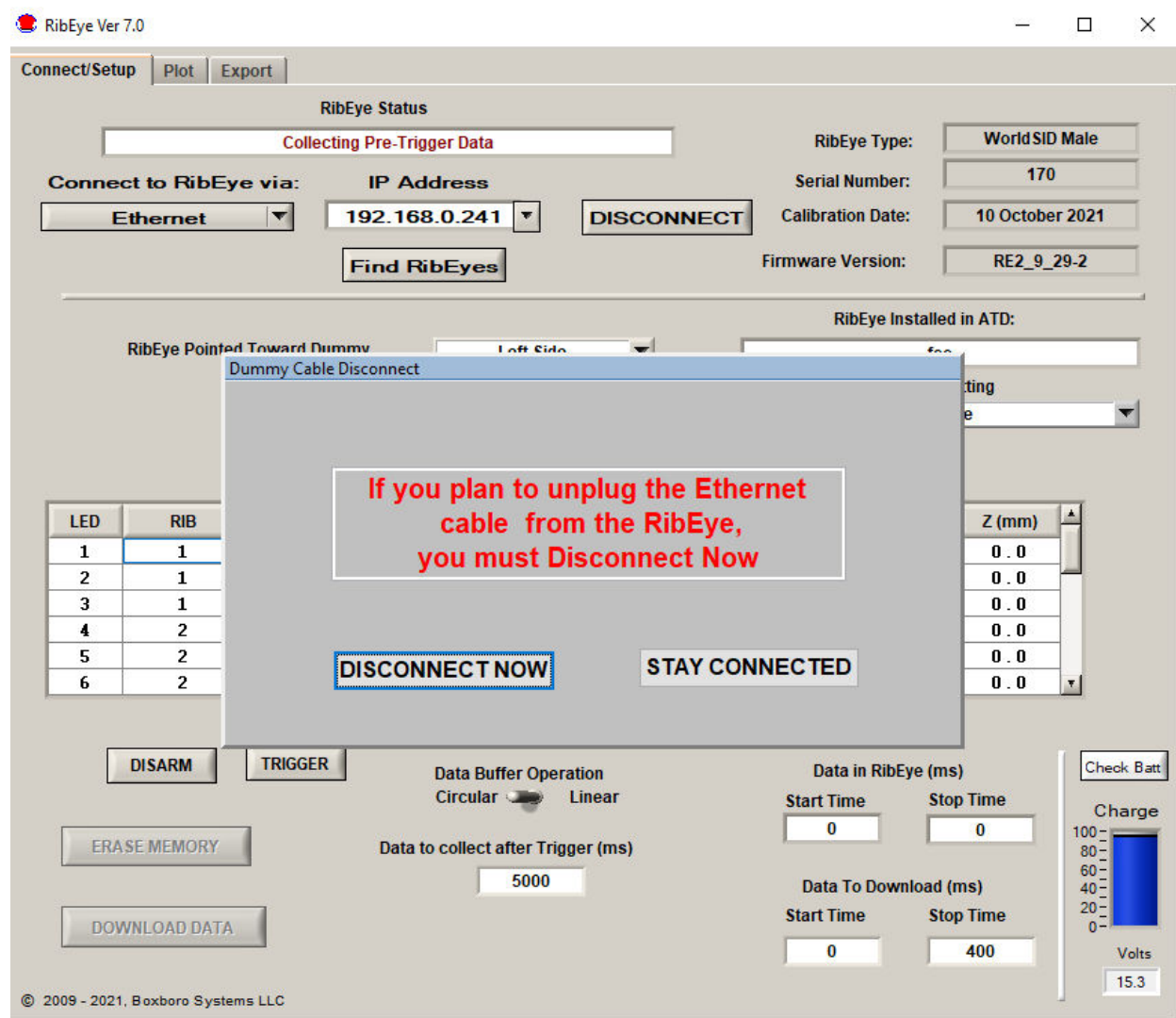
If you *do* plan to disconnect the cable, you must click on the "Disconnect Now" button. This will close communications to the RibEye so that disconnecting the cable will not lock up communications. If you *do not* plan to disconnect the Ethernet cable, you can click the "Stay Connected" button. After the test is completed and the Ethernet cable is plugged back in to the Trunk Box, you can click on the "Connect" button to re-establish communications with the RibEye.

The "Disarm" button causes the RibEye to stop collecting data, and ***no data will be stored***. The "Trigger" button marks a trigger event, and the RibEye will treat it as if a hardware trigger occurred.

During data acquisition, the RibEye Status displays either "Collecting Pre-Trigger Data" or "Collecting Post-Trigger Data and Storing to Flash". Once the data is stored to flash memory, the RibEye Status changes to "Connected-Idle". At this time, you can download the data collected.

2.9.5 "Download Data" Button

The "Download Data" button downloads data from the RibEye based on the "Start Time" and "Stop Time". You can set the start and stop times within your expected region of interest. However, the start and stop times must be within the range of data stored in the RibEye, or an error message will appear.

INI File Note: You can set the default values for the download start and stop times in the INI file's [connect_tab_controls] section.
When you click on the "Download Data" button, a progress bar appears showing the percent completion of the download. As part of the Download process, the software reads the ISO channel codes from the main tab and internally stores the channel codes with the data set. If the "ISO Test Object", "ISO Position", or "RibEye Pointed Toward Dummy" settings are incorrect, you have to re-download the data to store the correct values with the data set.

All RibEye data from your selected Start Time to Stop Time is downloaded. The LED X, Y, and Z data is downloaded in millimeters, and the ambient light readings for each sensor are downloaded in counts (65,535 maximum).

After the download is complete, the program displays the "Export" tab, allowing you to save the data. You can either save the data without seeing it or switch to the "Plot" tab (section 5.0) to preview the data before saving (see section 5.0, "Plot" Tab).

2.9.5.1 WorldSID Data Download and Conversion to Engineering Units

The WorldSID RibEye program downloads raw sensor data from the RibEye and converts it to engineering units in the software program. When you export the data from a WorldSID, the program also stores an additional file with the same name as the data files but with an RDF extension (RDF = raw data file). The second-generation WorldSID creates an RD2 raw data file instead of an RDF file.

The first generation WorldSID RibEye collects up to 25 seconds of data, and the second generation WorldSID RibEye can collect up to 180 seconds of data. For all WorldSID RibEyes the maximum amount of data that can be downloaded is 25 seconds due to limits in array sizes in the software. If you want to download the full 180 seconds of data from a second generation WorldSID RibEye, you must download it in 25 second intervals. This will require 8 downloads. This should only be necessary is you did not get a trigger, and were using a linear buffer. You will need to scan through the full data set to find the times the actual event occurred.

The RDF and RD2 files allow you to regenerate the engineering data in absolute, unfiltered format. They also let you change the impact side if the RibEye was set for the incorrect impact side when the test was run. For example, if the RibEye was installed for a right-side impact, but the software was still set on left-side impact, the data can be re-processed for right-side impact. It can also be used to change the ISO position and to test object codes if they were set incorrectly when the test was originally downloaded. See Section 5.1 "Select File" Button (on the "Plot" tab) for more information on regenerating data from the RDF or RD2 files.

Downloading raw data from a first-generation WorldSID and converting to engineering units in the PC is faster than converting to engineering units in the RibEye. To convert the raw data to engineering units, the calibration file for your WorldSID must be stored in the RibEye installation directory. The calibration file name format is:

<div align="center">SNXXX_CAL DATE_YYYY Side_cal.bin
Example: SN133_18 March 2017_Left Side_cal.bin</div>

Where: XXX is the serial number of the RibEye

              CAL DATE is the last calibration date for the RibEye

              YYYY is the RibEye's orientation, either left-side or right side

WorldSID RibEyes can be calibrated for left-side impact, right-side impact, or for impact on both sides. If the RibEye is calibrated for both left- and right-side impact, there will be two calibration files.

The calibration file is automatically placed in the RibEye program directory (typically C:\Program Files(x86)\RibEye_8_1) by the RibEye installer that is shipped with a new RibEye. A copy of the calibration file also appears in the "Calibration file for PC and README" directory of the software installation USB thumb drive, which is also shipped with the RibEye. However, if you download RibEye installation software from the Boxboro Systems website, or if the RibEye has been recalibrated, you have to manually copy the calibration file to the RibEye installation directory.

If you have already installed a previous version of the RibEye software for your WorldSID, the calibration file is stored in the installation directory for that version, such as C:\Program Files (x86)\RibEye_8_0. You can copy the calibration file from the existing directory to the new software version RibEye_8_1 directory.

2.9.5.2 "Could Not Find Calibration File" Error Message

If the RibEye software cannot find the calibration file in the installation directory, you will see a pop-up error message (Figure 14). If you see this error message, copy the correct calibration file to the RibEye software installation directory listed in the pop-up box. The calibration file will be on the thumb drive shipped with the RibEye when it was calibrated. Then you can download the data from the RibEye again, and it will be converted to engineering units.

Figure 14. Pop-up error message for "Could Not Find Calibration File"
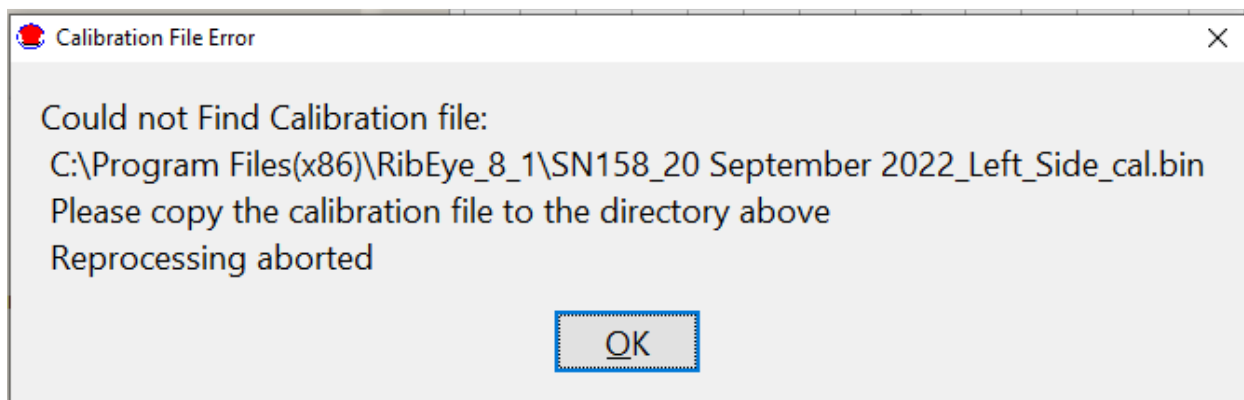
2.9.6 Error Codes in Data File

If the RibEye cannot accurately calculate a LED position, it generates error codes in the data file, causing a drop-out in the plots. The RibEye forces the X, Y, and Z data to the same error code. Error codes can be generated in three potential situations:

1.   Light from a LED is blocked between the LED and one of the sensors
2.   A LED moves out of the RibEye's range, so that the LED cannot send enough light to the sensor
3.   Too much ambient light exists to accurately resolve the LED's position.

For 2-axis systems, the X and Y data is forced to the following numbers:

1, if the left sensor (dummy's left) is blocked or sees too much ambient light

2, if the right sensor (dummy's right) is blocked or sees too much ambient light

3, if both sensors are blocked or see too much ambient light

327, if a divide-by-zero condition occurred in the data processing

For 3-axis systems, the X, Y, and Z data is forced to the following numbers:

1, if the top sensor is blocked or sees too much ambient light

2, if the bottom sensor is blocked or sees too much ambient light

3, if both top and bottom sensors are blocked or see too much ambient light

4, if the middle sensor is blocked or sees too much ambient light

5, if the middle and top sensors are blocked or see too much ambient light

6, if the middle and bottom sensors are blocked or see too much ambient light

7, if all three sensors are blocked or see too much ambient light

8, if a divide-by-zero condition occurred in the data processing

9, if data goes past the end of the calibration curves

Error codes are generated whenever the RibEye begins to operate outside of its measurement range. The RibEye's measurement range is defined in RibEye Hardware User manual for your version of the RibEye.

If an error code occurs, you must discount the data for a few milliseconds before and after the drop-out in the plots. The cause of a drop-out is usually a loose cable that swings between the LED and the sensors, blocking the light, or a chest pot arm that swings between the LED and sensor (usually rib 6 right). A drop-out can also occur in the 5th Female dummy if the lap belt forces the dummy's abdomen insert up into the rib cage, blocking the LEDs on ribs 6 and 5, which generally occurs when the dummy submarines under the lap belt.

In all of these cases, before and after the light is completely blocked, the obstacle reflects light or partially blocks light, which confuses the sensor and causes bad data to be reported. That's why a few milliseconds of data must be discounted before and after the blockage and drop-out.

> ***NOTE: The error codes can get masked by filtering the data. Therefore, we strongly recommend reviewing and saving a copy of the unfiltered data so that the error codes are preserved.***

2.9.7 Battery Fuel Gauge for Second-Generation WorldSID RibEye

The second-generation WorldSID RibEye includes a fuel gauge with the battery. The controller displays the battery charge level and the voltage when you connect to the RibEye. You can also press the "Check Batt" button to get the current values (Figure 15).

**Figure 15. Check battery button
and charge level**
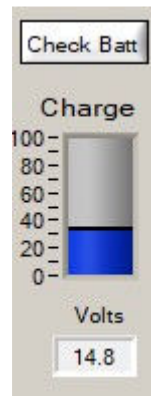
If the battery is not connected, an error message will be displayed (Figure 16). It will also be displayed when you arm the RibEye if the battery is not connected. The same message will be displayed post-test if the battery is disconnected.

Figure 16. Battery disconnected error message
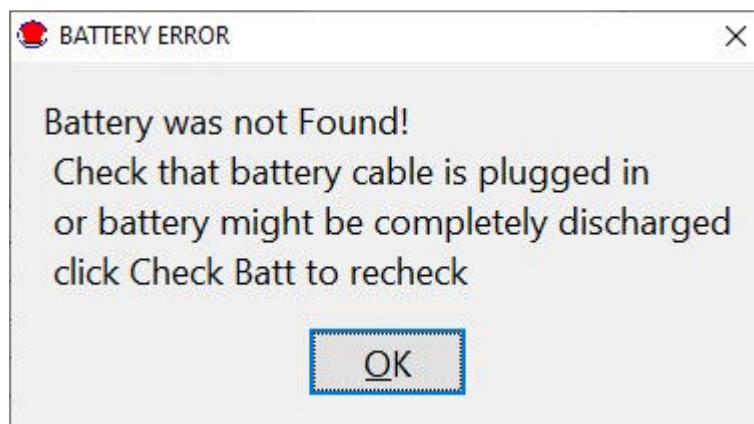
When you arm the RibEye, it will display a different error message (Figure 17) if the battery is less than 50% charged. When a test is complete, the RibEye will read the battery fuel gauge again and display the charge level on the screen.

Figure 17. Battery low error message
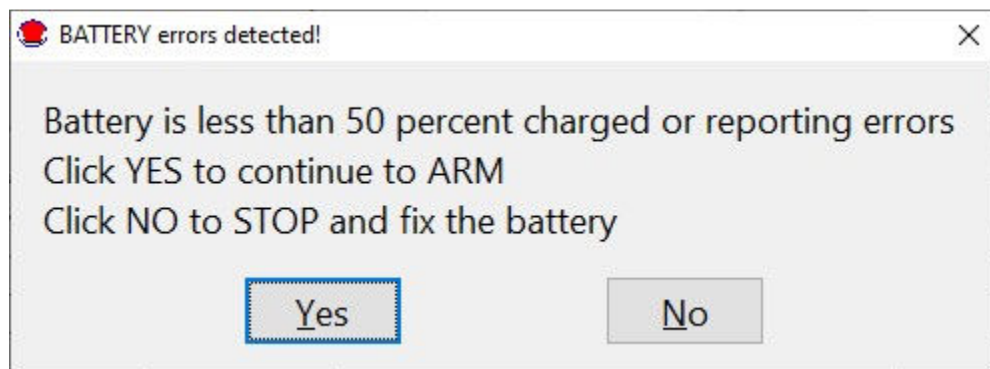
If the battery has been completely discharged, the fuel gauge chip will be reset, and it will not know the charge level. Then you will get the error message shown in Figure 18. To fix this, you must fully charge the battery (until the charger light is solid green) and then click on the "Fully Charged" button. If you close the screen shown below, it will come back again when re-connecting to the RibEye or clicking on the "Check Batt" button.

Figure 18. Fully discharged battery error message
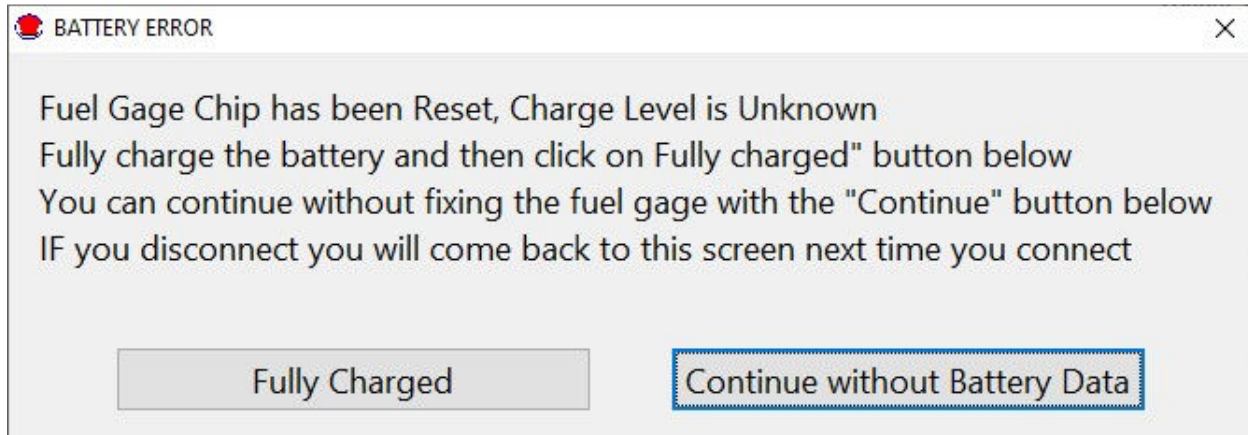
INI File Note: By editing the INI file, you can turn off the battery error messages and the battery display. See Appendix A for more details.

3.0   "Export" Tab

The "Export" tab is shown in Figure 19. If data has been downloaded from the RibEye, the "Data in Memory" field displays "Downloaded RibEye Data in Memory". If an existing RibEye data file was imported (see section 5.0, "Plot" Tab, for importing an existing file), the existing file name is displayed. You can export either downloaded data or an existing file.

You can choose to save and export the data in three formats: Diadem, CSV (comma-separated-values), or ISO. The data can be stored unfiltered or filtered at Class 1000, 600, 180, or 60. The data can have the pre-trigger offsets removed (Relative) or have the pre-trigger offsets preserved (Absolute).

Figure 19. "Export" tab with format selection box expanded
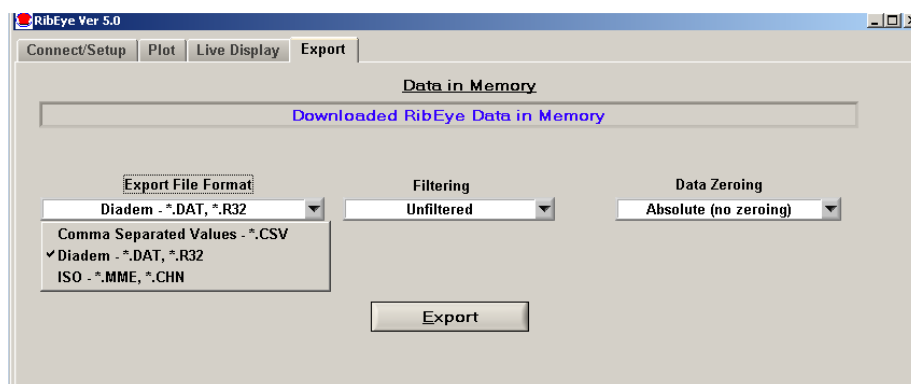
INI File Note: You can set default values for the Export File Format and Data Zeroing, as well as the default data Storage Location, in the [ExportDefault] section of the INI file. You can still over-ride the default and select other options in the drop-down box.

After you have chosen the data format, filtering, and data zeroing options, click on the "Export" tab to choose the file name and location and to export the data. The program brings up a file selection box as shown in Figure 20.

Figure 20. Export file selection panel for a Diadem file
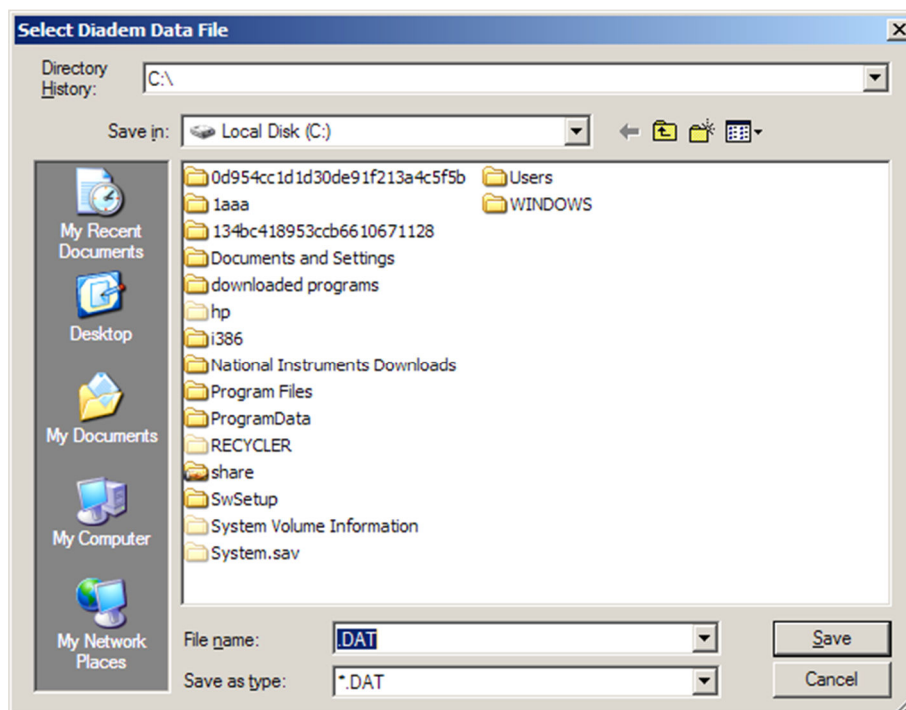
3.1   Data Zeroing

The Data Zeroing selection has two choices:

1. Relative to pre-T0 average, with the pre-trigger offsets removed

2. Absolute, with the pre-trigger offsets preserved.

3.1.1 Relative to Pre-T0 Average

This selection calculates the average of the first 100 data points (10 ms at 10-kHz sample rate) of each channel and subtracts the average from all of the channel data points. This forces each data channel to start at approximately zero mm displacement.

If the data set does not contain at least 100 data points prior to time zero, the relative calculation cannot be performed. The selection box is forced to "Absolute (no zeroing)" and grayed (see section 3.1.2 below), and a message is displayed as shown in Figure 21.

Figure 21. Insufficient pre-T0 data for zeroing
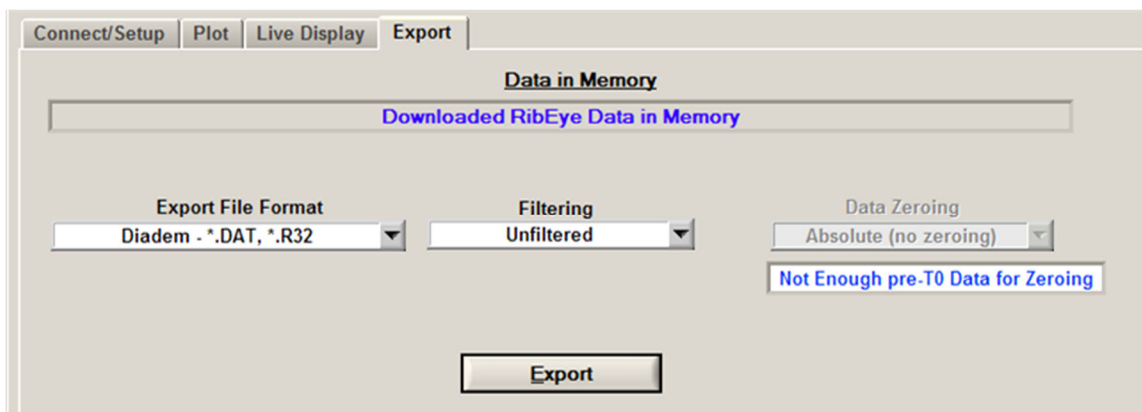
If you are reprocessing a CSV or ISO data file that was already zeroed, you cannot re-zero the data. The selection box is forced to "Relative to Pre-T0 Average", and a message is displayed that the data is already zeroed, as shown in Figure 22. The Diadem file format preserves the absolute data and uses offset data from the channel headers to create relative data, so data that was saved as relative in Diadem format can be re-exported as absolute. (Ambient light data is always stored as absolute data.)

Figure 22. Exporting data that was already zeroed
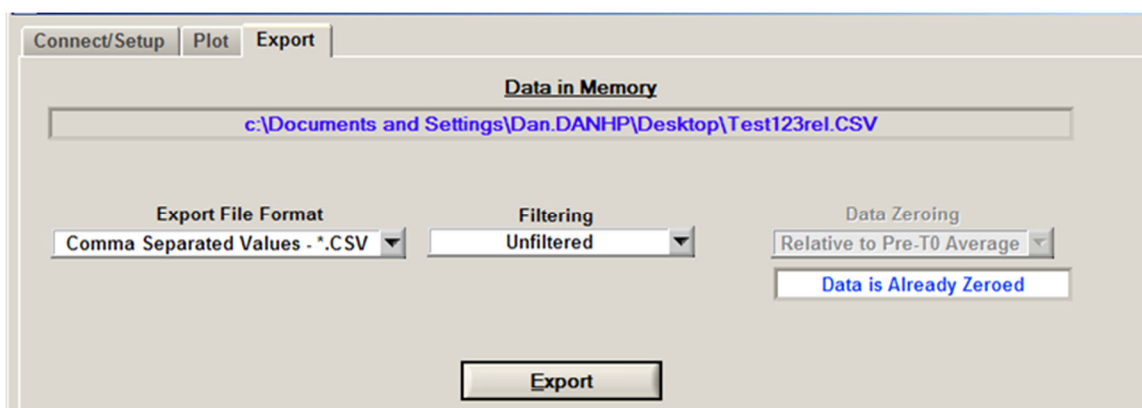
3.1.2 Absolute (no zeroing)

If you choose the Absolute data option, all channel data is the X, Y, or Z distance with respect to the origin of the RibEye coordinate system. Refer to your RibEye Hardware User Manual for the definition of the RibEye coordinate system. This selection preserves the initial positions of the LEDs.

3.2 Filtering

Data can be exported unfiltered or filtered at Class 1000, 600, 180, or 60. The program uses the phaseless 4-pole Butterworth filter used by NHTSA (National Highway Transportation and Safety Administration, U.S.). The last character of the ISO channel codes is set to the filter used:

0 = No Filter
A = Class 1000
B = Class 600
C = Class 180
D = Class 60

If you are exporting previously filtered data, you cannot re-filter the data. The "Filter Selection" box is set to the filter that the data was already filtered at and grayed-out so it cannot be changed, and a message appears that the data is already filtered, as shown as in Figure 23.

INI File Note: To support older legacy data processing systems, the filter code can also be set to P which has been used for analog data that was pre-filtered before digitizing. The use of the P code for unfiltered data is set in the INI file in the [LegacySoftwareFilterClassCode] section.

Ambient light data is always stored unfiltered, as noted above. Length Change calculations (see section 4.2 below) are always done with class 600 filtering of the X and Y data and cannot be re-filtered.

Figure 23. Exporting previously filtered and zeroed data
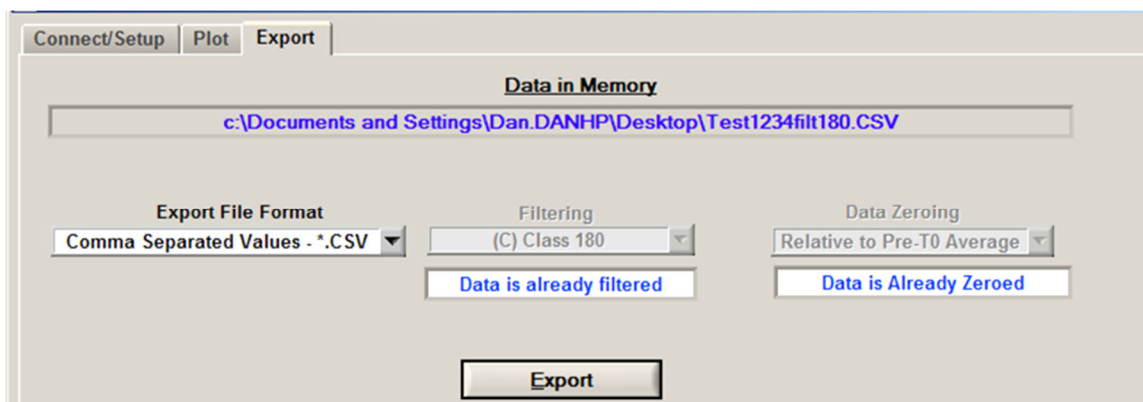
3.3   Data formats

All three data format options include the following information about the test:

- The test date
- RibEye type
- RibEye serial number
- The ISO channel codes, including the filter code as the last character
- Number of data points per channel and the start time relative to the trigger time
- The text from the field under "RibEye Installed in ATD" (see section 2.4).
- The trigger setting when the test was run
- Data stored as absolute or relative

3.3.1 Diadem Data Format

The Diadem data format is used for importing data into National Instruments' Diadem data processing program. When this format is chosen, the program opens a file selection box with the "Save as type" selection set to ".DAT". Enter a test file name, such as "mydata". The program creates two files:

mydata**.**DAT (an ASCII file describing the data)

mydata**.**R32 (a binary file with the test data in 32-bit floating point format)

For more information on the Diadem format, see the National Instruments web site (NI.com).

3.3.2 CSV Format

The CSV format (comma-separated values) creates a spreadsheet compatible file with a CSV extension. Data is arranged in columns, with the ISO codes as the column headers. The file selection box displays the "Save as type" selection set to ".CSV". Enter a test file name, such as "mydata', and the program creates a file called "mydata.CSV".

3.3.2.1 Alternative CSV Format

If you do not wish to use the standard ISO code channel header formats, an alternative CSV format has been added. To use the this alternative format, you must edit the INI file and set USE ALT CSV = 1. The alternative CSV format builds channel name headers as follows –

[dummy position in car][rib name and LED location][axis]

Where the axis is defined by a single character (X, Y, or Z).

In the INI file, you can define your own names, up to 10 characters, for the ISO seating position codes 0–9. You can also define the rib name and LED location for Hybrid III and WorldSID dummies, using up to 30 characters in the INI file.

The program uses your defined text for the dummy position and rib names/LED location and adds the 1-character axis at the end. For example, if you used ISO Code 1 for position and named it "Driver_", and you named the shoulder rib rear LED "Shoulder Rear_", for the X axis data the channel name header will be "Driver_Shoulder Rear_X".

Some information normally included in the ISO codes may not be in the user-defined alternative channel names. This information, such as the filter type and ISO Test Object, appears instead in the file header.

3.3.2.2 Ambient Light Channels

When using the alternative CSV format, the ambient light data channels use the seating position text, such as DRVR, and add text as shown below for Hybrid III and WorldSID:

Hybrid III Ambient Light Channels
DRVR_Amb_Left .... Left sensor
DRVR_Amb_Right .... Right sensor

WorldSID Ambient Light Channels
DRVR_Amb_Top_R .... Shoulder sensor
DRVR_Amb_Bot_R .... Thorax 2 sensor
DRVR_Amb_Mid_R .... Thorax 1 sensor
DRVR_Amb_Top_B .... Thorax 3 sensor
DRVR_Amb_Bot_B .... Abdomen 2 sensor
DRVR_Amb_Mid_B .... Abdomen 1 sensor

3.3.3 ISO MME Format

The ISO MME format is described in ISO/TS 13499 RED A (Version 1.4), Road vehicles – Multimedia data exchange format for impact tests. When you select the ISO format option, the file selection box displays the "Save as type" selection set to ".MME". When you enter a test file name, such as "mydata", the program breaks down the file location and filename into the format "/PATH/mydata". It then creates a directory called "/PATH/mydata" and builds the files as shown in Figure 24.

Figure 24. ISO MME format directory and files

**When you select an ISO file in the form: \PATH\mydata.MME
the program will create the folders and files shown below**

\PATH\mydata
    mydata.MME
    CHANNEL
         mydata.CHN
         mydata.001
         mydata.002
         mydata.003
          ●
          ●
          ●
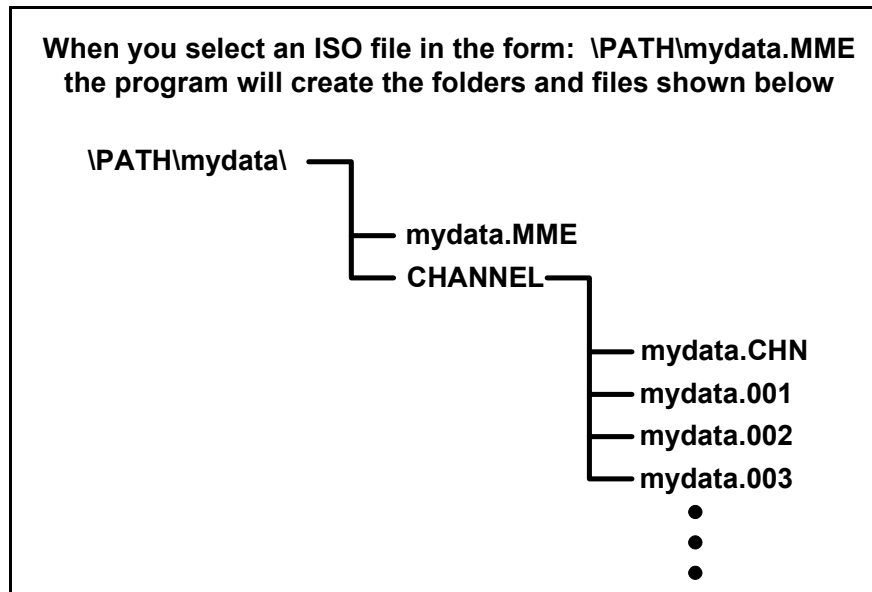
The file "mydata**.**MME" is a generic test descriptor file in ASCII format, where the only data that changes are the test data and a timestamp for when the file was created. Note that in previous versions of the RibEye software, the date was formatted as MM-DD-YYYY where MM= Month, DD = Day, and YYYY = Year. In version 8.0 of the RibEye software, this has been corrected to the ISO 8601 format as YYYY-MM-DD

The file "\CHANNEL\mydata**.**CHN" is an ASCII file that contains the number of data channels and a list of the ISO channel name codes.

The files "mydata**.**001" through "mydata**.**00n" are ASCII files, one per data channel, that contain the data for each channel in floating point format.

3.3.4 Diadem and ISO MME Channel Names for plots

For WorldSID Diadem and ISO MME output data formats a "Plot Name" for the data channels will be read from a .CSV file: "WorldSID Channel Names for Plots.csv"
For a Diadem file the plot name is in section 201, example below. In previous versions 201 had the ISO codes as shown in line 200 below.
  200,11SHRILEREWSDSX0
  201,RibEye Left Rear Shoulder Rib Displacement X

For an ISO MME channel file the plot name is in the Customer channel code as shown below. In previous versions the Customer channel code was NOVALUE.
  Name of the channel :11SHRILEREWSDSX0
  Laboratory channel code :NOVALUE
  Customer channel code :RibEye Left Rear Shoulder Rib Displacement X
  Channel code :11SHRILEREWSDSX0

If the file "WorldSID Channel Names for Plots.csv" is not found, ISO codes will be used as in the previous versions of the RibEye software. The WorldSID channel names file must be in RibEye program directory. The default RibEye program directory is:
  C:\Program Files(x86)\RibEye_8_1

For Hybrid III dummies the plot file names are hard coded, such as "RibEye Left Rib 01 Displacement X" and are stored in the locations described above for the Diadem and ISO MME formats.

4.0   Calculated Data Channels

For the WorldSID 5th and 50th ATDs, the software adds calculated data channels for what 1D and 2D IR-Traccs would report. This allows you to compare RibEye data to data collected with IR-Traccs. It also allows the use of rib certification corridors and injury levels developed using IR-Traccs.

A Length Change calculation has been added to the RibEye software for all of the LED positions (see section 4.2 below).

For existing test data sets, you can reprocesses the RDF or RD2 file to add the IR-Tracc and Length Change calculations to the data, calculated as described below, and re-export new files including this information in any of the three export formats.

4.1   1D and 2D IR-Tracc Calculated Channels

The 1D IR-Traccs pivoted at the face of the spine. The 2D-IR Traccs pivoted at a point approximately 22.5 mm from the face of the spine. In previous versions of the RibEye software, the calculations used the 2D IR-Tracc pivot point to report the calculated 1D and 2D IR-Tracc outputs. For software version 8.1, the WorldSID 50th IR -Tracc calculations have been updated to use the pivot point at the spine per the requirements of ISO 15830-3:2022 since the rib certification and injury data was based on the original 1D IR Tracc pivot point at the face of the spine.

The original WorldSID 5th Female (rev D and earlier) used a string pot for the shoulder, so only the uncorrected IR-Tracc output could be calculated for the shoulder. The calculations previously used the 2D IR-Tracc pivot point to report the calculated 1D and 2D IR-Tracc outputs. The program has been updated to estimate what a 1D or 2D IR Tracc would report for all ribs, with the pivot point at the spine face at each rib.

The WorldSID 5th Rev F, being developed by NHTSA, has different dimensions than the previous WorldSID 5th dummies. The program will automatically detect if the dummy is a rev F, and calculate the 1D and 2D IR-Tracc would report for the rev F dummy dimensions, with the pivot point of the IR Tracc referred to the spine face at each rib.

For all WorldSID dummies, the 1D IR-Tracc compression is called the *uncorrected IR-Tracc output*.

The 2D IR-Tracc compression is called the *X-corrected IR-Tracc output*, which includes a correction for motion in the X direction.

.   ### 4.1.1 IR-Tracc Data Channel Name Settings

The channel names for the calculated IR-Tracc data depend on an INI file setting in the [IRTracc_MME_Names] section. The variable "use_MME_IRT_Channel_Names" can be set to 0 or 1.

If "use_MME_IRT_Channel_Names" is set to 0:
The program will behave like version 5.3 of the RibEye software – that is, the channel names for the calculated IR-Tracc data will be the same as the channel names for the middle LED on each rib, with one difference:

1. For 1D IR-Tracc data, the direction code is changed to "U" for uncorrected
2. For 2D IR-Tracc data, the direction code is changed to "C" for corrected

For example, for the WorldSID shoulder rib middle LED, the IR-Tracc channel names for left-side impact would be –

SHRI LE MI WS DS **U** for a 1D IR-Tracc

SHRI LE MI WS DS **C** for a 2D IR-Tracc

(Please refer back to Table 2 for a list of the ISO codes used in RibEyes.)

INI File Note: If you have changed the ISO code names in the INI file, the IR-Tracc channel names will use your changed ISO code names with the U or C code for the axis direction. If you use the Alternative CSV format, the IR-Tracc channel names will use your designated channel names with the U or C code for the axis direction.

If "use_MME_IRT_Channel_Names" is set to 1:
The program will use the channel name format requested by the MME group. For left-side impact, the channel names for the 12 calculated IR-Tracc channels would be:

1D uncorrected data
SHRI LE 00 WS DS 0
TRRI LE 01 WS DS 0
TRRI LE 02 WS DS 0
TRRI LE 03 WS DS 0
ABRI LE 01 WS DS 0
ABRI LE 02 WS DS 0

2D corrected for X data
SHRI LE 00 WS DS Y
TRRI LE 01 WS DS Y
TRRI LE 02 WS DS Y
TRRI LE 03 WS DS Y
ABRI LE 01 WS DS Y
ABRI LE 02 WS DS Y

For right-side impact, the LE would be changed to RI.

4.1.2 Calculations for 1D and 2D IR-Tracc for WorldSID 50th Male RibEye

To calculate what an IR-Tracc would report, we need the pre-event length of the IR-Tracc and the relative X, Y, and Z data from the RibEye. We can use the absolute position data from the RibEye to determine the IR-Tracc Pot pre-event length. Please refer to Figure 25 (on the next page), where the symbol definitions and calculations are as follows:

Yo = Pre-T0 LED position = RibEye LED position absolute data

dY = change in RibEye Y (relative) = Yo – y(t) where y(t) is the RibEye Y at time t
dX = change in RibEye X (relative)
dZ = change in RibEye Z (relative)

Ys = distance from RibEye origin to IR-Tracc pivot point at the spine end
Ys = -21 mm for all ribs except shoulder
Ys = -32.6 mm for shoulder

L1 = Yo – Ys + Yr = initial length of IR-Tracc
Y1 = L1 – dY
L2 = sqrt (Y1^2 + dX^2 + dZ^2)

Uncorrected IR-Tracc displacement = L1 – L2 = IRTuc
Θ = IR-Tracc angle (rotation in the XY plane) = arctan [dX/Y1]

With the IR-Tracc uncorrected length and the angle Θ, the corrected Y and X for the IR-Tracc is:
   IRTcy = L1 – L2cosΘ
   IRTcx = dX

Therefore, with no Z motion of the rib:
   IRTcy = dY from RibEye
   IRTcx = dX from RibEye

With Z motion, IRTcy < dY and IRTcx < dX

Figure 25. Calculating IR-Tracc output from WorldSID 50th Male RibEye
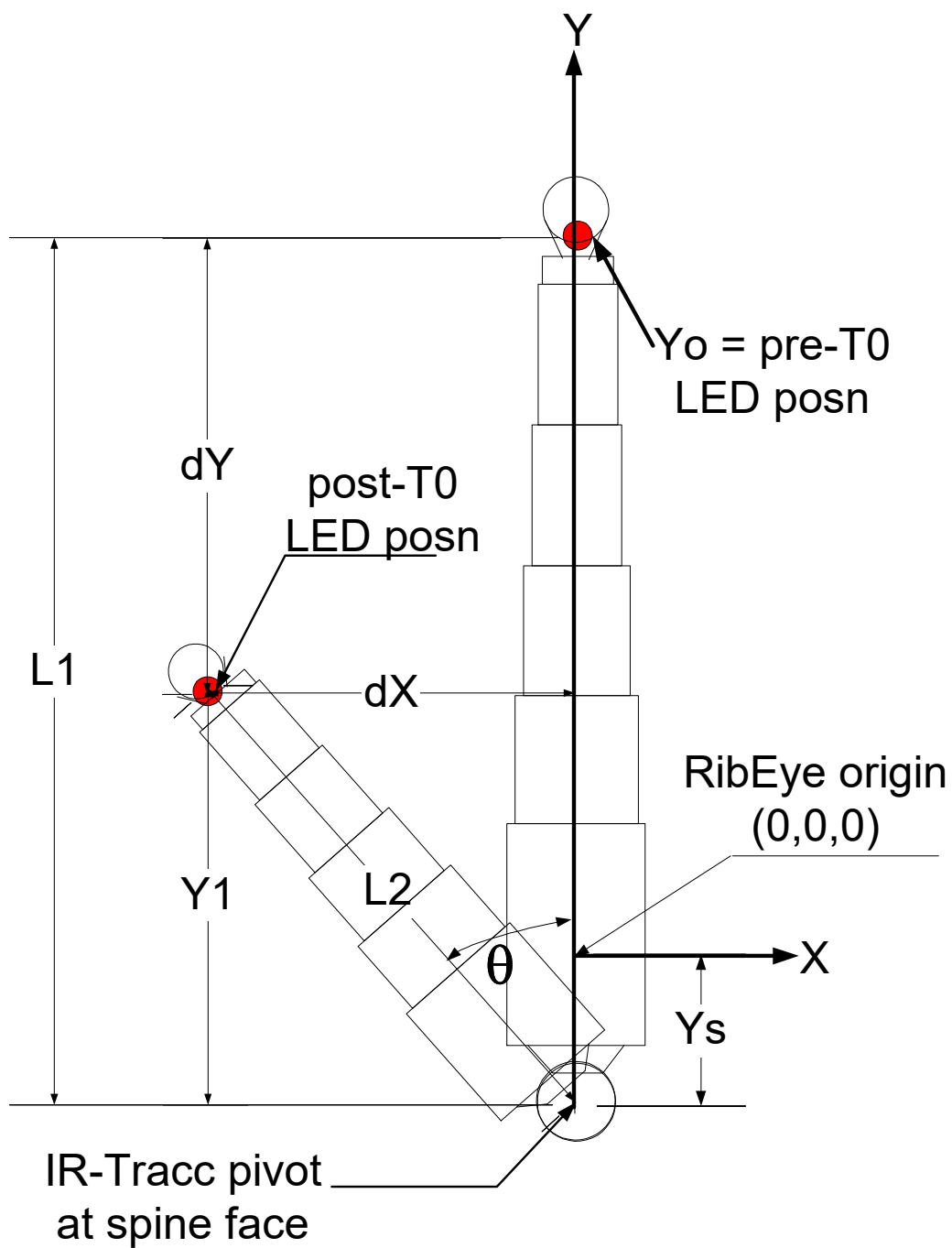
L1 = IR Tracc initial Length
L2 = IR Tracc length at time t

4.1.3 Calculations for 1D and 2D IR-Tracc for WorldSID 5th Female RibEye

The calculations for the WorldSID 5th are the same as described above for the WorldSID 50th, with the exception that the Ys values are different for the WorldSID 5th, and they are:

Ys = distance from RibEye origin to IR-Tracc pivot point at the spine end

For WorldSID 5th Rev D and earlier:
Ys = -14.244 mm for all ribs except shoulder
Ys = 25.844 for shoulder

For WorldSID 5th Rev F (Note: WorldSID 5th Rev E was tested but not formally released)
Ys = 15.943 mm for all ribs except shoulderl rib.
Ys = 16.043 mm for shoulder rib

4.2   Length Change Calculated Channels for WorldSID 5th and 50th RibEyes

The program calculates the Length Change for each LED to the RibEye origin in the XY plane for each of the 18 LEDs, adding 18 data channels to the output file. For each of the data channels, the program uses the same data channel name (either ISO codes or alternative CSV format name) and changes the axis to L for Length Change.

The RibEye origin is defined as the center of the Thorax 1 sensor for the upper three ribs and the center of the Abdomen 1 sensor for the lower three ribs (see Figure 26). The Shoulder, Thorax2, Thorax 3, and Abdomen 2 ribs are displaced in X relative to the RibEye origin. For the Length Change calculation, the LED X distance is shifted to the centers of the rib using the offsets shown in Table 6.

Table 6. X offsets for length change calculation

Rib	WS-50th	WS-5th	WS-5th Rev F
	X Offset (mm)		
Shoulder	−19.86	−7.09	−4.672
Thorax 1	0	0	0
Thorax 2	4.72	14.21	17.639
Thorax 3	−20	−20.01	−15.43
Abdomen 1	0	0	0
Abdomen 2	20	20.11	15.43

Figure 26. WorldSID 50th Male RibEye coordinate system
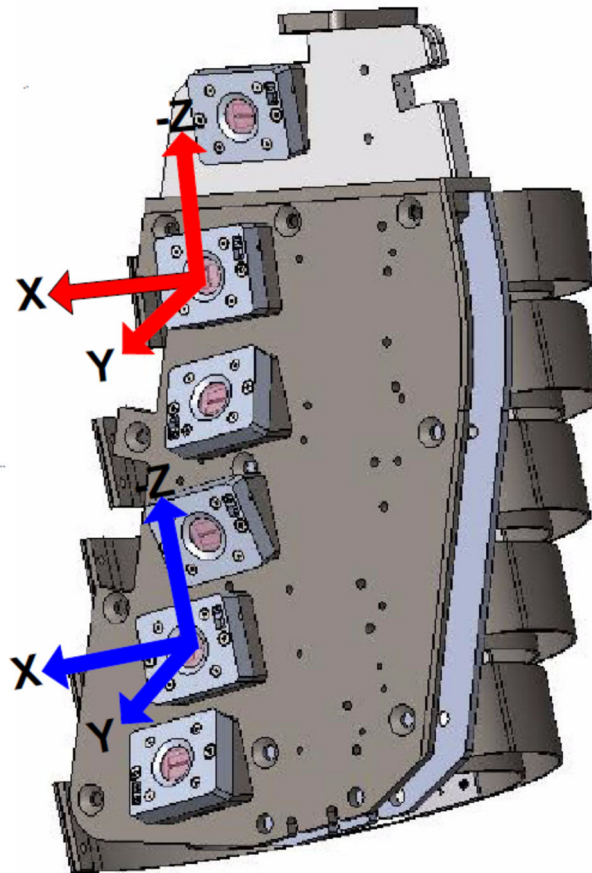
The Length Change for a LED at time t is the initial vector length from the LED to the RibEye origin in the XY plane minus the vector length from the LED to the RibEye origin at time t.
The Length Change is calculated as follows:

$$Lo = sqrt (Xo^2 + Yo^2)$$

Where:

Lo is the initial distance from the LED to the RibEye origin
Xo = pre-Time0 RibEye X – X Offset (from Table 6)
Yo = pre-Time0 RibEye Y

$$L(t) = Lo – sqrt (X(t)^2 + Y(t)^2) = Length Change at time t$$
X(t) = RibEye X data at time t – X Offset (from Table 6)
Y(t) = RibEye Y data at time t

On a purely lateral impact, the center LED shows the largest Length Change. If the dummy is hit obliquely, for a hit toward the front of the dummy, the front LED shows the largest Length Change. If the dummy is hit obliquely toward the rear, the rear LED shows the largest Length Change

The channel names for the calculated Length Change channels will be the channel name for the LED, but with the direction code set to L. For example, the length change channel for left-side impact, shoulder rib, rear LED, WorldSID 50th would be –

<p style="text-align:center">SHRI LE RE WS DS L B</p>

Note: The filter class for the Length Change calculations is always set to B = class 600. No other filtering options are allowed for the length change calculation.

If an error code occurs in the X or Y data while calculating Length Change, the Length Change data is replaced by the error code. If two error codes occur with less than 5 ms of data between the error codes, the period between the error codes is replaced with a code of 0.

Calculation Notes:

- The pre-Time0 is the average of the first 10 ms of the downloaded data. For example, if you download from –200 ms to +500 ms, the pre-Time0 data is calculated from –200 to –190 ms

- The X offset from Table 6 is subtracted from the unfiltered X data

- X data (including the offset) and the Y data are filtered separately, then the Length Change is calculated using the filtered X and Y data.

5.0   "Plot" Tab

The "Plot" tab (Figure 27) displays a quick view of RibEye data. If data has been downloaded from the RibEye, the "Current File" box displays "Downloaded RibEye Data in Memory". If an existing RibEye data file was read in, the existing file name is displayed.

Figure 27. "Plot" tab
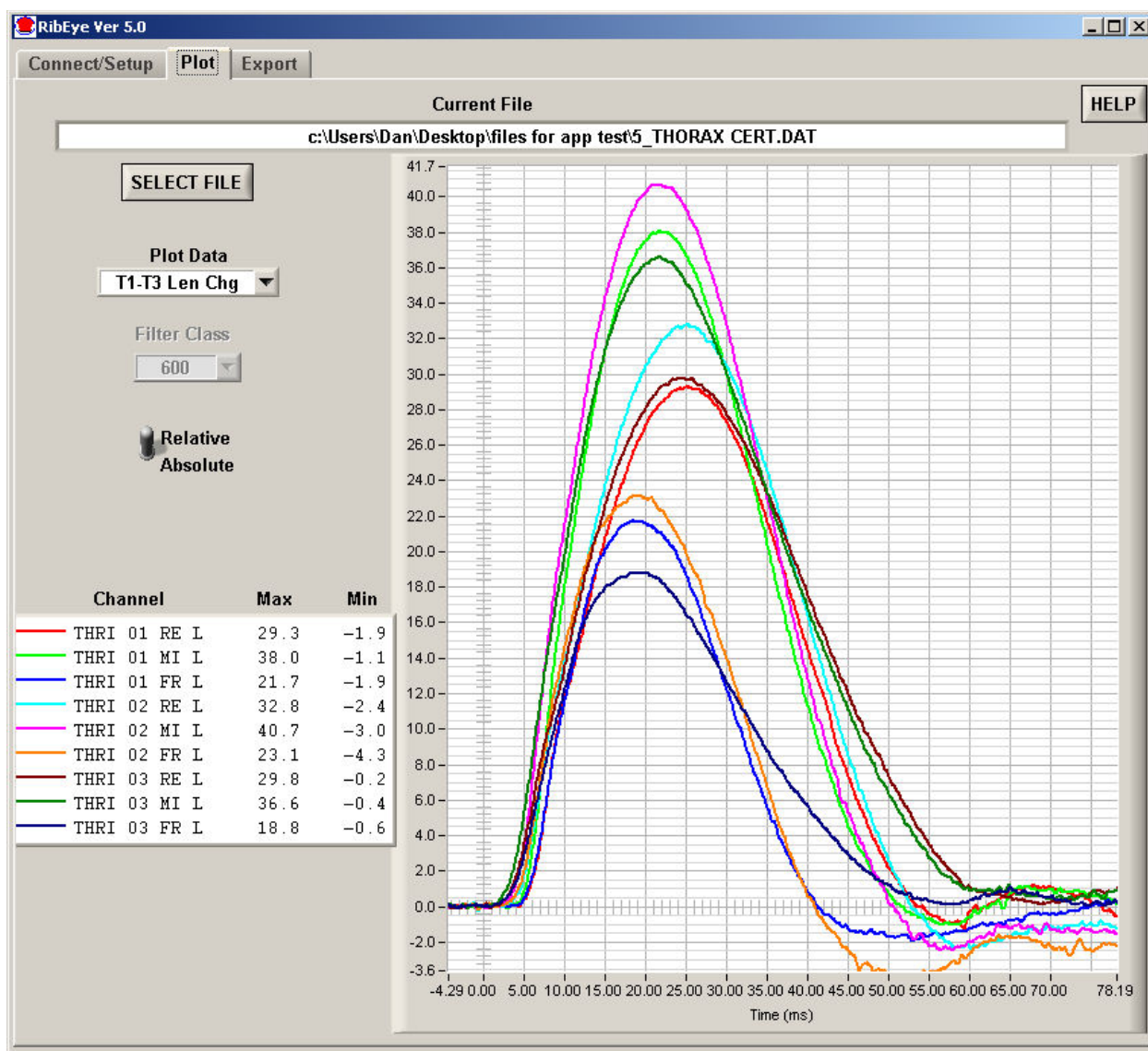
5.1 "Select File" Button

The "Select File" button allows you to read an existing RibEye data file to plot. After a file is read in, you can also re-export the file (see section 3.0 for more information on exporting).

When you click on the "Select File" button, a file browser opens (Figure 28) for you to choose the file to read. Set the "Files of Type" drop-down menu to:

*.DAT for Diadem files

*.CSV for Comma-Separated-Values files

*.MME for ISO files

*.RDF for raw data files downloaded from first-generation WorldSID RibEyes

*.RD2 for raw data files downloaded from second-generation WorldSID RibEyes

Select the Diadem, CSV, ISO, RDF, or RD2 file that you want to open.

If you open a WorldSID RDF or RD2 file, the program gives you the option to re-process the file with different ISO codes in case you made the wrong choice when you originally downloaded the file. It will use the appropriate calibration file (left- or right-side impact) for converting the data to engineering units.

Figure 28. "Select File" browser
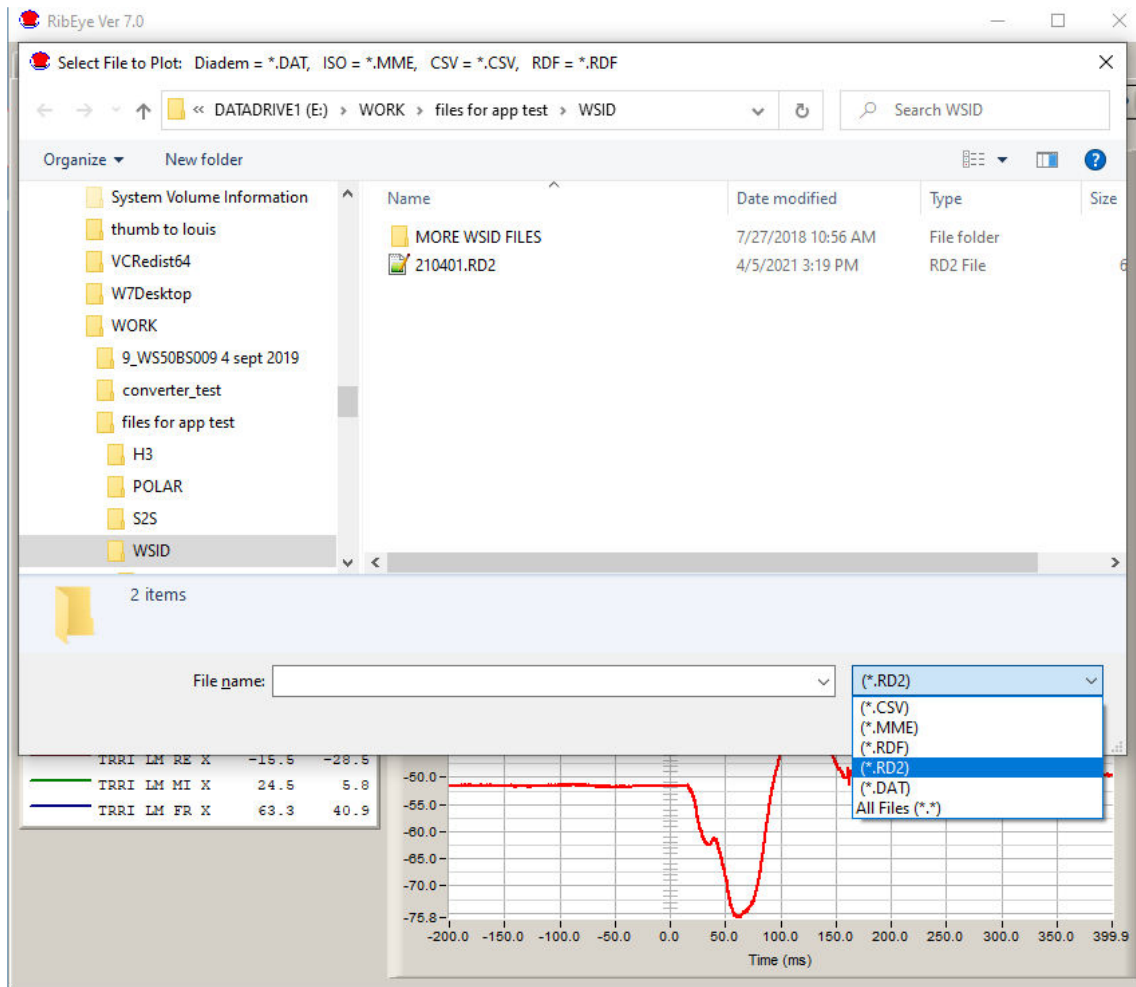
INI File Note: The [ReadFilesDefault] section allows you to select the default directory where the program will look for data files. You can always navigate to another location if the file you want to plot is not in the default location.

5.2 "Plot Data" Selection

The "Plot Data" selection allows you to select the data to plot. The options depend on the type of RibEye used to collect the data. You can view the X, Y, and Z displacement data. You can also view the ambient light readings. The ambient light data is useful to review if you see drop-outs in the data (refer to section 2.9.6 above for more information on error codes).

Additional plots include IR-Tracc calculations, length calculations, and XY and YZ cross-plots. Note that the XY and YZ cross-plots include the RibEye range when plotted in absolute mode. In relative mode, the plot is auto-scaled to the data, and the range is not shown. Figure 29 shows the plot options for a WorldSID dummy.

Figure 29. Plot options for a WorldSID
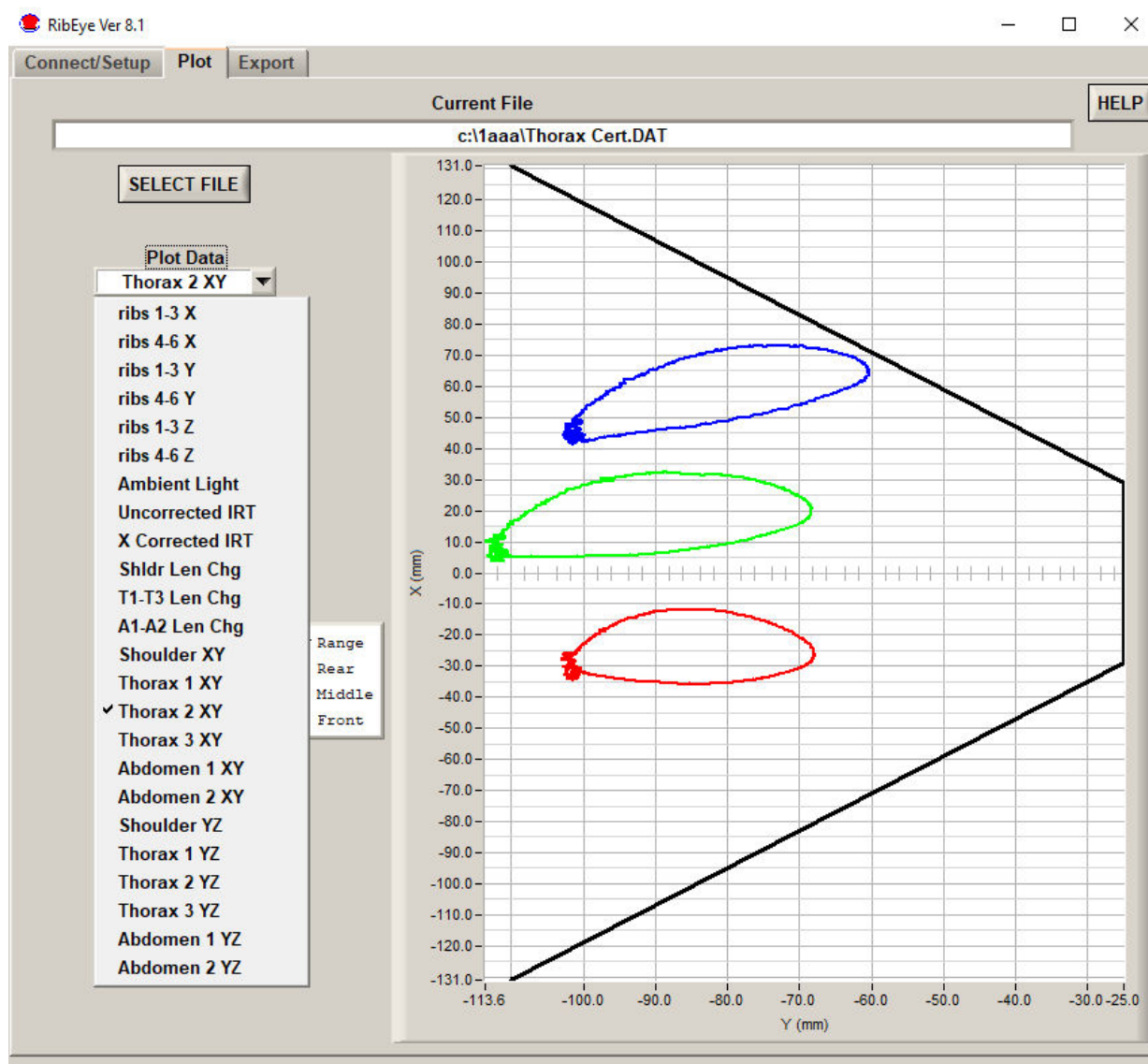
5.3   "Filter Class" Selection

The NHTSA standard phaseless Butterworth filter is used for filtering. You can view the data with the following filter classes:

No filter

CFC 1000

CFC 600

CFC 180

CFC 60

If pre-filtered data from a file is read in, the "Filter Selection" box is set to the filter used when the data was stored, and the data cannot be re-filtered. For a Length Calculation, the data is filtered to class 600 and cannot be changed.

5.4   "Relative/Absolute" Switch

The "Relative/Absolute" switch set to "Relative" removes the zero offsets from the data by subtracting an average of the first 100 samples from each channel from the rest of the channel data. If less than 100 samples of data (10 ms at 10 kHz) was downloaded prior to time-zero, the "Relative/Absolute" switch will be forced to the "Absolute" position, and the data cannot be zeroed.

If data is read from a file that was stored as "Relative" data, the "Relative/Absolute" switch will be forced to "Relative" and cannot be changed to "Absolute" for ISO and CSV files. Diadem files can always be viewed as "Absolute" or "Relative".

5.5   Zooming and Modifying a Plot Style

To analyze and modify a plot, perform the following steps:

- Zoom in on the plot by holding the "Ctrl" key and left mouse button and draw a box around the area of interest.

- Pan the plot by holding the "Ctrl" and "Shift" keys and left mouse button and moving the mouse.

- Undo zoom and pan operations by pressing "Ctrl" and the space bar. You can undo as many as the last 25 operations.

- Zoom out by holding the "Ctrl" key and clicking the right mouse button.

- Right-click on a trace name in the "Legend" box to change colors, line thickness, or plot style or to hide the trace (Figure 30).

**Figure 30. Changing plot styles by
right-clicking on a trace in the "Legend" box**
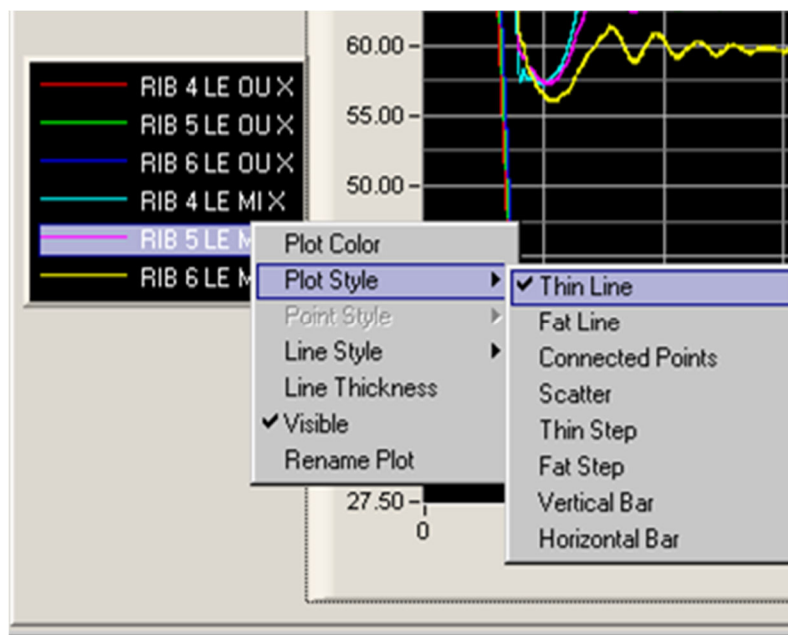
6.0   "Live Display" Tab

The "Live Display" tab shows the current positions of the LEDs, which are updated approximately 1 to 3 times per second depending on the RibEye model. You can use this display to verify that everything is working correctly. You can zoom the plots around the LEDs so you can see the effect of someone pushing on the ribs.

For 3-axis RibEyes, the "Coordinate System" switch shows the LEDs in either the XY or ZY planes. Figure 31 shows the "Live Display" tab for the WorldSID RibEye on a test fixture with the LEDs at X = –110, X = 0, and X = +110 mm. Figure 32 shows the same RibEye with the LED positions in the ZY plane.

Figure 31. "Live Display" tab for WorldSID RibEye, XY plane
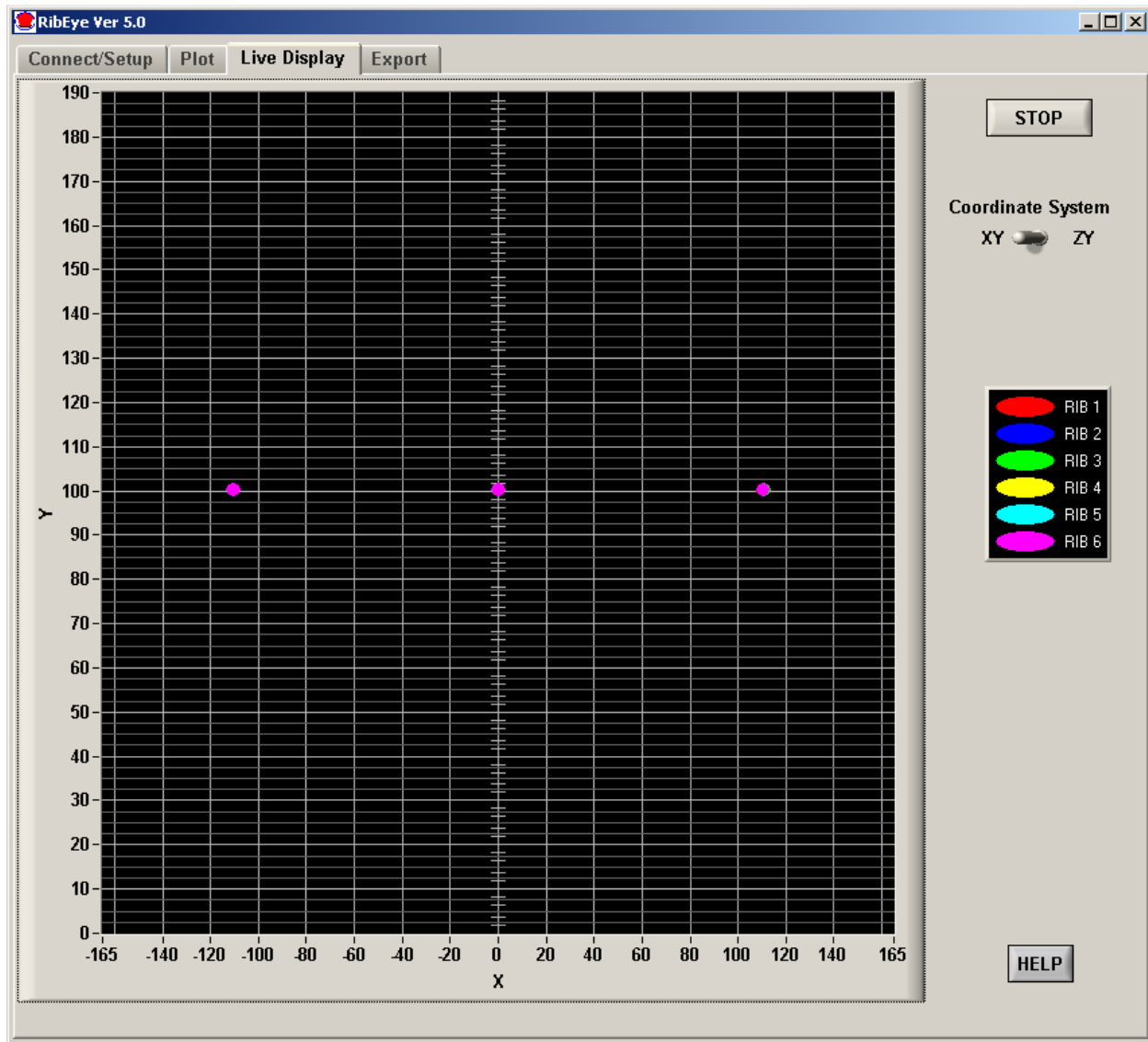
Figure 32. "Live Display" tab for WorldSID RibEye, ZY plane
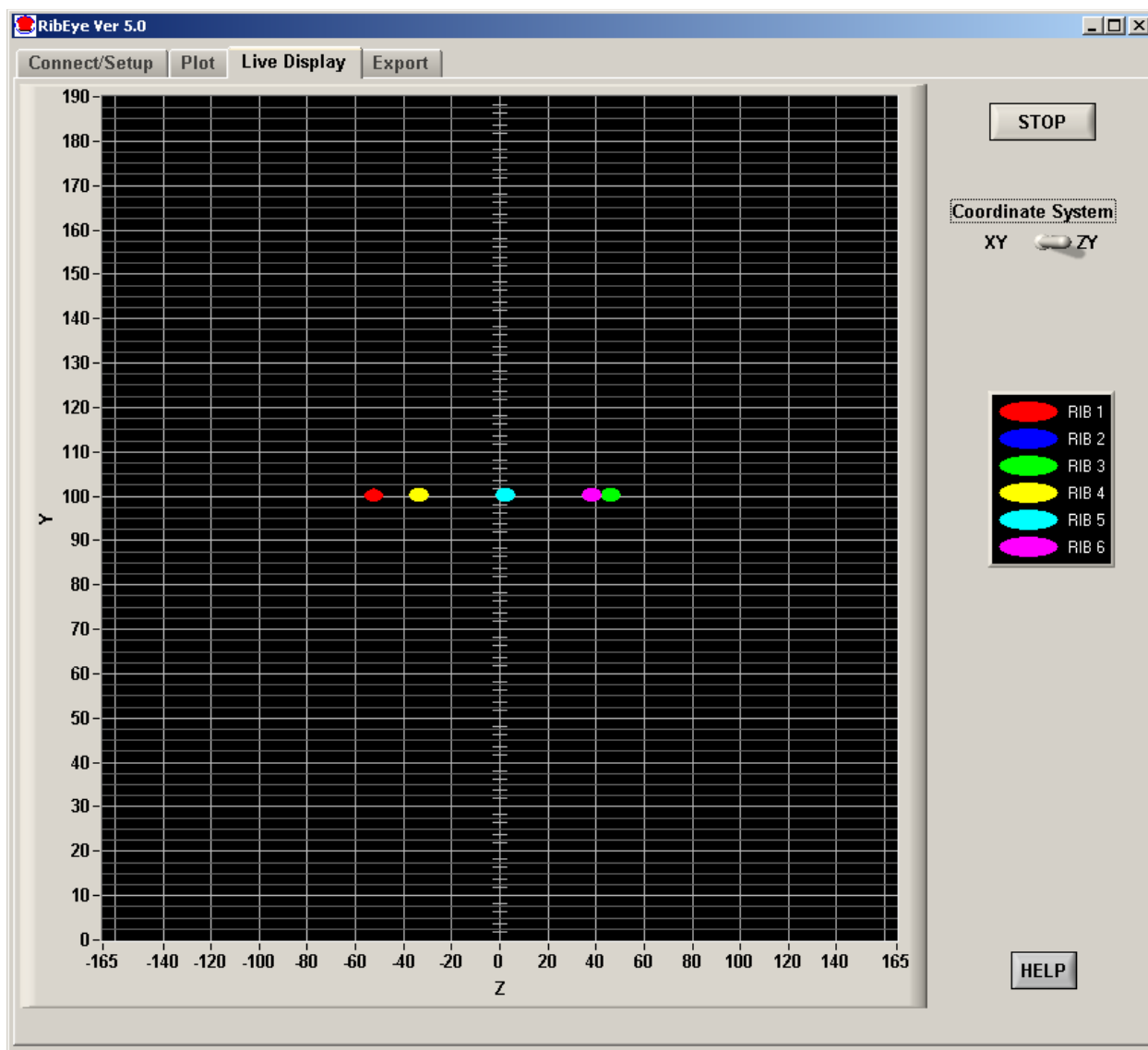
7.0   "Trigger Test" Tab

The "Trigger Test" tab allows you to run a trigger test without arming the RibEye. The "Trigger Test" tab will only appear for RibEyes that have firmware that supports trigger testing. When you open the "Trigger Test" tab, this screen will appear (Figure 33).

Figure 33. First "Trigger Test" screen
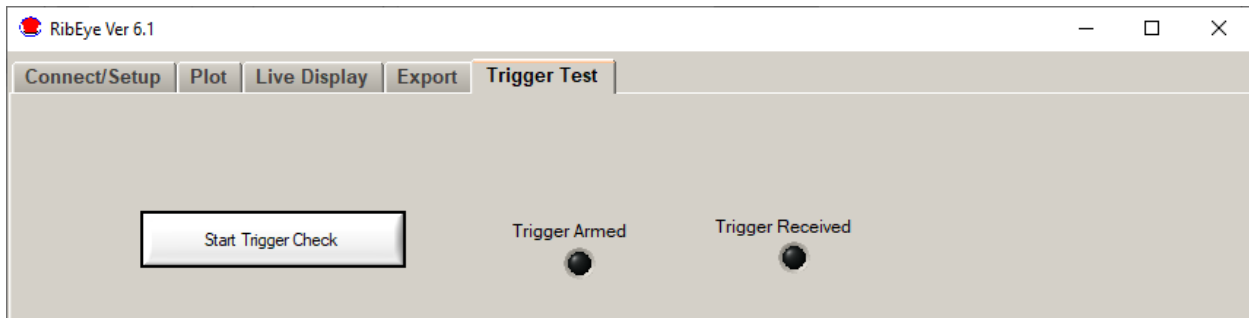
If you click on the "Start Trigger Check" button, the RibEye will arm the trigger circuit and the "Trigger Armed light" will light up as shown in Figure 34.

Figure 34. "Trigger Armed" light
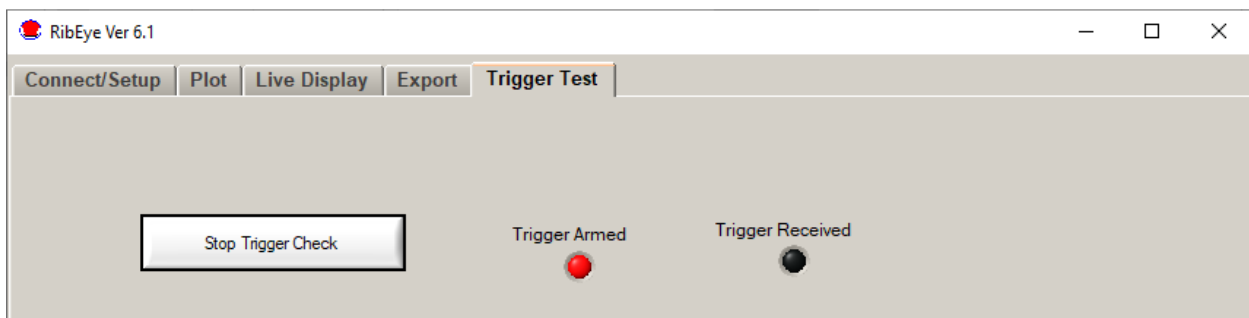
If a Trigger is received after arming, the "Trigger Received" light will light up as shown in Figure 35.

Figure 35. "Trigger Received" light
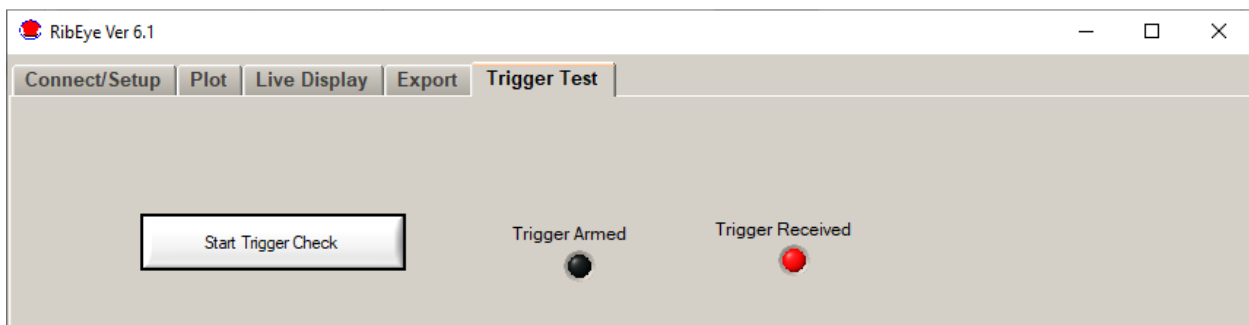
Remember that the trigger setting on the main screen controls whether the RibEye is looking for a rising-edge or falling-edge trigger. The trigger setting operation is described in Section 2.5.

Appendix A. Using the INI File to Configure Software

This version of RibEye software uses an initialization file, RibEye_8_0.ini, which is stored in the RibEye installation directory, typically C:\Program Files(x86)\RibEye_8_1. The initialization (INI) file lets you configure things like ISO codes for channel names and default values for most controls.

You can edit the INI file with any text editor such as Notepad, following the format presented below. If the INI file is accidently corrupted while editing it, a spare copy is installed in the installation directory. You can make a copy of the spare INI file, and change the copy's name to RibEye_8_0.ini to start with a fresh version.

When using the INI file, if you add comments or reminders of your own, you must preface each comment line with a semicolon (;) as the first character in the line.

The INI file has several sections. The section names are in brackets, and the variables that can be set follow the section names.

Battery Fuel Gauge for Second-Generation WorldSID

Set Fuel_Gauge_Installed = 1 for RibEye units with the battery/fuel gauge.

```
[Battery_Fuel_Gauge]
Fuel_Gauge_Installed = 1
```

Set Fuel_Gauge_Installed = 0 if the battery/fuel gauge is not installed. This will prevent the software from reminding you that the battery cannot be found.

ISO Codes for Channel Name Headers

The next three sections in the INI file show the ISO code channel names for the WorldSID and Hybrid III RibEyes, as well as the channel name format for the calculated IR-Tracc channels. In the INI file you can change the settings for the Main Location, Fine Position 1, and Fine Position 2 (CCCC, DD, and EE). Please refer to section 2.7, ISO Code Settings, for more information on ISO channel naming.

You can set the Main Location, Fine Position 1, and Fine Position 2 however you like. The INI file supplied with the RibEye software uses the settings defined by the ISO MME group. However, you do not have to use the MME group's settings and can enter your own preferences for the Main Location, Fine Position 1, and Fine position 2.

WorldSID ISO Channel Names

The WorldSID ISO codes are used for both the 50th Male and 5th Female WorldSID 3-axis RibEyes with 18 LEDs. Put in only 10 characters for each LED, including the spaces between the Main Location, Fine Position 1, and Fine Position 2.

WorldSID RibEye, Left-Side Ribs

```
[WorldSIDleft]
:
Shoulder Rib Rear LED =   SHRI LE RE
Shoulder Rib Middle LED = SHRI LE MI
Shoulder Rib Front LED =  SHRI LE FR
;
Thorax 1 Rib Rear LED =   TRRI LU RE
Thorax 1 Rib Middle LED = TRRI LU MI
Thorax 1 Rib Front LED =  TRRI LU FR
;
Thorax 2 Rib Rear LED =   TRRI LM RE
Thorax 2 Rib Middle LED = TRRI LM MI
Thorax 2 Rib Front LED =  TRRI LM FR
;
Thorax 3 Rib Rear LED =   TRRI LL RE
Thorax 3 Rib Middle LED = TRRI LL MI
Thorax 3 Rib Front LED =  TRRI LL FR
;
Abdomen 1 Rib Rear LED =   ABRI LU RE
Abdomen 1 Rib Middle LED = ABRI LU MI
Abdomen 1 Rib Front LED =  ABRI LU FR
;
Abdomen 2 Rib Rear LED =   ABRI LL RE
Abdomen 2 Rib Middle LED = ABRI LL MI
Abdomen 2 Rib Front LED =  ABRI LL FR
;
```

WorldSID RibEye, Right-Side Ribs

```
[WorldSIDright]
;
Shoulder Rib Rear LED =   SHRI RI RE
Shoulder Rib Middle LED = SHRI RI MI
Shoulder Rib Front LED =  SHRI RI FR
;
Thorax 1 Rib Rear LED =   TRRI RU RE
Thorax 1 Rib Middle LED = TRRI RU MI
Thorax 1 Rib Front LED =  TRRI RU FR
;
Thorax 2 Rib Rear LED =   TRRI RM RE
Thorax 2 Rib Middle LED = TRRI RM MI
Thorax 2 Rib Front LED =  TRRI RM FR
;
Thorax 3 Rib Rear LED =   TRRI RL RE
Thorax 3 Rib Middle LED = TRRI RL MI
Thorax 3 Rib Front LED =  TRRI RL FR
;
Abdomen 1 Rib Rear LED =   ABRI RU RE
Abdomen 1 Rib Middle LED = ABRI RU MI
Abdomen 1 Rib Front LED =  ABRI RU FR
;
Abdomen 2 Rib Rear LED =   ABRI RL RE
Abdomen 2 Rib Middle LED = ABRI RL MI
Abdomen 2 Rib Front LED =  ABRI RL FR
```

Note: In previous versions of the RibEye software, the WorldSID channel names were the same for both left- and right-side impact. You can still use the previous channel names by pasting the following code into both the [WorldSIDleft] and [WorldSIDright] sections of the INI file:

Code for using previous channel names

```
Shoulder Rib Rear LED =   SHRI 01 RE
Shoulder Rib Middle LED = SHRI 01 MI
Shoulder Rib Front LED =  SHRI 01 FR
:
Thorax 1 Rib Rear LED =   TRRI 01 RE
Thorax 1 Rib Middle LED = TRRI 01 MI
Thorax 1 Rib Front LED =  TRRI 01 FR
;
Thorax 2 Rib Rear LED =   TRRI 02 RE
Thorax 2 Rib Middle LED = TRRI 02 MI
Thorax 2 Rib Front LED =  TRRI 02 FR
;
Thorax 3 Rib Rear LED =   TRRI 03 RE
Thorax 3 Rib Middle LED = TRRI 03 MI
Thorax 3 Rib Front LED =  TRRI 03 FR
;
Abdomen 1 Rib Rear LED =   ABRI 01 RE
Abdomen 1 Rib Middle LED = ABRI 01 MI
Abdomen 1 Rib Front LED =  ABRI 01 FR
;
Abdomen 2 Rib Rear LED =   ABRI 02 RE
Abdomen 2 Rib Middle LED = ABRI 02 MI
Abdomen 2 Rib Front LED =  ABRI 02 FR
```

Calculated IR-Tracc Channel Names

Please refer to section 4.1 of this manual for a description of the ways that the calculated IR-Tracc channels are named. You can use either the original channel names, with U for uncorrected data and C for X-corrected data), or the newer MME naming convention.

To use the MME naming convention for IR-Tracc channel names, in the [IRTracc_MME_Names] section, set –

> use_MME_IRT_Channel_Names = 1

To use the RibEye 5.3 software naming scheme with just the dimension changed to U for 1D or C for 2D IR-Traccs, set –

> use_MME_IRT_Channel_Names = 0

IR-Tracc MME Channel Names

```
[IRTracc_MME_Names]
;
use_MME_IRT_Channel_Names = 1
;
```

Hybrid III ISO Code Formats

The Hybrid III ISO codes are used for both the 5th female and 50th Male 2-axis RibEyes with 12 LEDs. Rib 1 is the top rib, Rib 6 is the bottom rib.

Hybrid III RibEye

```
[HybridIII]
;
Rib 1 Left =  RIBS 01 LE
Rib 1 Right = RIBS 01 RI
;
Rib 2 Left =  RIBS 02 LE
Rib 2 Right = RIBS 02 RI
;
Rib 3 Left =  RIBS 03 LE
Rib 3 Right = RIBS 03 RI
;
Rib 4 Left =  RIBS 04 LE
Rib 4 Right = RIBS 04 RI
;
Rib 5 Left =  RIBS 05 LE
Rib 5 Right = RIBS 05 RI
;
Rib 6 Left =  RIBS 06 LE
Rib 6 Right = RIBS 06 RI
;
```

CSV Data Formats

Note that there are two CSV data formats that can be set in the [ALTCSV] section of the INI file. Please refer to this manual's section 3.3.2.1, Alternative CSV Format, for more information.

The normal CSV format uses the ISO MME channel names. To use standard ISO code format, set –

> USE_ALT_CSV = 0

The alternative CSV format lets you create your own non-ISO channel names, without the redundant information such as object type and filter type that is in the normal CSV file channel headers.

To use the alternative CSV format, set –

> USE_ALT_CSV = 1

The alternative CSV format channel names use the following format:

> dummy position in car_rib name and LED location_axis

The code formats in the INI file provide –

- Conversion from the ISO Seating Positions (up to 10 characters)
- Alternative Rib Names and LED Positions for WorldSID and Hybrid III RibEyes (up to 30 characters)

Note that for ISO Seating Positions, the program reads up to the maximum characters (up to 10), starting from the first non-blank character after the equal sign (=) and ending with the Enter key (carriage return) at the end of each line. Spaces are allowed within the text. However, do not use commas – the program will replace commas with an underscore (_).

The program automatically adds the axis at the end as a single character, X, Y, or Z.

For example, using the settings below, for a dummy in the driver's seat, the Hybrid III left-side rib 1 X axis would be –

> DRVR_RIB1_LE_DS_X

Please refer to the following code formats (which are included in the INI file) for configuring CSV data.

Normal CSV Data Format

```
[ALTCSV]
;
USE_ALT_CSV = 0
;
```

Alternative CSV Data Format:
Conversion from ISO Seating Positions (10 characters maximum)

```
;
ISO POSN 0 = OTHR
ISO POSN 1 = DRVR
ISO POSN 2 = 1MID
ISO POSN 3 = PASS
ISO POSN 4 = RR/L
ISO POSN 5 = RR/C
ISO POSN 6 = RR/R
ISO POSN 7 = 3R/L
ISO POSN 8 = 3R/C
ISO POSN 9 = 3R/R
;
```

Alternative CSV Data Format:
Hybrid III Rib Names and LED Positions (30 characters maximum)

```
;
alt H3Rib 1 Left =   _RIB1_LE_DS_
alt H3Rib 1 Right = _RIB1_RI_DS_
;
alt H3Rib 2 Left =   _RIB2_LE_DS_
alt H3Rib 2 Right = _RIB2_RI_DS_
;
alt H3Rib 3 Left =   _RIB3_LE_DS_
alt H3Rib 3 Right = _RIB3_RI_DS_
;
alt H3Rib 4 Left =   _RIB4_LE_DS_
alt H3Rib 4 Right = _RIB4_RI_DS_
;
alt H3Rib 5 Left =   _RIB5_LE_DS_
alt H3Rib 5 Right = _RIB5_RI_DS_
;
alt H3Rib 6 Left =   _RIB6_LE_DS_
alt H3Rib 6 Right = _RIB6_RI_DS_
;
```

Alternative CSV Data Format:
WorldSID Rib Names and LED Positions

```
;
alt WS Shoulder Rib Rear LED =    _SHRI_RE_DS_
alt WS Shoulder Rib Middle LED = _SHRI_MI_DS_
alt WS Shoulder Rib Front LED =  _SHRI_FR_DS_
;
alt WS Thorax 1 Rib Rear LED =    _THRI_RE_DS_
alt WS Thorax 1 Rib Middle LED = _THRI_MI_DS_
alt WS Thorax 1 Rib Front LED =  _THRI_FR_DS_
;
alt WS Thorax 2 Rib Rear LED =    _THRI_RE_DS_
alt WS Thorax 2 Rib Middle LED = _THRI_MI_DS_
alt WS Thorax 2 Rib Front LED =  _THRI_FR_DS_
;
alt WS Thorax 3 Rib Rear LED =    _THRI_RE_DS_
alt WS Thorax 3 Rib Middle LED = _THRI_MI_DS_
alt WS Thorax 3 Rib Front LED =  _THRI_FR_DS_
;
alt WS Abdomen 1 Rib Rear LED =    _ABRI_RE_DS_
alt WS Abdomen 1 Rib Middle LED = _ABRI_MI_DS_
alt WS Abdomen 1 Rib Front LED =  _ABRI_FR_DS_
;
alt WS Abdomen 2 Rib Rear LED =    _ABRI_RE_DS_
alt WS Abdomen 2 Rib Middle LED = _ABRI_MI_DS_
alt WS Abdomen 2 Rib Front LED =  _ABRI_MI_DS_
;
```

Find RibEyes Options

For more information, please refer to section 2.2 in this manual.

Older generation RibEyes require a 15-second wait when finding RibEyes on the network. The newer ones do not require a wait. If you are using only newer generation RibEyes, you can eliminate the 15-second wait time by setting the "widgetType" in the webwidget section.

For all WorldSID RibEyes and Hybrid III RibEyes with a single cable from the controller to the Trunk Box, set –

    widgetType = 1

For older generation RibEyes with two cables from the Controller to the Trunk Box, set –

    widgetType = 0

Find RibEyes

```
[webwidget]
;
widgetType = 1
;
```

Connect/Setup Tab Controls

For more information, please refer to section 2.9 in this manual.

This code allows you to set defaults for controls on the Connect/Setup tab.

- Set the default for Data Buffer Operation to

    0 for a circular buffer

    1 for a linear buffer

- Set the default for the data collection period after Trigger for both circular and linear buffers. The number is in milliseconds (ms) of data collection following Trigger.

- Set the default Download Time (in ms) – that is, the Start and Stop Times.

Connect Tab Settings

```
[connect_tab_controls]
;
Buffer Type = 0
;
Data After Trigger = 2000
;
Download Start Time = −10
;
Download Stop Time =  400
;
```

Export Formats and Data Storage

For more information, please refer to section 3.0 in this manual.

This section allows you to set your default export formats and the location where you want to store your data files.

Set the default export format to –
    0 for CSV
    1 for Diadem
    2 for ISO MME

The default for the Absolute/Relative data drop-down box is –
    0 for Absolute Data
    1 for data relative to pre-Time 0 data

The default storage location – that is, the file's path name – is the directory where you want to store your exported data. The path name can be up to 255 characters maximum. The default storage location appears on the program's export screen. You can set the default location to a local or network drive. The storage location can be changed during exporting to save the file in another location.

Note that you must put in two (2) backslashes (\\) for every single backslash in the path name. For example, for the C:\DATA directory, put in C:\\DATA.

Export Format and Data Storage Location

```
[ExportDefault]
;
Default Export Format = 1
;
Default Relative_Absolute = 0
;
Default Storage Location = C:\\DATA
;
```

Location to Read Stored Data Files

For more information, please refer to Section 5.0 in this manual.

This section allows you to set the default location for the program to read stored data files when you are on the "Plot" tab. The location can be up to 255 characters maximum, and can be a local file location or a network store. The file selection box will point to the default location, but can be changed to another directory during operation.

Note that you must put in two (2) backslashes (\\) for every single backslash in the path name. For example, for the C:\DATA directory, put in C:\\DATA

File Read Location

```
[ReadFilesDefault]
;
Default File Read Location = C:\\DATA
;
```

Legacy Software Filter Class Code

For more information, please refer to Section 3.2 in this manual.

This section allows you to set the filter code for unfiltered data to be a "P" instead of a "0" to support legacy data processing software.

Set the LegacySWUnfiltCode = 0 to use the normal "0" code for unfiltered data.
Set the LegacySWUnfiltCode = 1 to use the "P" code for unfiltered data.

```
[LegacySoftwareFilterClassCode]
;
LegacySWUnfiltCode = 0;
;
```

Appendix B. Instructions for Hybrid III 50th Male Adjustable-LED 2-Axis RibEye

Special firmware is available for the 50th Male 2-axis RibEye that allows the user to put any LED on any rib or on the sternum. The user may also place multiple LEDS on a single rib. Special LED mounts are available that attach the LEDs to the rib stiffener bars at the sternum in addition to the normal LEDs that attach to the ribs. When running the special firmware, the "RibEye Type" box displays "50th ADJ".

The 2-axis 50th Male RibEyes use different calibration curves to process the data for each rib. Therefore, the RibEye must know which rib each LED is located on. When the RibEye software connects to a "50th ADJ" RibEye, the LED position and ISO codes table have drop-down boxes on the RIB and POSITION columns, as shown in Figure B1.

Figure B1. Drop-down menus for the RIB and POSITION columns

LED	RIB		POSITION		ISO CODES	X (mm)	Y (mm)
1	1	▼	LEFT RIB	▼	1 1 RIBS 01 LE H3 DS X/Y	105.7	−44.2
2	2	▼	LEFT RIB	▼	1 1 RIBS 02 LE H3 DS X/Y	105.8	−44.1
3	1		LEFT RIB	▼	1 1 RIBS 03 LE H3 DS X/Y	105.9	−44.0
4	✓2		LEFT RIB	▼	1 1 RIBS 04 LE H3 DS X/Y	105.8	−43.9
5	3		LEFT RIB	▼	1 1 RIBS 05 LE H3 DS X/Y	105.8	−43.9
6	4		LEFT RIB	▼	1 1 RIBS 06 LE H3 DS X/Y	105.8	−43.9
	5						
	6						

LED	RIB		POSITION		ISO CODES	X (mm)	Y (mm)
1	1	▼	LEFT RIB	▼	1 1 RIBS 01 LE H3 DS X/Y	105.7	−44.2
2	2	▼	LEFT RIB	▼	1 1 RIBS 02 LE H3 DS X/Y	105.8	−44.1
3	3	▼	✓LEFT RIB		1 RIBS 03 LE H3 DS X/Y	105.9	−44.0
4	4	▼	LEFT STERNUM		1 RIBS 04 LE H3 DS X/Y	105.8	−43.9
5	5	▼	RIGHT RIB		1 RIBS 05 LE H3 DS X/Y	105.8	−43.9
6	6	▼	RIGHT STERNUM		1 RIBS 06 LE H3 DS X/Y	105.8	−43.9

Any of the 6 ribs can be selected for any LED. Rib 1 is the top rib, and Rib 6 is the bottom rib. The positions can be set to Left or Right, and Rib or Sternum as shown in Figures B1 and B2. Note that the ISO codes change with the RIB and POSITION settings.

Figure B2. RIB and POSITION changed

LED	RIB		POSITION		ISO CODES	X (mm)	Y (mm)
3	3	▼	LEFT RIB	▼	1 1 RIBS 03 LE H3 DS X/Y	105.9	−44.0
4	3	▼	LEFT STERNUM	▼	1 1 STRN 03 LE H3 DS X/Y	105.8	−43.9
5	6	▼	LEFT RIB	▼	1 1 RIBS 06 LE H3 DS X/Y	105.8	−43.9
6	6	▼	LEFT STERNUM	▼	1 1 STRN 06 LE H3 DS X/Y	105.8	−43.9
7	1	▼	RIGHT RIB	▼	1 1 RIBS 01 RI H3 DS X/Y	105.8	56.1
8	1	▼	RIGHT STERNUM	▼	1 1 STRN 01 RI H3 DS X/Y	105.9	56.0

Save LED Setup to RibEye	Cancel Led Setup Changes

When any of the RIB or POSITION entries are changed, two buttons appear: "Save LED Setup to RibEye" and "Cancel LED Setup Changes". When you have finished configuring the LEDs, you must either save the settings or cancel them. When you click on the "Save LED Setup to RibEye" button, the

LED setup data is written to the RibEye flash memory. The next time you connect to the RibEye, the software will read the LED settings from the RibEye flash memory and set up the LED table with the correct data. If you click on the "Cancel LED Setup Changes" button, the changes are cancelled, and the table resets to its last state.

WARNING: *Make sure that the LEDs are mounted on the rib you have specified in the table to prevent the RibEye from using the wrong calibration curves.*

Note that the "Download Data" button is grayed out and inoperable while you are editing the LED table and while the "Save LED Setup to RibEye" and "Cancel LED Setup Changes" buttons are visible.

If you put more than two LEDs on either side of the ribcage, you will have duplicate ISO channel codes for some channels. In this case, you can look at the absolute data from the RibEye to determine the initial location of each of the LEDs.

If you mount LEDs on the sternum stiffeners half-way between two ribs, you can use either rib number. For example, if the LED is mounted to the sternum stiffener half-way between ribs 3 and 4, you can set the RibEye software for either rib 3 or rib 4.

Appendix C. WorldSID Channel Names List Using INI File Defaults

Note - For all of the data channels:
Vehicle = 1
Position in Vehicle = 1
Data filtered Class 180
All data is displacement if not noted
Standard ISO codes based on default INI file settings – these can be changed by the user
Alternate CSV names based on default INI file settings – these can be changed by the user

In the table below, the column is the spreadsheet column if using a CSV data format.
The standard ISO codes shown are for left-side impact.

column	Standard ISO Codes	Alternative CSV Channel Names	Description
A	Time(ms)	Time(ms)	
B	11SHRILEREWSDSXC	DRVR_SHRI_RE_DS_X	Shoulder Rear X
C	11SHRILEREWSDSYC	DRVR_SHRI_RE_DS_Y	Shoulder Rear Y
D	11SHRILEREWSDSZC	DRVR_SHRI_RE_DS_Z	Shoulder Rear Z
E	11SHRILEMIWSDSXC	DRVR_SHRI_MI_DS_X	Shoulder Middle X
F	11SHRILEMIWSDSYC	DRVR_SHRI_MI_DS_Y	Shoulder Middle Y
G	11SHRILEMIWSDSZC	DRVR_SHRI_MI_DS_Z	Shoulder Middle Z
H	11SHRILEFRWSDSXC	DRVR_SHRI_FR_DS_X	Shoulder Front X
I	11SHRILEFRWSDSYC	DRVR_SHRI_FR_DS_Y	Shoulder Front Y
J	11SHRILEFRWSDSZC	DRVR_SHRI_FR_DS_Z	Shoulder Front Z
K	11TRRILUREWSDSXC	DRVR_THR1_RE_DS_X	Thorax Rib 1 Rear X
L	11TRRILUREWSDSYC	DRVR_THR1_RE_DS_Y	Thorax Rib 1 Rear Y
M	11TRRILUREWSDSZC	DRVR_THR1_RE_DS_Z	Thorax Rib 1 Rear Z
N	11TRRILUMIWSDSXC	DRVR_THR1_MI_DS_X	Thorax Rib 1 Middle X
O	11TRRILUMIWSDSYC	DRVR_THR1_MI_DS_Y	Thorax Rib 1 Middle Y
P	11TRRILUMIWSDSZC	DRVR_THR1_MI_DS_Z	Thorax Rib 1 Middle Z
Q	11TRRILUFRWSDSXC	DRVR_THR1_FR_DS_X	Thorax Rib 1 Front X
R	11TRRILUFRWSDSYC	DRVR_THR1_FR_DS_Y	Thorax Rib 1 Front Y
S	11TRRILUFRWSDSZC	DRVR_THR1_FR_DS_Z	Thorax Rib 1 Front Z
T	11TRRILMREWSDSXC	DRVR_THR2_RE_DS_X	Thorax Rib 2 Rear X
U	11TRRILMREWSDSYC	DRVR_THR2_RE_DS_Y	Thorax Rib 2 Rear Y
V	11TRRILMREWSDSZC	DRVR_THR2_RE_DS_Z	Thorax Rib 2 Rear Z
W	11TRRILMMIWSDSXC	DRVR_THR2_MI_DS_X	Thorax Rib 2 Middle X
X	11TRRILMMIWSDSYC	DRVR_THR2_MI_DS_Y	Thorax Rib 2 Middle Y
Y	11TRRILMMIWSDSZC	DRVR_THR2_MI_DS_Z	Thorax Rib 2 Middle Z
Z	11TRRILMFRWSDSXC	DRVR_THR2_FR_DS_X	Thorax Rib 2 Front X
AA	11TRRILMFRWSDSYC	DRVR_THR2_FR_DS_Y	Thorax Rib 2 Front Y
AB	11TRRILMFRWSDSZC	DRVR_THR2_FR_DS_Z	Thorax Rib 2 Front Z
AC	11TRRILLREWSDSXC	DRVR_THR3_RE_DS_X	Thorax Rib 3 Rear X
AD	11TRRILLREWSDSYC	DRVR_THR3_RE_DS_Y	Thorax Rib 3 Rear Y

AE	11TRRILLREWSDSZC	DRVR_THR3_RE_DS_Z	Thorax Rib 3 Rear Z
AF	11TRRILLMIWSDSXC	DRVR_THR3_MI_DS_X	Thorax Rib 3 Middle X
AG	11TRRILLMIWSDSYC	DRVR_THR3_MI_DS_Y	Thorax Rib 3 Middle Y
AH	11TRRILLMIWSDSZC	DRVR_THR3_MI_DS_Z	Thorax Rib 3 Middle Z
AI	11TRRILLFRWSDSXC	DRVR_THR3_FR_DS_X	Thorax Rib 3 Front X
AJ	11TRRILLFRWSDSYC	DRVR_THR3_FR_DS_Y	Thorax Rib 3 Front Y
AK	11TRRILLFRWSDSZC	DRVR_THR3_FR_DS_Z	Thorax Rib 3 Front Z
AL	11ABRILUREWSDSXC	DRVR_ABR1_RE_DS_X	Abdomen Rib 1 Rear X
AM	11ABRILUREWSDSYC	DRVR_ABR1_RE_DS_Y	Abdomen Rib 1 Rear Y
AN	11ABRILUREWSDSZC	DRVR_ABR1_RE_DS_Z	Abdomen Rib 1 Rear Z
AO	11ABRILUMIWSDSXC	DRVR_ABR1_MI_DS_X	Abdomen Rib 1 Middle X
AP	11ABRILUMIWSDSYC	DRVR_ABR1_MI_DS_Y	Abdomen Rib 1 Middle Y
AQ	11ABRILUMIWSDSZC	DRVR_ABR1_MI_DS_Z	Abdomen Rib 1 Middle Z
AR	11ABRILUFRWSDSXC	DRVR_ABR1_FR_DS_X	Abdomen Rib 1 Front X
AS	11ABRILUFRWSDSYC	DRVR_ABR1_FR_DS_Y	Abdomen Rib 1 Front Y
AT	11ABRILUFRWSDSZC	DRVR_ABR1_FR_DS_Z	Abdomen Rib 1 Front Z
AU	11ABRILLREWSDSXC	DRVR_ABR2_RE_DS_X	Abdomen Rib 2 Rear X
AV	11ABRILLREWSDSYC	DRVR_ABR2_RE_DS_Y	Abdomen Rib 2 Rear Y
AW	11ABRILLREWSDSZC	DRVR_ABR2_RE_DS_Z	Abdomen Rib 2 Rear Z
AX	11ABRILLMIWSDSXC	DRVR_ABR2_MI_DS_X	Abdomen Rib 2 Middle X
AY	11ABRILLMIWSDSYC	DRVR_ABR2_MI_DS_Y	Abdomen Rib 2 Middle Y
AZ	11ABRILLMIWSDSZC	DRVR_ABR2_MI_DS_Z	Abdomen Rib 2 Middle Z
BA	11ABRILLFRWSDSXC	DRVR_ABR2_MI_DS_X	Abdomen Rib 2 Front X
BB	11ABRILLFRWSDSYC	DRVR_ABR2_MI_DS_Y	Abdomen Rib 2 Front Y
BC	11ABRILLFRWSDSZC	DRVR_ABR2_MI_DS_Z	Abdomen Rib 2 Front Z
BD	11SENSTORE99PO00	DRVR_Amb_Top_R	Ambient Light on Shoulder Sensor
BE	11SENSBORE99PO00	DRVR_Amb_Bot_R	Ambient Light on T1 Sensor
BF	11SENSMIRE99PO00	DRVR_Amb_Mid_R	Ambient Light on T2 Sensor
BG	11SENSTOBL99PO00	DRVR_Amb_Top_B	Ambient Light on T3 Sensor
BH	11SENSBOBL99PO00	DRVR_Amb_Bot_B	Ambient Light on A1 Sensor
BI	11SENSMIBL99PO00	DRVR_Amb_Mid_B	Ambient Light on A2 Sensor
BJ	11SHRILE00WSDS0C	DRVR_SHRI_MI_DU_Y	Calc. Shoulder 1-D IR Tracc
BK	11TRRILE01WSDS0C	DRVR_THR1_MI_DU_Y	Calc. T1 1-D IR Tracc
BL	11TRRILE02WSDS0C	DRVR_THR2_MI_DU_Y	Calc. T2 1-D IR Tracc
BM	11TRRILE03WSDS0C	DRVR_THR3_MI_DU_Y	Calc.T3 1-D IR Tracc
BN	11ABRILE01WSDS0C	DRVR_ABR1_MI_DU_Y	Calc. A1 1-D IR Tracc
BO	11ABRILE02WSDS0C	DRVR_ABR2_MI_DU_Y	Calc. A2 1-D IR Tracc
BP	11SHRILE00WSDSYC	DRVR_SHRI_MI_DC_Y	Calc. Shoulder 2-D IR Tracc Y
BQ	11TRRILE01WSDSYC	DRVR_THR1_MI_DC_Y	Calc. T1 2-D IR Tracc Y
BR	11TRRILE02WSDSYC	DRVR_THR2_MI_DC_Y	Calc. T2 2-D IR Tracc Y
BS	11TRRILE03WSDSYC	DRVR_THR3_MI_DC_Y	Calc.T3 2-D IR Tracc Y
BT	11ABRILE01WSDSYC	DRVR_ABR1_MI_DC_Y	Calc. A1 2-D IR Tracc Y
BU	11ABRILE02WSDSYC	DRVR_ABR2_MI_DC_Y	Calc. A2 2-D IR Tracc Y

BV	11SHRILEREWSDSLB	DRVR_SHRI_RE_DL_X	Calc. Shoulder Rear Length Change
BW	11SHRILEMIWSDSLB	DRVR_SHRI_MI_DL_X	Calc. Shoulder Middle Length Change
BX	11SHRILEFRWSDSLB	DRVR_SHRI_FR_DL_X	Calc. Shoulder Front Length Change
BY	11TRRILUREWSDSLB	DRVR_THR1_RE_DL_X	Calc. T1 Rear Length Change
BZ	11TRRILUMIWSDSLB	DRVR_THR1_MI_DL_X	Calc. T1 Middle Length Change
CA	11TRRILUFRWSDSLB	DRVR_THR1_FR_DL_X	Calc. T1 Front Length Change
CB	11TRRILMREWSDSLB	DRVR_THR2_RE_DL_X	Calc. T2 Rear Length Change
CC	11TRRILMMIWSDSLB	DRVR_THR2_MI_DL_X	Calc. T2 Middle Length Change
CD	11TRRILMFRWSDSLB	DRVR_THR2_FR_DL_X	Calc. T2 Front Length Change
CE	11TRRILLREWSDSLB	DRVR_THR3_RE_DL_X	Calc. T3 Rear Length Change
CF	11TRRILLMIWSDSLB	DRVR_THR3_MI_DL_X	Calc. T3 Middle Length Change
CG	11TRRILLFRWSDSLB	DRVR_THR3_FR_DL_X	Calc. T3 Front Length Change
CH	11ABRILUREWSDSLB	DRVR_ABR1_RE_DL_X	Calc. A1 Rear Length Change
CI	11ABRILUMIWSDSLB	DRVR_ABR1_MI_DL_X	Calc. A1 Middle Length Change
CJ	11ABRILUFRWSDSLB	DRVR_ABR1_FR_DL_X	Calc. A1 Front Length Change
CK	11ABRILLREWSDSLB	DRVR_ABR2_RE_DL_X	Calc. A2 Rear Length Change
CL	11ABRILLMIWSDSLB	DRVR_ABR2_MI_DL_X	Calc. A2 Middle Length Change
CM	11ABRILLFRWSDSLB	DRVR_ABR2_MI_DL_X	Calc. A2 Front Length Change