CORVUS

USER GUIDE
Version 3.3

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1. Introduction

1.1. CORVUS Overview

CORVUS is a small, one-man carry, easy-to-use test tool for aircraft avionics and weapon systems; a combination of hardware and software tools providing a complete MIL-STD-1553 troubleshooting/testing capability for any triax/twisted pair bus network and cable integrity testing capability. Overall, CORVUS includes four testing and troubleshooting functions and associated cables.

Figure 1 CORVUS on Main Screen

Size	18” L x 11.5” W x 5.5” D
Weight	22lbs
Power	60 W, 115 VAC or 28VDC

1.2. Safety & Security

- SAFETY WARNING –

REFER TO THE LOCAL SHOP SAFETY RULES AND REGULATIONS. THIS DOCUMENT DOES NOT SUPERCEDE LOCAL REGULATIONS FOR SAFETY. USE REAR GROUNDING LINE OR SUITABLE REPLACEMENT PRIOR TO POWERING ON CORVUS.

WHILE USING THE TDR FEATURE OF THE CORVUS, THE AIRCRAFT MUST NOT BE POWERED.

1.3. Overview

There are several safety guidelines which must be followed while operating CORVUS. These guidelines ensure a safe operating environment. Ensure all other applicable safety guidelines and rules are followed in accordance with your facility or in your operational environment.

1	Place the CORVUS on a stable surface.
2	Insert the grounding phone cable plug into the grounding jack and clamp the other end on to earth ground.
3	Plug in CORVUS Unit
4	Connect the DC power supply AC IN to a standard 115VAC, 60Hz outlet
5	Connect the 28VDC power cord to the CORVUS connector panel (screw finger tight)
6	Power on CORVUS
7	Depress power switch and verify LED ring around switch illuminates BLUE

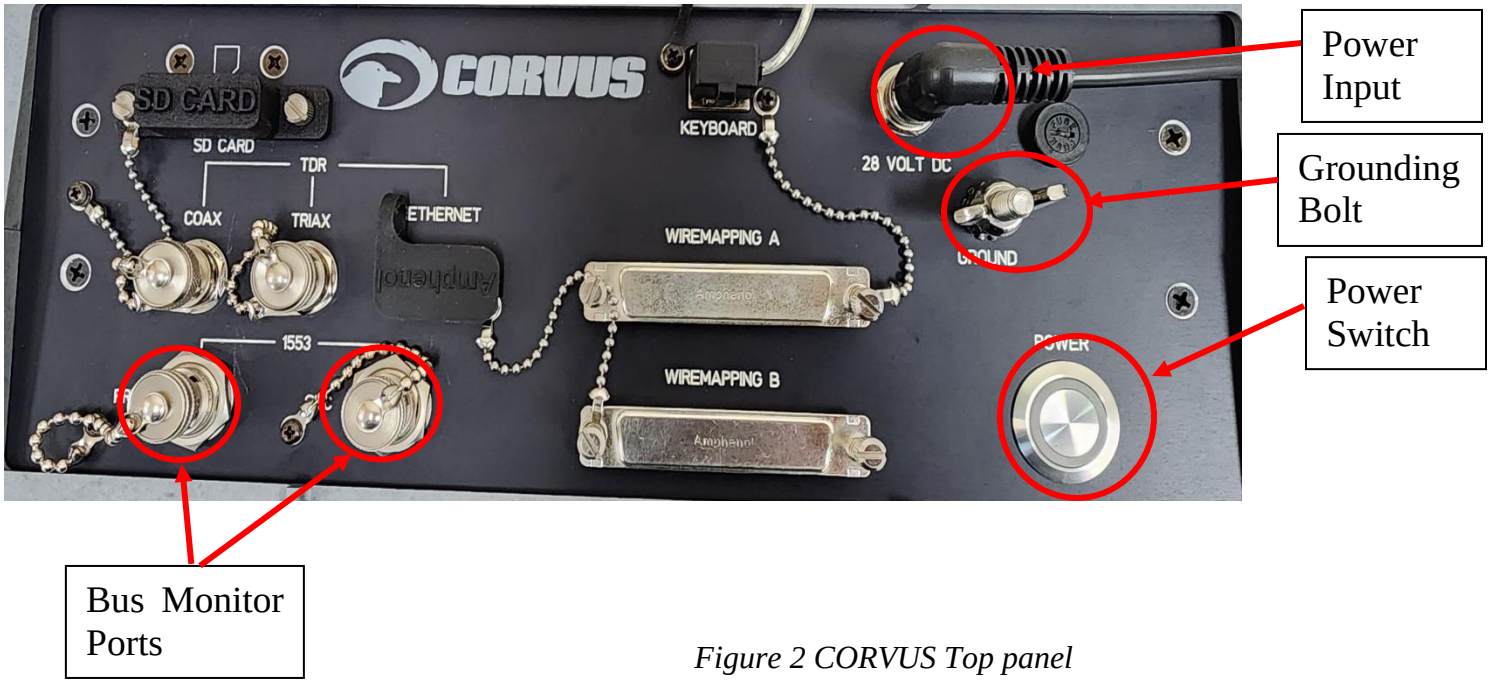


Figure 2 CORVUS Top panel

1.4. Functions

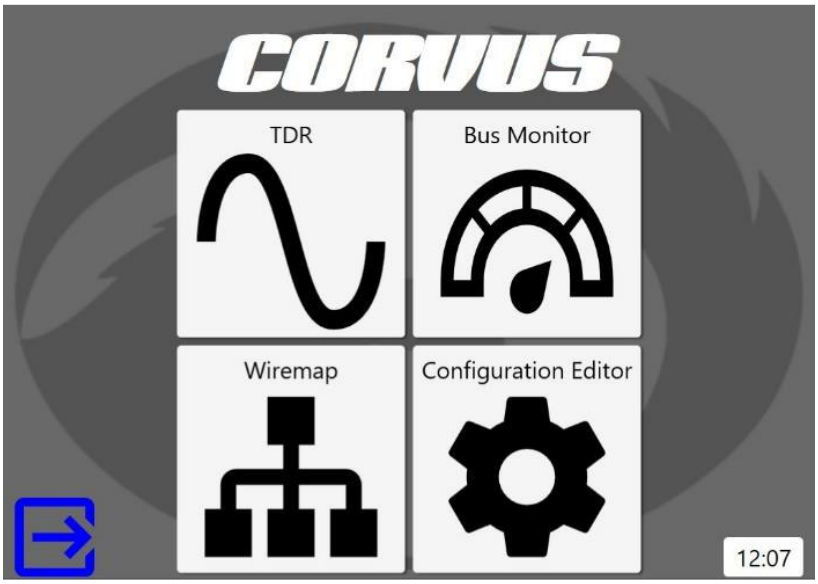


Figure 2 CORVUS Main Screen

The CORVUS main screen appears within 40 seconds after the power button is pressed. Either the touch screen or an external keyboard may be used to navigate the display. The external keyboard will use the USB keyboard connector on the adapter panel. The touch screen has an on-screen keyboard that is displayed when the user touches (NOT via mouse) any alphanumeric input area on the screen.

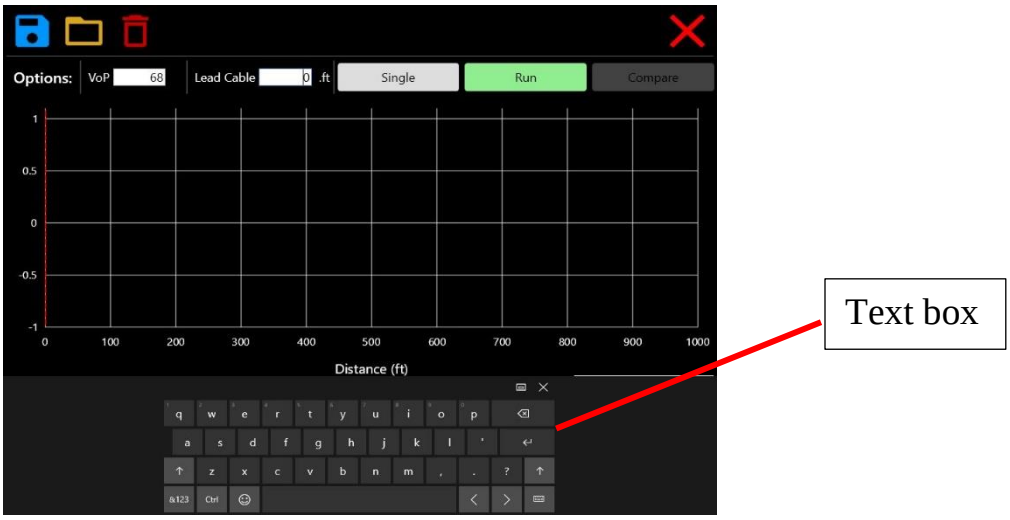
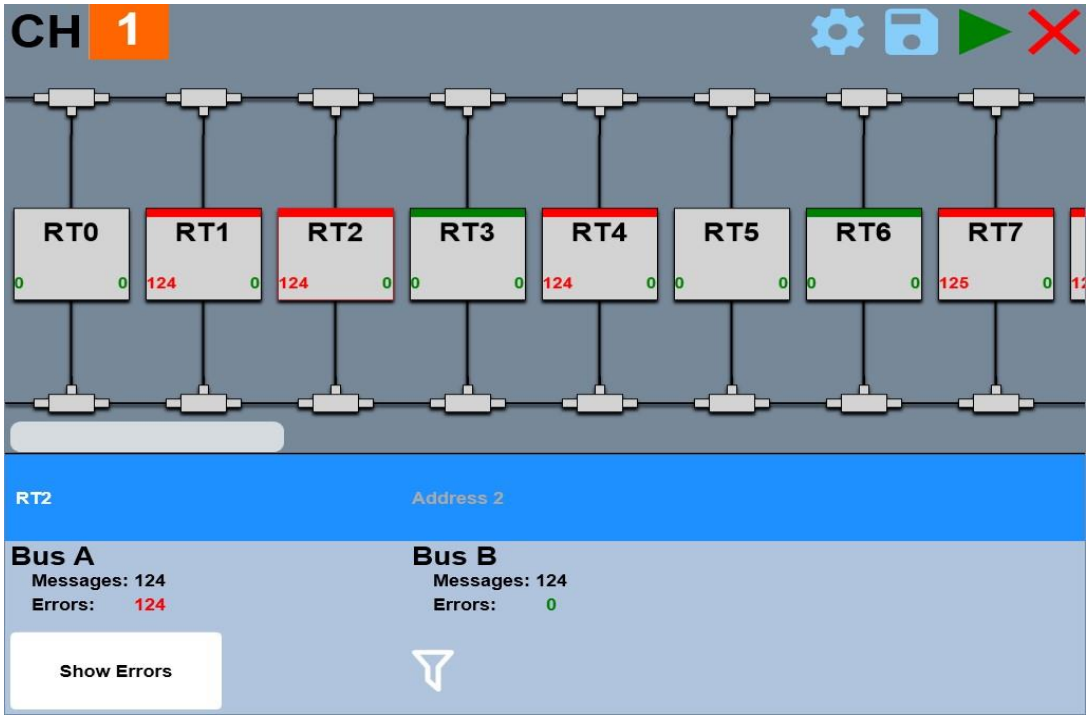


Figure 3 Example of Text box

Bus Interface Monitor

1.5. 1553 Bus Monitor Overview



The CORVUS bus monitor function provides features for dynamic MIL-STD-1553B bus analysis. This allows the user to quickly configure CORVUS and analyze the operation of the bus to identify bus loading and errors for a given set of up to 32 remote terminals (RT).

The CORVUS Model 300 bus monitor function may monitor up to one data bus in the configuration that reflects the actual topology of the aircraft.

During 1553 bus monitor testing on aircraft, the busses under test must be powered and active.

The bus monitor collects and displays bus health in an easily viewable format, to provide diagnostic capabilities for MIL-STD-1553B bus networks. This is accomplished using a non-intrusive monitor, which analyzes the bus traffic in comparison to MIL-STD-1553B protocol.

The CORVUS bus monitor GUI allows the user to define the bus topology in a graphical format representing the relative physical positioning of the various remote terminals on the bus. The bus topology can then be used to display bus statistics in an easy to read, color coded display.

1.6. Starting A Bus Monitor Session

To start, locate the CORVUS 1553 connectors on the connector panel. The Model 300 will have two triax connectors labeled “Pri” & “Sec” for 1553 Bus monitoring. (Shown in *Figure 1*)

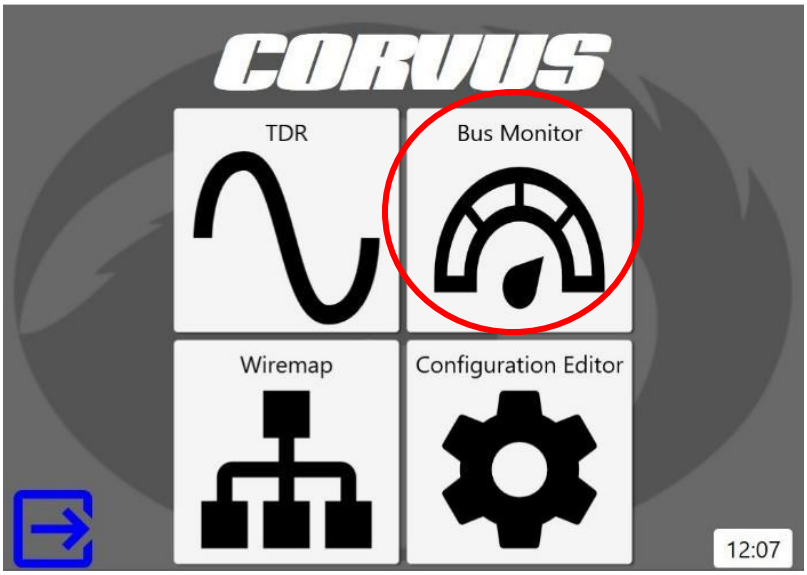


Figure 4 Bus Monitor Icon

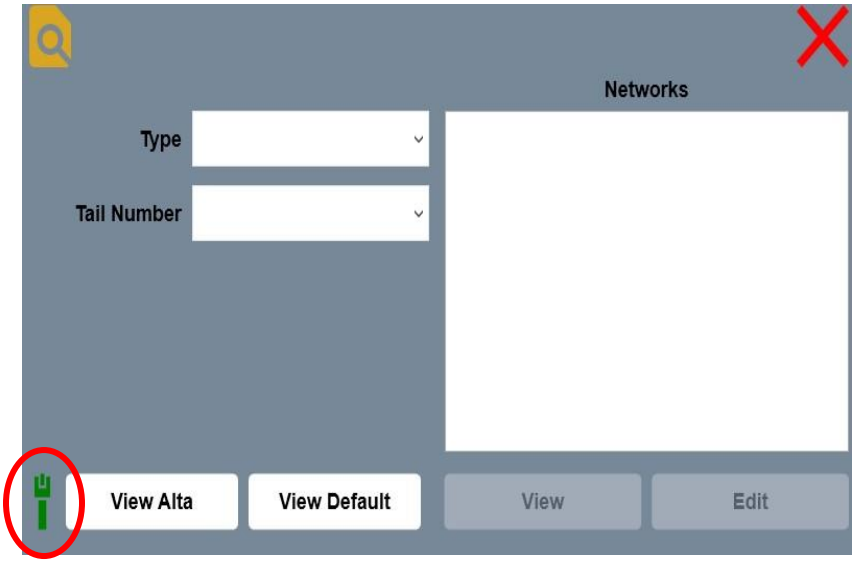
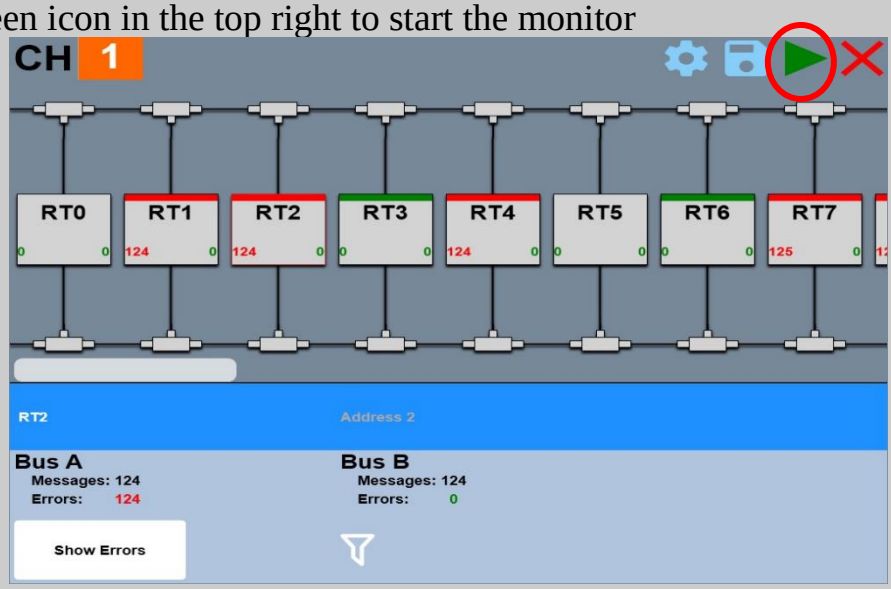


Figure 5 Bus Monitor Landing Screen

1	**Select** the bus monitor icon. Wait while the bus monitor test loads
2	Ensure the bottom left icon on the landing screen is green (shown in *Figure 6*)
3	**Select** the "view default" button
4	**Observe** a full, default bus with 32 terminals addressed from 0-31
5	**Select** the green icon in the top right to start the monitor 
6	**Select** the channel you wish to observe in the top left
7	**Select** a terminal with activity, indicated by status icons in the top and bottom of each terminal

1.7. Interpreting Bus Monitor Data

The bus monitor application is designed to present the relevant data for the configured bus for at-a-glance diagnostic. Once a monitor session has started, bus data quality indicators will be displayed on each terminal.

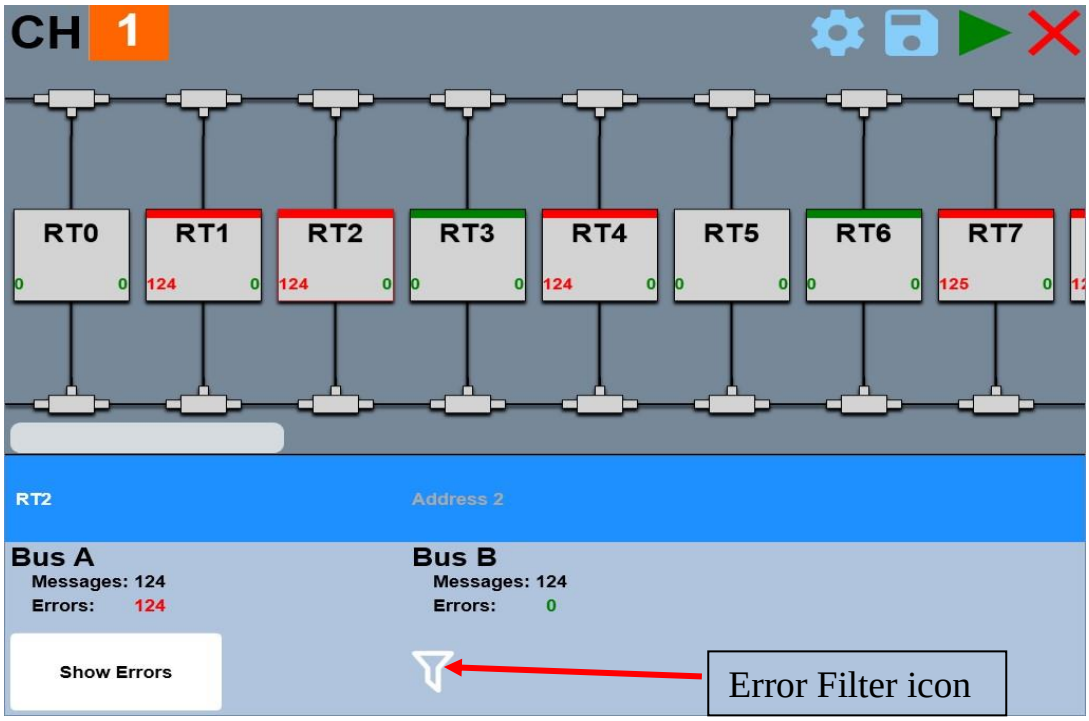


Figure 6 Example of a monitor session

The top section of each terminal represents the primary bus data quality for that terminal. Likewise, the bottom section represents the secondary bus data quality. A green bar represents good data with no errors while a red bar represents one or more errors. If a terminal has no activity on a bus, there will be no color.

There is a numeric indicator on each terminal with the total number of errors received during the current session. This allows the user to interpret and diagnose previous errors in the session.

Selecting a terminal will display the data for that terminal in a log at the bottom of the screen.

1.8. Filtering 1553 Data

The 1553 bus monitor function also allows filtering out any unwanted data. Once a custom bus configuration is implemented, only data for configured terminals will be included. Errors that are inconsequential to the user may be filtered out by configuring the error filter.

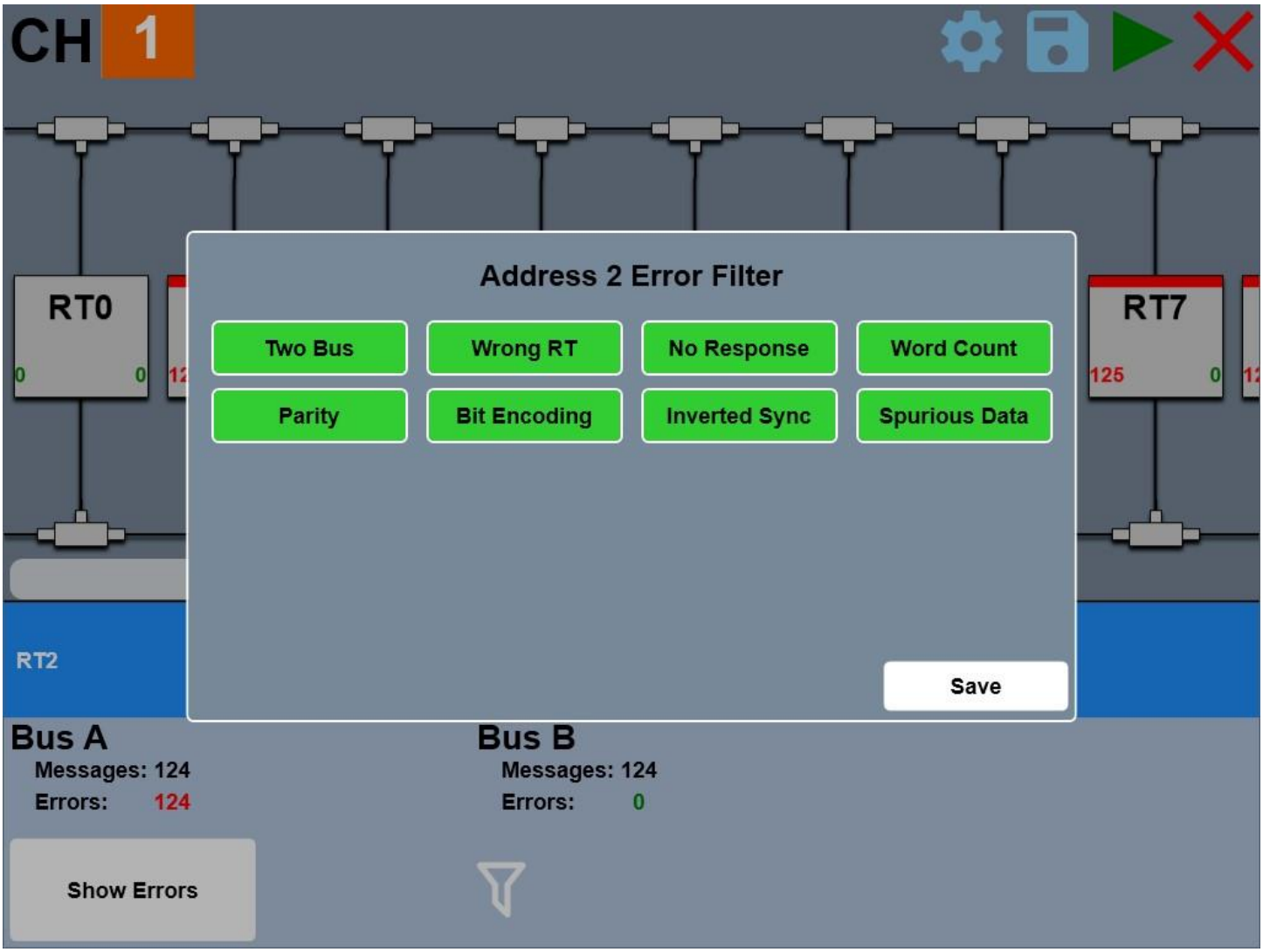
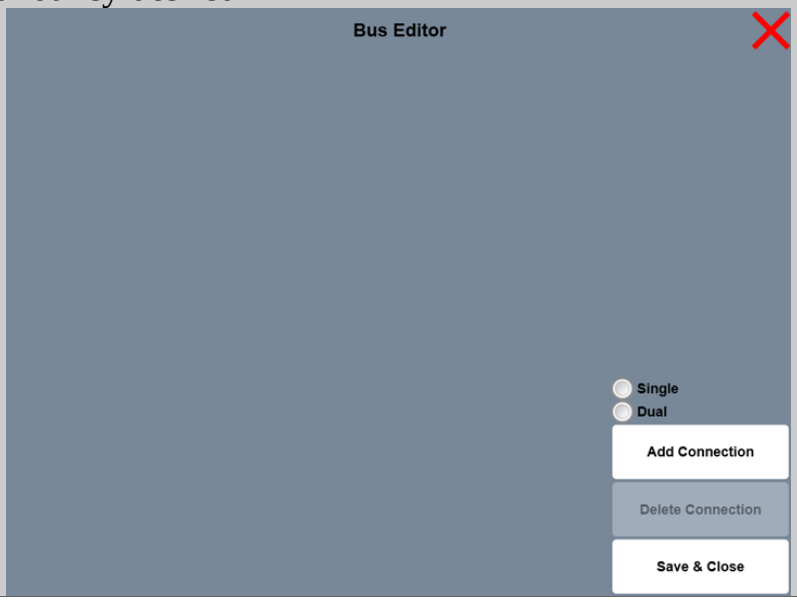


Figure 7 Bus Monitor Error Filter Popup

1.9. Custom Bus Layout

The CORVUS bus monitor GUI allows the user to define the bus topology to represent the relative physical positioning and metadata of the remote terminals and couplers on the physical bus. The bus topology can then be used to display bus statistics in an easy to read, color coded display that more closely resembles the physical bus.

A database is required to customize the bus topology. This can be generated in the configuration editor application from the main screen. See the Software Setup section for more information.

1	**Select** the file icon in the top left of the bus monitor landing screen
2	**Select** your database from the file explorer and **select** open
3	**Select** the aircraft type, aircraft, and network you wish to customize
4	**Select** edit
5	**Select** the bus redundancy desired 
6	**Select** the "add connection" button for each terminal the physical bus contains
7	**Select** each terminal and edit the name, address, and order as desired
8	**Select** the save & close button
9	**Select** view on the main screen
10	Follow instructions in starting a bus monitor session to see your filtered, relevant data

1.10. Exporting 1553 Data

The CORVUS can export the metadata and raw data words from a bus monitor session to CSV from the 1553 monitored data. This requires an SD card to remove the data from the system.

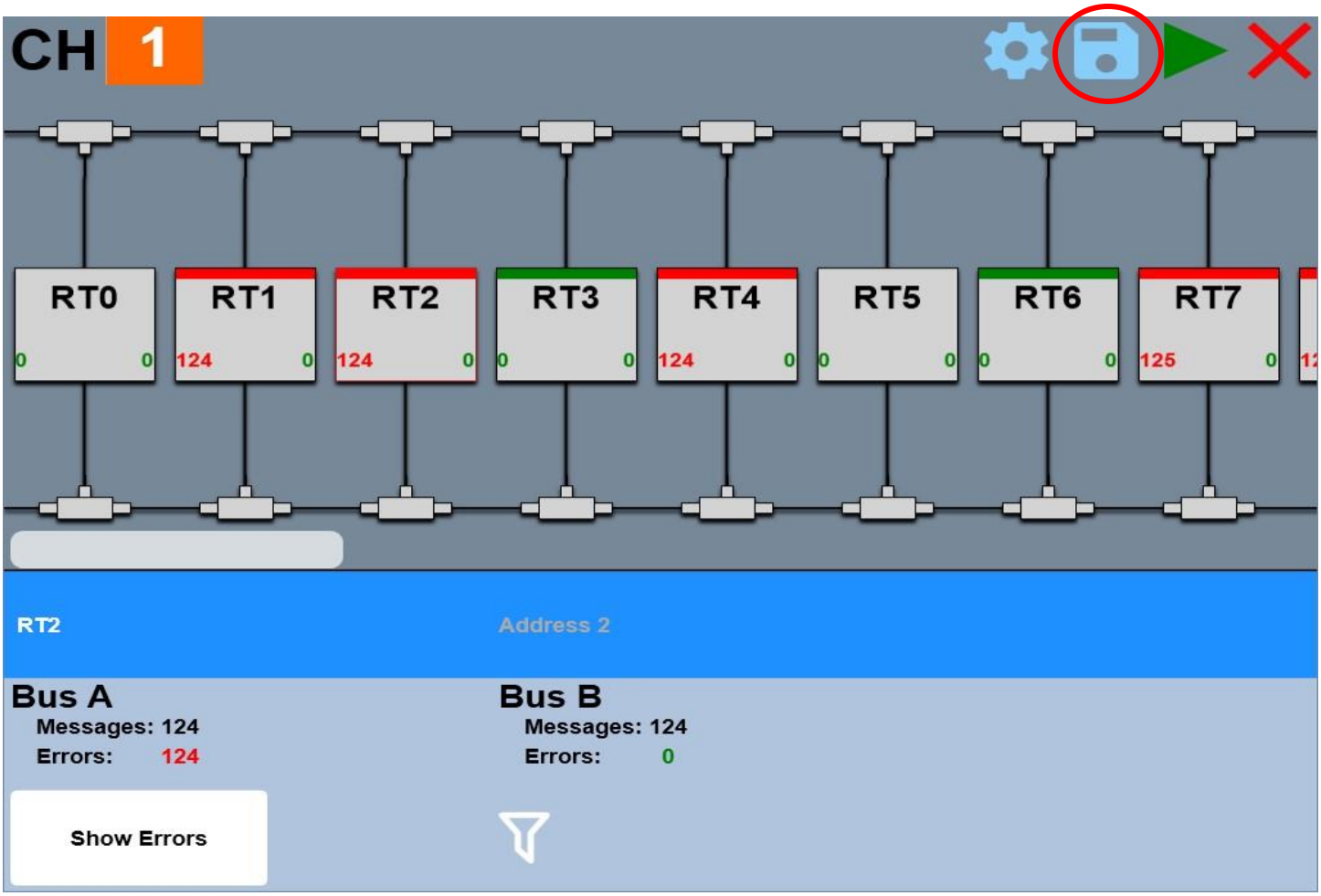


Figure 8 Save Icon After Bus Monitor Session

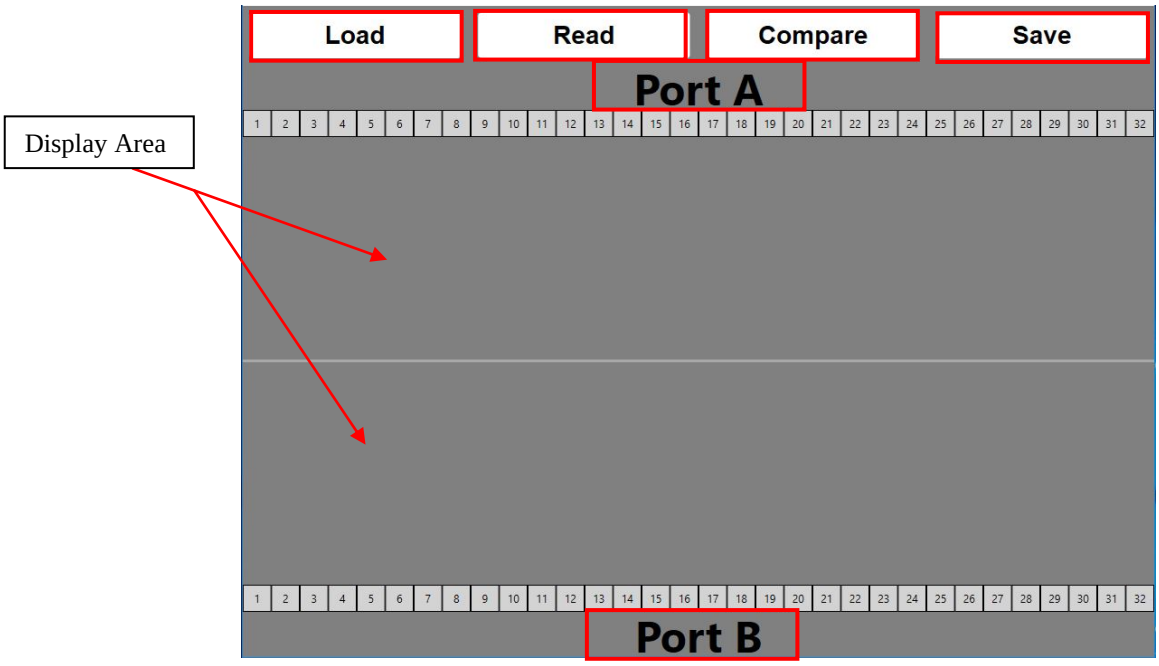
After a bus monitor session has been stopped the save icon will enable if any data was captured. Selecting this icon automatically exports to the SD card under:

<SD-root>/DragoonITCN/CORVUS/1553Exports/yyymmdd-time-1553BusData.csv

2. Wiremap

2.1. Wiremap Test Overview

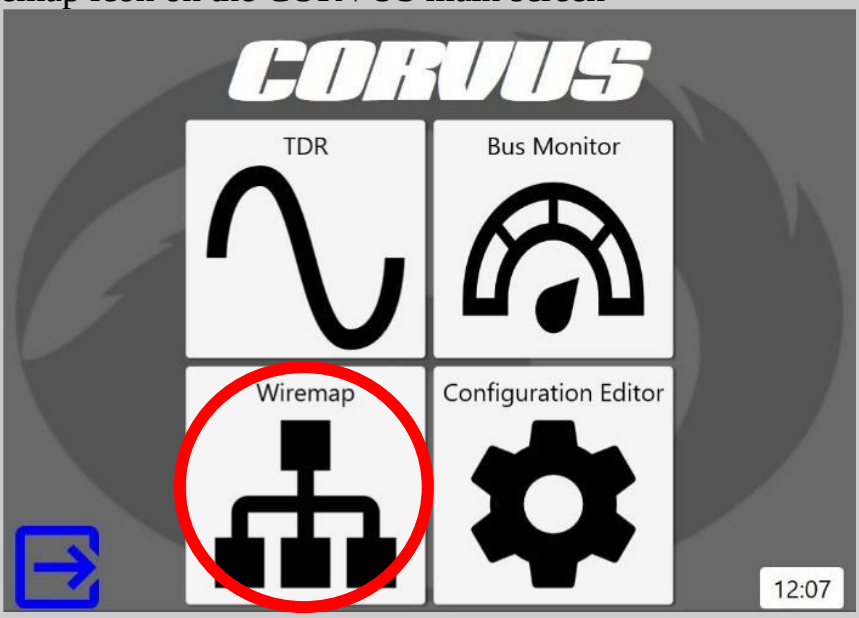
The wiremap test is used to determine if a cable is wired properly by performing continuity checks on all conductors. The CORVUS unit will scan the test cable for point-to-point conductors and display found connections in the UI. The user can compare a historical golden-standard wiremap to the currently connected cable to display any potential faults in the cable assembly. This includes shorts, opens, or misconnected wires.



Load	Loads a reference scan
Read	Takes a single scan of currently connected cable assembly
Compare	Compare current scan with a reference scan
Save	Saves current scan as a reference
Port A	Display connection corresponding with the Port A connector pins1-32
Port B	Display connection corresponding with the Port B connector pins1-32
Display Area	This area will display which pins are connect to each other.

2.2. Performing a Wiremap Test

Once an adapter has been built, the test is very simple to run.

1	**Select** the wiremap icon on the CORVUS main screen  *Figure 9 CORVUS Wiremap Main Screen Icon*
2	**Select** the "read" button to scan the cable's conductors. A screen like the figure below should populate.

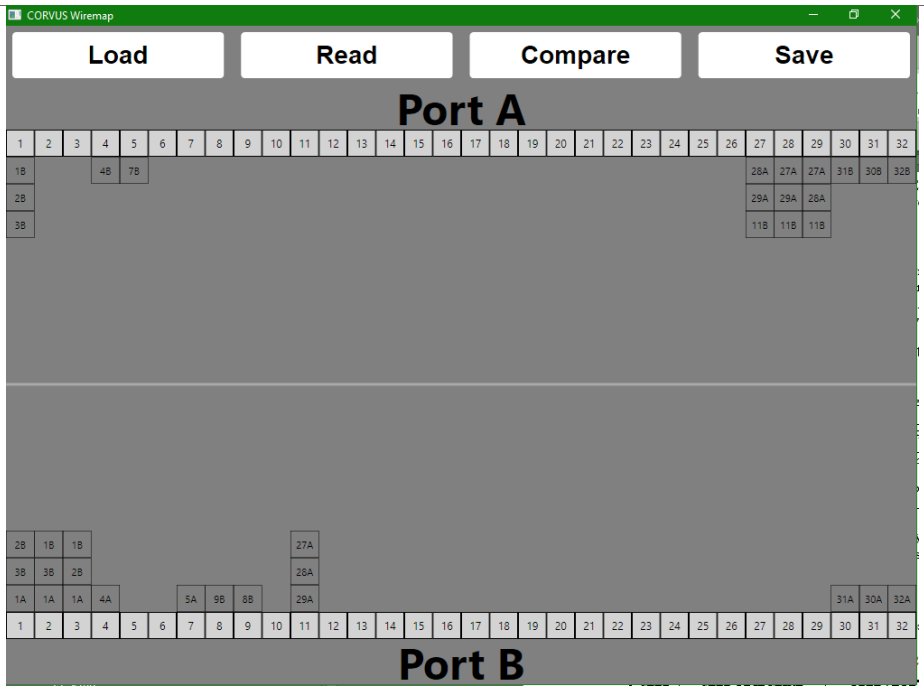
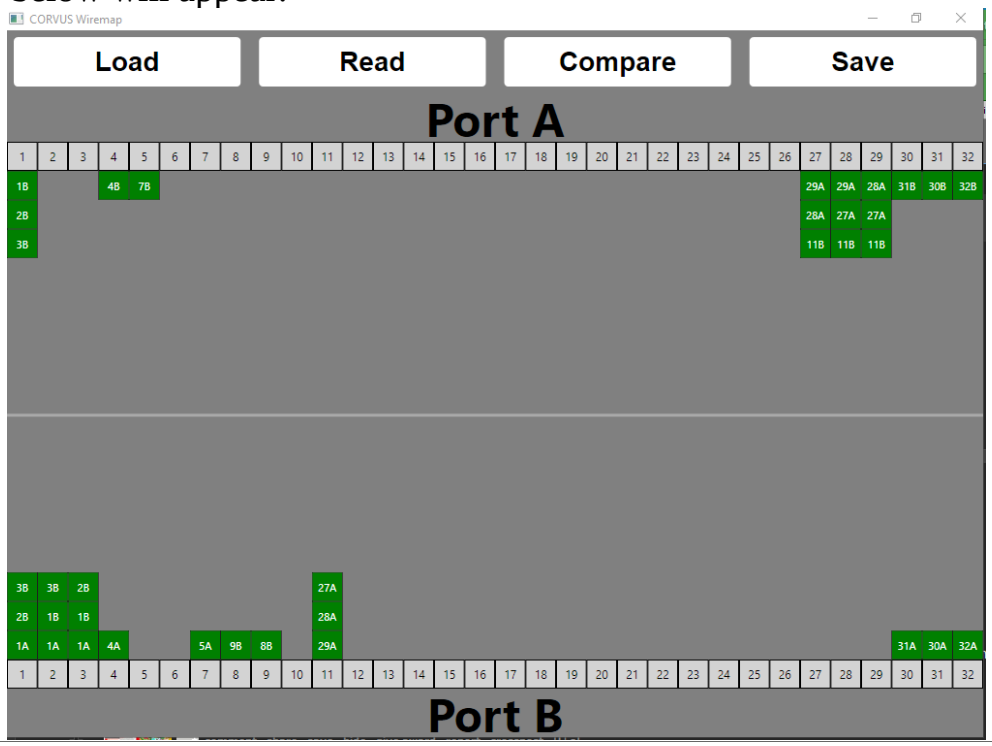


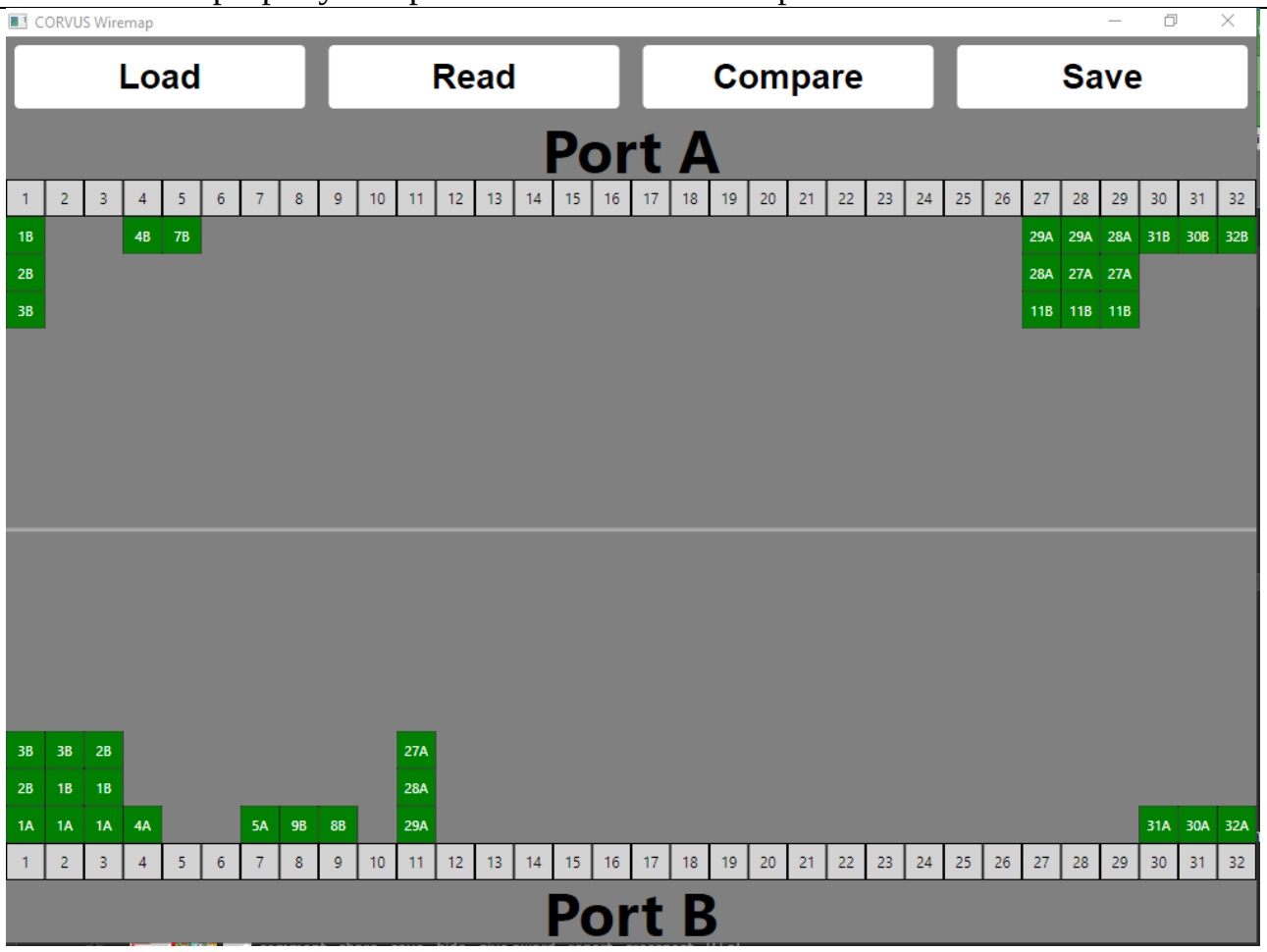
Figure 10 Collected Wiremap Data

3	**Select** the "Save" button. **Enter** a filename to accurately label the wiremap data. **Select** the "compare" button and **Select** the file you just saved. A screen similar to the figure below will appear.

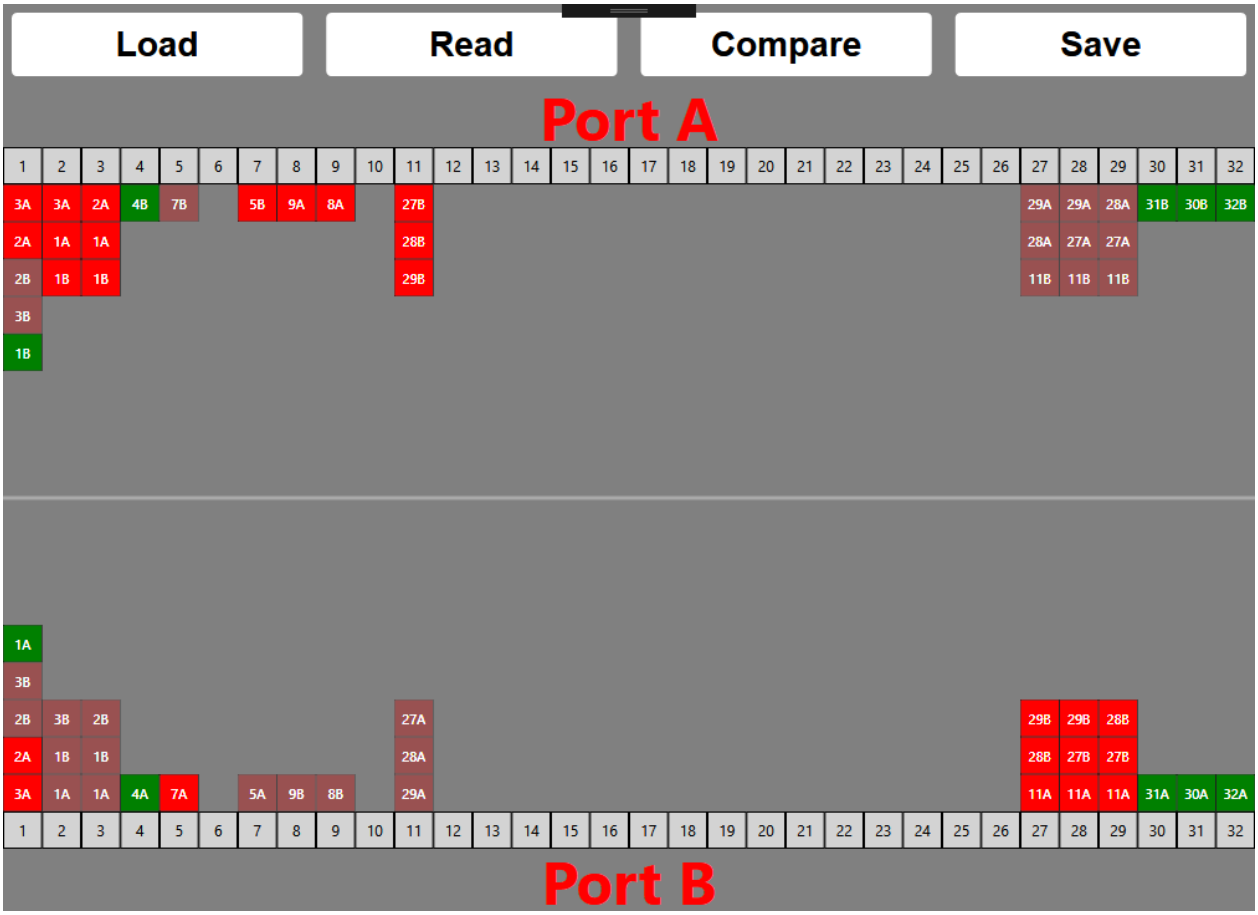


2.3. Interpreting Wiremap Test Results

Below is a properly compared cable with no unexpected or missed connections.



Below is a figure representing an incorrectly fabricated cable. Dark red connection squares represent connections that are expected to be there but are not. Light red connection squares represent connections that are in the source cable but not the compared historical wiremap.



2.4. Wiremap Interface Cable Construction

For the wiremap function to be fully utilized adapters for each end of the cable under test must be fabricated. The Corvus unit uses two D-Sub 37 connectors for the wiremapping interface. Wiremap A connector is shown in the wiremap application as Port A pins 1 through 32. Wiremap B connector shown in the wiremap application as Port B pins 1 through 32. The following shows the pinout of the Wiremap A and Wiremap B connectors as viewed from the topside of the Corvus connector panel.

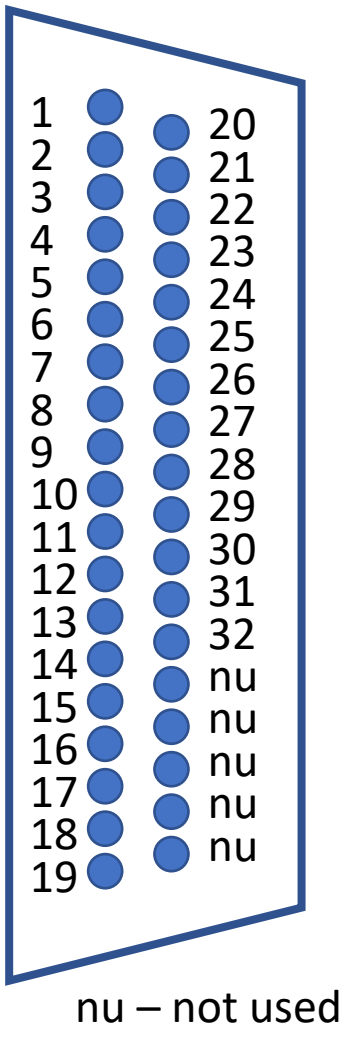


Figure 11 Wiremap Connector Pinou

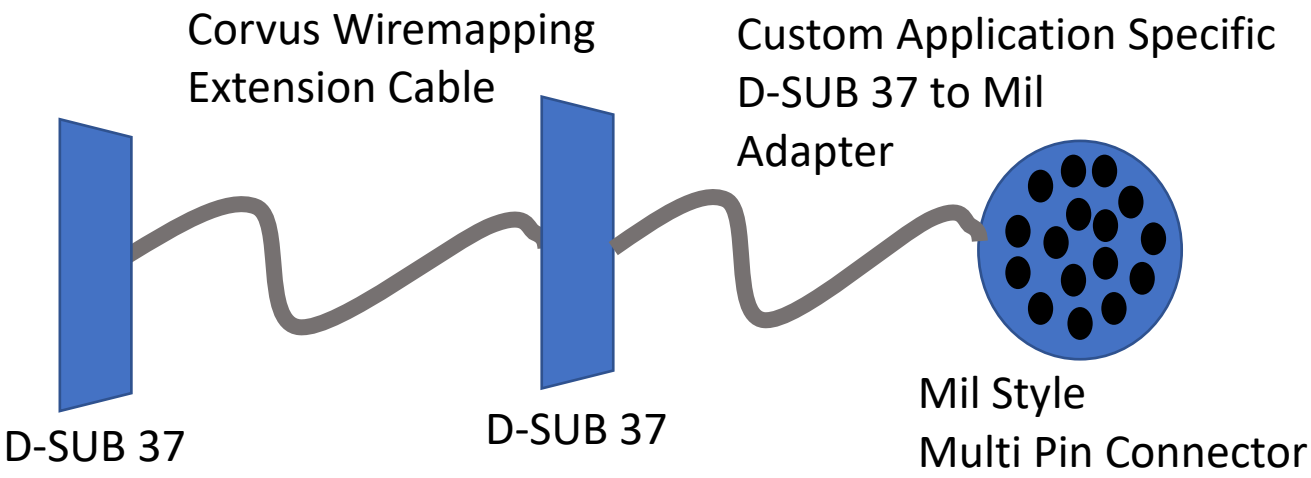


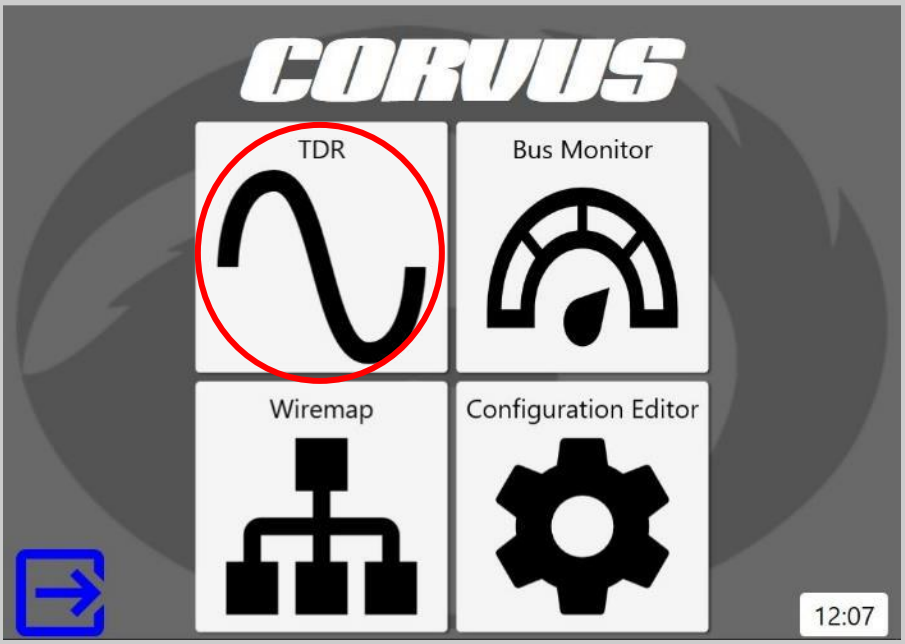
Figure 12 Wiremap Custom Adapter Example

3. Time Domain Reflectometer (TDR)

3.1. TDR Test Overview

The TDR application is used to isolate wiring shorts and opens on a cable assembly. The ability to compare reference data allows the user to view TDR traces taken from a previously known good cable network so that comparisons may be made to the active trace.

3.2. Performing a TDR Test

	Select the TDR icon on the CORVUS main screen  *Figure 13 TDR Application Icon on Main Screen*
	Wait while the TDR application initializes. Single/Run buttons will enable once ready.

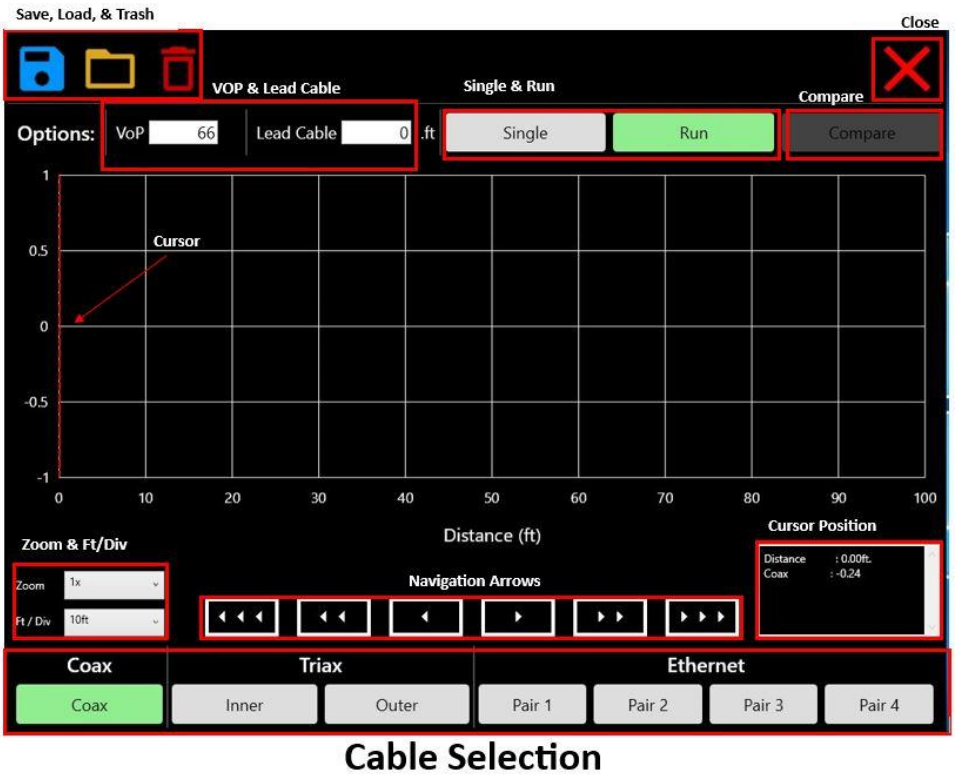


Figure 14 Initialized TDR Application

Connect the lead cable to the corresponding TDR connections on the top panel.

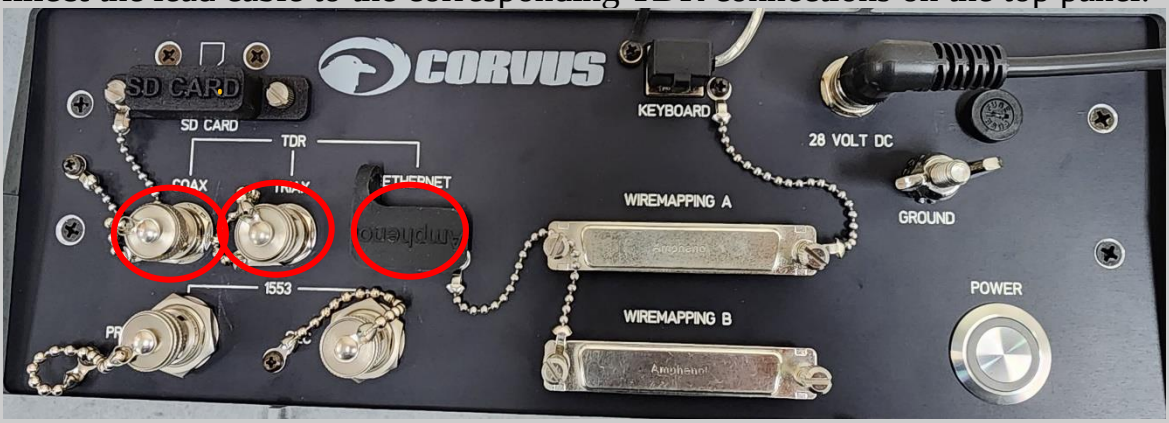


Figure 15 CORVUS Top Panel with Accented TDR Connections

Connect the other end of the lead cable to the cable under test.

Enter the lead cable length value and VoP value for the cable under test. Adjust distance value as necessary.

Select Single/Run. Run will continuously trace the cable under test.

3.3. Interpreting TDR Trace Data

The figure below is an example of a trace of a good 50ft Coax cable with no shorts.

Figure 16 Example 25ft TDR Ethernet Trace

The figure below is an example of an outer and inner triax trace. The cable is 100ft long but there is a short in the inner triax at 50ft.

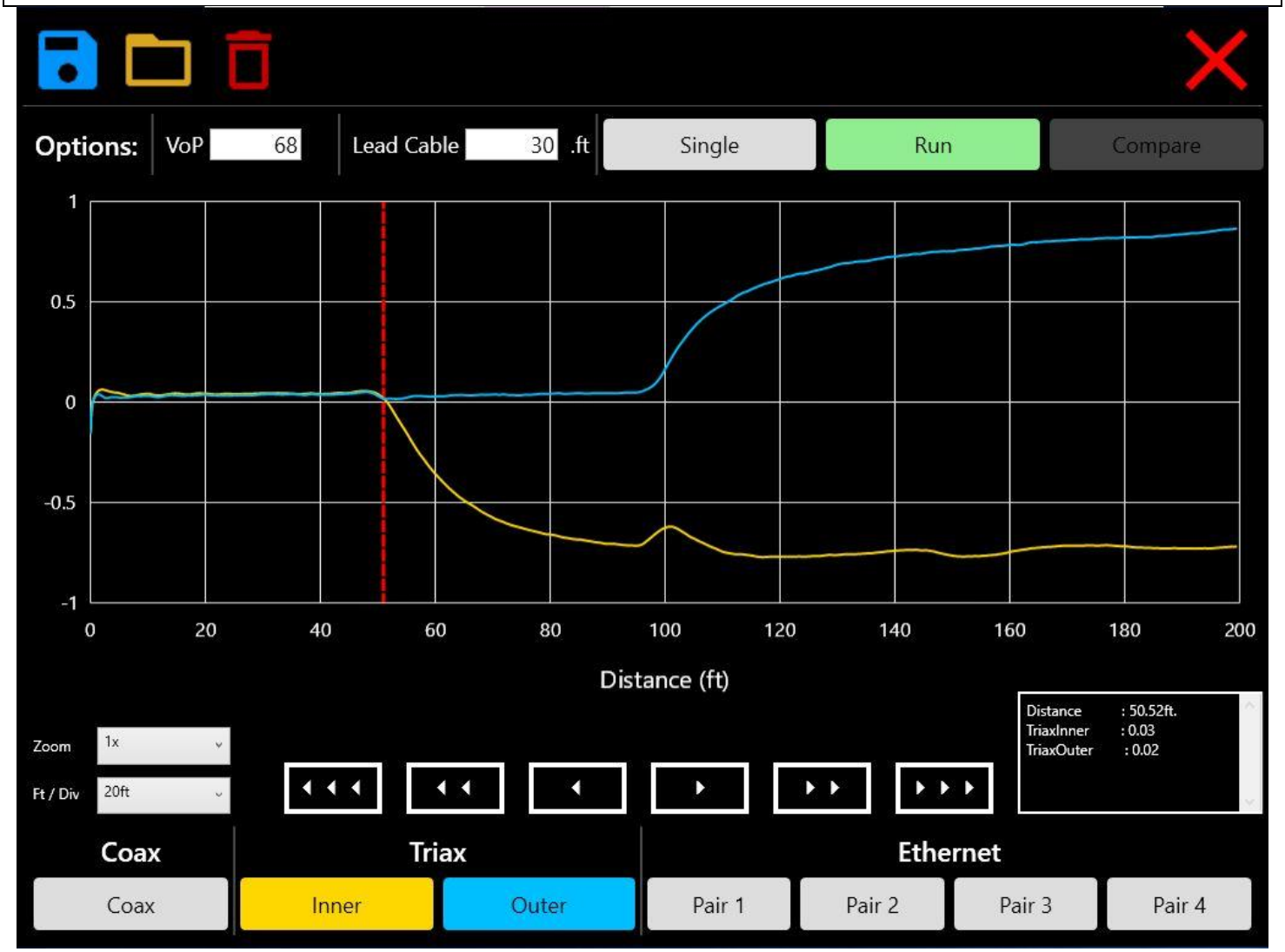


Figure 17 Example TDR Trace of Triax Inner & Outer with Short at 50ft on Inner

Example of a triax inner & outer trace with no shorts.

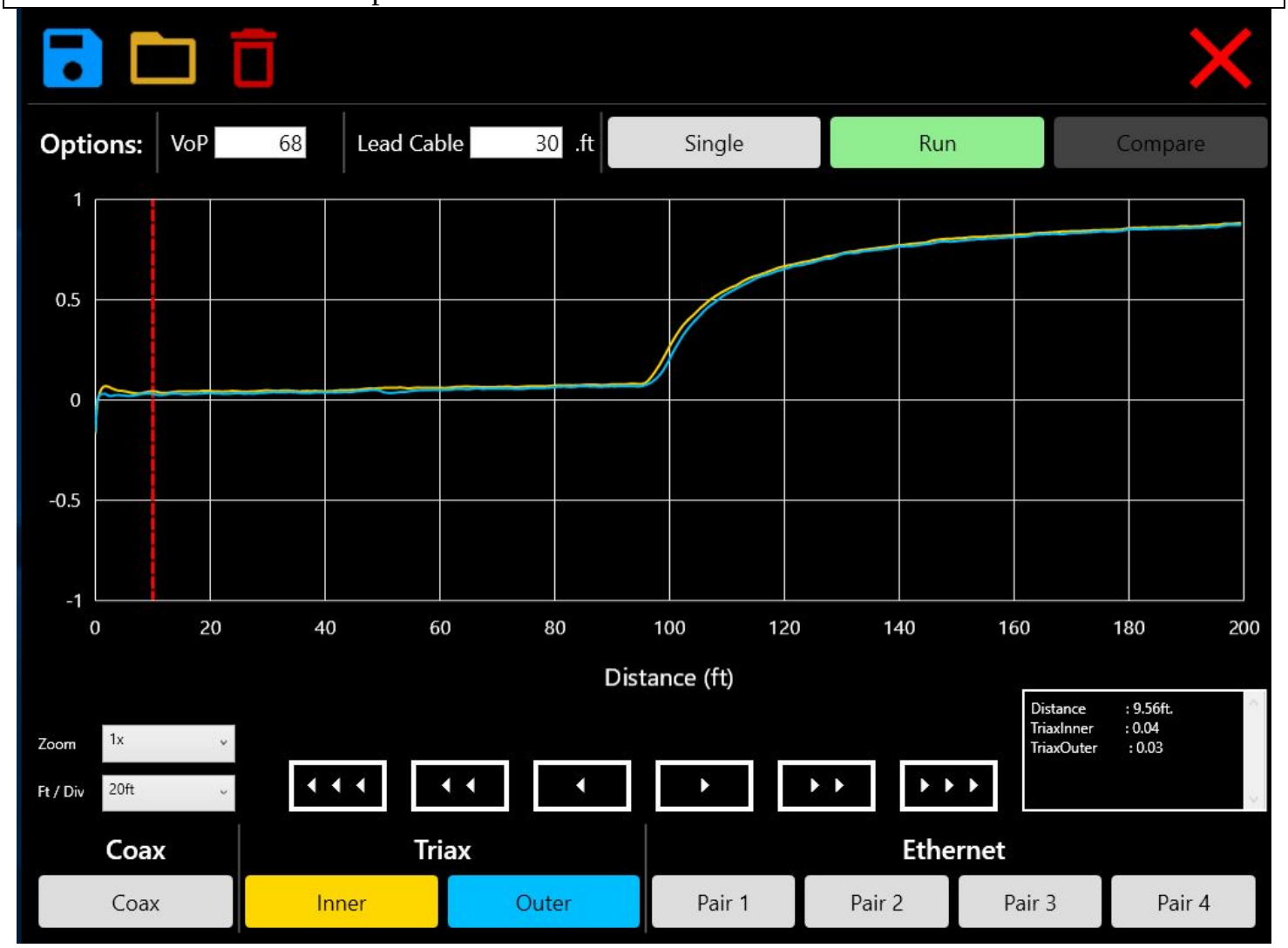


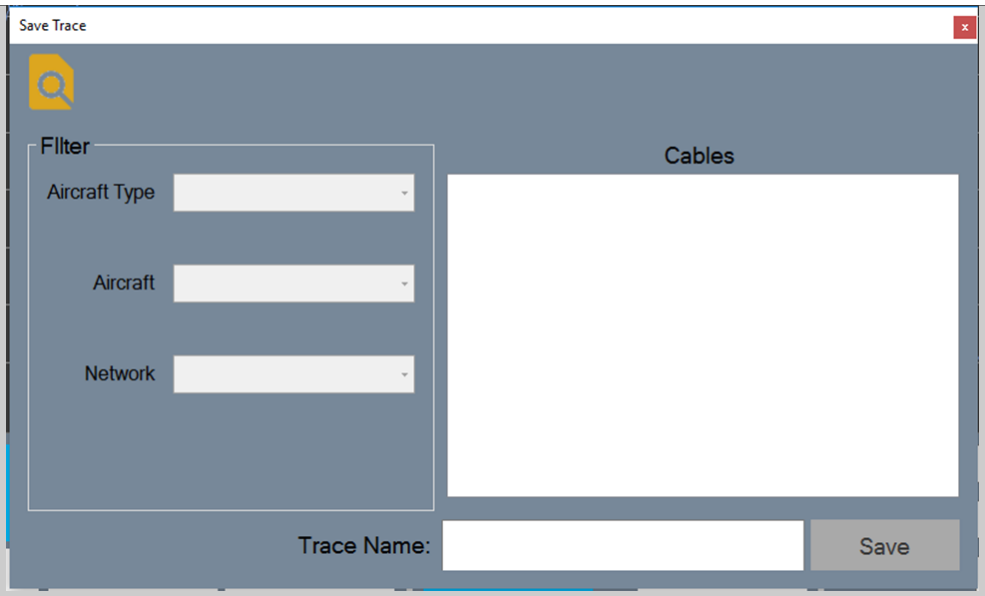
Figure 18 Example TDR Trace of Triax Inner & Outer with No Shorts

3.4. Saving a TDR Trace

1	Follow instructions for performing a TDR Test & Creating a Database
2	**Select** the blue save icon in the top left.

Figure 19 TDR Application Save Icon

3	**Select** the yellow file icon in the top left of the popup

	 *Figure 20 TDR Application Save Trace Dialog*
4	**Navigate to** and **Select** your database file in the file explorer. **Select** open
5	**Select** the cable you wish to store your trace under. Filtering is possible on the left. Cables may have any number of trace sets associated with them.
6	**Enter** a name for the trace
7	**Select** the "Save "button
8	The save dialog will close and the trace is now saved to that database for recall.

3.5. Loading a TDR Trace

1	Follow instructions for Saving a Trace
2	**Select** the load icon in the top left.  *Figure 21 TDR Application Load Icon*
3	The load dialog will appear.

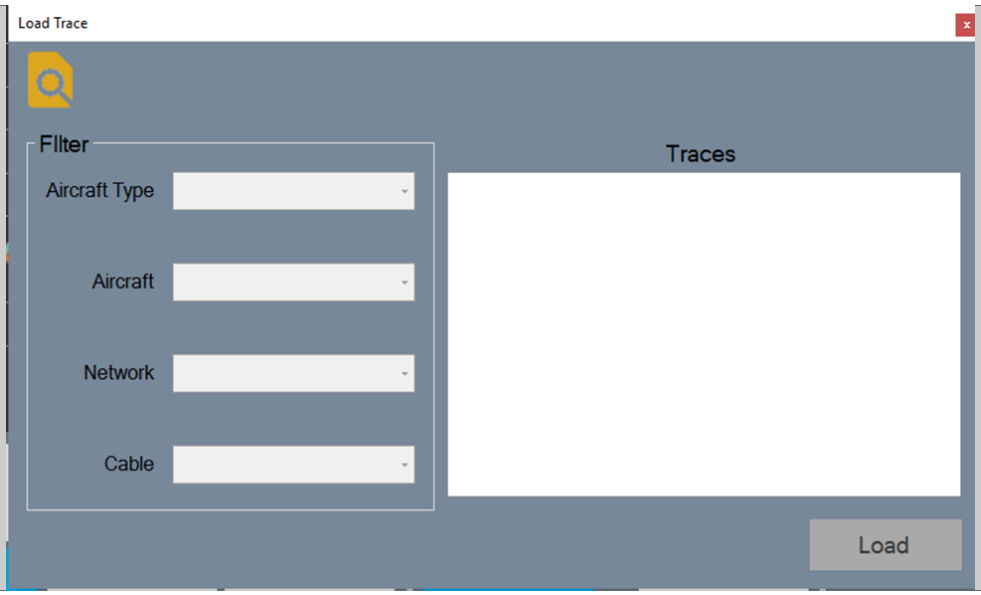
		
4	**Select** the file search icon in the top left.	
5	**Select** the database with a saved trace	
6	**Select** the trace desired. Filtering is available on the left.	
7	**Select** the "Load" button	
8	**Observe** as a faded trace will be plotted on the graph. This will persist through new traces until deleted.	

Figure 22 Load Trace Splash screen

3.6. Removing a TDR Trace

To remove any loaded or captured traces **select** the trash can icon on the TDR screen

Figure 23 Removing TDR Trace

4. Configuration

4.1. CORVUS Unit

The CORVUS unit is shipped in a Pelican transit case with custom foam inserts. Only the CORVUS unit is in the case.

4.2. Adapter Cables

A second Pelican case is supplied with CORVUS to house the Power Supply and Adaptor cables. The adaptor cables are critical to the CORVUS operation as they provide the physical interface between the CORVUS Unit and the test target. Pictured below from left to right are: CORVUS Power Cable, 1x 50 ft TDR Lead Cable (Coax), 2x 5 ft Wiremapping Cables, 1x 50 ft Grounding Cable, 2x 50 ft TDR Lead Cable (TRIAX), 1x 50 ft Ethernet Cable

Figure 24 Power Cable

Figure 25 50 ft Coax Cable

Figure 26 5 ft Wiremapping Cable

Figure 27 50 ft Grounding Cable

Figure 28 50 ft Triax Cable

Figure 29 50 ft Ethernet Cable

5. Software Setup

5.1. Creating a Database

1	**Select** the configuration editor icon on the CORVUS main screen
2	**Select** the + sign under Aircraft Type and **enter** an Aircraft Type in the popup and **select** Save. When supporting several aircraft type this helps to properly group the cable assemblies and networks.
3	**Select** the + sign under Tail number and **enter** the tail number of the aircraft the cable assemblies will be tested and select Save.
4	**Select** the + sign under Bus and **enter** a Bus name for the specific Bus to be tested. **Enter** the cable type and **select** Save.
5	**Select** the + sign under Cable and **enter** a specific cable assembly name or number to be tested. **Add** additional information such as cable length, and default VoP. Cable segments and their lengths can be added as well.
6	**Select** Save and **Enter** the file name of the new database to create.
7	**Select** Save to save this database or cancel to discard.
8	The new database is now created and saved to the selected location.

5.2. Loading and Editing a Database

Existing databases may be loaded into the configuration editor in order to makes changes or additions. Once loaded, changes are persisted automatically to the file

1	**Select** the configuration editor icon on the CORVUS main screen
2	**Select** the load button.
3	**Select** the desired database file.
4	Make changes as necessary, described in Creating a Database
5	**Close** the Configuration editor by selecting the X in the upper right-hand corner.

6. Troubleshoot/Service

DragoonITCN is committed to providing superior service and troubleshooting assistance to its customers.

6.1. Contact Information

In case of issues that are not addressed in this manual, please call Tim Myers at DragoonITCN at 937 439 9223 x 211. Email at tmyers@dragoonitcn.com

6.2. FAQ

What if the CORVUS unit fails to boot up?

Ensure the +28VDC is applied from the AC adapter or battery pack.

What if my screen is completely black but there is a faint outline of the main screen?

Reboot the machine. If the issue persists, contact DragoonITCN.

What if the TDR application fails to sweep the cable?

Ensure the graph is fully zoomed out. If it is, restart the application. If the issue persists, reboot the CORVUS.

What if the TDR application fails to switch connections when requested?

Reboot the CORVUS. If the issue persists, contact DragoonITCN.

What if the TDR graph has a red X?

Restart the application.

What if the bus monitor landing screen has a red connection icon?

Restart the CORVUS. If the issue persists, contact DragoonITCN.

What if I don't know my cable length for TDR?

If you have an accurate VoP value, set the cable length to 300ft+. The only negative to this solution is reduced quality in signal data when the graph is zoomed in. The TDR captures the same number of data points regardless of cable length.

What if I don’t know the cable VoP for TDR?

If you know the cable type and have a matching lead cable, set the lead cable value to 0 and take traces with varying VoP values until the trace reads open at your lead cable length. If you know the cable type and dielectric you can use this formula $V_p = \frac{1}{\sqrt{\varepsilon}}$

(1 divided by the square root of the dielectric constant).

7. Modifications

7.1. How to Update New Software

DragoonITCN will be developing a methodology for the user to upgrade the SW on CORVUS as part of PMEL while maintaining cyber security (i.e. no direct connection to Internet).

Using the SD card, periodic SW updates can be executed as CORVUS matures.

It is not recommended that the user open the CORVUS case for repairs.

8. Glossary of Terms

CORVUS - is an integrated test tool designed to enable complete cable integrity testing along with MIL-STD-1553B bus monitoring.

Bus Monitor - This application processes statistics about MIL-STD-1553 busses and displays it in a simple and easy to understand GUI format.

MIL-STD-1553B - is a military standard defining the characteristics of a serial data bus to be used for avionics. MIL-STD-1553B uses a differential, bi-phase Manchester encoded signal to reliably transmit data without a clock signal and supports up to 31 Remote Terminals and a Bus Controller.

Reference Trace - is a stored set of plotted data, characterizing a single cable. The software suite allows for multiple reference traces to be stored for each cable and allows for the analysis of cabling by comparing current conditions to past, saved references.

Time-Domain Reflectometry (TDR) – A measurement technique used to determine the characteristics of electrical lines by observing reflected waveforms. TDR is used to analyze electrical transmission media such as twisted pair cabling.

Terminator - Resistive electronic component designed to be connected on either end of a data bus, to minimize signal reflection.

Velocity of Propagation (VoP) - The percentage of the speed of light at which electrons can travel in each conductor.

RT – Remote Terminal

Figures