Tarsus3 and Bald Eagle RF User's Manual

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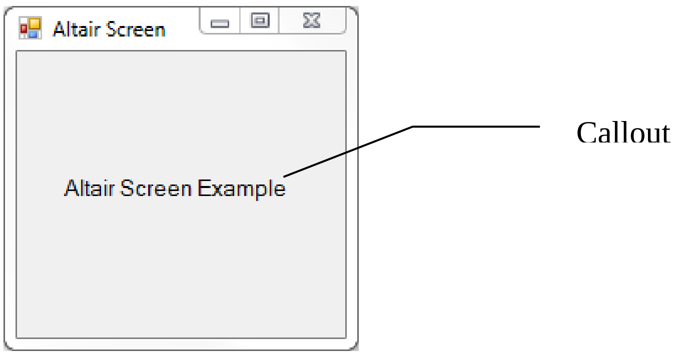
About this Manual

Conventions

Screen Instructions

Many ALTAIR software screens are shown throughout the manual. The screens are shown as graphical images with callouts on the left and right sides and lines pointing to specific features. The callouts indicate features and controls that are normally not explained in the step by step instructions for the screen.



Caution Notes

The caution sign is used throughout the manual to help clarify operational procedures and result from operations that may not be intuitively clear. The intent is to save the user time and eliminate frustration during the setup and operation of the Ulyssix system.

Special Features

Special features are advanced options that the Ulyssix engineers have developed to help customers solve complex problems, minimize setup problems, help in troubleshooting, and bring PCM equipment to the forefront in technology. Special features are indicated throughout the manual by the light bulb icon.

Menus Paths

Menus are a set hierarchal commands used to open windows or perform commands. Using menus usually consist of a multi-step process of selecting the top-level menu, then its sub-menu, and possibly sub-sub-menus. The multi-step menu process is used throughout the ALTAIR software and throughout this manual and is referred to as the menu path. All references to menu paths are indicated by ***Bold Italic*** text and each step is separated by the back-slash character “\”.

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Chapter 1 Introduction

1.1 Overview of Tarsus3 Hardware

The Digital Signal Processing (DSP) based Tarsus3 PCM Processor Board is a multi-mode PCM processor board that contains a DSP implemented digital Bit Sync/ Frame Synchronizer (Bit Sync / Frame Sync), IRIG Class II PCM decommutator (Decom), PCM simulator (Simulator), IRIG Time Code Reader, and optional Viterbi Decoder designed in the cPCI or PCIe form factor. By using state-of-the-art DSP dedicated Field Programmable Gate Arrays (FPGA), the Tarsus3 is the most flexible and technically advanced PCM Processor board available. The functional blocks (i.e. Bit Sync, Decom, Simulator, etc.) of the Tarsus3 can be used individually, or as a seamless combined PCM processing system. All the circuitry for the PCM Processor Board is located on a single PCB, eliminating the need for any mating daughter or add-on cards.

By using DSP based algorithms including Finite Impulse Response (FIR) filters, multi-stage recursive decimation filters, Modulated Numerically Controlled Oscillators (MNCO) and DSP implemented Phase-Locked Loops (PLL), the Tarsus3 Bit Synchronizer requires no calibration or tuning. A user-friendly Windows GUI (Graphic User Interface) based software is supplied for easy product installation into a Windows based host computer system. DSP algorithms are implemented in state-of-the-art FPGAs allowing for rapid enhancements or customization. There are two independent input serial bit stream inputs that are user selectable and received in analog form, conditioned with a digital auto gain control circuit, and then fed into a sophisticated anti-alias filter prior to a 14-bit digitizer.

The Tarsus3 Decommutator supports all the IRIG Class II features, including variable word length from 3 – 64 bits per channel, format switching, parameter concatenation, and asynchronous embedded formats. The input serial bit stream to the Decom is either TTL or RS-422 differential levels with input data rate capability from 1 bps to 40 Mbps for NRZ-L/M/S, RNRZ-L and 1 bps to 20 Mbps for Bi-Φ L/M/S. Two on board 12-bit DACs are standard features that give the Tarsus3 standalone word selection analog capability. The word-by-word parallel output of the Tarsus3 is available to the user to the user in several different forms through a high-speed memory buffering circuit for direct storage to the host computer for post Decom analysis and through many different Windows GUI displays, including oscilloscope/strip chart, FFT spectral, numeric, bar graph, and dials. The PCM Simulator has the same IRIG Class II frame and word features as the Frame Sync and Decom with user definable waveforms or fixed data values on a word-per-word basis.

The Tarsus3 also contains an IRIG Time Code Reader section allowing the user to embed external or internally generated time into the output archive data file of the Decom.

The Tarsus3 has an optional receiver daughter card. The Tarsus3 with the optional receiver daughter card is referred to as the Bald Eagle RF. The receiver includes C Band, S Band, L Band, Extended P Band, P Band, and IF frequency ranges. The IF bandwidth is software programable from 20kHz to 56MHz.

The Bald Eagle RF has an optional transmitter. The transmitter covers C Band, S Band, L Band, Extended P Band, P Band, and IF frequency ranges.

Bit Sync Features:

- Full Bit Sync designs using all DSP filter algorithms in FPGA technology for maximum performance capability.
- TTL and Differential Inputs.
- Accepts all IRIG PCM code types including: NRZ-L/M/S, RNRZ-L, RZ, Bi-Φ L/M/S or RNRZ 11/15, and program selectable.
- Bit Sync programmable input rates from 10 bps to 33 Mbps for NRZ-L/M/S, RNRZ-L, RZ, and 10 bps to 16.5 Mbps for other code types.
- Input signal level from 30 mVpp to 10 Vpp.
- Impedance software selectable (50, 75, or 10k Ohm).
- Less than 1 dB theoretical bit sync BER performance for bit rates up to 20 Mbps, less than 2 dB theoretical for 20 Mbps to 30 Mbps, and less than 2.7 dB to theoretical to 40 Mbps.
- Programmable loop bandwidth from 0.05% up to 3.0%.
- Digital bit sync algorithm update to a full 16-bit 2nd order Costas Loop linear implementation for improved FM/PM jitter fluctuation performance. The jitter peak rejection is specific to the loop bandwidth setting. The jitter rejection is based on the jitter frequency verses the loop bandwidth setting. Jitter rejection is greater than 5 times the loop bandwidth at 250 Hz, 20 times at 1000 Hz, and 40 times at 2000 Hz.
- Two independent sets of outputs (Clock and Data).
- One PCM code converter (uses second output).
- AGC freeze. (Auto Gain Control values “frozen,” to decrease resync acquisition time upon incidence of bit lock loss).
- Diagnostic displays.
- All IRIG PCM code type selectable PCM encoder output capability.

Frame Sync Features:

- Accepts internal from bit sync, or eternal inputs both TTL and RS422.
- Up to 16.7 Mb frame size.
- Frame sync patterns from 16 to 64 bits with all IRIG patterns stored for use or user custom frame sync patterns.
- Allows frame sync bit masking.
- Allows for 50%-bit slips of the entered minor frame size up to 10,000 bit slips (helpful if frame size is unknown).
- Allows sync errors.
- Sync Criteria is selectable.
- Supports Burst Mode:

    - Sync criteria ignored, in lock, as soon as first frame sync pattern found.
    - Eliminates losing the first minor frame.
- Supports Data in Search Mode:
    - Outputs data without frame sync lock.
    - Eliminates data loss.
- Handles both SFID and FCC.
- Frame Dump display allows quick look at the data coming through frame sync.

Decom Features:

- Supports all IRIG Class II Decom features including variable word length 3 to 64-bits variable from channel to channel, frame format identifier (FFI) format switching and random commutation.
- Supports up to eight Asynchronous Embedded Streams.
- Allows frame sizes up to 16.7 Mb.
- Supports two DACs for output to external bit syncs.
- Uses Microsoft style calculator for data processing, or EU conversion.
- Various display types like strip charts, dials, meters, discrete, tabular, bar charts, 3D models, and scopes.
- Drag and drop parameters into existing displays.
- Snap to grid alignment.
- High speed data transfer of user word selected channels to the cPCI or PCIe bus for disk storage and playback.
- Supports PCM streams up to 40 Mbps.
- Simulator with user defined waveform and fixed value channels.
- On card IRIG Time-code Reader for codes A, B, G and NASA 36.
- Two on card DACs for selected words analog output (output two's comp or binary data squelch feature for audio output).
- User-friendly Windows GUI based software for full setup of format frame, word selection and channel display capability.

PCM Simulator Features:

- Outputs bit rates from 1 bps to 40 Mbps (NRZL), or 20 Mbps (Bi-L).
- Outputs all IRIG code types.
- Supports all commutation types (super-, sub-, and normal).
- Built in Forward Error Correction (FEC).
- Output fixed word values or various functions using sine, square, saw tooth, and triangle waves, as well as a counter.
- Can playback (at any bit rate and code-type) frame sync achieved data previously captured (.tad file).

Archiving Data Features:

- Record to hard drive either raw frame sync data, or decom data by highlighting either frame sync or decom, and simply hitting the record button.

- Play frame sync archived data back through the simulator and IRIG time data through DAC1 (Licensed Feature).
- Export decom data in CSV form.

Time Features:

- IRIG time code reader accepts IRIG A, B, G, or NASA36 data.
- Output IRIG Time data in IRIG B or NASA 36 format (Licensed Feature).
- Capable of running off computer time.
- Enable freewheeling and board will interpolate time upon loss of time lock.
- Embedded time can be displayed by concatenating a parameter from all individual words:
    - Set as BCD and embedded time which will open Embedded Time Setup form.
    - Set as BCD time segments to appropriate bits of parameter.

Receiver Features (optional):

- FM, BPSK, QPSK, and SOQPSK demodulation types.
- No tuning and preventative maintenance required.
- Fully digital Demodulator for enhanced capabilities.
- C Band, S Band, L Band, Extended P Band, P Band, and IF frequency ranges.
- DSP implemented IF data bandwidth filtering from 20 kHz to 56 MHz.
- Fully programmable digital FIR output filter can be bypassed for higher PCM data rates.
- FPGA-based architecture allowing for rapid enhancements and customization.
- Digitally time synchronized and sampled output data available for FFT analysis and direct capture.
- Software enable/disable for demodulation of PCM signals without Pre-Mod filters.

Transmitter Features (optional):

- FM, BPSK, QPSK, and SOQPSK modulation types.
- No tuning and preventative maintenance required.
- Fully digital modulator for enhanced capabilities.
- C Band, S Band, L Band, Extended P Band, P Band, and IF frequency ranges.
- FPGA-based architecture allowing for rapid enhancements and customization.
- Software enable/disable Pre-Mod filter for PCM signals.
- Variable output power using a programmable attenuator. Output power from 0dBm to -90dBm depending on selected frequency band.

DEWESoft Advanced Features (3rd party and requires separate license):

- Bald Ealge supports a plug-in in a vast array of possible data sources:
    - Also supports, Video, Analog Data, GPS Data, 1553/ARINC429, CH10 File Recording/Processing or Ethernet UDP receiver/transmitter and Astromed Ethernet Interface
- Very powerful math processing.

- Many different displays, including FFT’s and strip-charts.
- Archive capability in custom .dxd, .tad, or .ch10 formats.
- Post playback capability with post processing math.
- Network data to multiple clients from a single server:
    - All remote clients do not need a DEWESoft software license.

1.2 An Overview of ALTAIR Software Suite

All Ulyssix hardware is controlled by, the Ulyssix Technologies supplied software package called ALTAIR. The software is a Windows based state-of-the-art setup, diagnostic, and analysis software package designed to interface with Ulyssix Technologies hardware product line.

The Windows GUI application is completely developed using "C-#" (pronounced C-Sharp) and runs under the Microsoft .NET environment. The software uses the latest Microsoft technologies to provide a stable, high performance, and user-friendly application. The software will run on Windows XP, Windows 7 32 bit, Windows 64 bit, or Windows 10.

For customers desiring to develop their own software to interface with the Ulyssix hardware, two options are made available: a Dynamic Link Library (DLL) or a hardware interface specification. The DLL module is developed in "C++" and is used by the ALTAIR GUI application to interface with the hardware. The hardware interface specification is a detailed document describing the hardware registers, their definitions, and how they are accessed. Please contact the factory for DLL or hardware interface specifications.

1.3 Specifications

Bit Synchronizer Input Specifications:	
Input Data Rate	Bit Sync programmable input tunable rates from 1 bps to 40 Mbps for NRZ-L/M/S, RNRZ-L and 1 bps to 20 Mbps for Bi-Φ L/M/S
Input Source	Two independent inputs (1 single ended BNC, 1 differential Twinax)
Input Impedance	Hi-Z/75Ω/50Ω, single ended input, software selectable with reed relay isolation
Maximum Safe Input	± 35 VDC
Input Signal Level	30 mVp-p to 10 Vp-p
DC Input Level	+/- 5 VDC
Input PCM Code Type Modes	NRZ-L/M/S, RNRZ-L, RZ, Bi-Φ L/M/S, program selectable (consult factory for other code types)
Derandomizer Input	RNRZ-11/15, forward/reverse, program selectable
Input Polarity	Normal, inverted or auto selectable using frame sync correlator

Bit Synchronizer Data Specifications:	
Loop Bandwidth	0.01% to 3.0%, to the programmed bit rate
Capture Range	+/-3 times of the programmed loop bandwidth
Data Tracking Range	+/-5 times of the programmed loop bandwidth
Sync Acquisition	less than 32-bits, typically 100-bits max
Bit Error Probability	Less than 1 dB to theoretical bit sync BER performance for bit rates up to 25 Mbps, less than 2 dB to theoretical from 25 Mbps to 33 Mbps, less than 2.7 dB to theoretical to 40 Mbps
PCM Encoder Output	TTL and RS422 Level driven
PCM Encoder Code Types	NRZ-L/M/S, RNRZ-L, RZ, Bi-Φ L/M/S or RNRZ 11/15, program selectable
Clock Output	0°, 90°, 180°, 270°

Frame Sync/Decommutator Specifications:	
Input Data Rate	Up to 40 Mbps
Input Signals	TTL Level single ended, RS-422 differential or direct from Bit Sync section of the PCM Processor, NRZ-L and clock
Word Lengths	3 to 64-bits variable from channel to channel
Minor Frame Length	3 to 16,777,216 bits
Major Frame Length	1 to 1024 minor frames per major frame
PCM bit word order	MSB or LSB, word by word basis, program selectable
Frame Sync Pattern	16 to 64-bits
Frame Sync Location	Leading the minor frame
Frame Sync Strategy	Search-Check-Lock, programmable counts per step
Subframe Sync	FCC or SFID
Sync Error Tolerance	0 to 8-bits, program selectable
Bit Slip Window	0 to 9999-bits, program selectable
Data Polarity	Normal or inverted on a channel by channel basis
Embedded Formats	Supports two asynchronous embedded formats or more when running under DEWESoft Software
Fragmented Words	Word combining with up to eight fragments or more

PCM Simulator Specifications:	
Output Data Rate	1 bps to 40 Mbps for NRZ-x, RNRZ-l, or 20 Mbps for all others
Output PCM Code Types	NRZ-L/M/S, RNRZ-L, RZ, Bi-Φ L/M/S, RNRZ 11/15/, forward/reverse, program selectable
Output Signal Levels	Data and Clock, TTL, and RS422 level driven
Word Lengths	3 to 64 bits, variable
Frame Length	Same as decommutator specs
Data Words	Fixed or math functions (sine wave, triangle, square wave, saw tooth, counter) with programmable sample rate

DAC Output Specification:	
Number of Channels	2
Output Level	0 Vpp to 5.0 Vpp, selectable in 0.1 Vpp steps, ± 2.5V offset in 0.1 VDC steps

Time Code Reader Specifications:	
IRIG Code Types	IRIG A, B, G & NASA-36

Receiver Input Specifications:	
Input Frequency Range	C Band 4400 to 5250 MHz S Band 2185 to 2485 MHz L Band 1420 to 1850 MHz Extended P Band 1150 to 1250 MHz P Band 200 to 500 MHz IF 50 to 90 MHz
IF Bandwidth	20 kHz to 56 MHz
Diversity Combiner	Polarization, Frequency, and Spatial
Combiner Modes	Pre-D
Frequency Tuning Resolution	50.0 kHz steps
Dynamic Range	-10dBm to -104 dBm

VSWR Ratio	2:1 typical 2.5:1 maximum
Noise Figure	5 dB typical 8 dB maximum
Max Safe Input	+20 dBm without damage
PM Deviation Range	
Demodulation Modes	FM, BPSK, QPSK, and SOQPSK
Nominal Impedance	50 Ohms
Spurious Rejection	60 dBc
AGC Time Constants	0.01 msec, 0.1 msec, or1.0 msec, selectable
AGC Modes	Automatic, Manual, Freeze
AM AGC Out	AC coupled AM AGC detector output, 50 kHz frequency response, 5 Vpp bipolar or unipolar output.
AGC DC Level Detector	DC coupled from 0 to +/= 4 VDC from min to max RF AGC attenuation

Receiver Demodulator Specifications:	
Data Rates	Up to 20 Mbps (FM) Up to 10 Mbps (BPSK) Up to 40 Mbps (SOQPSK)
Output Linearity	Less than 0.05% of the programmed full deviation bandwidth measured from best 3 point straight line
Output Harmonic Distortion	All harmonic terms are below -56 dB for single carrier sinewave modulation
Output Filtering Modes	Filter Mode: The FIR filter is programmed to be flat within 0.1 dB in the programmed passband and -60 dB attenuation at two times the programmed cutoff frequency. Bypass Mode: The digital and analog reconstruction filters are bypassed for maximum digital data throughput. The data frequency throughput is equal to the programmed deviation filter frequency.
Output Filter Range	Programmable from 1/64 to 1/2 times the IF Bandwidth, four digit resolution with a total range of 100 Hz to 56 MHz.
Wide Bandwidth Signal Tolerant	Software enable/disable for demodulation of PCM signals without Pre-Mod filters.

Transmitter Specifications:	
Data Rates	Up to 20 Mbps (FM) Up to 10 Mbps (BPSK) Up to 40 Mbps (SOQPSK)
Modulation Modes	FM, BPSK, QPSK, and SOQPSK
Output Dynamic Range	30 dB
Pre-Mod Filter	PCM signals have a software enabled Pre-Mod filter.
Output Impedance	50 Ohm SMA Connector
Power Range	Output power controlled by programmable attenuator from 0 dBm to -90 dBm.

Tarsus3 Physical Specifications:	
Dimensions	3U form factor, 100mm x 160mm
Interface Connectors	MDM-51 connector to individual BNC breakout cables (other configurations, consult factory)
Manufacturing	The design utilizes Surface Mount Technology (SMT), manufactured with robotic assembly techniques to IPC-610B Class 2 manufacturing standards
Temperature Range	Operating: 0°C to 50°C Storage: -20°C to 60°C
Power Consumption:	Less than 25 Watts total, for all supplies +5V 3 Amps +12V 0.5 Amp

Tarsus3 Receiver Card Physical Specifications:	
Dimensions	Mezzanine 74mm x 149mm
Interface Connectors	2x SMA Rx Inputs 2x SMA Tx Outputs Video and AGC BNC Outputs on Tarsus3 card.
Manufacturing	The design utilizes Surface Mount Technology (SMT), manufactured with robotic assembly

	techniques to IPC-610B Class 2 manufacturing standards
Temperature Range	Operating: 0°C to 50°C Storage: -20°C to 60°C
Power Consumption:	Less than 30 Watts total for Tarsus3 and RF daughter card, for all supplies

1.4 Warranty

Ulyssix Technologies, Inc. warrants its products to be free from defects in material and workmanship under normal use and service for one year from the date of shipment to the original purchaser. The equipment must be returned, transportation prepaid to the factory, and if found to be defective, at the company's option, will be repaired or replaced free of charge and returned transportation prepaid. If inspection by Ulyssix does not disclose any defect in material or workmanship, an Ulyssix standard repair service charge will apply. This warranty does not extend to any products that have been subject to misuse, negligence, modifications, abnormal operating conditions, or cover expendable items such as lamps, batteries, fuses, etc. Customer furnished equipment and hardware purchased for resale included in systems are covered by the original manufacturer's warranty. Ulyssix makes no express or implied warranties beyond those described herein, and in no event will Ulyssix be responsible for consequential damages of any nature arising out of, or connected with, the use of its products.

1.5 Repair Service Charges

Please call the Ulyssix Customer Service Department at 301-846-4800 for a quotation, return authorization number, and shipping information. All units repaired will be warranted for 90 days from the date of said repair. Equipment must be shipped to the factory with transportation prepaid.

Chapter 2 Installation

2.1 System Requirements

The ALTAIR software utilizes the latest software technologies by using Microsoft .NET framework, Microsoft DirectX, and Direct3D graphics interface. The following table contains the minimum computer configuration requirements for installing and operating the Ulyssix hardware and supporting software. For optimum performance, please install into a computer that meets or exceeds these Configuration Specifications.

Parameter:	**Minimum Configuration:**
Processor	Intel i7 Quad Core with Hyper-Threading
RAM	4 GB or Higher for 32-bit Windows OS 8 GB or Higher for 64-bit Windows OS
Available Hard Drive Space	40 GB
Operating System	Windows 7 or Windows 10 32-Bit (4GB) Windows 7 or Windows 10 64-Bit (8GB)
Power Supply	25 Watts available power per cPCI or PCIe card installed
Chassis	1 Slot is required for each cPCI or PCIe card installed
Drives	CD ROM
Video Adapter Card	GeForce GTX 660 2GB on-board RAM Video card must support DirectX and Direct3D.

Table 1 – Minimum System Requirements Table

2.2 ALTAIR Software and Ulyssix Driver Installation

The Windows based ALTAIR software runs on Windows 7 32-bit, Windows 7 64-bit, and Windows 10 64-bit operating systems. Please contact Ulyssix for questions about other Windows based operating systems.

Please install the Ulyssix driver before installing the Ulyssix cards into your computer chassis. This will simplify the installation process and prevents possible Windows Plug and Play issues.

2.2.1 Ulyssix Driver Installation

There are three scenarios to consider when installing the Ulyssix driver. Please consider which scenario applies to your system and follow the instructions accordingly.

1. Upgrading from the old Jungo Driver. See **2.2.1.1 Upgrading from the Jungo Driver**.
2. Upgrading from a previous version of the Ulyssix Driver. See **2.2.1.2 Upgrading from a previous version of the Ulyssix Driver.**
3. Installing the Ulyssix Driver onto a new computer. **See 2.2.1.3 Installing the Ulyssix Driver onto a new computer.**

2.2.1.1 Upgrading from the Jungo Driver

Upgrading from the original ALTAIR software that used the Jungo Plug ‘n Play Driver requires two steps. First, uninstall the Jungo Driver and WinDriver from your computer. Second, install the new Ulyssix Driver. Instructions for the first step are below. For the second step, please see Section **2.2.1.3 Installing the Ulyssix Driver onto a new computer.**

1. To remove the Jungo Driver, open the Control Panel and select the Device Manager. Expand the listing for “Jungo.” There should be two entries: “Ulyssix Technologies, Inc. Tarsus PCI Card” and “WinDriver.” Please see **Figure 1 – Device Manager with Jungo Driver**.
2. Using your left mouse button, highlight “Ulyssix Technologies Inc., TarsusPCI Card,” then hit the right mouse button and click on “Uninstall.” Check the “Delete the driver software from this device” and then hit the OK button on the Confirm Device Uninstall dialogue box.
3. Repeat the above steps to uninstall the “WinDriver” from the “Jungo” folder.
4. The Device Manager will refresh and Jungo will not appear in the device list.
5. Follow the instructions in **2.2.1.3 Installing the Ulyssix Driver onto a new computer**.

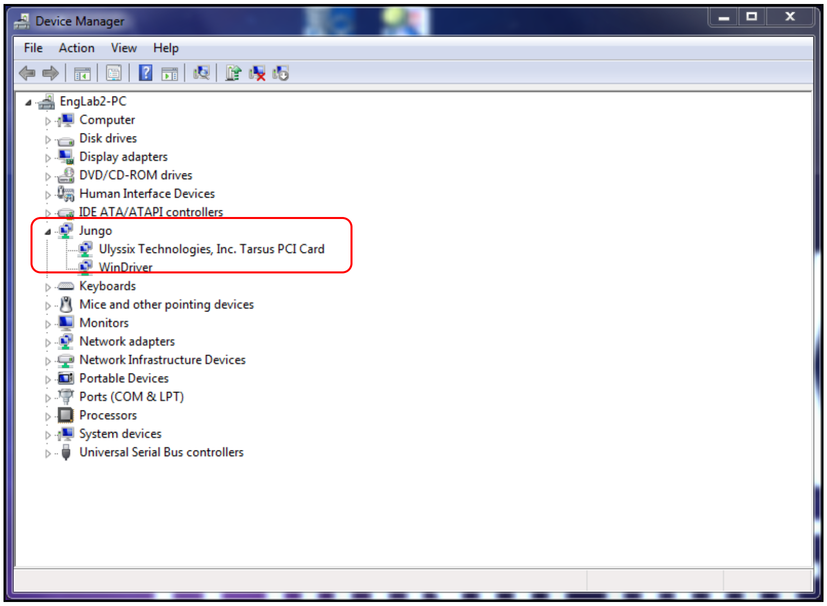
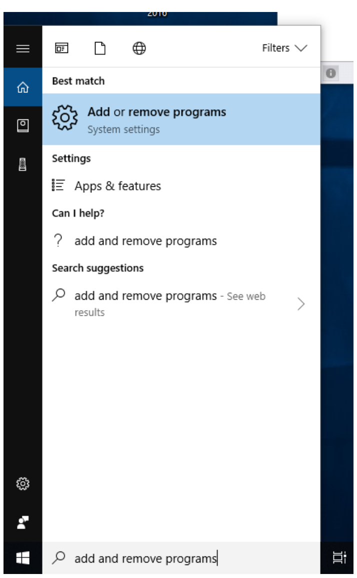


Figure 1 – Device Manager with Jungo Driver

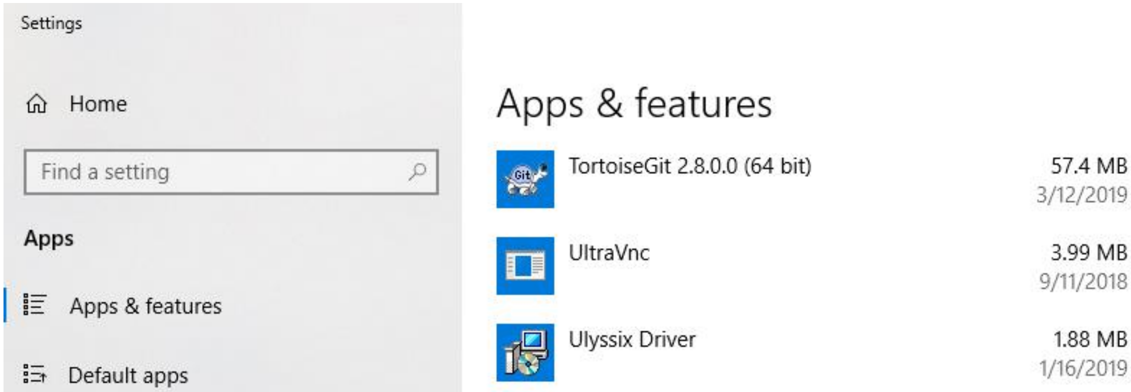
2.2.1.2 Upgrading from a previous version of the Ulyssix Driver

To upgrade from a previous version of the Ulyssix Driver requires two steps. First, uninstall the previous version of the Ulyssix Driver. Second, install the new version of the Ulyssix driver. Instructions for the first step are below. For the second step, please see Section **2.2.1.3 Installing the Ulyssix Driver onto a new computer.**

1. In the Windows Run prompt type "Add and Remove Programs." Select Add and Remove Programs from the list of applications.



2. In the Add and Remove Programs window, find Tarsus PCI driver. Highlight Tarsus PCI Driver and select Uninstall.



3. Windows will ask if you are sure that you want to uninstall this app, click Yes. This will launch the Ulyssix Driver uninstall wizard. Windows 10 might ask "Do you want to allow this app to make changes to your computer." Click Yes.
4. When the uninstall is completed, Tarsus PCI Driver will no longer be listed in the Add Remove Programs window.
5. Follow the instructions in **2.2.1.3 Installing the Ulyssix Driver onto a new computer**.

2.2.1.3 Installing the Ulyssix Driver onto a new computer

Select the correct Ulyssix Driver for the Windows operating system on your computer. The following drivers are currently available. Please contact Ulyssix for other Windows operating systems.

- For Windows XP, use installer "installer_WXP_x86.exe"
- For Windows 7 32-bit, use installer "installer_WIN7_x86.exe"
- For Windows 7 64-bit, use installer "installer_WIN7_x64.exe"
- For Windows 10 64-bit, use installer "installer_WIN10_x64.exe"

1. Select the correct Ulyssix Driver for your operating system and run the executable file. Windows 10 might ask "Are you sure that you want to allow this app to make changes to your computer?" Click Yes.
2. The installer will begin with this a welcome screen. Click the Install button to start the installation.

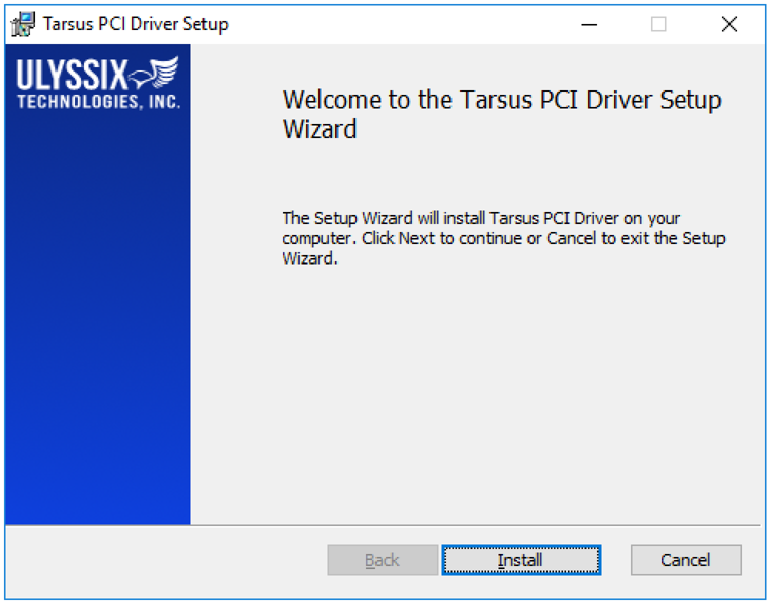


Figure 2 – Ulyssix Driver Installer Welcome Screen

3. As the new driver is being installed, you may see the following screen. Click “Install this driver software anyway” if this form appears. This is a Windows Security check for new driver installations.

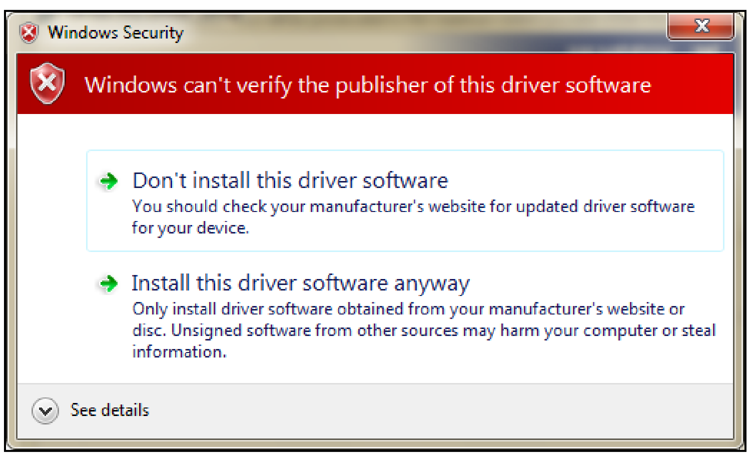


Figure 3 – Windows Security Screen

4. When the Ulyssix Driver Installation finishes, an installed completed screen will appear:

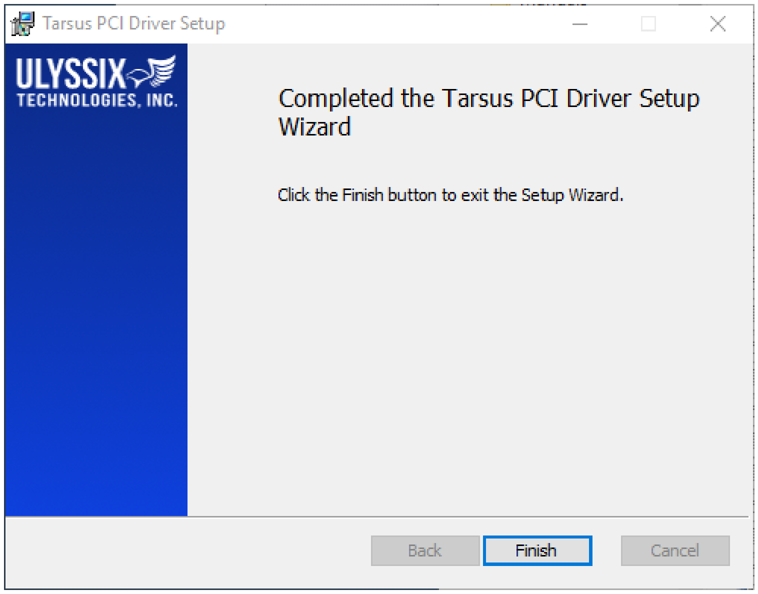


Figure 4 – Ulyssix Driver Completed screen

5. Verify the installation of the new Ulyssix Driver in Device Manager. Navigate to the Control Panel and then to the Device Manager. In the list of installed devices, look for the entry "Ulyssix Technologies, Inc." If you expand this entry, there should be an Ulyssix card listed below it. In the example below, a TarsusHS card is listed.

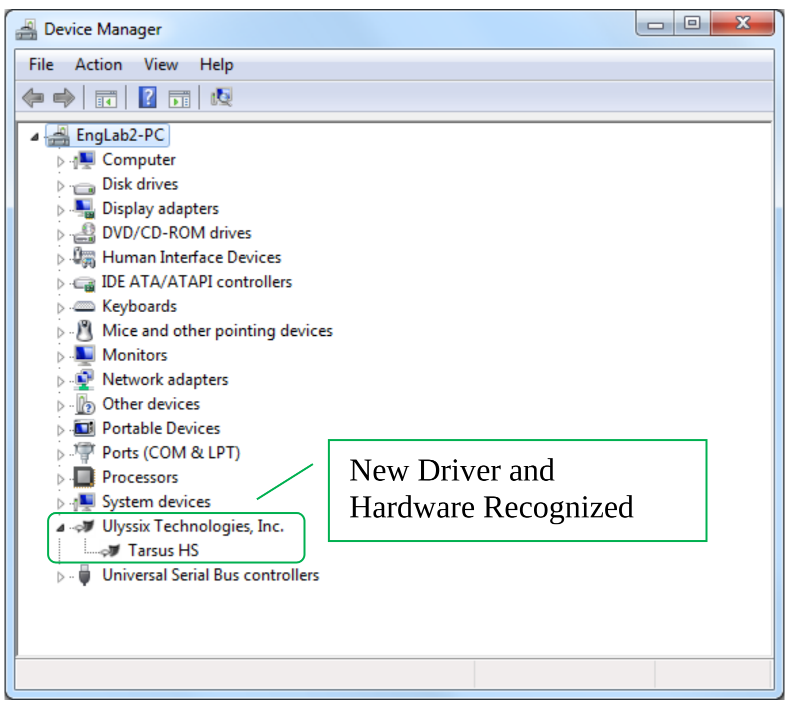


Figure 5 – Device Manager with a Successful Ulyssix Driver installation

2.2.2 Installing ALTAIR Software

Starting with ALTAIR version 18.7, there is a 32-bit release and 64-bit release of ALTAIR. ALTAIR 32-bit will run on Windows 7 or Windows 10 computer that meets the hardware requirements. ALTAIR 64-bit will only run Windows 7 64-bit or Windows 10 64-bit operating systems. Please contact Ulyssix with any questions.

The process for a new installation or an upgrade of the ALTAIR software is very similar. For an upgrade, please see **Section 2.2.2.2**. It is important to document the version numbers of your current software and DLL encase there is an issue after the upgrade.

2.2.2.1 New Installation of the ALTAIR Software

Installing ALTAIR software begins by acquiring the correct Altair.exe file for your computer. There is an installer for ALTAIR 32-bit and an installer for ALTAIR 64-bit. This installer is available on the Ulyssix webpage or on the CD that came with your Ulyssix hardware.

1. Double click to launch ALTAIR 32-bit.exe or ALTAIR 64-bit.exe.
2. The **ALTAIR Installer Setup** window will appear. Click the **Install** button to begin.

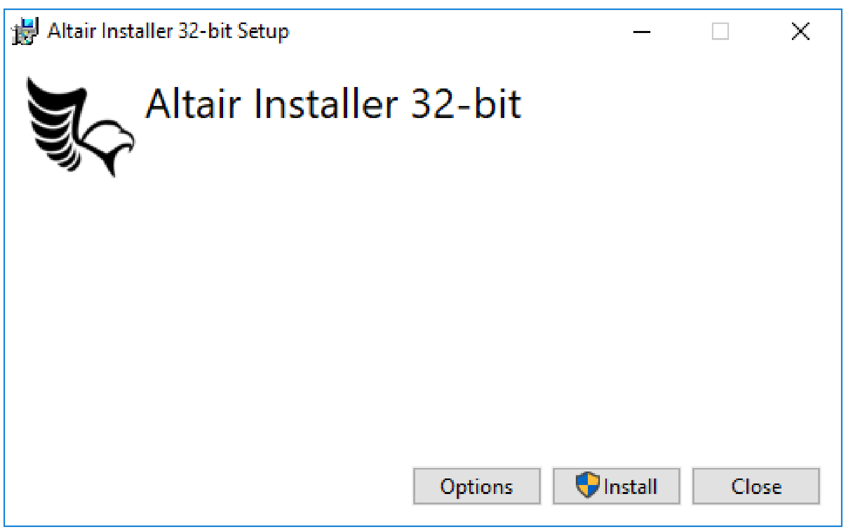


Figure 6 – Location to Extract Files

3. If Windows asks if you would like to let ALTAIR Installer make changes to your computer, click Yes.
4. After a brief wait, the installation process begins.
5. A window will appear for installing SlimDX. Check the box to accept the License Agreement and then click Install. SlimDX is a replacement for the Microsoft DirectX DLLs.

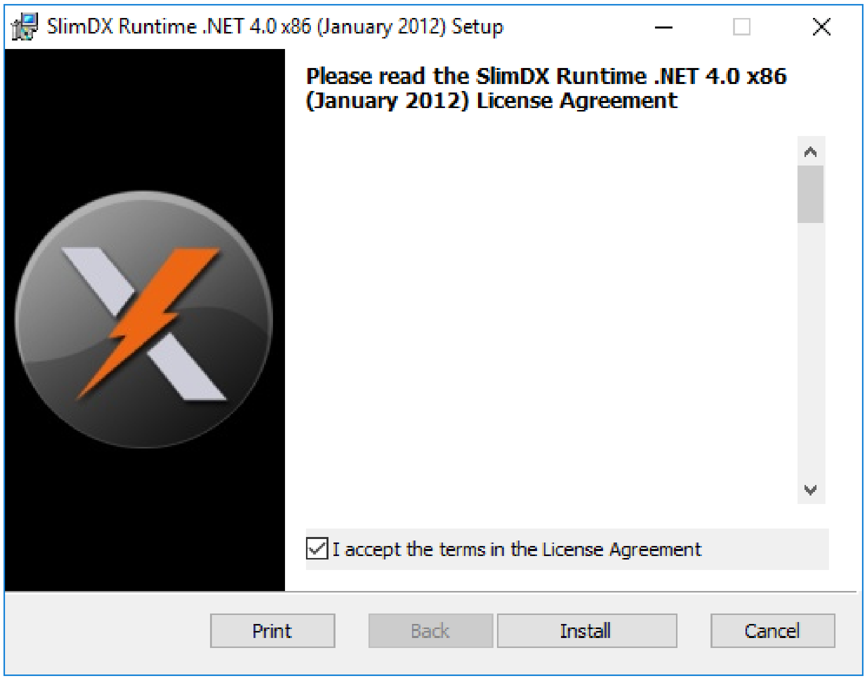


Figure 7 – SlimDX Install Wizard

6. SlimDX will install. SlimDX might require some applications to close to finish installation. If the installer asks to close application, please click Yes.
7. When SlimDX is finished installing, click Finish to continue installing ALTAIR.

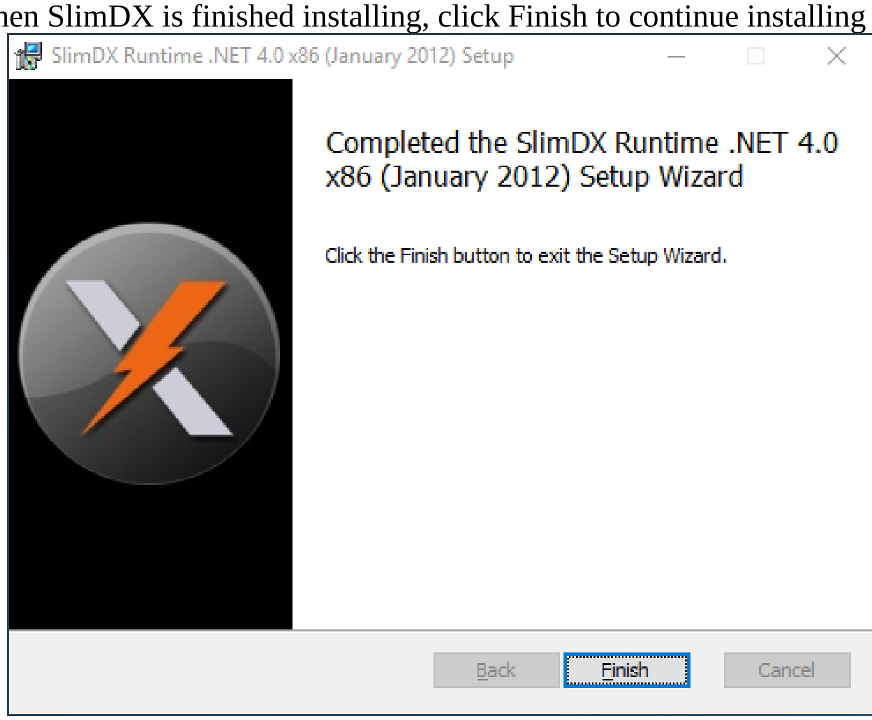


Figure 8 – SlimDX Install Complete

8. **ALTAIR Installer Welcome** screen will appear. Click **Next** to begin the installation.

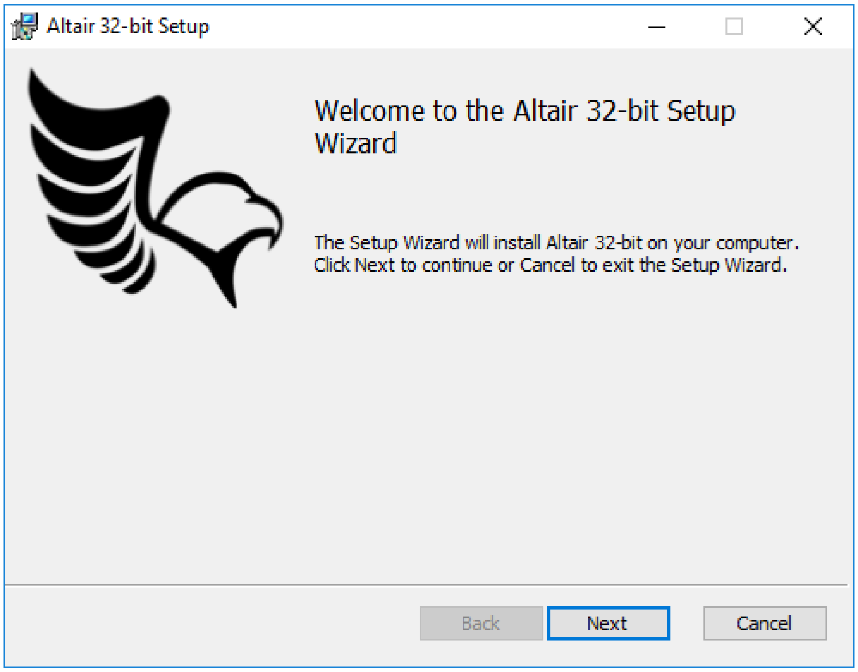


Figure 9 – ALTAIR Installer Welcome Wizard

9. The installer requests the destination folder. Strongly consider the default location. This will aid in any future troubleshooting. Also note that every user needs Read/Write access to the folder location for all features of the software to work. Click the **Next** button to continue.

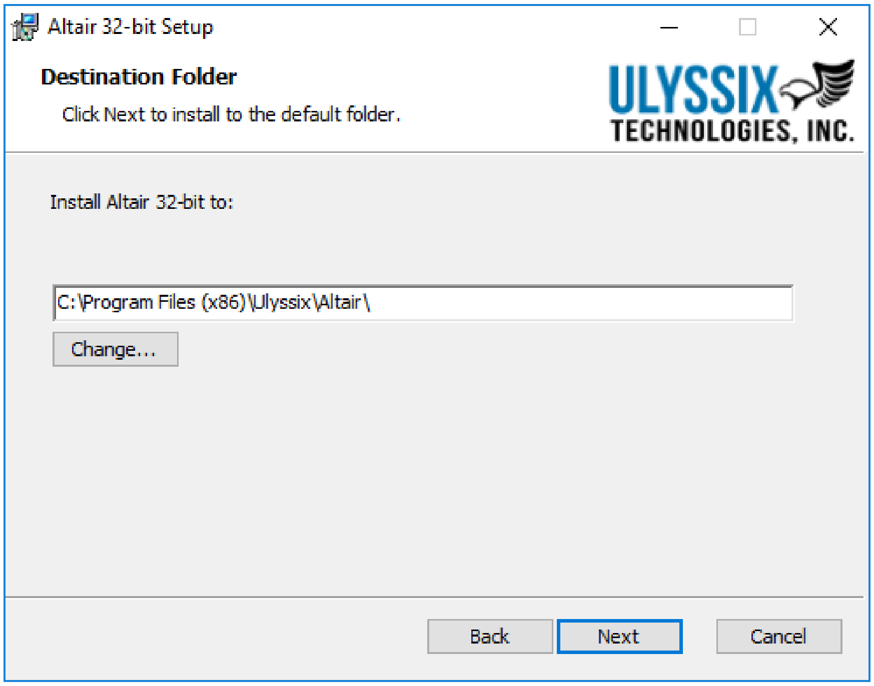


Figure 10 – Installer Destination Folder

10. The **Ready to Install the Program** window will appear. Please click the **Install** button to finalize the installation.

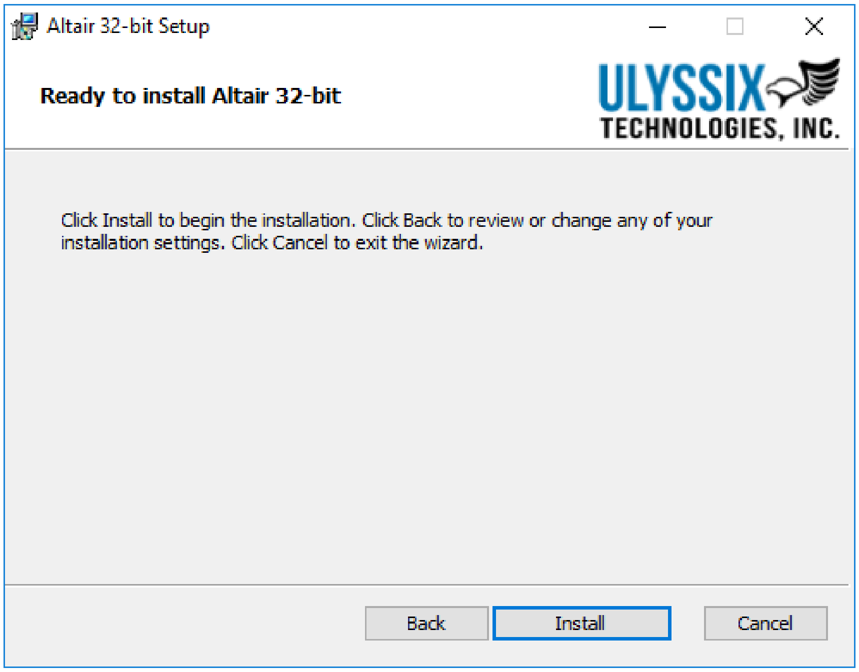


Figure 11 – Ready to Install the Program

11. The next window will be the **Installing ALTAIR** window. This window includes a bar to indicate progress. Be patient, it takes a period of time for the bar to start moving.
12. When the installation is complete, the Installation Complete window will appear. Click the Close button to close the installer.

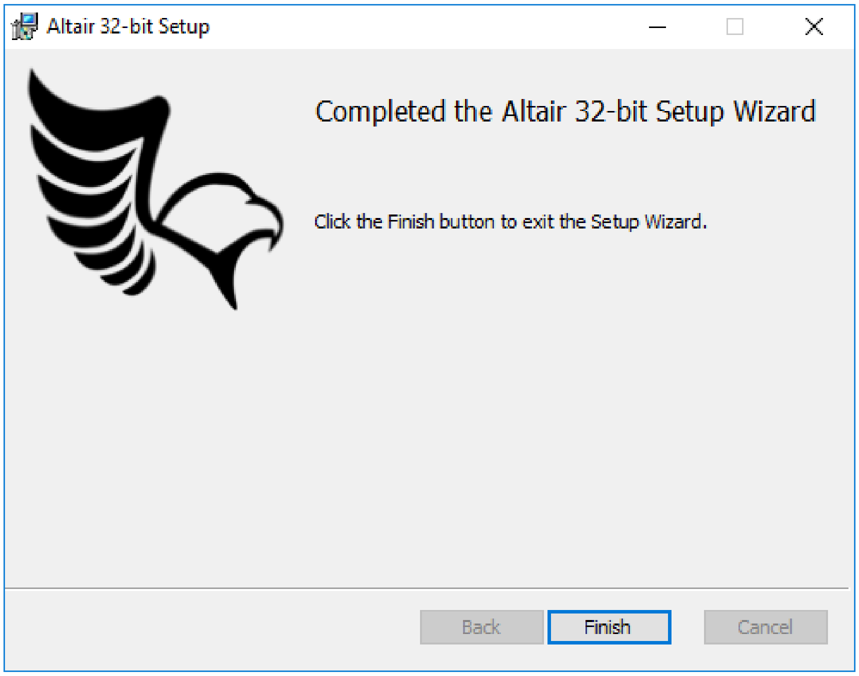


Figure 12 – ALTAIR Installation Complete

13. The ALTAIR Installer window will show the success window.

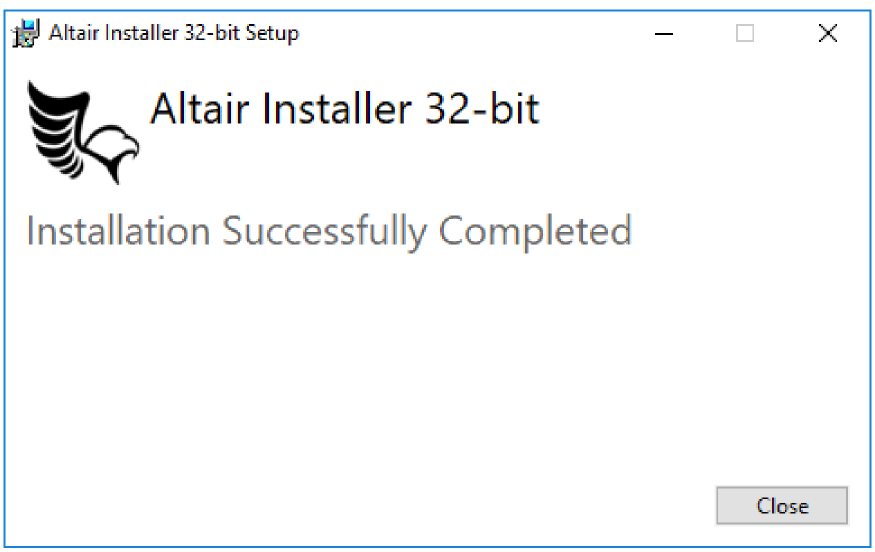


Figure 13 – ALTAIR Installer Successfully Completed

2.2.2.2 Upgrading ALTAIR Software

Upgrading the ALTAIR software is similar to a new installation of ALTAR. First, start by launching your current version of ALTAIR. The version numbers of ALTAIR and pcm_hw.dll are located at the bottom of the ALTAIR window. Record these two numbers before installing the new ALTAIR software and exit the ALTAIR software. These original version numbers are useful for troubleshooting any future issues.

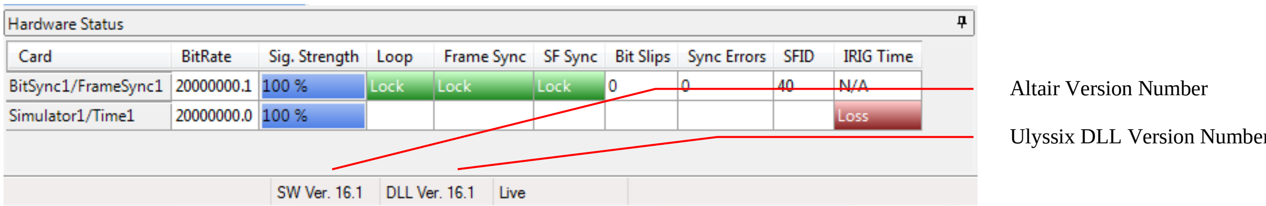


Figure 14 – ALTAIR Version Numbers

To upgrade ALTAIR, follow the instructions in **Section 2.2.2.1 New Installation of the ALTAIR Software.**

2.2.2.3 ALTAIR and the Windows Firewall

Windows 10 blocks applications from sending or receiving data through the Windows Firewall. In order to use the ALTAIR UDP Receiver or optional licensed feature UDP Publisher, ALTAIR must be added to the list of approved applications to communicate through the firewall. Please note, Administrator rights might be needed to change the Windows Defender Firewall settings.

1. In the Windows Search Bar, type Firewall and select “Allow an Application Through Windows Firewall” from the list of options.
2. Click the Change Settings button to allow the window to change settings to the Windows Firewall properties.
3. Locate Altair in the list of applications and click the Detail button to launch the Edit an App window. In the Edit an App window, click the Network Types button. In the Choose Network Types window, check the boxes for both Private and Public networks. Click OK in the Network Types window. Click OK in the Edit an Add window.
4. In the Allowed App window, check the box next to Altair. Click OK to finish the process.

2.2.2.4 Uninstall Software – Windows XP

1. To un-install the ALTAIR Software from your computer, click the Start Button, go to Settings, and select the Control Panel. Inside the Control Pane, double-click the **Add or Remove Programs** icon.
2. In the list of programs, highlight ALTAIR INSTALLER and click the **Add or Remove Programs** button.
3. If prompted by the software, select **Remove** to un-install the program. Uninstalling the software does not uninstall the driver or remove the Ulyssix hardware from the Windows registry.

2.2.2.5 Uninstall Software – Windows 7 or Windows 10

1. To un-install the ALTAIR Software from your computer, type Add and Remove Programs into the Run bar then select "Add and Remove Programs" from the list of suggested applications.
2. In the list of programs, highlight ALTAIR Installer 32-bit or ALTAIR Installer 64-bit and click the **Uninstall** button.
3. If prompted by the software, select **Remove** to un-install the program. Uninstalling the software does not uninstall the driver or remove the Ulyssix hardware from the Windows registry.

2.2.3 Power Cycling Guidelines

Ulyssix Technologies board level products are easily installed into almost any PCI, PCIe, or cPCI computer chassis. Unfortunately, all computers do not behave identically regarding the amount of time for the PCI, PCIe, or cPCI bus and the ATX power supply to settle after power down. The electronics on the Ulyssix boards require that the bus and power supply are fully settled before re-applying power to the system. We recommend you wait a minimum of 30 seconds after you power down before restarting your computer. This will ensure the system has had time to settle and the Ulyssix cards will start-up properly.

2.3 Product Identification

Each Tarsus3 card is assigned a unique serial number before shipment from the factory. This number is clearly marked on the reverse side of the PC board. (Please see Figure 15 – Tarsus3 cPCI Product Identification below.)

Figure 15 – Tarsus3 cPCI Product Identification

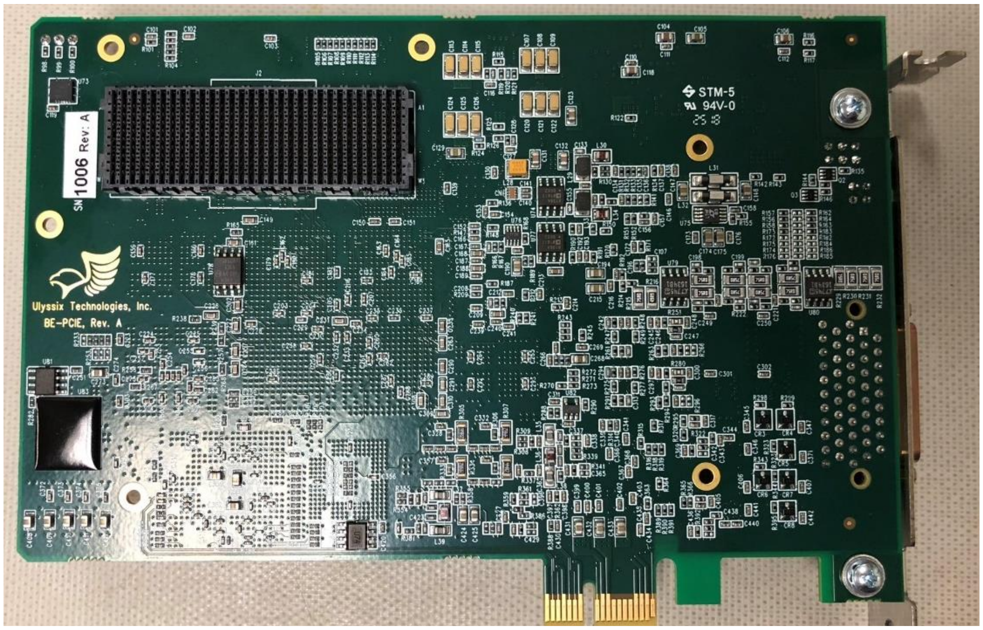


Figure 16 – Tarsus3 PCIe Product Identification

2.3.1 Model Number

The model number of the Ulyssix card indicates which options are installed on that specific unit. Our model number definitions are provided in the table below:

Model	Description
Tarsus3-cPCI-01 Tarsus3-PCIe-01	PCM Processor Card, 40 Mbps Bit Sync, Decom, Simulator, IRIG Time Code Reader with full archive capture capability
Tarsus3-cPCI-02 Tarsus3-PCIe-02	Dual 40 Mbps Bit Sync, Dual Frame Sync, IRIG Time Code Reader with full archive capture capability. Optional Simulator and Dual Decom

Table 2 – Tarsus3 Models

2.3.2 Serial Number

A unique serial number is assigned to each Tarsus3 board. Please reference this number to identify the specific unit during any communications with the factory.

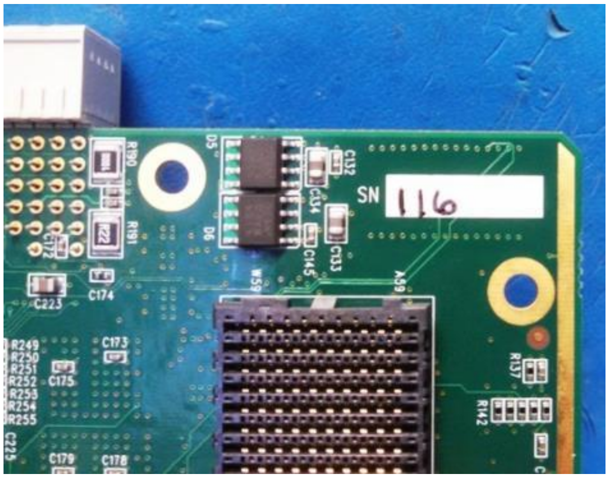


Figure 17 – Serial Number

2.4 Hardware Setup

The Tarsus3 is a sophisticated electronic device and damage can occur if the product is not handled or used properly. Care should be taken not to expose the unit to physical abuse, moisture, Electrostatic Discharge (ESD), or any other potentially harmful conditions. Carefully unpack the board in an ESD safe location and check the product for physical damage from shipment. Factory installed modification wires and components will be secured to the board with adhesive to prevent damage. If there's any question about the condition of the board upon receipt, please contact the factory immediately.

2.5 Hardware Installation

The Tarsus3 can be easily installed into any cPCI or PCIe chassis with an available slot. While the Tarsus3 card only requires one slot, it is preferable to install the Tarsus3 with an empty slot to the right. The Ulyssix driver as well as ALTAIR and FlashBurn software must be installed before installing the Tarsus3 card. Follow the steps below to install the Tarsus3 card:

WARNING - SERIOUS DAMAGE OR INJURY CAN RESULT IF THE POWER ISN'T TURNED OFF BEFORE INSTALLING THE TARSUS3 CARD.

1. Ensure the Ulyssix driver as well as ALTAIR and FlashBurn software has been installed before installing any hardware.
2. Turn off power to the computer.
3. Remove the blank plates that cover the needed cPCI or PCIe slots.
4. Carefully install the Tarsus3 card into the cPCI or PCIe slot.
   For the Tarsus3-cPCI, lock the cPCI handle in place and secure the Tarsus3-cPCI in place with the screw at the top of the panel.
   For the BalcEagle-PCIe, tighten the mounting screw on the PCIe panel to secure the card to the card cage.
5. Turn on power to the computer.

2.5.1 Adding Cards to an Existing System

Before adding any Ulyssix cards to an existing system it is important to verify that the host computer's power supply has adequate surplus power for the total number of installed cards. Calculate the total amount of power required by the Ulyssix cards by adding the individual card power requirements as noted on the product data sheets. Please contact the factory if you need assistance.

Additional Tarsus3 cards can be installed into any available slot in your computer at any time – just follow the installation instructions above. When you install additional cards into a computer, the computer bus may assign new ID numbers for existing or new cards depending upon the slot you install the card into and the configuration of the computer bus for your specific computer. If this happens, the configuration files will be corrupted and will not program the hardware properly.

Chapter 3 Configuring Hardware for Use

This chapter explains how to configure your Tarsus3 card, how to install connections, and determine if your hardware is functioning properly before the first use.

Before using your Tarsus3 card, you must complete the following:

1. Section 2.2.1 Ulyssix Driver Installation
2. Section 2.2.2 Installing ALTAIR Software
3. Installing FlashBurn

Upon power-up, you should verify proper LED indication and connect the input and output cables to the card. The LED indicators and interconnections are explained in the following sections.

3.1 Connecting to the Hardware

Input and output connections are made to the Tarsus3 through a MDM-51 connector on the rear panel. Ulyssix supplies the mating connections to the MDM 51 which contains BNC pigtails and Twin BNC pigtails. The mating cable is a multi-purpose cable used for both the Tarsus3-01 and Tarsus3-02. The cable inputs feed different hardware functions depending on the model. The cables are labeled to identify each output channel. (Please refer to Table 3 – Tarsus3-02 Hardware Connections and Table 4 – Tarsus3-01 Hardware Connections below for connector identification and functionality.) (see Appendix C – Tarsus3 and Bald Eagle RF for details on interconnecting cables).

3.1.1 Tarsus3-02 cPCI or PCIe Cable

Bold Labels are used on -02, normal labels are for the -01 only

Connection Location\Label	Connection Function
CH1 IN	Single Ended Analog Input BNC to Bit Sync 1
CH1 DIFFIN	Concentric Twin-BNC Differential Analog RS422 Input to Bit Sync 1 (Trompeter Part # PL75C-201)
B1 CLK1	Bit Sync1 Encoder Output 1 Clock
B1 OUT1	Bit Sync1 Encoder Output 1 Data Out
-01 TIME IN \ **CH2 IN**	Single Ended Analog Input BNC to Bit Sync 2
CH2 DIFFIN	Concentric Twin-BNC Differential Analog RS422 Input to Bit Sync 2 (Trompeter Part # PL75C-201)
-02 TIME IN	Single Ended Analog Input to the IRIG Time Code Reader
-01 SIM CLK \ **B2 CLK1**	Bit Sync2 Encoder Output 1 Clock
-01 SIM OUT \ **B2 OUT1**	Bit Sync2 Encoder Output 1 Data Out
CH1 DACOUT	Channel 1 DAC analog out (not used on Tarsus3-02)
CH2 DACOUT	Channel 2 DAC analog out (not used on Tarsus3-02)
B1 CLK2	Bit Sync1 Encoder Output 2 Clock
B1 OUT2	Bit Sync1 Encoder Output 2 Data Out
DECOM2 IN	External Channel 2 Decom Data In
DECOM2 CLK	External Channel 2 Decom Clock In
B2 CLK1 **B2 OUT1**	Bit Sync2 Encoder Output Clock Out Bit Sync2 Encoder Output Data Out
-02 SIM OUT **-02 SIM CLK**	PCM Simulator Data Out PCM Simulator Clock Out
DECOM1 IN	External Channel 1 Decom Data In
DECOM1 CLK	External Channel 2 Decom Clock In
B1 OUT1	Concentric Twin-BNC Differential RS422 Analog Bit Sync1 Ch1Encoder Data Out (Trompeter Part # PL75C-201)
B1 CLK1	Concentric Twin-BNC Differential RS422 Analog Bit Sync1 Ch1Encoder Clock Out (Trompeter Part # PL75C-201)
-01 SIM OUT \ **B2 OUT1**	Concentric Twin-BNC Differential CH2 Encoder Data Out (Trompeter Part # PL75C-201)
-01 SIM CLK \ **B2 CLK1**	Concentric Twin-BNC Differential CH2 Encoder Clock Out (Trompeter Part # PL75C-201)
DECOM1 CLK IN	Concentric Twin-BNC Differential RS422 Analog Decom 1 Clock Input (Trompeter Part # PL75C-201)
DECOM1 DATA IN	Concentric Twin-BNC Differential RS422 Analog Decom 1 Data Input (Trompeter Part # PL75C-201)

Table 3 – Tarsus3-02 Hardware Connections

3.1.2 Tarsus3-01 cPCI or PCIe Cable

Bold Labels are used on -01, normal labels are for the -02 only

Connection Location\Label	Connection Function
CH1 IN	Single Ended Analog Input BNC to Bit Sync
CH1 DIFFIN	Concentric Twin-BNC Differential RS422 Analog Input to Bit Sync (Trompeter Part # PL75C-201)
B1 CLK1	Bit Sync Encoder Output 1 Clock
B1 OUT1	Bit Sync Encoder Output 1 Data Out
-01 TIME IN \ CH2 IN	Single Ended Analog Input BNC to the IRIG Time Code Reader
CH2 DIFFIN	Concentric Twin-BNC Differential Analog Input to the Channel 2 Input (-02 only) (Trompeter Part # PL75C-201)
-02 TIME IN	Single Ended Analog Input BNC to the IRIG Time Code Reader (not used on Tarsus3-01)
-01 SIM CLK \ B2 CLK1	Simulator Output Clock
-01 SIM OUT \ B2 OUT1	Simulator Output Data
CH1 DACOUT	Channel 1 DAC analog out
CH2 DACOUT	Channel 2 DAC analog out
B1 CLK2	Bit Sync Encoder Output 2 Clock
B1 OUT2	Bit Sync Encoder Output 2 Data Out
DECOM2 IN	External Channel 2 Decom Data In (-02 only)
DECOM2 CLK	External Channel 2 Decom Data CLK (-02 only)
B2 CLK1 B2 OUT1	Asynchronous Embedded PCM Stream 1-Bit Output Clock Simulator Output Clock (-02 only)
-02 SIM OUT -02 SIM CLK	PCM Simulator Data Out (-02 only) PCM Simulator Clock Out (-02 only)
DECOM1 IN	External Channel 1 Decom Data In
DECOM1 CLK	External Channel 1 Decom Clock In
B1 OUT1	Concentric Twin-BNC Differential RS422 Analog Bit Sync1 Ch1 Encoder Data Out (Trompeter Part # PL75C-201)
B1 CLK1	Concentric Twin-BNC Differential RS422 Analog Bit Sync1 Ch1 Encoder Clock Out (Trompeter Part # PL75C-201)
-01 SIM OUT \ B2 OUT1	Concentric Twin-BNC Differential RS422 Simulator Data Out (Trompeter Part # PL75C-201)
-01 SIM CLK \ B2 CLK1	Concentric Twin-BNC Differential RS422 Analog Simulator Clock Out (Trompeter Part # PL75C-201)
DECOM1 CLK	Concentric Twin-BNC Differential RS422 Analog Decom 1 Clock Input (Trompeter Part # PL75C-201)
DECOM1 DATA	Concentric Twin-BNC Differential RS422 Analog Decom 1 Data Input (Trompeter Part # PL75C-201)

Table 4 – Tarsus3-01 Hardware Connections

3.2 Identifying Hardware Status

3.2.1 LED Indicators

The upper set of three LED Indicators on the rear panel of the Tarsus3 card provides the identification number. In the lower pair of LEDs, the left LED indicates Bit Sync 1 Lock status and the right LED indications the FPGA Programming Status.

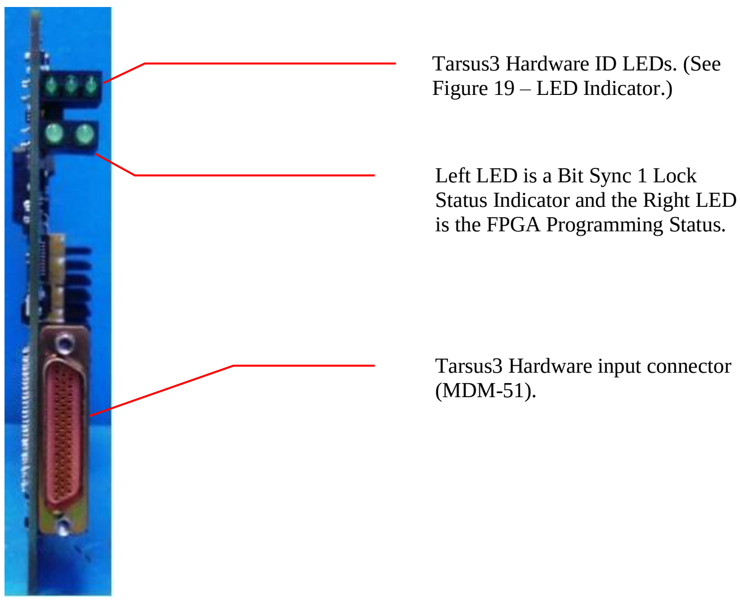


Figure 18 – Tarsus3 Rear Panel View of LED Indicators

The following diagram shows some examples of how the LEDs will appear for one or multiple card set-ups.

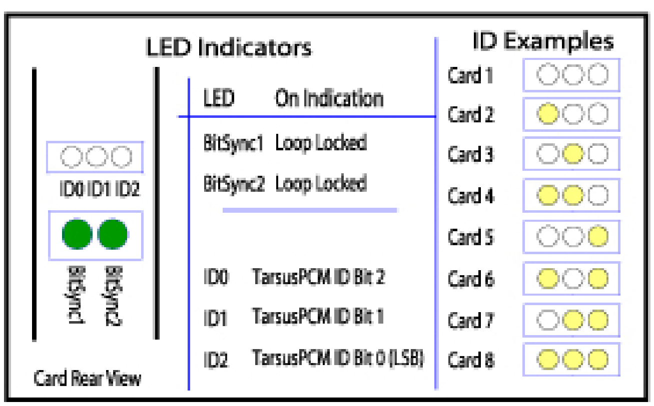


Figure 19 – LED Indicator Card Configuration Examples

3.2.2 Bit Sync Lock LED Indicator

The Bit Sync Lock LED will illuminate green when the Bit Sync digital phase lock loop has locked onto the incoming PCM signal. If the Lock LED is indicating NO LOCK when you expect it should be "locked," then verify all the input connections and software settings are correct before contacting the factory for support.

3.2.3 Tarsus3 LED ID Indicator

The ALTAIR software assigns a number to each Tarsus3 card detected in a chassis. As many as 8 cards can be identified by the LED ID indicator. The ID LEDs give a binary representation of the Tarsus3 number for each card. Look at the table below - 0 indicates LED off, and 1 indicates LED on.

ID2	0	0	0	0	1	1	1	1
ID1	0	0	1	1	0	0	1	1
ID0	0	1	0	1	0	1	0	1
Tarsus3 ID	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Table 5 – Tarsus3 ID Table

Chapter 4 Configuring ALTAIR Software

This section explains how to start up the ALTAIR software and use it to configure the Ulyssix hardware.

4.1 Introducing the ALTAIR Main Screen

The ALTAIR software offers an easy to use interface that allows users to control and analyze data from Ulyssix cards. ALTAIR's main screen is composed of dockable windows and toolbars. The main screen of the software gives a full view of all the Ulyssix cards installed in the computer along with each Signal Strength, Bit Rate, and Lock status. All configurations, setups, and data displays are launched from this screen. To begin using ALTAIR, double-click on the ALTAIR icon located on the desktop. After launching, ALTAIR will open to the main screen shown below.

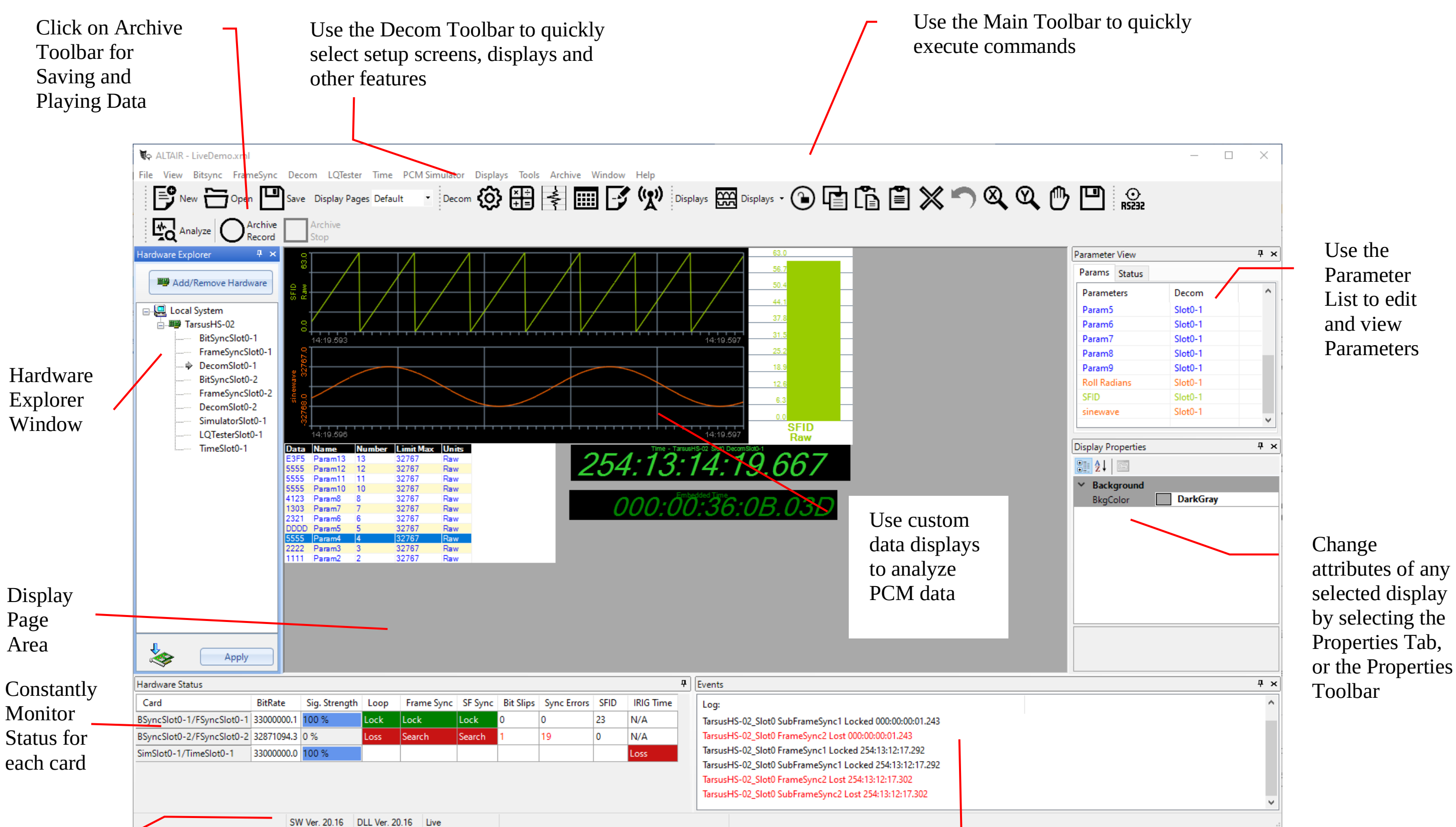


Figure 20 – ALTAIR Main Screen

The dockable windows can be dragged and positioned to dock on any edge of the display. Dockable windows can be stacked into a tabular window to conserve screen space. The dockable windows can be set to used or unused in the Hardware Explorer Window, Parameters Window, Display Properties Window, Hardware Status Window, and the Events Window.

The controls in the toolbars change based on which element is selected in the Hardware Explorer. There are specific toolbar controls for the Bit Sync, Frame Sync, etc. There are also additional toolbars for each data display type.

4.1.1 Toolbars

The most efficient way to use the ALTAIR software is by using a mouse and the toolbars. The ALTAIR software provides these toolbars:

- **Main Toolbar –** This toolbar is used for configuration file management, and hardware setup and display. (See Figure 21 – Main Toolbar below.)

- **Displays Toolbar** – This toolbar is available all of the time. There are four buttons that are always in the toolbar. Other buttons appear based on the selected display. (See Figure 22 – Displays Toolbar below.)

- **Bit Sync Toolbar** – This toolbar is available when Bit Sync is selected in the Hardware Explorer. (See Figure 23 – Bit Sync Toolbar below.)

- **Frame Sync Toolbar** – This toolbar is available when Frame Sync is selected in the Hardware Explorer. (See Figure 24 – Frame Sync Toolbar below.)

- **Decom Toolbar** – This toolbar available when Decom is selected in the Hardware Explorer. (See Figure 25 – Decom Toolbar below.)

- **Simulator Toolbar** – This toolbar available when Simulator is selected in the Hardware Explorer. (See Figure 26 – Simulator Toolbar below.)

- **Time Toolbar** – This toolbar is available when Time is selected in the Hardware Explorer. (See Figure 27 – Time Toolbar below.)

- **Archive Analyze Toolbar** – This toolbar is used when the user selects Analyze from the Archive Tool Bar. While the system is in Analyze mode, it will allow the user to Play, Stop, Step, jump playback data and return to Live Data mode. (See Figure 29 – Archive Analyze Toolbar below.)

New Button – Use the new button to open a new configuration file.

Open Button – Use the open button to open an existing configuration file.

Save Button – Use the save button to save the current configuration file

Display Pages – Use this drop-down section box to quickly switch between display pages.

Figure 21 – Main Toolbar

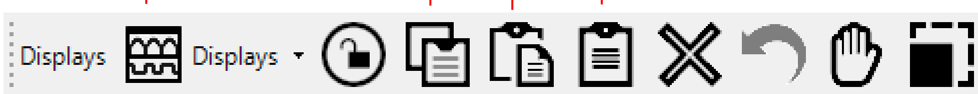
Select a new Data Display to add.

Lock / Unlock Data Displays position

Click once to Copy selected displays to clipboard

Click once to Paste from clipboard

Click once to Show Properties for selected display



Click to Delete selected display

Click to Undo last display delete

Click Pause / Run Display

Click to Auto size Display

Figure 22 – Displays Toolbar

Click once to Setup the Bit Sync

Click once to view Eye Pattern

Click once to view Waveform

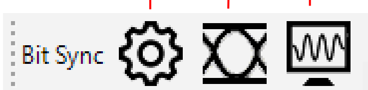


Figure 23 – Bit Sync Toolbar

Click once to Setup the Frame Sync

Click once for the Frame Dump

Click once for the UDP Receiver

Click for the UDP Frame Transmitter (Licensed Option)

Figure 24 – Frame Sync Toolbar

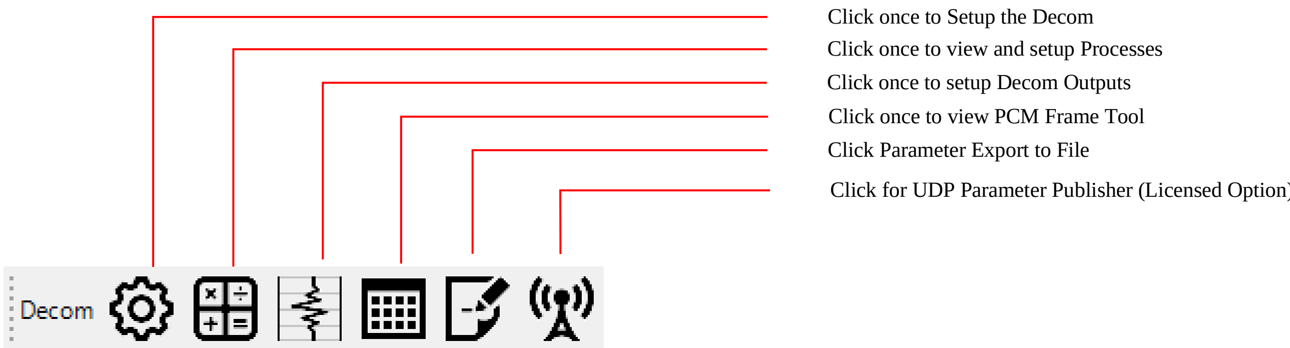


Figure 25 – Decom Toolbar

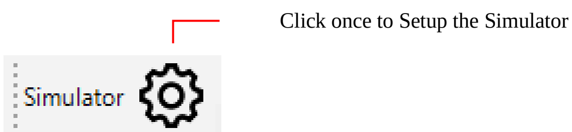


Figure 26 – Simulator Toolbar

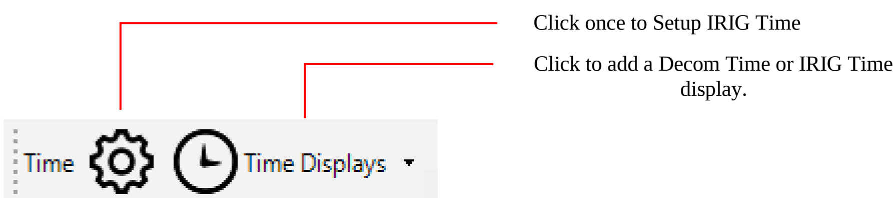


Figure 27 – Time Toolbar

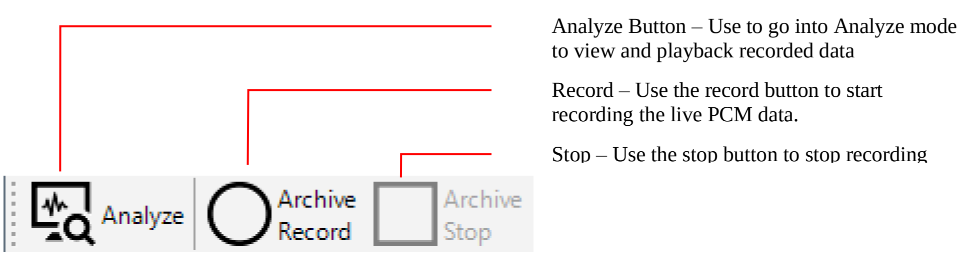


Figure 28 – Archive Toolbar

Live Data – Use to go back to Live Data Mode

Stop – Use the stop button to stop recording

Play – Use the play button to start playback of data

Pause – Use the pause to pause the playback without going to the beginning.

Step Forward – Use the step forward button to step the playback data forward by one step size. (See Step by description below.)

Figure 29 – Archive Analyze Toolbar

Step by – Use this drop-down selection to change the size of the play back stepping

Play Speed – Use this drop-down selection to change the playback data speed.

Play Loc. – Use this control combined with GO to jump to any time in a playback file.

Go – Use this button to cause the software to jump to a specified time in file and update the display.

4.1.2 Hardware Explorer Window

The Hardware Explorer is located on the main screen and displays the hardware configuration based on the configuration file and hardware in the system.

ALTAIR can control and monitor multiple Ulyssix PCI, PCIe, or cPCI cards within the same software package. A card can be added to a configuration even if it is not installed in the system. This allows setting up configuration files on a separate computer and later loading the configuration file on the hardware system. The software also allows a mixture of installed and uninstalled hardware.

When starting the software, the PCI, PCIe, or cPCI bus is automatically scanned to detect installed hardware. An icon located to the left of the Ulyssix card indicates the hardware installation status.

 - Indicates Installed Hardware

 - Indicates no hardware found

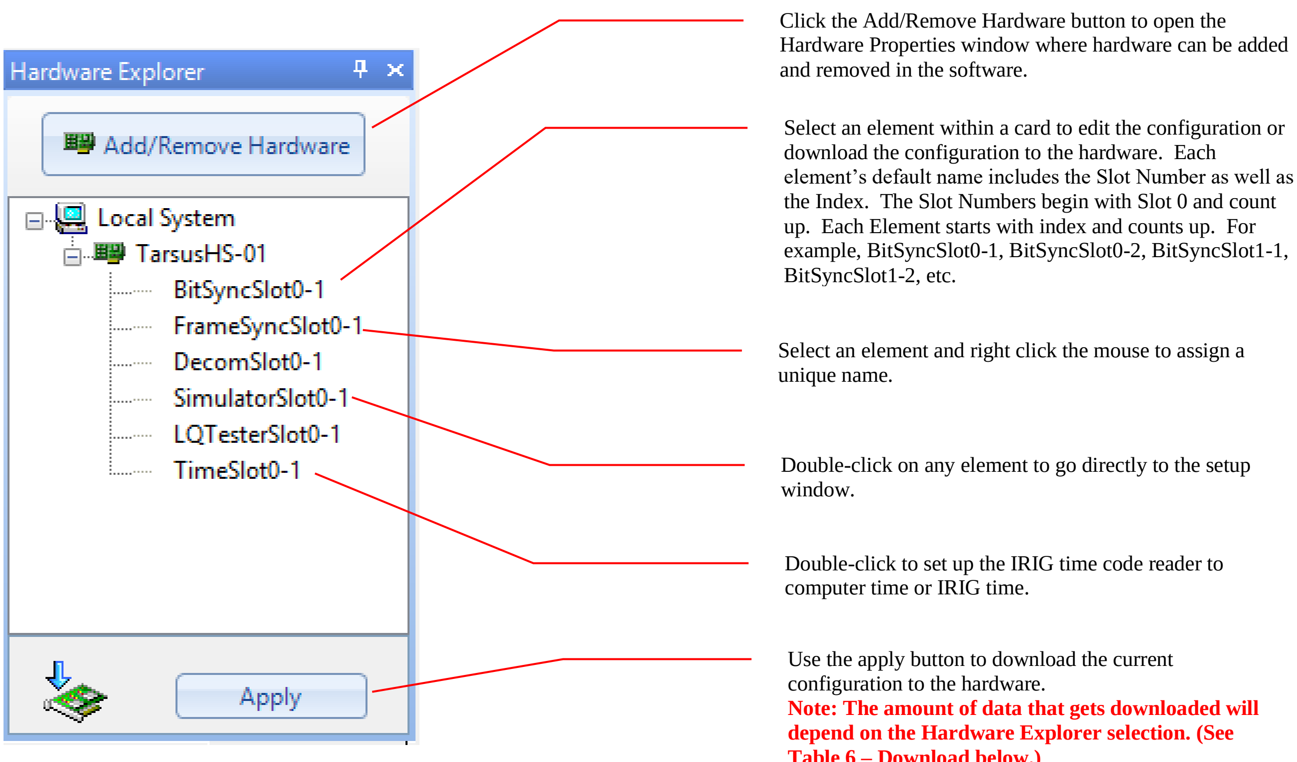


Figure 30 – Hardware Explorer

4.1.2.1 Add/Remove Hardware

In order to use new hardware, the Ulyssix card must be displayed in the Hardware Explorer window. All Ulyssix cards are Plug and Play devices. If the system doesn't recognize the hardware, then there are two ways to add hardware: using Auto Scan to scan the PCI bus and automatically install the recognized models and manually by clicking on the Add/Remove Cards button. These two methods are further explained below:

- **Auto Scan** – The auto scan method can be invoked automatically during the creation of a new configuration file, or manually by using the Add/Remove Cards form. If scanning the PCI, PCIe, cPCI bus upon creation of a new format is not desired, it can be disabled under the ***Tool/Options*** screen.
- **Manual** – Follow the procedure below to install cards manually:

1. From the ALTAIR main screen, click on the Add/Remove Cards on the Hardware explorer docking window. The Add/Remove Cards screen will be displayed. (See Figure 31 – Add/Remove Cards.)

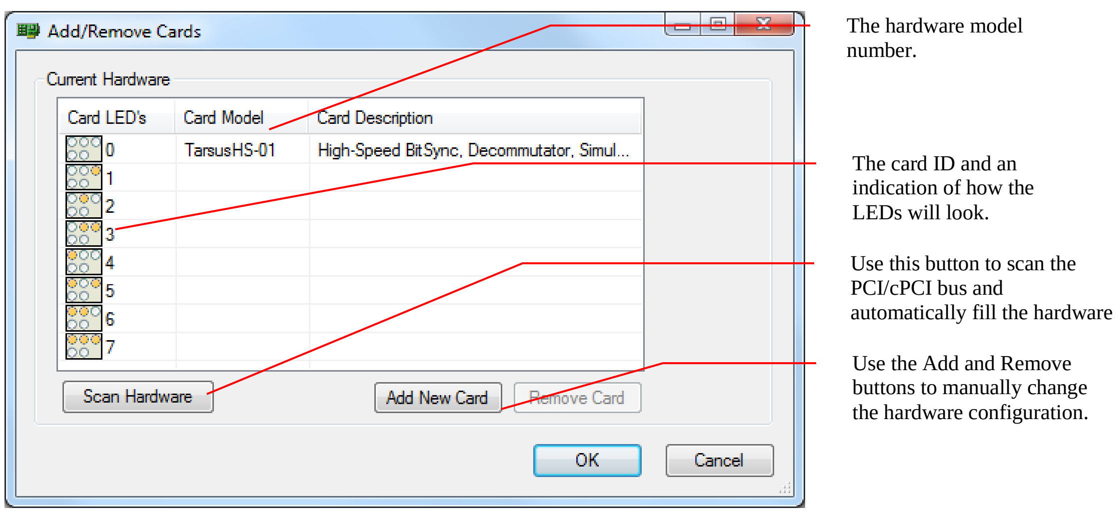


Figure 31 – Add/Remove Cards

2. Click on the Add New Card button and choose a hardware model form the pop-up list.
3. The Add New Card hardware list includes the PCM Virtual Card. The PCM Virtual Card is an instance of a Ulyssix Card in ALTAIR that is used to receive telemetry data via UDP. A PCM Virtual Card does not try to download any settings to a physical card on the PCI bus.
4. Click OK when complete or Cancel to abandon changes.

NOTE: When adding new Ulyssix cards to existing systems with established format files, be certain to install the new card in the computer as the furthest card from the

Single Board Computer (SBC). By doing this, existing format files will stay valid and the new card can be added to the existing format file.

4.1.2.2 Apply Button

Clicking the apply button will download the current configuration settings to the hardware. The amount and type of data downloaded will depend on the selections made in the Hardware Explorer window. (Please refer to Table 6 – Download for details on the download.)

Selected Element	Downloaded Data
Altair System	All data for all cards and their associated Bit Syncs, Frame Syncs, Decom and Simulator installed.
Tarsus3 Card	Data for the selected card and all elements under it.
Bit Sync	Only data for the Bit Sync selected.
Frame Sync	Only data for the Frame Sync selected.
Decom	Only data for the Decom selected.
Simulator	Only data for the Simulator selected.

Table 6 – Download

4.1.3 Parameter View

The Parameter View displays the user decom parameters and status parameters. The status parameters are automatically added for each setup. The Parameter View is a tabbed display. The Params tab is for decom parameters. The Status tab is for status parameters. When ALTAIR has one or more Asynchronous Embedded streams, the Parameter View has two additional tabs. The AsyncParams tab is for decom parameters from an asynchronous embedded stream. The AsyncStatus tab is for status parameters for the asynchronous embedded streams.

The Parameter View has two columns. The first column has the parameter name. The second column identifies the source of the parameter. The parameter source is defined by the slot number of the Ulyssix Card and the decom index. If the setup has an asynchronous embedded stream, the name of the stream is included in the parameter source.

The Status Parameters begin with an underscore and end with "Slot," the slot number, and then a dash with the decom number. For example, _BLOCK_Slot0-1 is the Bit Lock Status Parameter for Decom1 on the card is Slot0. The names of the Status Parameters are changed by right clicking on the parameter in the Parameter View and selecting Edit Status to launch the Parameter Edit/Add window. In the Parameter Edit/Add window, change the text in the Name text box and click the OK button.

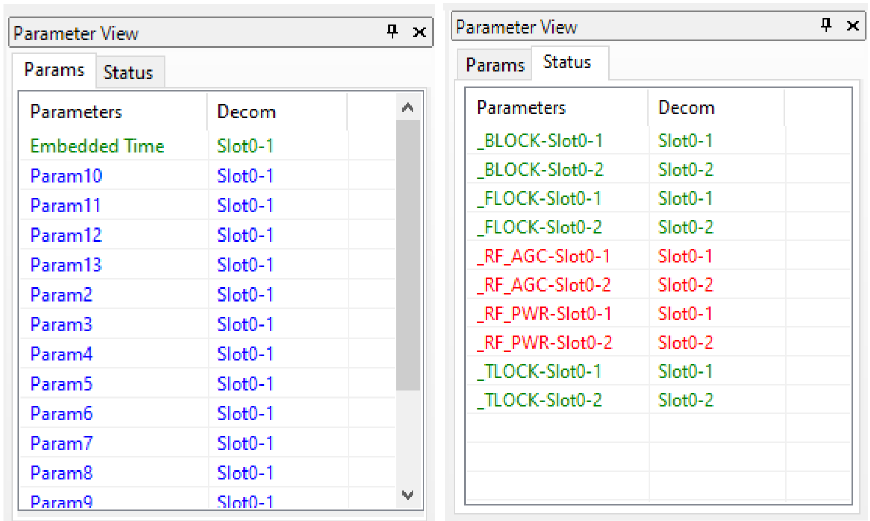


Figure 32 – Parameter View Params and Status Tabs

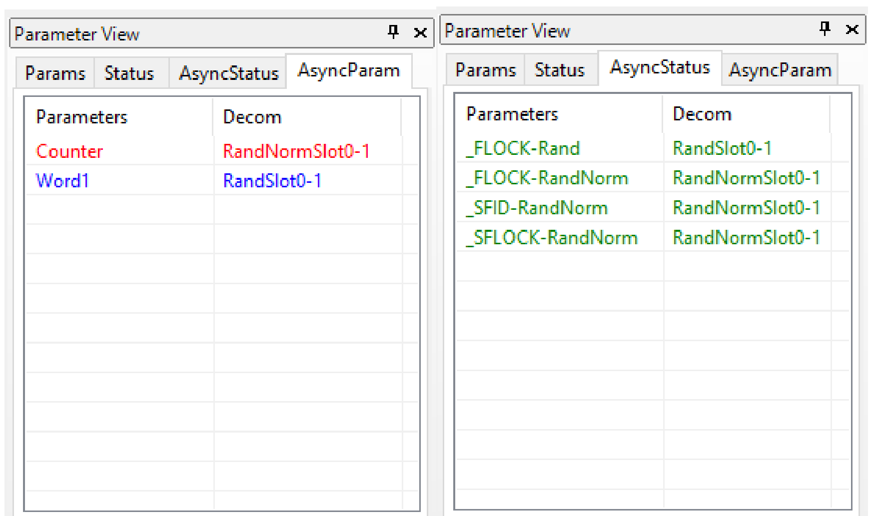


Figure 33 – Parameter View Async Embedded

The default color for PCM Status Parameters is green. The default color for RF Status Parameters is red. For Status Parameters, only the Range, Limits, Data Type, and Color can be edited in the Parameter Edit/Add window. The list of ALTIR status parameters is below:

- _BLOCK is the Bit Sync Lock Status. A value of 1 is lock and a value of 0 is unlock.
- _FLOCK is the Frame Lock Status. A value of 2 is lock, a value of 1 is check, and a value of 0 is search.
- _SFID is the value of the Subframe Counter (only available if the telemetry stream has a Sub Frame Sync defined in the Frame Sync setup).
- _SFLOCK is the Sub Frame Lock Status (only available if the telemetry stream has a Sub Frame Sync defined in the Frame Sync setup). A value of 2 is lock, a value of 1 is check, and a value of 0 is search.

- _TLOCK is the status of the IRIG Time Code Reader. A value of 3 is Time Reader Lock with flywheel, a value of 2 is Time Reader Lock without flywheel, a value of 1 is Time Reader Unlock with flywheel, and a value of 0 is Time Reader Unlock without flywheel.
- _RF_AGC is the auto gain control value for a Receiver in the Bald Eagle RF. The range is 0 to 73dB.
- _RF_PWR is the measure measured at the input to a Receiver in the Bald Eagle RF. The range is -128dB to 5dB.

Use the parameter window to edit parameters or load parameters into a data display. Right clicking on a parameter displays a menu with options to edit the parameter, add it to an existing display, or add it to a new display. Double clicking on a parameter launches the Parameter Edit/Add window.

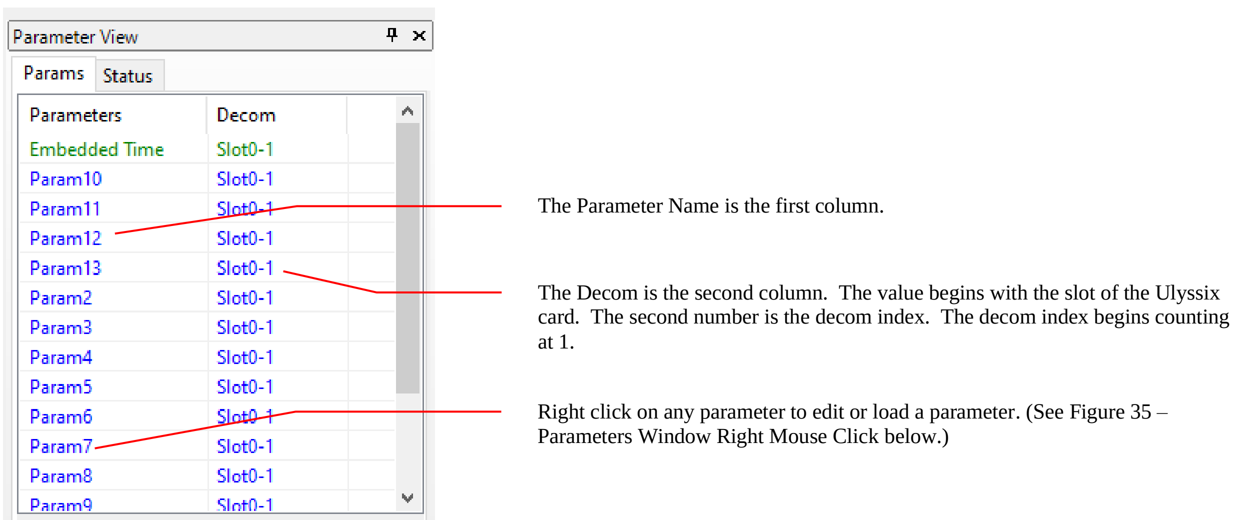


Figure 34 – Parameter Window

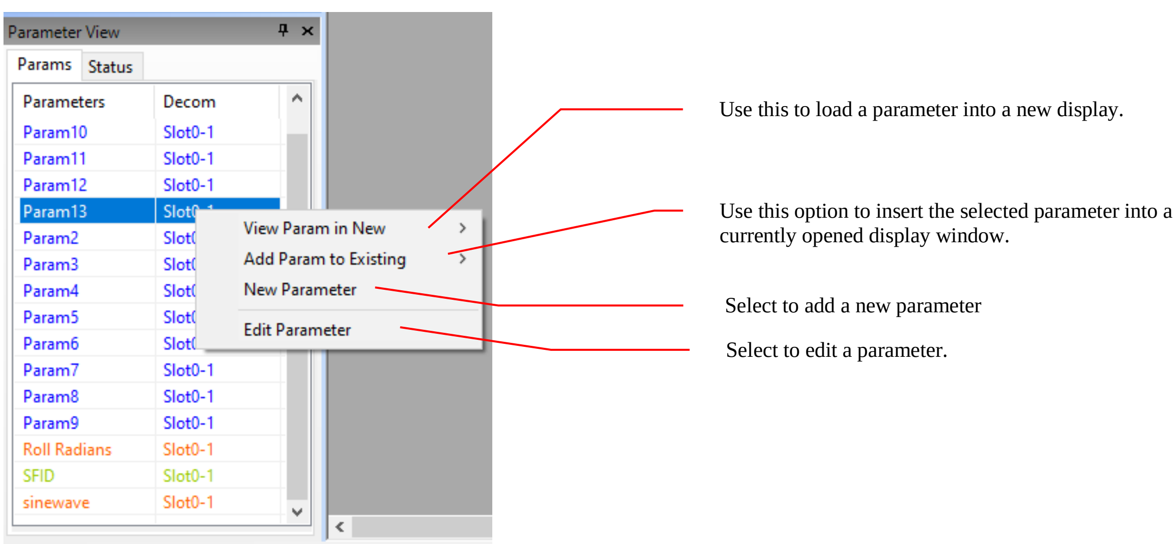


Figure 35 – Parameters Window Right Mouse Click

4.1.4 Display Properties Window

The Display Properties window shows the attributes of a selected display within the display area. Users can make immediate changes by editing its attributes. The example below is from a Tabular Display:

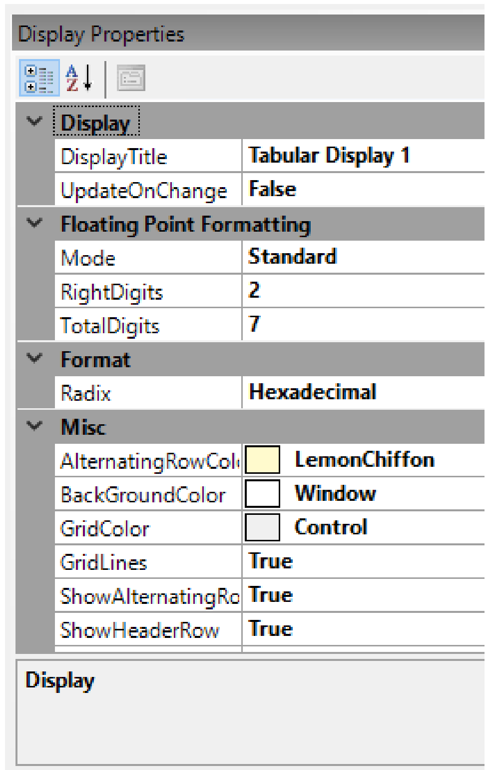


Figure 36 – Display Properties

4.1.5 The Hardware Status Bar

The Hardware Status bar on the main screen provides continuous status (updated on 250 millisecond intervals) of all Ulyssix cards and their associated Bit Syncs, Frame Syncs and Simulators. Use this bar during configuration to verify the proper setup and operation. Also use this bar during live testing to verify and monitor PCM signal existence, quality, and status. (See Figure 37 – Status Section of Main Screen below.)

Use this field to identify the Bit Sync element.

Use this field to view the detected bit rate for a bit synchronizer and the programmed bit rate for a simulator.

Use this field to verify there's a valid input signal connected. **NOTE: The Tarsus3 Auto Gain Control (AGC) Circuitry generates this value and typically runs between 50 and 90%. A missing signal typically causes the AGC to cycle from low to high looking for a signal.**

This field indicates the lock status of the bit synchronizer PLL loop.

Hardware Status

Card	BitRate	Sig. Strength	Loop	Frame Sync	SF Sync	Bit Slips	Sync Errors	SFID	IRIG Time
BSyncSlot0-1/FSyncSlot0-1	1000000.0	100 %	Lock	Lock	Lock	0	0	29	N/A
SimSlot0-1/TimeSlot0-1	1000000.0	100 %							Loss

Use this field to verify the Frame Synchronizer circuitry is setup and operating correctly. The status will be Search, Check, or Lock.

Use this field to verify the Sub-Frame Synchronizer is setup and operating correctly. The status will be Search, Check, or Lock.

Use this field to determine if the Frame Synchronizer circuitry has detected bit slips in the incoming PCM stream.

Use this field to determine if the Frame Synchronizer has found errors in the Sync Pattern of the incoming PCM stream.

Use this field to verify the Sub-Frame Identifier word in the incoming PCM stream is running.

Figure 37 – Status Section of Main Screen

4.1.6 Events Window

This Events Window logs noteworthy events that occur while the ALTAIR software is running. Archive Start and Archive Stop events are always logged. Frame Lock and Sub Frame Lock changes can also be logged. Logging for these events are enabled by going to the main menu clicking on **Tools** and then selecting **Options**. In the Options window, click on the **Events** tab and then check the box next to Frame Lock Change and Sub Frame Lock Change.

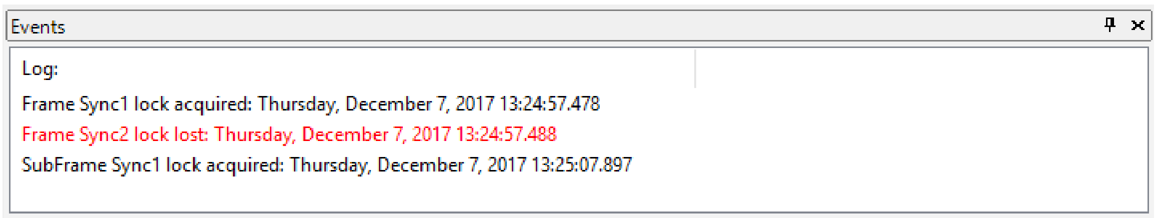


Figure 38 – Events Window

4.1.7 Displaying and Hiding Toolbars and Docking Windows

Toolbars and Docking Windows can be displayed or hidden. For example, some users may want to hide the Archive Toolbar until ready to change modes and use that toolbar. The Hardware Explorer, Parameters, and Hardware Status windows are referred to in this manual as **Docking Windows**. Docking Windows can be hidden in the same manner as the toolbars. To display or hide a toolbar, click on the **View** menu at the top of the ALTAIR main screen. Select a toolbar or Docking Window from the list to enable or disable.

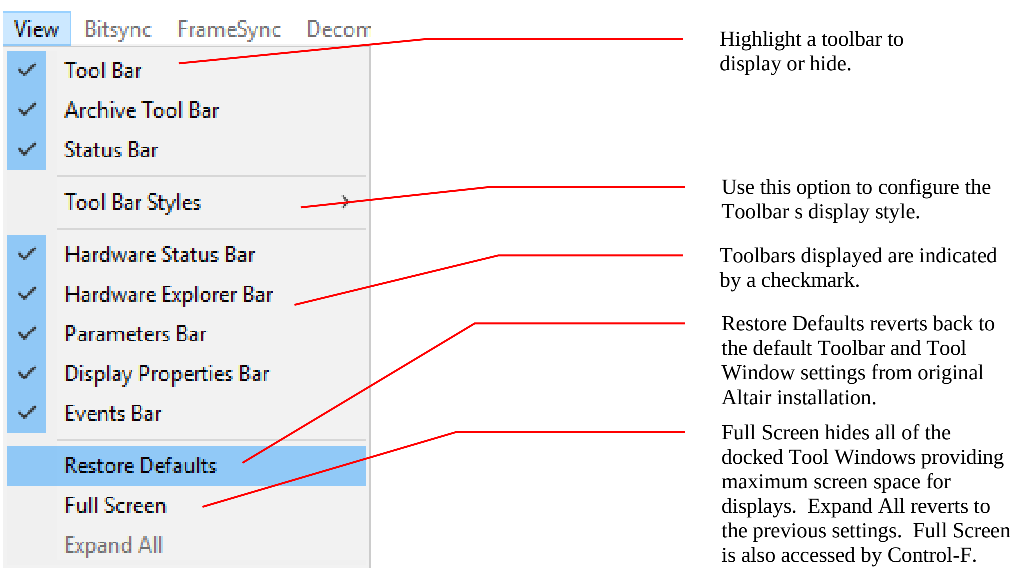


Figure 39 – View Menu

4.1.8 Moving Toolbars and Docking Windows

Toolbars are docked just below the menu while Docking windows are located either to the left or bottom of the ALTAIR main screen. To rearrange Toolbars and Docking windows, use the mouse and drag to a new location. Locations for toolbars are limited and during replacement will be placed at the closest acceptable position automatically. Docking windows are more flexible and can be docked anywhere on the screen or left in a “floating mode”. When dragging a Docking window, a “helper” overlay (see Figure 40 – Docking Help)will be displayed on the screen showing what points to drop the window.

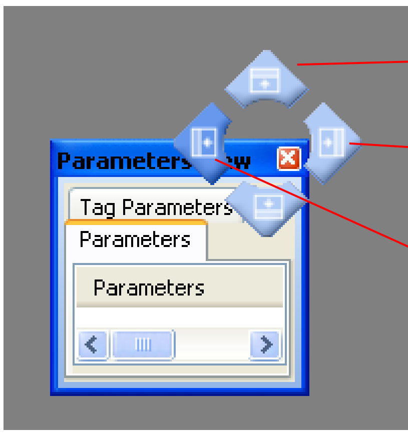


Figure 40 – Docking Helper

4.2 File Management

The ALTAIR software maintains configuration information in XML based data files. The XML file contains the configuration for the Ulyssix hardware as well as the ALTAIR software. The ALTAIR Display Screens are stored in separate XML file with the DP extension. ALTAIR also stores and loads hardware configuration via the IRIG106 Chapter 9 TMATS format.

The data files can be named, saved, and loaded upon request. Loading a configuration file causes the data to be read from the file, converted to a format compatible with the current Ulyssix hardware, and then sent to the hardware. This method of file management allows pre-creating many configuration files where they can be loaded prior to a test that collects PCM data.

The creation, saving, and naming of the configuration files can be done using the File menu.

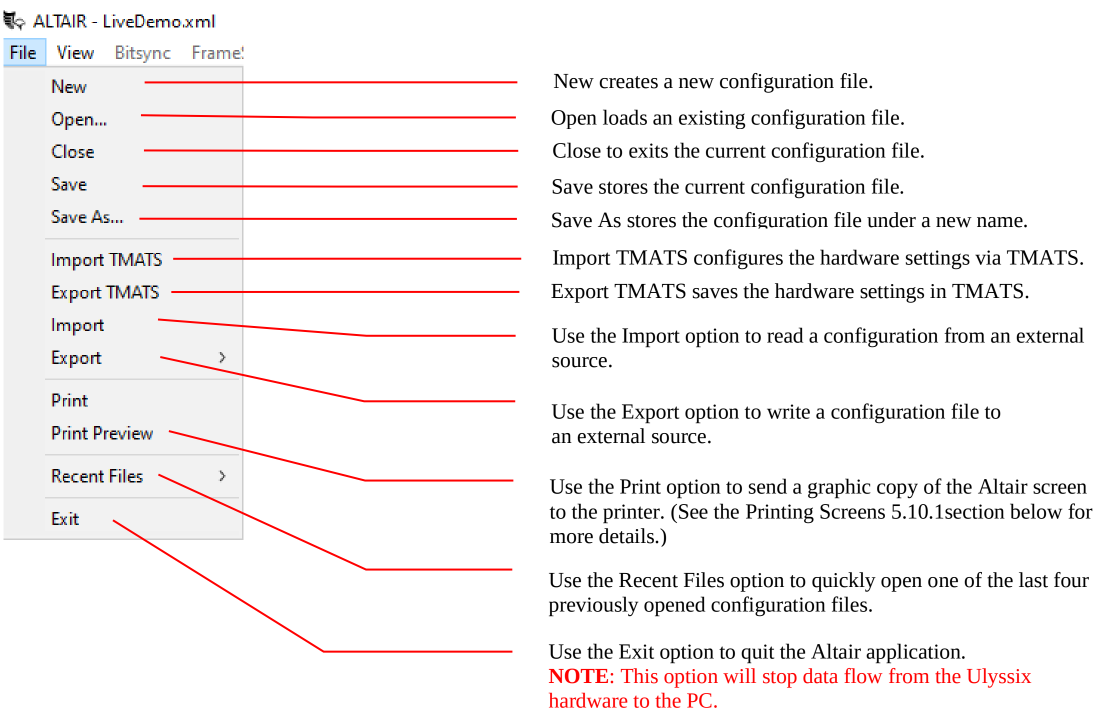
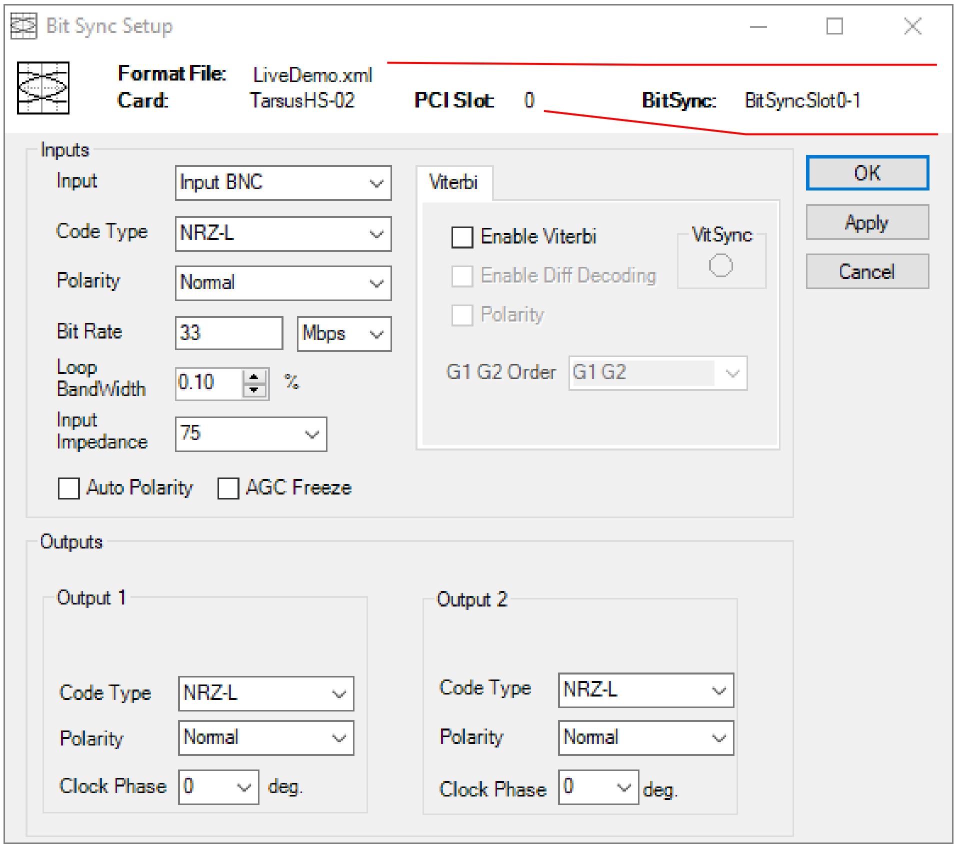


Figure 41 – File Menu

4.3 Configuring the Bit Sync

On the ALTAIR main screen, select a Bit Sync in the Hardware Explorer window or from the main menu select ***Bit Sync\Setup Bit Sync***. The Bit Sync setup screen will be displayed as shown below.



Use this field to verify the configuration file name.

Use the Card, PCI Slot, and Bit Sync name fields to verify the desired Bit Sync is being configured. **NOTE:** The PCI Slot will correspond to the Hardware LED's. (See section 3.2.1 LED Indicators)

Figure 42 – Bit Sync Setup

1. Select an input connection - either **Input BNC** or **Input Diff**. When Input BNC is selected, the Tarsus3 card will receive data from the BNC input connector. If **Input Diff**. is selected, the card will receive data from the concentric twin-BNC connector.

The Hardware uses a switch to choose the input; both are not active at the same time.

2. Select a Code Type for the incoming PCM stream.
3. Choose Polarity. If the polarity is unknown, select **Auto Polarity** and the software will determine the appropriate setting.
4. Enter the incoming PCM stream Bit Rate up to 40 Mbps. This rate unit (bps, Kbps, Mbps) is selectable by using the drop-down selection box.
5. The Loop Bandwidth setting is selectable between 0.01 to 3.00 percent. Use a smaller loop bandwidth to achieve a better BER performance out of the Bit Sync, however, if

the input PCM bit rate is slightly low or high; the Bit Sync might not lock. If a lock does not occur, try increasing the loop bandwidth.

6. Select **AGC Freeze** (where the Auto Gain Control values are "frozen") to decrease re-sync acquisition time upon incidence of bit lock loss.
7. Select the PCM code type for the first output of the Bit Sync. The output code types are; non-return to zero level (**NRZ_L)**, non-return to zero mark (**NRZ_M)**, non-return to zero space (**NRZ_S)**, bi-phase level (**BIΦ_L)**, bi-phase mark (**BIΦ_M)**, bi-phase space (**BIΦ_S)**, delay modulation mark (**DM_M)**, delay modulation space (**DM_S)**, return to zero (**RZ)**, randomized non-return to zero **RNRZ_11** and **RNRZ_15** and are completely independent from the input Code Type.
8. Select either **Normal** or **Inverted** polarity for the output PCM data stream.
9. Select a clock phase of **0**, **90**, **180** or **270** degrees. This setting changes the relationship of the data with respect to the PCM clock rising edge. The proper setting here depends entirely on the type of external equipment being attached.
10. Setup a second Bit Sync output for the same input signal, otherwise, press OK to save, or Cancel to abandon changes.
11. **Use External Input** if the second output is to be used as a standalone code converter.
12. Repeat steps 7 through 10.
13. Click the Apply button to immediately send the changes to the hardware. Click OK to store the changes to the in-memory database. Click Cancel to abort changes.

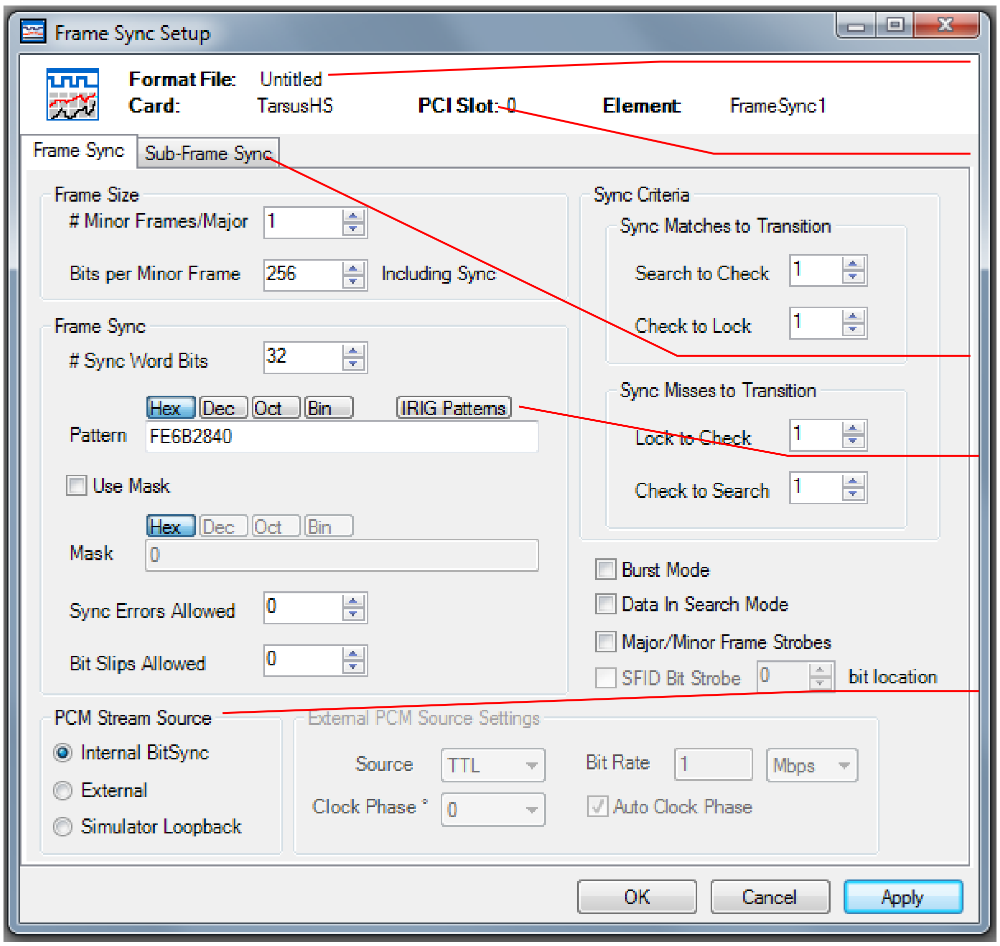
CAUTION

Clicking OK does not save the changes to the computer hard drive; it simply stores these changes to the in-memory database. Saving must be done from the main ALTAIR screen.

4.4 Configuring the Frame Sync

From the ALTAIR main screen, select a Frame Sync in the Hardware Explorer window or ***Frame Sync\Setup,*** from the main menu. The Frame Sync setup screen will be displayed as shown below.

The dual channel Tarsus3-02 and Bald Eagle RF-02 cards have external inputs for both Frame Sync 1 and Frame Sync 2. Frame Sync 1 External Input has inputs source options of TTL or RS422. Frame Sync 2 External Input source must be TTL.



Use this field to verify the desired configuration file is being changed.

Use the Card, PCI Slot, and Bit Sync name fields to verify the desired Frame Sync is being configured. **NOTE:** The PCI Slot will correspond to the Hardware LED's. (See section 3.2.1 LED Indicators.)

Use the folder tabs to switch between Frame Sync and Sub-Frame Sync setup forms.

Use this button to select from a list of IRIG recommended sync patterns. The IRIG patterns are directly from **IRIG STANDARD 106-17.**

Use the PCM Stream Source feature to send clock and data into the Frame Sync using either Internal Bit Sync or externally through the Clock and Data input BNC's. Simulator Loopback feeds the Simulator output to the Bit Sync inside of the card. A BNC is not needed.

Figure 43 – Frame Sync Setup

1. Enter the number Minor Frames per Major Frame from **1** to **1024**.
2. Enter the Number of bits per Minor Frame, including the number of Sync Word bits.
3. Enter the number of Sync Word bits from **16** to **33** bits.
4. Manually enter press the IRIG Patterns button to select the appropriate sync pattern for the incoming PCM stream.

5. Select the **Use Mask** to setup a mask value that causes the Tarsus3 frame sync circuitry to ignore certain bits of the sync word. To use Mask, enter a mask value using the following logic rules:

- A logic high or '1' in any bit position will cause the Frame Sync circuitry to ignore that bit. For example:

Sync Word Size:	32-bits
Sync pattern:	0xFE6B2840 (in Hexadecimal)
Mask value:	0x0000F000 (in Hexadecimal)

The example above will cause the Frame Sync circuit to ignore bits 12 through 15 during sync detection. Any value in the PCM stream where the **"2"** in the FE6B2840 pattern is located would cause a valid frame lock on the status screen. (See Figure 37 – Status Section of Main Screen.)

6. Enter the number of sync pattern errors the frame sync circuitry should allow in the incoming PCM stream before declaring the frame NOT locked. **NOTE:** A sync error is defined as any bit within the sync word that is not masked and does not match the entered sync pattern. (A non-allowed sync error will cause a transition in the sync criteria explained in steps 9-12 below.)
7. Enter the number of bit slips the frame sync circuitry should allow in the incoming PCM stream before declaring the frame NOT locked. (A non-allowed bit slip will cause a transition in the sync criteria explained in steps 9-12 below.)
8. Set the sync criteria for the number of "Search to Check" transitions the hardware should require before changing the frame status from ***Search*** to ***Check***. (See Figure 37 – Status Section of Main Screen.)
9. Set the sync criteria for the number of "Check to Lock" transitions the hardware should require before changing the frame status from ***Check*** to ***Lock***. (See Figure 37 – Status Section of Main Screen.)
10. Set the sync criteria for the number of "Lock to Check" transitions the hardware should require before losing the ***Lock*** status and changing it to ***Check***. (See Figure 37 – Status Section of Main Screen.)
11. Set the sync criteria for number of "Check to Search" transitions the hardware should require before losing the ***Check*** status and changing it ***Search***. (See Figure 37 – Status Section of Main Screen.)
12. Use the **Data In Search Mode** selection if the user desires data regardless of Frame Lock.
13. Use **Burst Mode** to archive frame data to the hard drive faster than normal mode. The criteria used for Burst Mode archive is to start storing data immediately after the minor frame sync pattern is recognized. The number of bits in the minor frame is ignored from the frame sync criteria and data will continue to archive as long as the minor frame sync pattern is detected. In effect, this is the same as setting the Frame Sync Criteria to 0 for Search to Check and 0 for Check to Lock, as well as, going out of Lock through Check and Search.
14. Select the PCM Stream Source - either **Internal Bit Sync**, **External**, or **Simulator Loopback.** The Internal Bit Sync requires data into the Bit Sync Input. The External Input requires clock and data into the Frame Sync Inputs.

The Simulator Loopback connects the Simulator to the Bit Sync inside of the Ulyssix PCM card. For Internal Bit Sync or Simulator Loopback skip to step 18.

15. For External PCM streams, set to either **TTL** or **RS422** for Frame Sync 1. Frame Sync 2 External Input must be **TTL**.
16. Enter the External PCM stream Bit Rate and Bit Rate Units from the drop-down list.
17. Select a Clock Phase - 0 degrees or 180 degrees for the external clock phase. A **Half Rate Clock GU** selection is available if the external clock is running at half-rate with data on both the rising and falling edge of clock. The check box for Auto Clock Phase will attempt to detect the Clock Phase.
18. Click the Apply button to immediately send the changes to the hardware. Click OK to store the changes to the in-memory database. Click Cancel to abort changes.

CAUTION: Clicking OK does not save the changes to the computer hard drive; it simply stores these changes to the in-memory database. Saving must be done from the main ALTAIR screen.

4.5 Configuring the Sub-Frame Sync

From the ALTAIR main screen, select a Frame Sync in the Hardware Explorer or ***Frame Sync\Setup,*** from the Main Menu. When the setup screen appears, select the Sub-Frame Sync folder tab. The Sub-Frame Sync setup screen will be displayed as shown below.

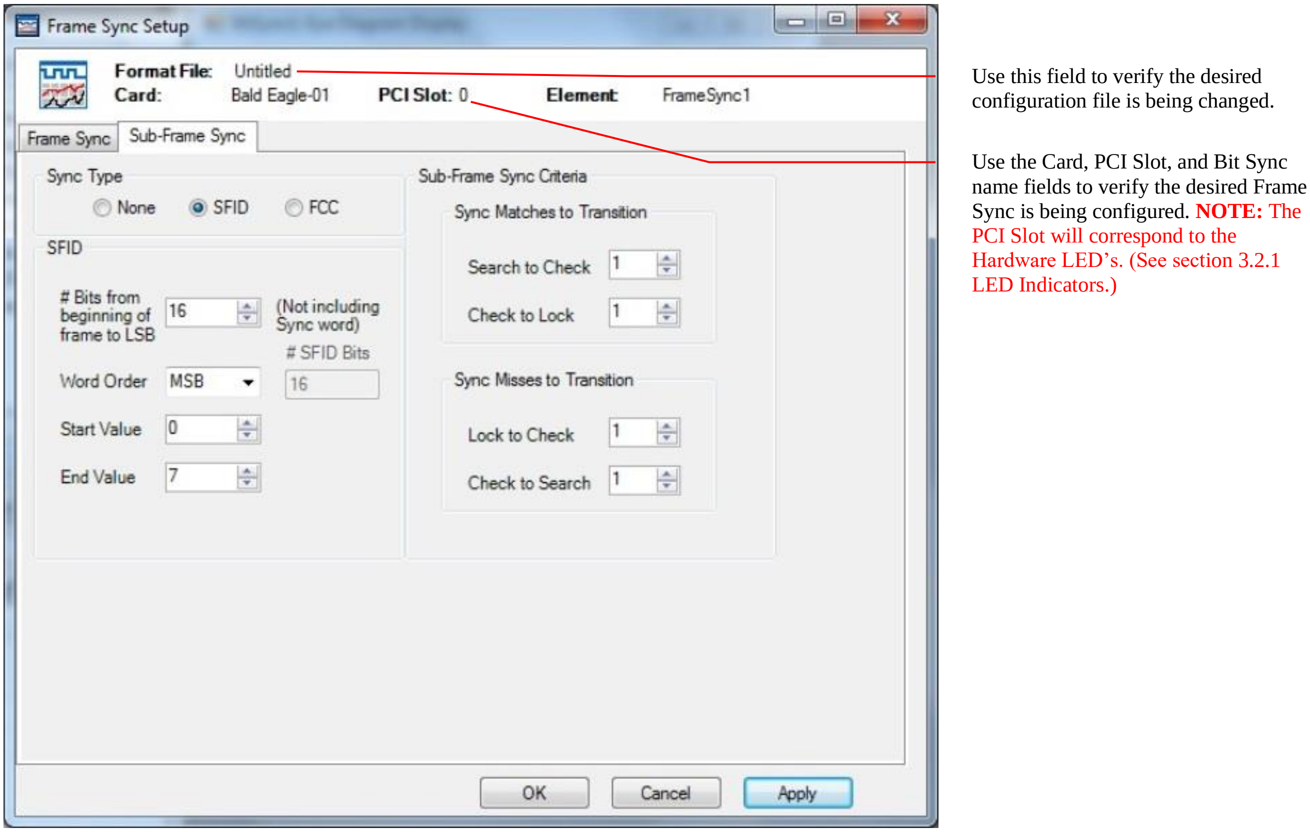


Figure 44 – Sub-Frame Sync Setup

1. Enter the Sync Type: Sub-Frame ID counter (**SFID**), Frame Code Complement (**FCC**), or no minor frame sync (**None**). (See Figure 62 – Example of a 32-bit Parameter Created from Two 16-bit PCM Words for details on how the Tarsus3 hardware is expecting frames to be defined.) If **SFID** is selected, go to step 2, otherwise skip to step 9.
2. For SFID, enter the number of bits from the beginning of the frame to the least significant bit (LSB) of the SFID word - not including the sync pattern. For example, if the SFID word is located at word location 1 and the data is transmitted most significant bit first (MSB), the number of bits would be the size of the SFID word.
3. Set the order in which the SFID data was transmitted in the PCM stream – MSB or LSB. If selecting LSB, enter the number of SFID word bits.
4. Enter the starting and ending value for the SFID. This usually starts at zero and ends at the number of minor frames, minus one.

5. Set the sync criteria for number of “Search to Check” transitions the hardware should require before changing the frame status from ***Search*** to ***Check***. (See Figure 37 – Status Section of Main Screen.)
6. Set the sync criteria for number of “Check to Lock” transitions the hardware should require before changing the frame status from ***Check*** to ***Lock***.
7. Set the sync criteria for number of “Lock to Check” transitions the hardware should ***requ***ire ***befo***re losing the ***Lock*** status and changing it to ***Check***.
8. Set the sync criteria for number of “Check to Search” transitions the hardware should require before losing the ***Check*** status and changing it ***Search***.
9. Click the Apply button to immediately send the changes to the hardware. Click OK to store the changes to the in-memory database. Click Cancel to abort changes.

CAUTION

Clicking OK does not save the changes to the computer hard drive; it simply stores the changes to the in-memory database. Saving must be done from the main ALTAIR screen.

4.6 Configuring the Decom

Decommutating PCM data is a combined effort of the Tarsus3 the hardware and the ALTAIR software. The following section describes the process of configuring the Tarsus3 hardware to decommutate a PCM stream. It also setups up the software to extract data from the PCM stream. The extracted data will be identified, combined, and processed so the user can then visualize and analyze the PCM data.

From the ALTAIR main screen, select a Decom in the Hardware Explorer window or select ***Decom/Setup*** from the Main Menu. The Decom setup screen will be displayed as shown below.

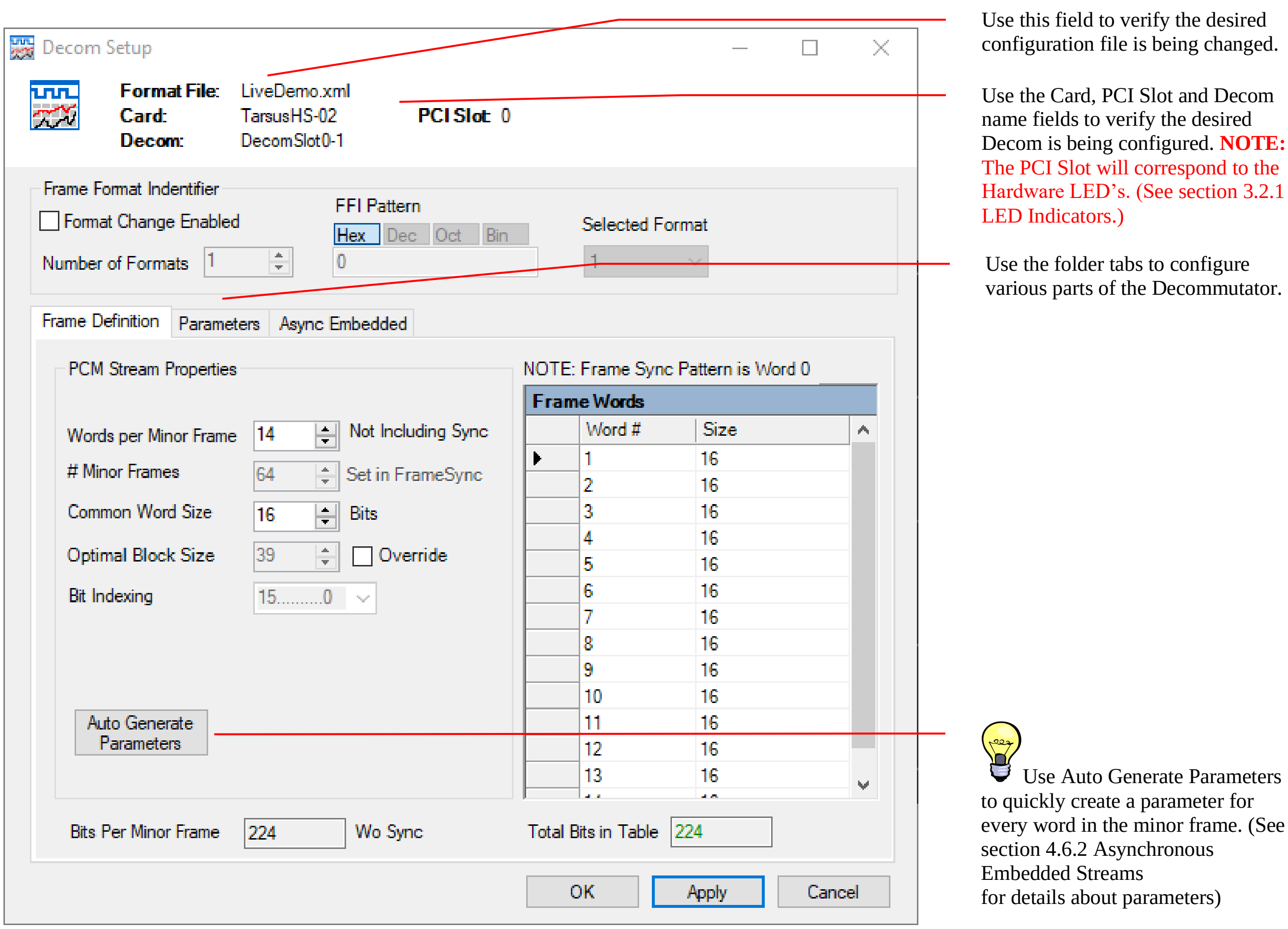


Figure 45 – Decom Setup

1. The next step will depend on whether the IRIG Class II Decom Frame Format Indicator (FFI) is used. If it is not used, verify the **Format Change Enabled** button is not checked and continue to step 11.
2. Enable the FFI feature by clicking the **Format Change Enabled** check box. This selection enables all other FFI fields at the top of the Decom window as well as the FFI Commutation Type in the Parameter Edit/Add window. To use the FFI, a FFI parameter must be created.

   a. A good explanation of this feature is defined in IRIG206 as: "Format change is defined as change with regard to frame structure, word length or location, commutation sequence, sample interval, or change in measurement list. Format changes shall occur only on minor frame boundaries. Bit synchronization shall be maintained, and fill bits used instead of intentional dead periods. Format changes are inherently disruptive to test data processing; fixed format methods are preferred." (IRIG STANDARD 106-17 Part I, page 4-6).
3. The next step is to select the number of unique formats in **the Number of Formats** control.
4. A Frame Format Identifier (FFI) word is needed to allow the Tarsus3 hardware to identify a unique pattern in the PCM stream and perform a format switch. Select the FFI Number in the **Selected Format** combo box and then enter the FFI pattern into the **Pattern** control. The **Pattern** control allows you to select Hex, Dec, Octal, or Binary to enter your FFI Pattern.
5. Repeat Step 9 for each of the FFI Numbers in the **Selected Format** combo box.

Clicking OK does not save the changes to the computer hard drive; it simply stores these changes to the in-memory database. Saving must be done from the main ALTAIR screen.

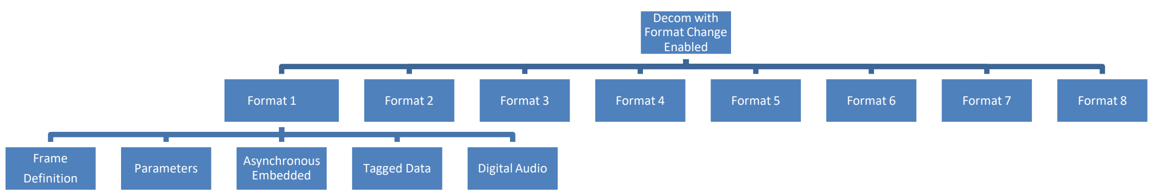


Figure 46 – Decom Data Configuration for a Single Format

4.6.1 Defining the PCM Frame

To define a PCM frame, follow the step by step procedure:

1. At the Decom Setup main screen, select the **Frame Definition** tab. The frame definition screen will be displayed. (See **Figure 47 – Frame Definition Setup**.)

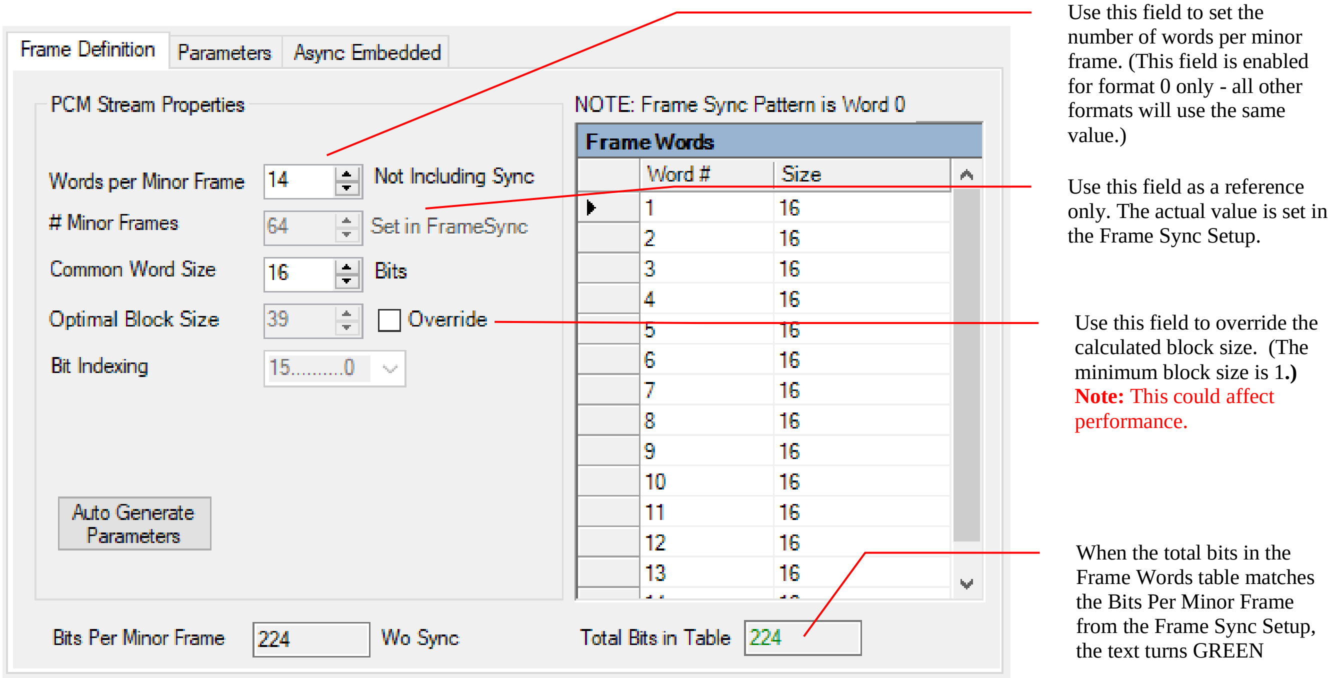


Figure 47 – Frame Definition Setup

2. Enter the number of words in each minor frame. Moving focus from this field will cause the **Frame Words** on the right-hand side of the screen to automatically update for the number of words entered.
3. Enter the common word size in bits. Moving focus from this field will cause the **Frame Words** to be automatically updated.
4. If words in the PCM frame have different word sizes, the last step is to define the word size for each word in the minor frame. The word size can be changed by selecting the size field in the **Frame Words** table for the appropriate word and directly typing in a new value. The sum of the Frame Words Size must be less than Bits Per Minor Frame.
5. If using **Optimal Block Size**, use the estimate best number of minor frames to pack in a single DMA transfer (approximately 10ms of data). (Typically, user would not want to change this number; however, the delay of real time data vs. what appears on screen will be approximately equal to this data block size. At lower data rates, changing this value is tolerated better than at high data rates (>20Mbps). If the data block is too small at high data rates, the chance of DMA buffer overflow due to processing time will be increased.)
6. Use **Bit Indexing** to define the MSB and LSB as 0, 1, or Nth bit of the Word.

4.6.2 Asynchronous Embedded Streams

Asynchronous embedded streams are secondary telemetry streams that occur inside a main telemetry stream. Each asynchronous embedded stream has its own frame sync pattern, frame length, and clock speed. The data from the embedded stream occupies a fixed number and location of decom words per minor frame in the main telemetry stream. The embedded stream is asynchronous to the main stream, meaning that the data clock of the embedded stream is different from the data clock of the main stream. Typically, the asynchronous embedded stream runs slower than the main stream. In the PCM Encoder of the test vehicle, the asynchronous embedded stream data is stored in a FIFO and when a complete frame is stored, it is dumped to the main stream in consecutive words. When the asynchronous embedded data is not available, the words in the main stream are filled with a specific filler word.

For example:

Main Stream:
Frame Rate: 5kHz (Bit Rate of 4Mbps)
Frame Sync Pattern: FE6B2840 (32-bits)
Frame Length: 800 bits (fifty 16-bit words)
Word Size: 16-bits
Minor Frames: 64
Asynchronous Embedded Size: 160 bits (ten 16-bit words) per minor frame

Asynchronous Embedded Stream:
Frame Rate: 400Hz (Bit Rate of 360kbps)
Frame Sync Pattern: EDE20 (20-bits)
Frame Length: 900 bits (ninety 10-bit words)
Word Size 10-bits
Minor Frames 1
Fill Word: 0xAAAA

In the example above, there are 160 bits of asynchronous embedded data per minor frame, but the asynchronous embedded frame is 900 bits longs. It will take 5.625 minor frames from the main stream to contain one frame from asynchronous embedded stream. One frame of asynchronous frame is 2.5mS (400Hz). In that same 2.5mS, the main frame has 12.5 minor frames. These 12.5 minor frames have 2,000 bits of asynchronous data. Since a minor frame of asynchronous embedded frame is only 900 bits, the remaining 1,100 bits of the 2,000 bits of the asynchronous data in the main frame is filled with the fill word.

Setting up the Asynchronous Embedded Stream:

1. Double click the Decom in the Hardware Explorer to launch the Decom Setup window.
2. In the Decom Setup window, select the Async Embedded tab.

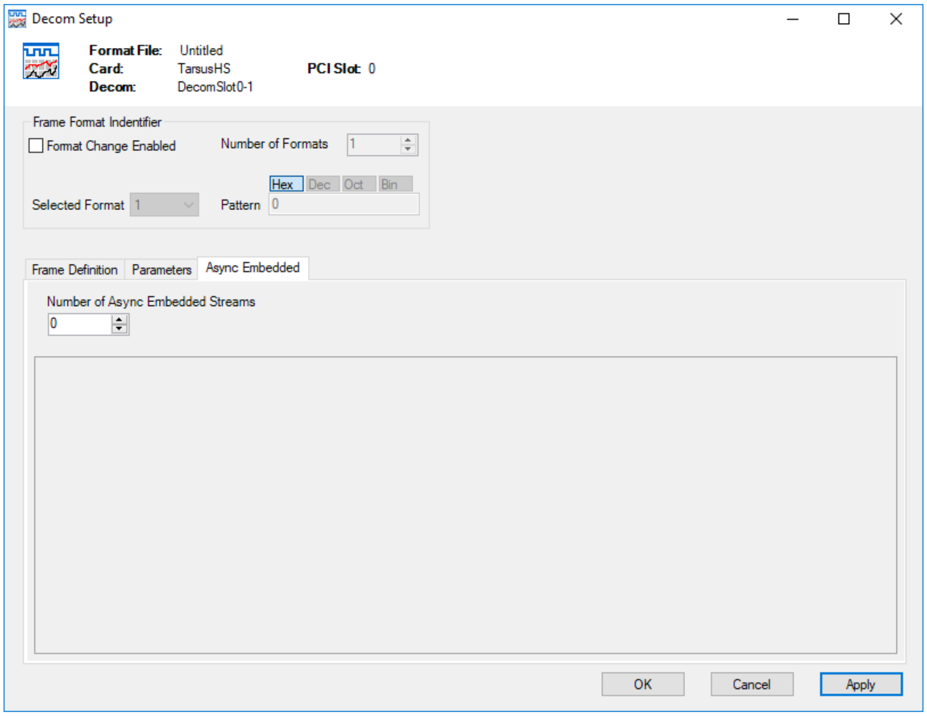


Figure 48 – Async Embedded Setup Window

3. Click the up arrow on the Async Embedded Streams numeric control to set the number of asynchronous embedded streams needed. ALTAIR allows up to eight asynchronous embedded steams. Please note that each asynchronous embedded stream has its own software frame sync and software decom, which use computer resources. The frame size and data rates of the main stream and asynchronous embedded streams determine the required computer resources.
4. Once the Async Embedded Streams numeric control is increased, a new Async Embedded Stream control appears.

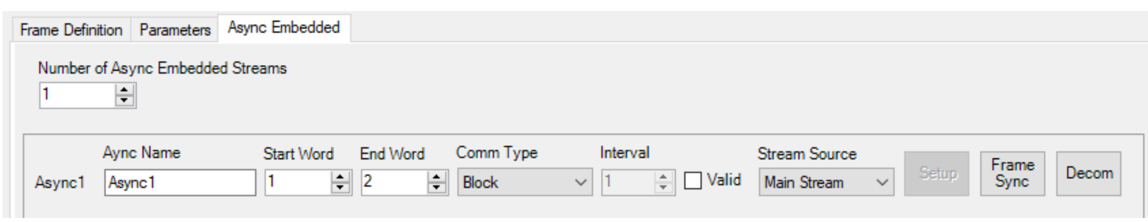


Figure 49 – Async Embedded Stream Control

5. The Async Embedded Stream control has the following controls:
   a. Async Name – this text box is the name of the asynchronous embedded stream. This is name is used to identify this asynchronous embedded stream in other parts of ALTAIR.
   b. Start Word – the staring word location for the asynchronous embedded stream in the main stream. This word references the variable bits per word table in the Decom Setup window.

c. End Word – the end word location for the asynchronous embedded stream in the main stream. This word references the variable bits per word table in the Decom Setup window.
d. Comm Type – the commutation type for the asynchronous embedded stream. There are four options: Block, Sample, RandomNormal, and Random.
    i. Block – every word between Start Word and End Word is part of the asynchronous embedded stream.
    ii. Sample – the asynchronous embedded stream begins at Start Word and increments by the interval to End Word. For example, if Start Word is 3, End Word is 7, Comm Type is Sample, and Interval is 2, then Words 3, 5, and 7 are the asynchronous embedded stream.
    iii. RandomNormal – the words for the asynchronous embedded stream are selected from anywhere in the minor frame. And those words are in the asynchronous embedded stream in every minor frame. When RandomNormal is selected, the Setup button is enabled. You must click the Setup button to choose the words in the minor frame for the Random Normal asynchronous embedded stream.
    iv. Random – the words for the asynchronous embedded stream are selected from anywhere in the major frame. When Random is selected, the Setup button is enabled. You must click the Setup button to choose the words in the major frame for the Random asynchronous embedded stream.
e. Interval – only used when Comm Type is set to Sample. Interval is the spacing between words in the asynchronous embedded stream. With a Start Word of 3, End word of 12, and Interval of 2 the asynchronous embedded streams uses Words 3, 6, 9, and 12.
f. Valid – this check box is not currently used.
g. Stream Source – this control determines the PCM stream source for the Async Embedded Stream. This control can be set to another Async Embedded Stream to implement an Async Embedded inside of another Async Embedded.
h. Setup – this button is only enabled for Comm Types of RandomNormal and Random. Clicking this button launches a window to enter the Word and Frame positions. The entry uses the format “W1,F1;” Where W1 is word 1. F1 is frame 1. There is a comma between W1 and F1. And there is a semicolon after F1.

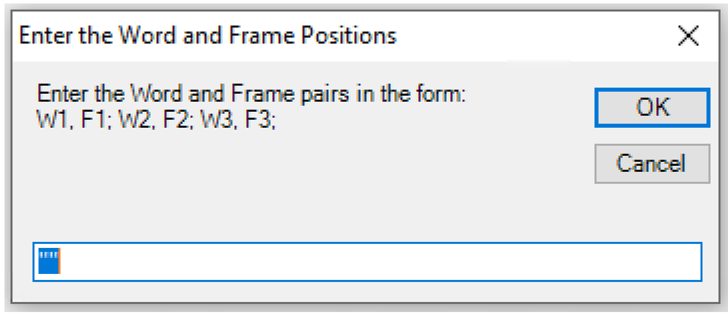


Figure 50 – Async Embedded RandomNormal and Random Word Entry

   i. Frame Sync – this button launches the Async Embedded Frame Sync window.
   j. Decom – this button launches the Async Embedded Decom window.
6. Set the Async Name text box to the name of the asynchronous embedded stream.
7. Set the Start Word, End Word, and Comm Type to define the location of the asynchronous embedded data in the main stream. If the Comm Type is Sample, then et the Interval.
8. Click the Frame Sync button to launch the Async Frame Sync window.

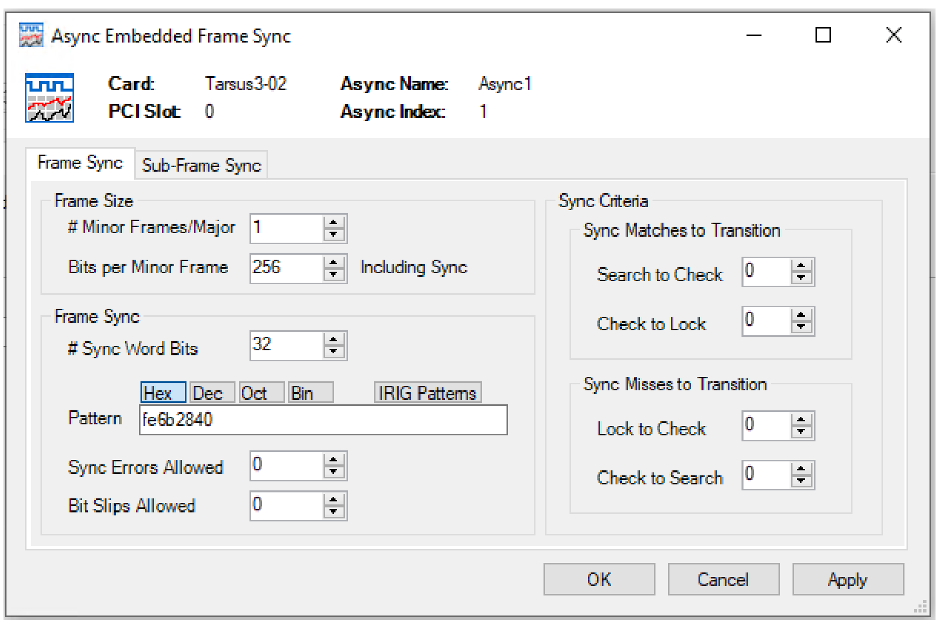


Figure 51 – Async Embedded Frame Sync Window

9. The Async Embedded Frame Sync window has similar controls to the Frame Sync Window:
   a. Frane Size
      i. Bits per Minor Frame – the total number of bits in the asnchronous embedded minor frame. This value includes the bits in the asynchronous embedded frame sync pattern.
   b. Frame Sync

        i. Number of Sync Word Bits – the number of bits in the frame sync pattern. This value needs to correspond to the entry in the Frame Sync Pattern control.
        ii. Frame Sync Pattern – the value of the frame sync pattern. This control has a button that allows you to select the defaul IRIG Pattern for the number of bits in the frame sync pattern. The Hex, Dec, Oct, and Bin buttons selece the numeric format for how the frame sync pattern is displayed and entered.
        iii. Sync Errors Allowed – the number of bits in the binary stream allowed not to match the frame sync pattern. Setting Sync Errors Allowed to one means that the frame sync will identify the frame sync pattern in the binary stream when all but one bit match.
        iv. Bit Slips Allows – the number of bits in the binary stream allowed to be off for the location of the frame sync pattern. Setting Bits Slip Allowed to one means that the frame sync will identify the frame sync pattern in the binary stream if it is located bits per minor frame plus or minus one bit from the prviously located frame sync pattern.
    c. Sync Criteria
        i. Search to Check – the number of found frame sync patterns to promote from Search to Check.
        ii. Check to Lock – the number of found frame sync patterns to promote from Check to Lock.
        iii. Lock to Check – the number of missed frame sync patterns to demote from Lock to Check.
        iv. Check to Search – the number of missed frame sync patterns to demote from Check to Search.

10. Set the Bits per Minor Frame, Number of Sync Word Bits, and the Frame Sync Pattern.
11. Set the Sync Errors Allowed and Bit Slips Allowed. The default values are 0. This is the recommended setting unless a change is needed to aid in keeping lock.
12. Set the Sync Criteria. The default values are 0. These values should stay at 0 unless there is a compelling reason for increasing them. Because the asynchronous embedded stream might have filler bits between frames, the frame sync needs to go from Search directly to Check when it finds a frame sync pattern and then from Check directly to Search when it misses a frame sync pattern. For more information, please contact Ulyssix.
13. The Frame Sync window has a tab for the SubFrame Sync. If the SubFrame Sync is not used, please skip to the next step.
    a. Click on the Sub-Frame Sync tab. The settings are similar to the SubFrame Sync menu for the Frame Sync
    b.

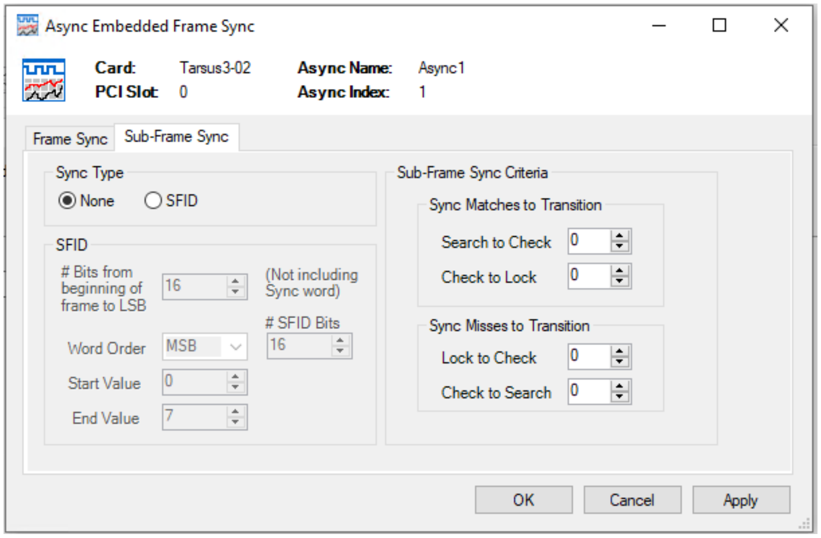


Figure 52 – Async Embedded SubFrame Sync Window

c. Select the use of the SFID.
d. Set the number of bits from the end of the Frame Sync Pattern to the end of the SFID. If the SFID is the 16-bit long and the first word in the minor frame, then the value is 16.
e. Set the Word Order for the SFID, either Most Significant Bit First (MSB) or Least Significant Bit First (LSB).
f. Set the Number of Bits in the SFID word.
g. Set the Start Value for the SFID to the first value in the SFID. This value is typically 0, but it can 1 or the SFID can count down from a number.
h. Set the End Value for the SFID to the last value in the SFID. This value is typically the number of minor frames minus one but can be the number or minor frame or even zero or one if the SFID counts down.
    i. Search to Check – the number of correct SFID to promote from Search to Check.
    ii. Check to Lock – the number of correct SFID to promote from Check to Lock.
    iii. Lock to Check – the number of wrong SFID to demote from Lock to Check.
    iv. Check to Search – the number of wrong SFID to demote from Check to Search.

14. Click the OK button to return to the Async Embedded controls in the Decom window.
15. Click the Decom button to launch the Async Embedded Decom window.

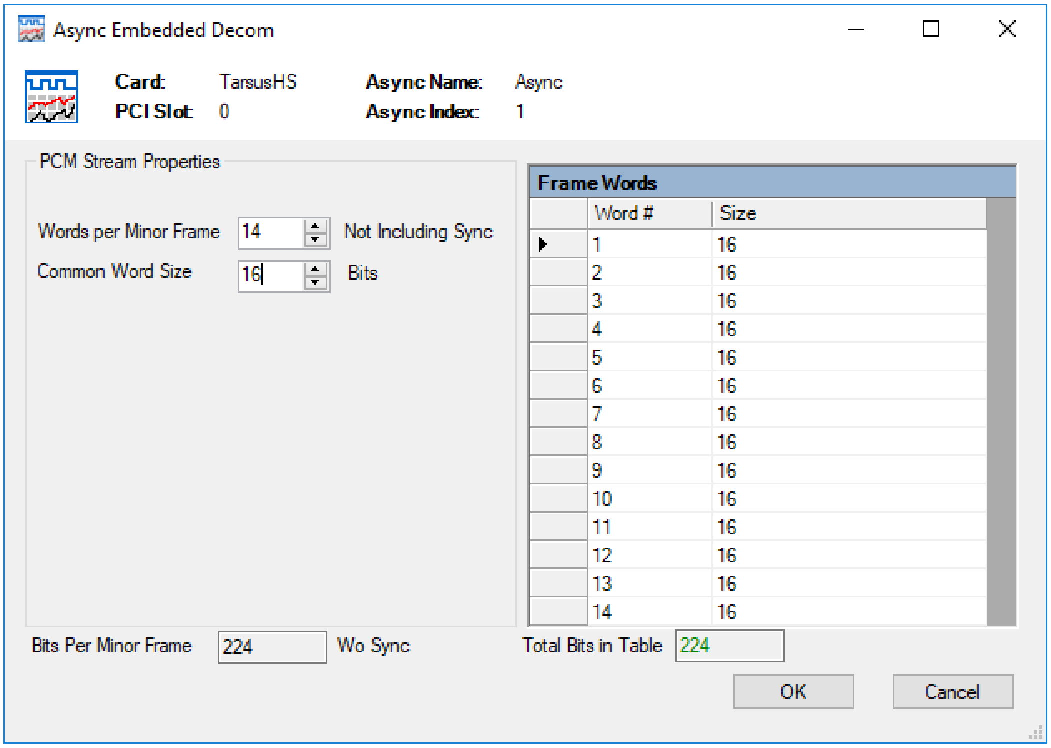


Figure 53 – Async Embedded Decom Window

16. The Async Embedded Decom window has controls similar to the Decom.
    a. Words per Minor Frame – the number of decom words per minor frame not including the frame sync pattern.
    b. Common Word Size – this the typical or base word size in bits.
    c. Frame Words Table – this table lists each word number and the bits in that word. Each word number can have its number of bits modified.
    d. Bits per Minor Frame – this indicator lists the total bits per minor frame minus the number of bits in the frame sync pattern.
    e. Total Bits in Table – this indicator lists the sum of all of the bit lengths from the Bits per Minor Frame table. The value in the Total Bits in Table indicator needs to match the value of the Bits per Minor Frame indicator.
17. Set the Words per Minor Frame and Common Words Size controls.
18. Check if the value of the Bits per Minor Frame indicator matches the value of the Total Bits in Table indicator. If the values match, then the number in the Total Bits in Table indicator will be green. If the values do not match, then the number in the Total Bits in Table indicator will be red.
19. If the values of the Bits per Minor Frame indicator and the Total Bits in Table indicators do not match, then the Async Embedded Decom settings need to be modified. If the asynchronous embedded frame uses a fixed word size, then ensure that the Words per Minor Frame and Common Word size controls are set to the correct value. If the asynchronous embedded frame uses variable bits per word, then ensure that the values in the Frame Words table are correct. The difference between the value of the Bits per Minor Frame and Total Bits in Table indicator might give a clue to which settings need to be adjusted.

20. Click ok on the Async Embedded Decom window to return to the Decom Setup window.
21. In the Decom Setup window, click OK to accept all of the changes to the Decom and Async Embedded settings.
22. Please see section 4.6.2 Asynchronous Embedded Streams for how to add a Decom Parameter for an asynchronous embedded stream. This section describes using a drop-down box to select the name of the stream source for the decom parameter. This drop-down box is populated with Main Stream as well as the name of each asynchronous embedded stream.

4.6.3 Creating Parameters

Parameters are entities which define how raw data is extracted out of the PCM frame, how the data is scaled or processed, and how the data is visualized. Once defined, Parameters can be displayed in any of the ALTAIR displays (see Using Decom Data Displays).

The Export button creates a CSV file with the decom parameters and their settings. The CSV file can be imported into ALTAIR using the Import button. This allows copying the decom parameters from one setup to another. Also, this CSV file is compatible with the decom parameter import in the DEWESoft software.

1. At the Decom Setup main screen, select the **Parameters** tab. The Parameters screen will be displayed. (See Figure 54 – Parameters Setup below.)

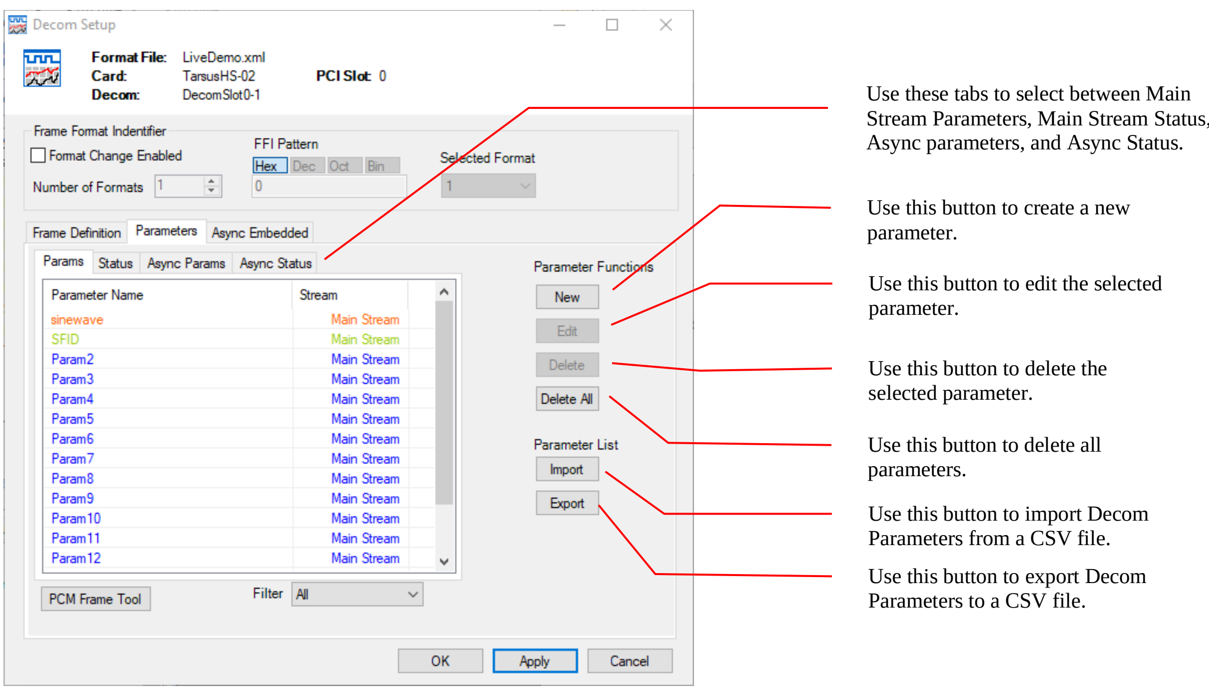
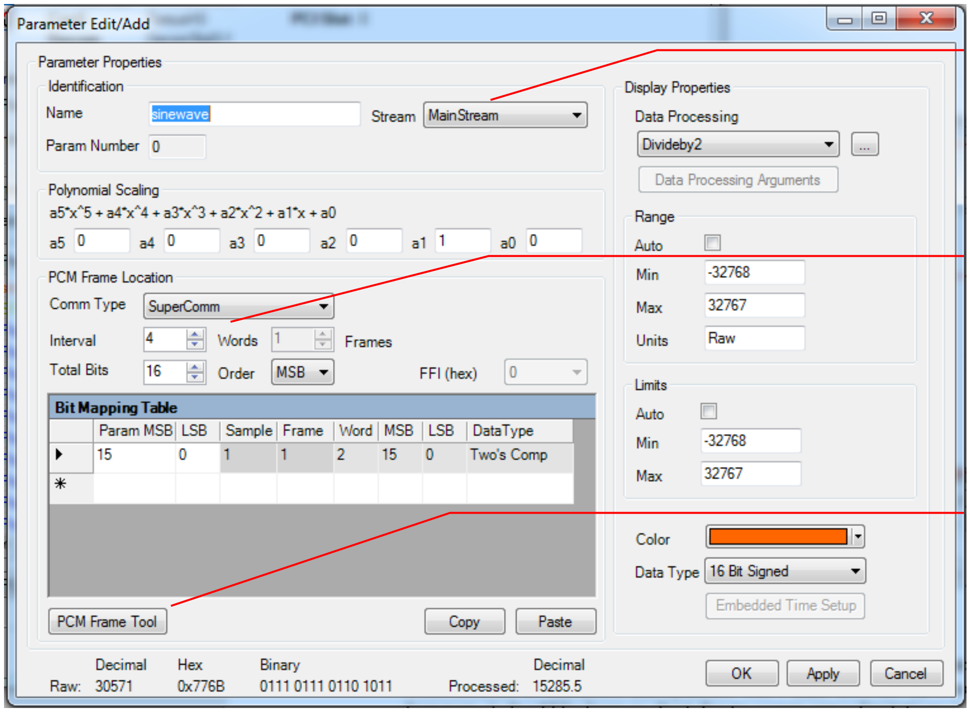


Figure 54 – Parameters Setup

2. Click on the **New** button to be presented with the Parameter Edit screen. (See Figure 55 – Parameter Edit/Add below.)



The Stream drop-down box is only visible when there is one or more Async Embedded Streams. The main telemetry stream is Main Stream. This box selects the stream source for the decom word.

Use the interval field to set the commutation interval. When defining super-commutated parameters, the interval between samples are in words and in Normal and sub-commutated parameters, the interval field defines the frames between samples.

Use the PCM Frame Tool to pick a word from a graphical representation of the PCM Frame and then insert it into the word field.

Figure 55 – Parameter Edit/Add

3. Enter a **Name** or keep the default name displayed. The **Name** can include any combinations of characters and symbols. The **Name** does not have a character limit; however, it should be keep as short due to screen space limitations in the ALTAIR displays.

CAUTION **Names** cannot be duplicated. The software will not allow duplicate names and will not save a new parameter with a duplicate name.

4. The **Parameter Number** is automatically generated. The number can be any integer between 0 and 2 raised to the 32^{nd} power.

CAUTION **Parameter Numbers** cannot be duplicated. The software will not allow duplicate numbers and will not save a new parameter with a duplicate name.

5. If the Stream drop-down box is visible, then select the desired stream source. The Stream drop-down box is only visible when one or more asynchronous embedded streams are added to the Decom setup. The main telemetry stream is listed as Main Stream. Any asynchronous embedded stream is listed by the name given in the Async Embedded control in the Decom Setup window. For more details, see section 4.6.2 Asynchronous Embedded Streams.

6. Select the parameter **Commutation Type** from the combo box. The possible commutation types are: Normal, Super Comm, Sub Comm, Random, or Random Normal. This field sets the commutation type for all words used to build this parameter. See the figures below for Commutations Type examples.

In Normal Commutation, the parameter occurs once per minor frame and always occurs in the same word number.

	Sync	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6	Word 7
Frame 1								
Frame 2								
Frame 3								
Frame 4								

Figure 56 – Normal Commutation

In Super Commutation, the parameter occurs multiple times in each minor frame. The occurrences of the parameter must be evenly spaced by a fixed number of words called the Interval. In the example below, the Interval is the words.

	Sync	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6	Word 7
Frame 1								
Frame 2								
Frame 3								
Frame 4								

Figure 57 – Super Commutation, Interval 3 Words

In Sub Commutation, the parameter occurs in the same word number but not in every minor frame. In Sub Commutation, the Interval is the number of minor frames between occurrences of the parameter. In the example below, the Interval is two minor frames.

	Sync	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6	Word 7
Frame 1								
Frame 2								
Frame 3								
Frame 4								

Figure 58 – Sub-Commutation, Interval 2 Frames

In Random Commutation, the parameter can occur in any word in any minor frame. The words are commutated in the order than they appear in the frame.

	Sync	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6	Word 7
Frame 1								
Frame 2								
Frame 3								
Frame 4								

Figure 59 – Random Commutation

In Random Normal Commutation, the parameter can occur in any word, but must occur in the same words in every minor frame.

	Sync	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6	Word 7
Frame 1								
Frame 2								
Frame 3								
Frame 4								

Figure 60 – Random Normal Commutation

The FFI is the same as Normal Commutation, except that it denotes that this is the parameter to use for the Frame Format Indicator. There can only be one FFI parameter.

	Sync	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6	Word 7
Frame 1								
Frame 2								
Frame 3								
Frame 4								

Figure 61 – FFI

7. If the selection in step 6 was **Super Comm**, enter an Interval in words. If the selection was **Sub Comm,** enter an Interval in frames.
8. Enter the total number of bits for the parameter in the **Total Bits** text box. (This value can be from 1 to 64-bits and will be made up of combinations of bits extracted from up to eight words in a PCM minor frame.)
9. Select either MSB or LSB from the combo box. MSB is when the most significant bit is farthest to the left. LSB is when the least significant bit is farthest to the left.
10. For Normal, Super Comm, or Sub Comm parameters, enter the mapping information into the Bit Mapping Table. The Copy and Paste buttons allow copying and pasting of the Bit Mapping Table to Excel as a Tab delimited data. This option is useful for complicated decom parameters.

    This table instructs the ALTAIR software how to extract data from PCM words and concatenate that data into the parameter. The parameter can consist of up to thirty-two independent words. There should be one row in the Bit Mapping Table for each word of data extracted from the PCM stream. (Please refer to Figure 62 – Example of a 32-

bit Parameter Created from Two 16-bit PCM Words for a graphical representation of extracting words to create a parameter.) The fields in the bit mapping table can be directly edited by clicking the field and typing the value. A description of each field is as follows:

- Param MSB – This is the most significant bit in the parameter where the data will be stored.
- Param LSB – This is the least significant bit in the parameter where the data will be stored.
- Sample – Only used only for Random and Random Normal Commutation types.
- Frame – Only used for Sub Comm and Random. This is the starting frame number where the desired data is located. Frame numbers count from one to the number of minor frames.
- Word – This is the word number in the incoming PCM stream where the desired data is located. The Frame Sync Pattern is defined as Word 0 by convention. The first word after the Frame Sync Pattern is Word 1, even if this is the Sub Frame ID. The word can be entered, or the **PCM Frame Tool** can be used to select a word in the frame.
- Word MSB – This is the most significant bit in the word where the data will be copied from.
- Word LSB – This is the least significant bit in the word where the data will be copied from.
- Data Type – This is how the data word extracted from the PCM stream is represented in memory. When Two's Comp or One's Comp is selected, the data will be represented as positive and negative values. These values will be sign extended when extracted from the PCM stream. The Binary and Binary Coded Decimal (BCD) selections will treat data as positive binary values with no sign extension.

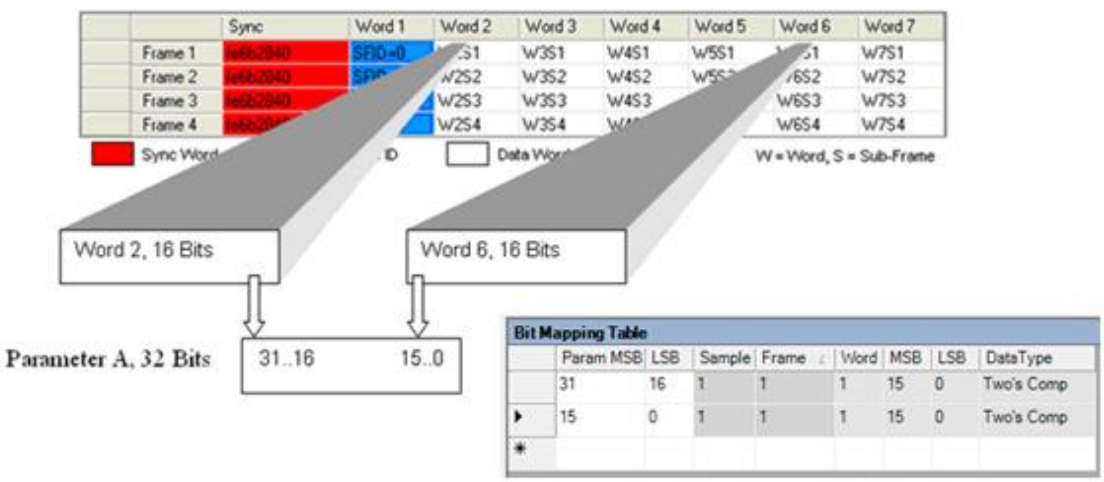


Figure 62 – Example of a 32-bit Parameter Created from Two 16-bit PCM Words

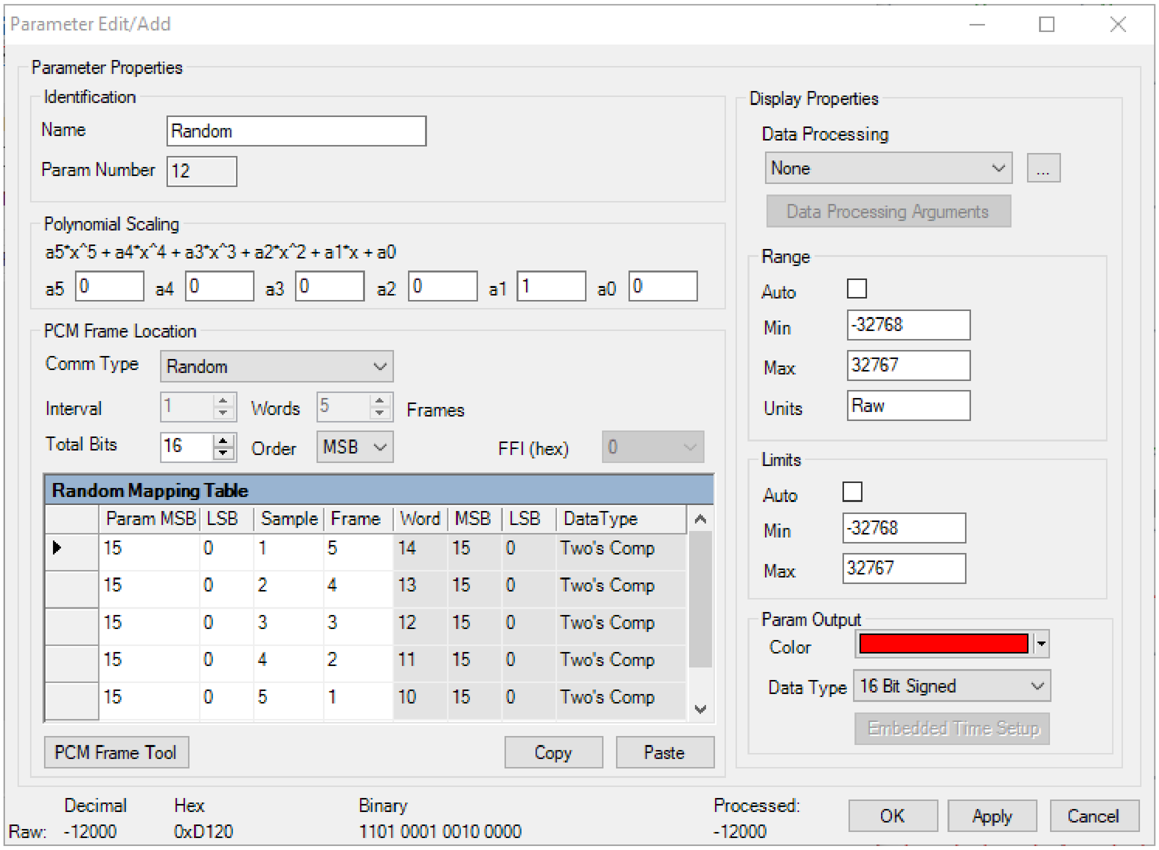


Figure 63 – Parameter Edit/Add Random Commutation

11. For a Random or Random Normal parameters, enter the random sample information into the Random Mapping Table (See **Figure 63 – Parameter Edit/Add Random Commutation**). The Copy and Paste buttons allow copying and pasting of the Random Mapping Table to Excel as a Tab delimited data. This option is useful for complicated decom parameters.

    This table informs the ALTAIR software of two things. First, how to extract data from PCM words and concatenate that data into the parameter. Second, the frame/word locations to sample for the commutation. The fields in the bit mapping table can be directly edited by clicking the field and typing the value.

    The Sample column differentiates words that are concatenated to form a parameter from commutation samples. Rows with the same value in the Sample column are concatenated together to form a single parameter. Rows with different values in the Sample column are the samples in the commutation.

    In the example below, the parameter is Random Normal commutation, each sample is 32-bit composed of two 16-bit words, and there are two samples. The Random Mapping Table has four rows, each 16-bits. Row 1 and Row 2 are concatenated to form Sample 1. Row 3 and Row 4 are concatenated to form Sample 2. The Random Normal Commutation is composed of Sample 1 and Sample 2 in each minor frame.

	Sync	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6	Word 7	Word 8
Frame 1									
Frame 2									
Frame 3									
Frame 4									

Random Mapping Table

	Param MSB	LSB	Sample	Frame	Word	MSB	LSB	DataType
	31	16	1	1	1	15	0	Two's Comp
	15	0	1	1	2	15	0	Two's Comp
	31	16	2	1	7	15	0	Two's Comp
	15	0	2	1	8	15	0	Two's Comp

Figure 64 – Example Mapping Table for Random Normal Commutation

A description of each field is as follows:

- Param MSB – This is the most significant bit in the parameter where the data will be stored.
- Param LSB – This is the least significant bit in the parameter where the data will be stored.
- Sample – Denotes the difference between commutation samples and words that are combined into one sample.
- Frame – Only used for Random and Sub Comm. This is the frame number where the desired data is located. Frame numbers count from one to the number of minor frames.
- Word – This is the word number in the incoming PCM stream where the desired data is located. The word can be entered, or the PCM Frame Tool can be used to select a word in the frame.
- Word MSB – This is the most significant bit in the word where the data will be copied from.
- Word LSB – This is the least significant bit in the word where the data will be copied from.
- Data Type – This is how the data word extracted from the PCM stream is represented in memory. When Two's Comp or One's Comp is selected, the data will be represented as positive and negative values. These values will be sign extended when extracted from the PCM stream. The Binary and Binary Coded Decimal (BCD) selections will treat data as positive binary values with no sign extension.

12. Next, setup the display properties by selecting or creating a new Data Process. (See the section on Configuring Data Processing for details.)
13. Enter the minimum value for the display range. (This value should correspond to the number of bits in the parameter and can have a minimum value of 4.94066e-324.)

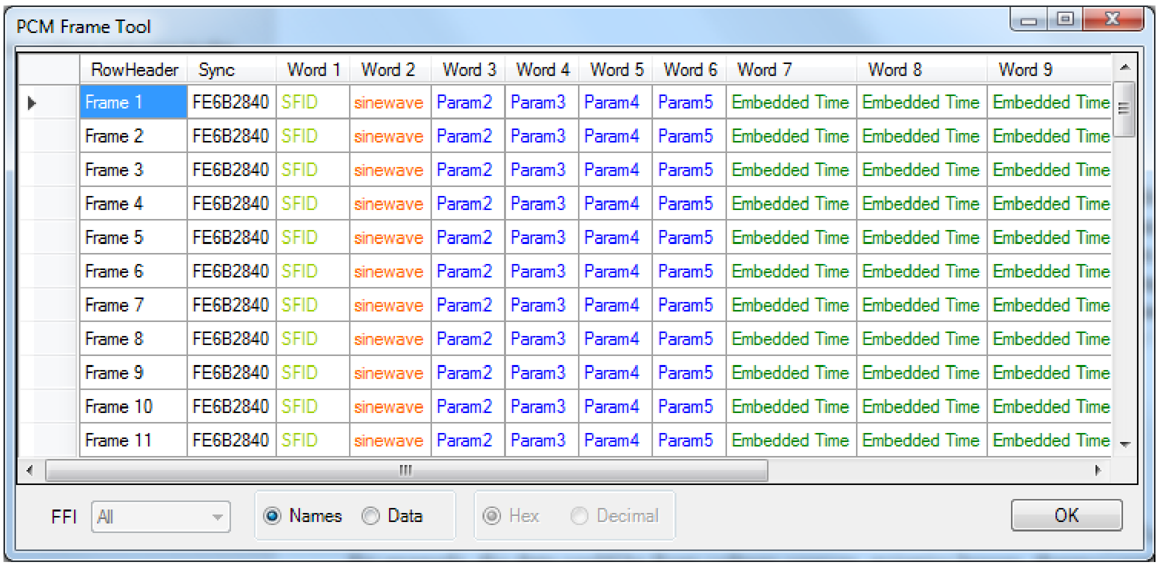
14. Enter the maximum value for the display range. (This value should correspond to the number of bits in the parameter and can have a maximum value of 1.79769e+308.)
15. Enter a string for the display units.
16. Set the display limits by entering a value for the minimum limit. (Display limits are used on most ALTAIR live displays to indicate to the user that data has exceeded a pre-defined threshold.) (This value should correspond to the number of bits in the parameter and can have a minimum value of 4.94066e-324.)
17. Enter a value for the maximum limit. (This value should correspond to the number of bits in the parameter and can have a maximum value of 1.79769e+308.)
18. Select the display Data Type for the parameter. The parameter data type allows the ALTAIR software to display parameter data in a format that is the same or similar to the original sensor that encoded the data. The data type will also affect how the properties of certain display windows work. For example, if a parameter with a data type of **32-Bit Signed** is loaded into a **Meter** window, the floating-point properties will not apply. Please note that Floats have a 23-bit mantissa and any value above the 23-bit mantissa with be an approximation. Doubles have a 52-bit mantissa and any number larger than 52-bits is an approximation.
19. Select a color for the parameter being created. The color will be used in all tables and displays. Colors can be used to visually separate parameters, grouping them by commutation type, data type, sensor type, or any other organization of data required by the user.
20. When complete press OK to save changes into memory.

CAUTION The changes are not saved to the computer hard drive. Saving must be done from the main ALTAIR screen.

4.6.4 PCM Frame Tool

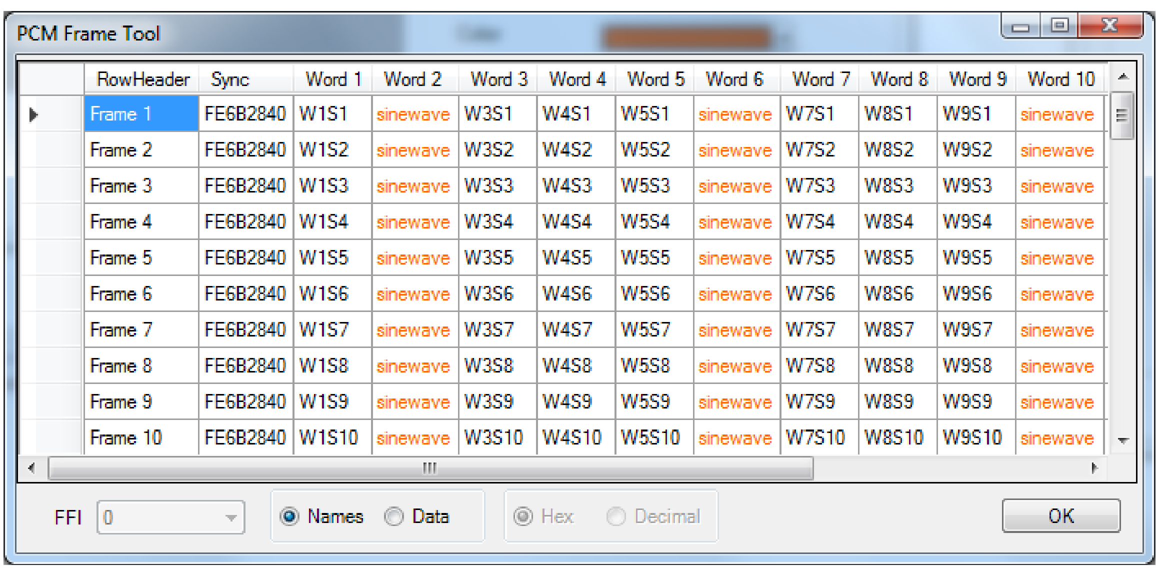
The PCM Frame Tool is a method to visualize the current frame and decom words setup. The PCM Frame Tool can be accessed three ways: from the Decom Toolbar, from the Parameter Tab in the Decom Setup form, and from the Parameter Edit / Add form. When launching the PCM Frame Tool from the Decom Toolbar or from the Decom Setup form, all decom parameters are displayed in the grid. When the PCM Frame Tool is launched from the Parameter Edit / Add form, only the parameter from the Parameter Edit / Add form is displayed in the grid.

The PCM Frame Tool has two sets of radio buttons to configure the display. Either the parameter names or the recent decommutated data can be displayed. The decomutated data is formatted in either Hexidecimal or Decimal format.



RowHeader	Sync	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6	Word 7	Word 8	Word 9
Frame 1	FE6B2840	SFID	sinewave	Param2	Param3	Param4	Param5	Embedded Time	Embedded Time	Embedded Time
Frame 2	FE6B2840	SFID	sinewave	Param2	Param3	Param4	Param5	Embedded Time	Embedded Time	Embedded Time
Frame 3	FE6B2840	SFID	sinewave	Param2	Param3	Param4	Param5	Embedded Time	Embedded Time	Embedded Time
Frame 4	FE6B2840	SFID	sinewave	Param2	Param3	Param4	Param5	Embedded Time	Embedded Time	Embedded Time
Frame 5	FE6B2840	SFID	sinewave	Param2	Param3	Param4	Param5	Embedded Time	Embedded Time	Embedded Time
Frame 6	FE6B2840	SFID	sinewave	Param2	Param3	Param4	Param5	Embedded Time	Embedded Time	Embedded Time
Frame 7	FE6B2840	SFID	sinewave	Param2	Param3	Param4	Param5	Embedded Time	Embedded Time	Embedded Time
Frame 8	FE6B2840	SFID	sinewave	Param2	Param3	Param4	Param5	Embedded Time	Embedded Time	Embedded Time
Frame 9	FE6B2840	SFID	sinewave	Param2	Param3	Param4	Param5	Embedded Time	Embedded Time	Embedded Time
Frame 10	FE6B2840	SFID	sinewave	Param2	Param3	Param4	Param5	Embedded Time	Embedded Time	Embedded Time
Frame 11	FE6B2840	SFID	sinewave	Param2	Param3	Param4	Param5	Embedded Time	Embedded Time	Embedded Time

Figure 65 – PCM Frame Tool Launched from Decom Toolbar and Decom Setup Form



RowHeader	Sync	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6	Word 7	Word 8	Word 9	Word 10
Frame 1	FE6B2840	W1S1	sinewave	W3S1	W4S1	W5S1	sinewave	W7S1	W8S1	W9S1	sinewave
Frame 2	FE6B2840	W1S2	sinewave	W3S2	W4S2	W5S2	sinewave	W7S2	W8S2	W9S2	sinewave
Frame 3	FE6B2840	W1S3	sinewave	W3S3	W4S3	W5S3	sinewave	W7S3	W8S3	W9S3	sinewave
Frame 4	FE6B2840	W1S4	sinewave	W3S4	W4S4	W5S4	sinewave	W7S4	W8S4	W9S4	sinewave
Frame 5	FE6B2840	W1S5	sinewave	W3S5	W4S5	W5S5	sinewave	W7S5	W8S5	W9S5	sinewave
Frame 6	FE6B2840	W1S6	sinewave	W3S6	W4S6	W5S6	sinewave	W7S6	W8S6	W9S6	sinewave
Frame 7	FE6B2840	W1S7	sinewave	W3S7	W4S7	W5S7	sinewave	W7S7	W8S7	W9S7	sinewave
Frame 8	FE6B2840	W1S8	sinewave	W3S8	W4S8	W5S8	sinewave	W7S8	W8S8	W9S8	sinewave
Frame 9	FE6B2840	W1S9	sinewave	W3S9	W4S9	W5S9	sinewave	W7S9	W8S9	W9S9	sinewave
Frame 10	FE6B2840	W1S10	sinewave	W3S10	W4S10	W5S10	sinewave	W7S10	W8S10	W9S10	sinewave

Figure 66 – PCM Frame Tool Launched from Parameter Add /Edit Form

The PCM Frame Tool has the following controls:

1. FFI – Combo box allows the user to select the Frame Format Indicator that is displayed in the PCM Frame Tool.
2. Names or Data – The PCM Frame Tool can display either the decom parameter name or a data value. The data values are sampled about every 250mS.
3. Hex or Decimal – Only enabled when the Data radio button is selected. Allows the data display to be in decimal or hexadecimal form.

Regardless of where the PCM Frame Tool is launched, double clicking on a cell will launch the Parameter Edit / Add form for the decom parameter associated with the clicked cell.

Right clicking on a cell brings up a menu with options to Add or Delete. The Add will create a new decom parameter for that cell. Delete will delete a decom parameter associated with that cell.

4.6.5 Decom Parameter Import and Export

The most difficult part of setting up telemetry software for a telemeter is configuring the decom parameters. The ALTAIR software includes an Import / Export of the decom parameters via CSV file. These Import / Export features use the same CSV format as DEWESoft to allow easy transition between the two software packages.

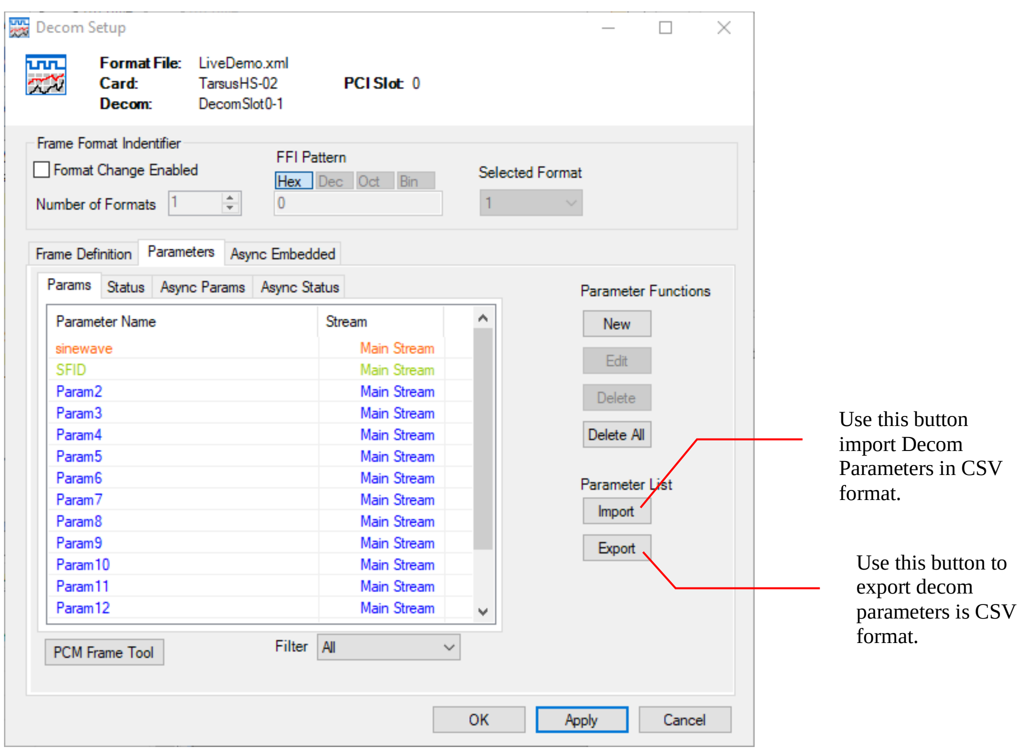


Figure 67 – Decom Parameter Import / Export in the Decom Setup Window

To Import or Export the Decom Parameters, open the Decom Setup window by double clicking on the desired Decom in the Hardware Explorer. Then click on the Parameters tab.

Click the Import button to launch a file open dialog box. Select the desired CSV file to import and click Open.

Click the Export button to launch file save dialog box. Select the file name and location and click Save. The resulting CSV file can be imported into ALTAIR or DEWESoft.

4.6.6 Configuring Data Processing

In telemetry applications, data in a PCM stream can come from a wide variety of sources, for example, the data could be from voltage sources, avionics busses, thermocouples, time sources, etc. Sometimes the data from these sources is not scaled properly for optimal viewing and analyzing. For example, the results from a thermocouple could be presented as non-linear data, thereby making small changes at certain levels hard to visually identify. In this situation, running a mathematical algorithm to linearize the data would be required to properly view the data.

The data processing of ALTAIR software provides a unique approach for solving these types of scaling and data manipulation. The software allows the user to create a custom algorithm, apply it to the live PCM data, and view the converted data in a display. The data processing algorithms can be created in the software by one of several methods:

- Formula – A one-line formula can be entered consisting of one or more parameters and all the mathematical and logical features shown in the buttons.

- C# Function – A C# (C-Sharp) Class/Function can be completed and compiled inline. This function must conform to the Microsoft C# Language definitions and should only be used by experienced C# developers. A blank template provides the C# class naming and structure. There are also two examples available in the Process Edit Window.

A third method of using data processing plug-in modules can be used. The plug-ins' are dynamic link libraries that can be developed using Microsoft .Net development tools. These files must run in a managed .Net environment and can be developed using C#, C++, and Visual Basic. Please contact factory for more information regarding development of your own plug-ins.

The section below some information on creating a data processing algorithm:

1. On the ALTAIR main screen, select a Decom in the Hardware Explorer window, select the Parameters folder tab, press New, and then in the Parameter Edit/Add form

under Display Properties press the browse button () to the right of the **Data Processing** field. The Available Processes setup form will open as shown below.

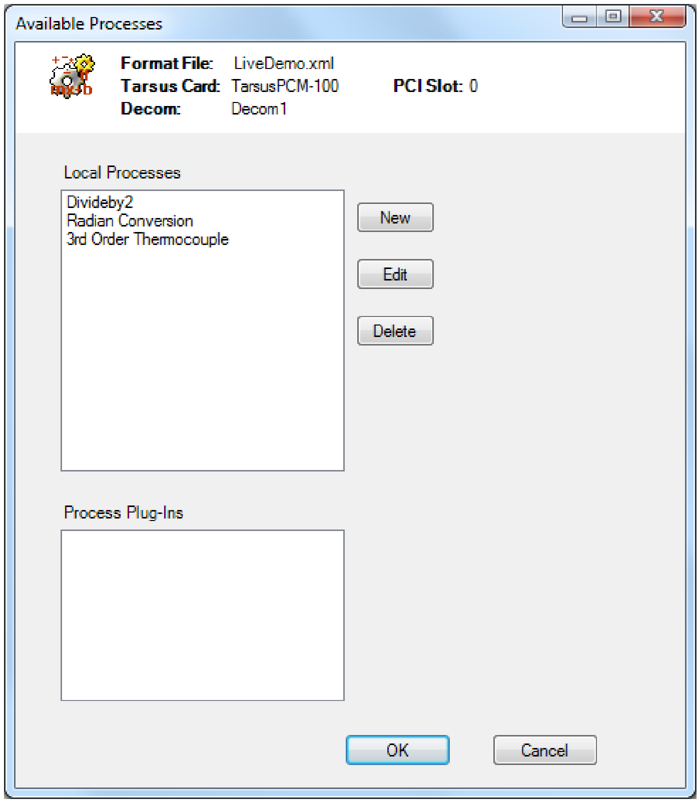


Figure 68 – Initial Data Process Setup Screen

2. Click on the **New** button to be presented with the Process Edit window. (See Figure 69 – Formula Editor in the Process Edit screen below.)

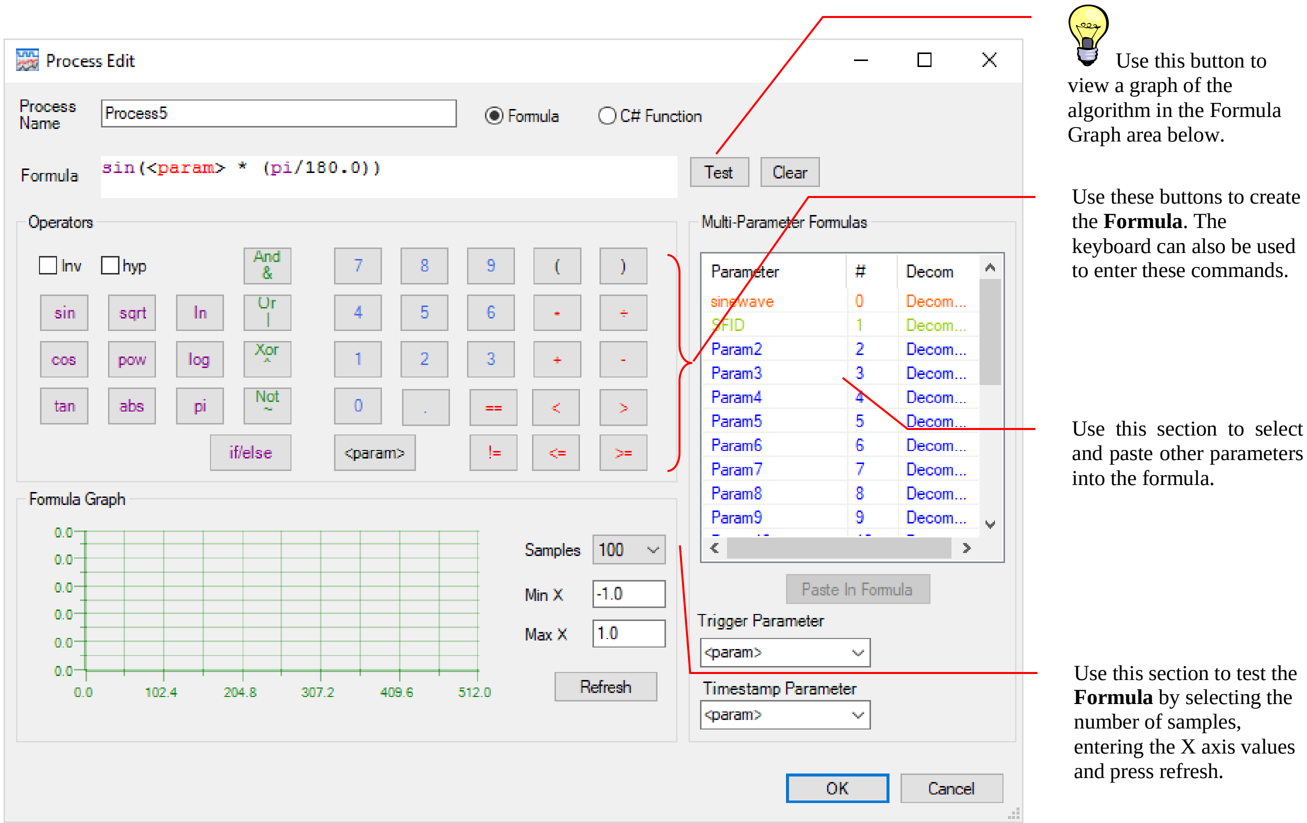


Figure 69 – Formula Editor in the Process Edit Window

3. At the top of the Process Edit window there are radio buttons for Formula and C# Function. The Process Edit window in the image above shows the Formula Editor. The Formula Editor is visible when the Formula radio button is selected. When the C# Function radio button is selected, the Process Edit window shows the C# Function Editor (see below). Both the Formula Editor and the C# Function Editor provide minimal syntax highlighting.

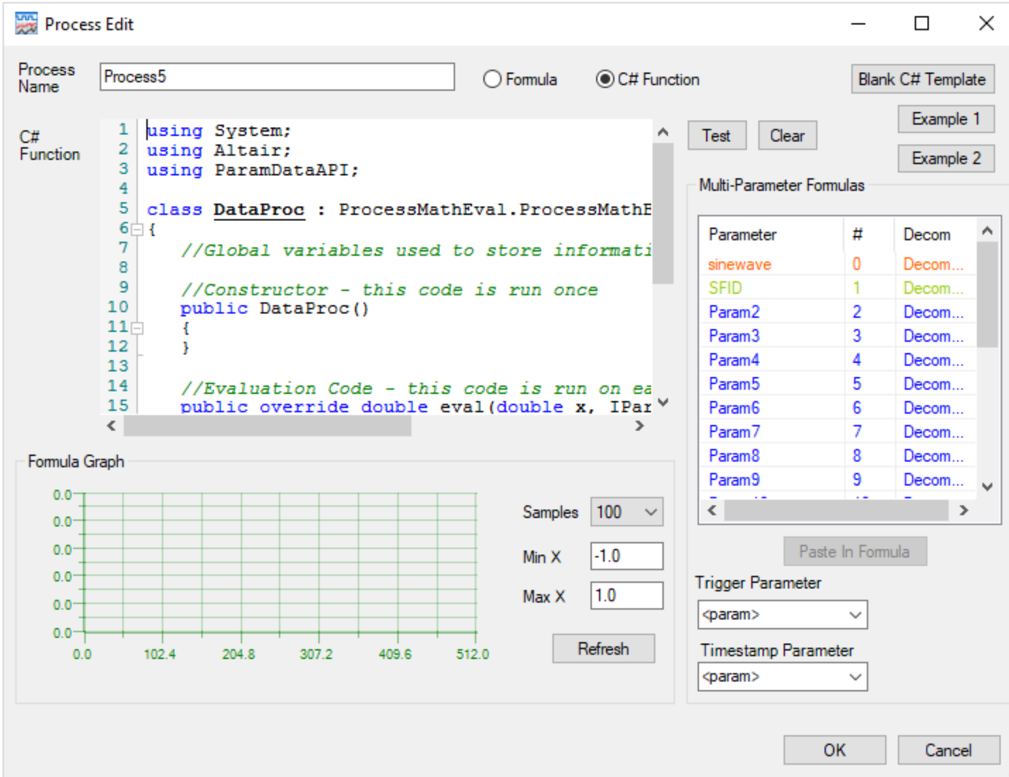


Figure 70 – C# Function Editor in the Process Edit Window

4. Enter a process name or keep the default name displayed. The process name entered can be made up of any combinations of characters or symbols. The length of the process name does not have a character limit; however, it should be keep as small as possible due to screen space limitations.

Process names cannot be duplicated. The software will not allow duplicate names and will not allow saving of the data process.

5. The next step is to create the Data Process. Immediately below are instruction for creating a Formula Data Process. Below that are instructions for creating a C# Function Data Process.
6. Create a Formula Data Process. The process and interaction of creating a formula is very similar to using an advanced scientific calculator with graphing ability.
   a. The formula can be made up of any valid combinations of mathematical functions and operations shown in the Operators section of the screen.
   b. The <param> button is used to represent the raw data for the parameter being processed. (This is similar to the **x** variable in a mathematical equation.)
   c. Multi-parameter formulas are created by selecting a parameter from the list box on the right-hand side of the screen and then clicking Paste in Formula button. After clicking the Paste in Formula button, a pop-up window presents the option of using Raw or Processed data. Raw data is the value extracted from the telemetry stream before any Data Processes are applied. Processed

data is the result of an applied Data Processes. Any number of parameters can be used in an algorithm.

d. When using more than one parameter in a formula, the Trigger Parameter determines at what point in time the data processing algorithm is executed.
e. The Timestamp Parameter determines the source of the time stamp for data from the formula.
f. The following table shows several examples of valid formulas:

Formula Example	Description
-0.04886825+(19673.14503*<param>)+(-218614.5353 * pow(<param> ,2))+(11569199.78*pow(<param>,3))	This shows an example of a polynomial equation for scaling thermocouple data.
<param> / 2.0	Simply divide the raw data by 2.0
<param>*(180.0/pi)	Convert the data from degrees to radians for use in a 3D Model which requires radians.
<param>-1005	Remove an offset out of the incoming data.
abs(<param>)	Get the absolute value of the parameter.
<param> * pow(2, 16)	Multiply the data by 2 raised to the 16th power.
(29.45 * <param>) + 30	Simple mx + b scaling where m=29.45, b = 30
param[1].raw + param[2].raw	Derive a parameter by adding raw data from parameter number 1 and 2.

Table 7 – Example Data Processing Formulas

7. Create a C# Function Data Process. The process of creating a C# function is very similar to using Visual Studio, Notepad++, or any other software integrated development environment.
   a. In the upper right-hand corner of the Process Edit window there are three buttons: Blank C# Template, Example 1, and Example 2. Each fills the C# Function text box with C# code.
   b. The structure of a C# function includes three required Using statements for System, Altair, and ParamDataAPI. After the Using statements, there is the class definition for DataProc. The DataProc class contains a location for global variables, the constructor for DataProc and a method for eval. The Names for the class, constructor, and method cannot be changed.
   c. Multi-parameter formulas can be created by using the list box on the right side of the screen or by typing the command.
      i. Select a parameter from the list box on the right-hand side of the screen and then clicking Paste in Formula button. After clicking the Paste in Formula button, a pop-up window presents the option of using Raw or Processed data. Raw data is the value extracted from the telemetry stream before any Data Processes are applied. Processed data is the result of an applied Data Processes. Any number of parameters can be used in an algorithm.
      ii. The command for accessing a parameter is: param[num] or param[“name”] where num is replaced with the parameter number and name is replaced with the parameter name. The parameter name must be in double quotes. The parameter name is not capitalization sensitive.

   d. When using more than one parameter in a formula, the Trigger Parameter determines at what point in time the data processing algorithm is executed.
   e. The Timestamp Parameter determines the source of the time stamp for data from the formula.
8. Once the Formula or C# Function is entered, use the Test feature validate the Formula or C# Function. The Test feature uses the Samples drop-down box, the Min textbox, and the Max textbox to determine the evaluation range for the Formula or C# Function. Click the Test button to evaluate the function and update the Formula Graph. Also, the number of samples and total evaluation time is displayed below the graph. This gives an indication of the CPU impact of the Formula or function. If there is a syntax error in the Formula or Function, then the Process Errors dialog box appears listing the errors.

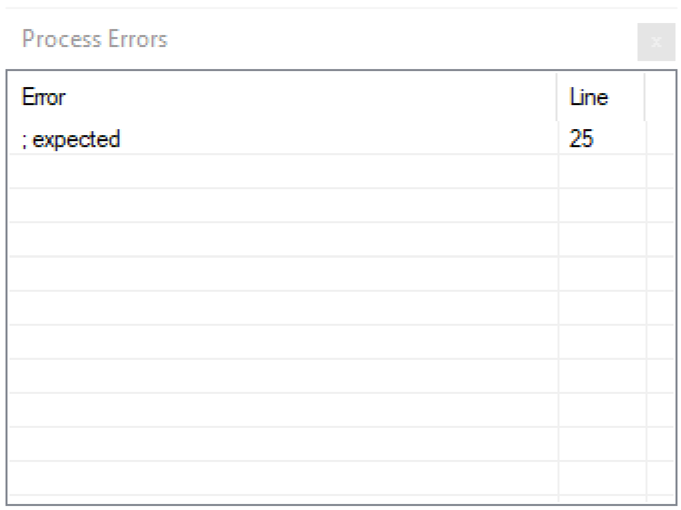


Figure 71 – Process Error Window

A unique feature of ALTAIR software is that it processes PCM data extremely fast. To obtain these speeds, the software dynamically creates software source code for the formulas, compiles the source code, and then attaches the executable binary to the ALTAIR software's own executable. Due to the compilation of the formula, any errors encountered in a formula must be corrected before saving the process. If Data Process with an error is saved and the decom parameter is used in a display (Meter, Strip Chart, etc), ALTAIR will display a warning message that there is an error with the Data Process and the display will not be updated. If this occurs, please delete all displays using the decom parameter with the erroneous Data Process.

The error messages displayed are actual messages generated by the compiler which can sometimes be misleading. Errors are generally due to missing operators, mismatched parentheses, or simple typing errors. When encountering an error, review the formula item-by-item to be certain there is an operation between every function, and all parentheses are used properly. Parentheses should always be used to assure proper precedence.

9. When satisfied with the results, press OK to save changes to the memory.

The changes are not saved to the computer hard drive. Saving must be done from the main ALTAIR screen.

4.6.7 Configuring Decom Outputs (DAC Out)

The Tarsus3 provides several methods of sending decommutated data from the card. It can extract raw PCM digital Audio data from the PCM stream, then the audio data is demodulated by the Tarsus3 hardware, converted into analog form, and routed to one of two digital to analog converter (DAC) outputs included on the card.

- On Board DACs – The hardware contains additional circuitry with two built in Digital to Analog converters (DACs), each containing programmable analog offset and gain control. The DAC hardware circuitry provides a convenient way of outputting raw data extracted from the PCM stream in analog form. The data can then be viewed on external equipment such as oscilloscopes, meters or even strip chart recorders.

Note: The data going to the DACs is only raw PCM words, not parameter data which can be concatenated and processed.

To configure decom outputs:

1. On the ALTAIR main screen, select a Decom in the Hardware Explorer window or select ***Decom\Decom Outputs*** from the main menu at the top of the screen. This setup form is used to set the parameter to be output through one of the two on board DAC's. The Decom Outputs setup screen is displayed below.

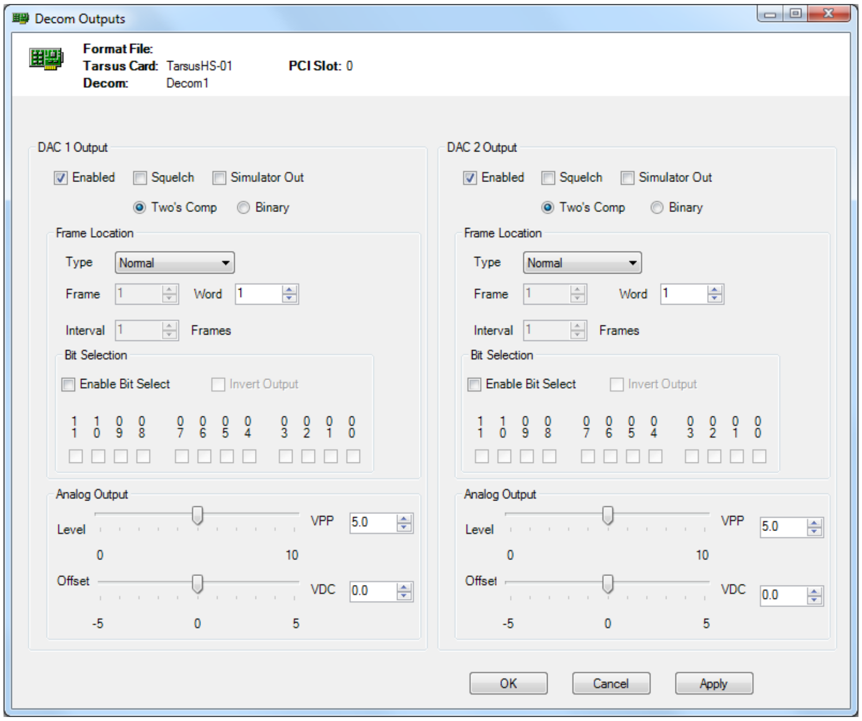


Figure 72 – Decom Outputs Setup

2. If using the hardware over the top connector (J2), select either **Status** to output the status signal, or **DAC Card** to output DAC data.
3. Enable the Decom DAC output by clicking on the **Enabled** box. If not using the **Squelch** or **Simulator Out** feature, move along to step 5.
4. Enable **Squelch** to suppress white channel noise on the audio signal. Enable **Simulator Out** to send the simulated PCM data out of the DAC connector.
5. Choose **Two's Comp** for a signed representation of binary data, or **Binary** for unsigned data represented by a 1 or 0.
6. Select **Super Comm**, **Sub Comm** or **Normal** for the type of the data to extract. (Default is Normal commutation.)
7. Enter the Word location in the PCM frame to extract for sending to the DAC.
8. Enter the interval in words if Super Comm or frames if Sub Comm for the data to be sampled and sent to the DAC.
9. Select from **0** to **5** Volts Peak to Peak (Vpp) for the analog output level.
10. Select from **-2.5** to **2.5** Volts DC (VDC) for the analog output offset.
11. If using two DAC outputs, repeat steps 2 through 7 for DAC2 outputs.
12. Click the Apply button to immediately send the changes to the hardware. Click OK to store the changes to the in-memory database. Click Cancel to abort changes.

Note: To play digital audio, users must set up self-powered speakers and possibly use an adjustable Low-pass filter. The Tarsus3 board will not be able to supply enough power to run speakers.

Clicking OK does not save the changes to the computer hard drive; it simply stores these changes to the in-memory database. Saving must be done from the main ALTAIR screen.

4.6.7.1 Configuring Single Bit Output

Each on board DAC allows for the output of a single selected bit. Of the most significant 12 bits of a word, the user can select 1 bit to be output via the DAC. For example: If there is a 16-bit word (calling bit 0 the LSB), only bits 4 - 15 would be available for selection. However, in the DAC form, the bits will be listed as 0-11 no matter what the word size. In this scenario, bit 4 of the word would correspond to bit 0 on the DAC output form. (See Figure 73 – Single Bit DAC Output below.)

To use the single bit output feature, follow the step-by-step procedure below:

1. Open the Decom Outputs Form. Select Decom in the Main Menu and then Decom Outputs.
2. Check the box to **Enable Bit Select**.
3. Select to invert the output or not (where 1 becomes 0 and 0 becomes1) by checking the **Invert Output** checkbox.
4. Select any ONE of the bit checkboxes corresponding to the desired bit for output. For example: If I wish to output bit 1 (LSB=0) of a 10-bit word then select bit 3 of this section because the word is being MSB aligned with bit 11 on this form.

For bit selection, the word is MSB aligned with bit 11 on this form. If the MSB of the word is bit 9, that would correspond to bit 11 on this form. In other words, the MSB of the word is ALWAYS in bit 11 of this form.

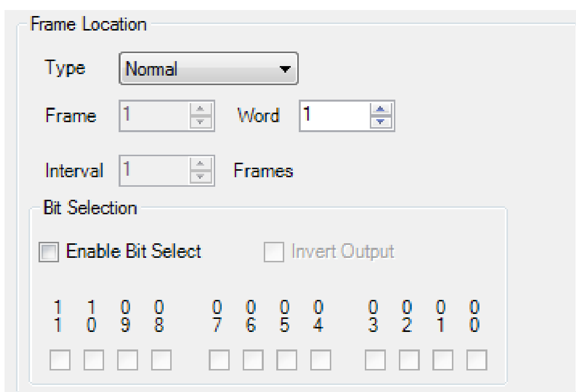


Figure 73 – Single Bit DAC Output

4.7 Configuring Time

The Tarsus3 and ALTAIR software system has two choices for acquiring time and time stamping PCM data:

- **Computer Time** – With computer time, the Tarsus3-01 hardware is initialized by the PC computer during a Decom download. The time is then maintained by the Tarsus3-01 hardware using an internal 86.0 MHz clock oscillator that is stable to ± 25 ppm. The internal maintained time is inserted into the header of the data packets that are transferred to the PC for displaying and archiving.

- **IRIG Time Code Reader** – The IRIG time code reader involves separate hardware circuitry in the Tarsus3-01 that reads IRIG-A, IRIG-B, IRIG-G and NASA 36 from an independent input, demodulate the time, and insert the time into the header of the data packets that are transferred to the PC for displaying and archiving.

Note: IRIG Time is sampled at the last bit in the Frame Sync Pattern of each minor frame.

1. On ALTAIR main screen, select a **Time** in the Hardware Explorer window or select ***Time*** in the Main Menu.

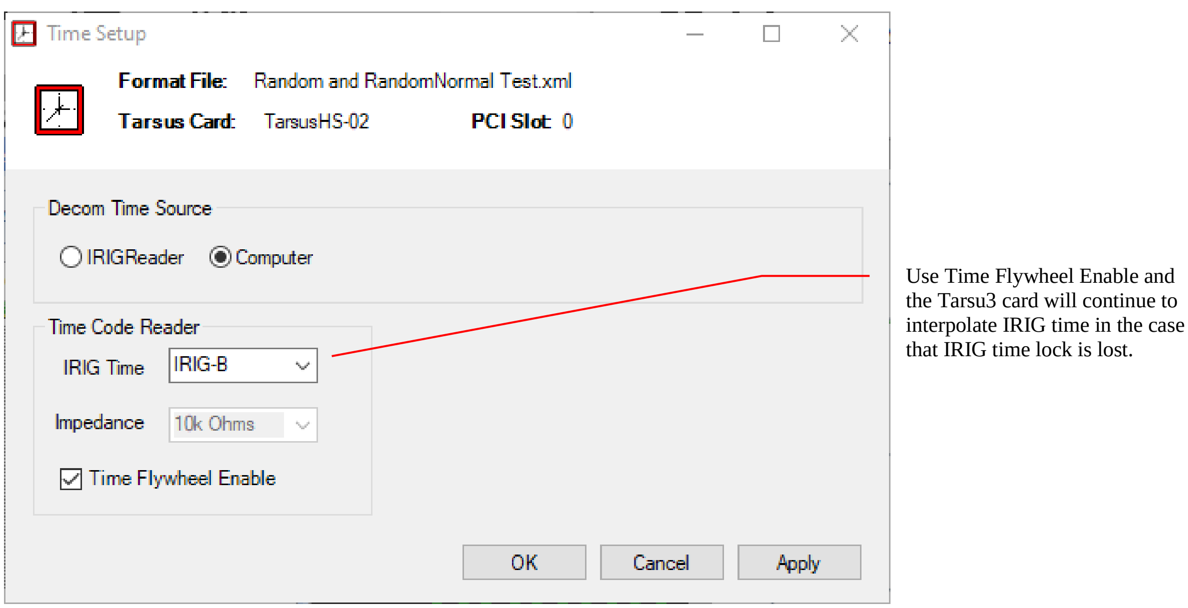


Figure 74 – Time Setup

2. Choose a Decom Time Source - either **IRIG Reader** or **Computer time**.
3. For the **IRIG Reader,** select from **IRIG-A**, **IRIG-B**, **IRIG-G, or NASA 36** in the drop-down box.

4. **Time Flywheel Enable** ensures time continues to be interpolated in the event of IRIG time lock loss. If this is not selected, the time output freezes at last IRIG time lock value.
5. When complete press OK to save changes into memory.

4.8 Configuring the Simulator

The Tarsus3 has a programmable Simulator that generates up to a 40Mbps PCM data stream and clock, and then outputs it to an output connector. The simulator has two modes of operation: one mode lets the user enter fixed data patterns and functions i.e. Sine Waves, Triangle Waves and Square Wave patterns, etc. and another mode that plays back previously archived data files (.tad).

The single channel Tarsus3-01 and the Bald Eagle RF-01 have a differential output for Simulator Data and Simulator Clock. However, in the dual channel Tarsus3-02 and Bald Eagle RF-02 these differential outputs are used by the second Bit Sync. In order to provide differential output for the Simulator, ALTAIR has the “Sim Diff Enable” checkbox. Checking this box outputs the Simulator Data from BS2-OUT1 and the Simulator Clock from B2-CLK1 instead of the associated Bit Sync2 Data and Clock Out.

1. On the ALTAIR main screen, select a Simulator in the Hardware Explorer window or select PCM Simulator from the Main Menu. The Simulator setup screen will be displayed as shown below.

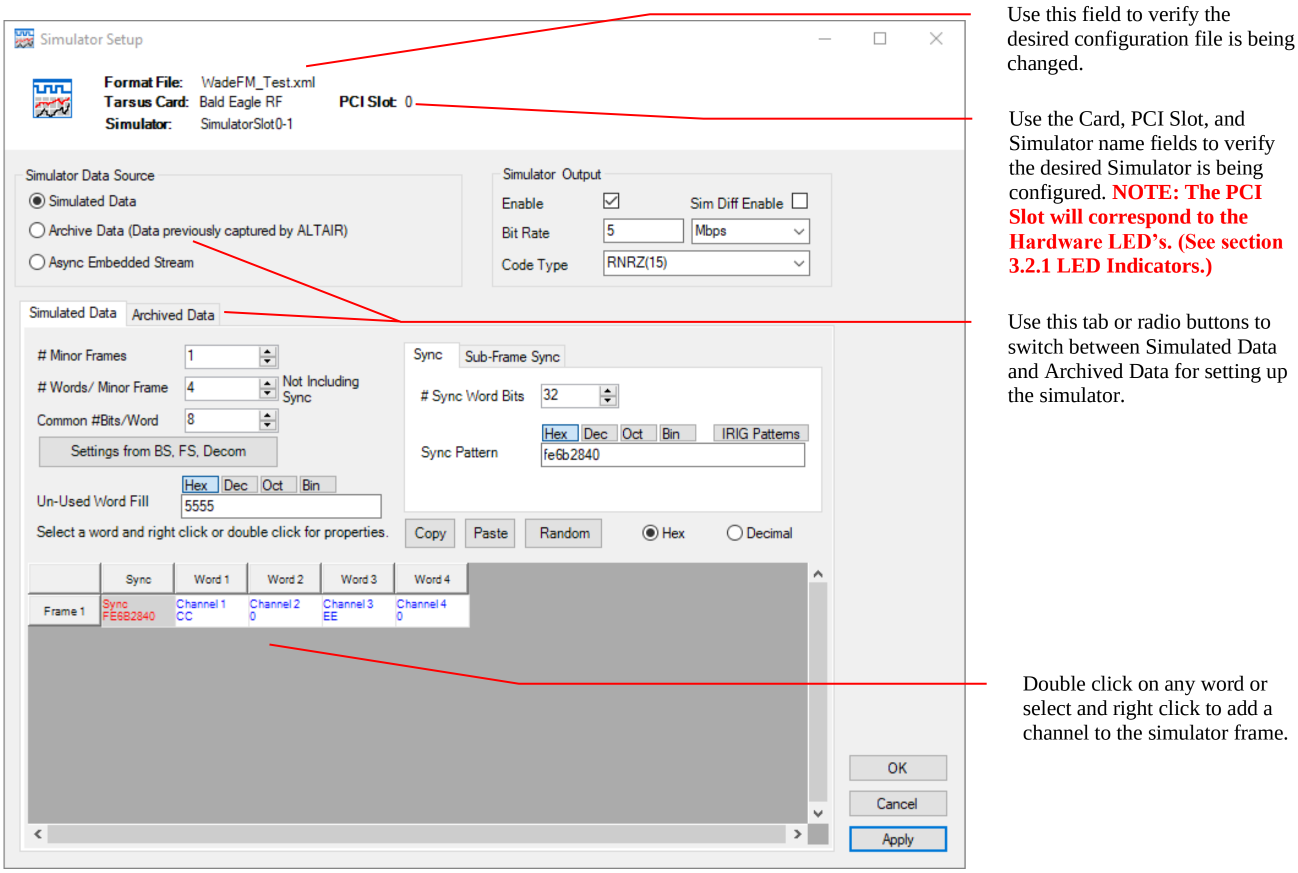


Figure 75 – Simulator Setup

2. Check the **Enable** box to enable the simulator output.

Due to a limited number of output connections, the Simulator output and Asynchronous Embedded Output 2 share the same hardware connection. Because of this, both features cannot be enabled at the same time. A message box will appear if attempting to enable both features at the same time.

3. Select **Simulated Data** or **Archived data** for the source of data being simulated.
4. Enter a Bit Rate and Units from the drop-down selection box.
5. Enter the PCM code type for the output of the Simulator. The output code types are: non-return to zero level (**NRZ_L)**, non-return to zero mark (**NRZ_M)**, non-return to zero space (**NRZ_S)**, bi-phase level (**BIΦ_L)**, bi-phase mark (**BIΦ_M)**, bi-phase space (**BIΦ_S)**, delay modulation mark (**DM_M)**, delay modulation space (**DM_S)**, return to zero (**RZ)**, randomized non-return to zero **RNRZ_11,** and **RNRZ_15**.
6. If **Simulated Data** was selected in step 3, click the Simulated Data tab and go to step 7, otherwise click the Archived Data tab and skip ahead to step 16.
7. Enter the number of minor frames in the Major Frame.
8. Enter the number of words per minor frame (not including sync).
9. Enter the number of **Sync Word Bits** found in the sync pattern.
10. Enter the **Sync Pattern** being fed out of the simulator.
11. Select the Sub-Frame Sync tab and define the sub-frame sync settings.
12. Enter the common number of bits per word.
13. Enter the **Un-Used Word Fill** pattern to be loaded in all words in the simulator frame that are not defined with either a fixed value or a function value. Clicking the Random button will fill all of the unused words with random number generated to the number of bits in the Common Bits / Word numeric input box.
14. The last step to setup the simulator data is to define the data patterns. The user entered data patterns consist of one or more channels, each containing a definition of the data type and the location within the frame. To enter data into the frame, double click on any word location in the frame. The simulator channel edit form will be displayed as shown below.

    The Copy button allow the user to copy the Simulator grid and paste it into Excel. It can be modified and copied to the clipboard in Excel. Then the Paste button in the Simulator form will paste the new settings back to the Simulator grid. Please note that when you paste the data into the Simulator grid, that each value is pasted as a Sub Comm word that only occurs once per major frame.

    The Random button fills all the unused words with randomly generated number of the bits per word of the common word size. Random values are a substitution for the bit transitions created by using a randomized Code Type.

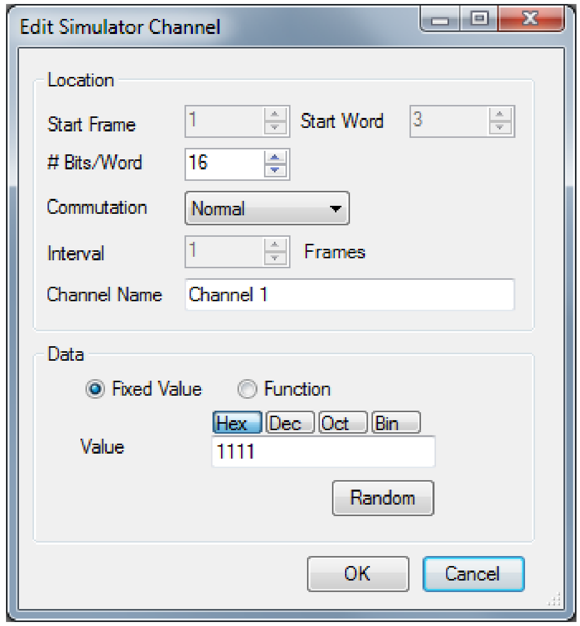


Figure 76 – Simulator Channel Edit Form

To define a channel:

a. Enter the number of bits for the word location entered.

If more than one minor frame is used, the size of a word in a specific location must be the same in all sub-frames at that word location.

b. Select a commutation type - **Normal**, **Super Comm**, or **Sub Comm**. (See Figure 56 – Normal Commutation, Figure 57 – Super Commutation, Interval 3 Words, and Figure 58 – Sub-Commutation, Interval 2 Frames for detailed diagrams of commutation.)
c. Enter the interval in words if Super Comm, or frames if Sub Comm for the simulator channel.
d. Optionally change the Channel Name from the default value.
e. Enter a **Fixed Value** or **Function** for the data type.
f. If **Fixed Value** was selected in Step E, go to Step G, otherwise skip ahead to Step H.
g. Enter the fixed value for the simulator channel. Clicking the Random button will set the Fixed Value with a random number of the selected Bits / Word. This value can be entered as any length; however, it will be truncated to the bits per word setting for this channel.
h. Select a function for the simulator channel from the drop-down selection box.
i. Select the number of points per period for the function.
j. Press OK to insert the simulator channel into the simulator frame and return to the main simulator screen.

15. Repeat step 11 when adding more channels to the simulator frame. When finished, skip ahead to step 20.

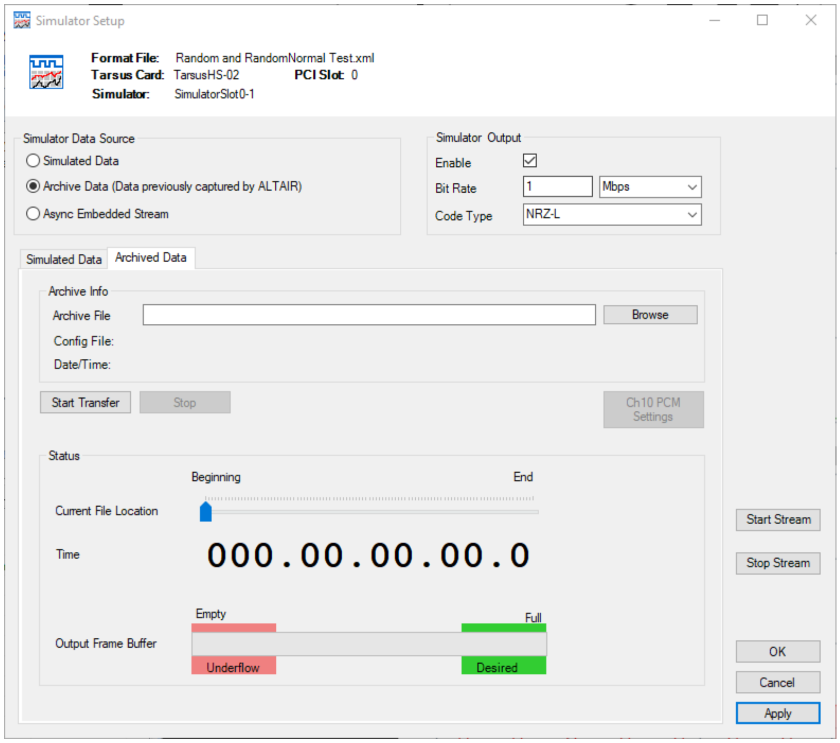


Figure 77 – Archive Simulator

16. For Archived Data playback, enter the complete file path and name of the .tad file or use the browse button.
17. Press **Start Transfer** to start .tad file playback.
18. The current file indicator displays the location of the archive file during playback. During playback, this indicator will move from Beginning to End and then repeat playback from the beginning again. The Output Frame Buffer indicator shows the real-time status of the hardware outputting the archived data.
19. Click Apply to immediately send the changes to the hardware. Click OK to store the changes to the in-memory database. Click Cancel to abort changes.

Clicking OK does not save the changes to the computer hard drive, it simply stores these changes to the in-memory database. Saving must be done from the main ALTAIR screen.

4.9 Configuring Archive

The ALTAIR software provides a method of storing data received from the Tarsus3 hardware directly to the computer's hard disk drive. The stored data can be used by third party analysis software packages or can be re-played into the ALTAIR software. To configure the Tarsus3 for performing archive, perform the following steps below:

1. There are two ways access the Archive Setup screen:
   a. Select a Frame Sync in the Hardware Explorer window and then click on the red record button on the Archive Tool Bar (see Figure 28 – Archive Toolbar).
   b. Select a Frame Sync in the Hardware Explorer window and then selecting the menu option ***Archive/Setup***. The Archive setup screen will be displayed. (See Figure 78 – Archive Setup below.)

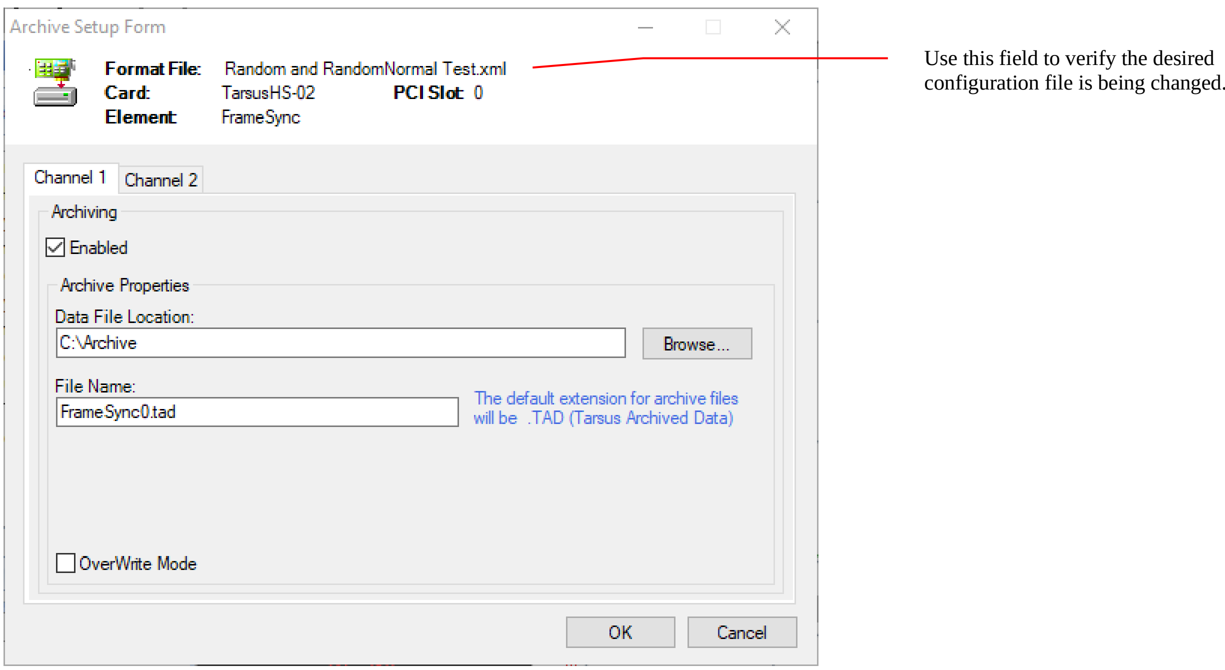


Figure 78 – Archive Setup

2. To enable archiving for the device selected, select the **Enable** box.

There must be at least one frame sync or decom element in the system with archiving enabled to record archive data. The record button on the Archive Toolbar will be disabled if there are no devices enabled.

3. Enter a path or use the browse button to set a location on the hard drive where the archived files will be stored.
4. Enter a name or keep the default name for the archived files. The file name entered will have the underscore character and an occurrence number automatically appended to the end if the overwrite mode is not selected.

5. To overwrite a single file each time, an archive record session is started, select the **Over Write Mode**. To write the archived data in separate files for each archive record session, un-select the **Over Write Mode.**
6. When complete, press OK.

Note: This will automatically set the corresponding playback filename to the recorded filename. This allows the user to immediately view the recorded data by clicking the Analyze button without having to set the playback filename.

The changes are not saved to the computer hard drive. Saving must be done from the main ALTAIR screen.

4.10 Configuring Receiver

4.10.1 Receiver Setup Window

The Tarsus3 has an optional daughter card containing receiver hardware. This configuration is referred to as the Bald Eagle RF. A Bald Eagle RF has a receiver in the ALTAIR Hardware Explorer. A Bald Eagle RF-01 has one receiver. A Bald Eagle RF-02 has two receivers. Select a Receiver in the Hardware Explorer. Either double click the Receiver or click the setup icon in the toolbar to launch the Receiver Setup window.

The Receiver Setup window has a Standard and Advanced modes. A combo box in the bottom left corner switches between Standard and Advanced. The Standard Receiver Setup window has settings for the Band, RF Frequency, Bit Rate, Modulation Type, Diversity Combiner, and Without PreMod Filter. ALTAIR uses the Bit Rate to calculate the required IF Bandwidth Filter and Output Filter Settings. To choose the filter settings, please use Advanced mode.

Figure 79 – Bald Eagle RF Receiver Standard Settings

The Advanced Receiver Setup window has four sections: Tuner Setup, Demod Setup, Displays, and Outputs. The Tuner Setup section configures the RF front end of the receiver. The Demod Setup section configures the demodulator for the receiver. The Displays section shows the Frequency Domain and Time Domain plots of the data. The Frequency Domain plot is generated using the Fast Fourier Transform (FFT). And the Output section configures the output signals from the Receiver to the Bald Eagle RF's two DAC BNC outputs.

Figure 80 – Bald Eagle RF Receiver Advanced Settings

Tuner Setup:

1. Frequency Band – Select the desired frequency band in the combo box. The allowed frequency range will appear beside the combo box. The frequency band selection will limit the allowed RF Frequency entries.
2. RF Frequency – This numeric entry control sets the RF Center Frequency. The allowed range for this control is set by the selection in the Frequency Band combo

box. The allowed frequency range is displayed next to the Frequency Range combo box.
3. IF Bandwidth – The numeric entry and combo box set the bandwidth and bandwidth units for the IF filter. The suggested value is 1.2 * Bit Rate for FM PCM signals.
4. Diversity Combiner – This check box enables and disables the Diversity Combiner. The Diversity Combiner uses both receivers to recover a better signal baseband signal than either receiver recovers on its own. This feature is available only on the Bald Eagle RF-02.
5. ARC Mode – This combo box turns the Auto Frequency Correction on and off. Auto Frequency Correction tracks the changes in the RF Carrier Frequency and automatically adjusts the RF Tuner.
6. AGC Mode – This combo box sets the AGC mode to Auto, Manual, or Off. In Auto Mode, the user selects a Time Constant for the AGC. In Manual Mode, the user selects a gain level.

Demod Setup
1. Bit Rate – The numeric entry and combo box set the Bit Rate. The bit rate is used in the demodulation calculations.
2. Read BSync Bit Rate – This button sets the Bit Rate numeric entry and Bit Rate Units combo box with the setting from the Bit Sync. This button ensures that the Receiver Demod and Bit Sync are using the same Bit Rate.
3. W/o PreMod Filter – This check box indicates if the incoming modulated PCM signal is Pre-Mod filtered. When a signal is not Pre-Mod filtered, the demodulator needs to compensate for the higher required bandwidth.
4. Modulation – This combo box selects the modulation type. Available choices are FM, BPSK, QPSK, and SOQPSK.
5. Output Filter – This combo box selects if the Output Filter is on or off. When applied, the Output Filter cleans up noise in the demodulated signal.
6. Output Filter Calc – This combo box selects the method for calculating the cutoff frequency for the Output Filter. The options are Auto DR 2, Auto DR 4, Auto DR 8, and Manual. The Auto DR settings use the IF Bandwidth setting to determine the Output Filter cut off frequency. Auto DR 2 is one half the IF Bandwidth. Auto DR 4 is quarter half the IF Bandwidth. Auto DR 8 is one eight the IF Bandwidth. Manual allows the user to set the cut off frequency in the Output Filter Freq controls.
7. Output Filter Freq – This numeric control and combo box set display the cut off frequency for the Output Filter. When the Output Filter Calc combo box is set to Manual, these controls will also set the Output Filter cut off frequency. The allowed range is the IF Bandwidth setting down to the IF Bandwidth divided by 128.

Displays

The two displays show the Frequency Domain and the Time Domain for the incoming signal. The incoming signal is selectable using the combo box below the Time Domain Plot. The options are RF Spectrum or Demod Out Filtered. The RF Spectrum selection displays the incoming modulated RF spectrum. The Demod Out Filtered shows the output of the demodulated data after it exits the Output Filter.

Outputs

The controls in the Output section setup the signals for the DACs. The Bald Eagle RF has two DACs and they are shared between the Decoms and the Receivers. Applying settings to the DAC over writes the previous settings. The hardware is configured by the last applied setting. The two DACs have the same controls.

1. DAC Out Enable – This enables the rest of the Output controls as well as configures the Bald Eagle RF card for the Receiver to use the DACs.
2. Output – This combo box selects the output for the given DAC. The options are Off, Demod, or AGC. When Off is selected, no changes are made to the current DAC settings for other functionalities that use the DAC. Demod selects the demodulated analog data for the selected DAC. AGC selects the AGC gain for the selected DAC.
3. Gain (Vpp) – This numeric control sets the gain level for the selected output signal. The Gain controls the maximum and minimum value for the selected DAC output. The max value is 5 Vpp. The min value is 0 Vpp.
4. Offset (Vpp) – This numeric control sets the offset level for the selected output signal. The Offset controls the center value for the selected DAC output. The max value is 2.5 Vpp. The minimum value is -2.5 Vpp.
5. Invert – This checkbox controls if the signal for the selected DAC is inverted.

4.10.2 Receiver Waveform Window

The Receiver Waveform window is accessible by clicking on a receiver in the Hardware Explorer and click the image on the tool bar as shown below.

Figure 81 – Bald Eagle RF Receiver Waveform Icon

The Receiver Waveform window has large displays of the Frequency Domain and Time Domain plots for the incoming data. The Frequency Domain plot is generated using the Fast Fourier Transform (FFT). The incoming data is selected via the combo box in the bottom left hand corner. The options are RF Spectrum or Demod Out Filtered. The RF Spectrum selection displays the incoming modulated RF spectrum. The Demod Out Filtered shows the output of the demodulated data after it exits the Output Filter.

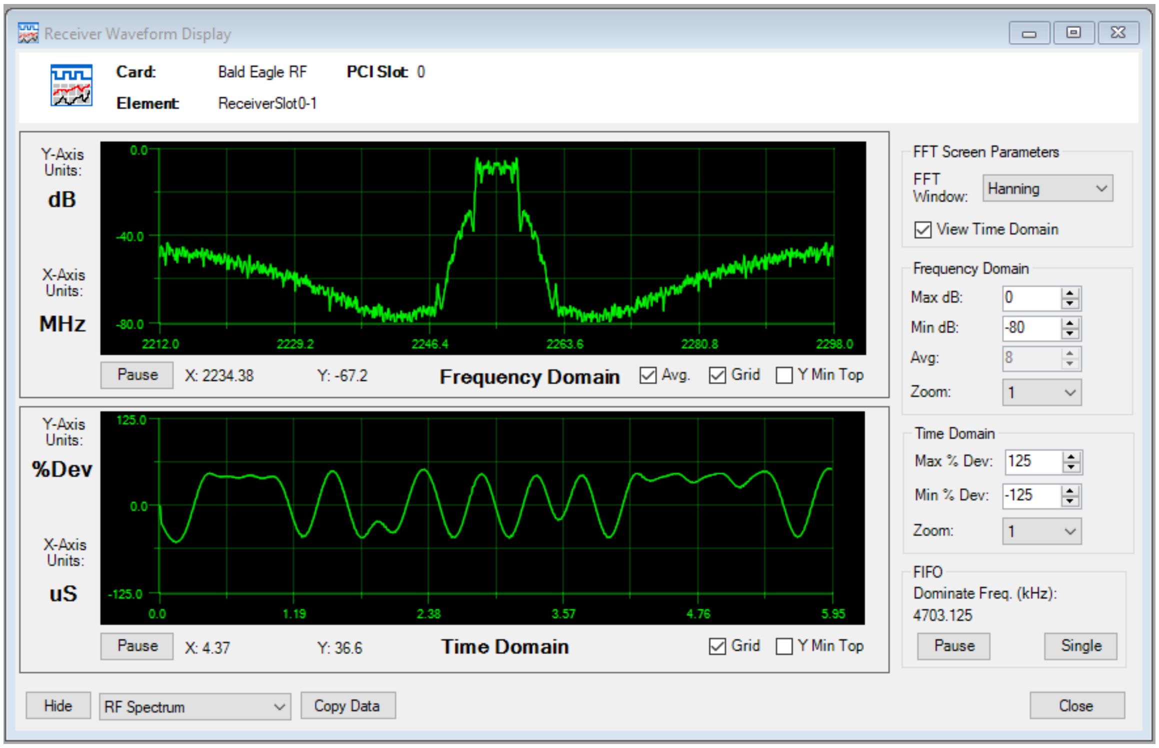


Figure 82 – Bald Eagle RF Receiver Waveform Window

The Receiver Waveform window also has controls for configuring the displays. The following controls apply to both the Frequency Domain and Time Domain displays except where noted.

1. FFT Window – This combo box selects the windows for the FFT. The options are Hanning, Hamming, Blackmon, and Rectangular.
2. View Time Domain – This checkbox enables and disables the Time Domain plot.

Under the Frequency Domain plot there are several controls:

1. Pause – This button pauses the Frequency Display. When paused, the button's name changes to Resume. Clicking the Resume button restarts data updates.
2. X or Delta X – This is the display of the current X-axis value of the cursor. The normal display is X. This is the current X-axis location of the cursor. When the delta cursor is used, the name changes to Delta X. The value is then the difference between the two cursors.
3. Y or Delta Y – This is the display of the Y-axis value of the intersection of the cursor and the Frequency domain data. The normal display is Y. When the delta cursor is used, the name changes to Delta Y. The value is then the difference between the intersection of the cursor and the Frequency domain data for the two cursors.
4. Avg – This check box determines if raw or averaged data is used for the plot. Frequency Domain plot only.
5. Grid – This check box determines if the plot has a grid.

6. Y Min Top – This check box determines if the data is inverted on the Y-axis. When checked, the minimum Y-axis value is at the top of the plot.

Frequency Domain

1. Max dB – This numeric controls sets the maximum value on the Y-axis of the plot.
2. Min dB – This numeric controls sets the minimum value on the Y-axis of the plot.
3. Avg – This numeric control sets the number of readings that are averaged for the data display. A higher number of averages smooths the data, but the display updates slower. To change the number of averages, the Avg checkbox must be unchecked.
4. Zoom – This combo box selects the zoom level for the X -axis of the plot. Available selections are 1, 2, and 4.

Time Domain

1. Max % Dev – This numeric controls sets the maximum value on the Y-axis of the plot.
2. Min % Dev – This numeric controls sets the minimum value on the Y-axis of the plot.
3. Zoom – This combo box selects the zoom level for the plot. Available selections are 0.5, 1, 2, 4, and 8.

Other Controls

1. Hide / Show – this button hides the controls and expands the graph to the entire window.

Both plots have cursors for analysis. When moving the mouse over a plot, a white vertical line will track the movement of the mouse. This is the cursor. The X-axis value of the cursor is displayed below the blow. The intersection of the cursor on the plot data is the Y value. A left mouse click locks the first cursor. The cursor is now yellow. Its position is reported at the bottom of the chart. A white vertical cursor will track with the mouse movement. Another left mouse click locks the second cursor, which will turn yellow. Once both cursors are locked, the difference between the cursors is shown below the plot. To clear the delta cursors, either left click again or right click and select Clear Delta Cursors from the pop up menu.

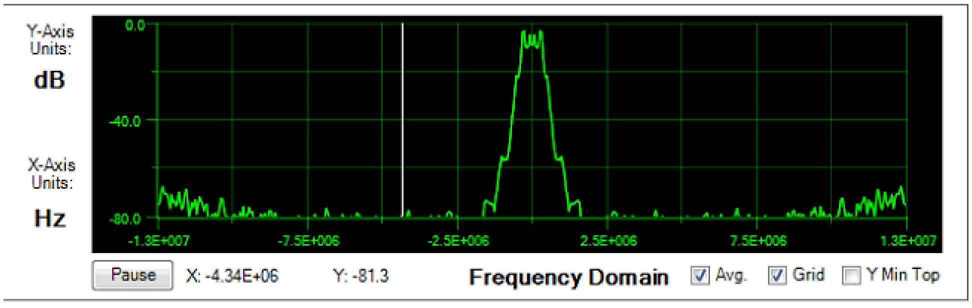


Figure 83 – Bald Eagle RF Receiver Waveform Normal Cursor

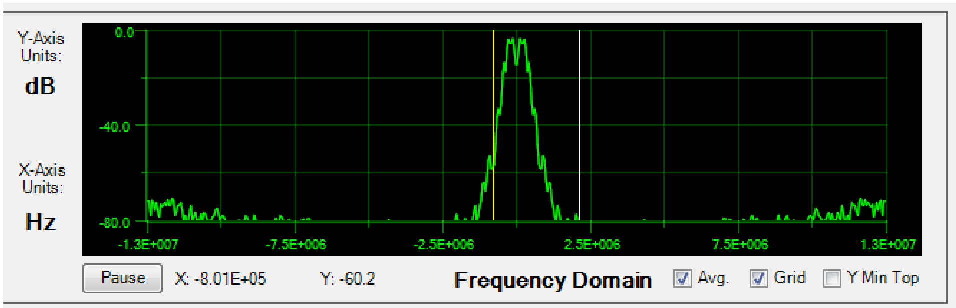


Figure 84 – Bald Eagle RF Receiver Waveform First Delta Cursor Selection

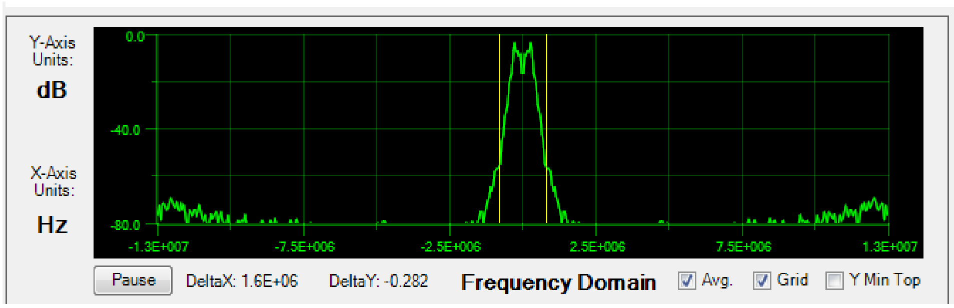


Figure 85 – Bald Eagle RF Receiver Second Delta Cursor Selection

4.10.3 Receiver Status Words

The Bald Eagle RF Receiver has two status words: _RF_AGC and _RF_PWR. These two parameters are related but have minor differences.

- _RF_AGC is the auto gain control value for a Receiver in the Bald Eagle RF. The range is 0 to 73dB and the parameter is measured in 1dB increments. The AGC adjusts based on the selected AGC Mode and the AGC Time Constant.
- _RF_PWR is the measure measured at the input to a Receiver in the Bald Eagle RF. The range is -128dB to 5dB and the value is measured in 0.25 dB increments. The Power is measured before the AGC and is not affected by the AGC settings

The Bald Eagle RF Receiver Status Parameters are like any other parameter in ALTAUIR. They can be displayed in Meters, Strip Charts, or any other display.

Chapter 5 Using ALTAIR Software

5.1 Display Pages

Then main area inside of the ALTAR window is the Display Page. This is where the various data displays are organized. ALTAIR supports unlimited display pages. Each Display Page is an XML file saved with the DP file extension. The display pages are switched using the Display Page combo box located next to the Save button in the File Toolbar.

Please note that changing the display page in the Display Page combo box saves any changes to the current display page before loading the new display page.

The Menu Bar has a Displays entry. This menu contains commands to add, modify, and save display pages:

- New Display Page – creates a new blank display and add it to the Display Combo Box.
- Open Display Page – uses an Open File Dialog to select a display page to open.
- Save Display Page – uses a Save File Dialog box to save the current display page. Can be used to create a copy of the current display page by saving it with a new name.
- Rename Display Page – uses a Save File Dialog box to rename the current display page to a new name.
- Delete Display Page – deletes the display page selected in the Display Page combo box.

5.2 Display Windows

Display windows are additional Display Pages that are in a separate window. Display Windows are used for systems with multiple display displays or to create multiple display windows for fast switching. The controls for the Display Pages are in the Display Menu from the toolbar. There is an entry to create a new Display Window and entry for each open Display Window.

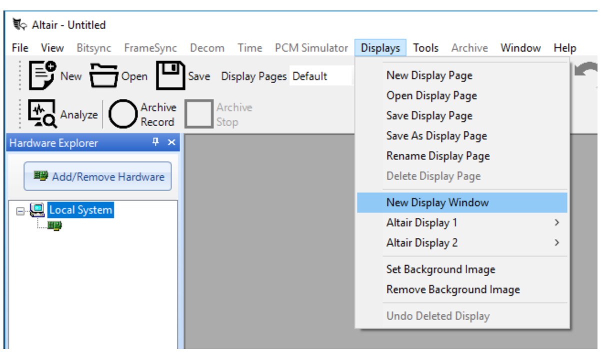


Figure 86 – Display Window options in the Display Menu

The entry for each open Display Window has an arrow next to it. Selecting the arrow expands the menu to display a list of all of the Display Pages. The selected Display Page is denoted with a check mark. Selecting a Display Page from this list changes the Display Page that is displayed in that Display Window. This feature allows the user sitting in front of the main display to change what is seen on other displays. This feature is useful for when the secondary display is a projector or large high definition TV in a control room.

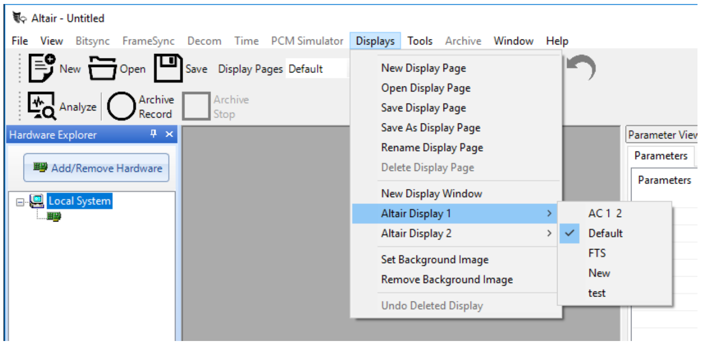


Figure 87 – Selecting the Display Page for a Display Window

The option "New Display Window" in the Display menu, creates a new Display Window. The Display Window can be maximized, minimized, or dragged to another display. The title bar of the Display Window displays the number of the display and the current ALTAIR Configuration file. The Display Page combo box selects which display page is used. The Refresh button reloads the Display Page. This feature is used when changes are made in the ALTAIR main window or in other Display Windows. The Save button saves any changes to the Display Page.

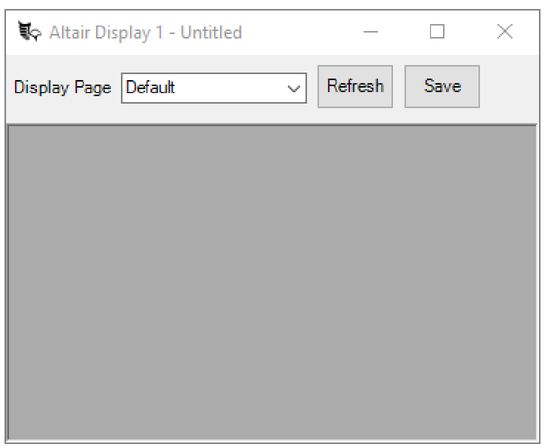


Figure 88 – Display Window

5.3 Introducing Data Displays and Properties

ALTAIR uses various types of Data Displays to visualize and accurately represent data. Most of the displays are resizable and use a snap-to-grid movement that allows users to easily customize and organize the display area. The displays are specifically designed for ease of use and consistency. Some features are common to all data display types. Data Displays fall into two categories: displays with title bars and displays without title bars.

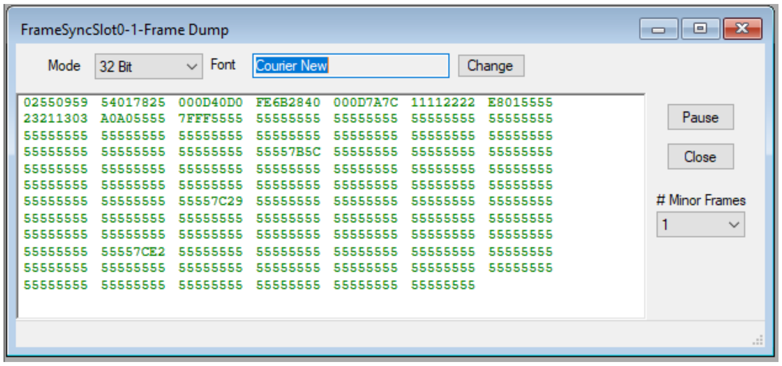


Figure 89 – Data Display with Title Bar

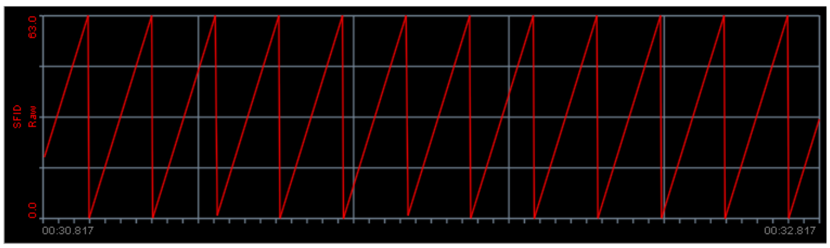


Figure 90 – Data Display without Title Bar

The title bar functions the same purpose as in all Windows operating system applications. It is the handle to move a window and contains the Minimize / Maximize button as well as the Close button. Data Displays with title bars are moved by positioning the cursor over the title bar, pressing the left mouse button, and moving the mouse to move the display. Release the left mouse button when the display is in the correct location. The Data Display with title bars are resized by hovering the mouse over any of the four size or four corners of the window. Data Displays with title bars cannot be multi-selected, therefore only one can be copied and pasted at a time.

Data Displays without title bars do not have buttons for Minimize / Maximize or Close. Resizing are resized by hovering the mouse over any of the four size or four corners of the window. Data Displays without title bars are moved by right clicking on the display when the mouse turns into the cross-hair icon. These displays are free moving but will snap and auto align to close by displays. The snap feature allows displays to put in to neat rows and columns. The snap also works when resizing a display that is adjacent to a display that is a different size. Data Displays without title bars can be multi-selected. Data Displays are multi-selected by either holding the Control key while selecting controls or by drawing a lasso around the controls. The lasso must start on the Display Page background and is drawn behind the controls, so until the lasso is only visible over the background. Multi-select is used is select multiple data displays for moving them as a group or for copying and pasting the group of displays. The Copy and Paste buttons are available in the Display Toolbar.

Displays are associated with different parts of the hardware. The various displays and their relationship to the hardware are listed below:

- Bit Sync Displays:
  - ***Input Waveform*** – A display for viewing data being transmitted into the Tarsus3 Bit Sync. This data is sampled directly after the front-end Analog to Digital converter.
  - ***Eye Diagram*** – A display provided to help validate the operation of the Bit Sync. This display shows the input PCM data in direct relationship to the newly created bit clock.
- Frame Sync Displays:
  - ***Raw Data Dump*** – A display for viewing the raw data in parallel form after it has been processed by the Bit Sync and Frame Sync.
- Decom Display:
  - ***Tabular*** – A display for columnized data in scientific floating-point mode or integer mode with hexadecimal, decimal, or binary formats.
  - ***Strip Chart*** – A display used to synchronously display every sample of data for a parameter in a scrolling waveform format.
  - ***Scope/FFT*** – A display used to synchronously display every sample of data for a parameter in a non-scrolling type display with the ability to run a Fast Fourier Transform on the data.
  - ***Bar Graph*** – A display used to represent data using vertical bars.
  - ***Lamp*** **–** A circular display that changes color based on defined criteria. Used like an indicator lamp: green for good and red for bad.
  - ***Meter*** – A display for representing data as digits in scientific floating-point mode or integer mode with hexadecimal, decimal, or binary formats. This display is similar to a digital multi-meter or LCD readout. The meter is also used for a textbox.
  - ***Dial*** – A display for representing data as a circular instrument or gauge. Use this display to simulate cockpits, dashboards, etc.
  - ***Digital/Discrete*** – A display used to represent data in a binary format or as specific states of a process.

- ***3D Modeling*** – A display used to represent data using a real-world 3D model.

5.3.1 Display Toolbar Buttons

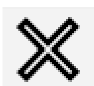
In ALTAIR, there are toolbar buttons associated with each Decom data display. Depending on the display type, a toolbar can contain one or many of the buttons shown below. Below is a list of Display Buttons:

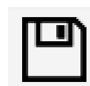
 Select Properties

 Pause Display

 Copy Selected Displays

 Paste Displays from Clipboard

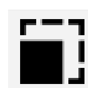
 Delete Display

 Save Display to Bitmap file

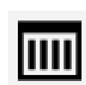
 Undo Delete Display

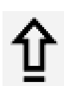
 Delete Parameter

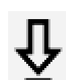
 Zoom X-Axis

 Auto Size Display

 Zoom Y-Axis

 Setup of Display

 Move Parameter Up

 Move Parameter Down

 Lock and Unlock Display Position

5.3.2 Using Display Properties

All data displays in the ALTAIR software contain properties. Properties are settings that determine how the display windows appear i.e. colors, borders, etc. These settings also determine how the data appears within the window: data format, data color, data precision, data scales, data limits, etc. All data displays will not have the same properties, but every data display will have some properties. Some displays will have one set of properties, while others may contain hierarchal sets of properties. For example, a strip chart display will have properties for each waveform loaded in the display and it will also have properties for the overall strip chart window.

The properties on all displays can be accessed two different ways.

1. Click on a display window or a parameter within the windows while the Display Properties Tab is selected.
2. Click on the window or a parameter within the windows and use the toolbar for that particular display.

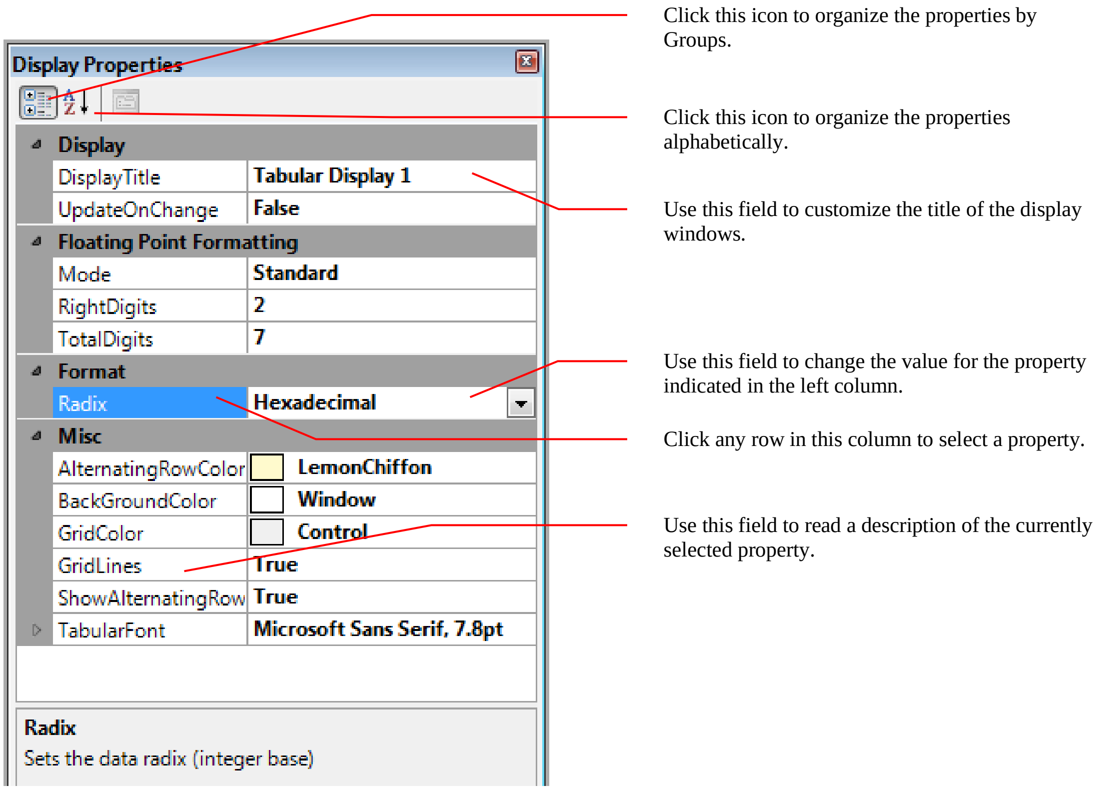
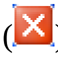


Figure 91 – Example of a Properties Window

Follow the step-by-step directions below to set properties on a data display:

1. Change the property located in the left column by clicking the options in the right column. (Some properties will display drop-down selection while others will require a value to be entered.)

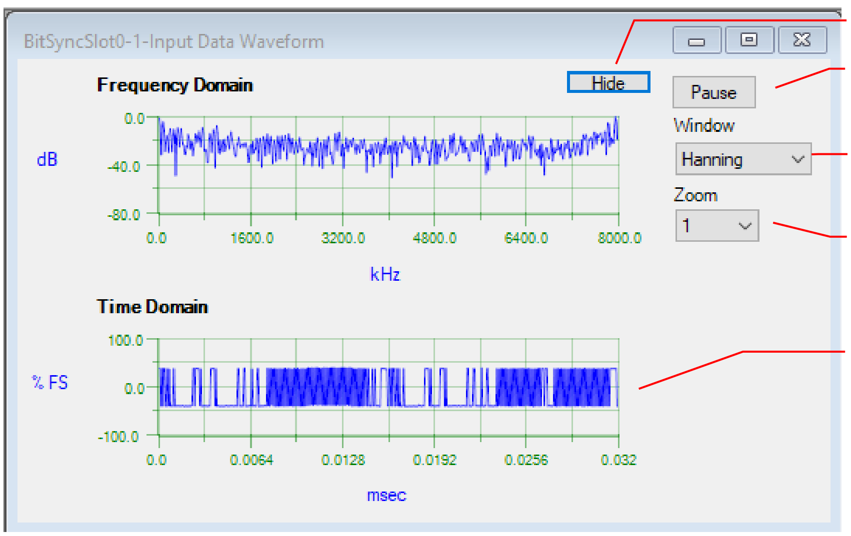
2. Click the close window button () on the top right of the screen to close the properties window and update the data display windows with the new settings.

5.4 Using the Bit Sync Displays

5.4.1 Waveform Display

The PCM input waveform display is a display tool used to verify the input PCM data. A snapshot is taken of the data and is displayed in a time domain, along with a Fast Fourier Transform (FFT). The data is sampled directly after the analog to digital converter on the Tarsus3 hardware and provides a good indication of whether the source of data is valid and connected. To access the Waveform Display:

1. On the ALTAIR main screen, select a **Bit Sync** in the Hardware Explorer window and click the Waveform button on the Bit Sync toolbar or select ***Bit Sync\Displays\Input Waveform*** from the main menu. The Bit Sync Input Data Waveform Display window will open as shown below.



The Hide / Show button hides the controls and expands the graphs.

Use the Pause button to pause or resume the update of live data.

Use this selection to change the FFT window process applied to the data.

Use the Zoom drop-down to select a zoom value for the Time Domain plot.

After pressing pause, click inside the waveform to get a crosshair. X and Y values will be displayed. (You can also right mouse click anywhere within the display to change properties like color as shown here.)

Figure 92 – Bit Sync Input Waveform Display

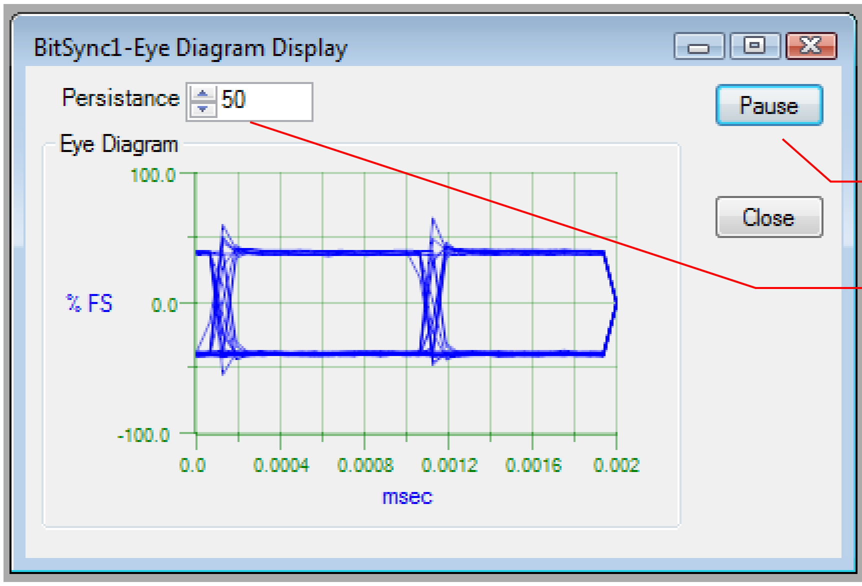
When complete, press the Close button to close the window. As long as the Bit Sync Waveform Display is open, frame sync data is not sent to the decom.

5.4.2 Eye Diagram Display

The Eye Diagram Display assists in determining the accuracy of a bit sync setup. To locate and use the Eye Diagram Display:

1. On the ALTAIR main screen, select a **Bit Sync** in the Hardware Explorer window and select the ***Bit Sync\Displays\Eye Diagram*** menu option from the main menu, or click the Eye Diagram button  on the Bit Sync toolbar. The Bit Sync Eye Diagram window will be displayed. (See Figure 93 – Eye Diagram below.)

The Tarsus3 hardware and software includes a special feature for setup up and analyzing the operation of the Bit Synchronizer.



Use this button to pause or resume the update of live data.

Use the persistence setting to indicate the number of data samples before clearing.

Figure 93 – Eye Diagram

5.5 Using the Frame Sync Displays

5.5.1 Using the Frame Dump Data Display

The raw Frame Dump Data Display is very helpful during frame sync setup and data analysis. To locate and use the Frame Dump Data Display:

1. On the ALTAIR main screen, select a Frame Sync in the Hardware Explorer window and either select the menu option ***Frame Sync\Displays\Frame Dump,*** or click the Frame Dump button on the Frame Sync Toolbar. The Frame Sync Frame Dump screen will be displayed. (See Figure 94 – Frame Dump below.)
2.

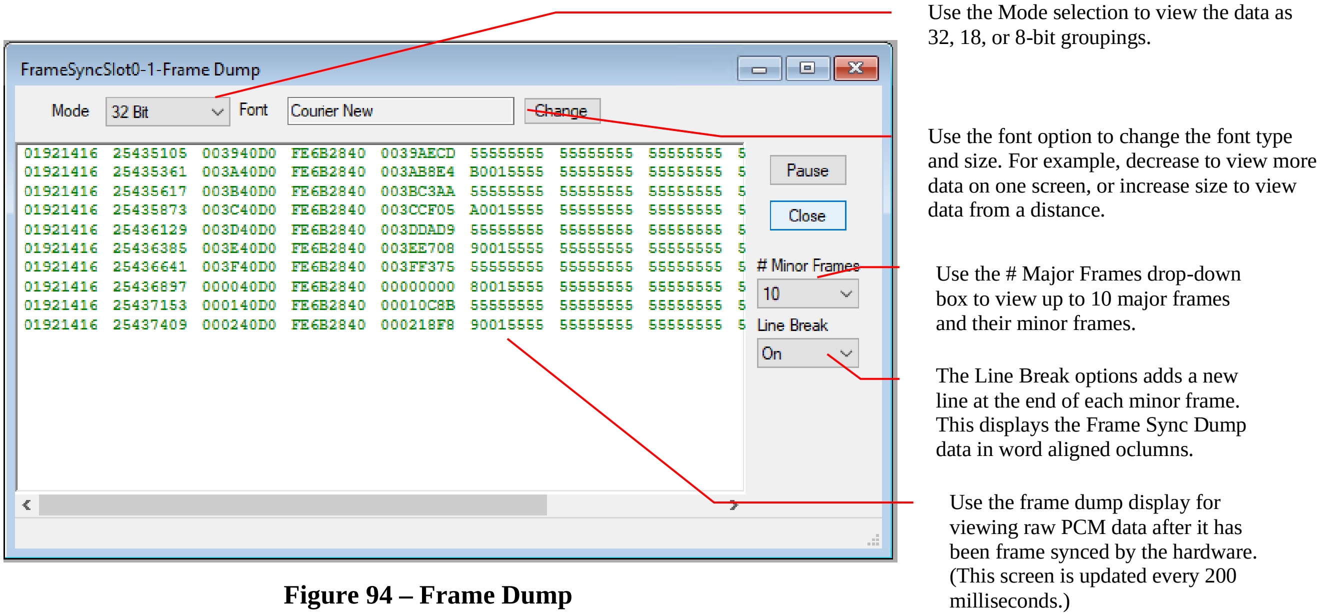


Figure 94 – Frame Dump

5.5.2 Using the Frame Sync Statistics Display

The Frame Sync Lock Statistics analyzes the quality of the signal using the Frame Sync Pattern and SFID Count as statistics for good signal. The display shows the number and percentage of "good" minor frames and "good" SFID. A "good" minor frame is when the Ulyssix PCM card is in frame lock. A "good" SFID Count is when the Ulyssix PCM card is in subframe lock and the minor frame counter is one greater than the previous counter. Each statistic is calculated as raw counts and a percent of total minor frames received.

The Frame Sync Statistics starts analyzing minor frames when ALTAIR loads a configuration file. Because the Frame Sync Statistics start before the Ulyssix PCM card is stable, there are often errors when you first launch the display. The Reset button clears the counters. The Pause button stops the analysis. The Run button restarts the analysis.

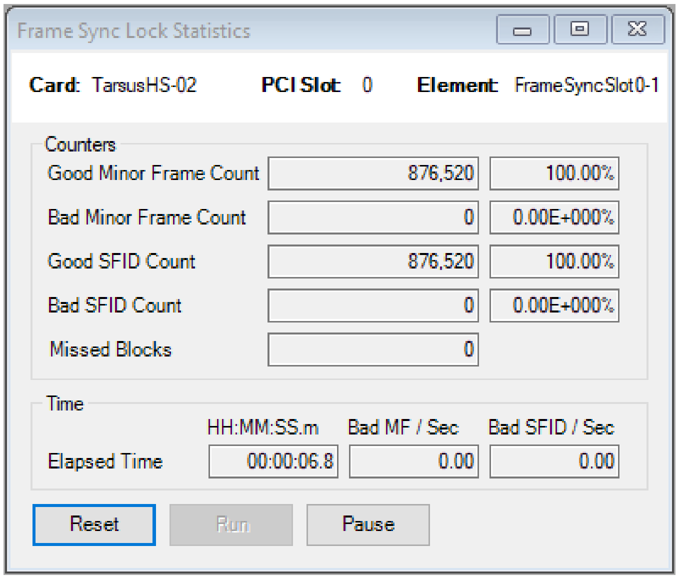


Figure 95 – Frame Sync Lock Statistics

5.6 Using the Decom Displays

The ALTAIR software Decom section provides the real power behind the ALTAIR product. This is where the PCM data can be viewed in data displays, analyzed, saved, and re-played. This section will describe how to use the data displays to get the most benefit from the ALTAIR software.

5.6.1 Using Decom Data Displays

The process of using data displays is consistent across all displays. To use a data display, follow the step-by-step procedure below:

1. On the ALTAIR main screen, select a Decom in the Hardware Explorer window and select a display by using one of the following methods:
   a. Select the main menu item ***Decom\Displays*** and choose one of the display types.
   b. Click the Displays button on the Decom Toolbar to select a display type.
   c. Highlight a parameter in the docking parameter window, right mouse click and choose either **"View Param in New"** or **"Add Param to Existing,"** then select a display.
2. Once a display is open, it can be re-sized, moved, and have its properties changed. To re-size, move, or adjust Decom Data Display properties:
   a. Sizing:
   - To change the width, point to the either then left or right window border. When the pointer changes into a horizontal double-headed arrow ↔, drag the border to the right or left.
   - To change the height, point to the top or bottom window border. When the pointer changes into a vertical double-headed arrow ↕, drag the border up or down.
   - To change the height and width at the same time, point to any of the four corners. When the pointer changes into a diagonal double-headed arrow, drag the border in any direction.
   - Sizing a display will snap to the edges and corners of nearby displays. This helps create neat columns and rows of displays.

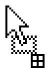
   b. Moving – To move a window, grab a window by left mouse clicking with the cursor in the window border region and drag the window to a new location. The Data Display will snap to the edges and corners of nearby displays. This helps create neat columns and rows of displays

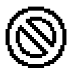
   c. Properties – Click on the Display Properties tab located in the Hardware Explorer or click on the Properties button on the Display Property Toolbar. To enable the toolbar, click View and check Display Properties.

5.6.1.1 Loading Parameters into Data Displays

The PCM data is viewed by loading predefined parameters into the data displays. This section explains how to load parameters into the display pages. Two methods are provided for loading parameters into data displays:

1. Drag and Drop – Using the drag and drop method is the easiest and quickest way of loading parameters. Simply select a parameter in the docking parameter view window (see section 4.1.3 Parameter), click and hold the mouse button, drag the parameter to a data display window and drop by releasing the mouse. The following cursors are used to indicate valid and non-valid drop zones:

    Indicates the area is a valid drop zone.

    Indicates the area is not a valid drop zone.

2. Parameter Window Menus – Select a parameter in the docking parameter view window (see section 4.1.3 Parameter), right mouse click to bring up a menu and select either **“View Param in New”** or **“Add Param to Existing”** and then select a display.

5.6.1.2 Deleting a Data Display

To delete a data display by left mouse clicking the display you want to delete and hit delete on keyboard. If deleting a multiple parameter display, you may be prompted by the Confirm Multiple Parameter Removal window if you want to continue with the delete. Click **Yes** to delete, or **No** to keep the display.

5.6.1.3 Deleting Parameters from Data Displays

To delete a parameter from a data display, select a parameter with the mouse and press the delete key, or right click on a parameter and choose Delete from the menu. Another way is to press the Parameter Delete button on the Display Toolbar.

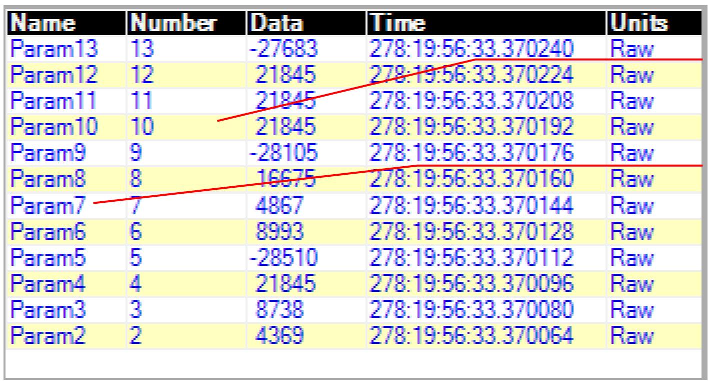
5.6.1.4 Using the Tabular Data Display

The Tabular Data Display organizes multiple Decom Parameters and their value into one display. It is customizable to set which columns are displayed. The Data Column can format the number into Binary, Octal, Hexadecimal, or Decimal.

When the Data Column is configured for Decimal, the Data Column can format the number in Standard, Fixed Decimal, or Scientific Notation. Standard is integer notation with zero decimal places. Fixed Decimal allows the user to set the number of decimal places using the Right Decimal property. Scientific Notation also uses Right Decimal to determine the number of decimal places.

Data Columns configured for Binary, Octal, or Hexadecimal display the Decom Parameter in the selected format. The number of digits is determined by the number of bits for the Decom Parameter.

The Tabular Display Property Update On Change allows the display to only be updated when a value changes. This feature is useful for tracking Status Parameters like Frame Lock or SubFrame Lock.



Name	Number	Data	Time	Units
Param13	13	-27683	278:19:56:33.370240	Raw
Param12	12	21845	278:19:56:33.370224	Raw
Param11	11	21845	278:19:56:33.370208	Raw
Param10	10	21845	278:19:56:33.370192	Raw
Param9	9	-28105	278:19:56:33.370176	Raw
Param8	8	16675	278:19:56:33.370160	Raw
Param7	7	4867	278:19:56:33.370144	Raw
Param6	6	8993	278:19:56:33.370128	Raw
Param5	5	-28510	278:19:56:33.370112	Raw
Param4	4	21845	278:19:56:33.370096	Raw
Param3	3	8738	278:19:56:33.370080	Raw
Param2	2	4369	278:19:56:33.370064	Raw

Drop parameter anywhere in the display to add a new parameter to the list.

Select a row with a left mouse click; right mouse click to view a menu, or hit the delete key to delete a parameter.

Figure 96 – Tabular Data Display

To add, remove, or rearrange parameter Columns and Rows in a Tabular Display:

1. Columns - Right mouse click a column or press the Columns button on the Tabular Property Toolbar. Columns can be added and removed by selecting a column name and moving it between the Available Columns and Chosen Columns window. A Column order can be changed by selecting a column name in the Chosen Columns window and using the **Move Up** and **Move Down** buttons.

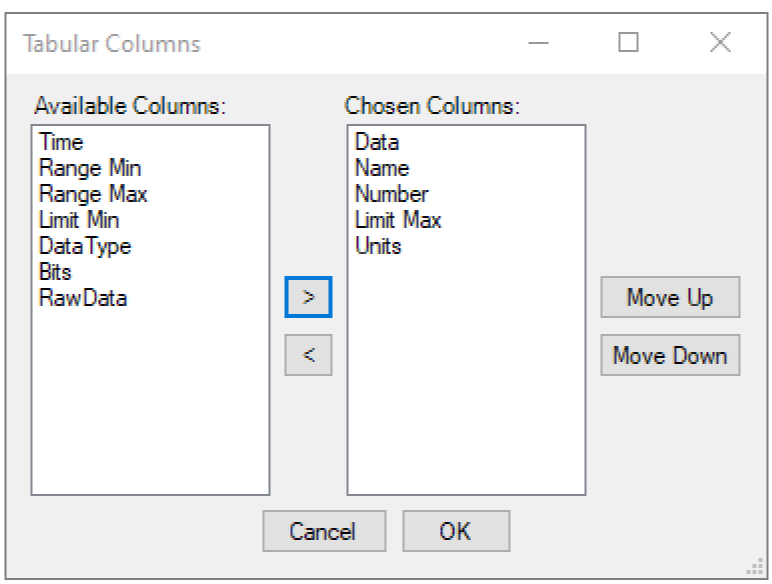


Figure 97 – Tabular display columns

2. Rows – Parameter rows can be re-arranged on the tabular display by selecting a row, clicking the right mouse button and selecting Move Up or Down. The Rows can also be moved by using the hot keys: Alt+Down Arrow and Alt+Up Arrow. There are also Parameter Up and Parameter Down buttons on the Tabular Property Toolbar.

5.6.1.5 Using the Dial Display

The Dial Display uses the parameters range to set the limits on a dial plot. Then needle points to the current parameter value. Optionally, the Dial Display prints the current value on the dial face.

Many aspects of the Dial Displays appearance are configured via the Display Properties window. The Border Color, Face Color, Needle Color, Text Color, and Range Font are defined in the Display Setup section. The Misc Section controls if the following values are displayed on the Dial Display: Digital Parameter Value, Parameter Name, and Parameter Units. The Scale section defines the Limits, Range, and Divisions. The Limits and Range are inherited from the Decom Parameter. The Type section defines if the Dial Display is a full circle and the angular location of the Minimum Value. All angles are defined with 0 degrees as the top, 90 degrees as the right, 180 degrees as the bottom, and 270 degrees as the left.

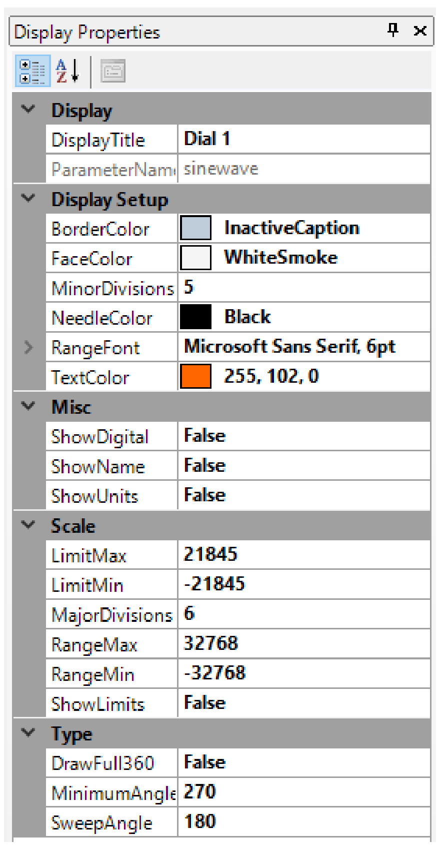


Figure 98 – Dial Display Properties Window

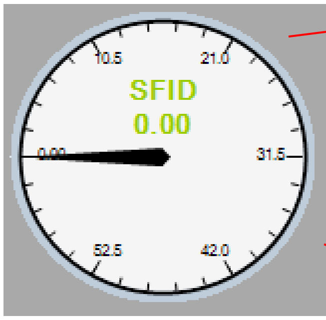


Figure 99 – Dial Data Display

The area outside of the Dial Display is transparent. It can be placed over background image.

Use properties to change the dial sweep angle and minimum/maximum locations.

Enable the **Show Digital** feature in properties to see the data as digits.

Use properties to change the color of the face, text, and needle.

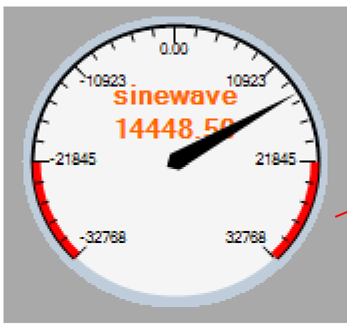


Figure 100 – Dial Data Display Showing Limits

Limits (in red) show the input data is out of range.

Below is an example of two Dial Displays that are 180 degrees each. This is accomplished by setting the DrawFull360 property to false and setting the Sweep Angle to 180 degrees. Then setting the Minimum Angle to determine the desired quadrant. The top Dial Display has Minimum Angle set to 270 degrees. The bottom Dial Display as the Minimum Angle set to 90 degrees.

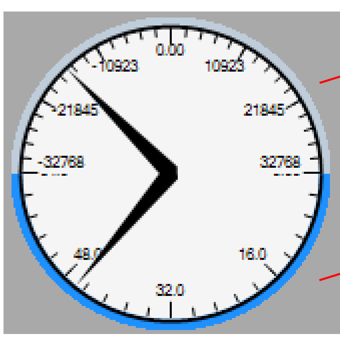


Figure 101 – Two 180 Degree Dial Displays

The top half is one parameter. It has a gray border.

The bottom half is a second parameter. It has a blue border.

5.6.1.6 Using the Meter Data Display

The Meter is a versatile data display. It can show either the numeric value of a Decom Parameter or an alphanumeric string. The Meter numeric display can format the number into Binary, Octal, Hexadecimal, or Decimal.

Meters configured for Decimal can format the number Standard, Fixed Decimal, or Scientific Notation. Standard is integer notation with zero decimal places. Fixed Decimal allows the user to set the number of decimal places using the Right Decimal property. Scientific Notation also uses Right Decimal to determine the number of decimal places.

Meters configured for Binary, Octal, or Hexadecimal display the Decom Parameter in the selected format. The number of digits is determined by the number of bits for the Decom Parameter.

1. The meter display can be setup for three different displays: Parameters, Embedded Time, and Text.
2. All settings on the meter display are done through the properties window.
3. To display a **Parameter,** select "Parameter" in the Meter Type menu on the Display Properties Window.

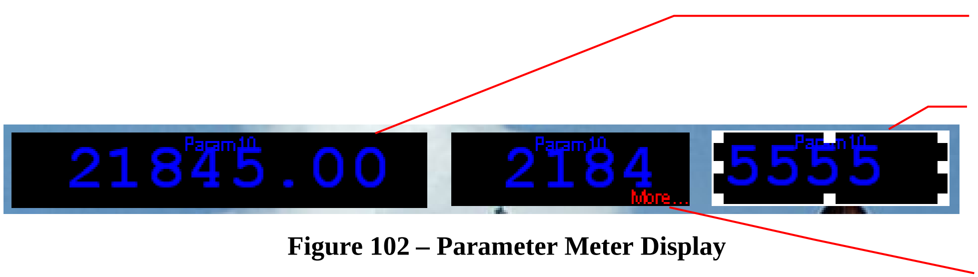


Figure 102 – Parameter Meter Display

4. To display **Embedded Time**, select "Embedded time" in the Meter Type menu in the Display Properties Window. The time format is set when creating a parameter in the Decom setup.

Figure 103 – Embedded Time Meter Display

5. To display **Text**, select "Text" in the Meter Type menu in the Display Properties Window. Enter custom text in the Meter Text field. Change text color in the Meter Text Color field.

Figure 104 – Text Meter Display

A Meter can display multiple Decom Parameters. When adding a Decom Parameter to an existing Meter, the new parameter is either added below the existing parameter or to the right of the existing parameter. The property Meter Direction determines the direction. The two options for Meter Direction are Vertical or Horizontal.

To add an additional Decom Parameter, right click on the meter and select "Add End" Add End will add the next Decom Parameter at the end of the Meter Group. The Swap to Horizontal option will rotate a vertical column of Meter Parameters to a horizontal row. If the Meter Group is currently a horizontal row, the pop-up menu will have an option for Swap to Vertical instead. To replace a Decom Parameter in the Meter, drag and drop a Decom Parameter from the Parameter Menu on top of the desired location.

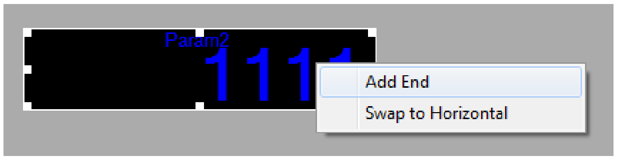


Figure 105 – Add Additional Decom Parameter to Meter

A Meter that already has multiple Decom Parameters has additional options in the right click menu. The Add After option adds the next Decom Parameter in the location after the Meter Parameter where the menu pops up. Delete Selected removes the Meter Parameter where the menu pops up and moves any Meter Parameters below it up or to the left (depending on the orientation).

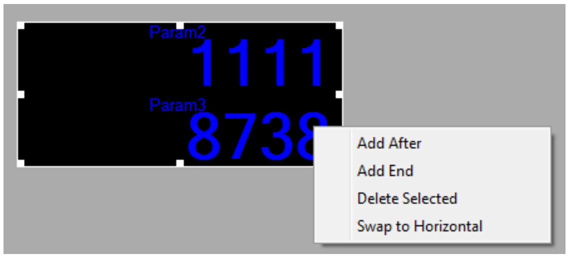


Figure 106 – Meter Pop Up Menu

5.6.1.7 Text Box Display

The Text Box Display is derived from the Meter display. The Text Box displays user specified text to label items in the ALTAIR Display Page. Text Boxes can be added to the ALTAIR Display by two methods. First, by selecting a Decom in the Hardware Explorer, selecting Decom from the toolbar menu, selecting Displays from the drop-down menu, and then selecting Text Box. Or second, by right clicking on a parameter in the Parameter View window, selecting Add Parameter in new, and then selecting Text Box.

Figure 107 – Text Box Display

The Text Box properties are edited by selecting the Text Box and then modifying the desired properties in the Properties Window. Many properties of the Text Box can be changed. These include text color, background color, font, and text alignment.

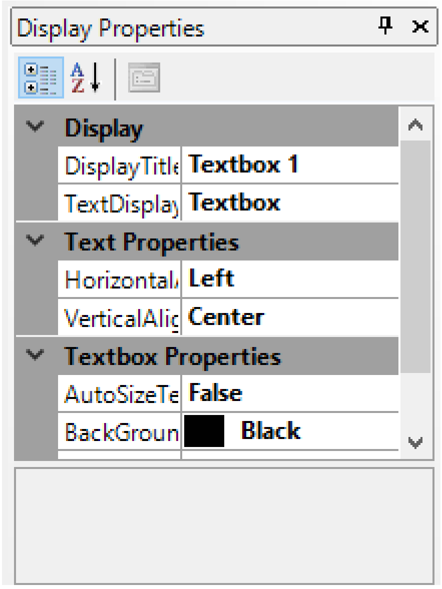


Figure 108 – Text Box Display

5.6.1.8 Using the Lamp Display

The Lamp display is an indicator that changes color based on defined conditions. The first step is to add a Lamp display and define the parameter for the lamp. Next, right click on the Lamp display and select "Setup" to launch the Lamp Setup form. For a new Lamp display the Lamp Setup form will not have any rows.

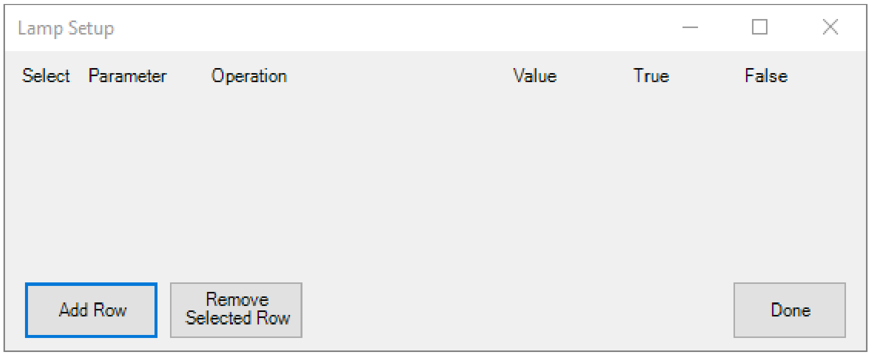


Figure 109 – Lamp Setup Form

Click the Add Row to add a new row. Up to eight rows are allowed. Each row has a check box to select the row, the parameter name, the operation, the value for the operation, and the color if the operation is true. The last row in the Lamp Setup form will also have the color if the operation is false.

The possible operators are:
Equal To
Not Equal To
Less Than
Less Than or Equal To
Greater Than
Greater Than or Equal To

The example below is for the Frame Sync Lock parameter "_FLOCK." The Frame Sync Lock parameter has three possible values: 0 = Search, 1 = Check, and 2 = Lock. The first row sets that if _FLOCK is equal to 2 then the Lamp will be green. The second row sets that if _FLOCK is equal to 1 then the Lamp will be orange, else the Lamp will be red.

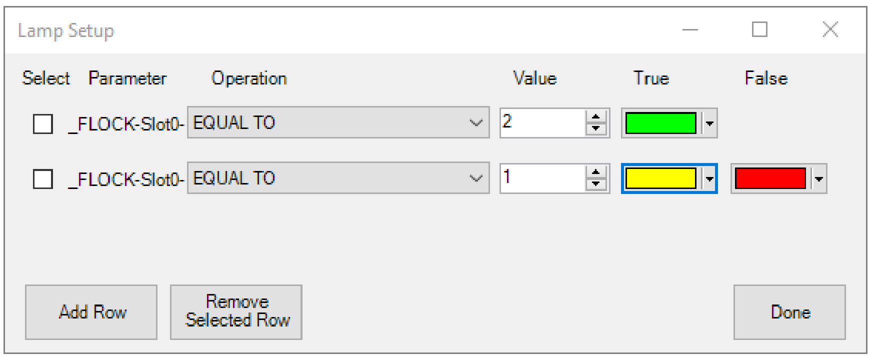


Figure 110 – Lamp Setup Example

By default, the Lamp has a black background and displays the parameter name at the top of the display and the current value at the bottom of the display. When the Display Properties ShowName and ShowValue are both set to false, the name and value are not displayed, and the background of the lamp becomes transparent.

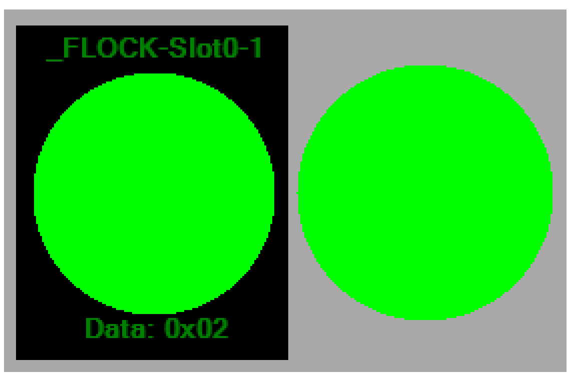


Figure 111 – Lamp Displays with and without Parameter Name and Value

5.6.1.9 Using the Discrete Data Display

The Discrete Data Display is different from the other data displays in ALTAIR. Since each bit in a parameter can represent a different entity, different sizes, and different types of data, the discrete setup information is stored with the parameter itself, and not in the display. This allows any parameter to be loaded into a discrete data display and causes the display to adjust to the parameter's discrete setup. When a new parameter is being set up for a discrete display, default settings will be loaded until further configuration is completed.

Anytime a parameter is loaded into a discrete data display and its size in bits are changed, setup must be performed on the discrete display to reflect the new size.

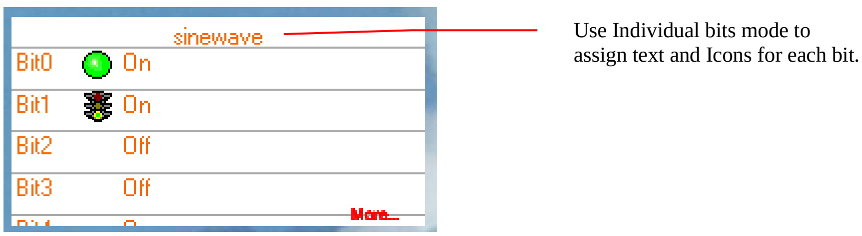


Figure 112 – Discrete Individual Bits

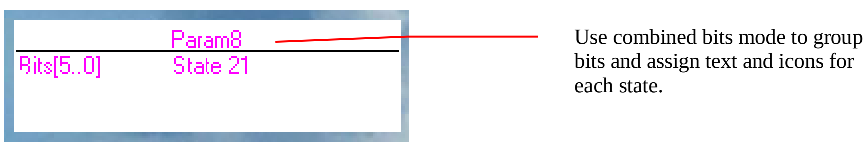


Figure 113 – Discrete Display Combined Bits

1. To change display modes or set text and icons, right mouse click on the display and select setup or click the Setup button on the Property Toolbar.

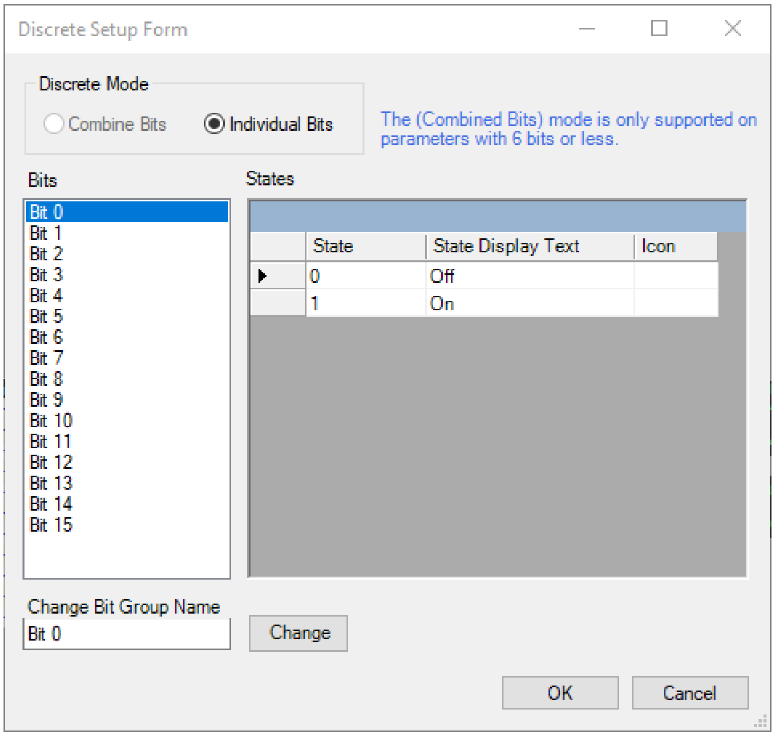


Figure 114 – Discrete Setup

2. Select **Combine Bits** or **Individual Bits** for the discrete mode.
3. Next, directly enter text in the States list.
4. Select icons for each stat by selecting the icon field, clicking the browse button, and then selecting an icon from the icon list. (See Figure 115 – Icon List).
5. When complete, press Ok to update the discrete display.

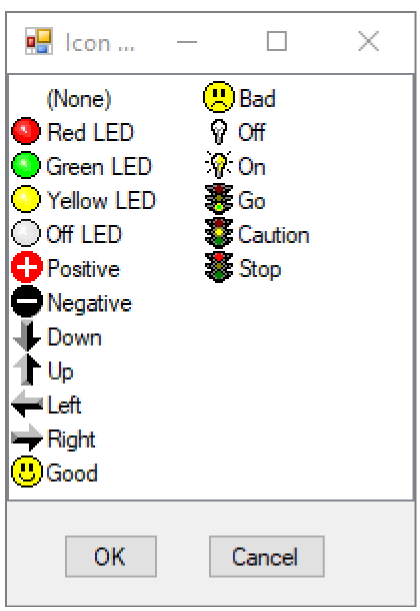


Figure 115 – Icon List

5.6.1.10 Using the Lookup Display

The Lookup display decodes a parameter into a known message. This display is useful for decoding Frame Format Indicators or translating a status word in different string messages based on value of the parameter. The control has a lookup table of hexadecimal values and strings. And if the parameter value matches the hexadecimal value in the lookup table, then the Lookup Display shows the string from that entry.

Lookup Display can be added to the ALTAIR Display by two methods. First, by selecting a Decom in the Hardware Explorer, selecting Decom from the toolbar menu, selecting Displays from the drop-down menu, and then selecting Lookup. Or second, by right clicking on a parameter in the Parameter View window, selecting Add Parameter in new, and then selecting Lookup.

To setup the lookup table, right click on the Lookup Display and select Setup from the menu. The Lookup Setup window can have multiple rows. To add more rows, click the Add Row button. To remove a row, click the checkbox for the row or rows to delete and then click the Remove Selected Row button.

Each row has an Operation, Value in hexadecimal, and a string for if the operation on the value is true. Please note that only the last row has an entry for False. In the example below, the lookup table is checking if the value of Parameter161 is 0x0. If this is true, the Lookup display will show the string Good. If the value of Param161 is less than 0x0, it will display string Negative. If neither of those conditions are true, then the Lookup Display will show the string Positive.

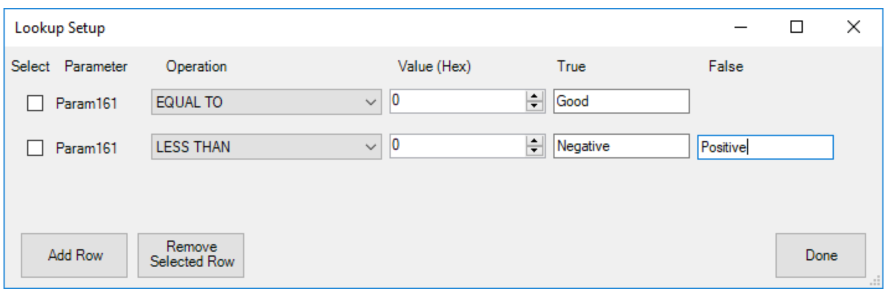


Figure 116 – Lookup Setup Window

Below is an example of a Lookup Display on the left and the Meter on the right for the same parameter, Param161. The value of Param161 is 0x0. The Lookup Display is decoding this value to the string "Good."

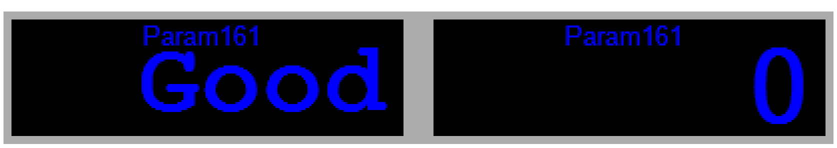


Figure 117 – Lookup Display and a Meter Display

5.6.1.11 Using the Log Data Display

The Log Data Display tracks the values and time stamps of a single parameter in a two-column table. The first column is the time stamp in IRIG format. The second column is the value of the parameter. New data is added to the bottom of the table. The Log Display hold up to 1024 rows, but it only displays the newest values that fit in the table.

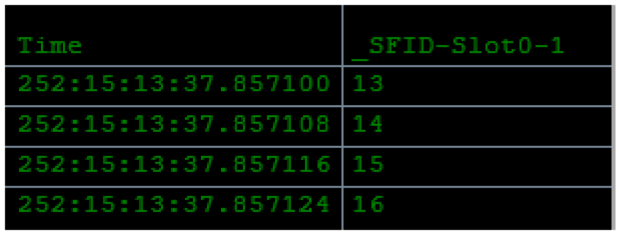


Figure 118 – Log Display

The Log Display Properties are edited by selecting the Log Display and then modifying the desired properties in the Properties Window. The UpdateOnChange property changes how the Log Display adds data. When set to true, the Log Display only adds a new row to the table when the value of the parameter changes. UpdateOnChange is useful for tracking changes in the Frame Sync Lock state (FLOCK).

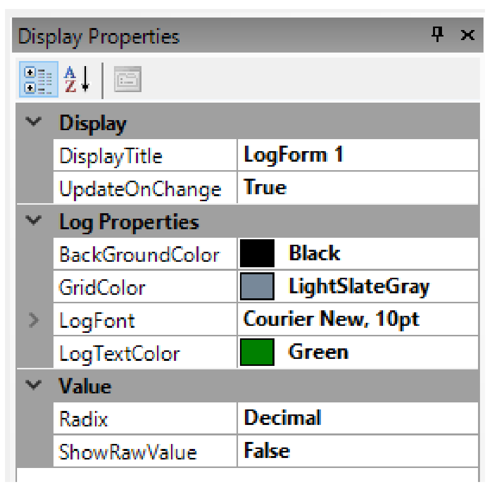


Figure 119 – Log Display Properties

Right clicking on the Lod Data Display bring up a menu with two options: Clear and Copy. Clear erases all data stored in the Log Display and begins collecting data again. Copy creates a copy of the data in clipboard in CSV format.

5.6.1.12 Using the Strip Chart Data Display

Strip Chart Data Displays plot the Decom Parameter value versus time. A Strip Chart Display contains one or more Strip Chart Plots. A Strip Chart Plot is one XY plot with an independent time X-axis. Each Strip Chart Plot can contain one or more Decom Parameters.

The Strip Chart Data Displays and Strip Chart Plots are configured via the Display Properties menu. There are three different Properties menus: Decom Parameter Strip Chart Properties, Strip Chart Plot Display Properties, and Strip Chart Data Display Properties. The different Display Property menus are selected by left clicking on different parts of the Strip Chart Data Display.

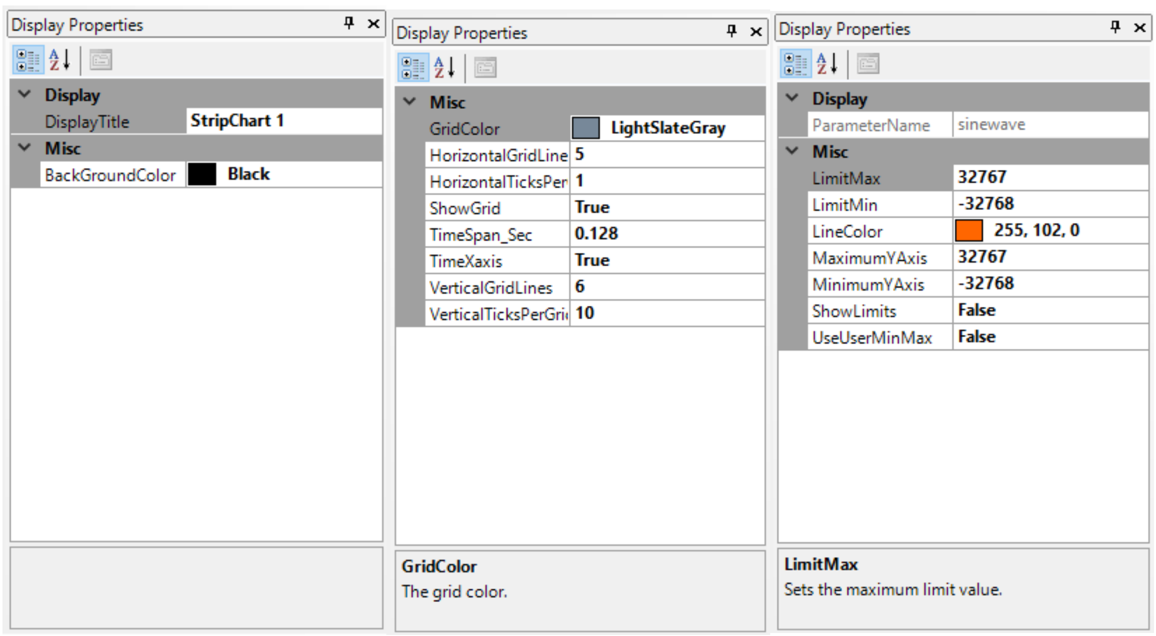


Figure 120 – Three Display Property Windows for the Strip Chart Display

To display the Decom Parameter Strip Chart Display Properties menu left click on the vertical Decom Parameter name on the left side of the plot. This Display Property menu has selections for the color for the data in the plot, the Y-axis minimum, or the Y-axis maximum.

To display the Strip Chart Plot Display Properties menu left click inside the plot area. This Display Property menu has selections for changing the X-axis grid spacing, the Y-axis grid spacing, the color of the grid lines, or the time span of the Strip Chart Plot.

To display the Strip Chart Data Display Properties left click the X-axis in any of the Strip Chart Plots. This Display Properties menu has selections for changing the background color of the Strip Chart Data Display and the Strip Chart Data Display Name.

There is a right mouse click menu associated with each Decom Parameter in the strip chart. To access the right mouse click menu, select a Decom Parameter by clicking the vertical text Decom Parameter name on the left side of the Strip Chart and then click the right mouse button. The menu includes: Properties, Delete Chart, Delete Parameter, Auto Scale Y Axis, and Set Y Axis to Param Range.

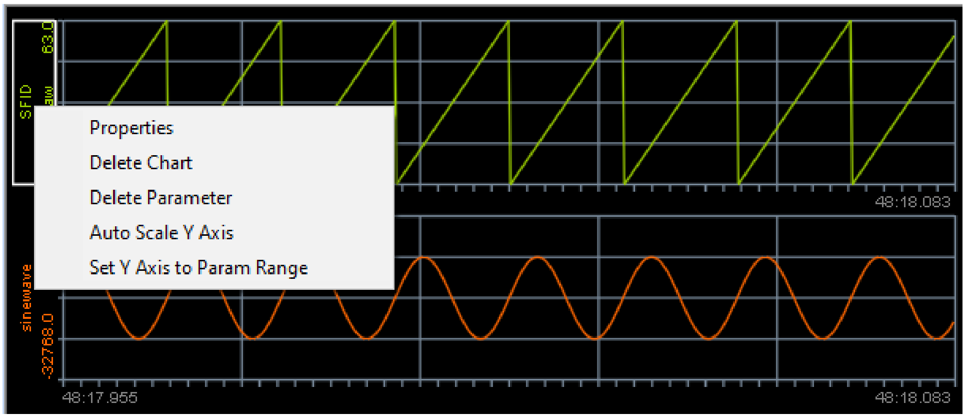


Figure 121 – Strip Chart Decom Parameter Right Mouse Click Menu

The Properties option sets the Display Property window to Decom Parameter Strip Chart Display Properties. The Delete Chart option deletes the chart including all Decom Parameters in the chart. Delete Parameter removes the selected Decom Parameter from the chart. Auto Scale Y Axis sets the min and mix for the Y-axis to the largest values currently in the chart. Set Y Axis to Param Range sets the Y-axis to the default values of min and max.

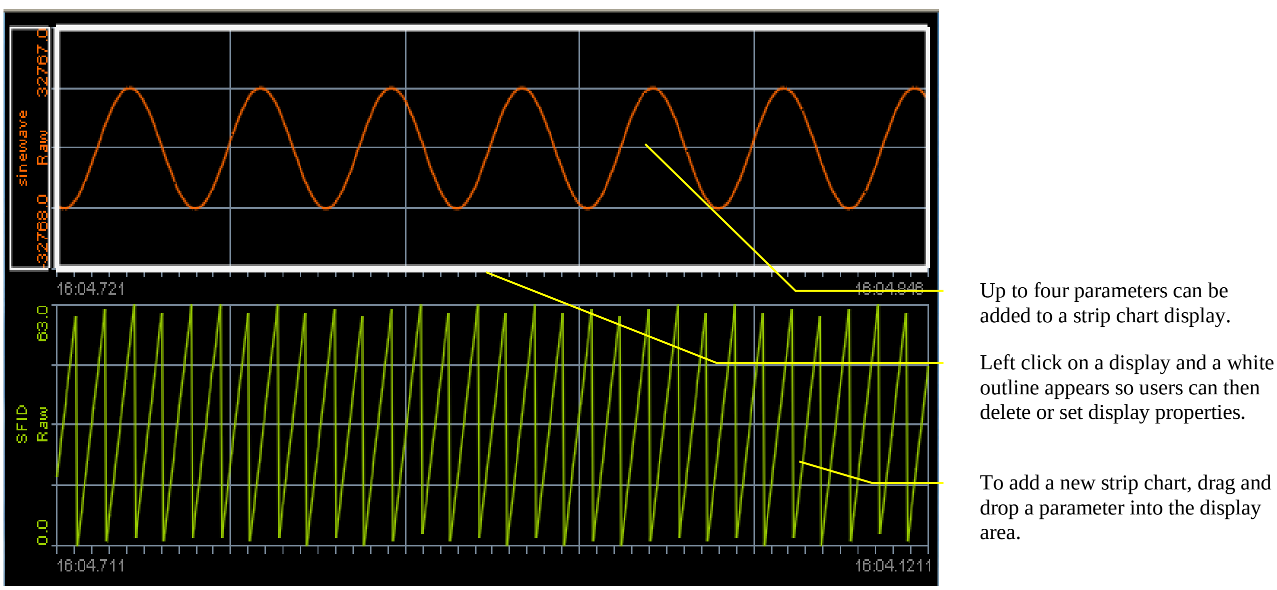


Figure 122 – Strip Chart Display

A Strip Chart Data Display can display multiple Strip Chart Plots. In the picture above, the Decom Parameters Sinewave and SFID are each in a Strip Chart Plot and the two Strip Chart Plots are in one Strip Chart Data Display. To add a new Stirp Chart Plot to an existing Strip Chart Display, drag and drop a Decom Parameter form the Parameter Menu to the X-axis of the bottom Stirp Chart Plot. A new Strip Chart Plot is added to the bottom of the Stirp Chart Display with the desired Decom Parameter. Please note: a new

Strip Chart Plot can only be added at the bottom; they cannot be inserted between existing Strip Chart Plots.

A Strip Chart Plot can display up to four Decom Parameters. To add a Decom Parameter to an existing Stirp Chart Plot, drag and drop the Decom Parameter from the Parameter menu to the plot area of the desired Strip Chart Plot. In the image below, Param13 was added to a Strip Chart Plot that already contained Sinewave. These two Decom Parameters are plotted using the same X-axis. This is a useful display for time correlating data.

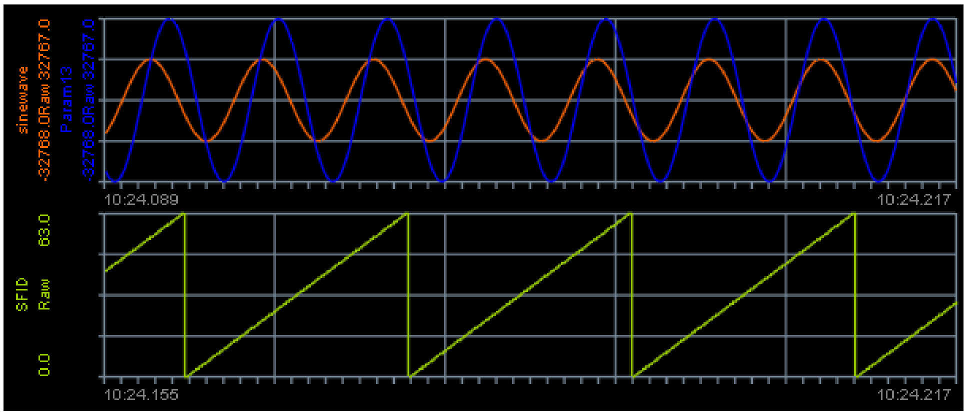


Figure 123 – Strip Chart Plot with Two Parameters

1. All settings on the strip chart display are done through the properties window. (See 5.3.2 Using Display Properties.)
2. To save display to a bitmap, press the Save button on the Strip Chart Toolbar.
3. Zoom in or out by using the Zoom X or Zoom Y buttons on the Strip Chart Toolbar. Select x or y in the toolbar, move the cursor over a display, and then right or left mouse click to adjust.
4. All of the Strip Chart Plots in one Strip Chart Data Display can be paused by pressing the hand icon in the Display Toolbar.

To pause the Strip Chart, press the hand icon in the Display Toolbar. While the Strip Chart is paused, a vertical cursor appears under the mouse and the X and Y values of the cursor are displayed below the Strip Chart. In the image below, the cursor is red, the Y value is 32, and the X value is 1 minute, 5 seconds, 508 mS, and 249 uS.

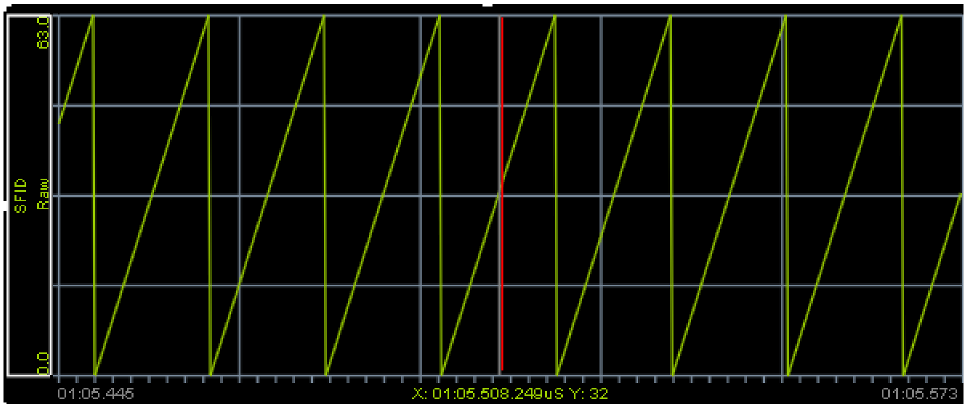


Figure 124 – Strip Chart Cursor

Clicking the left mouse button places a yellow cursor fixed at the click location and creates a second cursor. The display at the bottom of the Strip Chart shows the values for the second cursor. Click the left mouse button locks the second cursor and sets the display at the bottom of the Strip Chart to the delta between the two cursors.

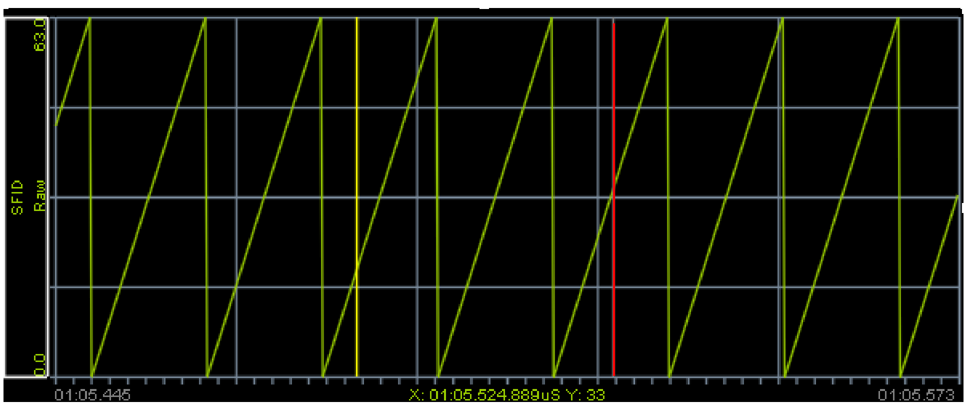


Figure 125 – Strip Chart Second Cursor

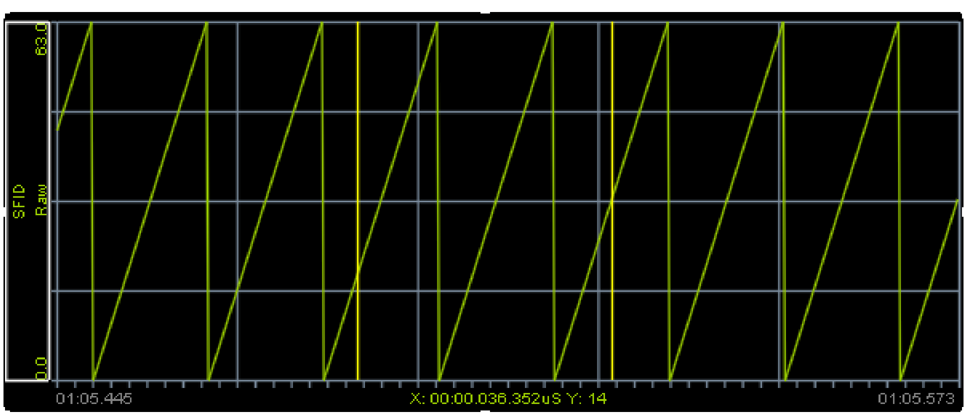


Figure 126 – Strip Chart Delta Cursor

5.6.1.13 Using the Scope/FFT Data Display

The Scope/FFT data display works similar to a digital oscilloscope. Continuous data is captured and once enough data is acquired to meet the horizontal control setting, the screen is refreshed. Each Scope/FFT Data Display can show up to four channels.

The XY plots in the Scope/FFT Data Display are configured in the Display Properties menu. There are three different Display Property pages for each XY plot.

To display the Decom Parameter Scope/FFT Chart Display Properties menu left click on the vertical Decom Parameter name on the left side of the plot. This Display Property menu has selections for the color for the data in the plot, the Y-axis minimum, or the Y-axis maximum.

To display the Scope/FFT Plot Display Properties menu left click inside the plot area. This Display Property menu has selections for changing the X-axis grid spacing, the Y-axis grid spacing, the color of the grid lines, or the time span of the Scope/FFT Plot.

To display the Scope/FFT Data Display Properties left click the X-axis in any of the Scope/FFT Plots. This Display Properties menu has selections for changing the background color of the Scope/FFT Data Display and the Scope/FFT Data Display Name.

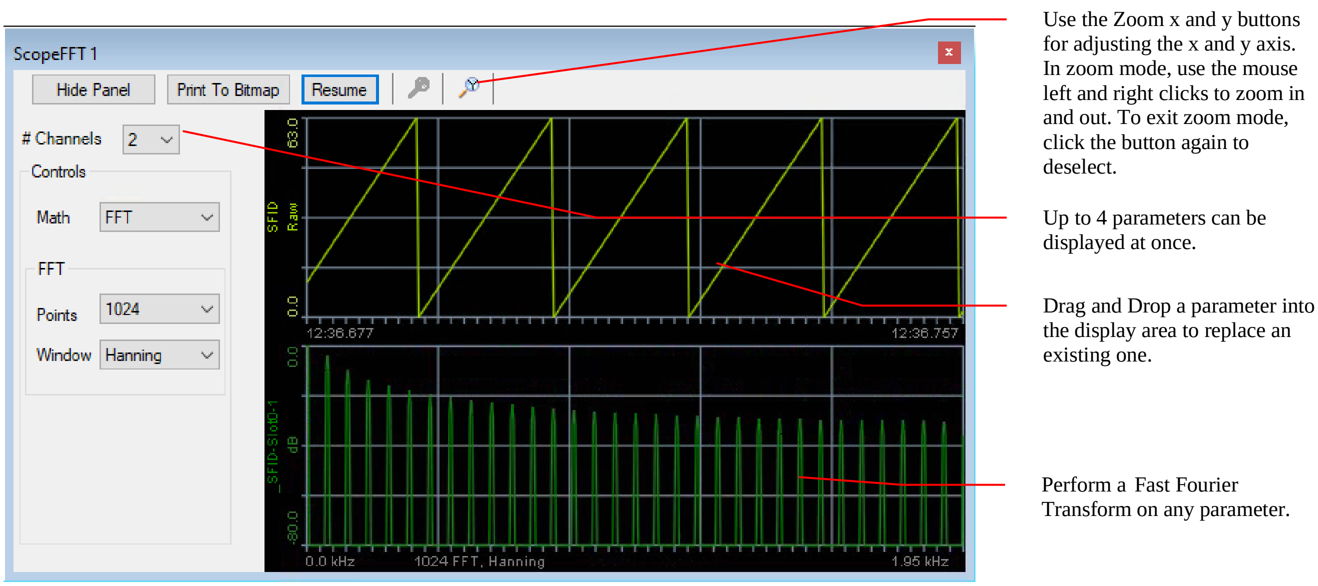
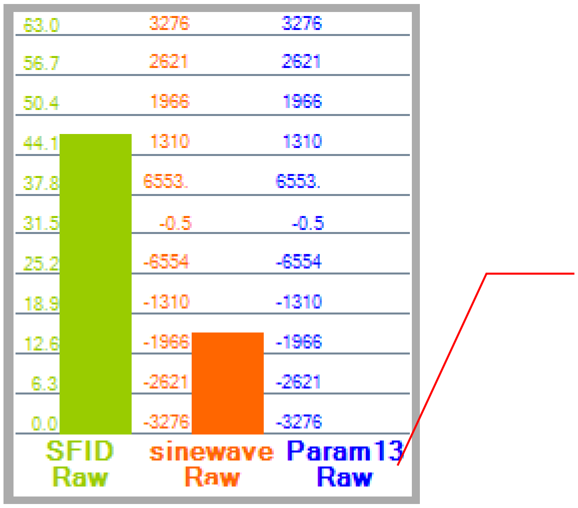


Figure 127 – Scope/FFT Data Display

1. Select the number of channels to display – up to 4.
2. Drag and Drop a parameter into one of the scope charts. To select a chart, move the cursor on top the display and left mouse click.
3. Select FFT or Off for the math operation.

4. If using an FFT Plot, then set the Points and Window settings for the selected chart.
5. Use Print To Bitmap to save and store a display to a .bmp file on your computer.

5.6.1.14 Using the Bar Graph Display



To delete a parameter, select the parameter name with mouse and then hit delete, or, right mouse click to edit properties.

Figure 128 – Bar Graph Data Display

1. All settings on the bar graph display are done through the properties window. (See 5.3.2 Using Display Properties.)
2. To delete parameter, select parameter name with mouse and hit delete. To delete the entire display, select the display and hit delete.
3. To edit properties, select parameter name with mouse and right click.

5.6.1.15 Using the 3D Model Data Display

The 3D Model Data Display in ALTAIR simulates real world objects. Several models are provided with the ALTAIR software and new models can be added by copying the model files to the ALTAIR installed software directory. The only type of 3D models supported by the ALTAIR software is the Microsoft X File format. Many third-party tools exist to convert models of other types into the X format.

To adjust 3D model properties, follow the procedure below:

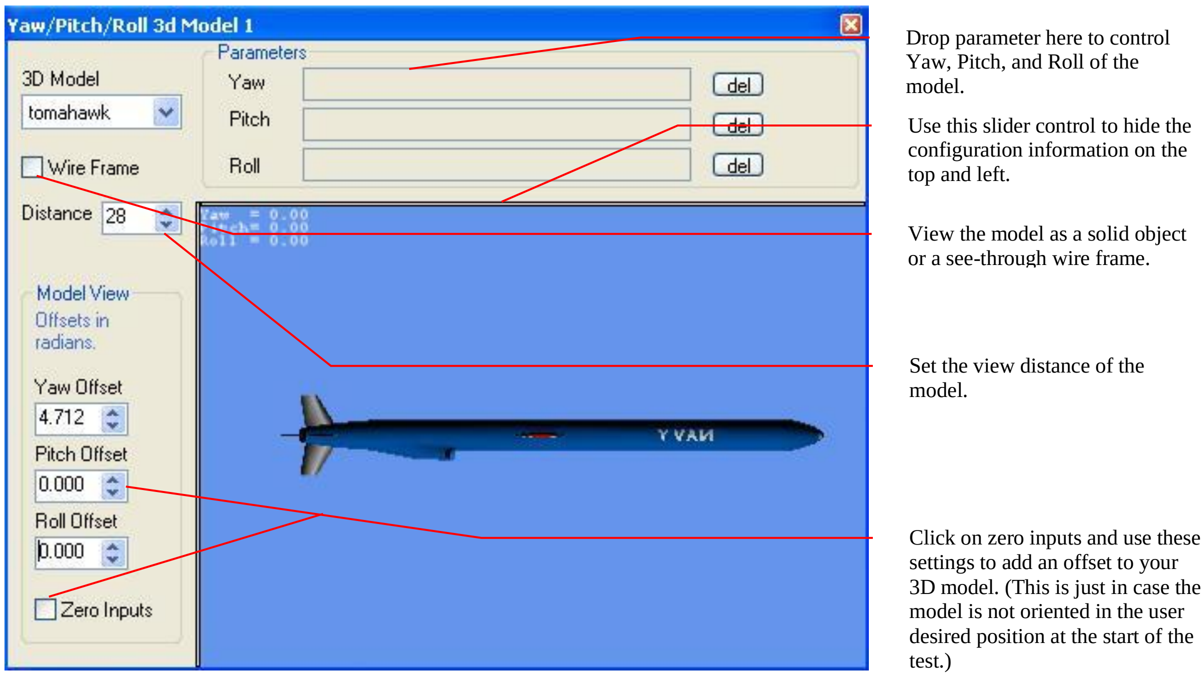


Figure 129 – 3D Model Data Display

1. Select a 3D Model to display.
2. If a solid model is desired, un-check the Wire Frame check box.
3. Set the Distance for the view of the model. (This setting does not have any real-world units so only adjust it as needed.)
4. Use Zero Inputs to verify the zero position is correct. If not, use the Yaw Offset, Pitch Offset, and Roll Offset to adjust the model. Clear the zero inputs option when complete with offset.
5. Drag and Drop parameters in the Yaw, Pitch, or Roll fields for the model to become animated.

5.6.2 Using Time Displays

5.6.2.1 Time Display

1. On the ALTAIR main screen, select Time in the Hardware Explorer or from the Main Menu select ***Time\Displays\Digital Decom Time Display*** or ***IRIG Time Display***. Both Time displays can also be selected by clicking on the Time Displays button in the Time Toolbar.

Figure 130 – Time Display

2. **Digital Decom Time Display** – This selection reads the time from the header of a data packet sent from the Tarsus3 hardware. This header includes time for either **Computer** or the **IRIG Time Code Reader**. (See 4.7 Configuring Time.)
3. **IRIG Time Code Reader Display** – Use to directly output the time read from the IRIG Time Code Source input on the CH2 IN TIME IN or CH3 TIME IN BNC. This display uses the same display format as the Decom Digital Time Display shown above.

5.6.2.2 Embedded Time Display

1. To use an Embedded Time Display, a time parameter must be defined, loaded into a Meter display window, and then set the Meter Type property field to Embedded Time. Set the Meter Type property to Embedded Time. (See Figure 131 – Embedded Time Setting in Meter Type property below.)

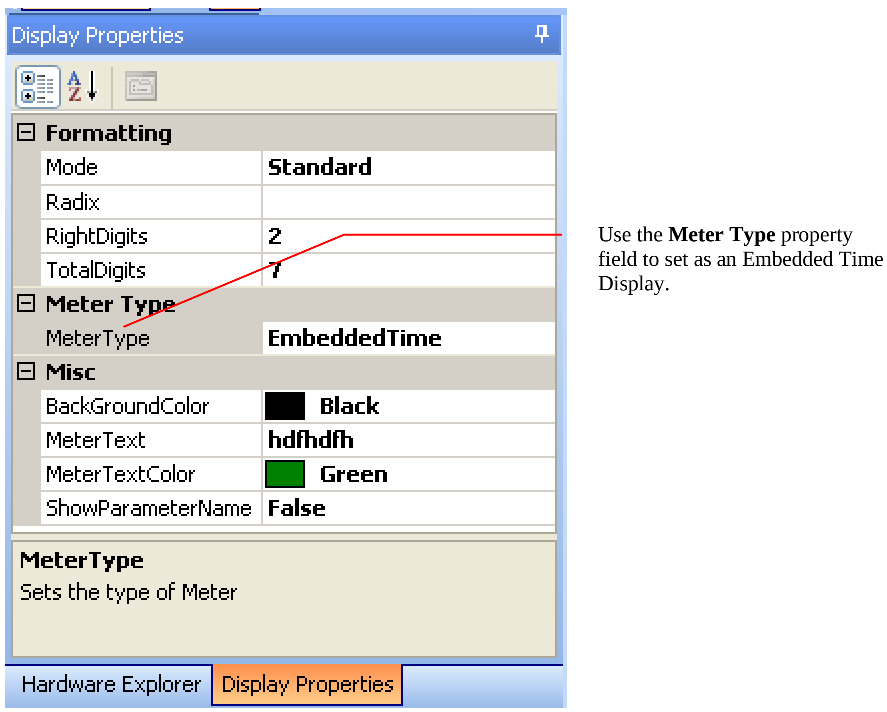


Figure 131 – Embedded Time Setting in Meter Type property

2. Create an embedded time parameter by defining the bits in the Bit Mapping Table of the Parameter Edit/Add form. For each set of bits in the table, set the Data Type to Binary Code Decimal (BCD).

3. Set the Data Type Field to **Embedded Time**. The Embedded Time Setup button will appear as shown below. (See Figure 132 – Embedded Time Parameter below.)

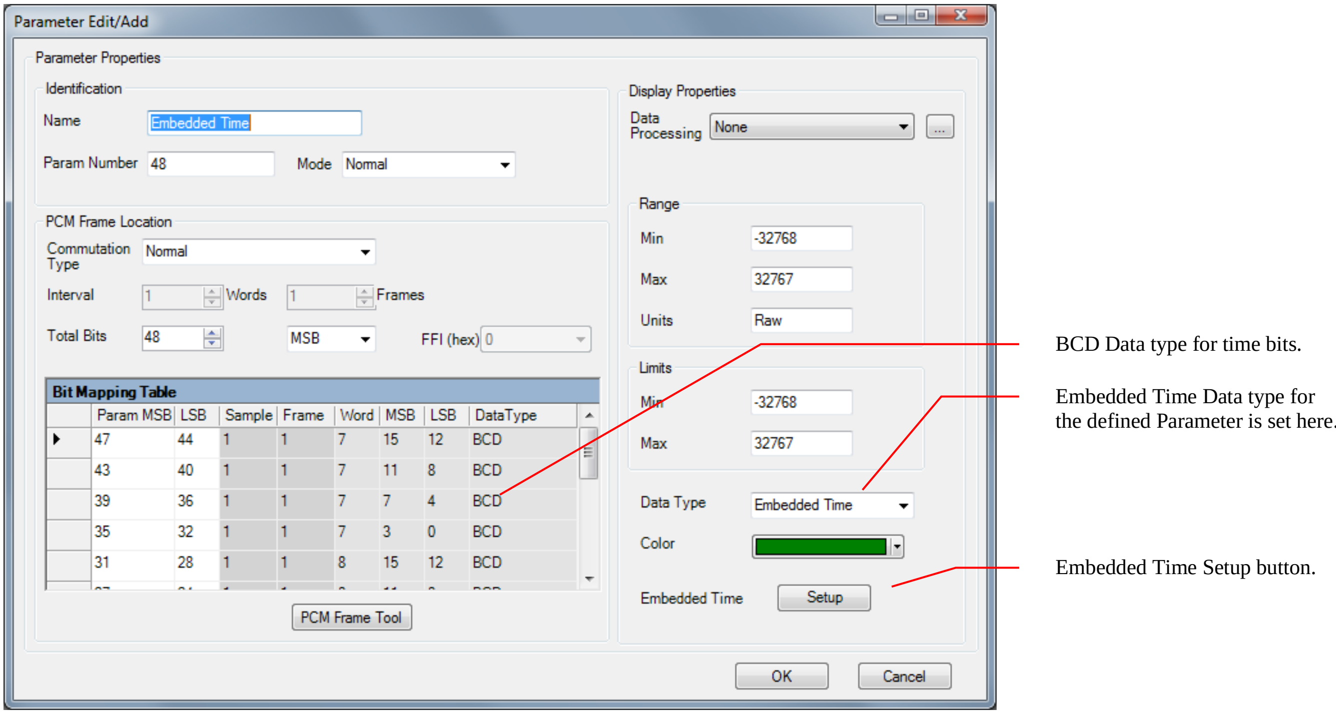


Figure 132 – Embedded Time Parameter

4. Open the embedded time word setup screen by clicking the **Setup** button. The embedded time words setup form will be displayed. (See Figure 133 – Embedded Time Word Setup.)

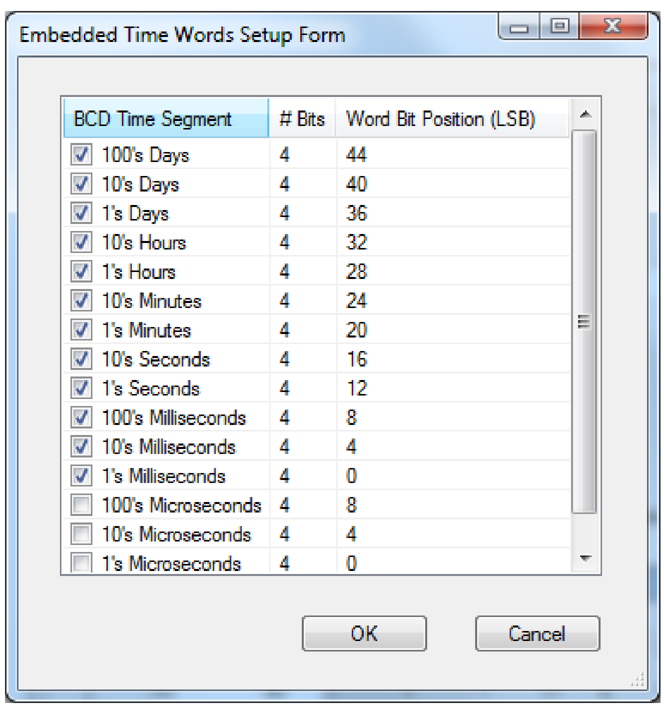


Figure 133 – Embedded Time Word Setup

a. Enable or disable each BCD time segment to be used. Since IRIG defined time words only include 2-bits of Days information, the Days portion of the time can be omitted by deselecting the Days BCD segment. Any segments, other than Days, that are not selected will result in zero for those segments. The # Bits column is a read only field and useful in determining the number of bits needed for each BCD time segment.
b. Select the number of bits for each time segment by clicking on the drop-down selection box.
a. Select the word bit position of the Parameter by selecting the time segment and clicking the drop-down selection box. The bit position corresponds to the location in the parameter where the least significant bit (LSB) of the time segment is located.

5.6.3 Using Display Pages

Display pages provide a method of grouping data displays, saving them, and quickly recalling them. All display properties and parameters are saved and recalled in the display pages. This feature provides a method for quickly viewing a group of parameters and then quickly switching to another group during a test. The number of display pages is virtually unlimited and each page can be named for easy identification. Saving a configuration file will store the name of the last viewed display page and will be automatically reloaded when opening the configuration file.

5.6.3.1 Saving Display Pages

1. After creating a display page by opening data displays, setting properties, and loading parameters, save the display page by selecting the ***Displays\Save Display Page*** menu option. The display page "save as" screen will be displayed. (See Figure 134 – Display Page Save As.)

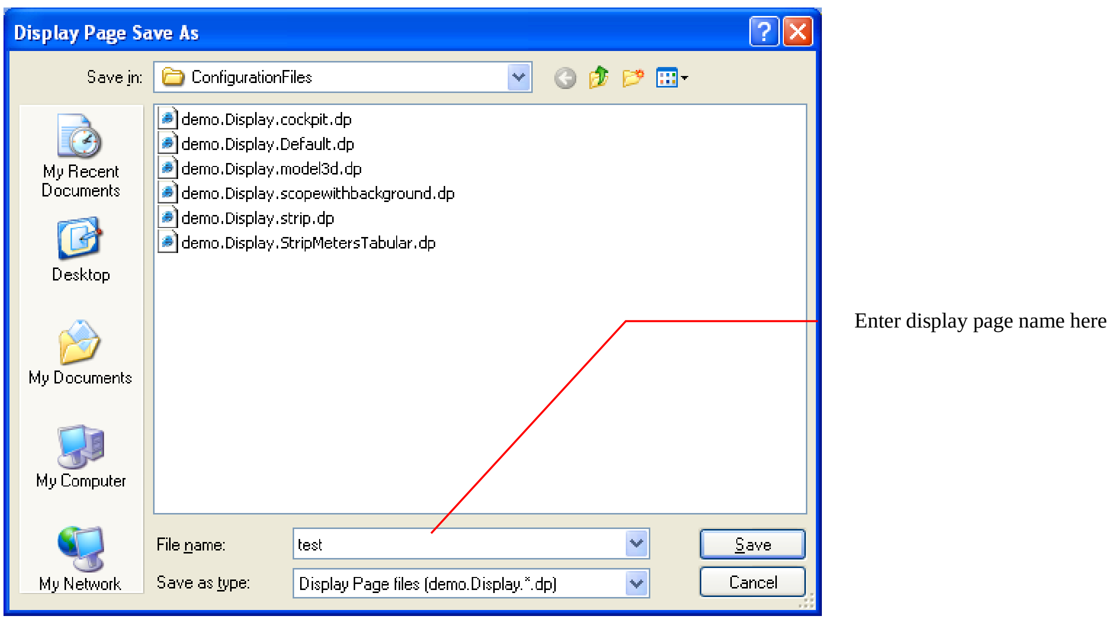


Figure 134 – Display Page Save As

2. Display pages are named as follows:
    a. (**Current Configuration File Name**).Display.**(Display Page Name**).dp.
3. When entering a display page name, you only need to enter your (**Display Page Name**) in the file name section shown above. The remaining portion of the name will be automatically added. For example, to save a display page called **Test1,** just enter "Test1" in the File Name entry box.
4. To save over an existing display page, select the file and click **Save**.

5.6.3.2 Opening Display Pages

The most convenient way to open a Display Page is to select the display page from the Configuration Tool Bar – drop-down box, or by selecting the ***Display\Open Display Page*** from the main menu.

5.6.3.3 Working with Display Page Backgrounds

Custom background images such as a cockpit can be added to the background of a display page to give users a vision of the unit under test. Background image formats that are supported by ALTAIR includes: .BMP, .JPG, .PNG, and .GIF files.

1. To add a background image to a display page, select from the main menu ***Display\Set Background Image***.

2. To remove a background image, select from the main ***Display\Remove Background Image***.

5.7 Using the Simulator

The simulator has two modes of operation: Simulated Data and Archive Data**.** In Simulated Data mode, a repeatable PCM frame is created using fixed data values or common waveform patterns. The frame is then continually transmitted at a frequency from 1bps to 40 Mbps based on a programmable clock selection. The data is output to the simulator clock and data hardware outputs.

In Archive Data simulator mode, a previously recorded PCM stream can be played back through the simulator, thereby re-creating the exact data used in a prior archive session. The Archive Data mode supports the Ulyssix TAD format, packed binary files, and padded binary files. The Ulyssix TAD format is the default binary data storage format for the ALTAIR software. The TAD format is minor frame aligned data with a 96-bit header attached before each minor frame. Each minor frame is zero padded to fill 32-bit integers. More information about the TAD format is available in the Appendix of this document. The packed binary format is raw binary data with no padding. Each minor frame is directly followed by first bit of the next minor frame. The padded binary format is raw binary data with each minor frame zero padded to a 32-bit integer.

To use Archive Simulator, select a previously recorded archive file and press Start Transfer. During the transfer, the output frame buffer status gauge should be monitored and remain above the underflow area. An underflow condition indicates the bit rate is too high for the capability of the computer platform. When an underflow occurs, either lower the bit rate or obtain a higher performance PC.

NOTE: The archive file selected must be a Frame Sync archive file. A Decom archive file cannot be used due to data packing in the Decom archived data.

CAUTION

When playing an archive file containing a PCM frame with sub-commutated parameters, please note that the second minor frame (the first should always be ignored) and the last minor frame may not be consecutive frames. This causes a temporary loss of lock and data during the wrapping point of the archive data file. To correct this problem, truncate the end of the archive file or insert dummy frames to line up with the second recorded minor frame.

5.8 Using Archive

As stated in the configuration section of this manual, the ALTAIR software provides a method of storing data received from the Ulyssix hardware directly to the computer's hard disk drive and then provides the ability to re-play the data back into the data displays. The ALTAIR software also provides the ability to re-play the data back into the data displays and the ability to export archived data as processed parameter data to a common file format which can be used in third party analysis and graphing software packages. The export format can be the "comma separated value" (CSV) file format which is accepted by Excel, MATLAB, and other popular software applications, or it can be a simple ASCII text file. Using the archive feature requires extensive use of the Archive Toolbar.

5.8.1 Recording

1. To record archive data:
    a. Highlight a Frame Sync in the Hardware Explorer.
    b. Go to the Archive Menu on the main menu and select Archive Setup.
    c. In the Archive Setup window, mark the **Enabled** checkbox and then select a file name and storage location. Click **OK** to accept the changes.
2. Press the **record** button on the Archive Toolbar. Data will immediately begin archiving to disk. A status window will pop-up indicating a recording is in process. This window includes a timer for the recording length and which Ulyssix PCM Cards are recording.
3. To stop recording, press the **Stop** button on the Archive Toolbar.
4. Starting or Stopping an Archive Recording will post an event to the Events Window. An indicator can be found in the status bar at the bottom of the ALTAIR main screen that also shows if the system is "Recording" or in "Live Mode."

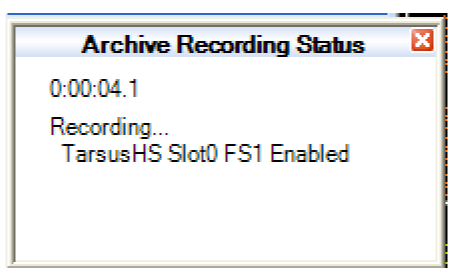


Figure 135 – Archive Recording Status Window

CAUTION The record button on the archive toolbar is disabled when no hardware devices are enabled for archiving.

5.8.2 Analyze Mode

1. Figure 28 – Archive Toolbar). The system will **not** be in Live Mode.

2. The playback file is automatically set to the recording filename when the user presses the record button and then OK. This is the file that is used when the user enters Analyze Mode. Press **Play** to begin playing the data from the file. The user can select a different file for playback once they are in Analyze Mode. To select a file, click the **Files** button on the archive toolbar. (See Figure 136 – Archive Toolbar Files Window.)

3. To select another file, click the **Files** button on the archive toolbar. After the file is selected, press **Play** to begin playing the data from the selected file. While in playback mode, live data from the hardware is ignored by the software. To stop playback, press the **Stop** button.

4. To go back to Live Mode, press the “Live Data” button on the Archive Analyze Tool Bar. (See Figure 29 – Archive Analyze Toolbar.)

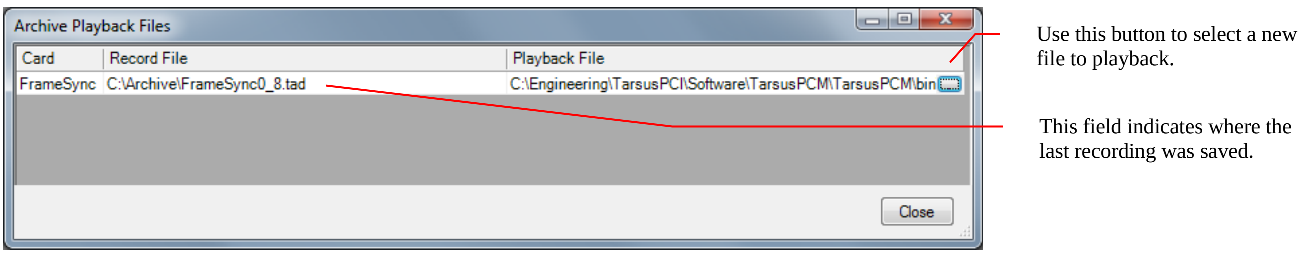


Figure 136 – Archive Toolbar Files Window

5.8.3 Data Export

To export archived data as decommutated parameters, select a Frame Sync in the Hardware Explorer then select Archive from the menu bar and select Data Export from the Archive menu. A series of Archive Export Wizard windows will be presented with 1 of 5 shown below:

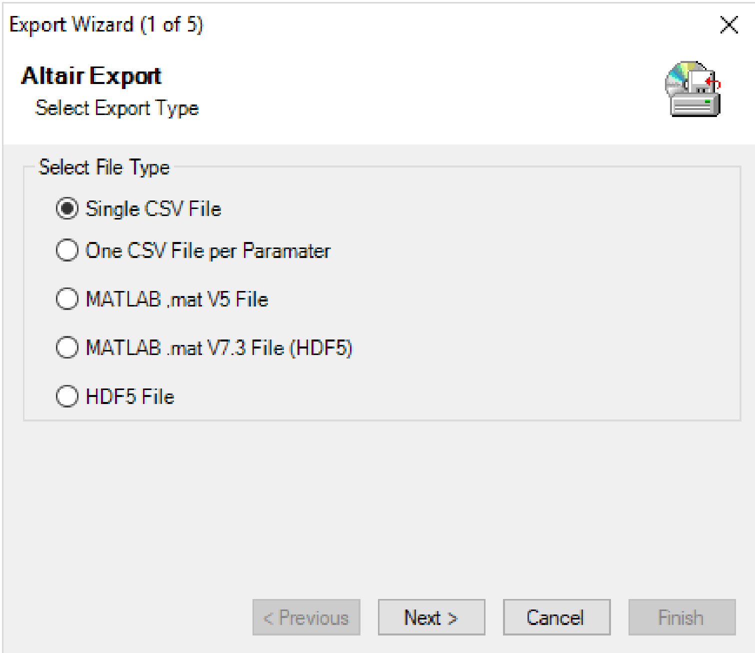


Figure 137 – ALTAIR Export Step 1, Archive Type

1. Select the File Type and press Next to continue:
    a. Single CSV (Comma Separated Values) File – single file with all selected parameters. This file type has multiple options for time tagging the parameter data.
    b. One CSV File per Parameter – creates a CSV file for each selected parameter.
    c. MATLAB .mat V5 File – MATLAB mat file version 5, which has a limit of 4GB per parameter.
    d. MATLAB .mat V7.3 File (HDF5) – MATLAB mat file version 7.3 which uses the HDF5 format with a MATLAB header. There is not a limit for the size of any parameter.
    e. HDF5 file – HDF5 file format for large datasets and interoperability. This file type is similar to the MATLAB version 7.3 file type, except it does not include the MATLAB file header.

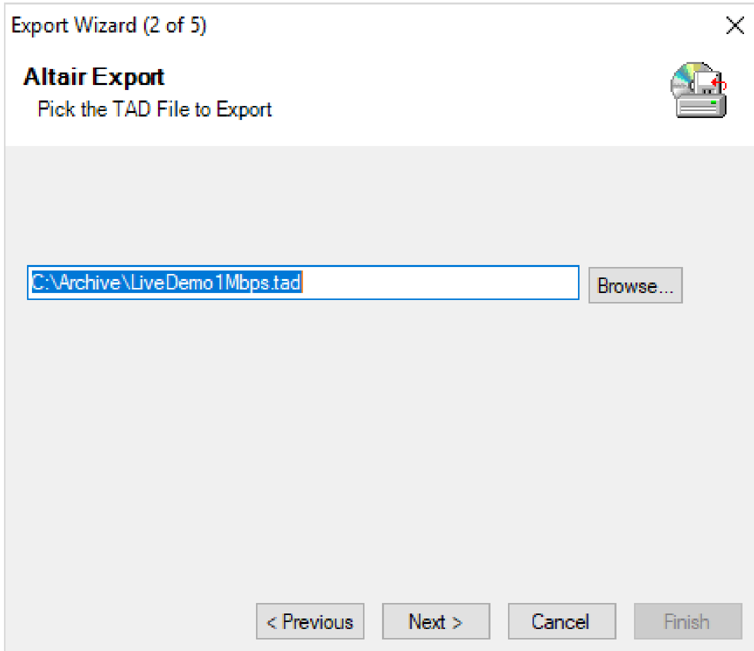


Figure 138 – ALTAIR Export Step 2, Archive File Selection

2. Enter a path and file name or use the Browse button to select an existing archive file to export. When complete, press the next button to go to step 3.

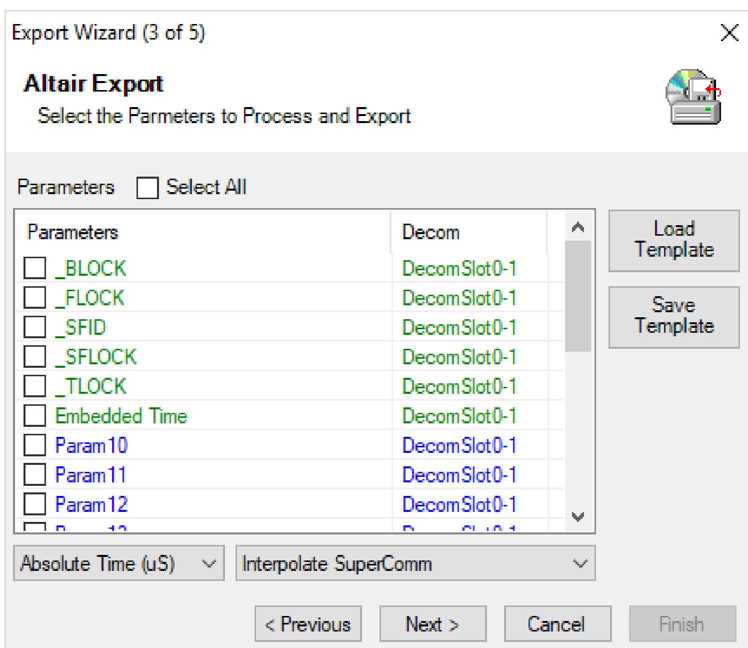


Figure 139 – ALTAIR Export Step 3, Parameters to Export

3. The Parameters to Export window has controls to select parameters, save the selected parameters as a template, and configure time. When done, click Next to continue.

a. There are three ways to select parameters. First, scroll the through the list and check the desired parameters. Second, click the Select All checkbox at the top. Third, use the Load and Save Template buttons on the right side of the window. The Save Template button saves the checked parameters. The Load Template button loads a previously saved template.
b. The Load Template and Save Template buttons allow the user to save the current configuration to an Export Template File (.etf). The etf is a simple text file with the checked parameter names.
c. The first combo box allows the user to select Absolute Time (uS) or Relative Time (uS). Absolute Time counts the number of microseconds into the year (including the 28^{th} day of Feburary for leap years). Relative Time counts microseconds from the beginning of the recording. Selecing Relative Time also allows the user to select a Time Offset. Time Offset is used to set Time 0 to the launch time if the recording is longer than the test event.
d. The second combo box allows the user to select how time is interpolated in the file. Most of these options apply to the Single CSV file type were the parameter names are columns and each time stamp is a row:
    i. Interpolate SuperComm – Time tags Normal and SubComm parameters with the Minor Frame time stamp but interpolates all values of SuperComm parameters.
    ii. No Interpolation – All parameters are time tagged with the Minor Frame Time Stamp. SuperComm parameters have multiple rows per minor frame.
    iii. Interpolate All – Time is interpolated for every parameter. In this configuration, each row only has a value for parameter and the other cells are left blank.
    iv. Interpolate All with Fill – Time is interpolated for every parameter. In this configuration, once a value is assigned for a parameter, then the value is reapeated until its value changes. The only blank cells are at the top the table.
    v. One Row per Minor Frame – Each row is the time stamp for a minor frame. Normal and SubComm parameters have one column. A SuperComm parameter has a column for each entry in the minor frame. If the SuperComm parameter occurs twice per minor frame, then it has two columns and the values are in the order that they occur in the minor frame.

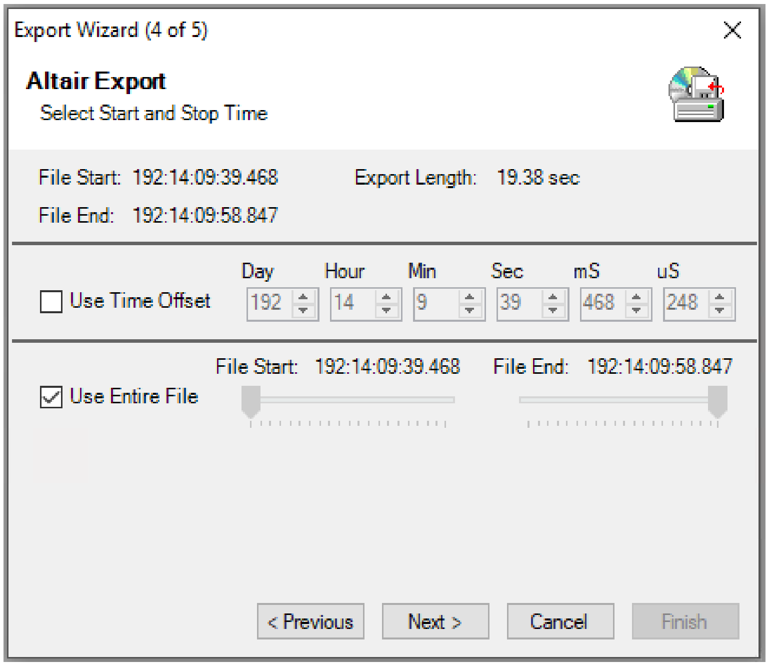


Figure 140 – ALTAIR Export Step 4, Time Selection

4. The Time Selection window allows the user to either select the entire file or select the start and stop time of the export. The start and stop time is displayed in the IRIG Time format of Day of Year: Hour : Minute : Second . Millisecond. If Relative Time was selected in the previous window, then the Use Time Offset option is enabled. The Time Offset option allows the user to set a time for Time Zero. Any time before Time Zero is reported as a negative. This allows the user to set the Time Offset as the launch time and relative time as the time into the test event.

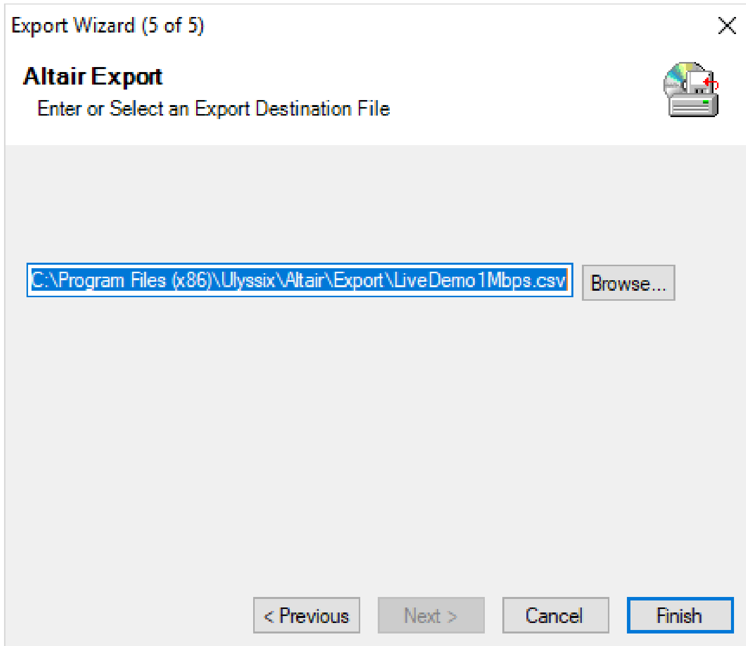


Figure 141 – ALTAIR Export Step 5, Destination File

5. Enter a path and file name or use the Browse button to select a path and file name for the destination of the exported parameter data.
   a. **NOTE:** In the Multiple CSV file type, only the path is selected because the file names are based on the parameter names. Press Finish to start the export process.

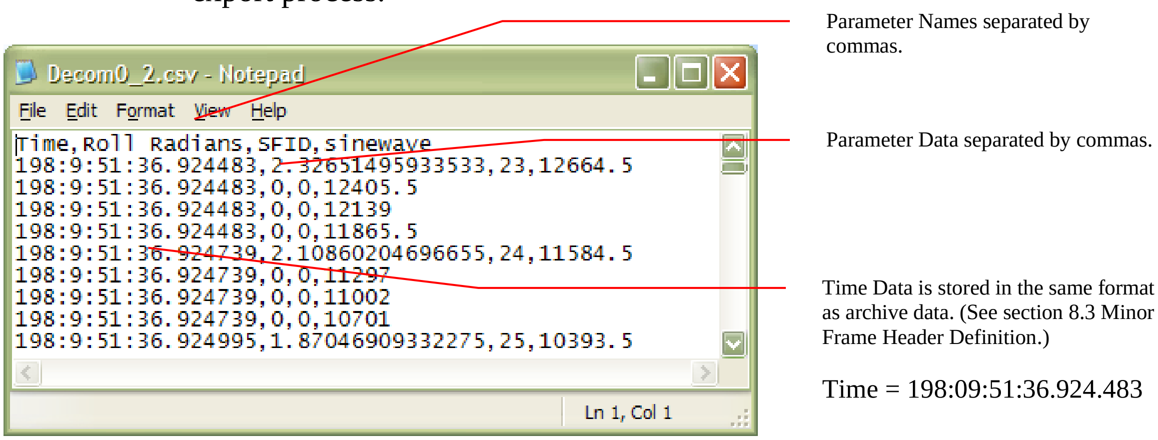


Figure 142 – CSV Export File Example

5.8.4 Data Quality Metric

The Data Quality Metric is a software tool in ALTAIR that analyzes recorded telemetry data files. ALTAIR records telemetry data in the Tarsus Archive Data (TAD) format files. In a TAD File, each minor frame has a 96-bit header that contains a 64-bit header, a 16-bit minor frame counter, and a 16-bit status word. The TAD Minor Frame Header is the data source for the Data Quality Metric.

The Ulyssix Tarsus3 bit synchronizes and frame synchronizes the telemetry stream, tags each minor frame with a TAD Minor Frame Header, and then transfers the data to ALTAIR. For the Data Quality Metric, the Frame Sync is placed in "Data in Search Mode." In this mode, the Ulyssix Tarsus3 card transfers data to the ALTAIR software even when the Frame Sync is in Search. Data in Search Mode sends all of the received bits to the software for Data Quality Metric Analysis.

The Data Quality Metric takes one or more TAD files as input. It reads the data in each TAD file, analyzes its Frame Lock Status and SubFrame Locks status, and outputs a time collated Data Quality Metric CSV file. The first column in the Data Quality Metric CSV file is time and each of the TAD files has a column for Frame Lock Status and SubFrame Lock Status. The Data Quality Metric also creates a. PNG file for Frame Lock Status and SubFrame Lock Status for each TAD file. These .PNG files are plots of the status versus time where Lock is a 2, Check is a 1, and Search is a 0. These .PNG files create a quick look at the Data Quality Metric. For a more detailed analysis, the data from the CSV file is pasted into an Excel template.

In ALTAIR, select a Frame Sync in the Hardware Explore. ALTAIR enables the Archive menu when a Frame Sync is selected; it does not matter which Frame Sync that you select. In the menu bar at the top of the ALTAIR screen, select Archive and in the menu list click on "Data Quality Metric" to launch the Data Quality Metric window.

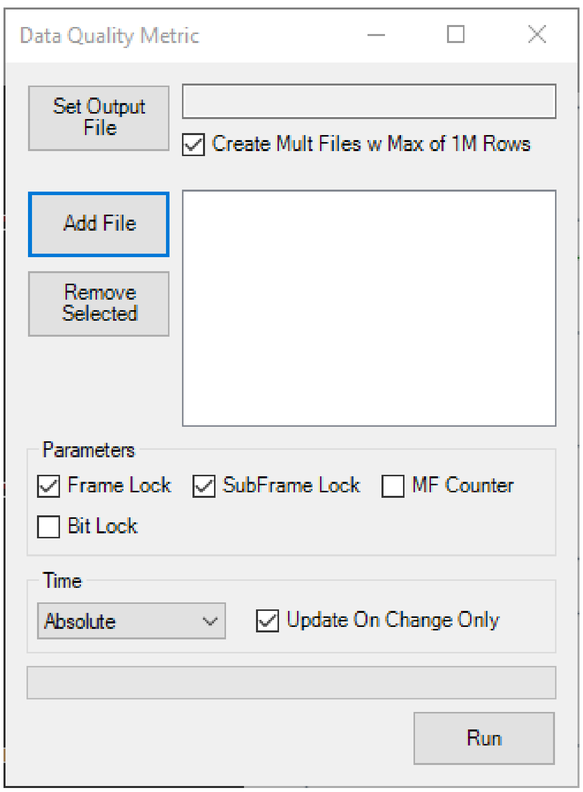


Figure 143 – Data Quality Metric Window

In the Data Quality Metric window, do the following:

1. Click the “Set Output File” button. This launches a Save File Dialog window where you select the file name and location for the output CSV file.
2. Click the “Add File” button to add a TAD file to the Data Quality Metric. The file names are displayed in the Listbox to the right of the “Add File” button. To add additional files, click the “Add File” button and select the desired files. To remove a file, selected it in the Listbox and click the “Remove Selected” button.
3. Select the Parameters for the Data Quality Metric analysis. The default selections are Frame Lock and SubFrame Lock. The default selections are sufficient for most applications.
4. Configure Time Type for the Data Quality Metric CSV file using the combobox. The options are Absolute and Relative. Absolute time uses the IRIG Standard Day of Year, Hour, Minute, Second, Millisecond, and Microsecond. Relative time sets the first data in the mission at T0 and counts up from there. The default setting is Absolute time.
5. Leave the “Update On Change Only” checkbox checked. This feature only updates the CSV file when the Lock Status of one or more elements changes. The “Update On Change” features is required for using the Data Quality Metric CSV in the Excel template.
6. Click the “Run” button to execute the Data Quality Metric on the selected TAD files. The progress bar at the bottom of the Data Quality Metric window denotes the progress of building the CSV file. A pop-up will notify you when the process is complete.

The Data Quality Metric outputs three kinds of files: The Data Quality Metric CSV file, Data Quality Metric Summary CSV file, and the PNG images. These files are stored to the file location selected in the Data Quality Metric window. In the image below, there is an example of a Windows Explorer with the Data Quality Metric Output files.

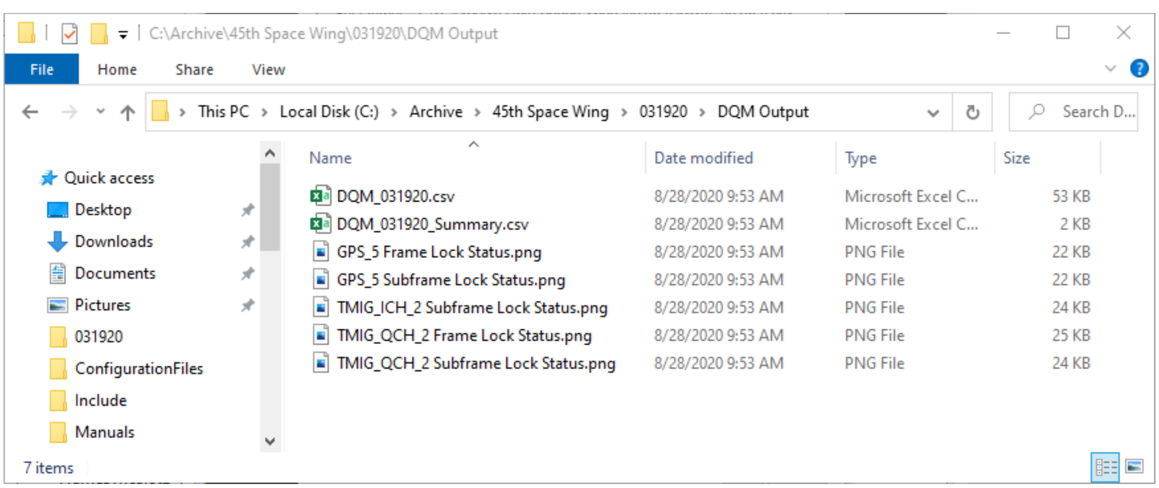


Figure 144 – Data Quality Metric Output Files

In the image above, the Data Quality Metric CSV file is named DQM_031920.csv. The file has three columns for time and then a column for Frame Lock Status and SubFrame Lock Status for each TAD file. The first column is the IRIG Time as a string. The format is "Day : Hour : Minute : Second . Millisecond Microsecond." This is the most accurate time stamp but it is not friendly with Excel Plots. The second column is Microseconds. This column is the number of microseconds since midnight on January 1st. This time is friendly with Excel Plots, but is not easy to understand. The third column is Time in the Excel format that is both easy to read and friendly with Excel Plots. This time format is HH:MM:SS.mS. This is the column that Excel Template uses. The next six columns are Lock Status. The first part of the column name is the name of the TAD file. The second part of the column name is the Lock Status name. FLOCK is Frame Lock. SFLOCK is SubFrame Lock.

In the example Windows File Explorer above, the Data Quality Metric Summary CSV file is named "DQM_031920_Summary.csv." This file has statistical summaries of each Lock Status for each TAD file. The Summary CSV is used for debugging issues with the data. There are four types of statistics: Time in Seconds for each Lock State. Time Percent in each Lock State. Minor Frame Counts in each Lock State. And Minor Frame Percent in each Lock States. There is one instance of each statistic for Frame Lock Status and for SubFrame Lock Status.

	A	B	C	D	E	F
1			Frame Sync Status Time in Seconds			
2	Source	FLOCK LockTime(s)	FLOCK SearchTime(s)	FLOCK CheckTime(s)	FLOCK TotalTime(s)	
3	TMIG_ICH_2	164.92	0.23	2.178	167.328	
4	TMIG_QCH_2	164.935	0.169	2.226	167.33	
5	GPS_5	167.201	0	0	167.201	
6						
7			Frame Sync Status Time Percent			
8	Source	FLOCK LockTime%	FLOCK SearchTime%	FLOCK CheckTime%		
9	TMIG_ICH_2	98.56	0.14	1.3		
10	TMIG_QCH_2	98.57	0.1	1.33		
11	GPS_5	100	0	0		
12						
13			Frame Sync Status Minor Frame Counts			
14	Source	FLOCK Lock	FLOCK Search	FLOCK Check	FLOCK Total	
15	TMIG_ICH_2	65966	92	830	66888	
16	TMIG_QCH_2	128841	132	940	129913	
17	GPS_5	1672	0	0	1672	
18						
19			Frame Sync Status Minor Frame Percent			
20	Source	FLOCK Lock%	FLOCK Search%	FLOCK Check%		
21	TMIG_ICH_2	98.62	0.14	1.24		
22	TMIG_QCH_2	99.17	0.1	0.72		
23	GPS_5	100	0	0		
24						

Figure 145 – Data Quality Metric Summary CSV File

The Data Quality Metric creates a PNG image file of each Lock Status for each TAD file. The PNG image is the Lock Status plotted against the time axis. The file name is combination of the TAD file name and the Lock Status. Lock is a value of 2. Check is a value of 1. And Search is a value of 0. The example is below is for the

TMIG_QCH_2.tad file for the Frame Lock Status. The file name is TMIQ_QCH_2 Frame Lock Status.png.

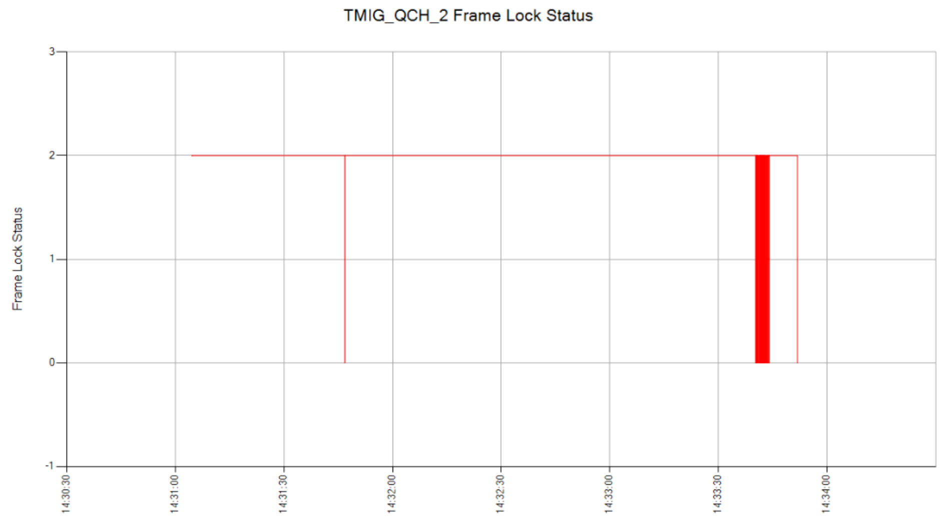


Figure 146 – Data Quality Metric Frame Lock Status PNG File

5.9 UDP Receiver

The UDP Receiver feature allows the ALTAIR software to receive time stamped minor frames in TAD format (see Appendix B – Archive Data Files Explained for details) via UDP and then decommutate and display the data. The UDP Receive feature works in ALTAIR even if the software is running on a computer without a Ulyssix card installed. This feature allows a computer with a Ulyssix PCM card to acquire the telemetry stream and then broadcast the TAD data in UDP packets over the network. Then multiple computers on the network can receive, decommutate, and display the data. Broadcasting TAD UDP data is licensed feature in both the ALTAIR and DEWESoft software packages.

5.9.1 Configuring ALTAIR to use the UDP Receiver

Configuring ALTAIR to use the UDP Receiver is simple. Load the desired ALTAIR XML file to configure the software. This ALTAIR XML needs to have the Frame Sync configured the same as the computer that is broadcasting the UDP data. The ALTAIR XML file can also have the Decom and displays pre-configured.

5.9.2 UDP Receiver GUI

The UDP Receiver GUI is accessed by selecting a Frame Sync in the Hardware Explorer and then selecting UDP Receiver from the Archive menu. If the Ulyssix PCM selected in the Hardware Explorer has multiple Frame Syncs, then the UDP Receiver Setup window will have a tab for each Frame Sync.

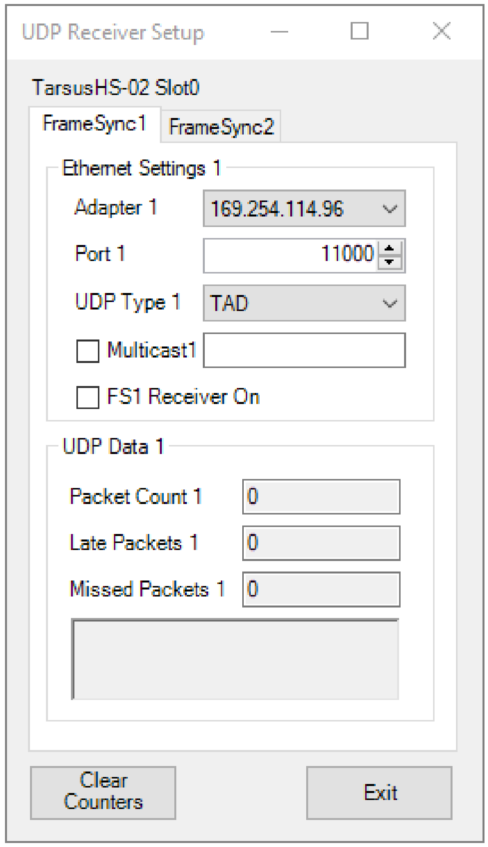


Figure 147 – UDP Receiver

1. Enable UDP Data Source – this check box enables the UDP Data Source for the selected Frame Sync. If the computer has a Ulyssix PCM card, this disconnects data from the Ulyssix PCM card and connects the data path to the UDP Receiver.
2. IP Address - This is combo box that is populated with the IP Addresses of every internet connection on the computer. Use the combo box to select the desired internet connection for the UDP Receiver.
3. Port – This sets the port address for the UDP Receiver on the IP Address. The default value is 11002. The allowed range is 1024 to 65535. Please note that many of these port numbers have default usages.
4. UDP Type – This combo box selects the type of UDP data packets for the UDP Receiver. The default is TAD. There is a licensed option to receiver Chapter 10 UDP packets.
5. Multicast – The checkbox enables subscribing to a UDP Multicast on the IP Address in the textbox.
6. FS Receiver On – This checkbox turns the UDP Receiver on and off.

5.9.3 Using ALTAIR with the UDP Receiver

Once the UDP Receiver is configured and started, data will flow through the ALTAIR software. All of the normal ALTAIR features are available, including displays and archiving. Please contact Ulyssix with any questions.

5.10 Generating Reports

The ALTAIR software stores configuration information in an XML based file. This file can be easily viewed using Microsoft Internet Explorer or other third-party XML viewers.

5.10.1 Printing Screens

The ALTAIR software provides the ability to print graphical screen images of the data display screens.

1. On the ALTAIR main screen, select the menu option ***File\Print*** or ***File\Print Preview***. The print selection screen will be displayed. (See Figure 148 – Print Type Selection Form below.)

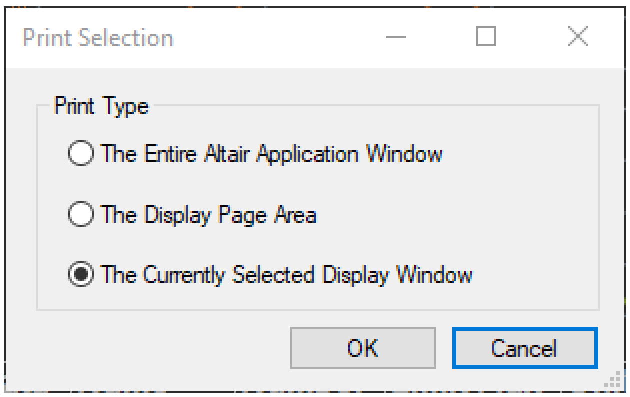


Figure 148 – Print Type Selection Form

2. Select one of the following options:
   - **The Entire ALTAIR Application Window** – Prints the entire Tarsus application window, including all toolbars, menus, and status windows.
   - **The Display Page Area** – Prints the display page area, including the background image.
   - **The Currently Selected Display Window** – Prints the currently selected data display window that resides within the display page area.
3. Simply select the type of print screen and click **ok**.
4. The standard windows print form will then appear.

5.11 Tools Menu

The Tools menu holds a collection of utilities in the ALTAIR software suite. The tools include default tools as well as Licensed Options (for more information see Chapter 6 Licensed Options).

5.11.1 Card Info

Information about each Ulyssix card installed in the computer is available by selecting a card in the Hardware Explorer, clicking on the ***Tools*** menu, and then selecting ***Card Info***. The Card Info window contains Product ID, Production Year, Production Month, Production Day, Board Number, Model, DAC Revision, Serial Number, the version numbers for the FPGAs, and the FPGA Identity. At the bottom of the Card Info window is a list of the Optional Licensed Features on the Ulyssix Card.

All the information in the Card Info window can be copied by right clicking an item of text and selecting "Copy" from the popup menu. This information can be pasted into Excel using the delimiter as "Tab."

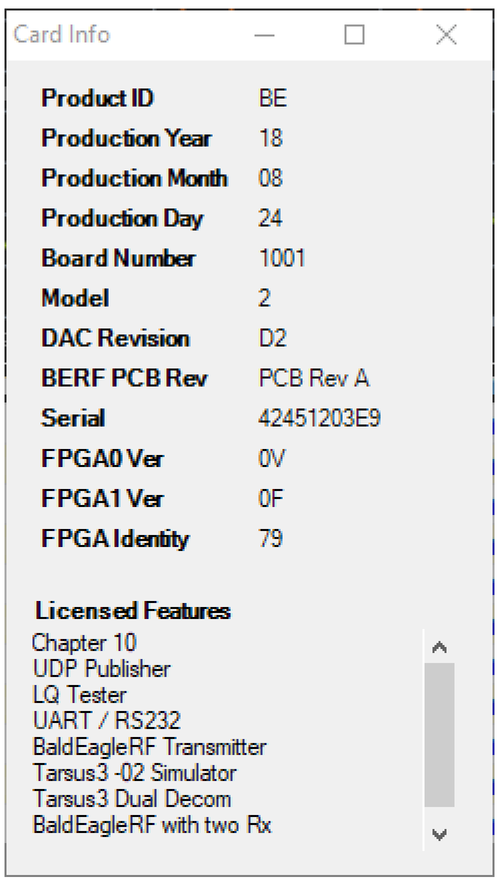


Figure 149 – Card Info

5.11.2 Diagnostic

The Diagnostic feature saves a file to help Ulyssix in debugging hardware issues. To save a Diagnostic file, select a TarsusHS, Tarsus3, or Bald Eagle RF card in the Hardware Explorer, click ***Tools*** in the menu bar, and then select ***Save Diagnostic***.

The Save Diagnostic window has a text box where the user can enter any comments about their configuration or issues. Clicking the Save Diagnostic button will launch a Windows Save File dialog box. Enter a file name and select a directory for saving the file. The file extension should be .TDD (Tarsus Diagnostic Data). Click the Save button. When the file save is complete, please email the file to Ulyssix.

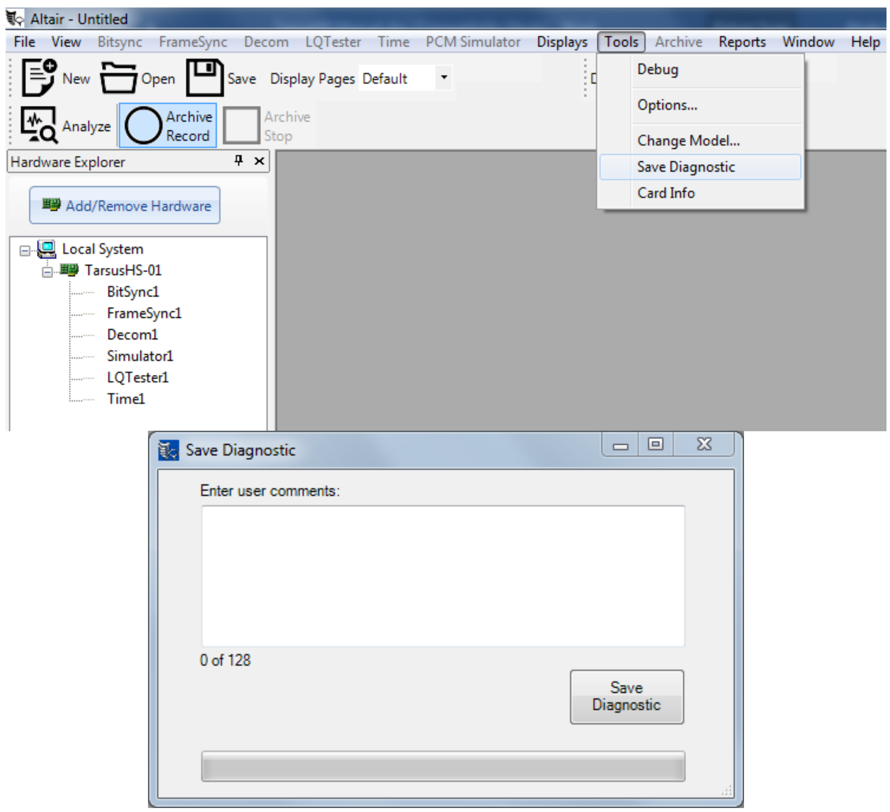


Figure 150 – Save Diagnostic File

5.11.3 Flash Storage

The Tarsus3 and Bald Eagle RF cards have an optional Flash Storage capability. If desired, the Flash Storage can be hardware disabled at factory. The Flash Storage is an on-card memory used to record frame synchronized data. The data is stored in the Tarsus Archive Data minor frame format (see Appendix B – Archive Data Files Explained for more information).

The Flash Storage window is accessed by selecting a Tarsus3 or Bald Eagle RF card in the Hardware Explorer, clicking ***Tools*** in the menu bar, and then selecting ***Data Flash Storage***.

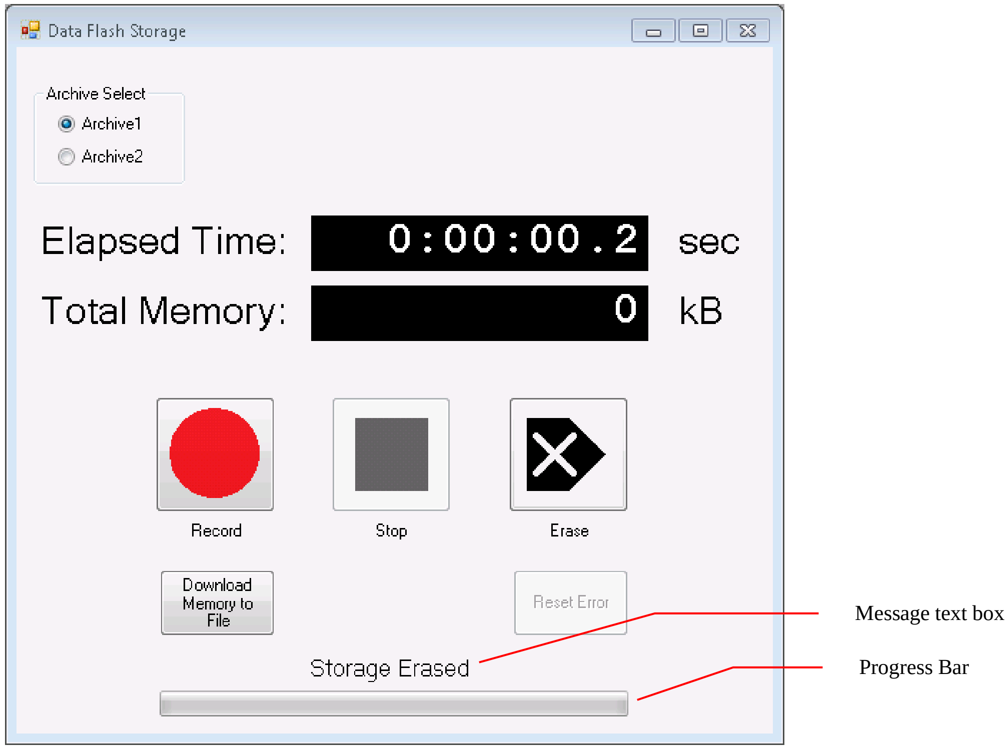


Figure 151 – Flash Storage

The Flash Storage window has multiple controls and displays.

- Archive Select is enabled for a dual decom Tarsus3 or Bald Eagle RF card. When Archive 1 is selected, data from Frame Sync 1 is recorded in the flash. When Archive 2 is selected, data from Frame Sync 2 is recorded in the flash.
- The Elapsed Time display shows the time of the current operation. While recording, it displays the record time. When erasing, it displays the elapsed time of the erase operation. When downloading data to a file, it displays the elapsed time of the download.
- The Total Memory display shows the amount of memory, in kilobytes, used in the flash.
- The Record button starts recording data from the selected frame sync to the flash. The Record button is disabled during Erase and Download processes.
- The Stop button stops the recording process. The Stop button is only enabled when the Flash Storage is recording.
- The Erase button clears the flash memory. This will erase all data from the flash.
- The Download Memory to Flash button transfers the data stored in the flash to a TAD file stored on the computer hard drive.

- The Message text box is above the Progress Bar. It displays the current status of the Flash Storage. Example messages are: Recording, Erase in Progress, Saving TAD File, and TAD File Saved.
- The Progress Bar displays a green scrolling bar the Flash Storage is active. The Progress Bar is gray when the Flash Storage is idle.

5.12 RBF Programming

The Tarsus3 and Bald Eagle RF products are based on the latest advances in Altera FPGA technology and the latest data acquisition integrated circuits which create a very versatile telemetry processor card. The board can perform unique data acquisition and telemetry processing functions, including dual full digitally implemented Bit Syncs, PCM Decoms, multi-channel clock data recovery (CDR) modules, SGLS modulator/demodulator, and many other data acquisition applications. The basis for the card is two 14-bit analog to digital paths into over 3 million gates of user configurable space. The configurable space is made up of Altera high-density FPGAs. The FPGA circuitry can be modified in the field by using the FlashBurn™ utility.

Appendix F – FlashBurn™ Utility describes how to use FlashBurn™, a proprietary stand-alone utility to program the FPGA circuitry.

References

[1] Telemetry Standards, IRIG STANDARD 106-17, Secretariat, Range Commanders Council, White Sands Missile Range, Mew Mexico. **http://jcs.mil/RCC**

Chapter 6 Licensed Options

Ulyssix Technologies Inc. provides optional features which can be purchased separately through our sales department. This chapter will provide a brief overview of all our current available options and some detailed information about a select few. The following options listed below are currently available:

- **Viterbi Decoder and Forward Error Correcting Option** – Provides Viterbi decoding on Bit Sync and Forward Error Correcting on the PCM Simulator.

- **Chapter 10 Option –** Receive and transmit Chapter 10 UDP packets as well as record and replay Chapter 10 files. Includes playing PCM data and IRIG Time from a Chapter 10 file out of the PCM Simulator and DAC Output.

- **UDP Publisher Option** – Provides UDP streaming of time tagged frame data and/or decom parameters.

- **Telemetry Over IP (TMOIP)** – Broadcast or receiver IRIG 2018 Telemetry Over IP UDP Packets via Internet Protocol Version 4.

- **LQ Tester Option** – Provides functionality for the latency and quality of a PCM signal.

- **RS232 (UART) Output Option** – Provides the ability to transmit Decom parameter data through 4 RS232 (UART) on-board ports.

- **Real Time Simulator** – Allows the user to change PCM Simulator word values in real time via slider or numeric entry.

- **IRIG Time Output** – Outputs amplitude modulated IRIG-B or NASA 36 time through a BNC connector. Time is set from current computer time, user entered seed time, or from an archive file.

- **CVSD Audio Output Option** – provide audio playback through the computer sound card for uncompressed and CVSD audio embedded in the telemetry stream.

- **Cyclic Redundancy Check Option** – Uses the CRC error detecting code and a check value word in the frame to verify frame data integrity.

- **Best Source Selector Option** – This feature allows the Tarsus3-02 to perform a best source selection between two channels. It selects the best PCM stream based on frame sync and outputs it. (This feature is only available with the Tarsus3-02.)

- **Missed Distance Calculator Option** – Uses Doppler data to calculate distance between two objects.

- **Tarsus3-02 Dual Decom** – Enables two Decoms on a Tarsus3-02 card. This option converts a Tarsus3-02 to two channels of Bit Sync, Frame Sync, and Decom.

- **Bald Eagle RF Transmitter** – Adds one RF transmitter per PCM channel to the Bald Eagle RF. The Transmitter licensed feature includes all of the following bands: C, S, L, Extended P, P, and IF.

6.1 License Management

Ulyssix Technologies, Inc. provides optional features which can be purchased separately through our sales department. A license key will be provided for changing the licensed features on a Ulyssix card. These license keys are entered into the FlashBurn utility (See **Appendix F – FlashBurn™** Utility).

6.2 Viterbi Decoding and Forward Error Correcting Option

6.2.1 Viterbi Decoding in the Bit Sync

The Bit Sync uses a commonly known Viterbi algorithm to decode convolutionally encoded data that has a k/n = ½ rate, constraint length K =7, and G1, G2 generator polynomials 171_8, 133_8 and 3-bit soft decision.

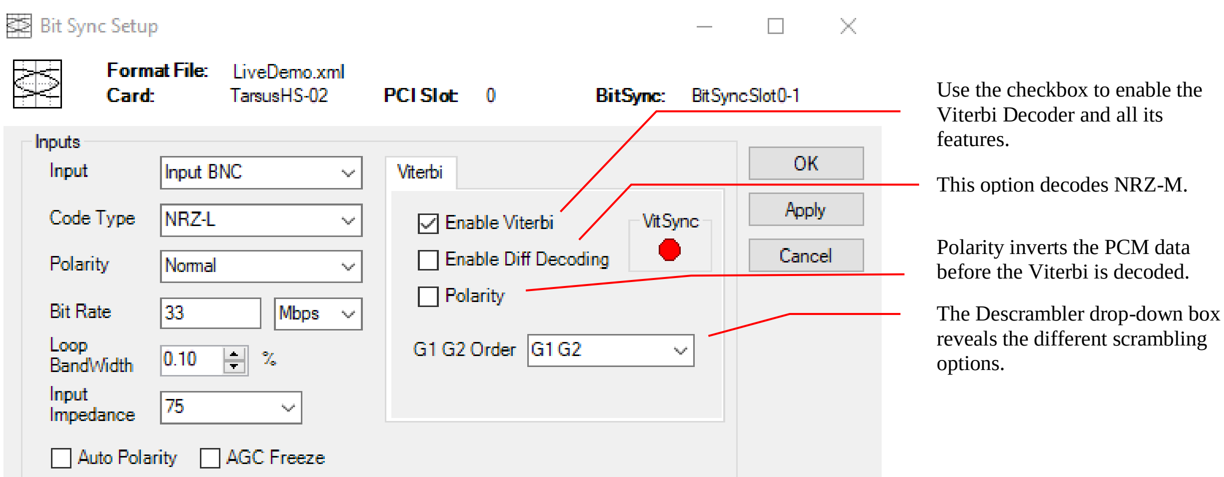


Figure 152 – Bit Sync Setup Window Displaying Viterbi Features

Once the ALTAIR software has detected a valid Viterbi license, an additional tab is made available in the Bit Sync Setup window as shown in Figure 152 – Bit Sync Setup Window Displaying Viterbi Features.

<u>Viterbi Options:</u>

- Enable Viterbi: Turns on the Viterbi Decoder.
- Diff Encoding: On, decodes NRZ-M data.
  Off, decodes NRZ-L data.
- Polarity: Inverts the PCM data before the Viterbi decoder.
- G1G2 Order:
  - i. G1 G2
  - ii. G1 G2Inv
  - iii. G1Inv G2
  - iv. G1Inv G2Inv
  - v. G2 G1
  - vi. G2 G1Inv
  - vii. G2Inv G1
  - viii. G2Inv G1Inv

When Viterbi decoding is enabled, the user must click the Apply button to download the settings to the FPGA. Since this is a rate ½ decoder, data being received by the Bit Sync is actually moving at twice the specified bit rate. The actual Viterbi bit rate is shown at the bottom of the main ALTAIR window. (See Appendix G – FEC and Viterbi Theory for a detailed explanation on FEC and Viterbi decoding.) Users can verify successful Viterbi Decoding by monitoring the Frame Sync indicator. Whenever the decoder is running, the Frame Sync lock indicator will display a green lock light. If the lock light is not green, make sure the box labeled "Enable Viterbi" is checked, and click the Apply button again. If that doesn't resolve the problem, verify the Encoder is running and the received message was encoded to match the design constraints of the Viterbi decoder.

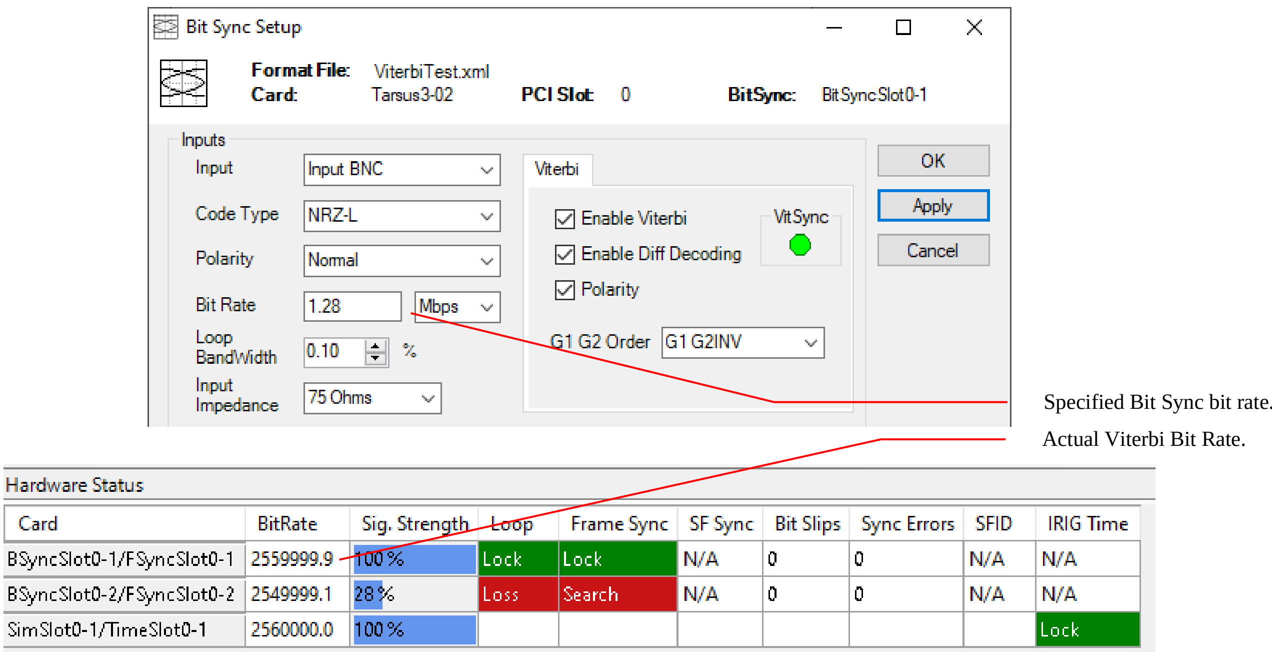


Figure 153 – User Specified Bit Rate and Viterbi Bit Rate

6.2.2 Forward Error Correcting in the PCM Simulator

The Ulyssix Simulator provides Forward Error Correction capabilities by creating a convolutionally encoded G1, G2 serial data stream. This feature is available with the purchase of an additional license. Please contact manufacturer for details. The FEC options are located under the FEC tab as shown in Figure 154 – Simulator Setup Displaying FEC Features. Select this tab and check the box labeled Enable to turn on the convolutional encoder. The Encoder is a rate ½, constraint length =7 and G1, G2 generator polynomials 171_8 and 133_8.

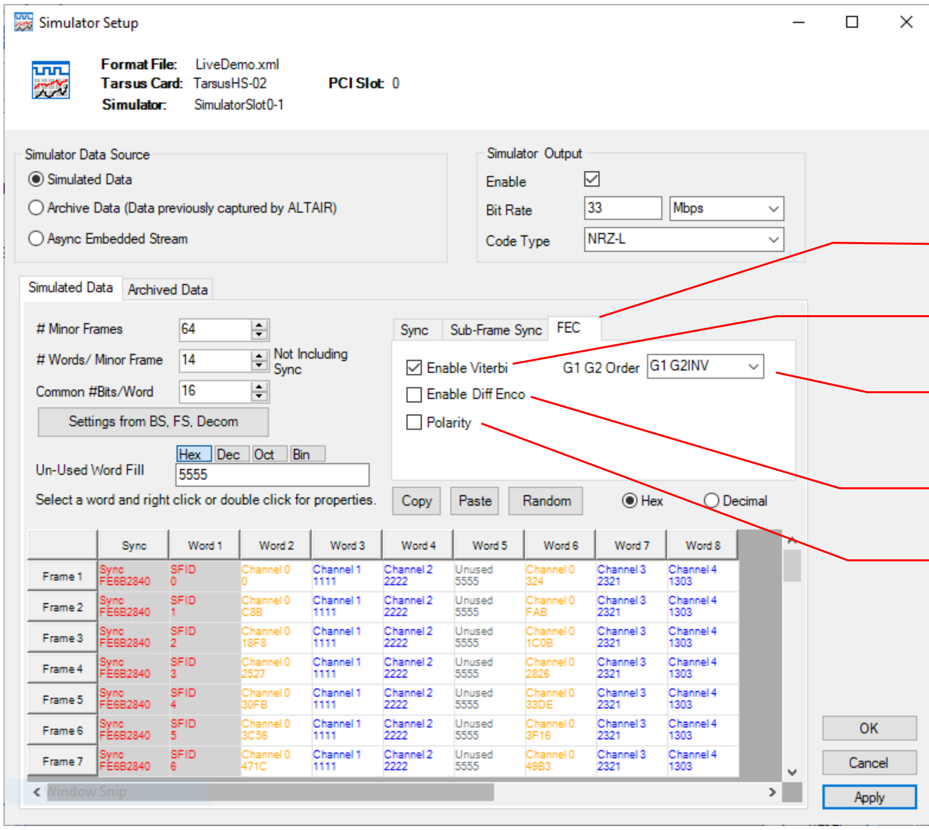


Figure 154 – Simulator Setup Displaying FEC Features

FEC Options:

- Enable: Turns on the Convolutional Encoder.
- Diff Encoding: On, provides convolutionally encoded NRZ-M data
  Off, provides convolutionally encoded NRZ-L data
- Polarity: Inverts the PCM signal before the FEC encoding.
- G1G2 Order:
  - ix. G1 G2
  - x. G1 G2Inv
  - xi. G1Inv G2
  - xii. G1Inv G2Inv
  - xiii. G2 G1
  - xiv. G2 G1Inv
  - xv. G2Inv G1
  - xvi. G2Inv G1Inv

6.3 Chapter 10 Option

The Ulyssix Chapter 10 Option includes a suite of tools for IRIG106 Chapter10 files and UDP streams for the ALTAIR software. With the Chapter 10 Option, ALTAIR records multiple PCM streams in a Chapter 10 file. ALTAIR extracts a PCM channel from a Chapter 10 file and outputs the PCM data from the Ulyssix card's Archive Simulator. The Chapter 10 Option includes tools for publishing and receiving Chapter 10 UDP streams. There is also an implementation of the IRIG 106 Chapter 6 Record and Reproducer Command and Control TCP Interface. This TCP interface configures ALTAIR and the Chapter 10 UDP Publisher remotely via a standard TCP command set.

6.3.1 Recording Chapter 10 File

ALTAIR records one Chapter 10 file that contains each of the PCM channels acquired by the Ulyssix PCM cards in the computer. Each PCM channel is recorded using the same PCM Mode.

To configure the Chapter 10 File recorder, select on any Frame Sync in the ALTAIR Hardware Explore. In the menu bar, click on Tools and select Chapter 10 Rec Settings from the list to launch the Ch10 Rec Settings Form.

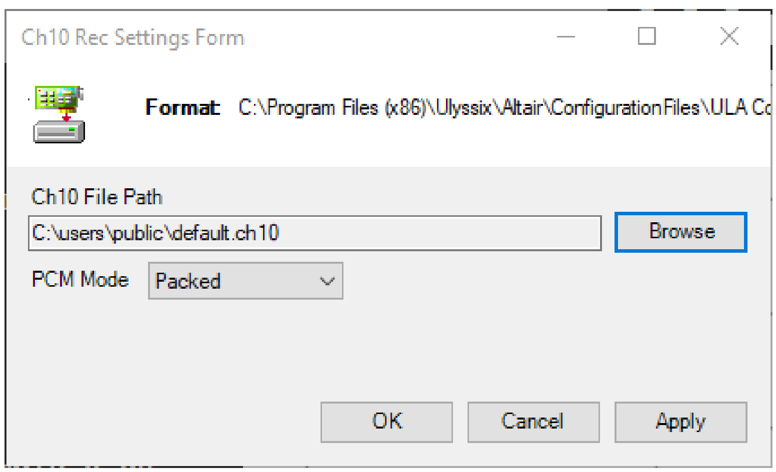


Figure 155 – Ch10 Record Settings Form

The Ch10 Rec Settings Form has a Browse button to select the location and file name for the Chapter 10 file. There is also a combo box to select the PCM Mode. The available PCM Modes are: Throughput, Packed, Unpacked, and Throughput Aligned. To record data in Throughput Mode, the ALTAIR turns off the Frame Sync in the Ulyssix PCM card. When the Frame Sync is off, ALTAIR does not receive data for displays.

Throughput Aligned Mode is not part of the IRIG106 Chapter 10 Standard. The PCM data is frame synchronized and then stored in an IRIG106 Chapter 10 PCM Throughput Mode packet. The advantage of Throughput Aligned Mode is that the Ulyssix PCM card Frame Sync is on and therefore ALTAIR receives data for displays and the PCM data is stored in the familiar Throughput Mode format.

Click OK or Apply to save any changes. Please note that these setting apply to each PCM channel. ALTAIR does not currently support recording multiple Chapter 10 Files at once or recording multiple PCM Modes in the same Chapter 10 file.

Starting and stopping a Chapter 10 file uses the same controls as the Archive feature. The toolbar contains an Archive Record button and an Archive Stop button. Click the Archive Start button to begin recording the Chapter 10 and TAD file. Click the Archive Stop button to end the recording.

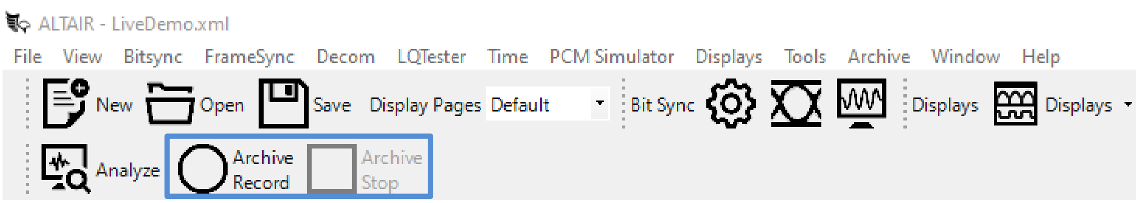


Figure 156 – Archive Record and Archive Stop Toolbar Buttons

6.3.2 Playing Chapter 10 File Through the Archive Simulator

ALTAIR extracts a PCM channel from a Chapter 10 file and plays the PCM stream through the Archive Simulator. The Chapter 10 PCM channel can be either Throughput or Packed Mode; Unpacked Mode is not supported. Chapter 10 files recorded in ALTAIR's Throughput Aligned Mode are considered Throughput Mode for Archive Simulator playback. Contact Ulyssix for questions about using the Simulator with Unpacked Mode Chapter 10 PCM Packets.

Launch the ALTAIR Simulator Setup window by double clicking on the desired Simulator entry in the Hardware Explorer. In the Simulator Setup window, select the Archive Data radio button to change the Simulator Setup into Archive Simulator mode. In the Simulator Output section, ensure that the Enable checkbox is checked, enter the Bit Rate, and select the Code Type.

In the Archive Info section of the Simulator Setup window, click the Browse button to launch a File Open dialog window. In the File Open dialog window, select a Chapter 10 file and click the Open button. Next, ALTAIR scans the selected Chapter 10 file. The length of the scan depends on the number of channels and the length of the Chapter 10 file. Once the scan is complete, click the Ch10 PCM Settings button to launch the Chapter 10 File window.

In the Chapter 10 File window, select the PCM Channel and set the time range of the PCM Channel. Use the PCM Chan drop-down box to select the desired PCM Channel. The PCM Chan drop-down box includes the PCM Mode of the channel. When the PCM Chan drop-down box selection changes, the Frame Settings section of the window also changes. These settings are read from the Chapter 10 file TMATS. The displayed settings are only as accurate as the TMATS. These settings are used for display purposes only. In the Time Selection section, use the Start and End sliders to select the start and end times of the PCM data. The default is to play the entire recording. Click the OK button to confirm the settings.

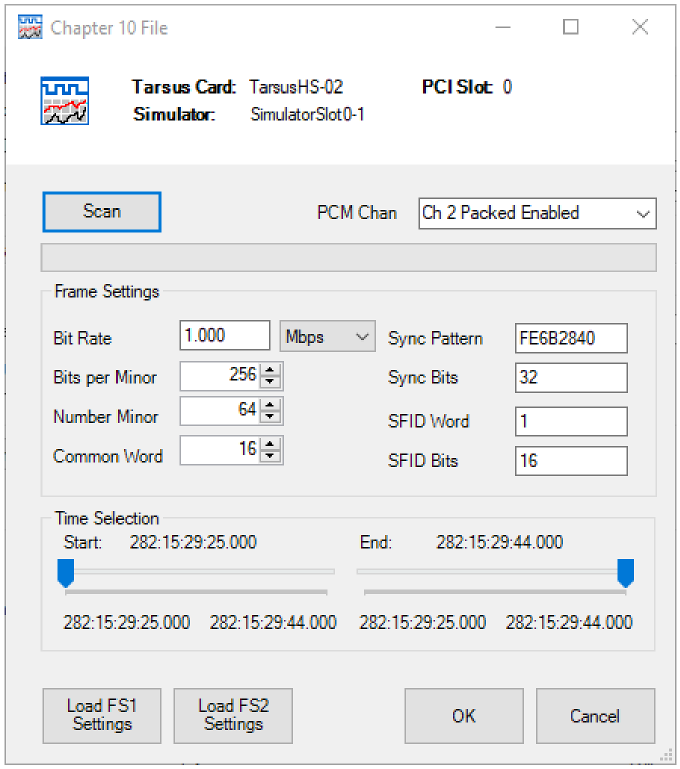


Figure 157 – Chapter 10 File Window

In the Simulator Setup window, click the Start Transfer button to begin playing the Chapter 10 PCM Channel out of the Archive Simulator. The Current File Location will move as ALTAIR reads through the Chapter 10 file. When ALTAIR reaches the end of the file, it wraps back to the beginning of the file. The Time display shows the time stamp from the IRIG Chapter 10 file. The Output Buffer Display shows the status of the Ulyssix PCM Card's Archive Simulator FIFO. Click the Stop button to end playing the Chapter 10 file.

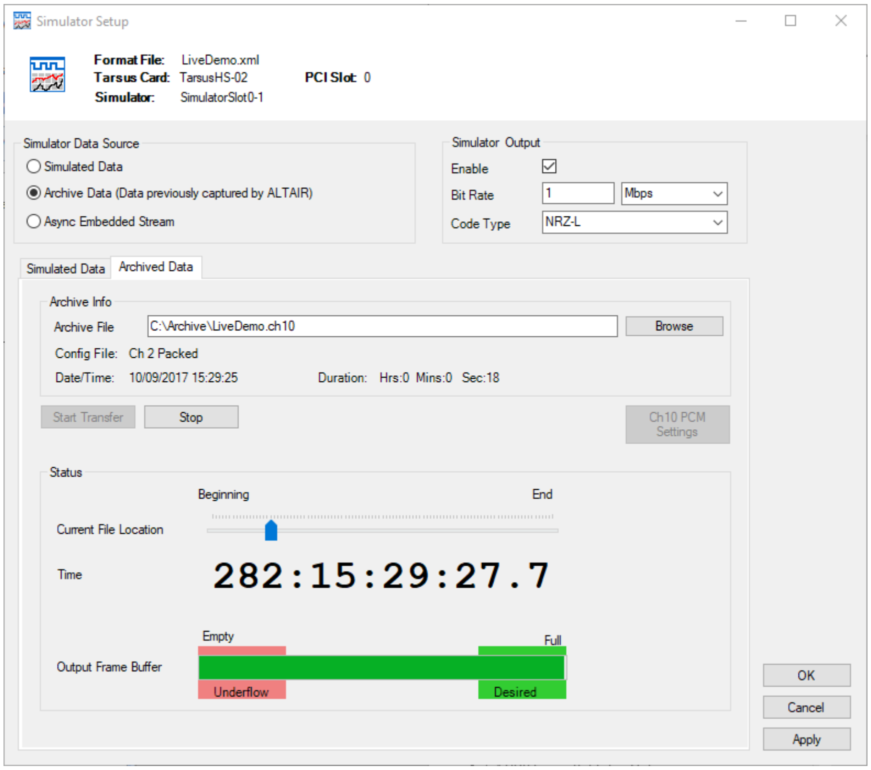


Figure 158 – Simulator Setup Window Chapter 10 Archive Simulator

6.3.3 Publishing Chapter 10 UDP

ALTAIR publishes Chapter 10 UDP packets to one UDP stream that contains each of the PCM channel acquired by the Ulyssix PCM cards in the computer. Each PCM channel uses the same PCM Mode.

To configure the Chapter 10 UDP Publisher, select any Frame Sync from the Hardware Explorer and click the UDP Publisher icon, located at the right side of the toolbar, to launch the Ch10 UDP Publisher window.

Figure 159 – Chapter 10 UDP Publisher Toolbar Icon

The Ch10 UDP Publisher window configures the output Ethernet Adapter, the UDP transmission type, and the PCM Mode. There is also an option to save the TMATS to a text file.

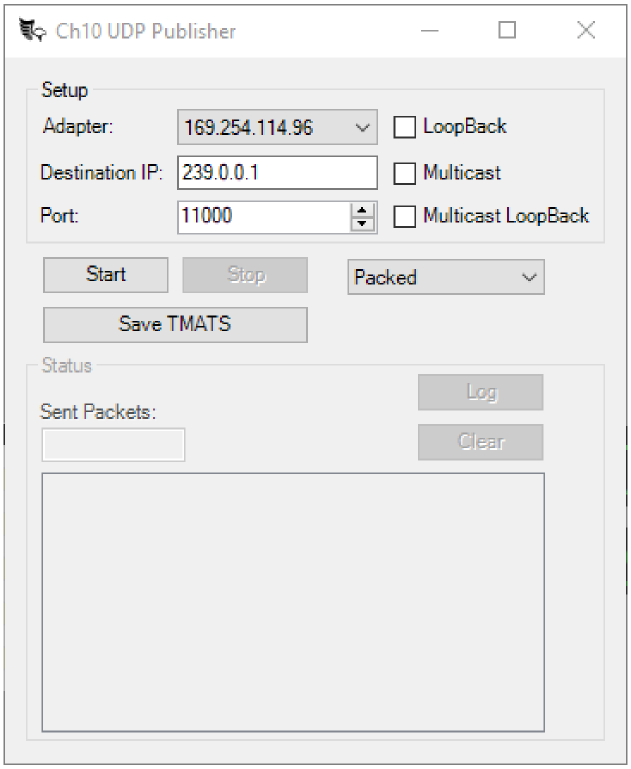


Figure 160 – Ch10 UDP Publisher Window

UDP packet transmission has three modes: unicast, broadcast, and multicast. Unicast delivers UDP packets to a single IP address. Broadcast delivers UDP packets to every IP address on any node set to 255. For example, 192.168.255.255 delivers UDP packets to every computer on the network whose IP address begins with 192.168. Multicast delivers UDP packets to one or more computers that subscribe to the multicast address. The ALTAIR computer sends the UDP packets to a router and then the router makes copies of the packets and sends them to any computer that subscribes to the multicast.

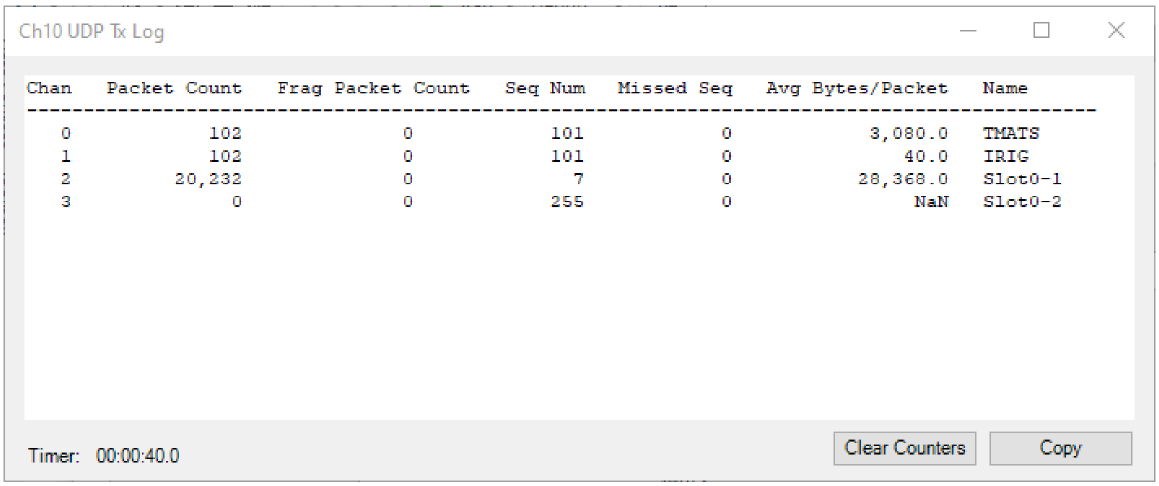
The Adapter combo box determines which Ethernet adapter ALTAIR uses for UDP stream. ALTAIR populates the combo box with every Adapter and IP address on the computer. The Adapter combo box also contains the IP Address 127.0.0.1 for local loopback. The Adapter combo box is import when a computer has multiple Ethernet connections.

The Destination IP textbox defines the destination IP address for unicast, broadcast, and multicast. This textbox will error check the entry to ensure that the entry is in the valid format for an IP address. Invalid entries turn red.

There are three checkboxes: LoopBack, Multicast, and Multicast LoopBack. Only one of the three checkboxes can be checked. Checking the Lookback checkbox forces the Destination IP address to the Loopback IP address of 127.0.0.1. In LoopBack mode only one application receives the Ch10 UDP packets. Checking the Multicast checkbox sets the Ch10 UDP Publisher into Multicast mode. The error checking on the Destination IP

Address text box will enforce a valid Multicast IP address. The valid Multicast IP address range is 224.0.0.0 to 239.255.255.255. Checking the Multicast LoopBack checkbox sets the Ch10 UDP Publisher into Multicast LoopBack mode. Multicast LoopBack is a special case of Multicast where the UDP Packets do not leave the computer. The Ethernet adapter receives the UDP packets, handles the subscription to the Multicast group, and distributes the packets as needed. Multicast LoopBack distributes Chapter 10 UDP packets to multiple applications on the same computer.

Clicking the Start button begins the UDP Packet Publishing. The Stop button stops the UDP Packet Publishing. The UDP Ch10 Publisher window displays the number of sent packets in a textbox. The start and stop times are logged in the text window. Clicking the Log button launches a window that logs the statistics for each channel in the Chapter 10 stream.



Chan	Packet Count	Frag Packet Count	Seq Num	Missed Seq	Avg Bytes/Packet	Name
0	102	0	101	0	3,080.0	TMATS
1	102	0	101	0	40.0	IRIG
2	20,232	0	7	0	28,368.0	Slot0-1
3	0	0	255	0	NaN	Slot0-2

Figure 161 – Ch10 UDP Publisher Log Window

The Ch10 UDP Publisher Log Window displays a line for each Chapter 10 Channel. IRIG106 Chapter 10 defines Channel 0 as TMATS. In ALTAIR, Channel 1 is always IRIG Time. The window shows the number of packets sent, how any packets were fragmented, the current Chapter 10 Packet Sequence Number, the number of missed Sequences, and the Average Bytes per Packet. This information is used to help debug any issues with an application has issues receiving Chapter 10 UDP Packets from ALTAIR.

IRIG106 Chapter 10 defines a Fragmented Packet as a Chapter 10 packet that broken into one ore fragment because the original packet is larger than 32kB. Chapter 10 sets 32kB as the maximum UDP packet size. The Chapter 10 Sequence number is part of the Chapter 10 Packet Header. Each Chapter 10 gets an 8-bit Sequence Counter. When the Sequence Counter reaches 255, it wraps back to 0. For more information about Fragmented Packets and Sequence Counters, please see IRIG106 Chapter 10 documentation.

6.3.4 Receiving Chapter 10 UDP

ALTAIR can receive one Chapter 10 UDP stream and distributes its PCM channels to user selected Frame Syncs in ALTAIR. To configure the ALTAIR Chapter 10 UDP Receiver, click on any Frame Sync in the Hardware Explorer, select Tools from the menu bar, and select Chapter 10 UDP Rx from the list to launch the Ch10 UDP Rx window.

The Ch10 UDP Rx window has four section: Ethernet Settings, UDP Packets, TMATS, and PCM Channels. The Ethernet Settings configure the Ethernet Adapter, Port Number, and the IP Address of the Chapter 10 UDP source. The UDP Packets section displays statistics on the received packets as well as options to display Packet Details and saving the UDP Packet counter log to a file. The TMATs section displays the PCM Channels and their settings as they are described in the TMATS of the Chapter 10 UDP stream. There is a button to save the TMATS to a file for detailed examination. The PCM Channel section defines which Chapter 10 PCM Channel is assigned to which ALTAIR Frame Sync.

In the Ethernet Settings section, select the Ethernet Adapter by its IP Address. The Adapter drop-down lists the active IP Addresses in the computer as well as 127.0.0.1, which is the LoopBack IP Address. Next, enter the Port Number. Enter the IP Address of the Chapter 10 UDP source. If the Chapter 10 UDP source is Multicast, check the Multicast checkbox. Click the UDP Receiver On button to start the UDP Receiver. When the UDP Receiver is on, the button is light blue. When the UDP Receiver is off, the button is gray. The UDP Packet section counters begin logging the received UDP packets. When Chapter 10 UDP Receiver processes the first TMATS packet, ALTAIR populates the TMATS section and enables the PCM Channels section.

The PCM Section has a line of controls for each Frame Sync channel listed in the ALTAIR Hardware Explorer. The first control is the Enable button. The Enable button controls if the selected Chapter 10 PCM Channel data is sent to the ALTAIR channel. When enabled, the button is light blue. When disabled, the button is gray. The second control is the Ulyssix Card. This control shows the Ulyssix Card’s Model Number and PCI Slot. The third control is the Frame Sync number. The Frame Sync number indicates which Frame Sync number in the Ulyssix Card. The last control is a drop-down box to select the Chapter 10 PCM Channel.

To configure the PCM Channel Section, first click the Enable button to enable the Frame Sync Channel. Second, select the Chapter 10 PCM Channel number. Details for the Chapter 10 PCM Channel Number are located in the TMATS section. Once the PCM Channels are configured, press the Apply button to pass the settings to ALTAIR.

The Chapter 10 UDP Receiver settings are saved to the ALTAIR configuration file. When you open the file, ALTAIR will automatically configure and enable the Chapter 10 UDP Receiver.

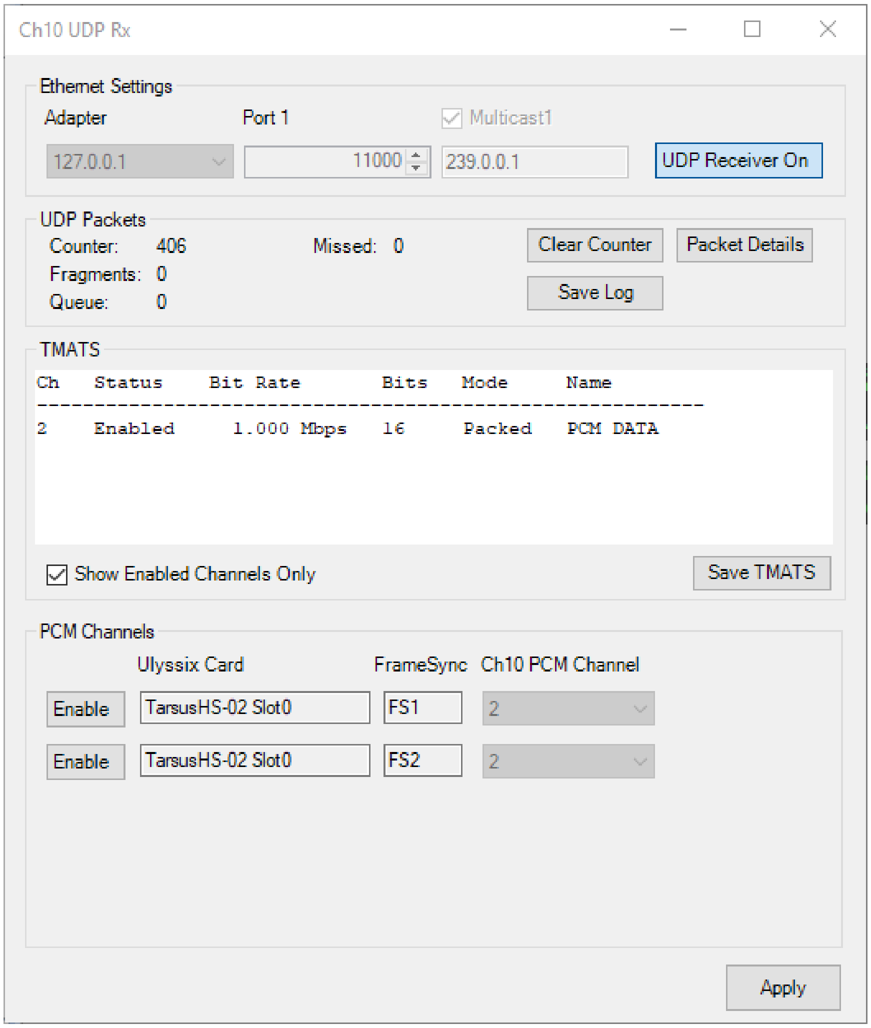


Figure 162 – Ch10 UDP Rx Window

In the UDP Packets section, there are three buttons: Clear Counters, Packet Details, and Save Log. The Clear Counters button resets the counters in the UDP Packets. The Save Log button saves a log file with the details about any fragmented or missed packets. The Packet Details button launches the Ch10 UDP Rx Packet Log window.

The Ch10 UDP Rx Packet Log window displays the packet statistics for each of the channels in the Chapter 10 UDP stream. By definition, TMATS is always Channel 0. In ALTAIR, Channel 1 is always IRIG Time. Each channel has its enabled state, packets per second rate, packet counter, missed packets, late packets, and missed packet rate. This information is provided to help debug UDP transmission issues. The Clear Counters button resets the counters to zero. The Copy button copies the text to the clipboard, then the data can be pasted into another application.

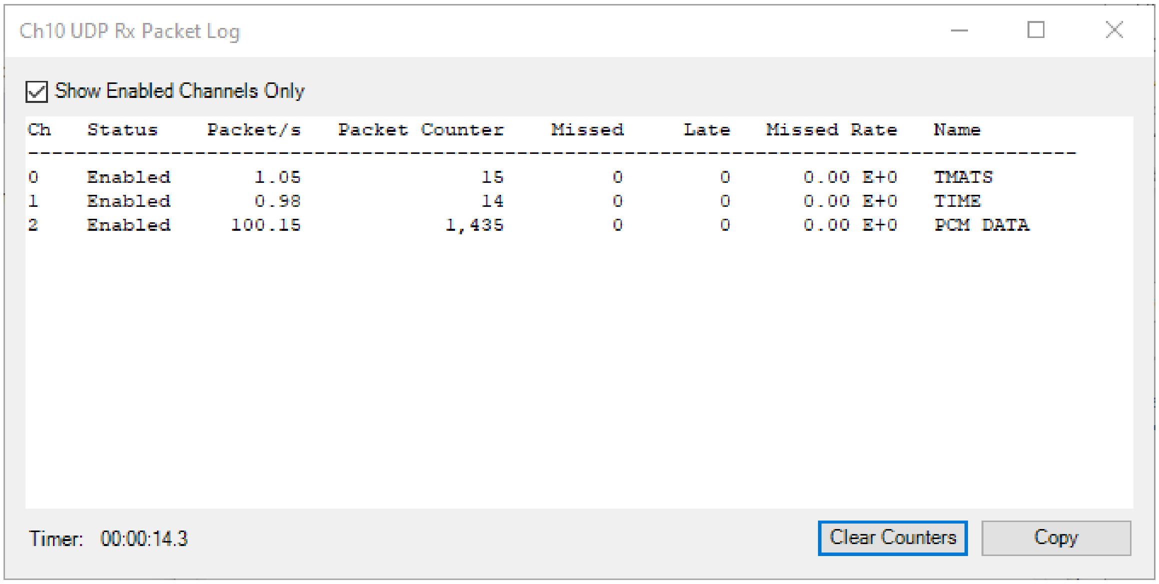


Figure 163 – Ch10 UDP Packet Log

6.3.5 IRIG106 Chapter 6 Recorder and Reproducer Command and Control

ALTAIR accepts the IRIG106 Chapter 6 Recorder and Reproducer Command and Control via a TCP connection. By default, the Chapter 10 TCP Listener server is disabled when ALTAIR starts. The user must manually start the Chapter 10 TCP Listener manually or configure ALTAIR to start the Chapter 10 TCP Listener when it starts. The Chapter 10 TCP Listener is disabled by default to alleviate security concerns.

To configure the Chapter 10 TCP Listener, select Tools from the menu bar and click on Options to launch the Options window. In the Options window, click on the Ch10 tab to access the Chapter 10 TCP Listener settings. The settings in the Option window are stored in a XML on the computer and are loaded when ALTAIR launches. The checkbox "Enable Ch10 Listener when ALTAIR Starts" controls if the TCP listener is launched when ALTAIR starts. The Chapter 10 TCP Listener IP Address drop-down box sets the IP Address for the TCP listener. The Chapter 10 TCP Listener IP Address must be set before the Chapter 10 TCP Listener is launched. IRIG106 Chapter 10 Section 10.4.3 defines the Port Number as 10610. This value cannot be changed.

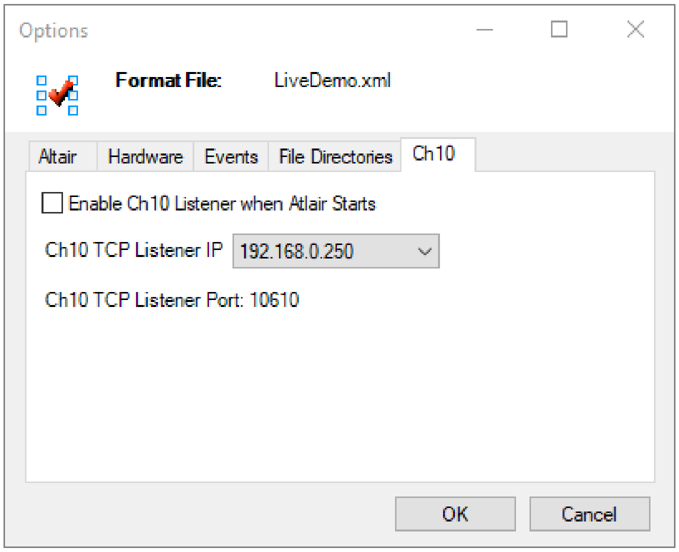


Figure 164 – ALTAIR Options Ch10 Settings

To manually start the Chapter 10 Listener, select a Frame Sync from the Hardware Explorer, click on Tools in the menu bar, and then select “Ch10 TCP Listener” from the menu list to launch the Ch10 TCP Listener window. When the Ch10 TCP Listener window is open, the TCP Sever is open and waiting for connections. Once the Ch10 TCP Listener window is opened, the IP address cannot be changed.

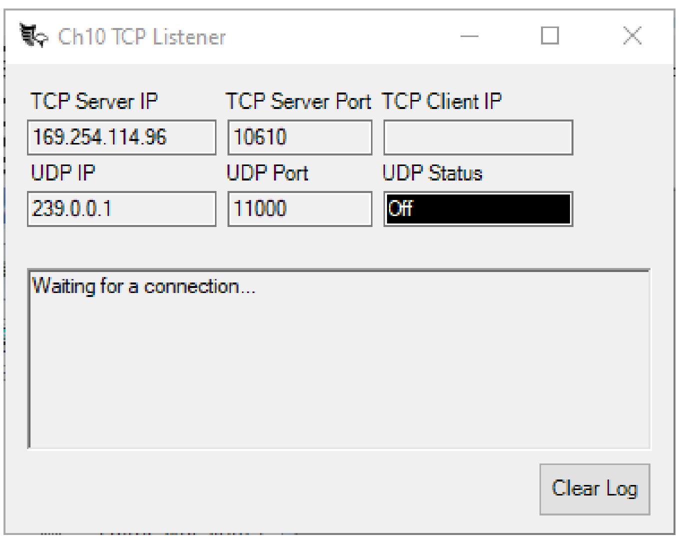


Figure 165 – Ch10 TCP Listener Window

The command set for the Chapter 10 TCP Listener is a subset of the commands from IRIG106 Chapter 6 section 6.2 CLI Command and Control. These commands all begin a period and end with a carriage return and line feed. The commands are not case sensitive in ALTAIR. The specifics for the command syntax and rules are in Ch6 6.2.1. The Error Codes are listed in Ch6 6.2.2. For example code to send IRIG106 Chapter 6 CLI Commands, contact Ulyssix.

The command ".TMATS WRITE 0" tells ALTAIR to wait for a TMATS file. The file is transferred via the TCP connection. ALTAIR know that the TMATS file is complete when it receives the command "END." After the END command, ALTAIR processes the TMATS file uses the R Group and P Group to configure the Bit Syncs and Frame Syncs in the computer.

The command ".PUBLISH" returns the current IP Address and Port Number.

The command ".PUBLISH START 192.168.0.123 11000 1" will start streaming the Chapter 10 UDP on IP 192.168.0.123 Port 11000 Stream 1. ALTAIR does not use the Stream number. Any number is allowed.

The command ".PUBLISH STOP 192.168.0.123 11000 1" stops streaming the Chapter 10 UDP. Please note that the IP Address and Port Number in the Stop command must match the values from the start command. The Stream number is not required to match.

1. Supported commands:
    a. .HELP
        i. IRIG106 Chapter 6 Section 6.2.3.4
        ii. No parameters.
        iii. Returns a list of implemented commands.
    b. .IRIG106 and .IRIG-106
        i. IRIG106 Chapter 6 Section 6.2.3.5
        ii. No parameters.
        iii. Returns the IRIG106 Ch10 Version number
    c. .PUBLISH [Keyword] [Parameter List]
        i. IRIG106 Chapter 6 Section 6.2.4.22
        ii. Parameters: Keyword and Parameter List
            1. Keyword: secondary commands. Ulyssix implemented both possible Keywords: START and STOP. If the Keyword is blank, then the response is the current IP Address, Port, and Stream.
            2. Parameter List: used to send the IP Address, Port, and Stream for the Publish Start Command. The Ulyssix Implementation does not require a Stream value. It will accept any value for Stream, but the value will be ignored. Ulyssix did not implement selection of output data by Stream.
        iii. Implementation Keywords:
            1. START – sets the IP Address and Port Number for the UDP transfer and begins sending UDP Packets. IP Addresses in the UDP Multicast Range of 224.0.0.0 to 239.255.255.255. A START command sent while the UDP

is already running will receive an error message of “E 05” for Command Failed.

2. STOP – stops sending UDP packets. A STOP command sent while the UDP is not running will receive an error message of “E 05” for Command Failed.
3. {blank} – no keyword queries the current settings for IP, Port, and Stream. The stream is set to ALL by default but changing the value of Stream has no effect on the software.

d. .TMATS {mode} [N]
   i. IRIG106 Chapter 6 Section 6.2.3.11
   ii. Parameters: Mode and N
      1. Mode: secondary command. Ulyssix implemented three of seven possible Modes: WRITE, READ, and CHECKSUM.
      2. N: Range of 0-15 to save up to sixteen TMATS files. Ulyssix implementation will accept any value of N, but it will be ignored. Ulyssix implemented only one TMATS file.
   iii. Implemented Modes:
      1. WRITE – transfers TMATS from the host computer to the Ulyssix computer.
      2. READ – transfers TMATS from the Ulyssix computer to the host computer.
      3. CHECKSUM – calculates the SHA-256 hash for the TMATS file. The SHA-256 hash calc excludes the TMATS tag g\SHA and its associated text.

6.4 UDP Frame Publisher Option

The UDP Publisher options is composed of two separate features: UDP Frame Publisher and the UDP Parameter Publisher. Both features ship data from the ALTAIR software via User Datagram Protocol (UDP). The UDP Frame Publisher sends UDP packets of time tagged minor frame data. The UDP Parameter Publisher sends UDP packets of user selected decom parameters.

6.4.1 UDP Frame Publisher

The UDP Frame Publisher data is transmitted in packets in Little Endian format. Each packet begins with a four-byte packet header. The packet header is a thirty-two-bit packet counter. The rest of the packet contains multiple minor frame data blocks. The number of minor frame data blocks is determined by the bits in a minor frame and the bit rate. A UDP packet is sent approximately every 10mS.

The minor frame data block is composed of a twelve-byte header followed by a minor frame of data. The header contains a time tag and information about the lock status. This is the same data format that is used in the Archive Data File (.TAD File). For more information about data format, please see Chapter 8 Archive Data Files Explained.

If the Telemetry Over IP (TMOIP) option is purchased, then the UDP Frame Publisher has the option to broadcast IRIG 218 UDP Telemetry Over IP via Internet Protocol Version 4. This option is available in the Packet Type combo box.

6.4.1.1 Configuring the UDP Frame Publisher

After the UDP Frame Publisher is licensed, select a Frame Sync from the Hardware Explorer window, click Archive from the menu bar, and select UDP Publisher.

6.4.1.2 UDP Frame Publisher Setup Form

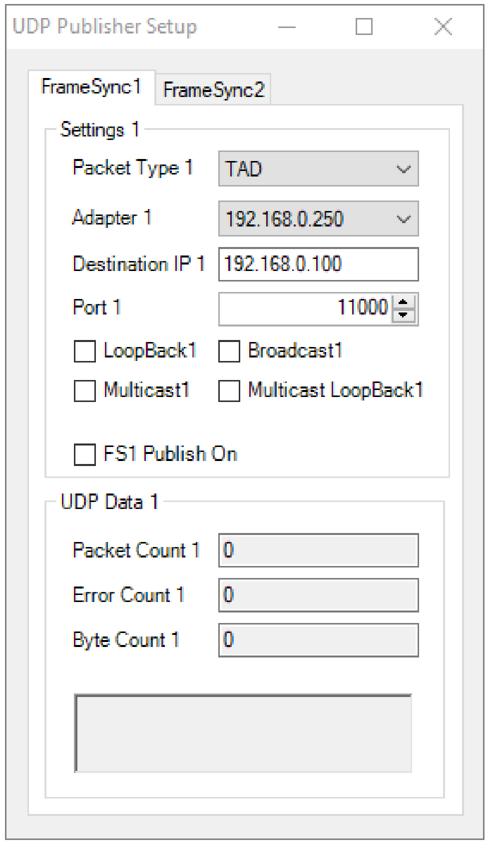


Figure 166 – UDP Frame Publisher Setup Form

The UDP Frame Publisher Form requires the following settings:

1. Packet Type – This combo box selects the data type for the UDP packet. The primary packet type is the Ulyssix TAD format. If the Telemetry Over IP option is purchased, the TMOIP packet type is added.
2. IP Address – This is a combo box populated with a list of all the computer's network cards IP addresses. The user should select the entry of the network card to broadcast the UDP packets.
3. Destination IP – This is the network address of the computer to receive the UDP packets. The check boxes for Loop Back and Multicast disable the Destination IP text box and use a fixed destination IP.
4. Loop Back – Sets the Destination IP address to 127.0.0.1. This IP address causes the ethernet port to internally loop the output to the input. Loop Back is used to export data in real time to an application running on the same computer. Only one application can receive Loop Back UDP packets
5. Multicast – Configures the UDP Publisher into Multicast mode. This requires a Multicast compliant IP Address between 224.0.0.0 to 239.255.255.255.
6. Broadcast – Sets the last byte of the Destination IP address to 255. The first three bytes of the Destination IP address stay the same resulting in x.y.z.255. Setting the last byte to 255 causes the ethernet adapter to broadcast the UDP packets to all computers with the IP address with the first three bytes of x.y.z. Some industrial

network switches will block packets addressed to x.y.z.255. Please consult your network administrator for more details.

7. Multicast Loop Back – Configures the network adapter into special case of Multicast where the UDP Packets do not leave the computer. The Ethernet adapter receives the UDP packets, handles the subscription to the Multicast group, and distributes the packets as needed. Multicast Loop Back distributes UDP packets to multiple applications on the same computer.
8. Port Number – Selects the port on the selected network adapter IP address. The default value for FrameSync1 is 11000 and the default value for FrameSync2 (available on some Ulyssix PCM Cards) is 11001. Only one Frame Sync can broadcast on a given IP Address and Port Number. The Port Number is limited to the range 1024 to 65535.
9. FS Publish On – When checked, the UDP broadcast is on and the other UDP Publisher controls are disabled. When unchecked, no UDP packets are broadcast.

The UDP Frame Publisher form also displays the number of packets sent, the number of errors sending packets, and the number of bytes sent. The Packet Count text box displays the number of packets broadcast. The Error Count text box displays the number of packets that did not broadcast due to transmission

6.4.2 UDP Parameter Publisher

The UDP Parameter Publisher allows the user to select decom parameters for publishing in UDP Packets. A UDP Parameter Packet is sent approximately every 10mS.

The UDP Parameter Packet consists of a Packet Header, a Payload Header, and a Payload. The Packet Header has a 32-bit Integer UDP Packet Counter and information about the setup of the Payload. The Payload Header includes information about Payload as well as the time stamp of earliest parameter in the payload. The UDP Parameter Packets are described in detail in the document Ulyssix UDP Parameter Packet Format.

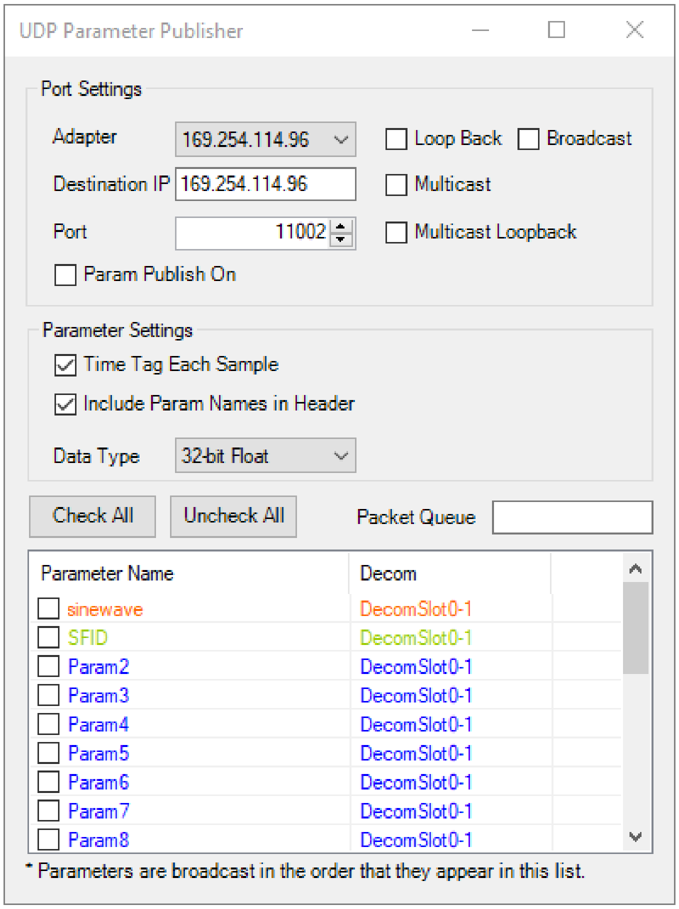


Figure 167 – UDP Parameter Publisher Setup form

6.4.2.1 UDP Parameter Publisher Setup Form

The configuration of the UDP Parameter Publisher Form begins with the Port Settings. These determine the source and destination IP address and port number.

1. IP Address – This is a combo box populated with a list of all the computer's network cards IP addresses. The user should select the entry of the network card to broadcast the UDP packets.
2. Destination IP – This is the network address of the computer to receive the UDP packets. The check boxes for Loop Back and Multicast disable the Destination IP text box and use a fixed destination IP.
3. Loop Back – Sets the Destination IP address to 127.0.0.1. This IP address causes the ethernet port to internally loop the output to the input. Loop Back is used to export data in real time to an application running on the same computer.
4. Broadcast – Sets the last byte of the Destination IP address to 255. The first three bytes of the Destination IP address stay the same resulting in x.y.z.255. Setting the last byte to 255 causes the ethernet adapter to broadcast the UDP packets to all computers with the IP address with the first three bytes of x.y.z. Some industrial

network switches will block packets addressed to x.y.z.255. Please consult your network administrator for more details.

5. Multicast – Configures the UDP Publisher into Multicast mode. This requires a Multicast compliant IP Address between 224.0.0.0 to 239.255.255.255.
6. Multicast Loop Back – Configures the network adapter into special case of Multicast where the UDP Packets do not leave the computer. The Ethernet adapter receives the UDP packets, handles the subscription to the Multicast group, and distributes the packets as needed. Multicast Loop Back distributes UDP packets to multiple applications on the same computer.
7. Port Number – Selects the port on the selected network adapter IP address. The default value for FrameSync1 is 11000 and the default value for FrameSync2 (available on some Ulyssix PCM Cards) is 11001. Only one Frame Sync can broadcast on a given IP Address and Port Number. The Port Number is limited to the range 1024 to 65535.
8. FS Publish On – When checked, the UDP broadcast is on and the other UDP Publisher controls are disabled. When unchecked, no UDP packets are broadcast.

The Parameter Settings controls give the user the ability to configure the UDP packet.

1. Time Tag Each Sample – When checked, each data value is paired with a time stamp. If the Data Type is 32-bit float, then the time is a 64-bit float. If the Data Type is a 64-bit signed integer, then the time is a 64-bit unsigned integer.
2. Include Param Names in Header – When checked, the names of the selected parameters are included at the end of the data packet header.
3. Data Type – There are two options in the drop-down: 32-bit Float and 64-bit Signed Integer. The 32-bit Float option sets the data to 32-bit float and the time stamp to 64-bit float. The 64-bit Unsigned Integer option sets the data to 64-bit signed integer and time stamp to 64-bit unsigned integer.

The last set of user controls are for selecting the desired parameters from the provided list and the Packet Queue. The Packet Queue is the number of UDP packets waiting to be shipped out the port. Also, there is a list of parameters with check boxes. All decom parameters are included. If the Ulyssix PCM card is equipped with two Decoms, the parameters from both Decoms are included in the list.

When the box is checked, that parameter is included in the UDP packet. There is a "Check All" button to select all parameters and an "Unchecked All" button to unselected all parameters. The standard Windows usage of the Shift key and Control key also work.

The Shift key allows the selection of multiple consecutive rows. Left click the mouse to select one parameter and then hold the Shift key and click another parameter. All the rows will be highlighted. Now click a check box and all the highlighted rows will have same check state.

The Control key allows the selection of multiple rows. Hold the Control key and left mouse click to select rows. The rows do not have to be consecutive. Now click a check box and all the highlighted rows will have the same check state.

6.4.2.2 Using the UDP Parameter Publisher Data Rate

The UDP Parameter Publisher has a data rate limit, above this data rate the UDP packets back up in the Packet Queue and data is lost. The data rate calculation depends on many factors and the calculation below is good estimate. There are situations where this calculation is too conservative, and a higher data rate will be successful. Please watch the Packet Queue counter. It should stay at a stable low number.

Calculate the data rate using the follow:
Minor Frame Rate = Bit Rate / Bits per Minor Frame
Data Rate = Number of Selected Parameter Occurrences per Minor Frame * Minor Frame Rate

The Number of Selected Parameters Occurrences per Minor Frame is the total number of times that a selected decom parameter appears in a minor frame. This calculation is complicated by Sub Comm, Super Comm, Random, and Random Normal commutation types.

The number of bits in the decom parameters do not play in this calculation. When the decom parameter is extracted from the telemetry stream, the Bit Order and Numeric Data Type applied and then the resulting value is stored in a 64-bit integer. This 64-bit integer is then converted into Data Type selected in the UDP Parameter Publisher form. Therefore, whether the decom parameter originated as an 8-bit word or 16-bit word, it will be transmitted in the UDP Parameter Packet as the same fixed size.

Calculation Example:
Bit Rate – 10 Mbps
Bits per Minor Frame – 800 bits

There are four parameters selected:

1. One – Normal Commutation occurs once per minor frame.
2. Two – Super Commutation occurs four per minor frame.
3. Three – Random Commutation occurs twice per minor frame
4. Four – Normal Commutation occurs once per minor frame.

Minor Frame Rate = 10 Mbps / 800 bits = 12.5 kSamples / sec
Number of Selected Parameter Occurrences per Minor Frame = 1 + 4 + 2 + 1 = 8
Data Rate = 8 * 12.5 kSample / sec = 100 kSample / sec

Data Rate Limits (Data Type as 32-bit Float):
With Time Tagging Each Sample 1.2 MSamples / sec

This is approximately an entire frame of 16-bit decom words at 20Mbps (with both Time Tag Each Sample and Include Parameter Names in Header turned on). The Data Rate Limit increases when Time Tag Each Sample is turned off. Omitting the time tagging reduces the data in each packet.

6.5 LQ Tester Option

The LQ Tester measures both the quality of the data through a bit sync, as well as, the latency time it takes to go from the Tarsus3-01 simulator back to the internal bit sync or external data path. The LQ Tester setup form has a Bit Error Rate Tester (BERT) section that can be configured to use an internally setup simulator format or pre-stored industry standard patterns.

6.5.1 Initiating the LQ Tester

When an LQ Tester license is active, an LQ Tester will appear in the Hardware Explorer window. To setup the LQ Tester, double click LQ Tester in the Hardware Explorer.

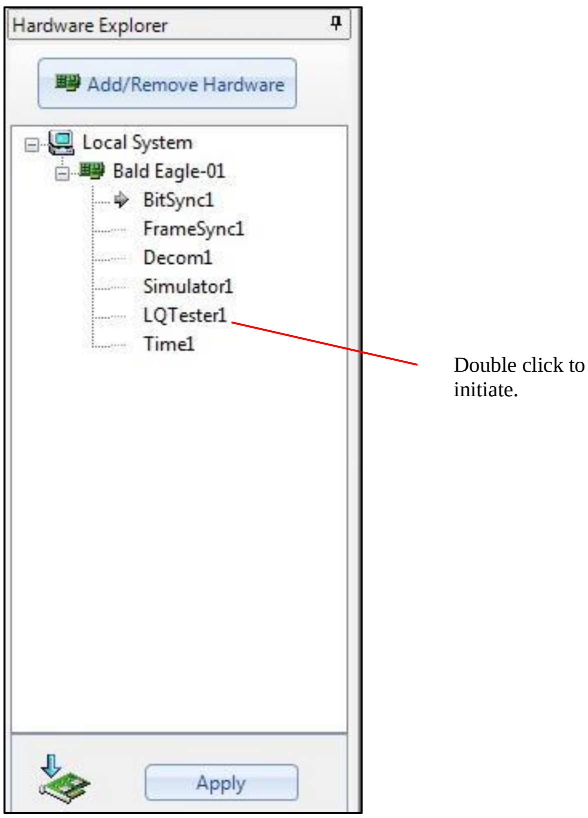


Figure 168 – LQ Tester Startup

6.5.2 LQ Tester Setup Form

The LQ Tester Setup Form is used to setup both the transmit function and the receive function for both the latency and the quality (BERT) functions.

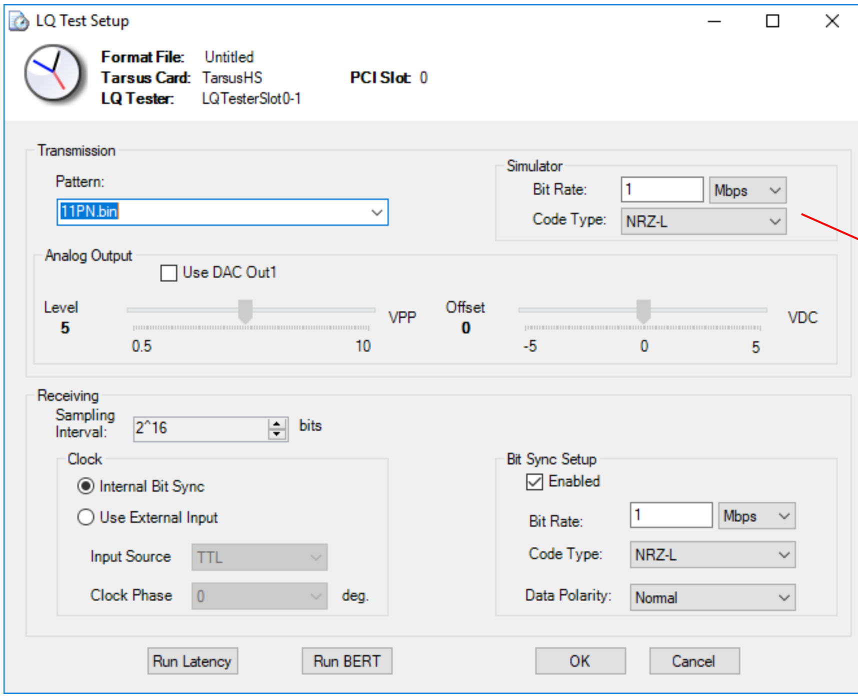


Figure 169 – LQ Tester Transmission Setup Form

1. For **Transmission**, the following patterns are selectable:

    - **<u>Current Simulator Setup</u>** - uses the last configuration used in the PCM simulator.

    - <u>The **256B** Pattern</u> - is a 256-bit pattern with the IRIG 32-bit sync pattern of 0xFE6B2840 and then a pattern of 16-bit words that change the transition density from all ones to all zeros.

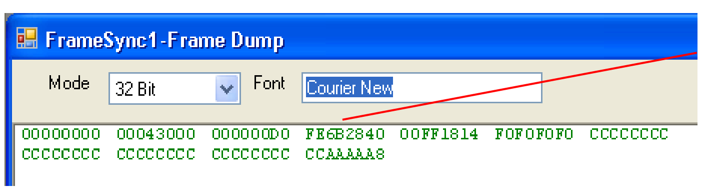


Figure 170 – 256B pattern

- The **1024B** Pattern - is a 1024-bit repetitive pattern that also uses the IRIG 32-bit sync pattern of 0xFE6B2840 and then the same pattern of the 256B. After the end of the 256 bits then there is a repetitive pattern of 0xAAAA for the remaining 1024 bits to increase the bit transition density.

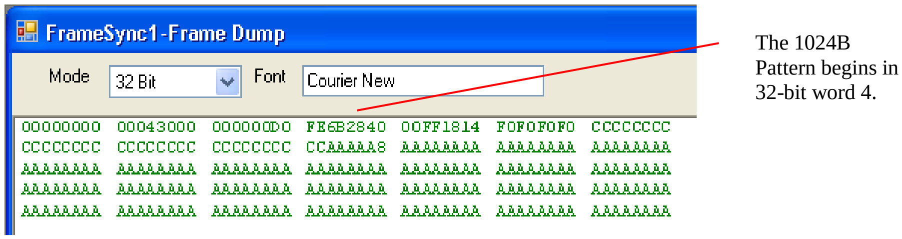


Figure 171 – 1024B pattern

- The **11PN** Pattern - is a standard 2047-bit pseudo-random pattern that starts with a 32-bit sync pattern of 0xB70D671F and then continues with the 11PN exclusive-OR pattern for the remaining 2047 bits. The exact values within each pattern can be seen in the figure below

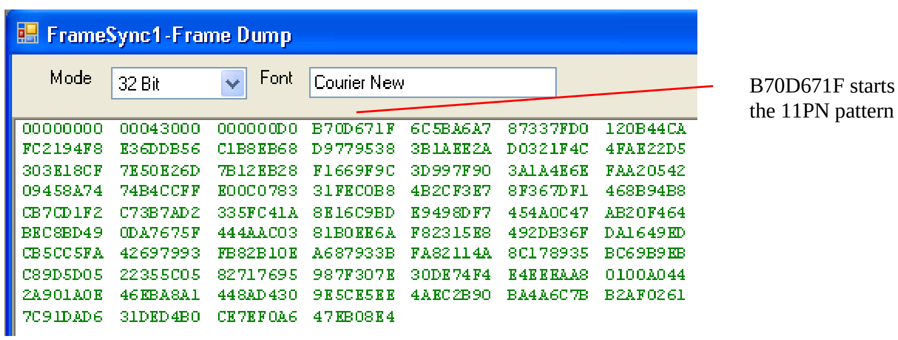


Figure 172 – 11PN pattern

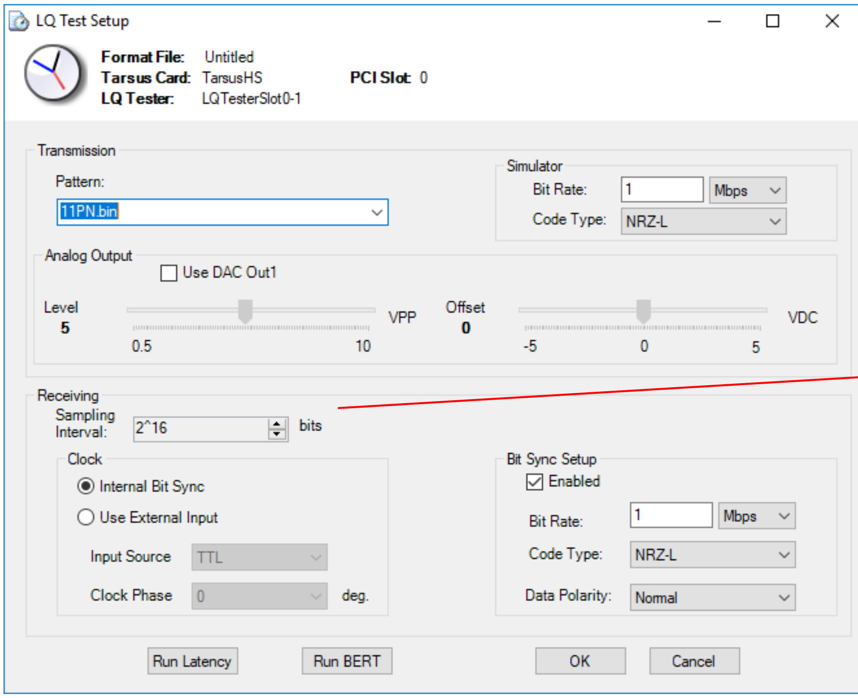
- The **25TD** Pattern - is a 25% transition density pattern.

- The **GU** Pattern - is a 32-bit sync pattern of 0xC4B890EC followed by 358 sixteen-bit words of 0xA0A0. This pattern creates a string of six '0's then a '1' then a '0' then a '1' which is very difficult to lock onto at high bit rates (above 20 Mbps).

2. Select the transmission bit rate and code type for the PCM data to be output from the LQ Tester. The data is output through the SIMOUT and SIMCLK BNC outputs on the Tarsus3 pigtail connector.

3. When setting up the **Receiving** section of the LQ Test Setup form, select a sampling interval for the BERT function. This interval is used to select the resolution and accuracy desired for the bit rate and data type selected. The larger the intervals, the more the number of samples are measured, the longer the time

between measurements occurs. The sampling interval is selectable for intervals from 2^8 to 2^32 with 2^4 spacing.



LQ Tester Receiving section setup form

Figure 173 – LQ Tester Receiving Setup Form

4. Use **Internal Bit Sync** for receiving data through the CH1IN BNC, or use **External Input** and the data will be input through the DECOMIN and DECOMCLK BNC cables on the Tarsus3 pigtail. An external **Clock Phase** is also selectable - similar to the Frame Sync input section in the ALTAIR software.

5. If using **Internal Bit Sync**, the user can change the Bit Sync settings from the LQ Tester form by checking the “Enabled” box under **Bit Sync Setup**. These controls change the input bit rate, code type, and data polarity.

CAUTION If the transmitting and receiving sections have different bit rates or code type, then the exact same pattern must be generated and used to obtain a correct BERT reading.

6.5.3 BERT Run Form

To start a Bit Error Rate Test, click the **Run BERT** button on the LQ Tester setup form. The following form will open:

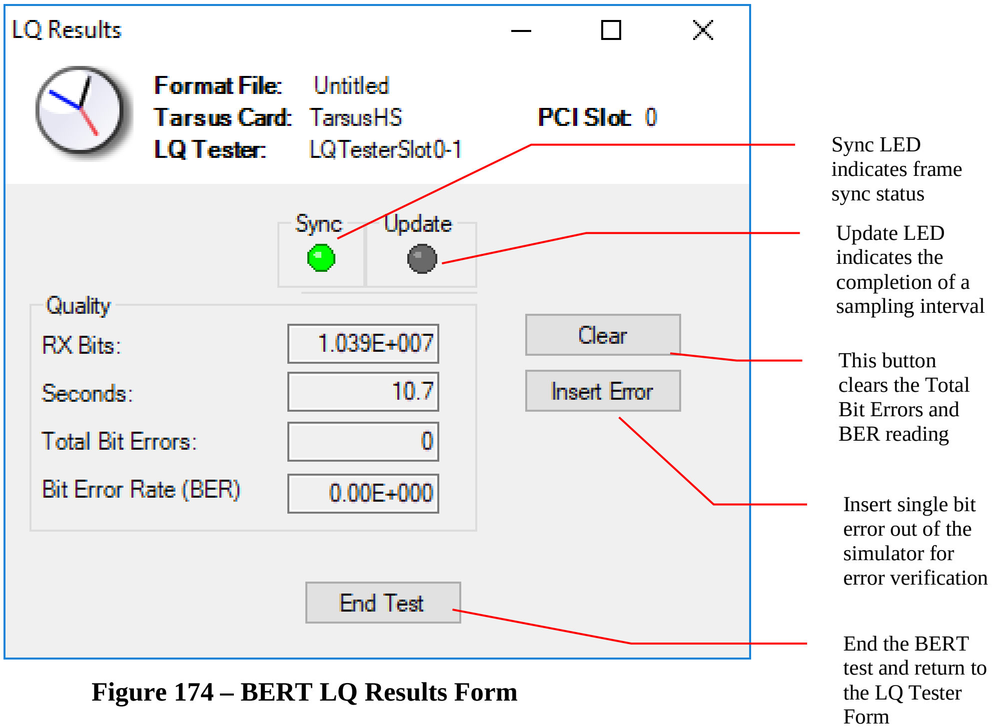


Figure 174 – BERT LQ Results Form

1. A **Sync** indicator shows the Frame Sync Status. The **Update** indicator blinks one time per completion of a sampling interval.
2. The **RX Bits** field shows the total number of received bits since the test was started.
3. The running time of the test is displayed in **Seconds**.
4. **Total Bit Errors** indicates the number of bits received by the BERT that didn't match the values transmitted.
5. The **Bit Error Rate** is updated at the sampling interval selected. It is the calculation of the number of bit errors seen over the number of bits transmitted with the selected sampling interval.

6.5.4 Latency Test Form

A Latency Test measures the time difference between when the data leaves the Tarsus3 Simulator output to when the Frame Sync receives the data. Clicking the **Run Latency** button on the LQ Tester Setup Form launches the Latency Test form and starts a continuous running latency test. The form displays the **Current Delay** as the external time. The software takes the measured time and subtracts the calibrated the internal time delay of the card. The internal timer doing the calculations has an 11.2 nanosecond resolution.

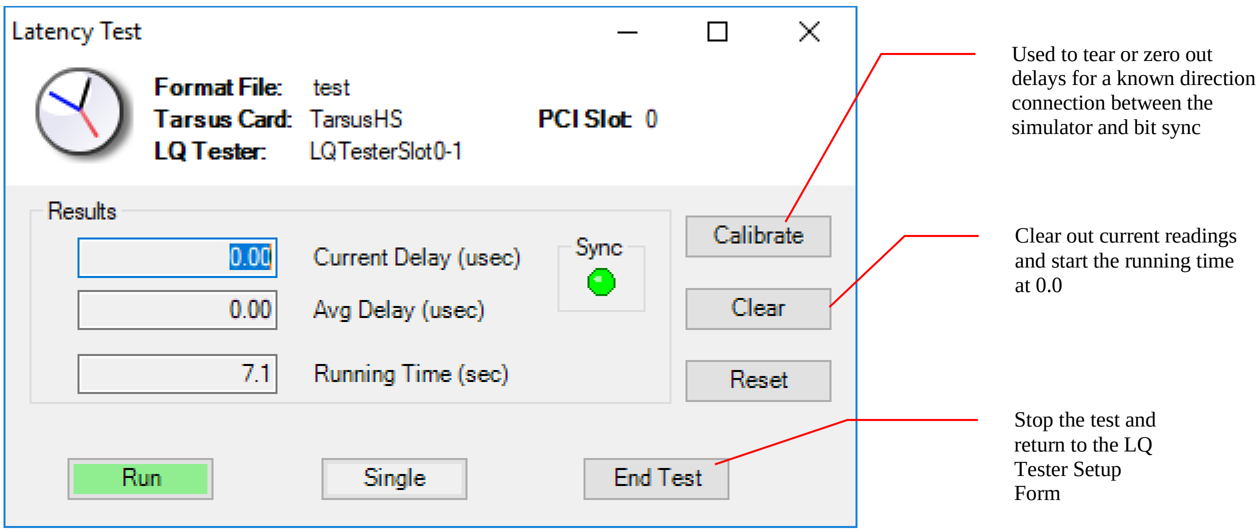


Figure 175 – Latency Test Form

1. The **Current Delay** reading is a single test reading in microseconds where the **Avg. Delay** reading is a running boxcar average of the last one hundred single latency readings.

2. To run a single latency test, hit the **Single** button. This disables the continuous run mode and only gives a single reading. To restart continuous mode, hit **Run.**

3. Use the **Calibrate** button to calibrate, or zero, the latency tester for the current connection between the simulator output and the Bit Sync input. The way to use this feature is to connect a short BNC cable between the two BNC connections and then hit the Calibrate button. The display should show a reading of +/- 0.5 microseconds. This is the calibrated delay for the next cabling configuration.

4. Hit the **End Test** button to return to the LQ Tester setup form. After completing a test using the LQ Tester, users can save the setup by hitting the **Save** button for the entire project. The LQ Tester settings will be saved with the rest of the ALTAIR setup in a specified .xml file format.

6.6 RS232 Parameter Output (UART)

The RS232 Parameter Output option outputs decom parameters through any of the four Universal Asynchronous Receiver/Transmitter (UART) outputs. Multiple parameters can be selected to be output through each UART port, allowing users to output an asynchronously sampled parameter. However, each parameter can only be output to one UART port. To output the same data to multiple BNCs, the user must create additional decom parameters referencing the desired data. All UART port settings are programmable.

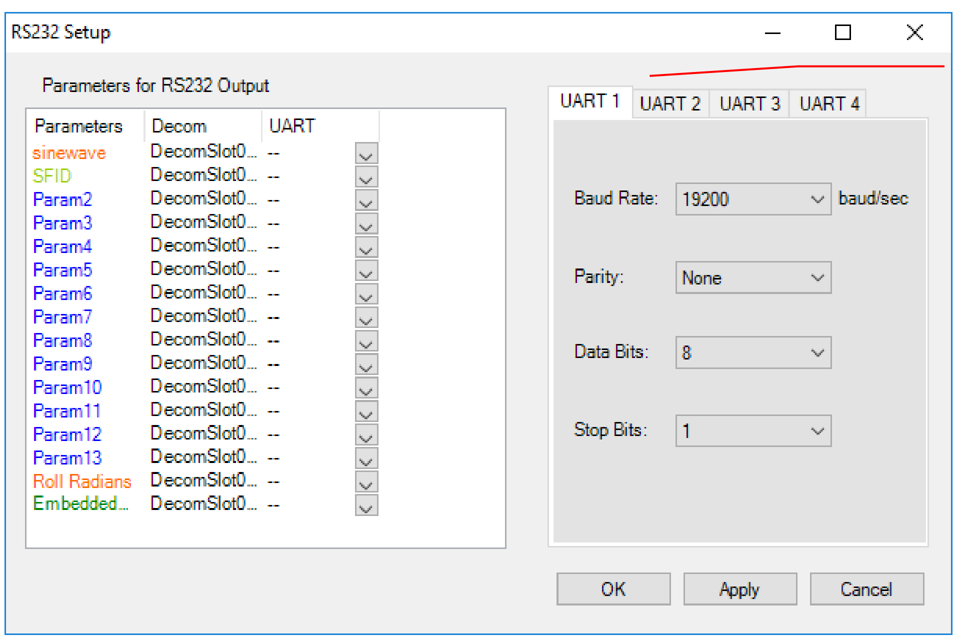
6.6.1 RS232 Setup

When the RS232 Parameter Select feature is licensed and a Tarsus3 card is selected in the Hardware Explorer, a new icon will appear in the toolbar. This button allows the user to quickly open the RS232 Setup Form for the system.

Figure 176 – RS232 Setup Button

After the form opens a list of all selectable parameters will be displayed as well as the Universal Asynchronous Receiver/Transmitter (UART) settings. To setup a channel:

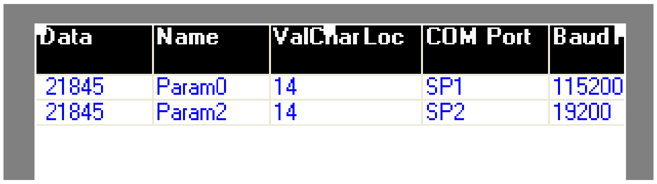
1. Select and enable desired UART port by clicking on a UART folder tab.



Click to select and enable desired UART port.

Figure 177 – RS232 Setup Form

2. Set the UART baud rate, data bits, stop bits, and parity. The baud rate is only limited by the receiving hardware.
3. Check the parameters for the selected port.
4. Press Done to update RS232 Param Display and to apply changes to the hardware.
5. Place the selected parameters into a tabular display and output them through the UART BNC.



Data	Name	ValCharLoc	COM Port	Baud
21845	Param0	14	SP1	115200
21845	Param2	14	SP2	19200

Figure 178 – RS232 Parameter Display

A parameter will only be output through the UART BNC if it is in a parameter display and the assigned valid character bit is high.

6.6.2 Valid Character Bit

The Ulyssix RS232 Output feature allows the user to select a single bit of the desired parameter to function as the valid character bit. When this bit is high (binary value of 1), the parameter data is valid and the parameter is output through the UART BNC. If the bit is low (binary value of 0), the data is invalid and the parameter is not output via the UART BNC.

The Valid Character bit is set on each parameter's Parameter Edit/Add form. To open this form, double-click the parameter in the Parameter View screen.

The Valid Character bit is defined according to the parameter bit mapping. For example, if a parameters LSB (least significant bit) is defined as bit 0, and the Valid Character bit is set to bit 1, this indicates that the Valid Character bit is the second least significant bit of the parameter.

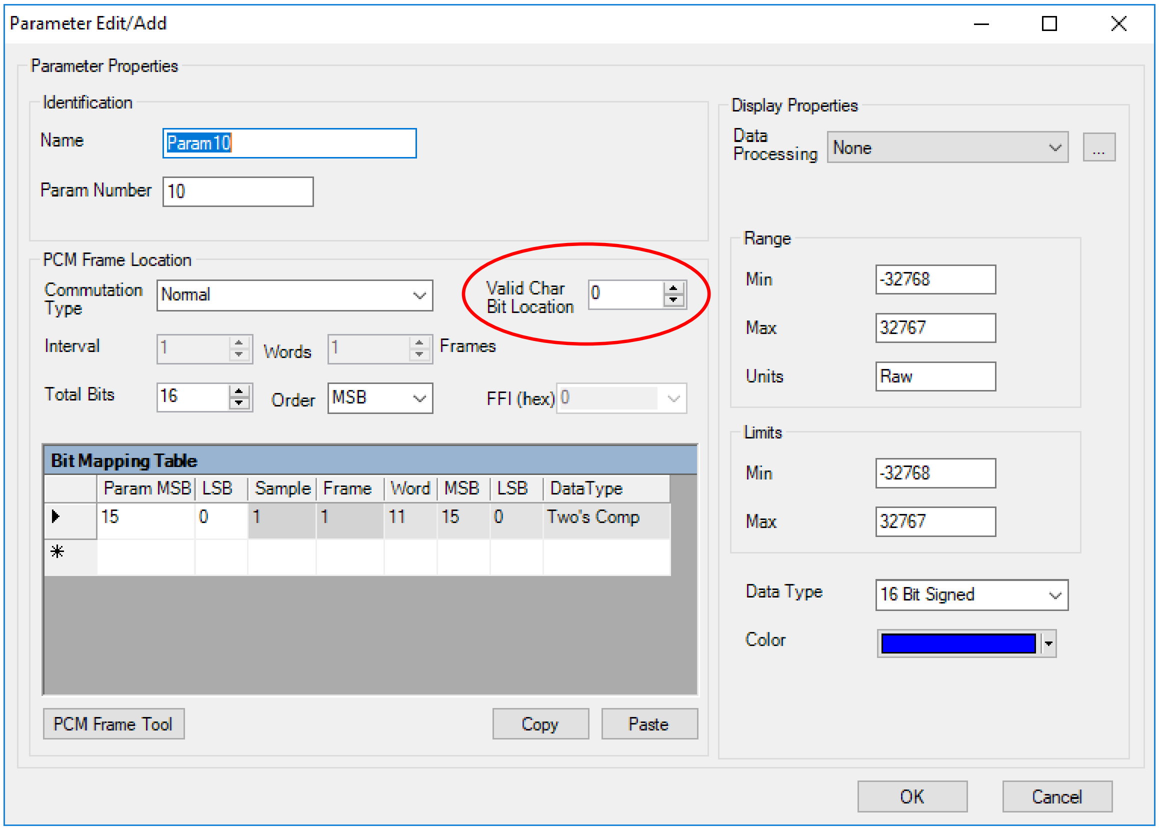


Figure 179 – Parameter Edit/Add Form

6.7 CVSD Audio Output Option

The CVSD Audio Option takes embedded audio from the telemetry stream and plays it out of the computer sound card. A sound card with external speakers is required for this option. The CVSD Audio Option played both uncompressed embedded audio and CVSD compressed embedded audio.

The CVSD Audio Output Option is selected by selecting a Decom from a Ulyssix PCM Card and then selecting "Auto Output" from the Decom menu. Or by selecting the Audio Output icon from the toolbar.

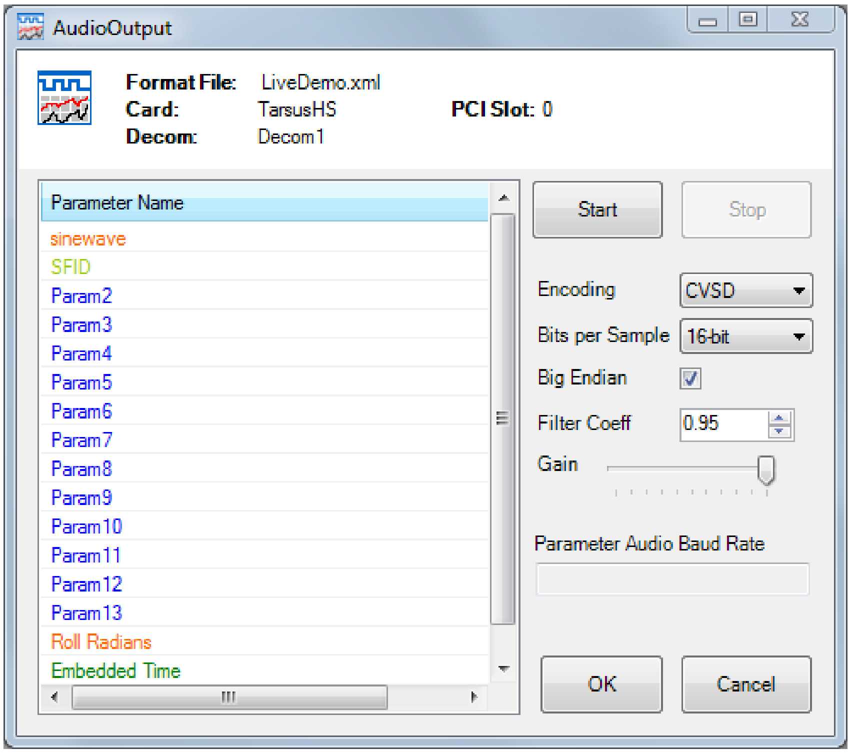


Figure 180 – Audio Output Form

The list on the left-hand side of the window contains all of decom parameters for the selected decom. The controls for the Audio output on are the right side.

1. Start – This button starts the audio playback. It disables all the controls except for the Gain.
2. Stop – This button stops the audio playback.
3. Encoding – This drop-down box has the option for CVSD or Raw. Raw is uncompressed audio.
4. Bits per Sample – This drop-down box selects the encoding for the audio. The options are 16-bits or 8-bits. Please contact Ulyssix for other Bits per Sample options.

5. Big Endian – This check boxes indicates if the data is in Big Endian or Little-Endian format. Typically, Big Endian is used if the decom parameter is configured correct.
6. Filter Coeff – This control allows the user to decrease the cut off frequency for the low pass filter. Reducing the value from the default 0.95 will decrease the noise in the audio at the cost of both gain and frequency range. The maximum allowed value is 1.00 and the minimum allowed value is 0.50.
7. Gain – This slider controls a digital gain for the audio. Reducing the digital gain can reduce audio clipping and signal distortion.
8. Parameter Audio Baud Rate – This displays the Audio Baud rate for the selected signal and settings. This value should match the audio baud rate specified for the telemeter.

6.8 Real Time Simulator Option

The Real Time Simulator feature allows the user to change the values of predefined fixed value parameters in the PCM Fixed Frame Simulator using a slide bar or numeric entry. This feature is designed to trigger warning level for parameters.

Begin by setting up the major frame simulator. Below, is a simulator with five parameters defined: Sine, Param2, Param3, Time0, and Time1. There are two new buttons: Start Stream and Stop Stream. These buttons start and end the Real Time Simulator.

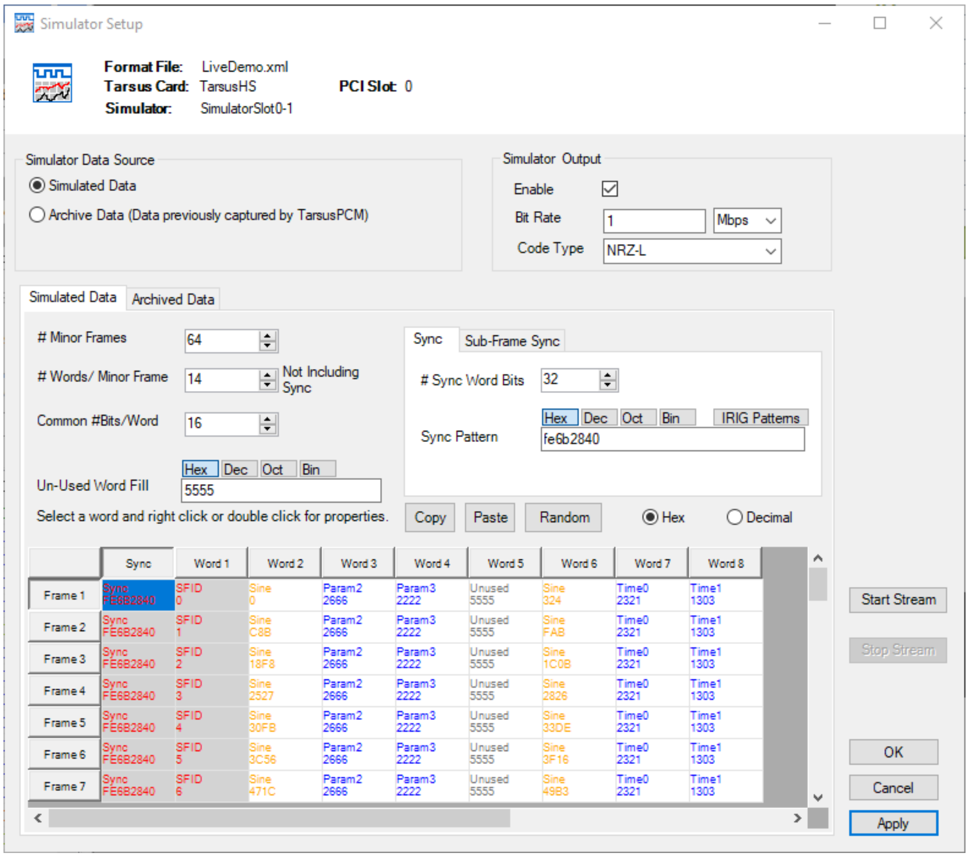


Figure 181 – Simulator Form with Real Time Simulator Licensed Feature

Clicking the Start Stream button begins the Real Time Simulator and launches the Simulator Channel Control form. The form contains two sections. The top section determines how many Channel Controls are below and how the data is displayed. The bottom section contains the Channel Controls.

Form Controls

1. The Num of Controls numeric control determines how many Channel Controls are displayed in the form. The form is resizable to fit as many controls as desired.
2. The Hex and Decimal radio buttons determine if the values are displayed in decimal or hexadecimal format.

Channel Controls

1. Left and Right Arrow – Select the simulator channel for the control. The right arrow increases the channel number. The left arrow decreases the channel number.
2. Channel # – This is either the channel number or channel name of the selected simulator channel.
3. Word – This is the PCM word number in the frame for the selected simulator channel.
4. Frame – This is the frame number where the word first occurs. This will always be one for Normal and Super Commutated words.
5. Comm Type – The commutation type for the selected simulator channel.
6. Bits: The number of bits in the selected simulator channel.
7. Param Type – This displays the value for Fixed Value simulator channels and the function name for Function simulator channels.
8. Data Type – Sets the data computation value for the Control channel. Binary allows values from 0 to 2^n -1 where n is the number of bits in the simulator channel. Two's Compliment allows from -2^(n-1) to 2^(n-1)-1 where n is the number of bits in the simulator channel.
9. Value – There is a numeric control and a slider control. These two controls are tied together; changing one changes the other. Changing the value of either control changes the value in the PCM Simulator for this simulator channel.

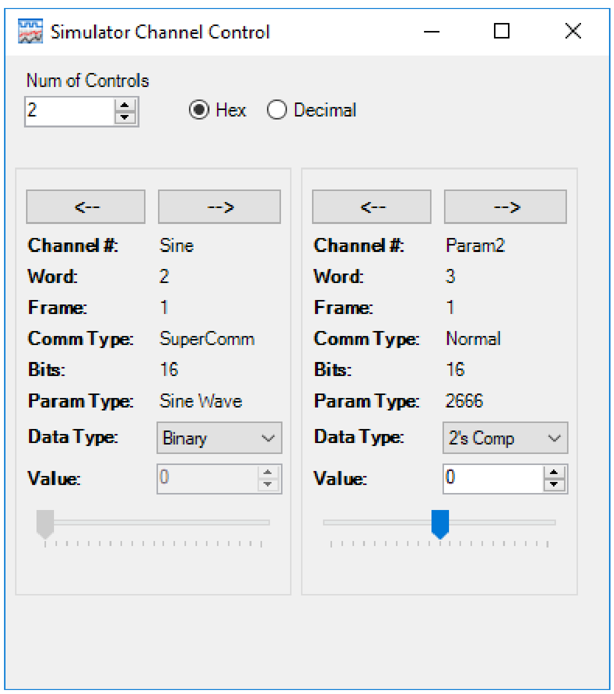


Figure 182 – Simulator Channel Control Form

In the example below, we examine Param2. The current value in the Channel Control is zero. This is the same value displayed on the strip chart and the numeric display in the first image. In the second image, the value is changed to 6553. The third image shows a value of -16384. This is below the limit of -1600 set for Parm2 and the meter shows the "Low Limit" warning.

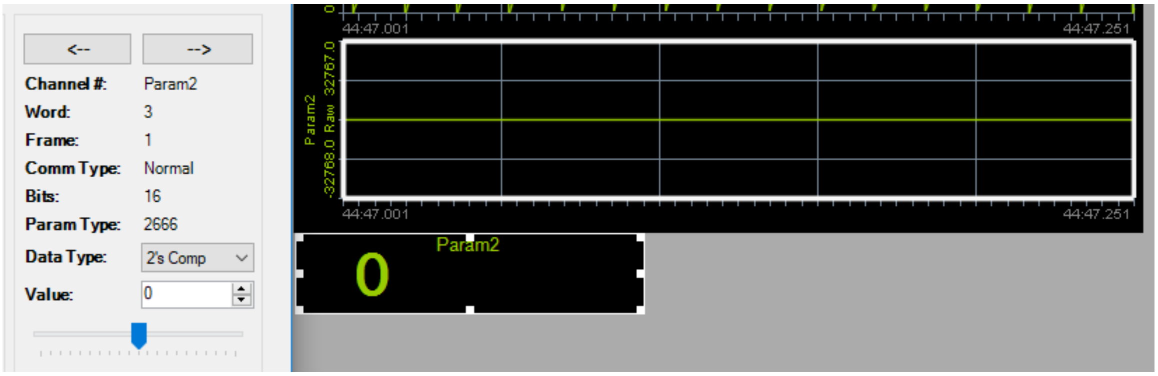


Figure 183 – Channel Control Form Value of 0

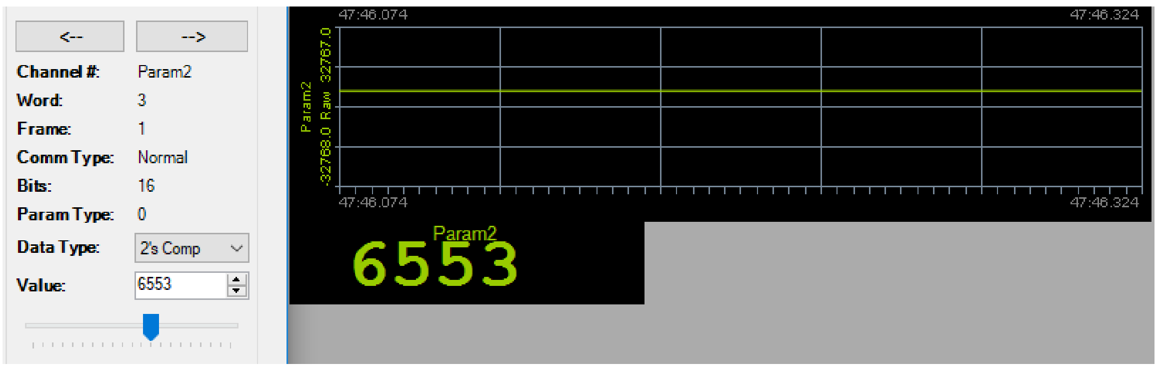


Figure 184 – Channel Control Form Value of 6553

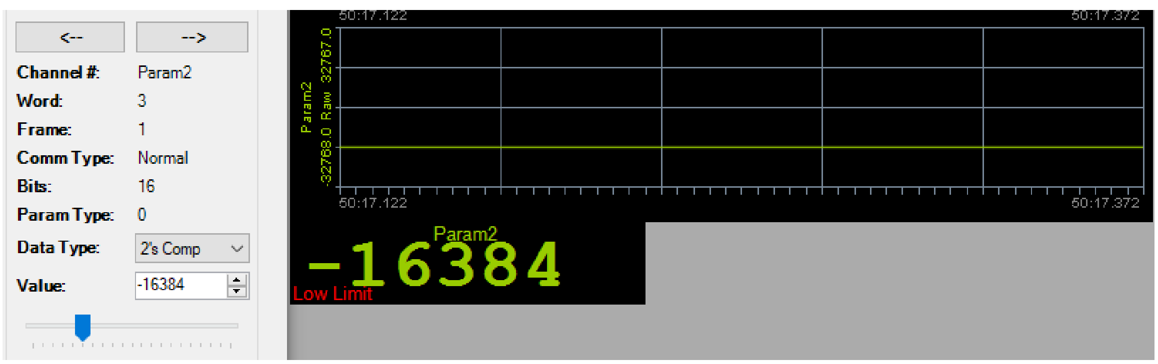


Figure 185 – Channel Control Form Value of -16384 and Low Limit Violation

If the strip chart is zoomed out far enough, dragging the slider left to right will cause an oscillation in the strip chart.

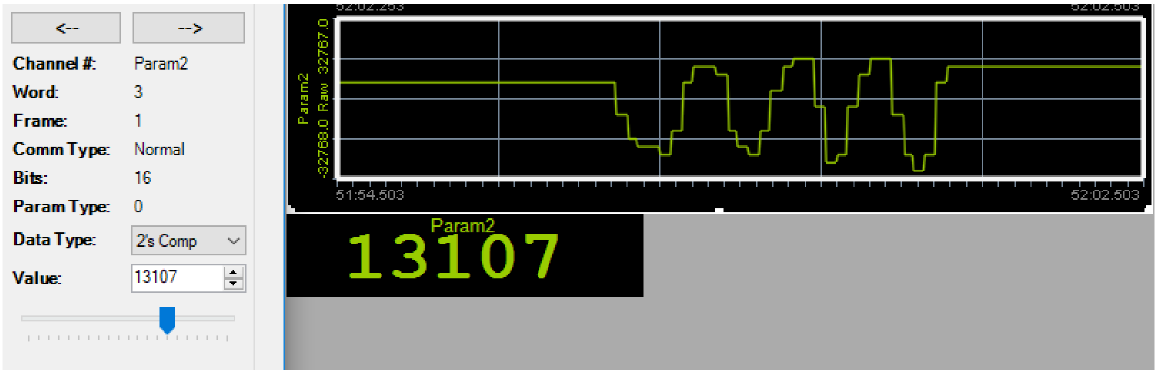


Figure 186 – Channel Control Form and Oscillation in the Strip Chart

6.9 IRIG Time Output Option

The IRIG Time Output feature plays amplitude modulate time code out of the DAC1 BNC. The available time codes are IRIG-B (B123) and NASA 36. The IRIG Time Output is accessible in the Time Setup Form as well as part of the Archive Simulator in the Simulator Setup Form.

Time Setup Form

In the Time Setup form, the Time Code Output controls are only available if the feature is licensed. The seed time for the IRIG Time Output can be set to the current computer time or seeded to any day of the year, hour, minute, second, and millisecond. The time output does not start until the Apply or OK button is pressed.

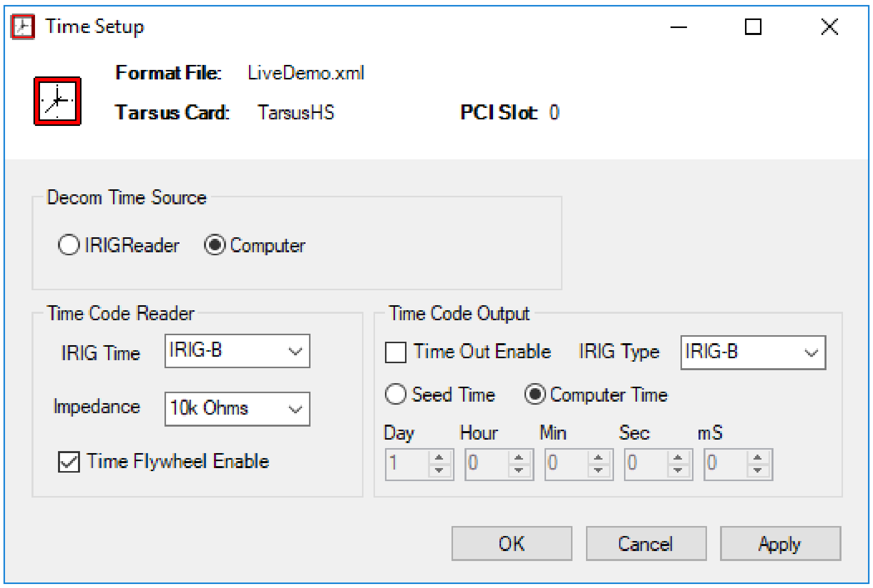


Figure 187 –Time Setup form with IRIG Time Output Controls

1. Time Out Enable – This checkbox determines if the IRIG Time is output from the DAC1 BNC.
2. IRIG Type – This combo box selects the IRIG Time Type. The available sections are IRIG-B and NASA 36.
3. Seed Time and Computer Time – This radio button determines if the time output seed is from the computer time or from a user specified time. Selecting Seed Time causes the numeric controls for Day, Hour, Min, Sec, and mS to become enabled.
4. Day – Sets the Julian Calendar day of the year. Valid from 0 to 365 (365 is for leap year).
5. Hour – Sets the hour of the day from 0 to 23.
6. Min – Sets the minute. Valid from 0 to 59.
7. Sec – Sets the second. Valid from 0 to 59.
8. mS – Sets the millisecond. Valid from 0 to 999.

Archive Simulator

IRIG Time Output has controls inside of the Archive Simulator. The IRIG Time Output works in conjunction with the Archive Simulator on both TAD and Chapter 10 Files (Licensed Feature).

Below the Start Transfer button, there is a check box to enable the Time Output and a combo box to set the IRIG Time Type. The available choices for the IRIG Time Type are IRIG-B and NASA 36. Before pressing the Start Transfer button, select the desired IRIG Time Type and check the Time Output check box. Click the Start Transfer button and the PCM data flows out of the Simulator BNC and IRIG Time flows out of the DAC1 BNC.

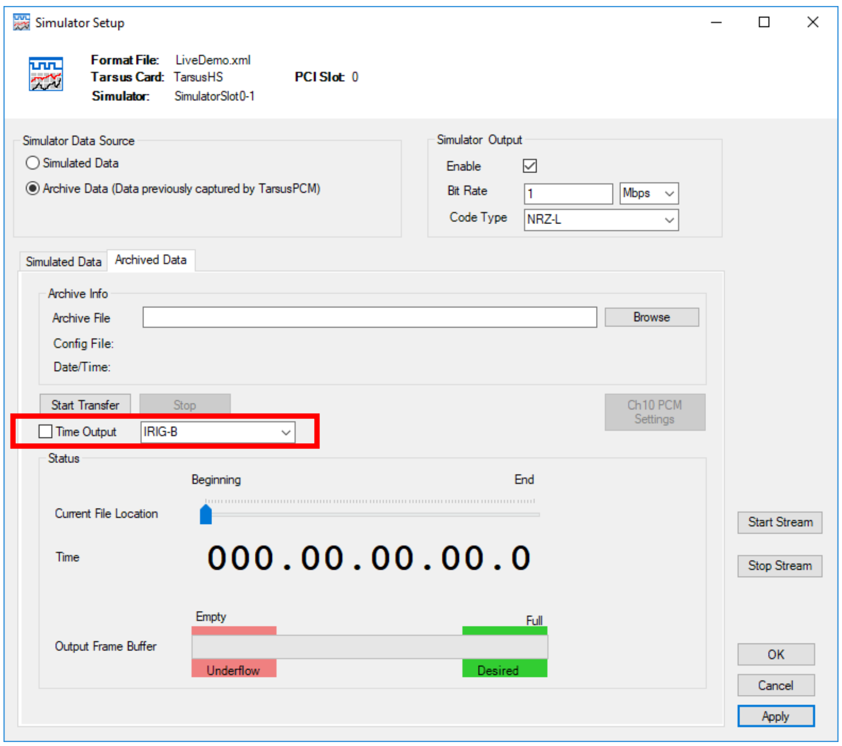


Figure 188 –Archive Simulator form with IRIG Time Output Controls

6.10 Bald Eagle RF Transmitter

The Bald Eagle RF Transmitter feature includes one transmitter per receiver channel on the card. A Bald Eagle RF has one transmitter. The Transmitter setup is accessible as a tab inside of the Receiver Setup window.

The transmitter power range is approximately 0 dBm to -80 dBm, depending on the selected frequency band. The frequency bands include C Band (4400 to 5250 MHz), S Band (2185 to 2485 MHz), L Band (1420 to 1850 MHz), Extended P Band (1150 to 1230 MHz), P Band (200 to 500 MHz), and IF (50-90MHz).

The transmitter produces a continuous wave or modulated signal. The source for the modulator is either the Bald Eagle RF simulator or the RF down converted signal from the receiver. Setting the transmitter source to the receiver's down converted signal is referred to as the Frequency Translator. The Frequency Translator take an input of a RF signal at one frequency and then transmits at a different frequency. This is useful for moving a signal between frequency bands, like from S Band to C Band, for testing purposes.

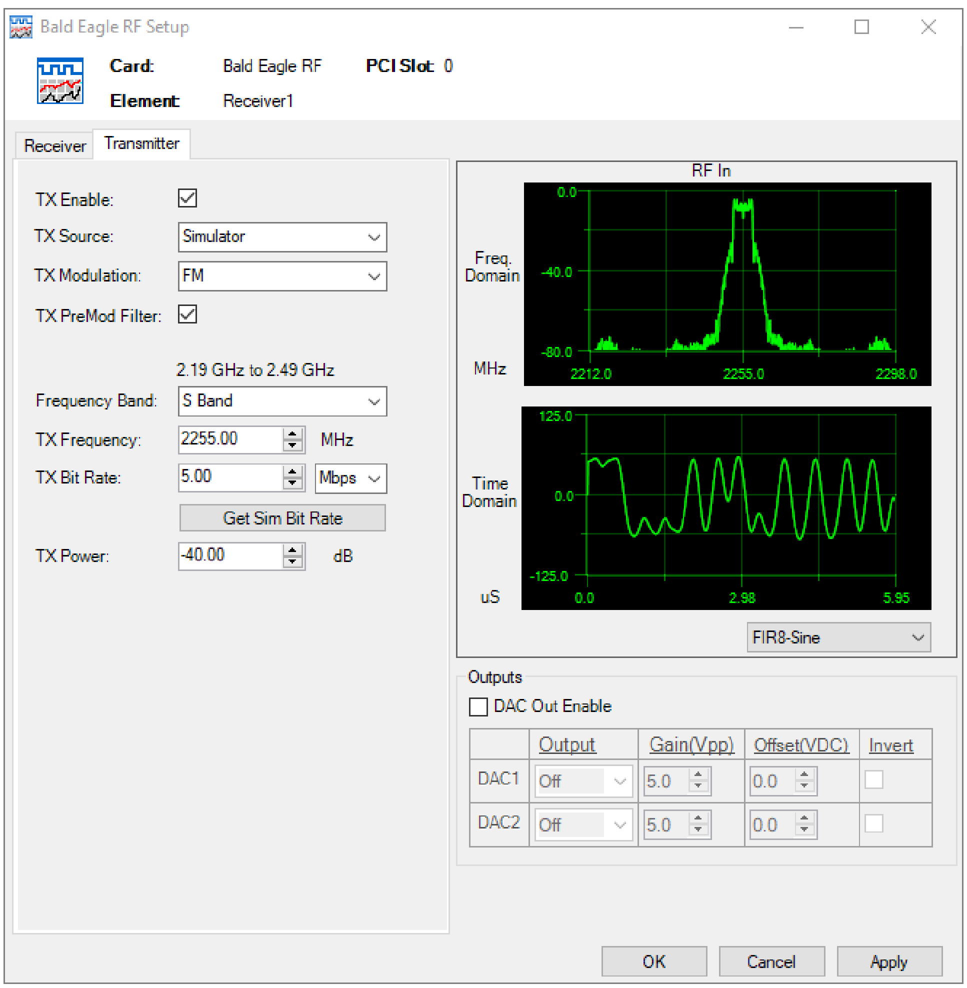


Figure 189 – Bald Eagle RF Transmitter Setup

1. Tx Enable – This checkbox enables and disables the transmitter power.
2. Tx Source – This combo box selects the input source for the transmitter. There are three options. They are Freq Translator, Simulator, and TTL Input. The Freq Translator option uses the down converted signal from the Receiver as the data source for the transmitter. The Simulator option uses the PCM data from the Bald Eagle RF's simulator and the modulator for the data source of the transmitter. The TTL Input uses the external DECOM IN BNC's as an external PCM TTL input stream to modulate the Bald Eagle RF transmitter.
3. Tx Modulation – This combo box sets the modulation scheme for the transmitter. The options are CW (Continuous Wave), FM, BPSK, and QPSK. CW sets the transmitter to output an unmodulated continuous wave at the Tx Frequency. FM, BPSK, QPSK, and SOQPSK use a modulator to create the baseband modulated signal from the PCM Simulator data.
4. Tx PreMod Filter – This checkbox turns on and off the pre-modulation filter for PCM data. This option is not available when the Tx Modulation is set to CW.
5. Frequency Band – This combo box selects the frequency band for the transmitter. The allowed bands are: C Band. S Band, L Band, Extended P Band, P Band, and IF. The frequency range for the selected band is displayed next to the combo box. The selection of the Frequency Band sets the range of allowed values for the Tx Frequency control.
6. Tx Frequency – This numeric entry sets the desired RF carrier frequency for the transmitter. Entries are in the units of MHz and the allowed range is set by the selection in the Frequency Band combo box.
7. Tx Bit Rate – The numeric entry and combo box set the Bit Rate value and Bit Rate Units for the modulator. This value is used as part of the settings for the modulation of the PCM Simulator data.
8. Get Rx Bit Rate – This button sets the Tx Bit Rate numeric entry and Tx Bit Rate Units combo box to the values for the receiver. This is a one click way to set up a full loop RF test.
9. Tx Power – This numeric control sets the output power of the transmitter. Allowed values are from 0 dB to -100 dB even though the minimum power specification is -70 dB. The true output power is limited based on the selected frequency band.

Chapter 7 Appendix A – Installation Troubleshooting/Problems

Troubleshooting problems with the installation is broken into two categories: Hardware Detection and Video Adapter Support.

7.1.1 Hardware Detection

One common problem when installing hardware-based software is the installation of the device drivers.

The first step in trouble shooting hardware installation is to determine whether the ALTAIR software recognizes the hardware. Complete the following steps to determine this:

1. Start the ALTAIR software and verify under the ***Tools/Options*** screen that the "Automatically Scan Hardware on New Configuration" option is checked.
2. On the main screen of the Tarsus software, click on the "New" toolbar button.
3. Verify the hardware installed is displayed in the **Hardware Explorer** window. (See **4.1.2 Hardware Explorer Window**) If the hardware is not detected, continue to the next step.
4. Verify that Windows has identified the newly installed hardware. Open the Control Panel/System window. Select the Hardware tab and then click on the **Device Manager** button.
5. If your system is running the Jungo driver, open the Jungo folder in the hardware list. The display should look similar to **Figure 190 – Device Manager Jungo Driver**.
6. If your system is running the Ulyssix driver, open the Ulyssix Technologies, Inc folder in the hardware list. The display should look similar to **Figure 191 – Device Manager Ulyssix Driver**.

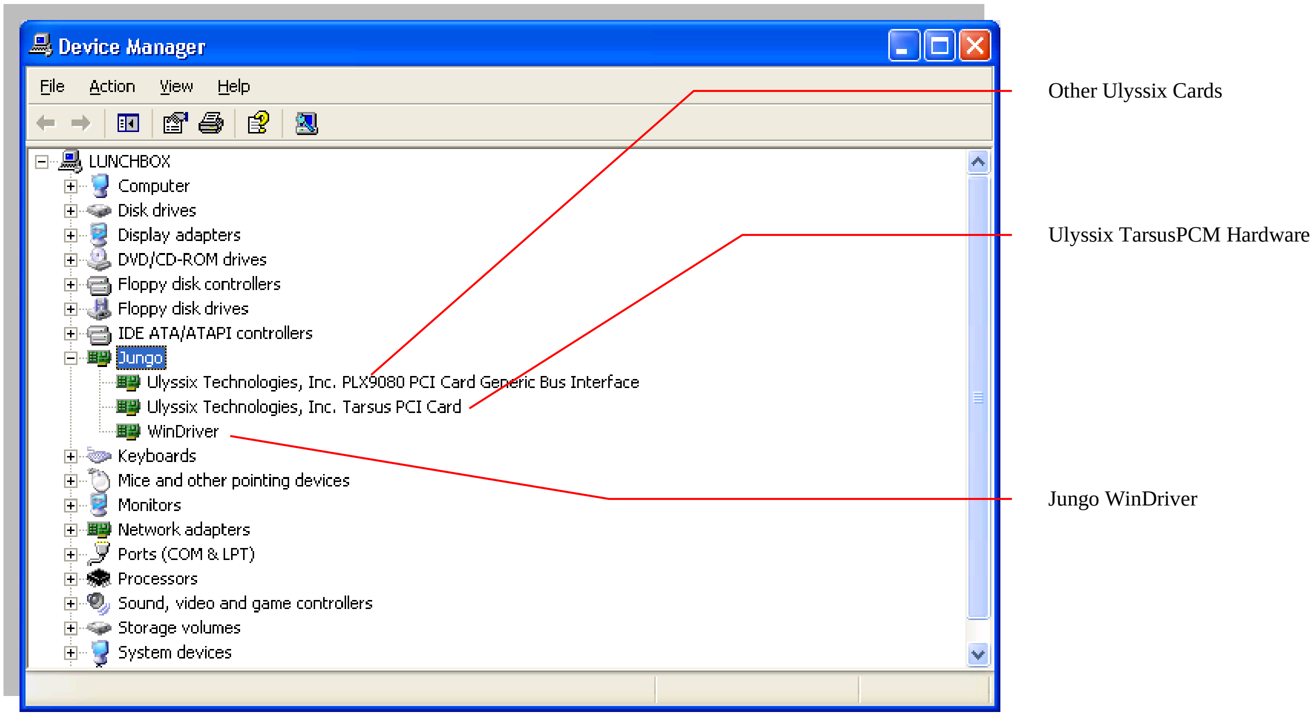


Figure 190 – Device Manager Jungo Driver

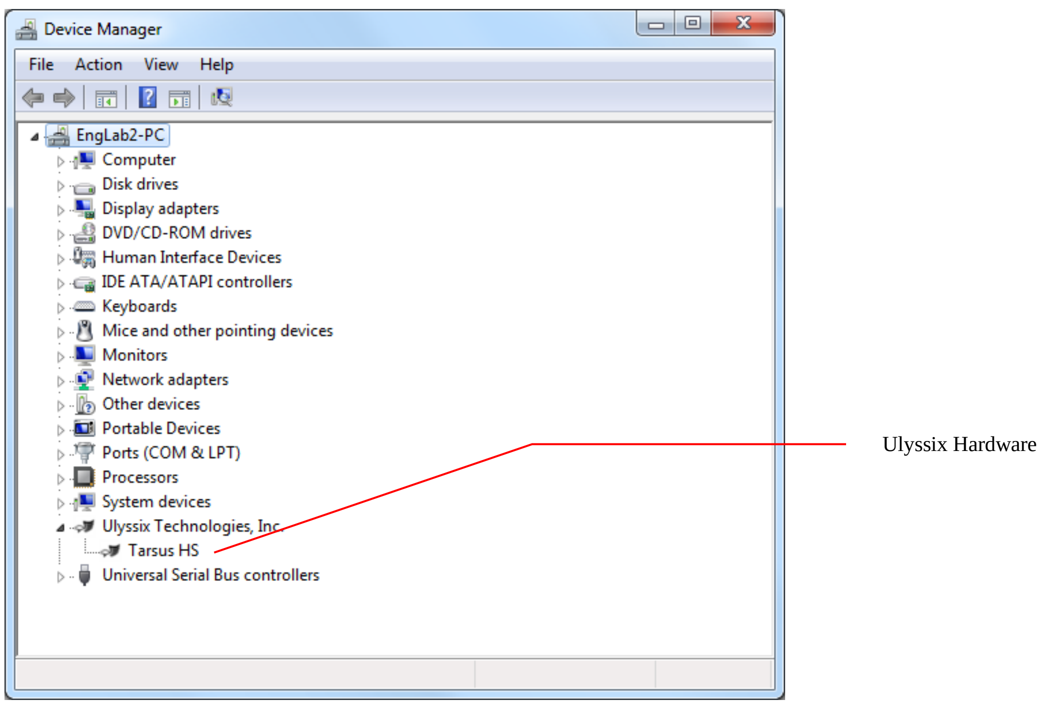


Figure 191 – Device Manager Ulyssix Driver

7. If the device manager does not show the Ulyssix card, the next step is to look for any devices that say “Unknown PCI Bridge Device” or “Unknown PCI Device

Type." This indicates that the hardware is not properly associated with the installed driver.

8. In the menu of Device Manager, select Action → Scan for Hardware Changes. This force a hardware scan with Windows Plug and Play. The Device Manager will update hardware when done.
9. Contact the factory for additional help.

Chapter 8 Appendix B – Archive Data Files Explained

Archive files recorded by the ALTAIR software are binary files containing data from either the Decom or Frame Sync circuitry of the ALTAIR hardware. The archive data files begin with a 328-byte File Header. After the File Header, the rest of the file is composed of minor frame blocks. Each minor frame block begins with a 12-byte Minor Frame Header, which contains the time stamp of the minor frame and lock indicator information. After the Minor Frame Header, the minor frame data follows. All archive data files end with the extension ".tad" (Tarsus Archive Data). This section of the manual explains the format of the archive data.

For a Decom archive file, the PCM data is received in the hardware, bit synchronized, frame synchronized, and then decommutated. The decommutated data is word aligned and stored into a large dual port memory device. This byte aligned data is stored as the minor frame data in the archive file.

For a Frame Sync archive file, the PCM data is received in the hardware, bit synchronized, and frame synchronized. The minor frame data is packed into a bit stream and stored into a large dual port memory device. This continuous bit stream data is stored as the minor frame data in the archive file.

8.1 Data Storage Format

The Tarsus3 hardware and ALTAIR software stores archive data in "Little Endian" format. "Little Endian," derived from the phrase "Little End In," means the little end of the data is stored in memory first. For example, 0x12345678 would be stored in memory as (0x78 0x56 0x34 0x12).

8.2 File Header Definition

Each archived data file contains one file header structure. The file header is stored to indicate the date, time, and configuration file used during the archive sequence. All file header data is in ASCII characters to allow viewing with a standard text editor. The header consists of 328 bytes and is defined as follows:

10 bytes – Signature
12 bytes – Version
22 bytes – Date/Time **Note:** Time stamped when the file is created
260 bytes – Configuration file and path
12 bytes – Input Data Source (Either "Frame Sync" or "Decom")
1 Unsigned Integer (32 bits) - Bits/Minor Frame
1 Unsigned Integer (32 bits) - Spare
1 Unsigned Integer (32 bits) – Spare

8.2.1 File Header Example

```
00000000  54 61 72 73 75 73 50 43  4D 00 31 2E 38 2E 32 2E  TarsusPCM.1.8.2.
00000010  32 00 00 00 00 00 32 2F  31 31 2F 32 30 30 35 20  2.....2/11/2005
00000020  31 31 3A 34 39 3A 35 38  20 41 4D 00 43 3A 5C 50  11:49:58 AM.C:\P
00000030  72 6F 67 72 61 6D 20 46  69 6C 65 73 5C 55 6C 79  rogram Files\Uly
00000040  73 73 69 78 5C 54 61 72  73 75 73 50 43 4D 5C 43  ssix\TarsusPCM\C
00000050  6F 6E 66 69 67 75 72 61  74 69 6F 6E 46 69 6C 65  onfigurationFile
00000060  73 5C 64 65 6D 6F 2E 78  6D 6C 00 00 00 00 00 00  s\demo.xml......
00000070  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
00000080  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
00000090  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
000000a0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
000000b0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
000000c0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
000000d0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
000000e0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
000000f0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
00000100  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
00000110  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
00000120  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
00000130  46 72 61 6D 65 53 79 6E  63 00 00 00 00 02 00 00  FrameSync.......
00000140  00 00 00 00 00 00 00 00                           ........
```

File Header Information
Signature = TarsusPCM
Version = 1.8.2.
Date/Time = 2/11/2005 11:49:58 AM
Configuration File = C:\Program Files\Ulyssix\TarsusPCM\ConfigurationsFiles\demo.xml
Source = Frame Sync

Figure 192 – Archive File Header Example

8.3 Minor Frame Header Definition

As stated above, header data precedes every minor frame in the archive file. The header contains time in Binary Coded Decimal (BCD) along with various status indicators. The time stamp for each minor frame occurs at the first bit on the frame sync pattern. The header data is defined as three 32 bit-data words with the following format.

<table>
<tr><th rowspan="5">32 BIT WORDS</th><th colspan="33">BITS</th></tr>
<tr><td></td><td>31</td><td>30</td><td>29</td><td>28</td><td>27</td><td>26</td><td>25</td><td>24</td><td>23</td><td>22</td><td>21</td><td>20</td><td>19</td><td>18</td><td>17</td><td>16</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td colspan="4">0000</td><td colspan="4">100's days</td><td colspan="4">10's days</td><td colspan="4">1's days</td><td colspan="4">10's hours</td><td colspan="4">1's hours</td><td colspan="4">10's minutes</td><td colspan="4">1's minutes</td></tr>
<tr><td>1</td><td colspan="4">10's seconds</td><td colspan="4">1's seconds</td><td colspan="4">100's msec</td><td colspan="4">10's msec</td><td colspan="4">1's msec</td><td colspan="4">100's usec</td><td colspan="4">10's usec</td><td colspan="4">1's usecs</td></tr>
<tr><td>2</td><td colspan="16">Minor Frame Count</td><td>TC R Bit</td><td>TC F Bit</td><td>I/E</td><td>Slip</td><td colspan="4"># Sync Errors</td><td>B Lock</td><td colspan="2">SF Lock</td><td colspan="2">MF Lock</td><td colspan="3">FFI</td></tr>
</table>

Table 8 – Archive Data Header Definition

- TC R Bit: Time Code Reader Status Bit
- TC F Bit: Time Code Flywheel Status Bit
- I/E: Bit Sync Source (0 = Internal, 1=External)
- Slip: Bit Slip (1 = yes, 0 = no)
- B Lock: Bit Sync Loop Lock
- SF Lock: Sub-Frame Lock (2 = Lock, 1 = Check, 0 = Search)
- MF Lock: Minor Frame Lock (2 = Lock, 1 = Check, 0 = Search)
- FFI: Current Format # Indicator

8.4 Data Description

The Ulyssix hardware aligns the archived Decom data on 16-bit boundaries regardless of the PCM word size. The 16-bit alignment provides an efficient way of extracting a single word of data out of the archive file. The PCM data will always be right justified in a 16-bit word. For example, a 12-bit PCM word with a value 0x444 hexadecimal followed by another word with a value of 0x555 hexadecimal will show up in the archive file as 0x04440555. This value can be broken into four hexadecimal bytes: 0x04, 0x44, 0x05, and 0x55.

The ALTAIR hardware bit packs the archive Frame Sync data. The bit packing provides a smaller data size, however it makes extracting a single word of data out of the archive file more difficult. For example, a 12-bit PCM word with a value of 0x444 hexadecimal followed by another word with a value of 0x555 hexadecimal will show up in the archive file as0x 444555. This value can be broken into three hexadecimal bytes: 0x44, 0x45, and 0x55.

The following examples show the actual archived data using a hexadecimal viewer application:

8.4.1 Archive Data 32-Bit Sync 16-Bit Data

For this configuration, a Decom Archive File and a Frame Sync Archive file will have identical data. Since the Frame Sync and Word Size are both integer multiples of 8-bits, the byte aligned Decom archive data and the bit stream Frame Sync archive data are identical.

Sync Pattern Size: 32 bits
Sync Pattern: FE6B2840
Minor Frames: 1
Words per Frame: 16

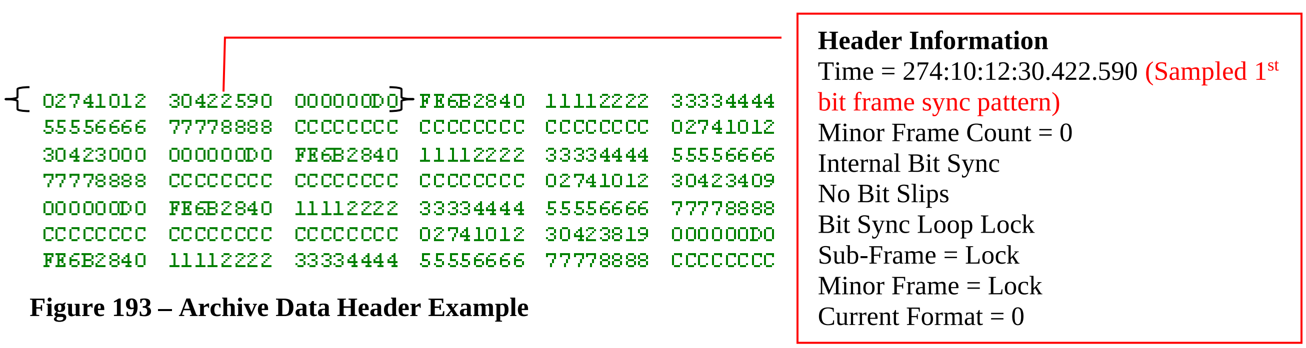


Figure 193 – Archive Data Header Example

02741012	30422590	000000D0	FE6B2840	11112222	33334444
55556666	77778888	CCCCCCCC	CCCCCCCC	CCCCCCCC	02741012
30423000	000000D0	FE6B2840	11112222	33334444	55556666
77778888	CCCCCCCC	CCCCCCCC	CCCCCCCC	02741012	30423409
000000D0	FE6B2840	11112222	33334444	55556666	77778888
CCCCCCCC	CCCCCCCC	CCCCCCCC	02741012	30423819	000000D0
FE6B2840	11112222	33334444	55556666	77778888	CCCCCCCC

Data Information
Word 1 = 1111
Word 2 = 2222
Word 3 = 3333
Word 4 = 4444
Word 5 = 5555
Word 6 = 6666
Word 7 = 7777
Word 8 = 8888
Word 9 – 14 = CCCC

Figure 194 – Archive Data Example

8.4.2 Archive Data 24-Bit Sync 12-Bit Data

For this Frame Sync configuration, the Decom archive data will have leading zeros as the 12-bit decom word is packed into a 16-bit space. The Frame Sync archive will not have the leading zeros; therefore, the Frame Sync Archive minor frame will take up fewer bytes than the Decom Archive minor frame.

Sync Pattern Size: 24 bits
Sync Pattern: FAF320
Minor Frames: 1
Words per Frame: 8

02860949	31131514	000000D0	00FAF320	01110222	03330444	05550666	07770888
02860949	31131633	000000D0	00FAF320	01110222	03330444	05550666	07770888
02860949	31131752	000000D0	00FAF320	01110222	03330444	05550666	07770888
02860949	31131870	000000D0	00FAF320	01110222	03330444	05550666	07770888
02860949	31131989	000000D0	00FAF320	01110222	03330444	05550666	07770888
02860949	31132107	000000D0	00FAF320	01110222	03330444	05550666	07770888
02860949	31132226	000000D0	00FAF320	01110222	03330444	05550666	07770888

Data Information
In (Hexadecimal)
Word 1 = 0111
Word 2 = 0222
Word 3 = 0333
Word 4 = 0444
Word 5 = 0555
Word 6 = 0666
Word 7 = 0777
Word 8 = 0888

Figure 195 – 12-bit Archive example

00000000	00043000	000010B0	FAF32001	11222333	44455566	67778880
00000000	00043000	000010B0	FAF32001	11222333	44455566	67778880
00000000	00043000	000010B0	FAF32001	11222333	44455566	67778880
00000000	00043000	000010B0	FAF32001	11222333	44455566	67778880
00000000	00043000	000010B0	FAF32001	11222333	44455566	67778880
00000000	00043000	000010B0	FAF32001	11222333	44455566	67778880
00000000	00043000	000010B0	FAF32001	11222333	44455566	67778880

Data Information
In (Hexadecimal)
Word 1 = 111
Word 2 = 222
Word 3 = 333
Word 4 = 444
Word 5 = 555
Word 6 = 666
Word 7 = 777
Word 8 = 888

Figure 196 – 12-bit Frame Sync Archive Example

Chapter 9 Appendix C – Tarsus3 and Bald Eagle RF Cables and Panels

The Tarsus3 cable is designed for optimum performance up to 40 Mbps. The type and quality of the interconnection cable affects any system running high speed data. The type of coax cable used for the Tarsus3 pigtail connector is RG179 75-ohm BNC (see the figure below). Ulyssix recommends using 75- ohm cables (either RG59 or RG179 coax cable) to connect to the Tarsus3 hardware. For applications below 5 Mbps, the impedance matching of the mating cables is not as critical.

The Tarsus3-cPCI card only occupies one slot in the cPCI chassis, however a larger cPCI panel is available with bulk mounted connectors. This allows direct connection of cables to the Tarsus3-cPCI without the need for the pigtail.

Figure 197 – Tarsus3 -01/-02 Pigtail Connector

Figure 198 – Tarsus3 Panel Connectors in a cPCI Chassis

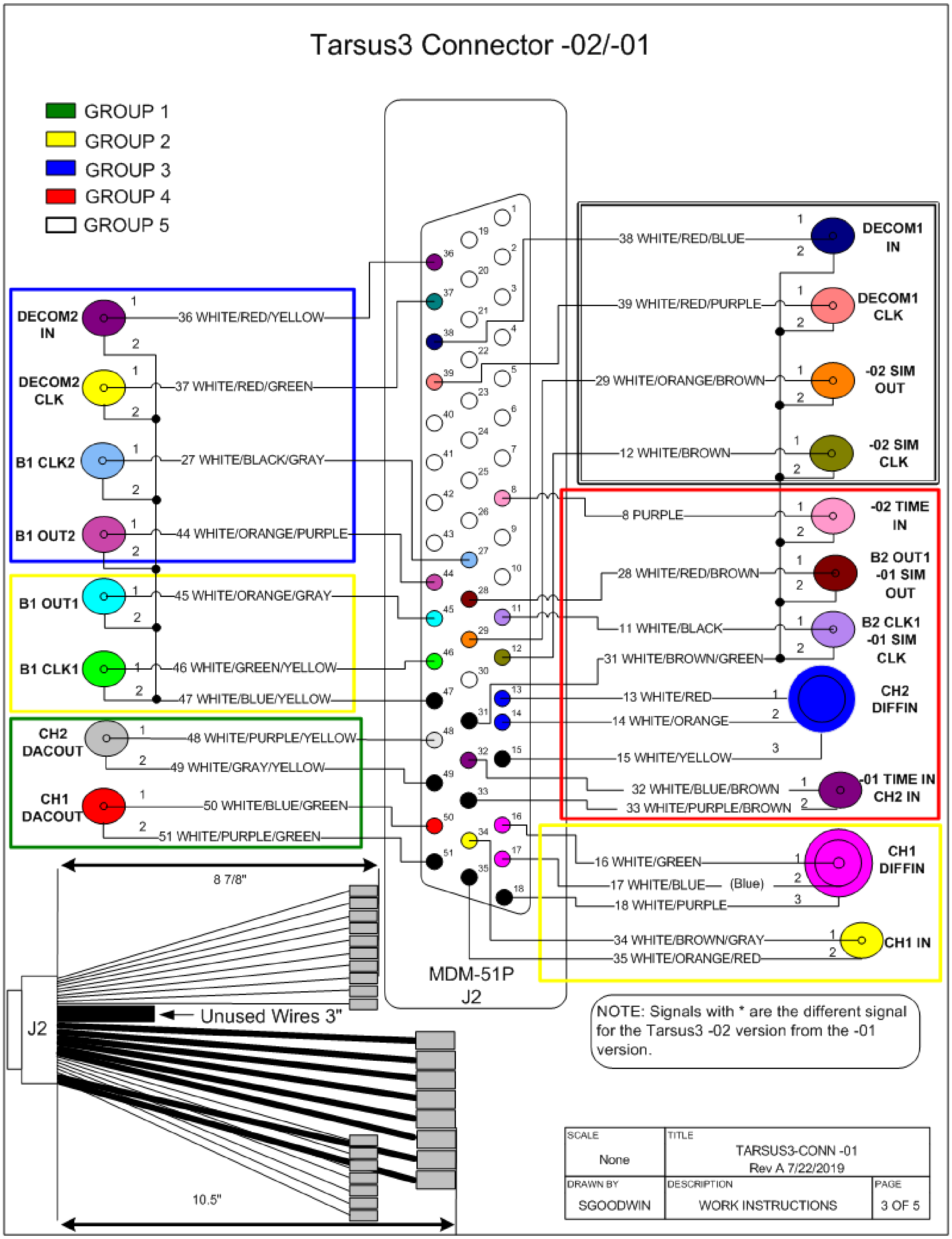


Figure 199 – Tarsus3-02/-01 Connector Diagram Part 1

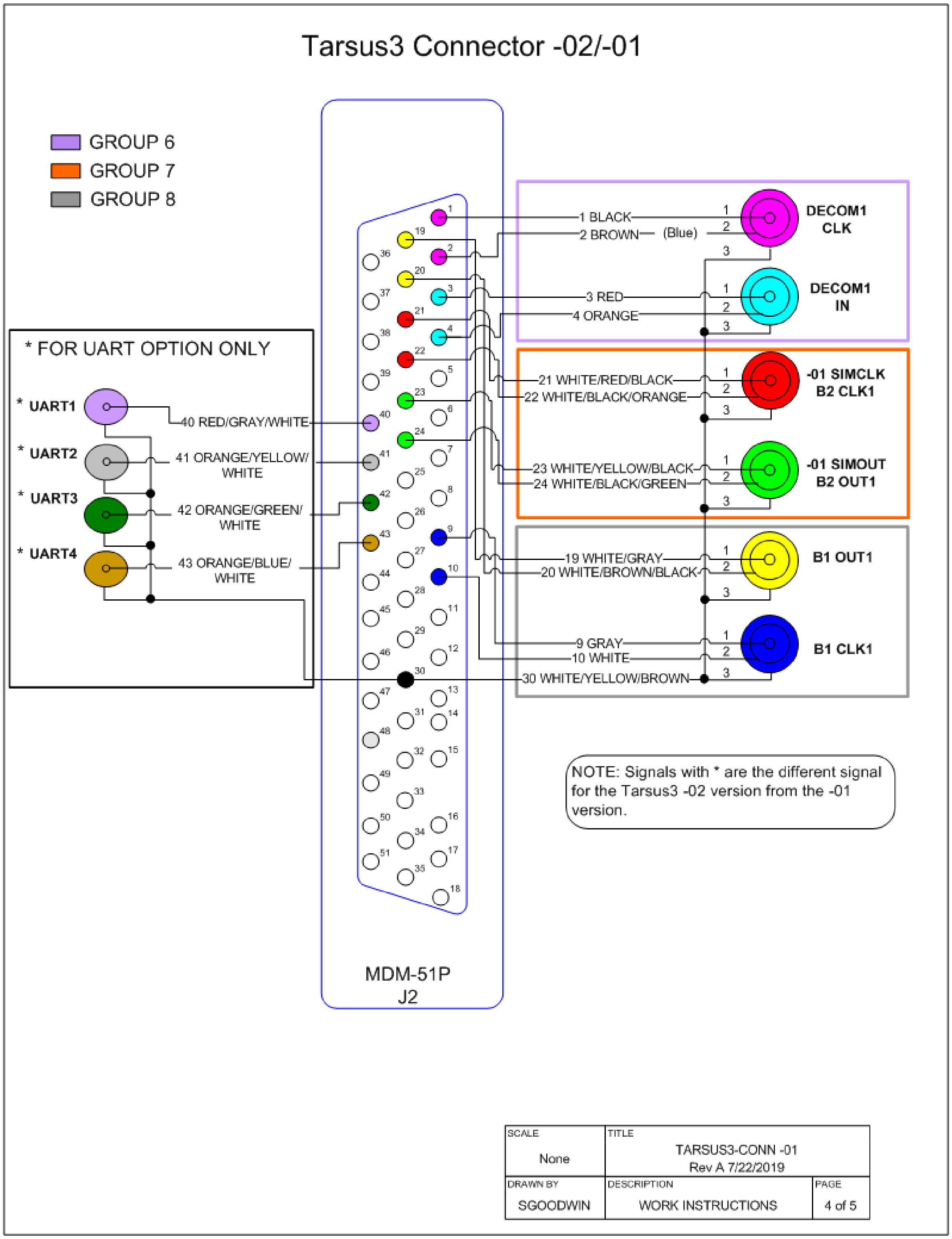


Figure 200 – Tarsus3-02/-01 Connector Diagram Part 2

Chapter 10 Appendix D – Bald Eagle RF Connections RF

The Bald Eagle RF is designed for optimum performance up to C Band at 56 MHz of bandwidth. The quality of any system running high RF frequencies and bandwidth is greatly affected by the type and quality of the interconnection cables. The Bald Eagle RF uses SMA connectors for the receiver inputs and the transmitter outputs. Care should be taken not only for the type of cabling used for the RF signals but also to any converters from SMA to other connectors.

The Bald Eagle RF also has a Data Out port for baseband I and Q data output. Please contact Ulyssix for more details on using this connector.

Figure 201 – Bald Eagle RF Panel

Chapter 11 Appendix E – User Software Development

Upon request, Ulyssix provides a software development kit for the hardware API. The software development kit includes a manual for the API (including example code) as well as a dynamic linked library, C++ header files, C# wrappers, and a Delphi wrapper. Numerous Ulyssix customers have developed custom software applications for the Ulyssix hardware. Please contact Ulyssix for more details on the Software Development Kit.

Chapter 12 Appendix F – FlashBurn™ Utility

The Tarsus3 is designed using the latest advances in Altera FPGA technology with the latest data acquisition integrated circuits; creating a very versatile telemetry processor card. The board is able to perform many different, unique, data acquisition and telemetry processing functions including: dual full digitally implemented Bit Syncs, PCM Decoms, multi-channel clock data recovery (CDR) modules, SGLS modulator/demodulator, and many other data acquisition applications. The basis for the card is two 14-bit analog to digital paths into over 3 million gates of user configurable space. The configurable space is made up of Altera high-density StratixIII® FPGAs. The FPGA circuitry can be modified in the field via Ulyssix proprietary Windows application software called "FlashBurn™". This appendix describes how to use the Tarsus FlashBurn™ software, herein referred to as **FlashBurn™**.

Care must be taken when loading Ulyssix supplied .rpd files into the Tarsus3 hardware. Loading the wrong rbf file into the wrong Tarsus3 FPGA can cause the cPCI or PCIe bus circuitry on the card to lock up. When this occurs, there's no way to access the Tarsus3 hardware via FlashBurn™ or ALTAIR.

12.1 Programming

There are 3 modes of rbf programming: **Single Card**, **All Cards**, and **Single FPGA**. First:

- Install FlashBurn™ onto the system from www.Ulyssix.com/Downloads/Software, or from a Software Installation DVD from Ulyssix. Run the program and follow the installation instructions. When finished, restart the system.

- After restart, open FlashBurn™ by double clicking on the FlashBurn™ icon 

located on the desktop.

- Make certain the .rbf files supplied by Ulyssix Technologies, Inc. is installed in a RBF folder on the systems hard drive. This can be done online or from a DVD. **Note: FlashBurn™ cannot load rbf files from read-only media.**

- When programming, enter the full path and name of the rbf file in the programming files fields. Ulyssix supplies instructions with the rbf files that indicate the order in which the file should be loaded.

NOTE: It is very important to follow the instructions provided with the rbf files.

12.1.1 Programming a Single Card

In Single Card programming, the user selects a single card to be programmed:

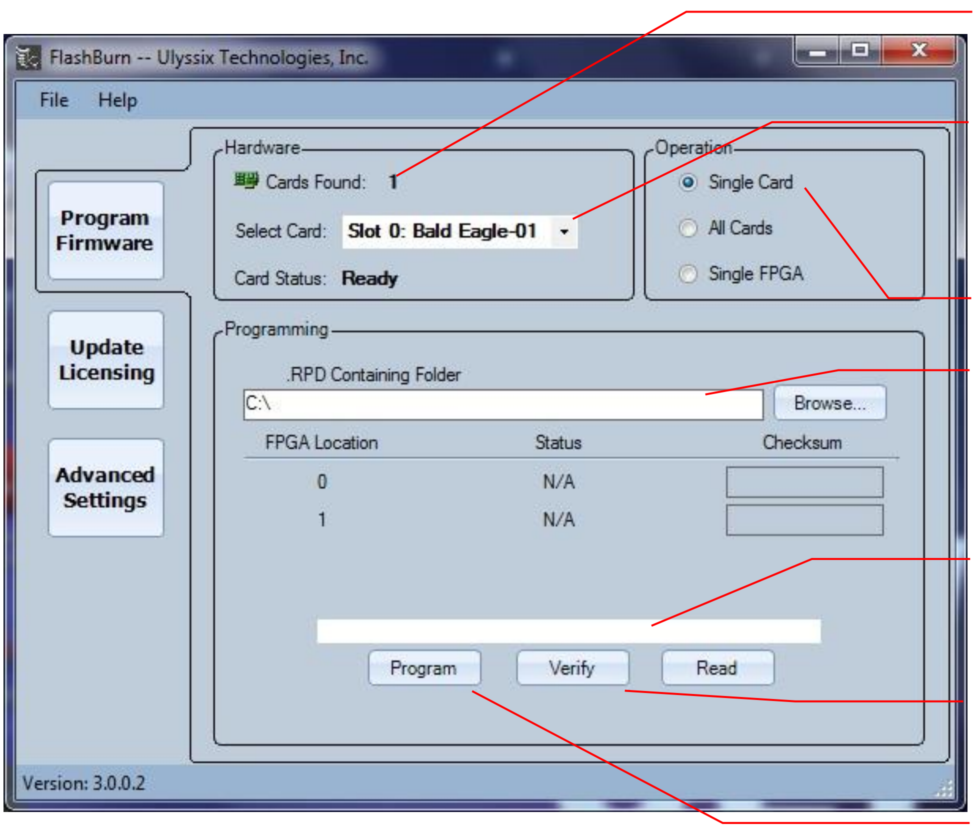
1. Open FlashBurn™ from the Start Menu, or double click on the 

desktop icon.

2. After entering or selecting the rbf file names, press the program button at location 0. A check sum will be displayed in the checksum field along with a done status.

3. Verify the checksum matches the checksum supplied with the rbf file. (Readme file)

4. Once all the programs are loaded the Status will say “done” and above the progress bar will say “programming and initialization complete!”



Use this field to determine the number of Tarsus3 cards FlashBurn has detected. (There must be at least one.)

Use this field to select the Tarsus3 card to program. (Only one card at a time can be programmed.)

Use this field to select the type of programming operation.

Use these fields to enter the name of the Ulyssix supplied FPGA files. (All FGPA configuration files end with the .rbf extension.)

The progress bar shows the card number and progress of the FPGA location being reconfigured.

Use the Verify button to compare the data in the Tarsus3 Flash memory to the data in the .rbf file.

Use the Program button to send the data from the .rbf file to the Tarsus3 Flash memory.

Figure 202 – Flash Burn Utility – Single Card Mode

12.1.2 Programming All Cards

In All Cards programming, all of the FPGA's in all of the cards in the system will be programmed:

1. Open FlashBurn™ utility from the Start Menu, or double click on the 

desktop icon.

2. Manually enter or select the rbf file name using the browse button and press the program button to start configuration. (A check sum will be displayed in the checksum field along with a done status when complete.)

3. Verify the checksum matches the checksum supplied with the rbf file. (Readme file)

4. Once all the programs are loaded the Status will say "done" and above the progress bar will say "programming and initialization complete!"

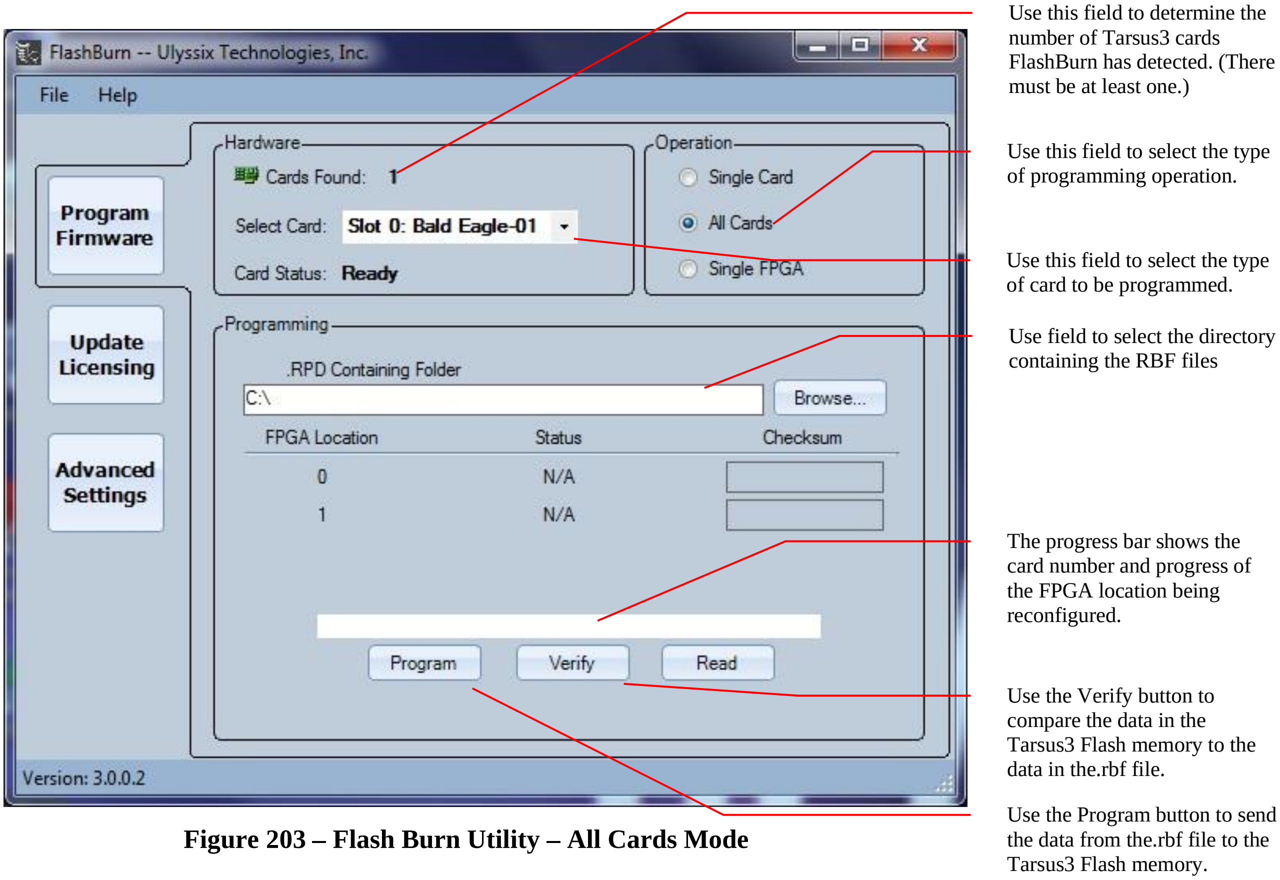


Figure 203 – Flash Burn Utility – All Cards Mode

12.1.3 Programming Single FPGA's

Use Single FPGA Mode, to manually program any/all FPGAs for any card in the system:

1. Open FlashBurn™ utility from the Start Menu, or double click on the 

desktop icon.

2. After entering or selecting the rbf file names, press the program button at location 0. A check sum will be displayed in the checksum field along with a done status.

3. Verify the checksum matches the checksum supplied with the rbf file. (Readme file)

4. Once all the programs are loaded the Status will say "done" and above the progress bar will say "programming and initialization complete!"

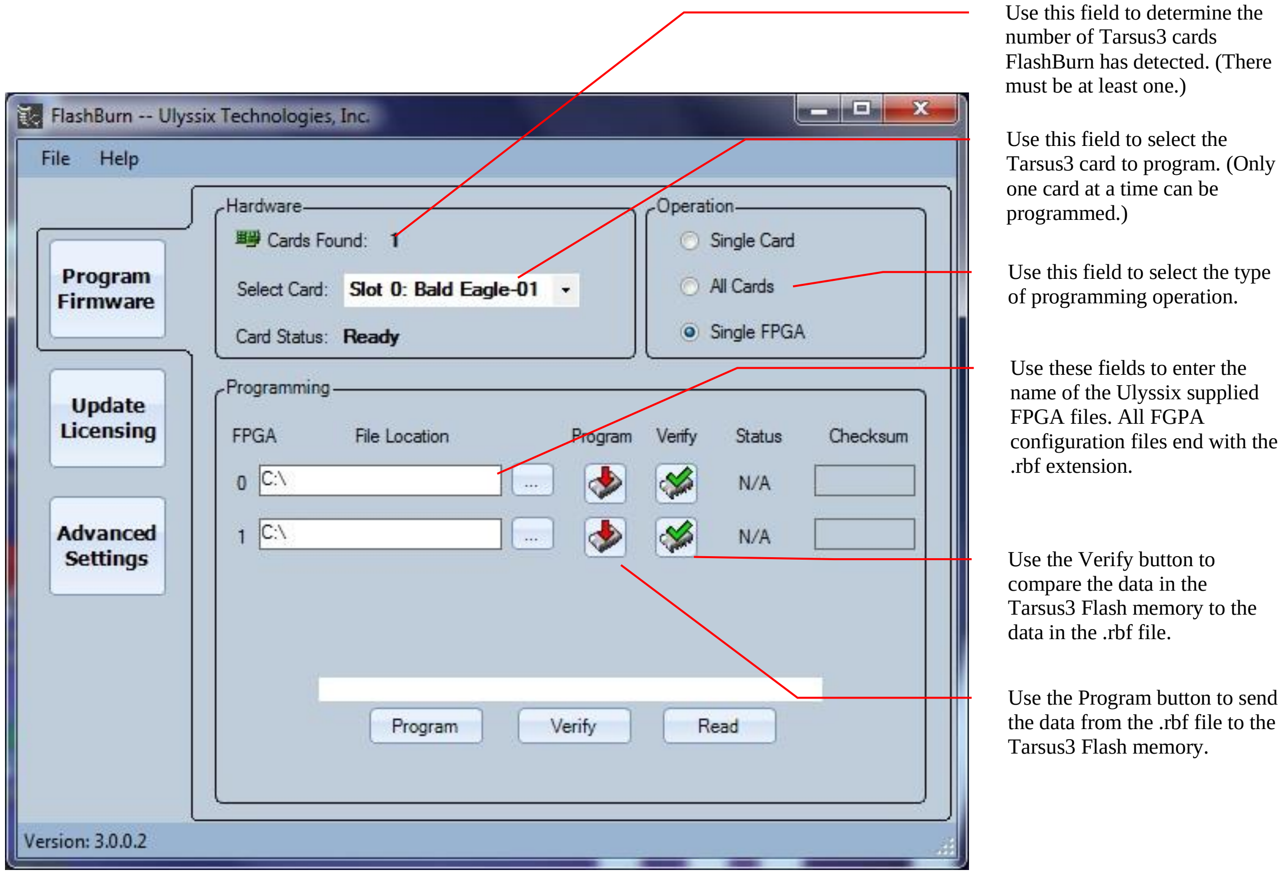


Figure 204 – Flash Burn Utility – Single FPGA Mode

12.2 Troubleshooting Display Issues

FlashBurn sometimes has display issues on super high-resolution displays when Windows artificially increases the size of applications or fonts. These options in Windows are designed to increase the size of applications, but sometimes distort the application in the process. Methods to correct this distortion vary depend on the version of Windows.

12.2.1 Windows 10 Display Issues

Below are methods to address a display issue with FlashBurn in Windows 10. Please try them in order. When you find one that is successful, no further changes are needed.

Override high DPI scaling behavior. This will only affect FlashBurn.

1. Right click on the FlashBurn icon on the desktop and select Properties from the menu.
2. In the Properties window, select the Compatibility tab.
3. In the Compatibility tab, check the box next to Override high DPI scaling behavior.
4. Change the Scaling Performed by combo box to System (Enhanced) and then click the OK button.
5. For the setting to take effect, the user must log out of Windows 10 and then log back in.

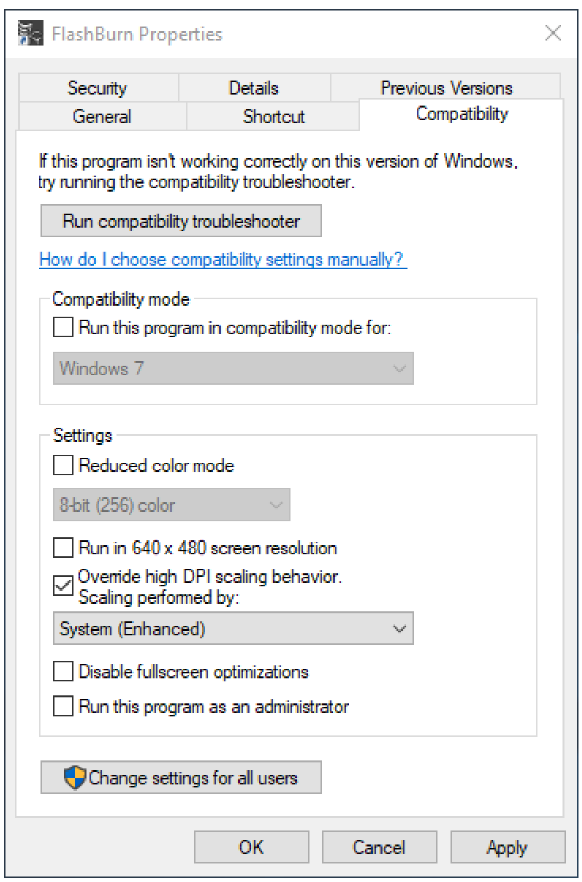


Figure 205 – FlashBurn Windows 10 Override high DPI Scaling Behavior

Change the size of text, apps, and other items. This will affect all applications running on the computer.

1. Right click on the desktop and select “Display Settings.”
2. Under the heading Scale and Layout, find the combo box for Change the size of text, apps, and other items.
3. Select 100% on the combo.
4. For the setting to take effect, the user must log out of Windows 10 and then log back in.

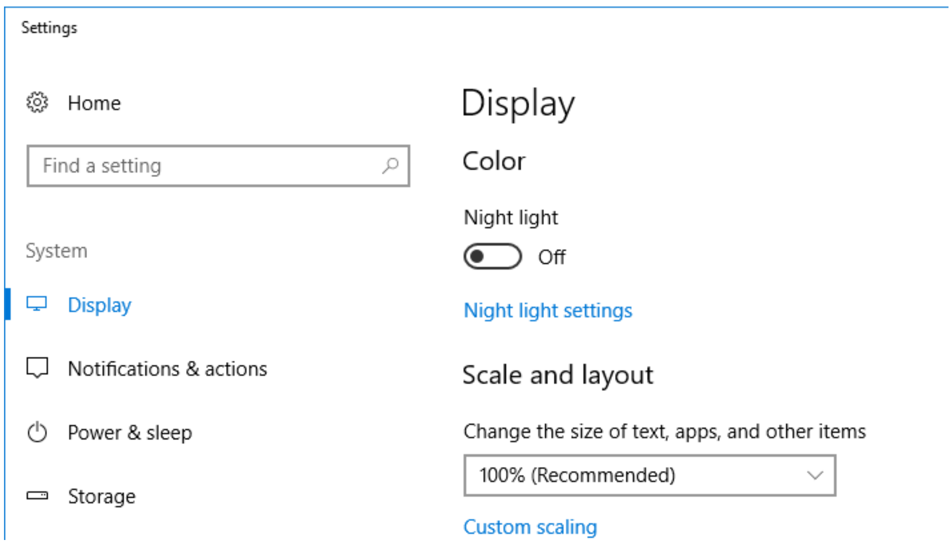


Figure 206 – Windows 10 Display Scale and Layout Properties

12.2.2 Windows 7 Display Issues

Below are methods to address a display issue with FlashBurn in Windows 10. Please try them in order. When you find one that is successful, no further changes are needed.

Disable display scaling on high DPI settings. This will only affect FlashBurn.

1. Right click on the FlashBurn icon on the desktop and select Properties from the menu.
2. In the Properties window, select the Compatibility tab.
3. In the Compatibility tab, check the box next to Disable display scaling on high DPI settings and then click the OK button.
4. The change should take effect instantly. If it does not, try restarting Windows 7.

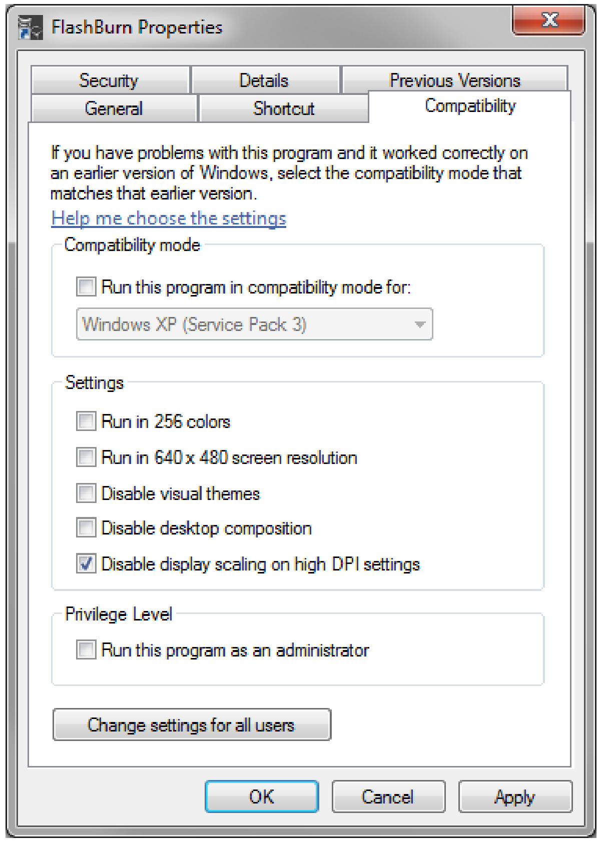


Figure 207 – FlashBurn Windows 7 Disable Display Scaling on high DPI Settings

Change the size of text, apps, and other items. This will affect all applications running on the computer.

1. Navigate to the Control Panel and select Appearance and Personalization and then Display.
2. In the Display window select 100% from the list of choices and then click the Apply button.

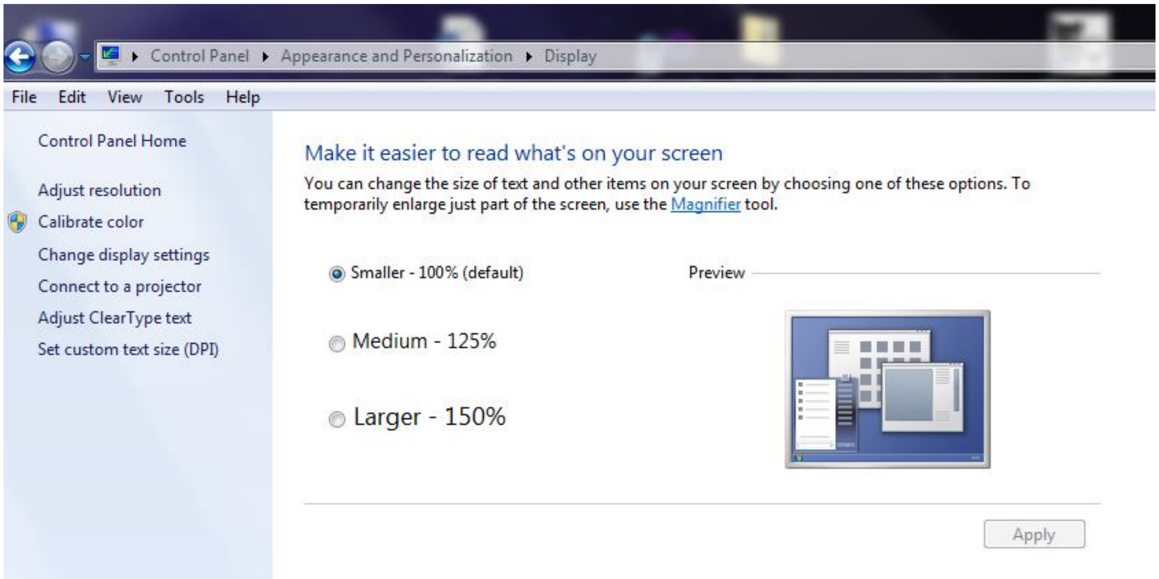


Figure 208 – FlashBurn Windows 7 Display Scaling

3. On the menu on the left side of the screen, click Set custom text size (DPI).
4. In the Custom DPI Setting window, select 100% from the combo box and click OK.

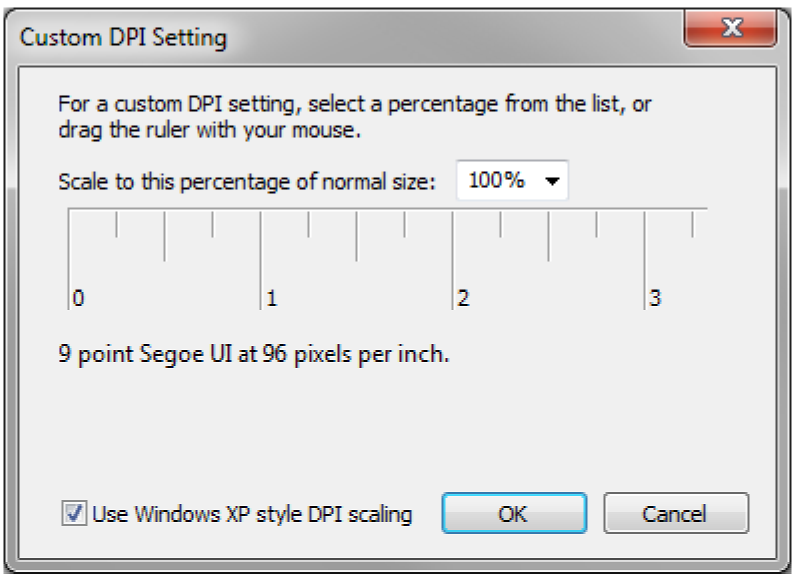


Figure 209 – FlashBurn Windows 7 DPI Scaling

5. The change should take effect instantly. If it does not, try restarting Windows 7.

Chapter 13 Appendix G – FEC and Viterbi Theory

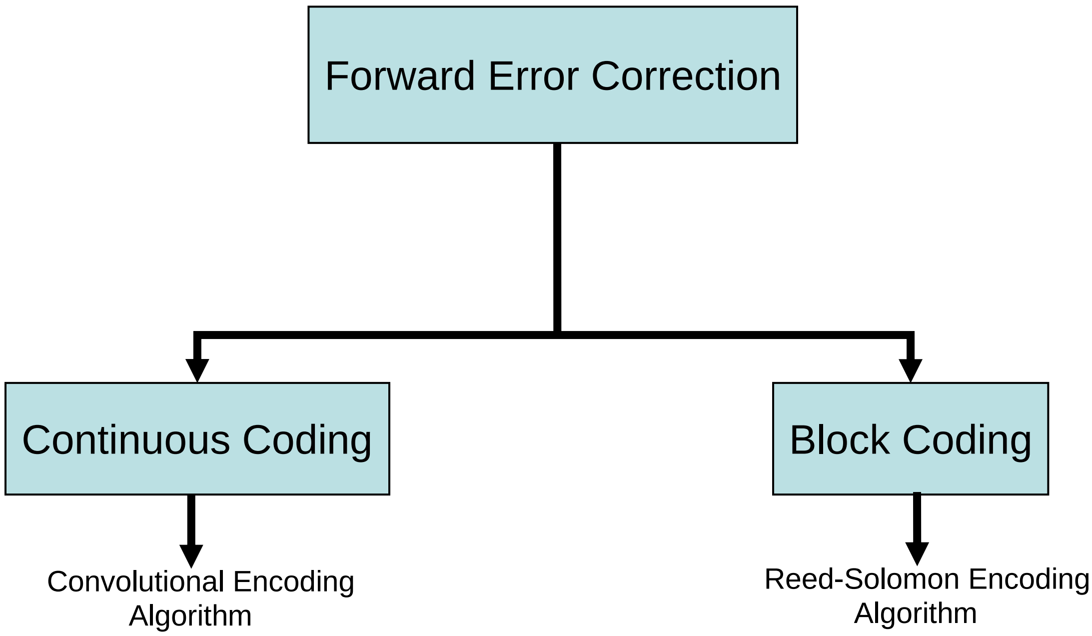


Figure 210 – Forward Error Correction Block Diagram

Figure 110 shows a diagram describing the algorithm choices to implement Forward Error Correction. Viterbi Decoding is the most common algorithm used in conjunction with a Convolutional Encoder and is the choice for the Ulyssix decoder.

- **<u>Forward Error Correction (FEC):</u>**

  - Forward error correction is a method that allows users to improve error control capabilities.

  - This is accomplished by transmitting redundant bits to the original data stream which can then be used to detect and correct errors.

  - Eliminates the need to resend data that usually results from transmission errors.

  - The error correcting ability is determined by the design of the error correcting code.

- **<u>2 Most Common Categories of FEC:</u>**

  1.) Continuous Codes:
  - Performs operations on bit or symbol streams of arbitrary length.
  - Commonly referred to as **Convolutional Coding**
  - Most common decoding method **Viterbi Decoding**

  2.) Block Codes:
  - Performs operations on fixed-size blocks or packets of symbols whose size is usually a function of a preset algorithm.
  - Most common type is **Reed-Solomon Coding**

- **<u>Convolutional versus Block Encoding:</u>**

  - Soft-Decision Data permits Convolutionally Encoded System gain to degrade slowly as the error rate increases, whereas Block-Level codes only correct errors up to a point and the gain drops off rapidly afterwards.
  - Convolutional codes do not require block synchronization
  - Convolutional codes are decoded after an arbitrary length of data whereas block-level codes require the reception of an entire data block before decoding begins.

- **<u>Convolutional Encoder Parameters:</u>**

- Commonly specified by three parameters:
  - n : number of output bits
  - k : number of input bits
  - m : number of memory registers

- Code Rate: k/n
  - Ratio describing the number of input to output bits
  - Also an indicator of code efficiency
  - Expressed as k/n
    - k ranges from 1 to 8, m from 2 to 10 and k/n from 1/8 to 7/8

- Constraint Length: K
  - Represents the number of bits in encoder memory
  - Directly affects the generation of output bits n

- Generator Polynomials: G1, G2
  - Used to choose which register bits are selected from registers
  - Number of polynomials is dependent on n

<u>Viterbi Soft Bit Decision:</u>

Soft-Decision increases the Viterbi decoder's ability to correctly decode an incoming data stream by quantizing a specified number of bits. The Ulyssix Viterbi Decoder uses three bit soft decision making. This means that for rate ½ each of the two encoded bits are now represented by 3 bits instead of one. When only a single bit is used for the two encoded bits this is called Hard Bit Decision. Since we are using three bits, eight represents the maximum likely hood that a binary '1' was received whereas 0 represents the maximum likely hood that a binary '0' was received.