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BOXBORO systems

USER'S MANUAL

RibEye™ Multi-Point Deflection Measurement System

2-Axis Version for the Polar ATD

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USER’S MANUAL
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2-Axis Version for the Polar ATD

1.0 Polar RibEye Description

The Polar RibEye mounts to the lower spine of the Polar dummy. The RibEye can be positioned to face either the left or right side of the dummy. Six light-emitting diodes (LEDs) are mounted on the Polar ribs – two each on Ribs 4, 5, and 6. For each rib, one LED is mounted on the outer part of the rib on the side of the dummy, and one LED is mounted at the sternum end of the rib close to the middle of the dummy chest. The RibEye records and reports the X and Y positions of each LED at a sample rate of 10 kHz. The RibEye records up to 30 seconds of data in dynamic random access memory (D-RAM). After the test, the RibEye copies 2 seconds of data in flash memory. **Figure 1** shows a front view of the Polar RibEye. The connector for the LEDs is in the center of the front cover.

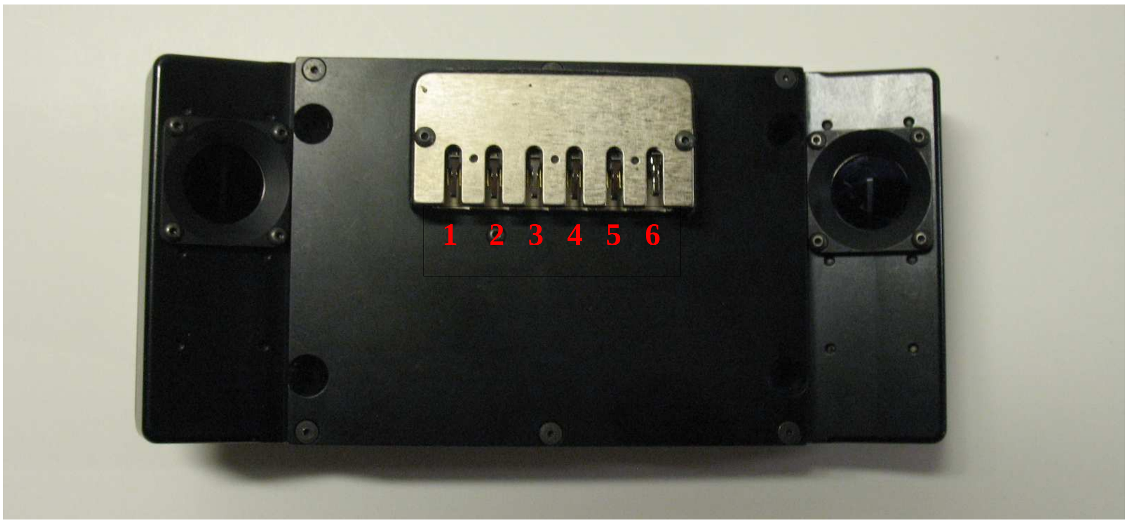

Figure 1. Polar RibEye (front view)

The RibEye receives Ethernet connectivity, power, and a trigger signal from the DTS-G5DB. Please refer to the DTS documentation for configuring the DTS system. All of the signals from the G5DB are connected to a 25-pin Micro-D connector on the back of the RibEye as shown in **Figure 2**. In the current configuration, the DTS software does not control the RibEye; however, DTS control could be an option in the future. Currently, the RibEye is operated by the RibEye control application, which runs on a PC. The RibEye control software configures the RibEye, shows its current LED positions, and downloads data from the RibEye. Data from the RibEye is stored in Comma-Separated-Variable files. The control software also provides a quick plot of the data.

Figure 2. Polar RibEye (back view)

1.1 RibEye Measurement Range

The RibEye measurement range is shown in **Figure 3**, superimposed on a view looking down the Polar ATD chest. Ribs 4, 5, and 6 are shown with the LEDs attached. In this view, the RibEye is facing the ATD's left side. The RibEye X-Y plane is rotated 41 degrees with respect to the ATD X-Y plane. When the RibEye saves and displays the LED positions, its control software automatically converts the RibEye data to the ATD's coordinate system.

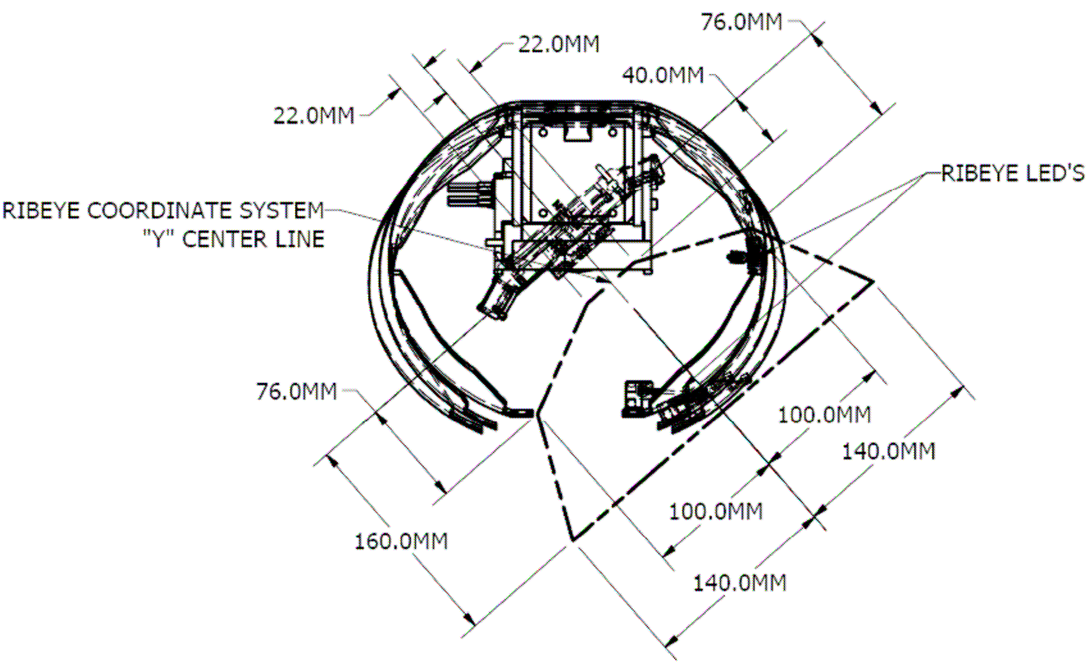

Figure 3. RibEye measurement range in Polar ATD

2.0 RibEye Mounting

Before mounting the RibEye, the cable from the G5DB should be attached to the 25-pin Micro-D connector on the back of the RibEye, and the jack screws on the connector should be fully tightened. The RibEye is mounted to the spine using two 6-32 x 1.25 inch countersunk hex screws as shown in **Figure 4**.

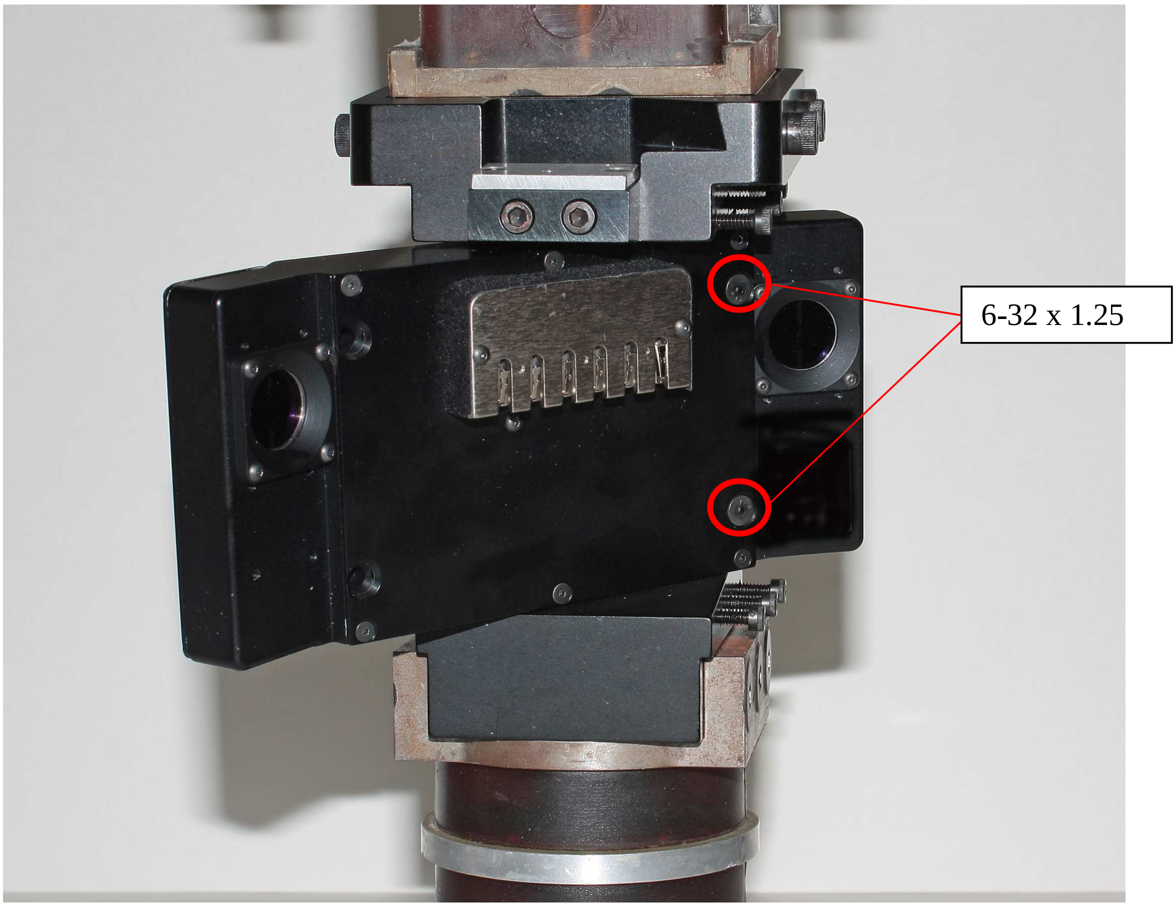

Figure 4. Mounting RibEye to Spine

Use two 6-32 x 5/16 screws to attach the RibEye to the angle bracket on the back side as shown in **Figure 5**.

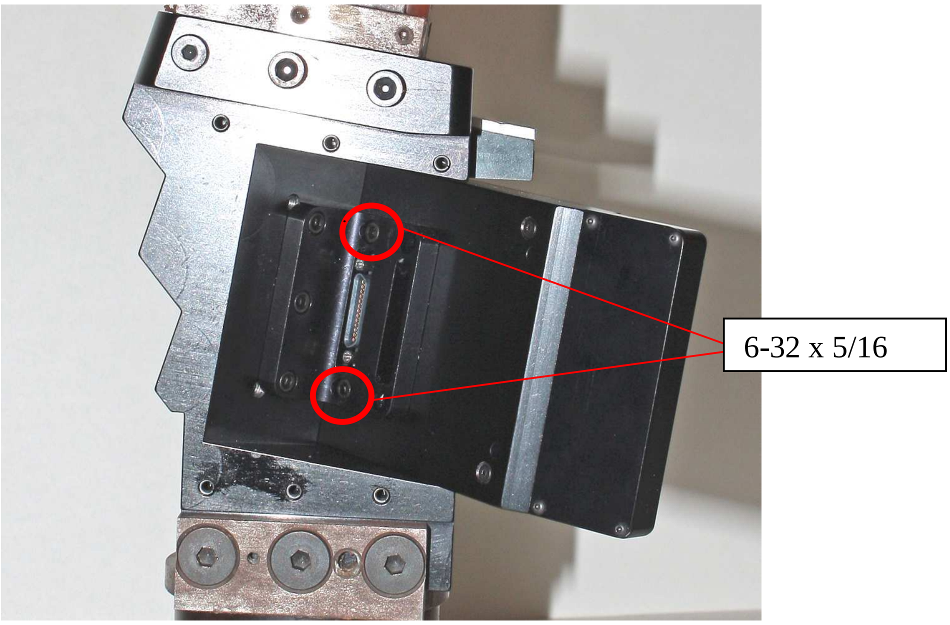

Figure 5. Mounting RibEye to spine (back side)

2.1 LED Mounting to Ribs

The three LEDs mounted on the outer part of the ribs on the side of the dummy are each attached with two nylon zip-ties. The three LEDs mounted at the sternum end of the ribs close to the middle of the dummy chest are attached to the bolts that connect the ribs and sternum. **Figure 6** illustrates how the three outer LEDs are mounted. **Figure 7** shows how the LEDs at the sternum end of the ribs are mounted.

Figure 6. Mounting outer LEDs on ribs

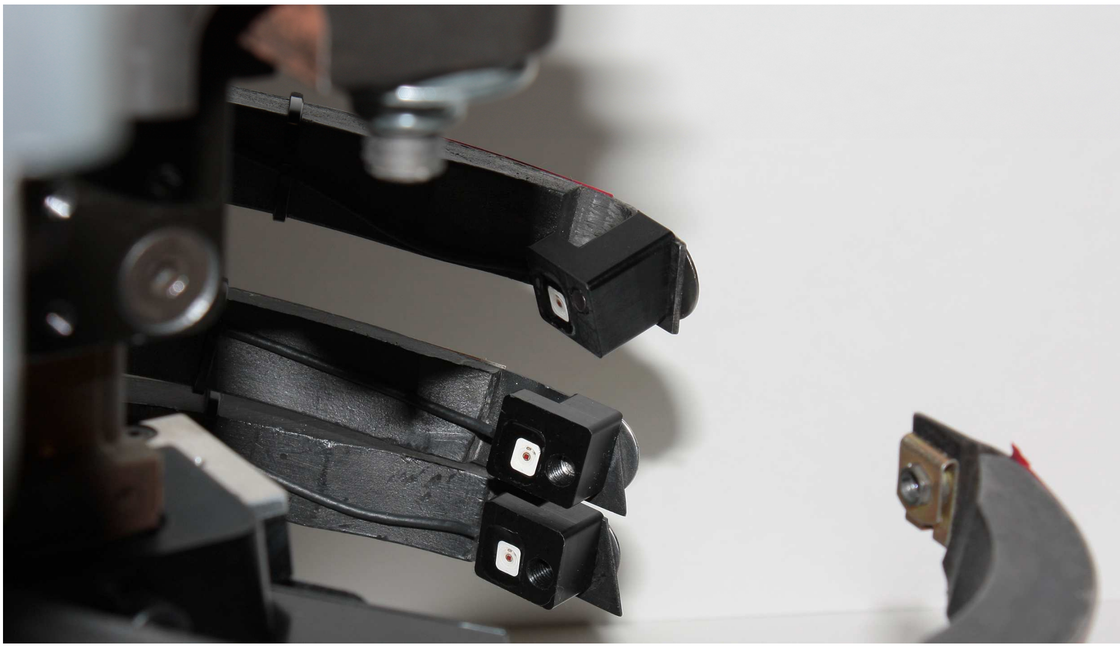

Figure 7. Mounting LEDs on sternum end of ribs

The LED cables are routed along the inside of the ribs. Make sure that the LED cables cannot move into the field of view during the test. The connectors on the ends of the LED cables are plugged into the socket on the front cover of the RibEye as shown in **Figure 8**.

Figure 8. LED connections to RibEye

The LEDs must be plugged into the connector in the order listed in **Table 1**.

Table 1. LED connections

LED number	Rib number	Location on rib
1	4	Outer
2	5	Outer
3	6	Outer
4	4	Middle
5	5	Middle
6	6	Middle

3.0 RibEye Software

The RibEye is configured using PC-based software that communicates over the local area network (LAN) through the DTS-G5DB. The RibEye control software allows you to configure how much data to collect using either a circular or linear buffer. The control software is also used to download the data and generate Comma-Separated-Variable data files (**.**CSV format). Channel names are configured using standard ISO channel codes. The RibEye control software also provides a quick plot of the data channels, as well as an ambient light reading which is taken during every sample. The software also includes a live mode that displays the positions of the LEDs at a 3 sample/second update rate.

The RibEye receives its power from the DTS G5DB, so you must turn on the G5 system in order to turn on the RibEye. When the RibEye is powered on, it will flash each of the LEDs for about 1 second. The LEDs will flash in the following order:

1. Rib 4 Outer
2. Rib 5 Outer
3. Rib 6 Outer
4. Rib 4 Middle
5. Rib 5 Middle
6. Rib 6 Middle

3.1 RibEye Control Software Installation

First, insert the Polar RibEye CD into your CD drive. Using Windows Explorer, open the “RibEye Installer” directory and run the “setup.exe” program. Then follow the instructions on the screen. This program will install the RibEye control software and the LabWindows/CVI Run-Time Engine.

3.2 RibEye Control Software Operation

The main screen upon start-up of the RibEye control software is shown in **Figure 9**. Note that most of the controls are grayed out, and only the “Connect/Setup” and “Plot” tabs are visible. At this point, the software can be used only to re-plot existing datasets. The “Status” box shows the current state of the RibEye (disconnected).

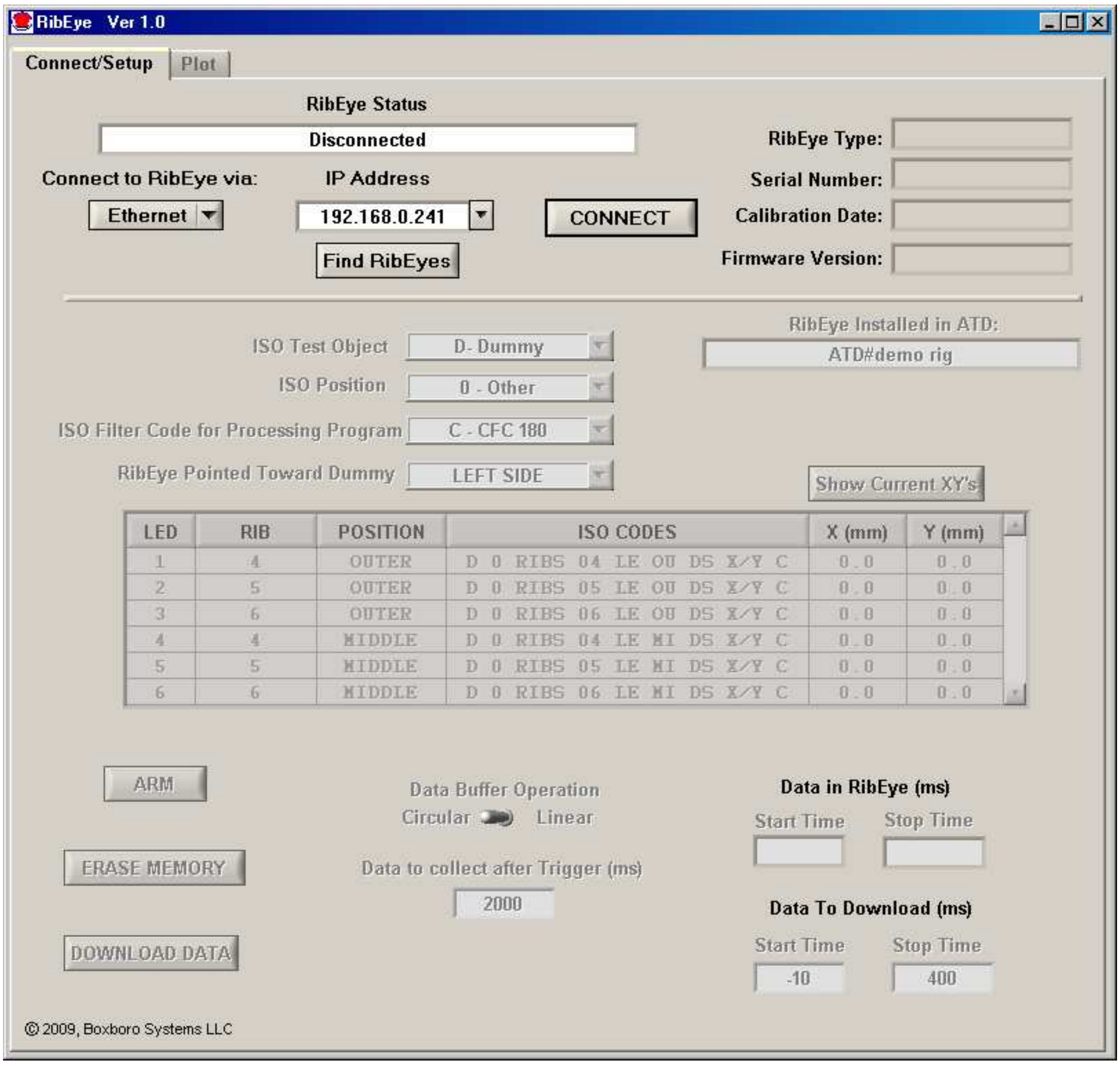

Figure 9. RibEye control software main screen upon start-up

3.3 Connecting to the RibEye

The Polar RibEye communicates via Ethernet over the LAN. The "Connect to RibEye via" drop-down menu has the option for connecting via RS232 Serial and USB for other RibEye models, but you should ignore these and select the Ethernet connection.

Next, select the IP address for your RibEye in the "IP Address" box. If your RibEye is not listed on the drop-down menu, you can type your RibEye's IP address into the box. Alternatively, you can click on the "Find RibEyes" button, which will search for all RibEyes currently connected to the LAN and powered up. If you click on the "Find RibEyes" button, a message will pop up asking you to wait for 15 seconds. After the RibEyes have been found, they will be displayed and added to the IP Address drop-down menu as shown in **Figure 10**.

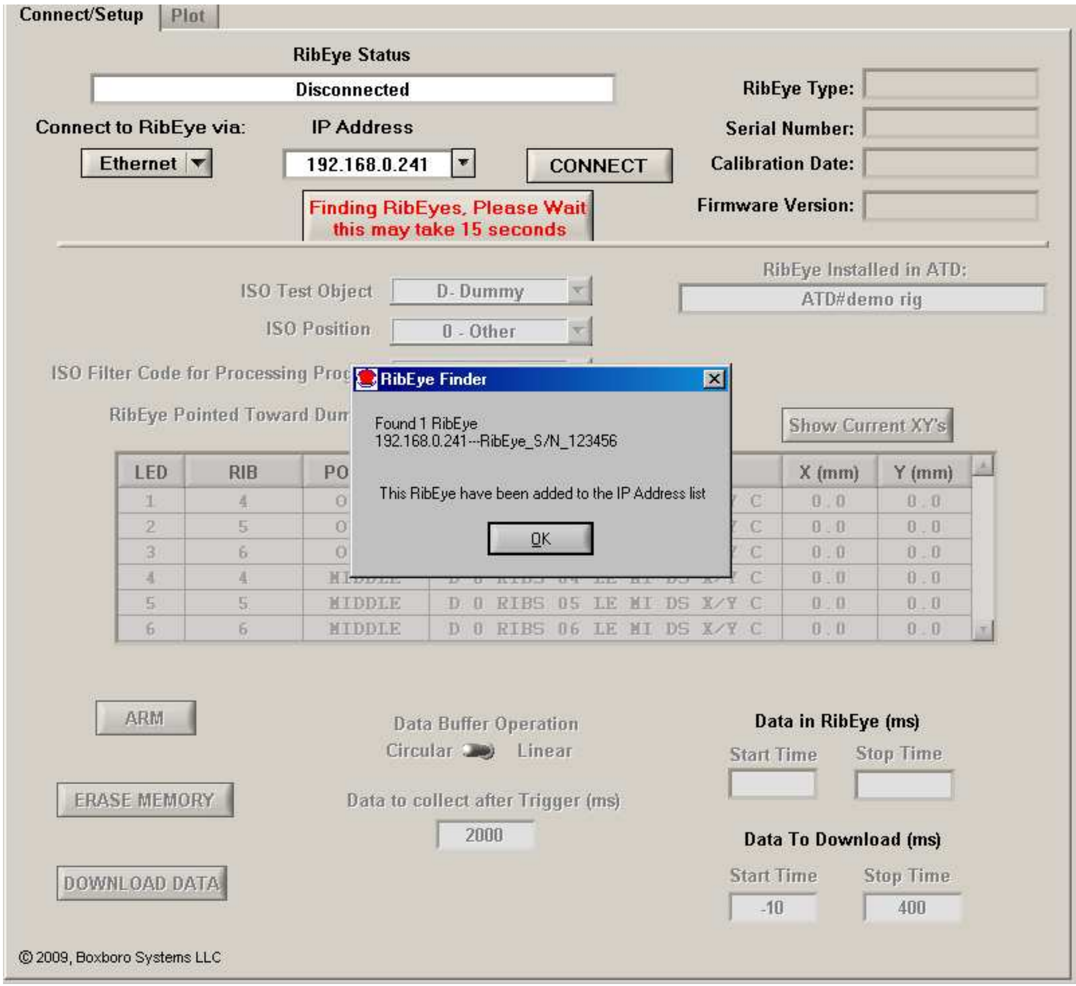

Figure 10. "Find RibEyes" screen

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 will retrieve the following data and fill it in on the screen: RibEye Type, Serial Number, Calibration Date, and Firmware Version. The software will also retrieve and fill in the ATD Number. **Figure 11** 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.

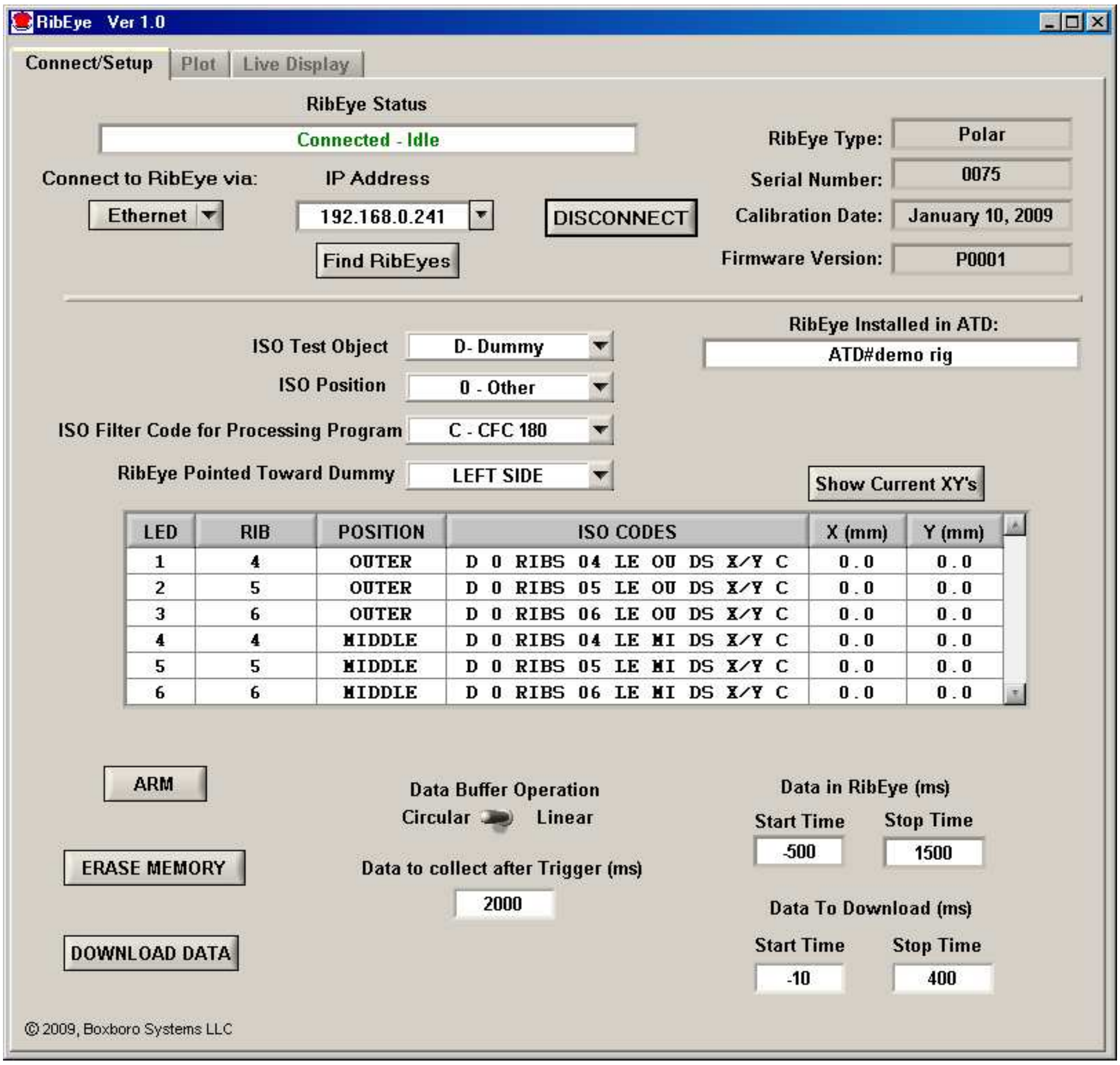

Figure 11. RibEye control software main screen after connecting to RibEye

3.4 Text Field Under "RibEye Installed in ATD"

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

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. Then the software will write the updated information to the RibEye. A confirmation box will pop up as shown in **Figure 12**. Click on "OK" to close the box.

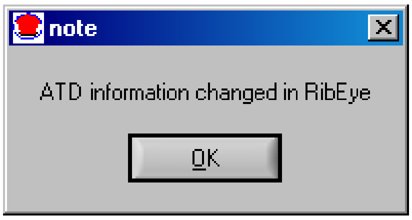

Figure 12. Confirmation of updated data under "RibEye Installed in ATD"

3.5 ISO Code Settings

The drop-down boxes for "ISO Test Object", "ISO Position", "ISO Filter Code for Processing Program", and "RibEye Pointed Toward Dummy" (**Figure 13**) are used to generate the standard ISO channel naming codes as shown in the table. When you change any of the values in the drop-down boxes, you will see the changes reflected in the ISO codes in the table. The ISO codes are used as channel headers in the CSV 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.

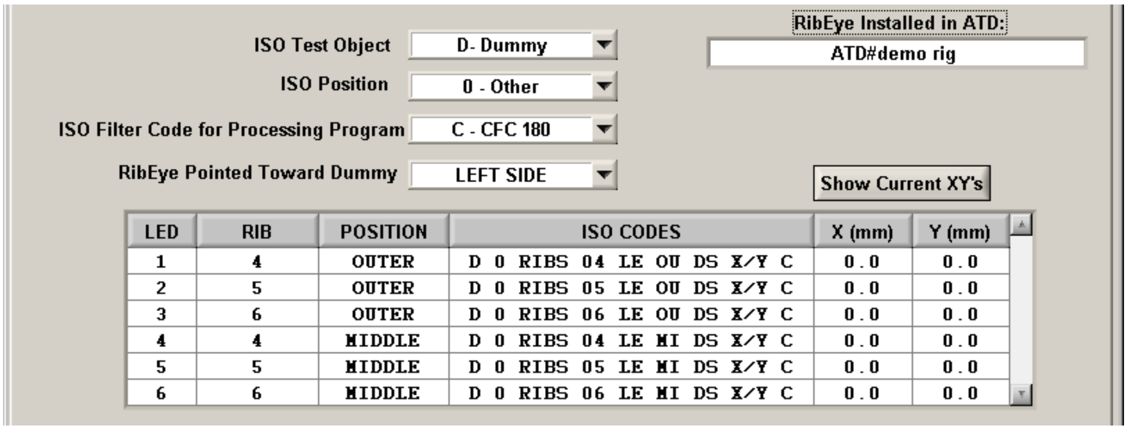

Figure 13. ISO code settings

Note that the "Filter Code" setting is just used to tell the final processing program what filter to use when processing the data. Typically, RibEye data is best processed using a CFC 180 filter. The RibEye and the control software ***do not*** filter the RibEye data stored in a CSV file.

The "RibEye Pointed Toward Dummy" Left or Right side selection is used to convert data from the RibEye coordinate system to the dummy coordinate system. Make sure that this setting is correct, or the coordinate system conversions will generate bad data. The RibEye coordinate system is rotated about the Z axis of the dummy by plus or minus 41 degrees. When you click on the "Show Current XY's" button, downloaded data will be converted so that it is aligned with the dummy's X and Y coordinates based on the setting of the "RibEye Pointed Toward Dummy" field.

3.6 "Show Current XY's" Button

The "Show Current XY's" button will turn 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" selection box.

3.7 Data Collection Setup, Arm, and Download Controls

Figure 14 illustrates these controls, which are described in the following sections.

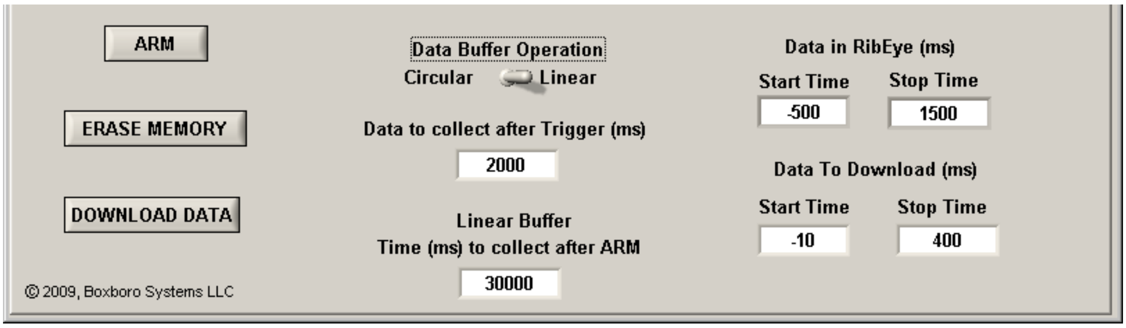

Figure 14. Data collection setup, arm, and download controls

3.7.1 Data Buffer Operation

The RibEye has a 30-second D-RAM data buffer, which can be configured as a circular or linear buffer. If the data buffer is set to “Circular”, only the “Data to collect after Trigger” box will be shown. In this mode, when the RibEye is armed, it will begin collecting data to a circular buffer. It will continue to collect data to the circular buffer until it receives a trigger signal (see section 3.7.3 “Disarm” and “Trigger” Buttons). After a trigger is received, RibEye will continue to collect data for the number of milliseconds entered in the “Data to Collect after Trigger” box. You can set this value from 1 to 30,000 milliseconds (ms).

When the data buffer is set to “Linear”, the RibEye collects up to 30 seconds of data, starting from when it is armed. If a trigger is received, it will continue 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 will stop 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 2** shows some examples.

Table 2. 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

3.7.2 Flash Memory Data Storage

Immediately after data collection stops, data is copied from the RAM buffer to flash memory. 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 will hold data from –500 to 1500 ms, where Time 0 is the time the trigger occurred. If no trigger occurred, the RibEye will store the last 2 seconds of data acquired in flash memory. If the linear buffer was set to 30,000 ms to collect after arm, the flash will hold 28,000–30,000 ms.

Note that if power is interrupted while the RibEye is writing data to flash memory, when RibEye is rebooted, it will report the data in flash as –

Start Time = –29, 999 ms
Stop Time = 27,9999 ms

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

3.7.3 "Erase Memory" Button

The "Erase Memory" button will erase the RibEye RAM and flash memory. This typically takes about 14 seconds, but the memory specifications say that it can take longer. The RibEye "Status" box will display "Erasing RibEye Flash Memory", and a progress bar will appear.

3.7.4 "Arm/Disarm" and "Trigger" Buttons

Clicking on the "Arm" button (see **Figure 14** above) will start the RibEye collecting data. Note that if memory is not erased as described above, the arm action will be aborted, and a message will pop up telling you to erase the memory.

When you click the "Arm" button, the button label will change to "Disarm", and a "Trigger" button will appear as shown in **Figure 15**.

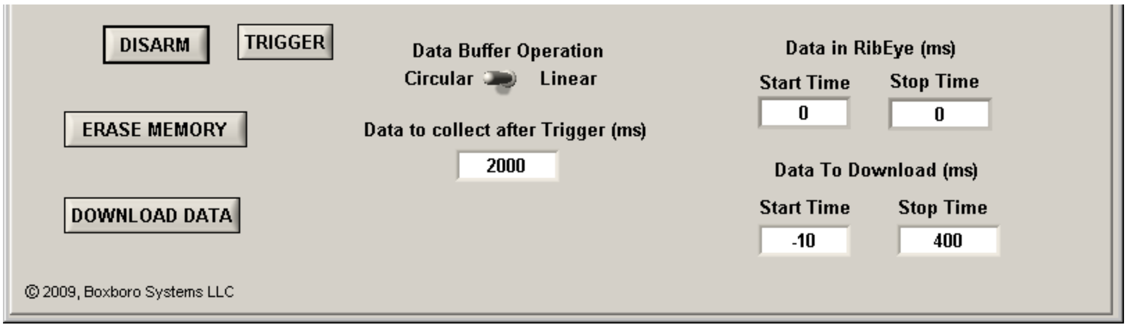

Figure 15. "Disarm" and "Trigger" buttons that appear after arming

The RibEye Status box will display "Collecting Pre-Trigger Data", and a message will pop up, asking if you plan to disconnect the communications cable to the dummy (**Figure 16**). 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 dummy communications cable, you can click the "Stay Connected" button. After the test is completed and the communications cable is plugged back in to the dummy, you can click on the "Connect" button to re-establish communications with the RibEye.

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

During data acquisition, the RibEye Status will display 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 will change to "Connected-Idle". At this time, you can download the data collected.

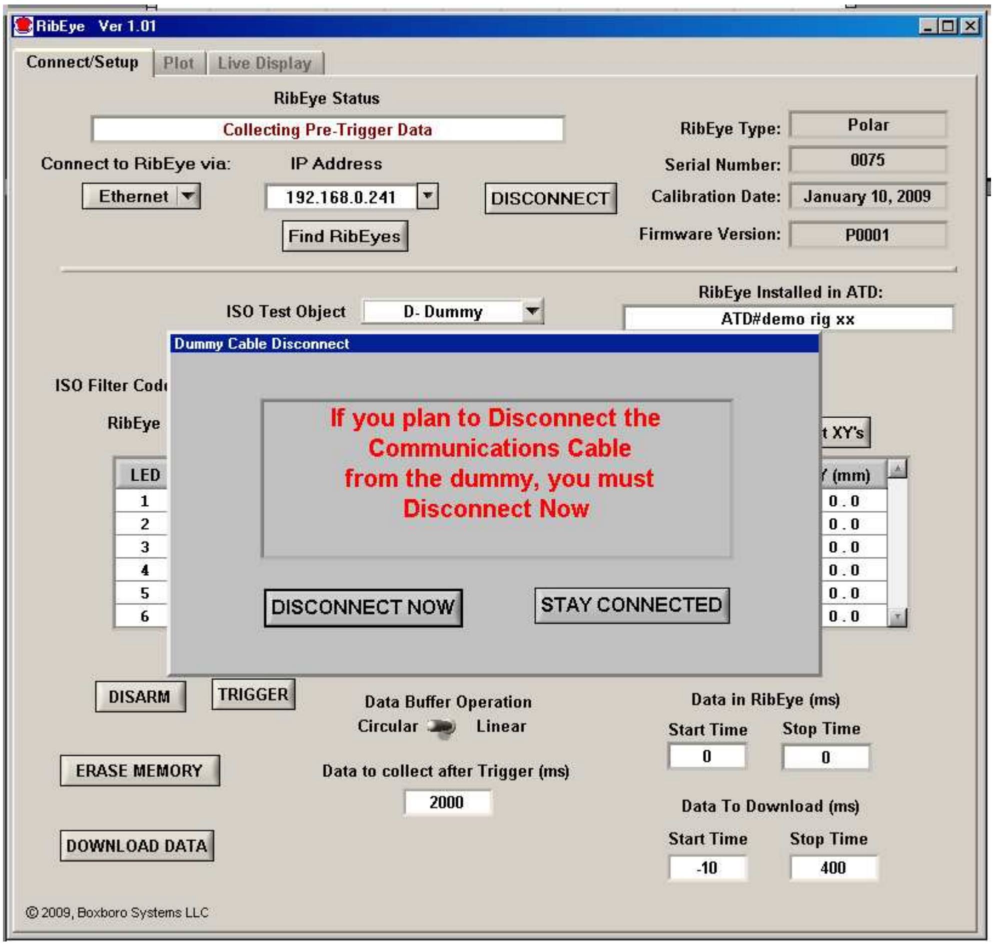

Figure 16. Message pop-up after arming

3.7.5 "Download Data" Button

The "Download Data" button will download data from the RibEye based on the "Data to Download", "Start Time", and "Stop Time" settings. 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. When you click on the "Download Data" button, a progress bar will appear showing the percent completion of the download. After the download is complete, a file storage window will appear. Navigate to the location where you want to store the file, and enter a file name. The file extension will always be **.**CSV.

After the data is downloaded, you will be taken to the plot tab for a quick view of the data. The format of the .CSV file is shown in **Table 3**, where –

- The first line shows the RibEye type
- The second line shows how the RibEye is oriented in the dummy
- The third line shows the ATD number or whatever text you entered in the field
- The ISO codes for the channel headers are shown in the columns to the right of "Time".

Table 3. Data file (*.CSV) format

RibEye Type:Polar														
RibEye Pointed Toward Dummy LEFT Side														
ATD: ATD#00000001														
Time(ms)	D0RIBS04LEOUDSXC	D0RIBS04LEOUDSYC	D0RIBS05LEOUDSXC	D0RIBS05LEOUDSYC	D0RIBS06LEOUDSXC	D0RIBS06LEOUDSYC	D0RIBS04LEMIDSXC	D0RIBS04LEMIDSYC	D0RIBS05LEMIDSXC	D0RIBS05LEMIDSYC	D0RIBS06LEMIDSXC	D0RIBS06LEMIDSYC	D0SENSLE9999PO00	D0SENSRI9999PO00
0	80	-102.8	82.9	-104.4	87.2	-104.3	108.2	-73.4	111.8	-73.1	114.2	-72.4	908	1021
0.1	79.5	-102.6	82.9	-104.4	87.1	-104.2	108.1	-73.5	111.6	-73	114.1	-72.4	875	1011
0.2	79.8	-102.7	82.9	-104.4	87	-104.1	108.2	-73.4	111.7	-73.1	114.1	-72.3	893	1019
0.3	79.8	-102.7	82.9	-104.4	87	-104.1	108.2	-73.4	111.6	-73	114.1	-72.3	874	1003
0.4	79.9	-102.7	83	-104.5	87.1	-104.2	108.2	-73.4	111.6	-73.1	114.1	-72.4	867	1013
0.5	79.8	-102.8	82.7	-104.4	87	-104.1	108.1	-73.5	111.6	-73.1	114	-72.3	891	988
0.6	79.8	-102.7	82.8	-104.4	87	-104.1	108.2	-73.5	111.6	-73.1	114	-72.3	864	1008
0.7	79.8	-102.7	82.9	-104.4	87.1	-104.2	108.1	-73.5	111.6	-73.1	114.1	-72.4	842	1006
0.8	79.8	-102.7	82.9	-104.4	87.2	-104.1	108.2	-73.4	111.6	-73.1	114.1	-72.3	868	1026
0.9	79.8	-102.8	82.6	-104.2	87.1	-104.2	108.2	-73.5	111.7	-73.1	114.1	-72.4	840	1024

3.7.6 Error Codes in Data File

If the RibEye cannot accurately calculate a LED position, it will generate error codes in the data file, causing a drop-out in the plots. The RibEye will force both the X and Y data to the same error code. The error codes are generated when light from a LED is blocked between the LED and one of the sensors, or if there is too much ambient light to accurately resolve the LED position. Both X and Y will be forced to:

1. If the right sensor (when facing the RibEye) is blocked or sees too much ambient light
2. If the left sensor (when facing the RibEye) is blocked or sees too much ambient light
3. If both sensors are blocked or see too much ambient light.

If an error code occurs, discount the data a few milliseconds before and after the drop-out, because the LED brightness control loops must stabilize. Most often , the cause of a drop-out is a loose cable that swings between the LED and the sensors, blocking the light.

3.8 "Plot" Tab

The "Plot" tab (**Figure 17**) shows a plot of the data file. The file name and path is shown in the "Current File" box.

3.8.1 "Plot Data" Selection

The "Plot Data" selection allows you to generate the following plots:

- X and Y versus time – all of the data collected
- X vs. time
- Y vs. time
- Ambient light vs. time.

The ambient light data is useful to review if you see drop-outs in the data (please refer to section 3.7.6 Error Codes in Data File).

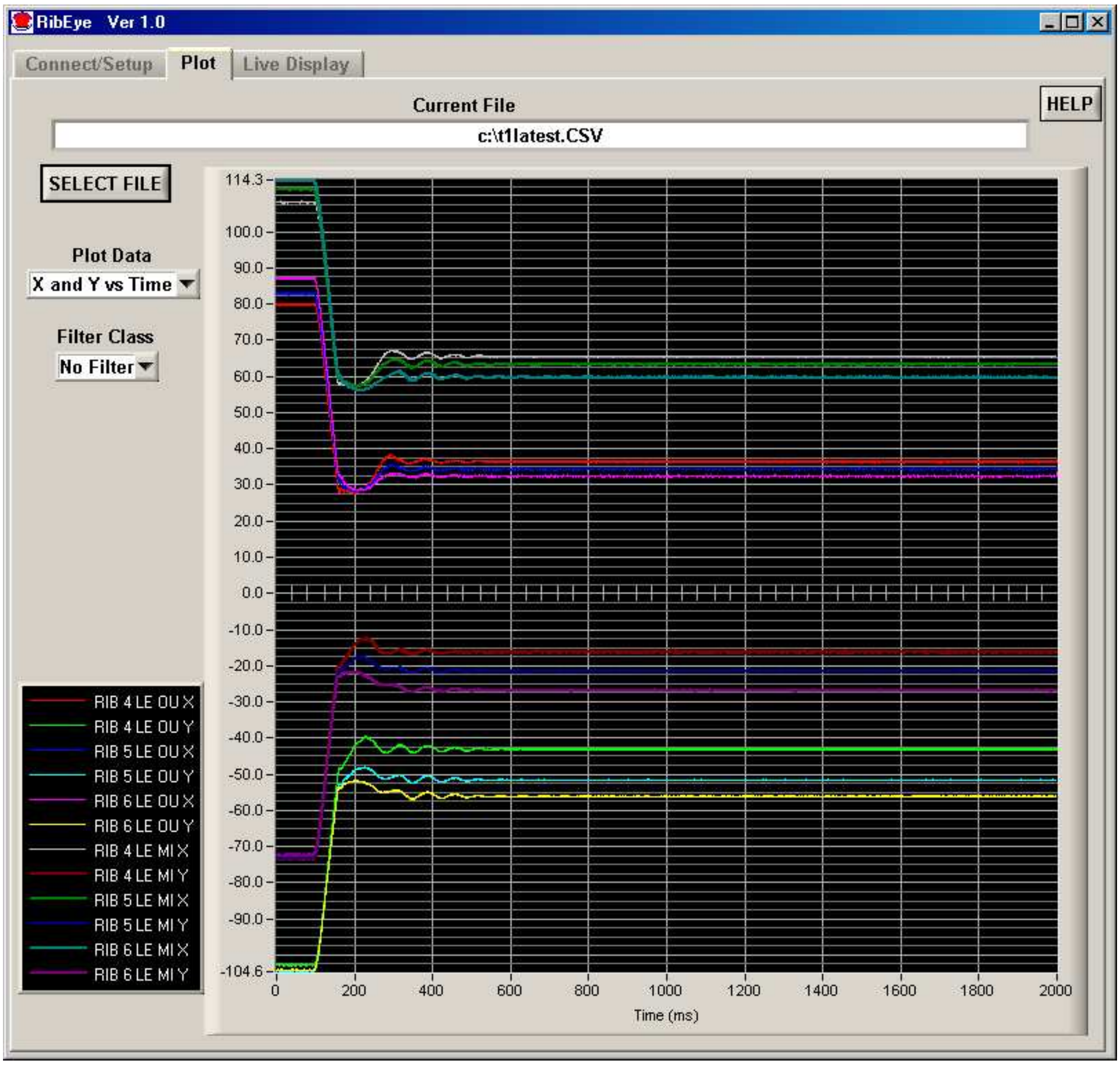

Figure 17. Plot tab

3.8.2 "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.

3.8.3 "Select File" Button

The "Select File" button will bring up a file browser to allow you to select a RibEye data file to plot. This button will also allow you to re-plot a test when you are not connected to a RibEye.

3.8.4 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, and plot style (**Figure 18**).

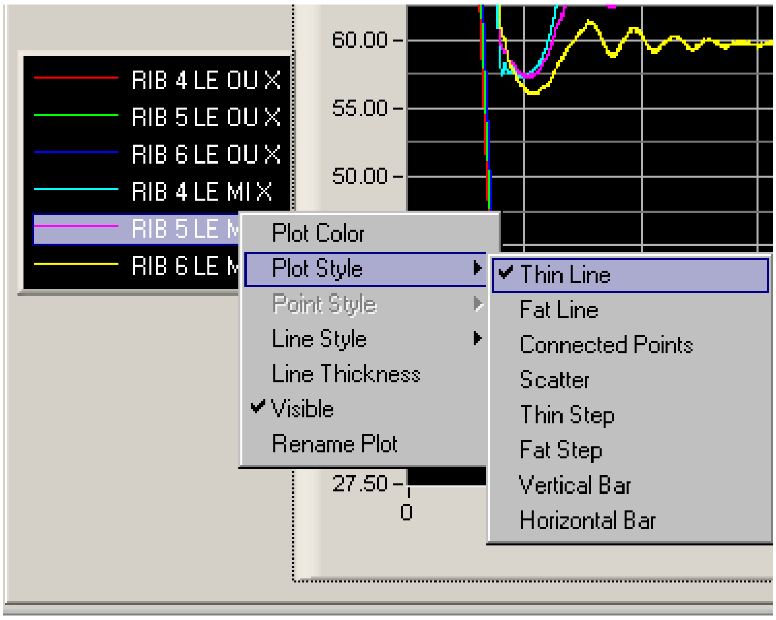

Figure 18. Changing plot styles by right-clicking on a trace in the “Legend” box

3.9 “Live Display” Tab

The “Live Display” tab shows the current positions of the LEDs, which are updated approximately 3 times per second. 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. You can select to see the data either in the RibEye coordinate system or in the dummy coordinate system.

Figure 19 shows the “Live Display” screen with LEDs in the approximate positions when the RibEye is mounted facing the dummy’s left side. The display shows the LED positions in the RibEye coordinate system. **Figure 20** shows the “Live Display” screen with the LED positions shown in the dummy coordinate system. This plot uses the same data as **Figure 19**, but with the coordinate transforms applied to convert RibEye data to the dummy coordinates.

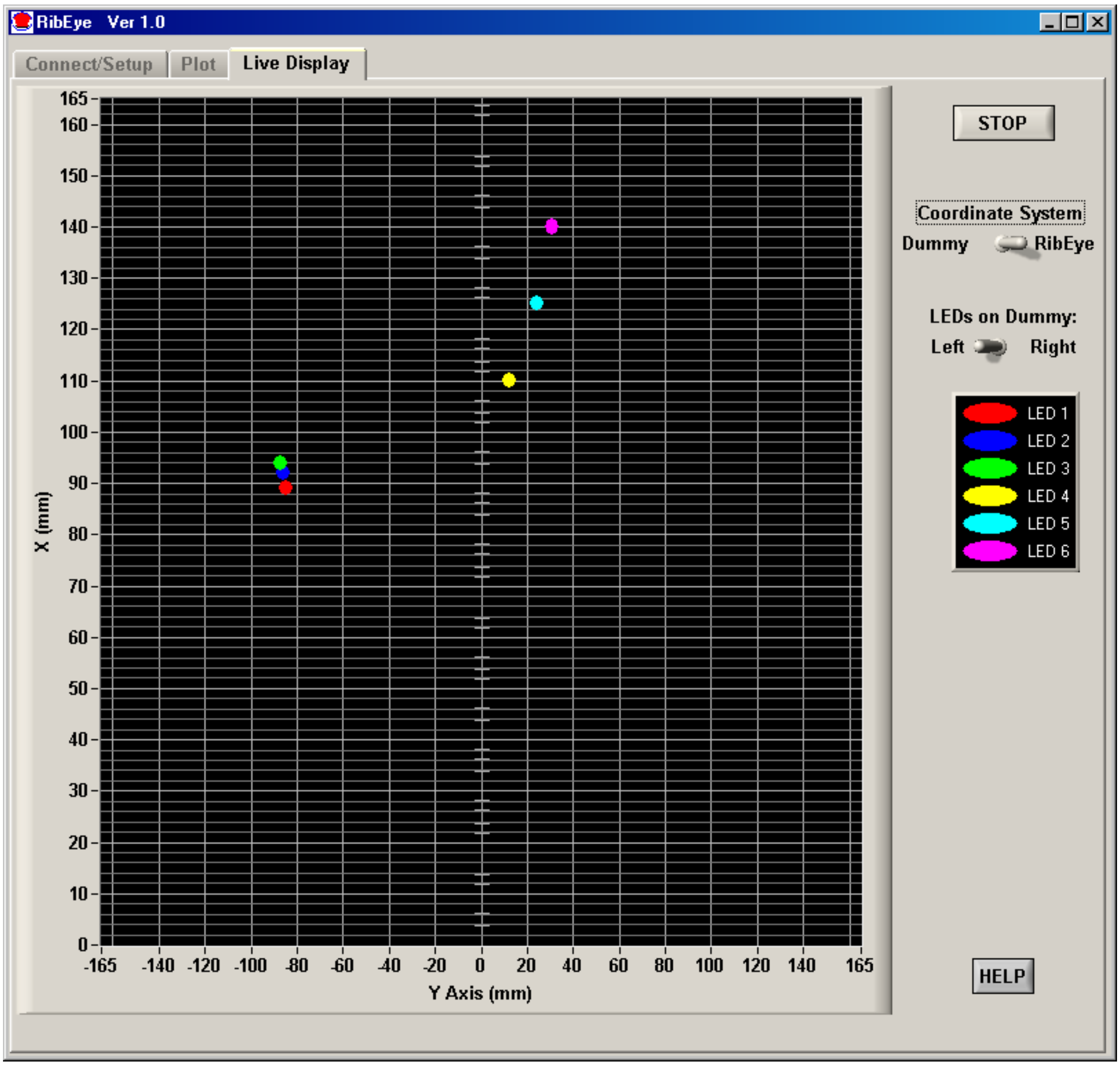

Figure 19. "Live Display" tab with data shown in the RibEye coordinate system

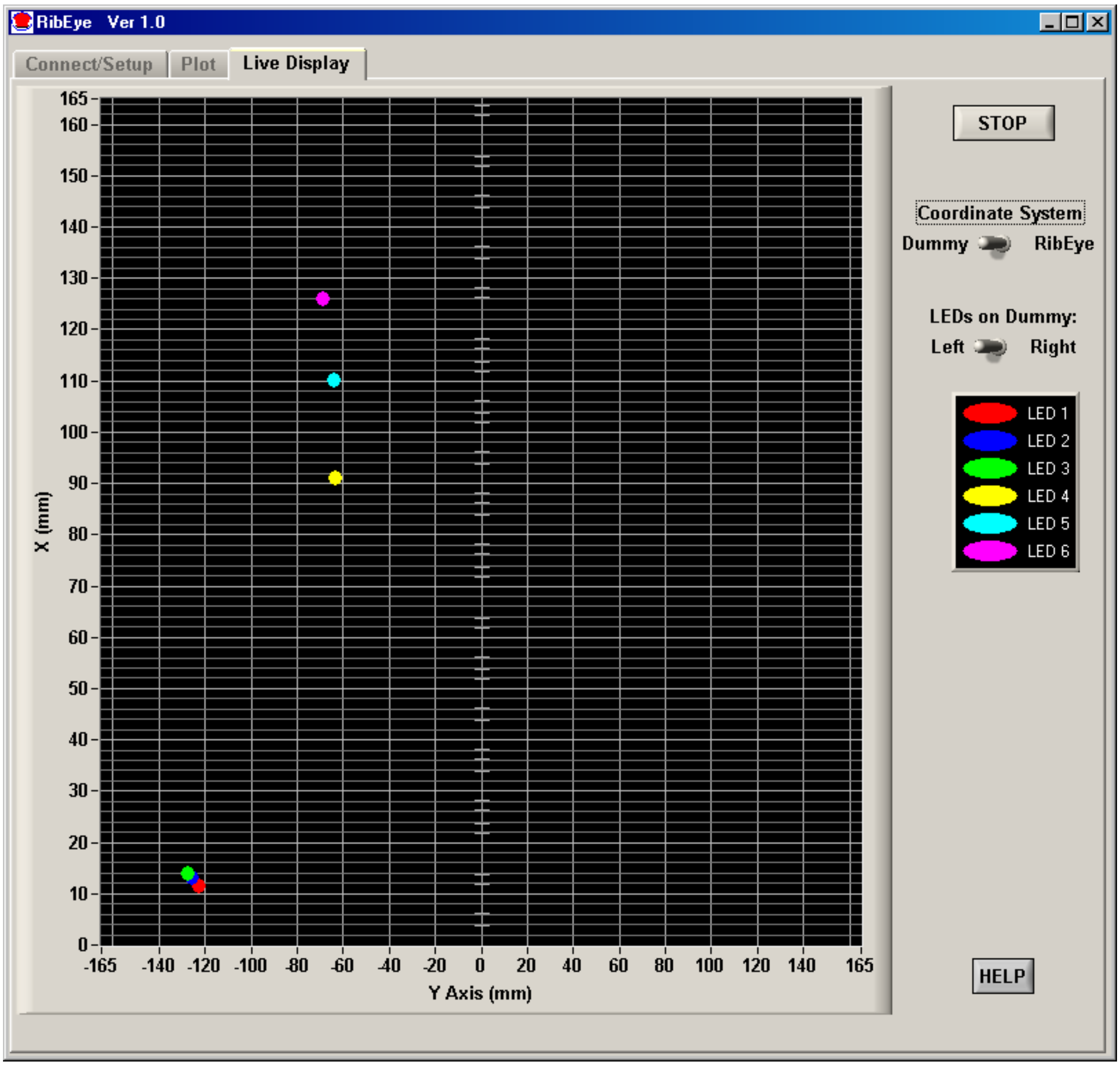

Figure 20. "Live Display" tab with data shown in the dummy coordinate system

Appendix A. Setting the RibEye's IP address

When the RibEye ships from the factory, its IP address is set to 192.168.1.240. You can change the RibEye's IP address by sending commands to the RibEye over the LAN connection to port 23 using a Telnet terminal program.

The following example uses Windows HyperTerminal. Refer to **Appendix B** for instructions on configuring Windows HyperTerminal to communicate with the RibEye. If you are using an operating system other than Windows, refer to your documentation for the Telnet program installed on your system.

To change the RibEye's IP address using Windows HyperTerminal, follow these steps.

1. Start Windows HyperTerminal
2. Hit the "Enter" key until the command prompt appears (pound/number sign, #)
3. At the command prompt, type the following, but replace the "x"s with your new IP address—

   set ip eth0 ip-address xxx.xxx.x.xxx

4. Press the "Enter" key again.

The IP address of the RibEye is now changed temporarily. It is not permanently stored in the RibEye flash memory, so if the RibEye is powered down, it will not remember the change.

Because the IP address has been changed, HyperTerminal will no longer communicate with the RibEye, so you must change the HyperTerminal host address:

1. Go to "File/Properties" and change "Host Address"
2. Click on "Call/Disconnect"
3. Click on "Call/Call"
4. If you don't immediately get a command prompt, press the "Enter" key until you do
5. Finally, type "Save".

You should see the message "Saving Configuration and Exiting", which indicates that the change of IP address is permanent. You may wish to re-save your HyperTerminal session with the new IP address so that it will connect immediately the next time. **Figure A1** shows the HyperTerminal screen after saving.

IMPORTANT: *If you change the RibEye IP address, you should write the new IP address on a sticker and attach the sticker to the RibEye so that the number is readily available for the next time you are using the RibEye.*

NOTE: *If you change the RibEye IP address to a different subnet (that is, if you change more than the last three digits), you might have to change the IP address of your PC to the new subnet also, depending on your LAN configuration.*
For example, if you change the RibEye IP from—

192.168.0.240

to—

192.168.**2.**240

*you might have to change your PC to an IP address on the 192.168.**2** subnet.*

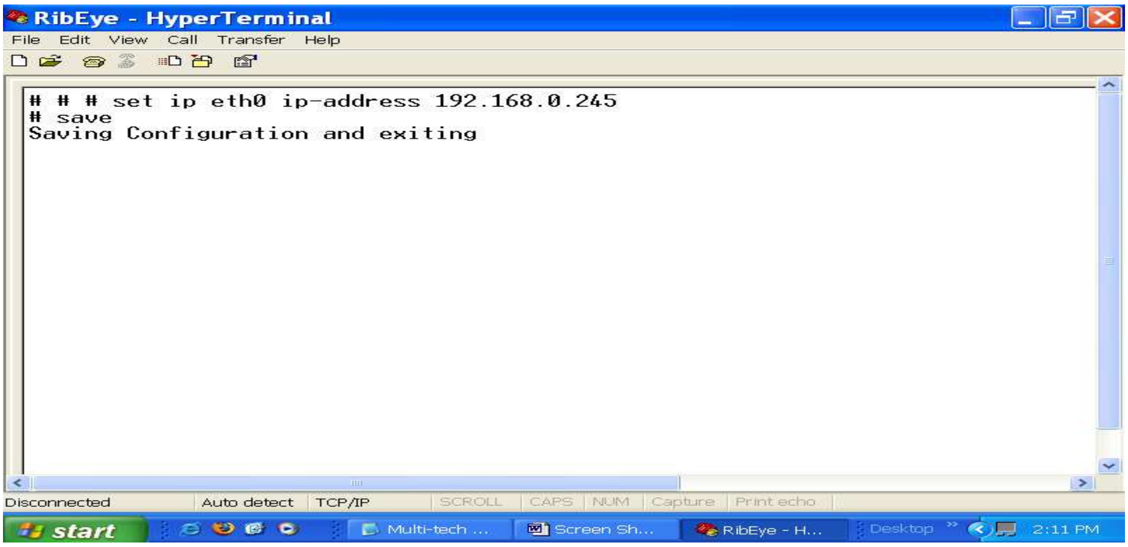

Figure A1. HyperTerminal screen

Appendix B. Setting Up a Windows HyperTerminal

Follow these steps for setting up a Windows HyperTerminal.

1. Go to "Start → Programs → Accessories → Communications → HyperTerminal"
2. Set up the HyperTerminal Connection

At the first screen (**Figure B1**), enter a name for the connection and choose an icon to represent it. Then click on the "OK" button.

Figure B1. HyperTerminal connection screen 1

At the next screen (**Figure B2**), ignore the first three lines and click on the drop-down menu for the last line ("Connect using:"). Select "TCP/IP (Winsock)."

Figure B2. HyperTerminal connection screen 2

Selecting this option, even without clicking “OK”, causes the following screen to appear (**Figure B3**):

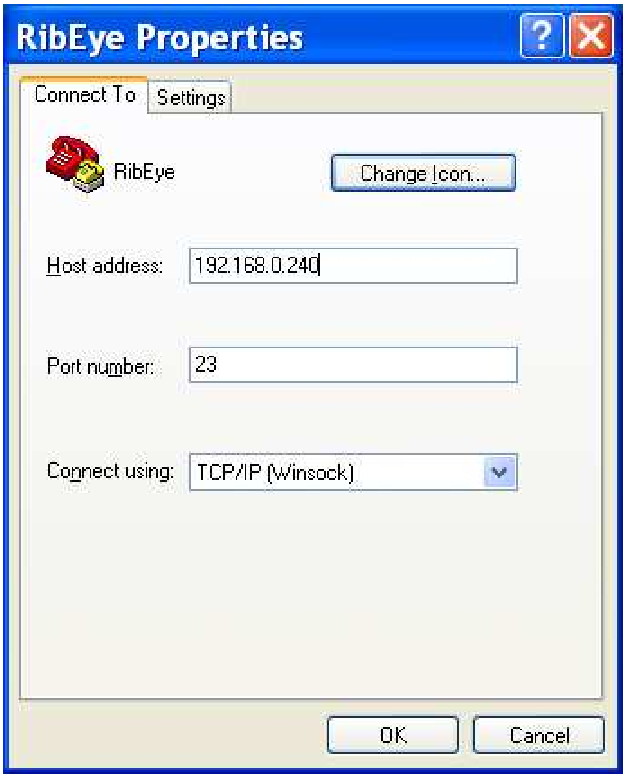

Figure B3. HyperTerminal connection screen 3

Enter an IP address for the RibEye connection. Make sure that the port number is set to 23 as shown. Click on the “OK” button. The HyperTerminal window will appear (**Figure B4**) with the name you have chosen for the connection at the top of the screen. The bottom left-hand side of the screen shows that there is no connection yet between the computer and the RibEye.

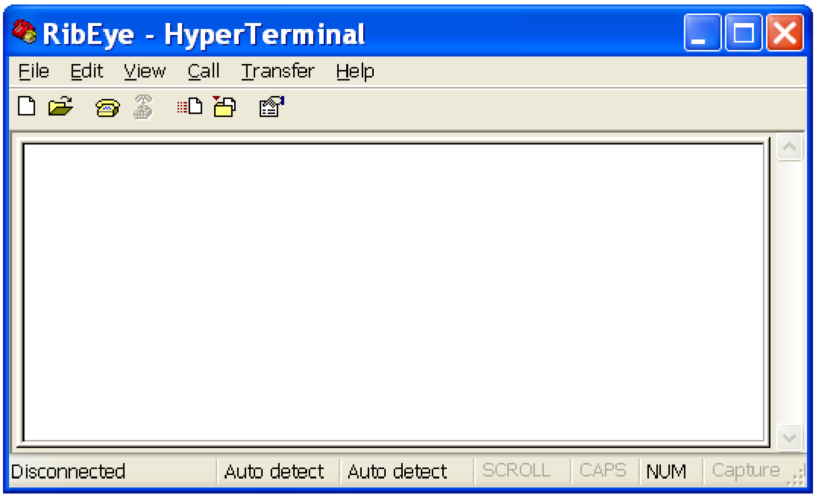

Figure B4. HyperTerminal connection screen 4

To connect to the RibEye, press the "Enter" key until the command prompt (pound/number sign = #) appears. When the connection is successful, the word "Connected" will appear at the bottom left-hand corner of the HyperTerminal screen (**Figure B5**).

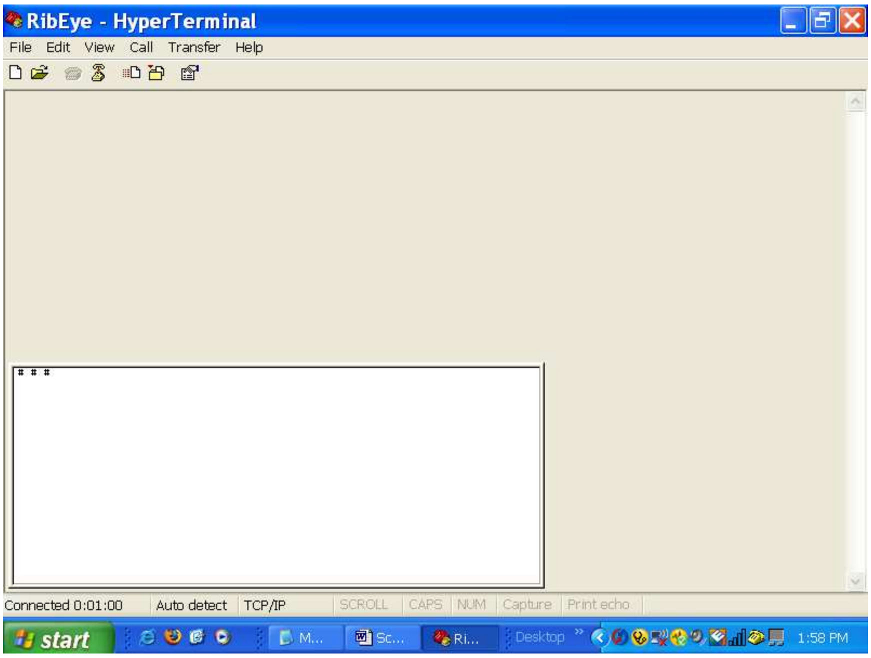

Figure B5. HyperTerminal connection screen 5

Saving the HyperTerminal Setup for Future Connections

Go to the top of the screen and select "File → Save As". Type a name for the HyperTerminal connection as shown in **Figure B6**. After the initial setup, you need only click on the file name in order to set up a communication connection to the RibEye.

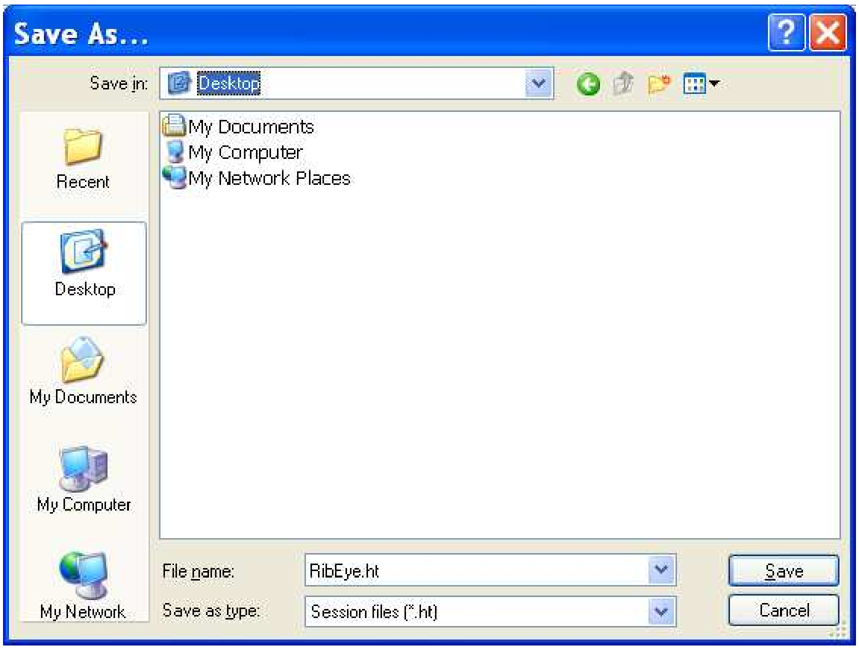

Figure B6. Saving the HyperTerminal connection

Appendix C. Configuring Windows XP for a Fixed IP Address

If you want to connect a PC directly to the RibEye instead of through your LAN, you must set up your IP with a fixed address on the same subnet as the RibEye. For example, if the RibEye IP address is 192.168.0.240, you must set up your PC IP address to be 192.168.0.xxx, where "xxx" is any number between 1 and 254, except 240. If you are running an operating system other than Windows XP, refer to your operating system documentation for setting a fixed IP address.

On Windows XP, follow these steps:

On the desktop, right-click on "My Network Places", then click on "Properties". You will get a screen like **Figure C1**.

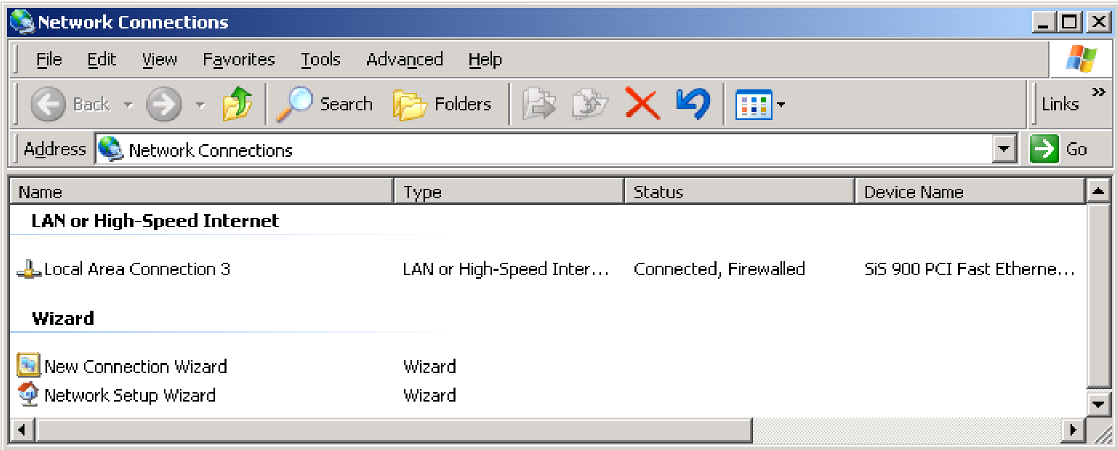

Figure C1. Windows XP configuration screen 1

Right-click on your Local Area Connection and click on "Properties". You will get a screen like **Figure C2**.

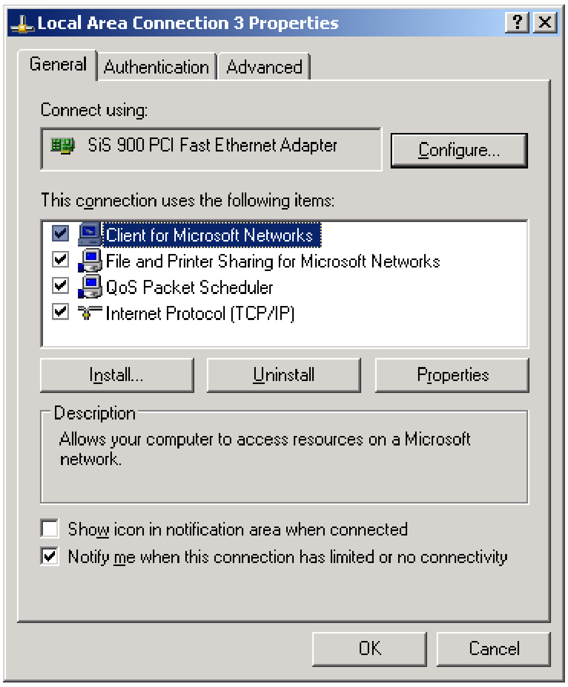

Figure C2. Windows XP configuration screen 2

Click on “Internet Protocol (TCP/IP)” to highlight it, and then click on “Properties”. You will get a screen like **Figure C3**.

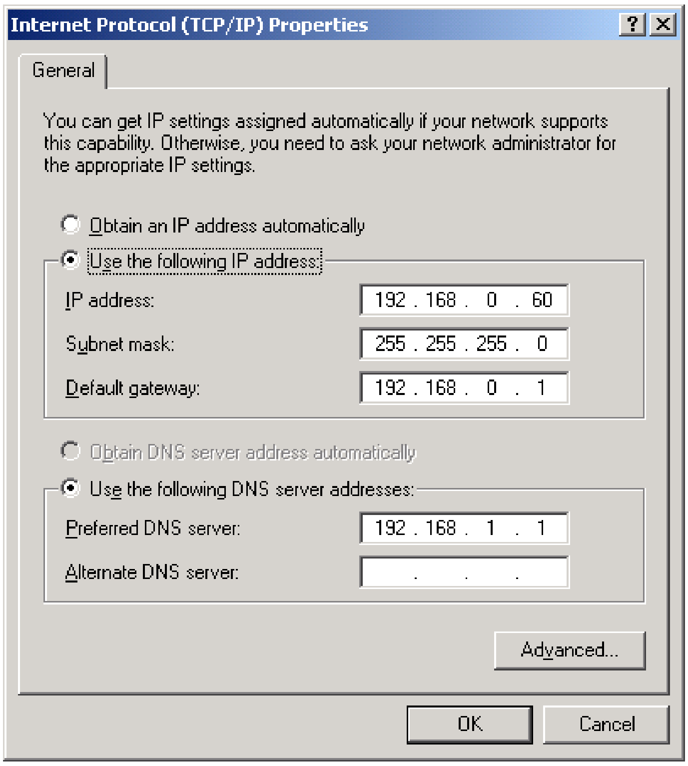

Figure C3. Windows XP configuration screen 3

Select “Use the following IP address”.

Set the IP address to your desired address, and make sure that the subnet mask is set to 255.255.255.0 as shown in **Figure C3**. You don’t have to fill in the default gateway or DNS server addresses.

Then click on the “OK” button until all windows are closed. You might get a message saying that you have to re-boot for the changes to take effect.

You are now set to a fixed IP address.

Appendix D. Micro-D Connector

The connector on the back of the Polar RibEye is a Glenair Micro-D MWDL 25 SSP. The mating connector basic part number is MWDL 25 PSS. See www.glenair.com for more information on the connectors and related hardware. The connector is currently configured to receive power, Ethernet, and trigger from the DTS G5DB. The connector pins currently used are shown in **Table D-1**.

Table D1. Existing connector pin configuration

Pin #	Signal	Pin #	Signal
1	no connect	14	+Power (Note 3)
2	Shield (Note 1)	15	+Power (Note 3)
3	Ethernet +Rx	16	no connect
4	Ethernet –Rx	17	no connect
5	Ethernet +Tx	18	+Power (Note 3)
6	Ethernet –Tx	19	Trigger (Note 4)
7	no connect	20	no connect
8	Power On (Note 2)	21	Ground
9	no connect	22	Ground
10	no connect	23	Ground
11	no connect	24	Ground
12	Shield (Note 1)	25	Ground
13	Ground		

Notes:

1. Shield is internally tied to ground pins.
2. Power On must be tied to ground for RibEye to power up. Connect to +Power to turn off RibEye.
3. +Power can be +10 to +15 VDC with respect to ground.
4. Trigger should be held at ground for no trigger. A positive pulse to greater than 6 volts DC will cause a trigger. The trigger occurs on the rising edge of the trigger pulse.

Appendix E. RibEye specifications

Measurement accuracy and range

The RibEye meets the requirements of SAE J211/1 (July 2007) as both a sensor and a data acquisition system. **Figure E1** shows the RibEye measurement range in the RibEye X-Y plane. The overall accuracy of the RibEye depends on the amount of Z deflection of each rib. The Polar RibEye does not measure Z, so it cannot correct for errors induced by Z motions. However, the Polar RibEye was tested at rib Z deflections of +/–10 mm and +/–25 mm. Refer to the calibration report for your unit to see the measurement errors over the X-Y plane at the Z deflections. The largest errors tend to be at the edges of the range. **Table E1** gives the accuracy ranges at Z deflections tested. Note that Z is positive downward.

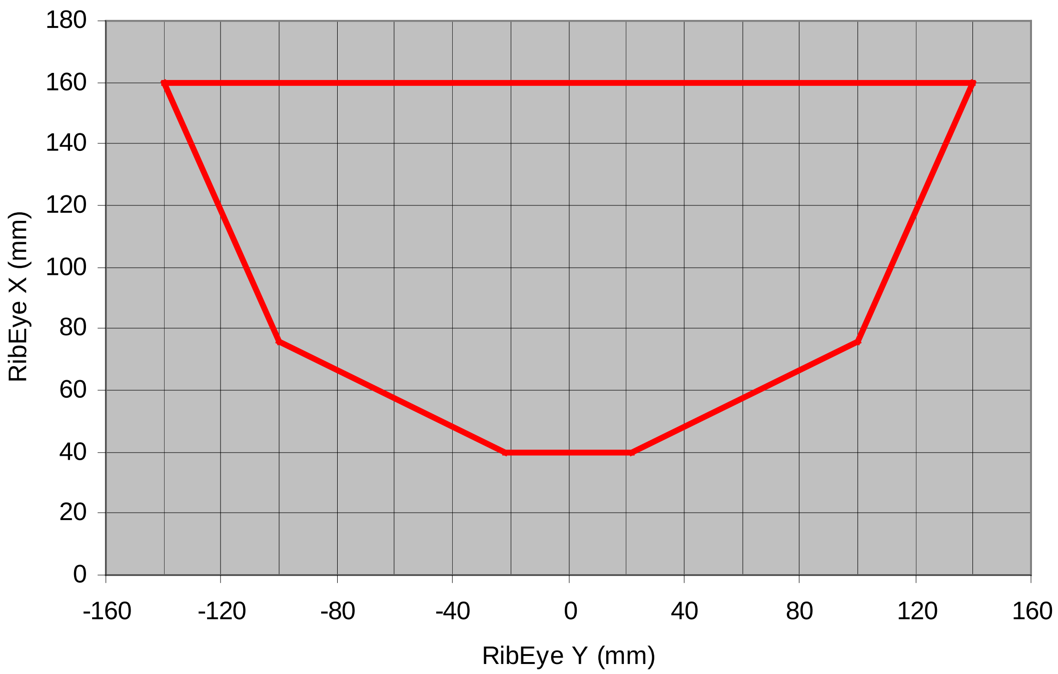

Figure E1. RibEye measurement range in X-Y plane

Table E1. RibEye error limits versus Z deflection (Z is positive downward)

Z offset (mm)	Maximum Error (mm)	
	X	Y
0	1	1
+10	1	1
–10	1	1
+25	1.5	1.5
–25	2	2

Power requirements

The RibEye can be powered by any DC voltage source from 10 to 15 Volts, and it is intended to be powered by the DTS G5DB. The power draw depends on the RibEye's operating conditions, as shown in **Table E2**. The power draw data was taken at an operating voltage of 15.0 volts.

Table E2. RibEye power requirements

Condition	Power (Watts)
On/idling	5.2
Collecting data (typical)	8.4
Maximum*	13

* When all LEDs are out of view of both sensors and are driven to full power.

Data acquisition and storage

Sample rate: 10,000 samples per second per LED

Modes: Linear or circular buffer

Acquisition time: 30 seconds

Data Storage: 30 seconds in RAM, 2 seconds in flash (non-volatile)

Data is collected to RAM memory and stored post-test in flash memory.

Control signals

See **Table D1** in **Appendix D** for connector pinouts.

Trigger: Positive going pulse greater than 6 volts. Trigger occurs on rising edge

Communication: 10/100 MBS Ethernet