

*NI Analog SSS SB Real-time
Data Acquisition Application Note*

Revision 18.0, 5/22/2018

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1 NI Analog Data Acquisition – 16-bit and 24-bit options

This document contains tips about using the Chesapeake Technology, Inc (CTI) 5-BNC box 16-bit analog interface for collection 1-2 channel side-scan or sub-bottom sonar data. A set-up like this can follow CTI SonarWiz installation, and involves the following steps:

1. Install the NI DAQmx CD software, which provides USB drivers to process the incoming A/D data from the USB-6210 card inside the CTI 5-BNC box;
2. Attach the CTI 5-BNC 16-bit (or 24-bit) box to the SonarWiz PC using the USB cable
3. Verify connections and test the analog interface box, using the NI software; then finally
4. Configure and start the NIAAnalogServer or NIAAnalogSBServer or SB24Analog server.

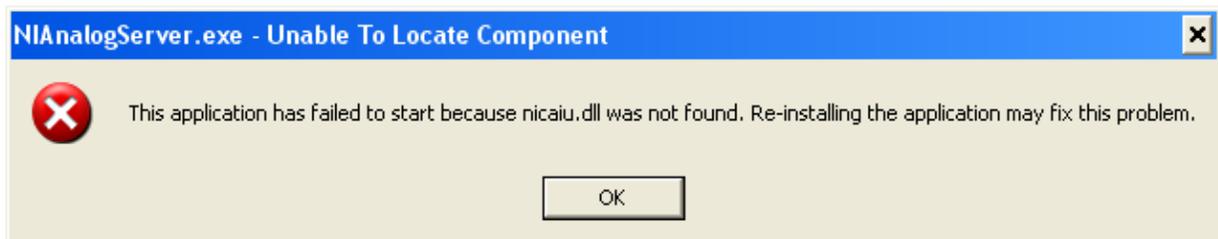
The sections below helps you through this set-up process, and explain some common error messages which users have encountered during the set-up process.

In addition to the longstanding SonarWiz support for 16-bit analog sidescan and sub-bottom real-time acquisition, new in 2014 is the availability of the new 24-bit analog sub-bottom server. This is sold with a companion hardware 24-bit analog interface box, which is now also described in this document.

1.1 Installation / Set-up Caveats: Errors You May See

1.1.1 NI Software Not Installed – Error Message

If the NI CD has not been installed yet, and you try to run the NIAAnalogServer or NIAAnalogSBServer, you will encounter one of these error messages:



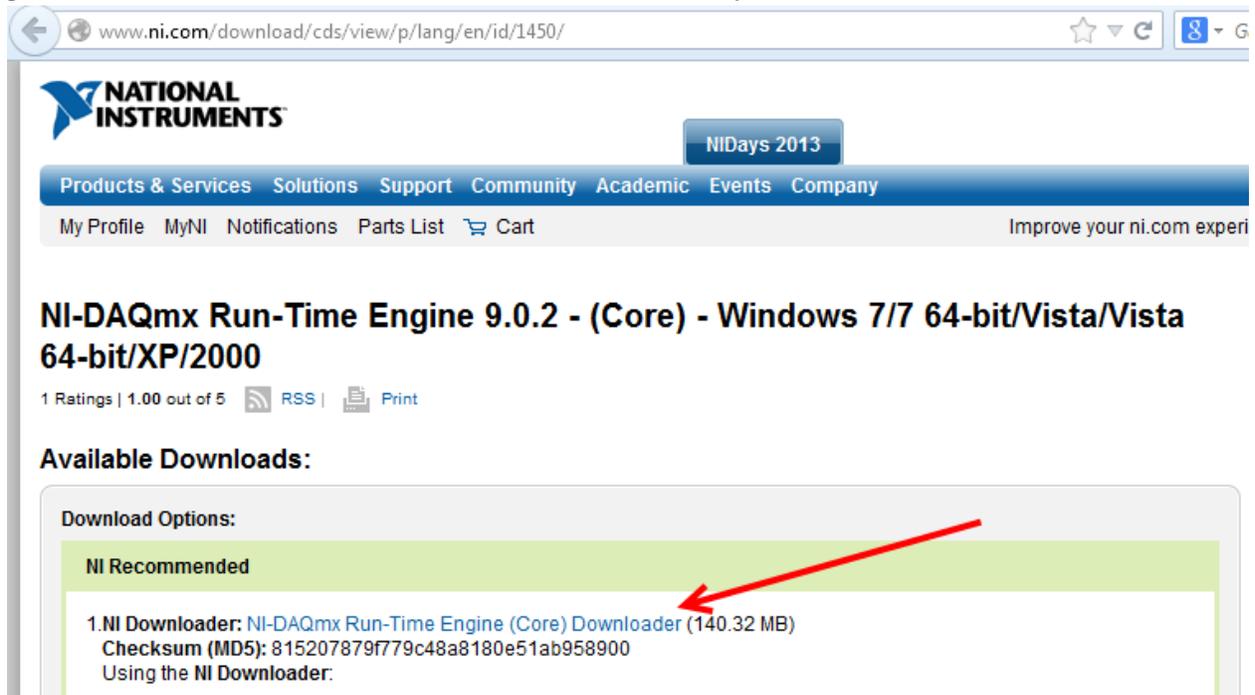
or



It just means you should go back and install the NI CD software first. Use the CD which came with SonarWiz, or download it from [www.NI.com](http://www.ni.com) at:

<http://joule.ni.com/nidu/cds/view/p/lang/en/id/1450>

and select the NI-DAQmx Run-Time Engine (Core) Downloader, This is a really great link to a 140MB download, because the current (December, 2013) download link for the general NI USB-6210 drivers is 1.5GB and will take you FOREVER:



1.1.2 CTI 5-BNC Box Not Connected yet – Error Message

A better pair of error messages may be encountered, if you DO have your NI CD software installed, but just have not connected your CTI 5-BNC box to the USB port yet. In that case, you are further along the installation path (better), but now quite there yet. Here's what you might see:



Or



If either of these messages occurs, just plug the USB connector into the CTI 5-BNC box and try again.

1.1.3 NI CD Software Not Installed – Error message

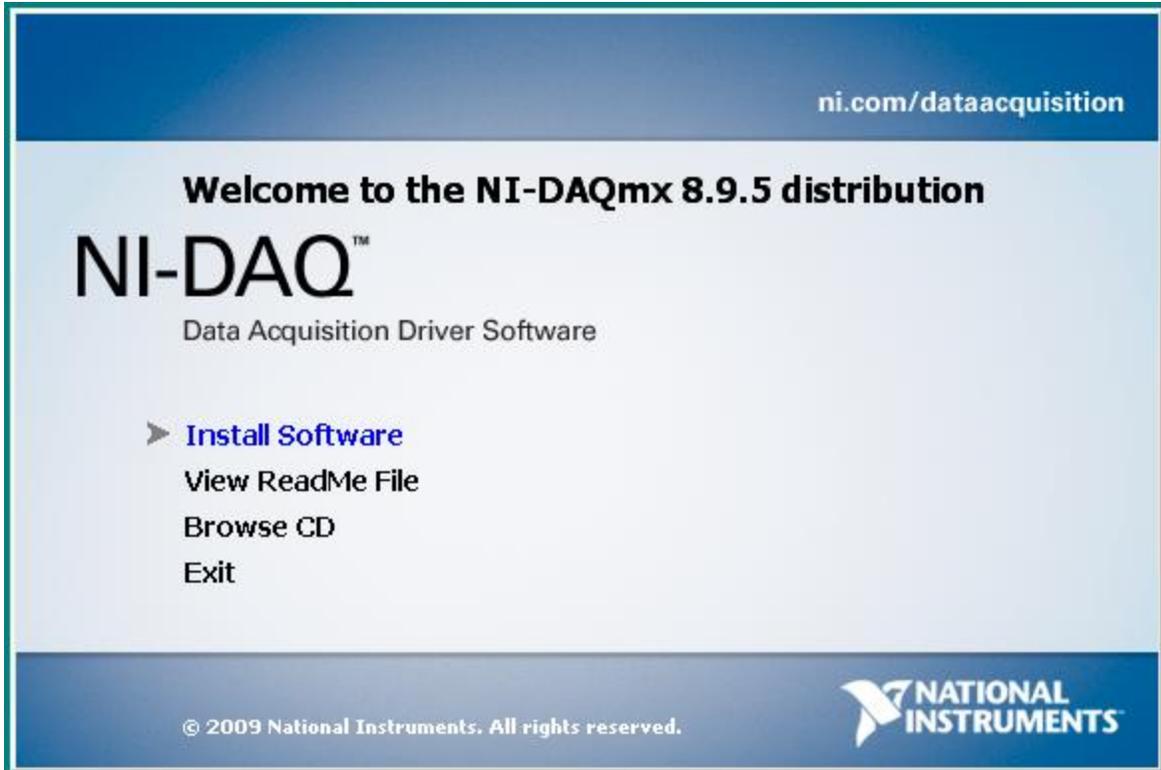
If the NI CD NI-DAQMx software has not yet been installed, and you try to run the NIAnalogServer.exe or the NIAnalogSBPServer.exe software, you will see one of these two errors:



or



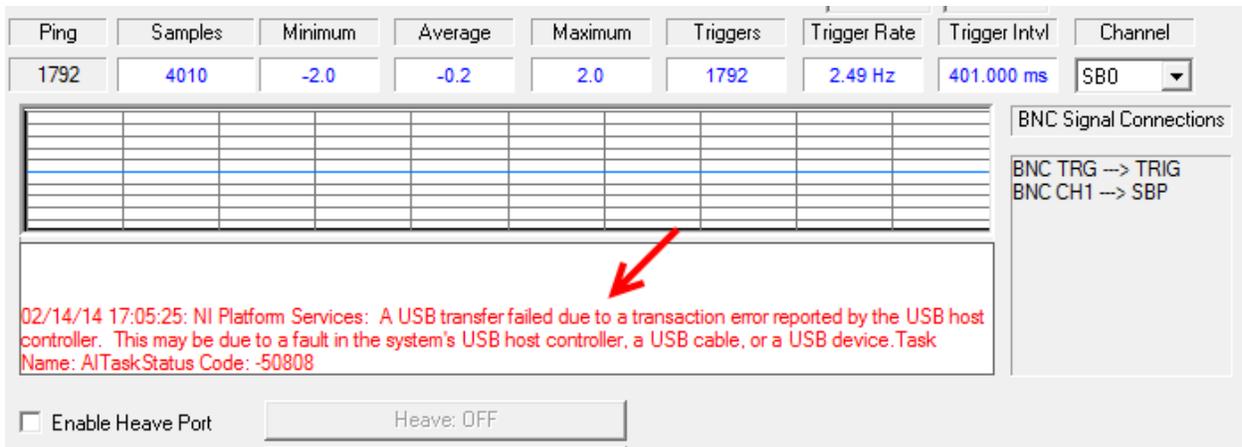
In either of these errors occur, just stop SonarWiz and the server, and insert the NI CD which came with the Analog interface purchase, and install the software. The NI CD software self-installs when the CD is inserted, and presents this view:



Just click on Install Software and away it goes.

1.1.4 Disconnected Analog Interface USB Cable - What you will see

If you are initially connected, and then the USB cable gets disconnected, you may see an error like this in the NI Server information display window:



In this case, check or replace the cables and verify connections, and re-start the analog server software.

2 All Systems Go! What it Looks Like When It Works!

2.1 No Errors and a Green Blinking LED

When the CTI 5-BNC box has successfully connected to the SonarWiz PC USB port, the GREEN LED on the CTI 5-BNC box will be slowly blinking, indicative of a successful connection.

2.2 BNC Connections Impedance Recommendation

Finally, the tip below is a helpful guideline on the BNC-connection impedance necessary to minimize cross-talk in multi-channel recording situations. The information below is adapted directly from a National Instruments information PDF file, NI manual 370503k.pdf pp. 2-10.

2.2.1 Use Low Impedance Sources to Minimize Inter-channel Crosstalk

2.2.1.1 USB-6210 - 16-bit case

To ensure fast settling times, your signal sources should have an impedances of <1 k(Ohm). The settling time specifications for your (USB-6210 A/D card) device assume a 1 k(Ohm) source. Large source impedances increase the settling time of the PGIA (processing chip) , and so decrease the accuracy at fast scanning rates. Settling times increase when scanning high-impedance signals due to a phenomenon called charge injection. Multiplexers contain switches, which are usually made of switched capacitors.

When one of the channels, for example channel 0, is selected in a multiplexer, those capacitors accumulate charge. When the next channel, for example channel 1, is selected, the accumulated charge leaks backward through that channel. If the output impedance of the source connected to channel 1 is high enough, the resulting reading of channel 1 can partially reflect the voltage on channel 0. This is referred to as ghosting, or crosstalk.

2.2.1.2 USB-4431 - 24-bit case

The equivalent information for NI USB-4431 cards (24-bit Sub-bottom) is here:

<http://www.ni.com/pdf/manuals/372485e.pdf>

NATIONAL INSTRUMENTS

Input range
 NI USB-4431±10 V_{pk}
 NI USB-4432±40 V_{pk}

FIFO buffer size1,023 samples (shared between all channels)

Input couplingAC or DC, each channel independently software selectable

Input Impedance

Terminal	NI USB-4431 Input Impedance	NI USB-4432 Input Impedance
Between positive input and negative input	200 kΩ 130 pF	800 kΩ 120 pF
Between negative input and chassis ground	1 kΩ	1 kΩ

Since both trigger and signal lines connect to these AI inputs on the USB-4431 nit, it is important to have the proper input impedance, and absence of stray driving voltage, on each line. Otherwise a trigger pulse coming OUT of AO0, may not make it into AI0, due to excessive voltage load when connected to the sonar equipment.

2.3 Sample 16-bit Analog Sidescan Server – current release April, 2013

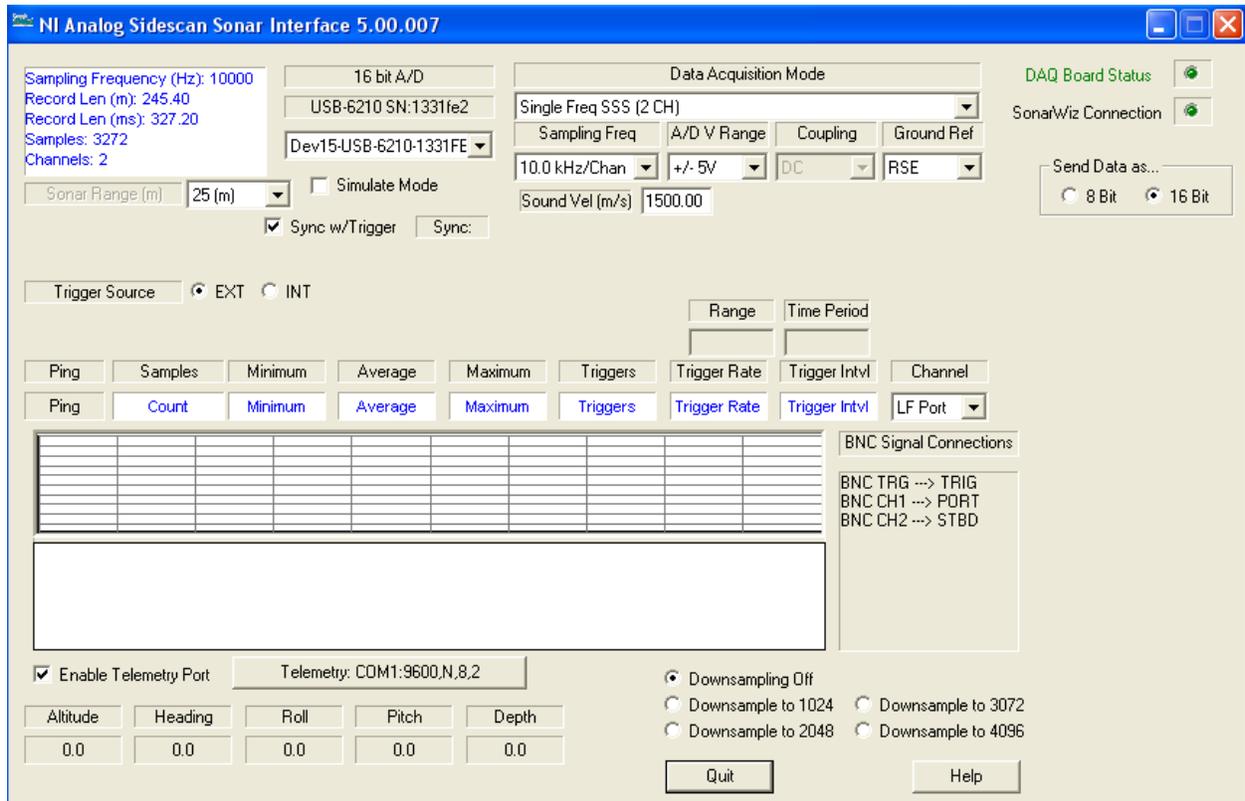


Figure 2.3

2.4 Sample 16-bit Analog Sub-bottom Server – current release February, 2014

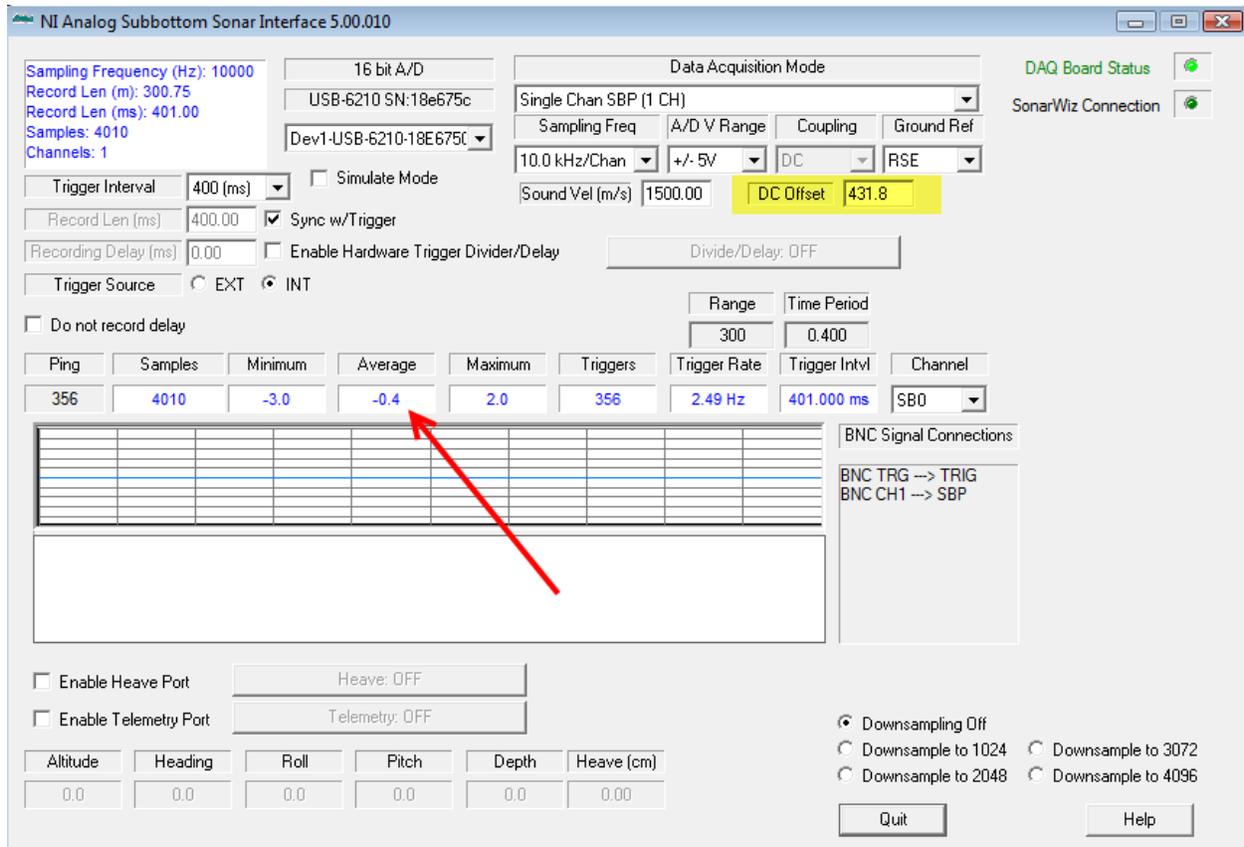


Figure 2.4 DC Offset feature shown with a grounded input, 431.8 compensating for -431.8 (approx) offset

2.5 Sample 24-bit Analog Sub-bottom Server – current release February, 2014

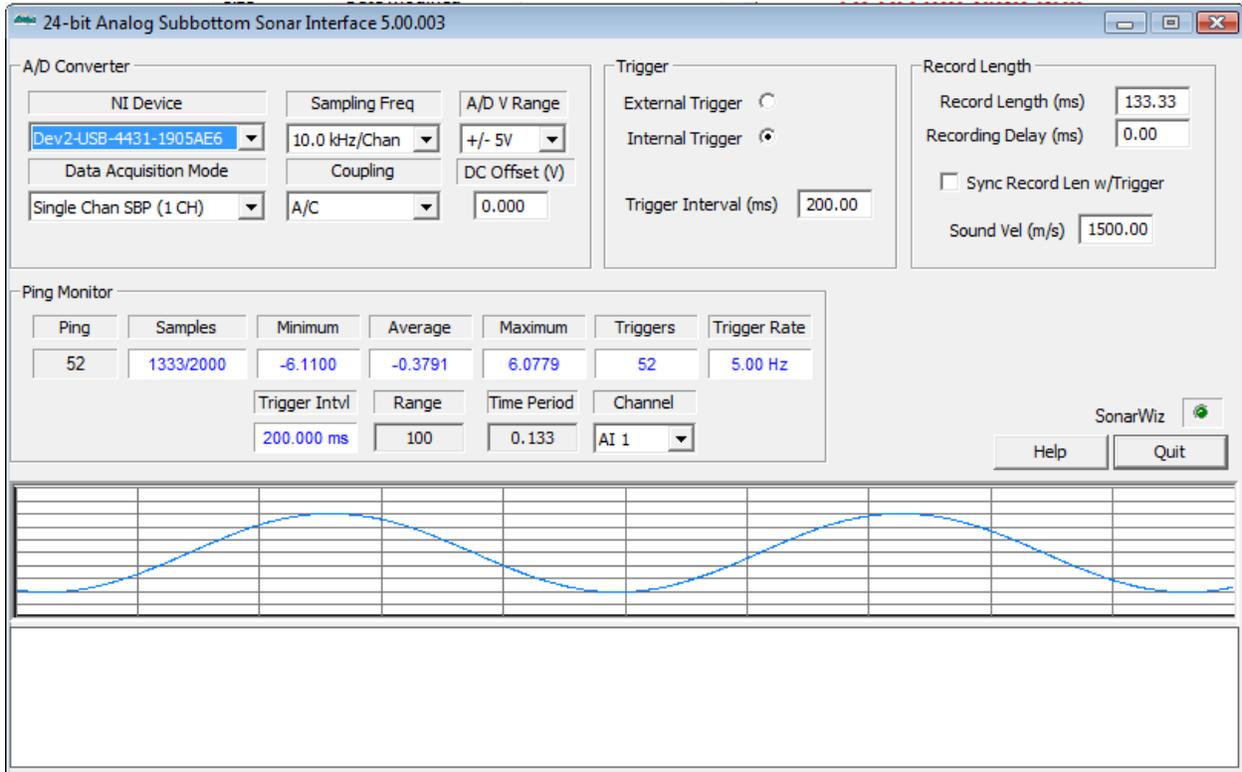


Figure 2.5

3 Single 5-BNC box Use in 16-bit SSS / SB Data Collection Configuration

This section describes an example configuration for collection of either side-scan (SSS) or sub-bottom (SB) sonar data from an analog interface.

The diagram below shows how one might collect SSS or SB data with an analog interface, using a single 5-BNC box to sample 1-2 channels of input analog data.

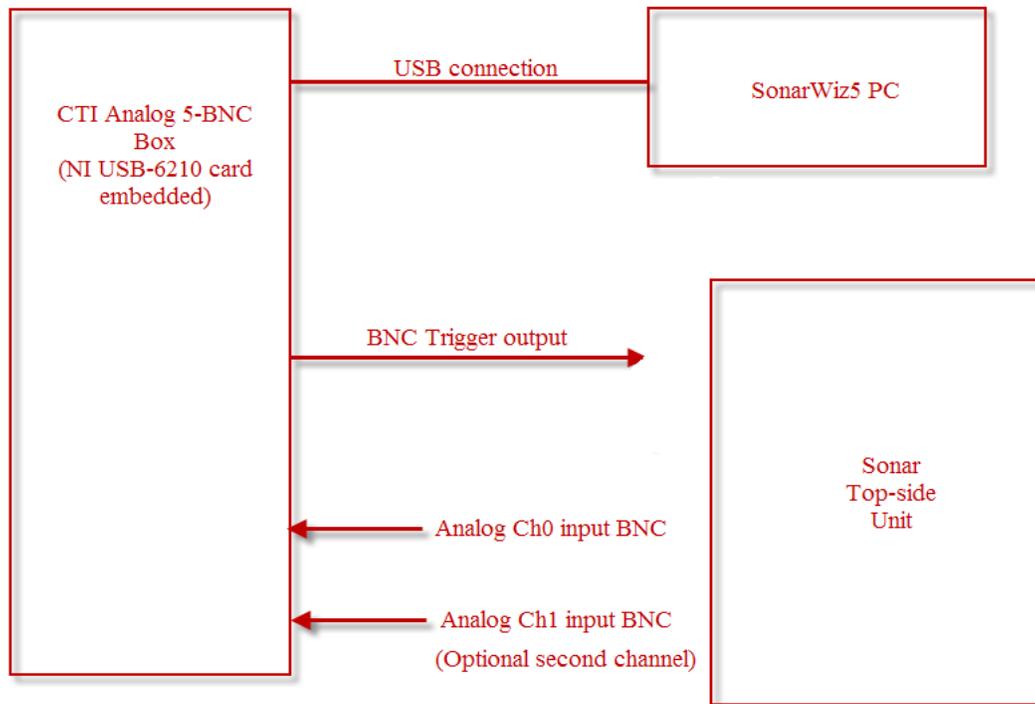


Figure 3. Single-analog-box SSS or SB recording set-up

This would be the simplest equipment scenario for analog recording, with one or two BNC cables connecting the CTI 5-BNC box to the analog outputs of the top-side sonar unit, and a single trigger output BNC connected to trigger-in on the top-side unit.

4 Same-Ping-Rate SSS / SB Data Dual-Collection Configuration

4.1 Single CTI 5-BNC Box Set-up

The diagram below shows how one might collect SSS and SB data simultaneously with an analog interface, using a KDD box to separate the triggers in time. There are a few things to note about this:

1. The configuration is simplistic and cost-efficient, as it uses only 1 CTI 5-BNC box
2. The triggers would be separated in time allowing for distinct SSS & SB return
3. The configuration assumes a same-ping-rate for both SSS and SB data

The problems with this are that SB sonar typically runs slower than SSS, as the capacitors have to charge. SB max ping-rate is usually 8 Hz for a 125msec period. On the other hand, SSS recording usually uses ping-rates in the range of 10-15 Hz. You would sacrifice SSS recording quality in this configuration!

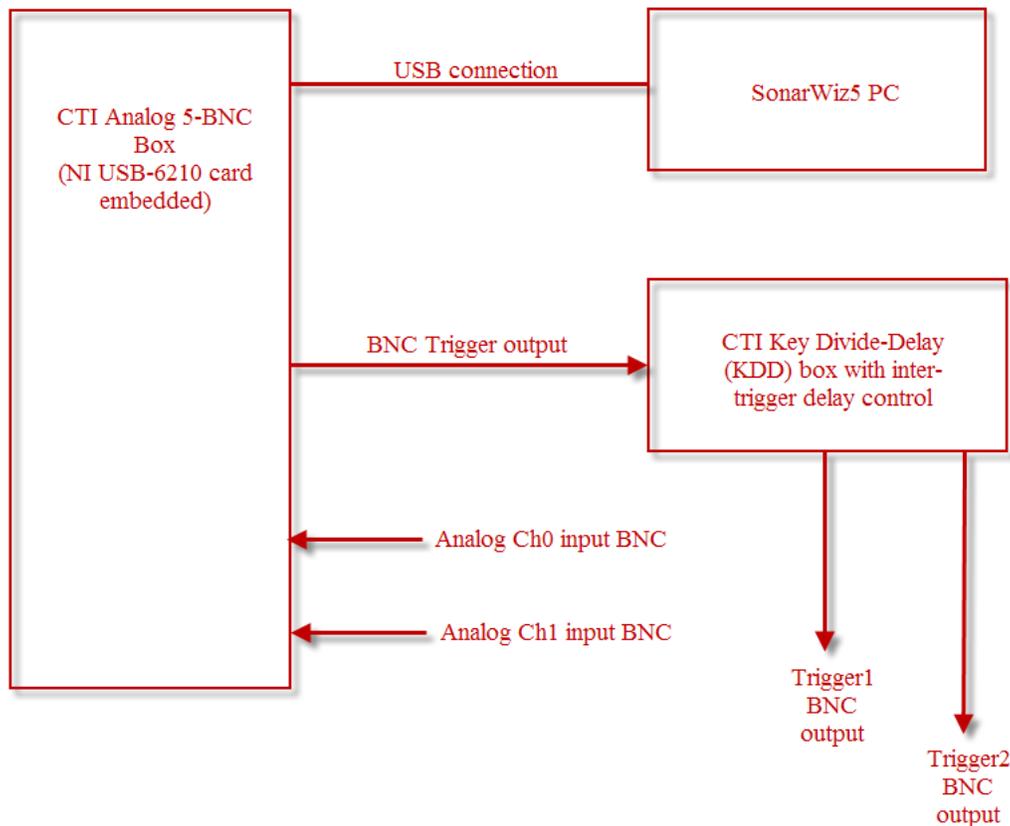


Figure 4.1. KDD-synchronized single-analog-box SSS & SB recording set-up

4.2 Independent Ping-Rate SSS / SB Analog Dual-Collection Configuration

In contrast, consider the slightly more complicated and expensive dual-5-BNC box configuration below, as a means of simultaneous SSS and SB analog recording.

The advantages are:

1. SSS ping-rate can be 10-15 Hz for perfect XFT file recording, driven by the NIAnalogServer.exe
2. SB ping-rate is independently triggered by the NIAnalogSBServer.exe and data is simultaneously saved in a SEG Y file.

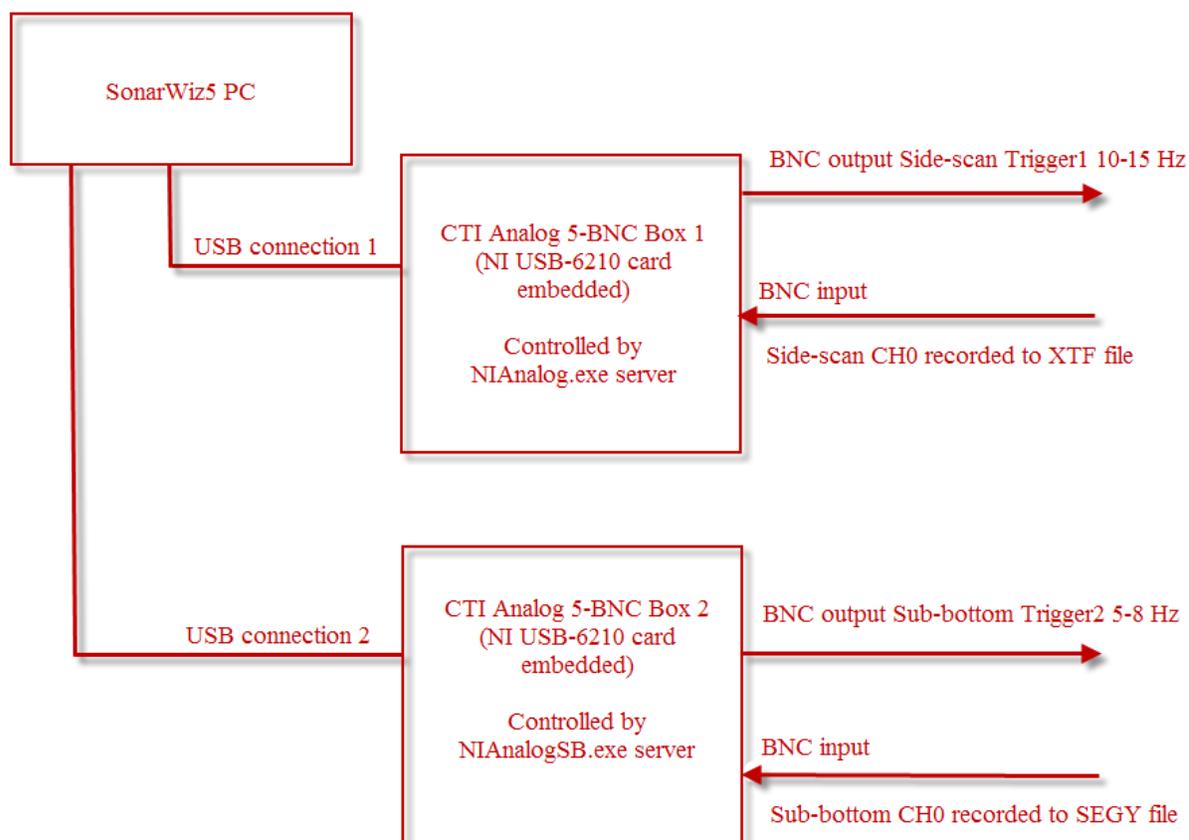
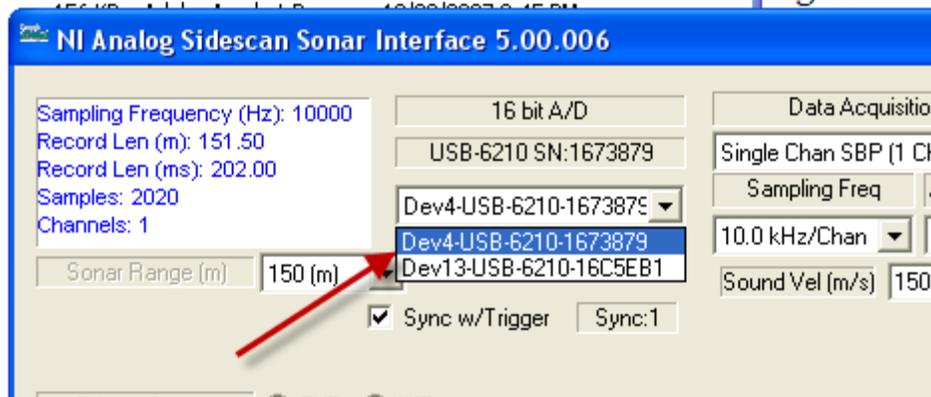


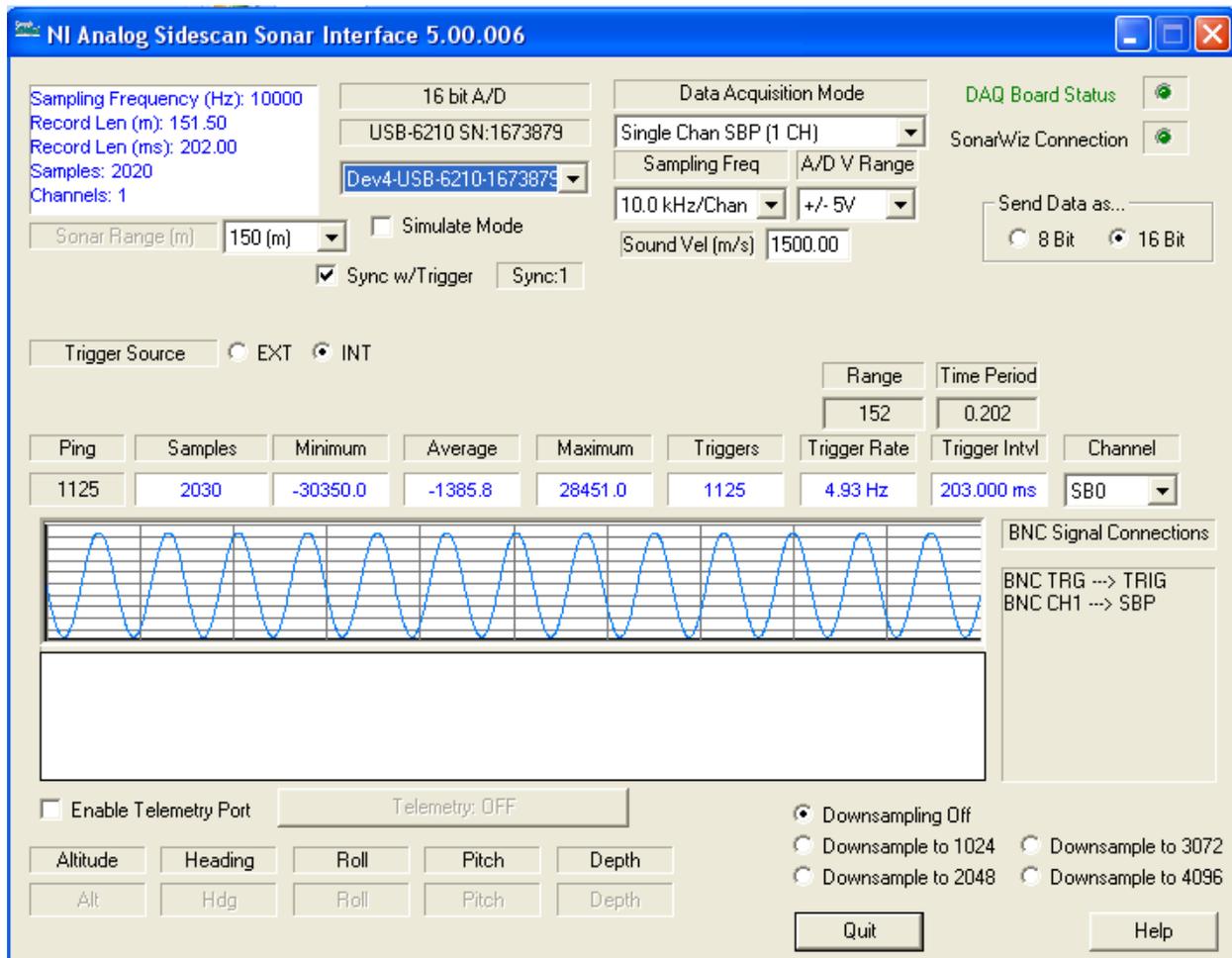
Figure 4.2. Independent ping-rate dual-analog-box SSS & SB recording set-up

Setting up this dual-recording scenario is easy, as you simply plug each USB cable from the 2 CTI 5-BNC boxes into separate USB ports on the PC, and they get auto-discovered by Windows. In the NI analog servers, of which you are allowed to run one sidescan, and one sub-bottom at the same time, you simply select DEVICE to be different on the two servers:

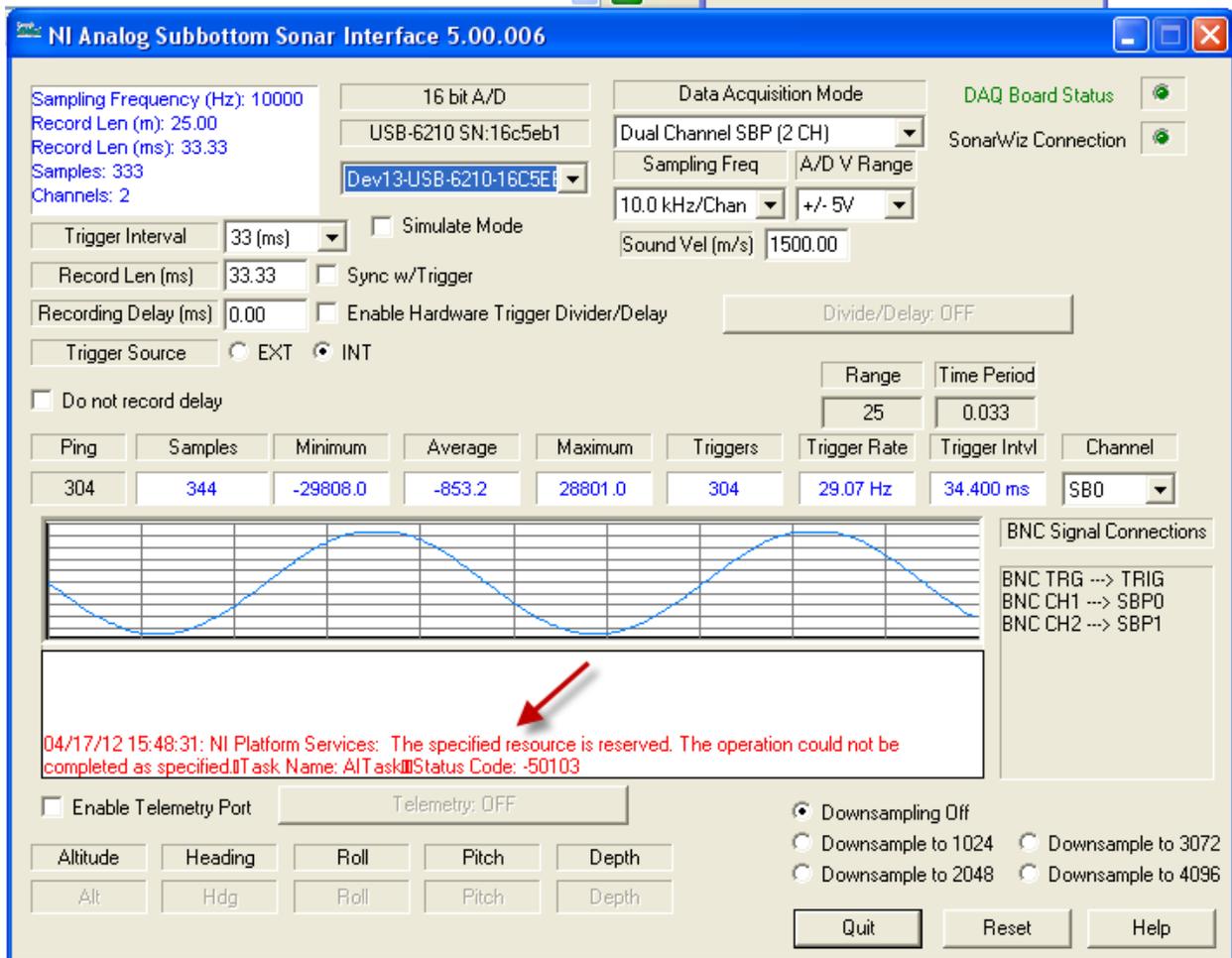
You will see the serial number presented as the identifier of the device, and the serial number of the NI USB-6210 card is marked in tape on the bottom of the CTI 5-BNC box, and also labeled on the card itself inside the box, should you need to correlate which box is which:



In each of the NI AnalogSS and NI AnalogSB servers, select only one (and different ones) of the available devices. E.g. use Dev4 as sidescan, and Dev13 as sub-bottom. Then they can run concurrently, like so:



When the second server starts, it may default to the first device and appear to fail at first (red arrow) until you select the different device:



4.3 Synchronized Dual-Interface SS / SB / KDD recording Set-up

Here's an example of how to rig a pair of CTI 5-BNC boxes and a KDD box, synchronizing them. The principle would be to trigger sidescan internally, generating the master trigger signal. The KDD box would receive this, divide (e.g. 1:4), so SS triggers at 10 Hz, SB triggers at 2.5 Hz. Also, a DELAY is added of your choice, in KDD, so that the trigger OUTPUT from KDD feeds the CTI 5-BNC box for the SB data, and offsets the start of a trigger some msec AFTER the SS trigger, to prevent ping-return interference. You can work exact values that work for you empirically, at the depths you are surveying. Here's the example diagrammed:

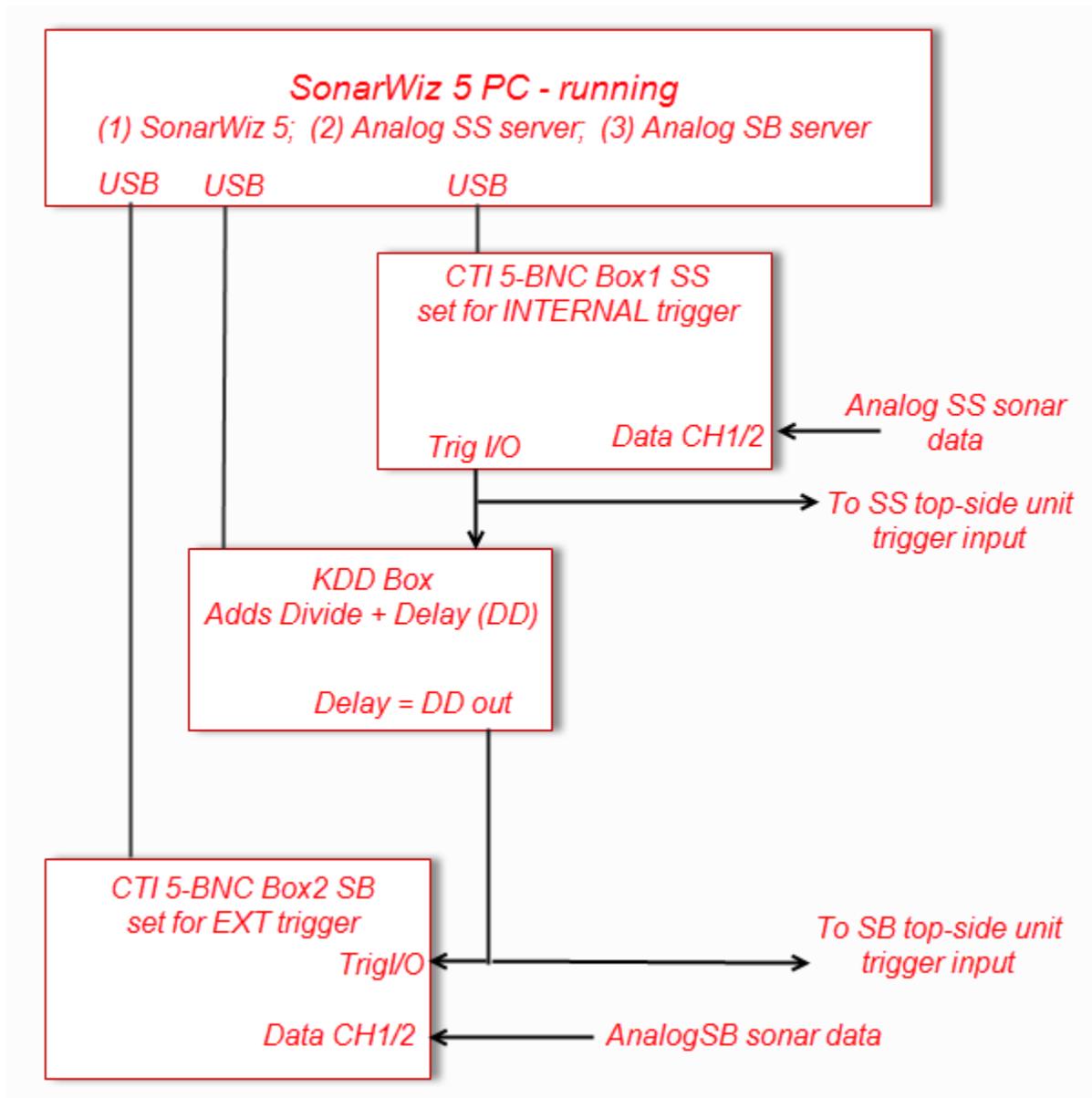


Figure 4.3

4.4 24-bit Analog Sub-bottom recording Set-up

The NI USB-4431 unit is used, instead of the CTI 5-BNC box, with the SB24Analog server. A complete separate reference PDF exists for this server and hardware interface, here:

[SBP24Server.pdf](#)

5 Analog Recording Advice Section

Here's an example recording set-up in the 5.00.006 version NI Analog SB server. We will describe some of the recording parameters, why they are set the way they are, and under what conditions you might change them.

The screenshot shows the NI Analog Subbottom Sonar Interface 5.00.006 software window. The interface includes the following sections:

- Parameters:**
 - Sampling Frequency (Hz): 10000
 - Record Len (m): 75.00
 - Record Len (ms): 100.00
 - Samples: 1000
 - Channels: 2
 - 16 bit A/D
 - USB-6210 SN:146057f
 - Dev1-USB-6210-146057F
 - Data Acquisition Mode: Dual Channel SBP (2 CH)
 - Sampling Freq: 10.0 kHz/Chan
 - A/D V Range: +/- 5V
 - Sound Vel (m/s): 1500.00
 - Trigger Interval: 100 (ms)
 - Record Len (ms): 100.00
 - Recording Delay (ms): 0.00
 - Trigger Source: EXT (selected), INT
 - Range: 75
 - Time Period: 0.100
- Table:**

Ping	Samples	Minimum	Average	Maximum	Triggers	Trigger Rate	Trigger Intvl	Channel
99	2010	-21002.0	-661.1	18870.0	99	4.98 Hz	201.000 ms	SB0
- Waveform Graph:** A graph showing a periodic square-wave pulse signal.
- BNC Signal Connections:**
 - BNC TRG ---> TRIG
 - BNC CH1 ---> SBP0
 - BNC CH2 ---> SBP1
- Telemetry:** Telemetry: OFF
- Downsampling:** Downsampling Off, Downsampling to 1024, Downsampling to 2048, Downsampling to 3072, Downsampling to 4096.
- Buttons:** Quit, Help

5.1 Trigger Interval

5.1.1 Internal Trigger – Output Signal Characteristics - CTI 5-BNC

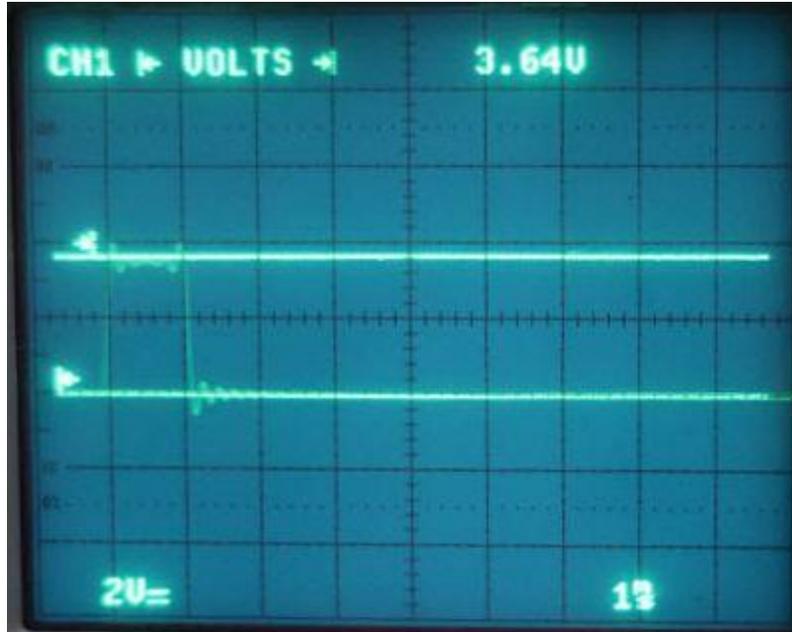
Setting to INTERNAL trigger generates an output trigger, which appears as a 0v to +5V square-wave pulse 1-msec wide on the TRIG I/O output BNC connector of the CTI 5-BNC box connected to your SonarWiz PC. Ground isolation on TRI I/O is nominally 50 kohms.

100 msec here means a 10hz “ping” rate. You should keep in mind you want pings every so often to get a good picture of the sea floor. Going faster in your boat, you may lose resolution unless your ping rate is high enough to keep up. Going slowly at 2.5-3.5knots may be fine and maybe a 4-5 Hz ping rate is best, especially if you have

boomer/sparker or unit with condensers that take time to charge and you don't want to overdrive them.

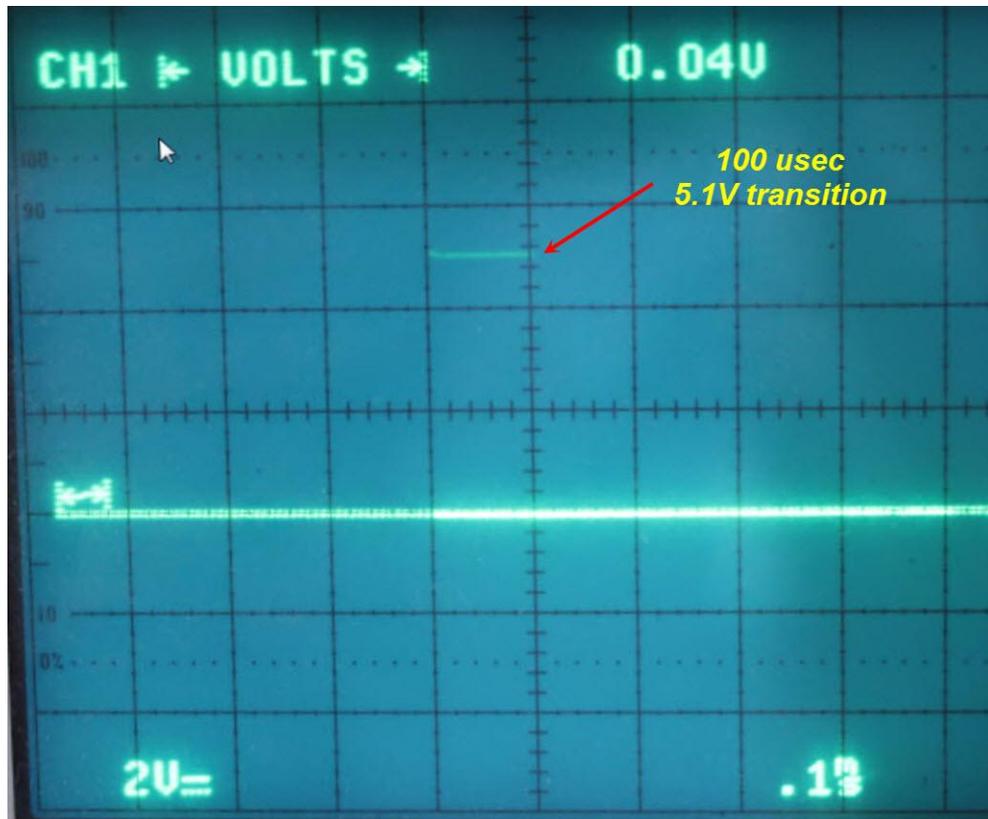
5.1.2 Internal Trigger – Output Signal Characteristics - SB24 NI USB-4431unit

Setting to INTERNAL trigger generates an output trigger, which appears as a 0v to +3.74V square-wave pulse 1-msec wide on the TRIG I/O output BNC connector of the CTI 5-BNC box connected to your SonarWiz PC. Connecting trigger to another unit (e.g. CTI 5-BNC Trig I/O, simulating customer top-side unit equipment), the trigger voltage can even drop a bit and we have recorded 3.64 V, 1 msec duration ourselves:



Ground isolation on AO0 is nominally 50 kohms. (We've measured it and get 51 ohms) The trigger signal is also split, since AO0 loops to AI0 on the 4431 unit, as well as a BNC Tee sending trigger to your sonar top-side unit. So an impedance mismatch here may be critical, in addition to the low voltage starting trigger level. Impedance mis-match here is when the ground isolation on the top-side unit is far LARGER than 50 ohms. The amount of current going to your top-side unit will be a ratio of the ground isolation impedance there, versus the nominal 50 ohms at the 4431 AO0 BNC. If your impedance was say 1 kohms at the top-side unit, then 50/1000 of the trigger current (power) would go to your top-side unit, and 950/1000 of the current would go to AI1. There's not much voltage drop, but there would be a current drop. A number of customers ONLY using the NI USB-4431 and internal trigger, have had trouble generating pings at the top-side unit, due to this low starting voltage, and the fan-out issue of impedance mismatch. **For these reasons, we recommend purchase of a KDD box along with the NI USB-4431, if you intend to use the SB24Server and NI USB-4431, and internal trigger.**

KDD output trigger example - 100 usec square-wave pulse and 0-5.10 V transition:



5.1.3 External Trigger – Input Requirements

Setting to EXTERNAL trigger means you will send in a trigger pulse. This section describes the waveform, duration, and amplitude of the signal you should send in. Normally the input would expect a TTL signal - 0V = 0 and 5V = 1. The change over voltage is typically around 2 to 3 V, so an approx 5V input signal amplitude for the trigger pulse is recommended. For duration, the input trigger is detected with an internal Schmitt trigger circuit, then stretched before sending it on to the NI USB-6210 card, so a pulse duration as small as 1usec is fine, and a 1msec duration square-wave pulse is optimal. The rising edge of this input signal triggers the trigger-detection circuitry.

5.1.4 Synchronizing a dual-trigger – dual CTI-5BNC Box plus KDD box

The general principle here is to get good empirical results such that the SS and SB triggers and ping returns do not interfere with each other. The CTI 5-BNC box 1 could be set for internal trigger, and serve to feed the KDD box master trigger input. Then the divided, delayed output (DELAY connector on KDD) could be the INPUT trigger, and have CTI 5-BNC box 2 set for EXTERNAL trigger, so it is timed by the trigger signal from KDD, delayed some msec after the SS trigger. Doing this may not work optimally for all recording depths, but if you can trigger SS and record, then trigger SB and record, within the main trigger interval, you're good.

5.2 Record Len / Sound Vel / Sampling Freq / Recording Delay Values

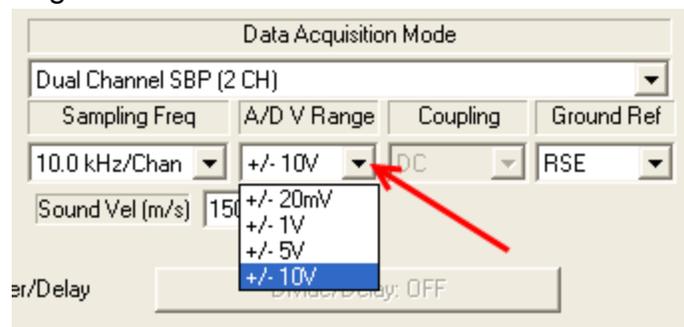
This is the amount of time the server is performing an A/D conversion after the trigger. In shallow water, for example, with 1500.0 meters/sec sound velocity (nominal), this would equate to a 1.5 meters per msec sound travel rate. So a 50 msec output and 50 msec return, equivalent to 100 msec total recording time, would allow sounds to proceed to $50 \times 1.5 = 75\text{m}$ depth and back.

If you need resolution to be 1000 sample per record, for example, 100 msec at 10khz sampling rate would do it. If you need higher resolution, perhaps 20-30k sample rate would be better.

For deeper water, you might want to extend the recording time. Like for 500 meters, sound travel time down & back would be $1000 \text{ meters} / 1500 \text{ m/sec} = 666 \text{ msec}$, so you'd need a record time of 666 msec. To avoid creating a HUGE sample, you might reduce the record length but add a record delay to reduce the water column portion of the record. It's a good idea to adjust and test on this sort of thing, to get the best recording, before running the actual survey.

5.3 Optimizing your Voltage Range

The NI USB-6210 card supports several voltage ranges, and the server software makes use of all possible choices. These are presented when clicking the down-arrow to the right of the voltage range like so:



It is best to maximize the dynamic range of the numbers you record, like for a 16-bit integer, voltage values can translate to -32767 to +32868, and if your data are coming in like -100 to +100, you are only using a tiny fraction of the numeric range, and will have poor resolution. For a very small input signal, use the +/- 20mV range, for a larger signal step up to 1, 5, or 10V range – but use the smallest setting you can. Try to avoid clipping, but record with the smallest voltage range that represents your input signal well.

5.4 Downsampling

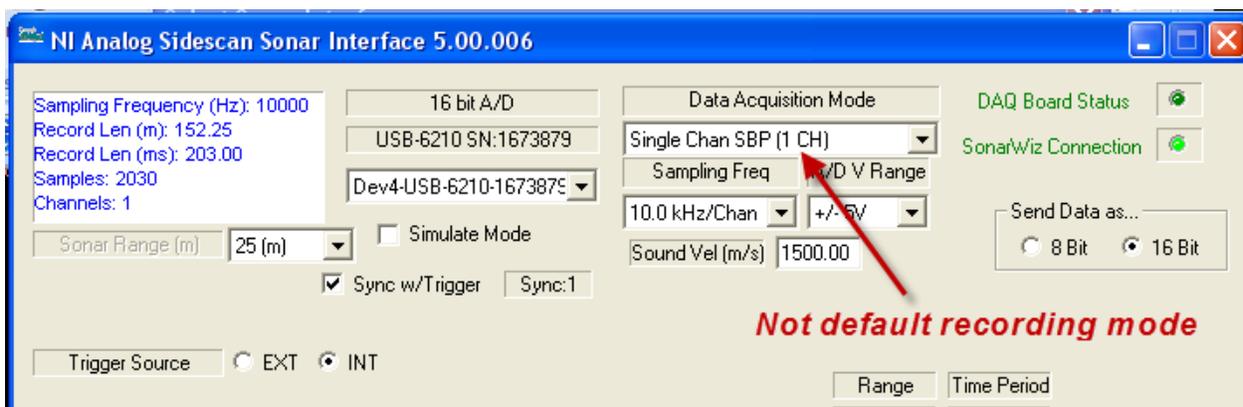
This value is best left OFF unless the record is huge due to a deep water recording, with a correspondingly large sample size (record length).

5.5 Sound Vel(ocity)

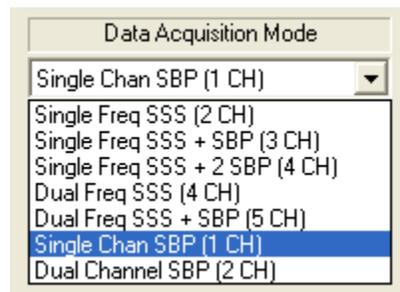
It's probably best to use the nominal 1500.0 m/s (meters /second) for this, unless you have some valid local data on water temp, salinity, etc. with a more valid measurement.

5.6 Recording Modes: Sidescan/Sub-bottom Recording Scenario Example

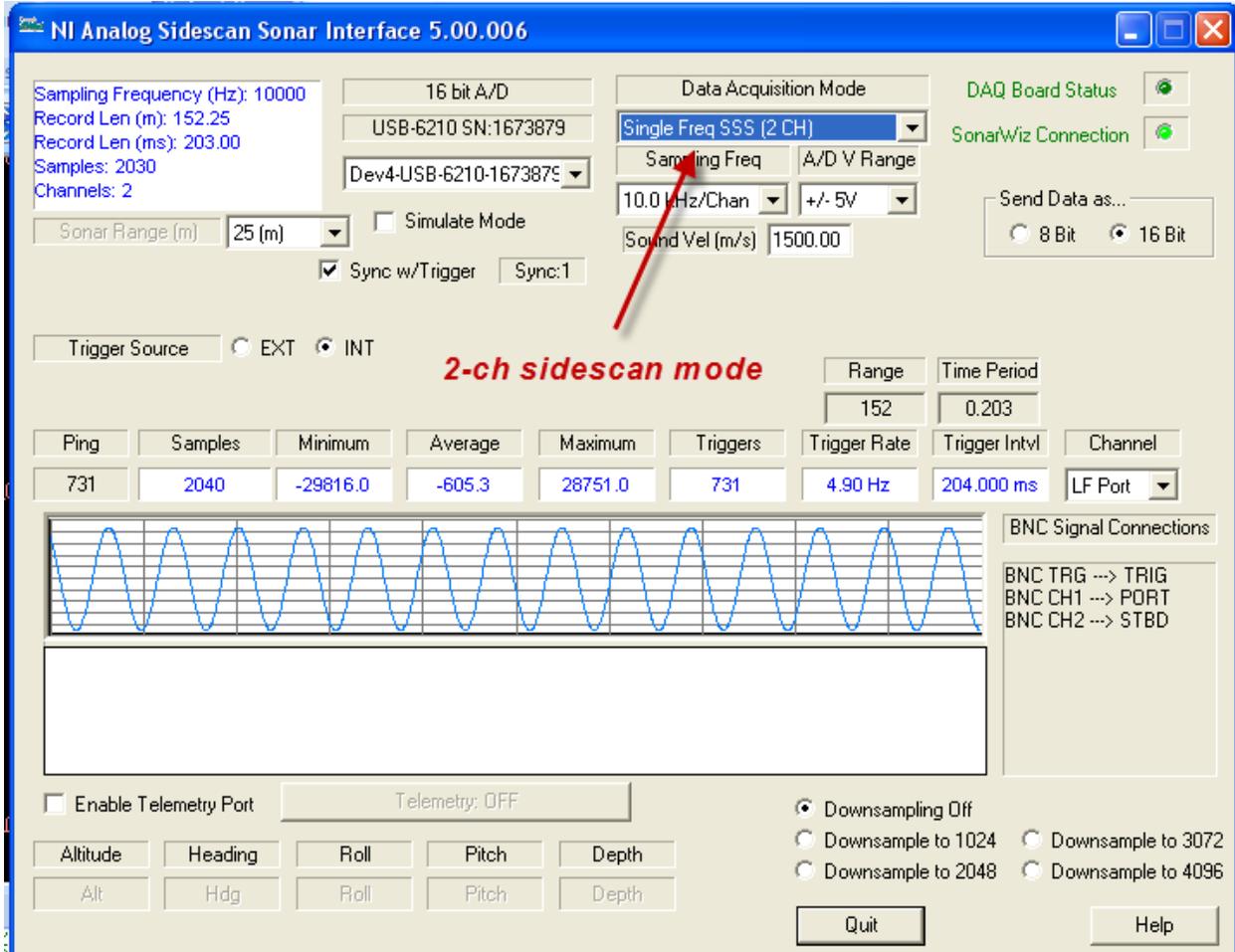
Note that the sidescan server may start in sub-bottom recording mode, and you may need to change this to record sidescan data:



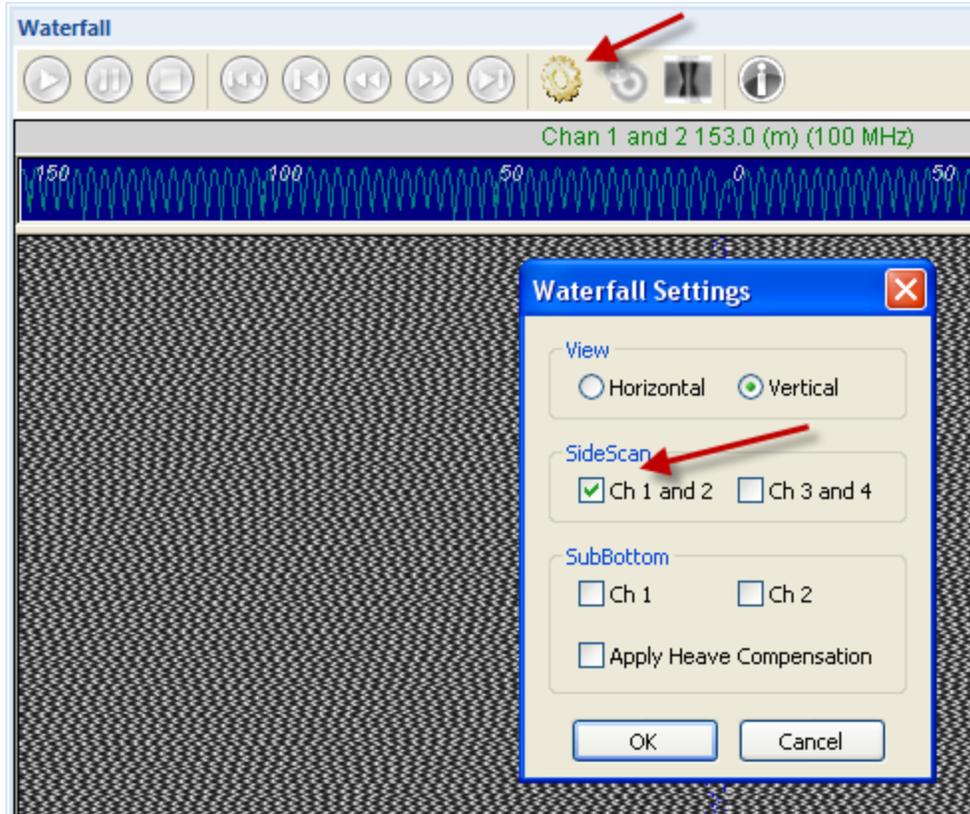
Here are the recording options in this server:



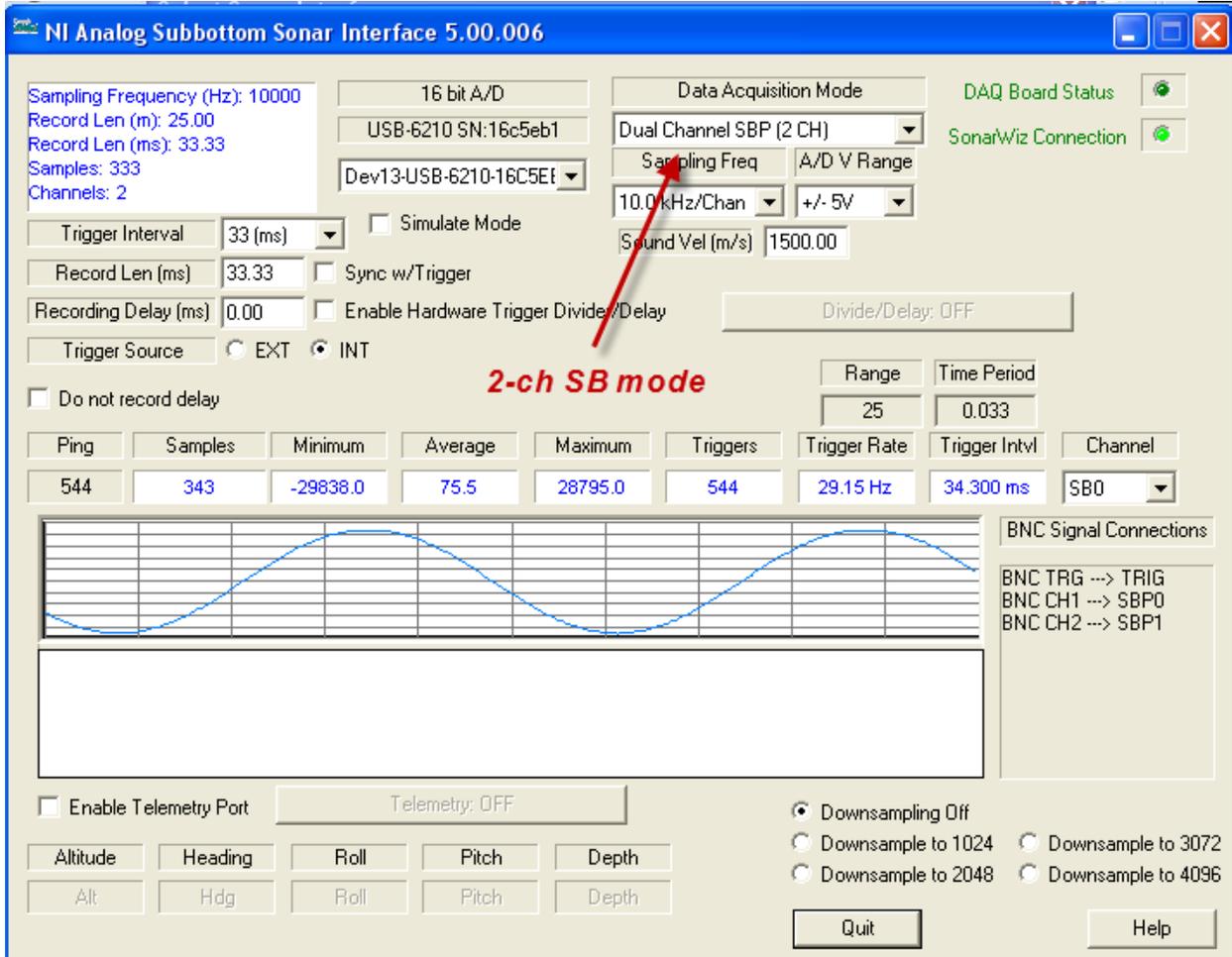
So to collect single-frequency 2-ch sidescan data, select the top option:



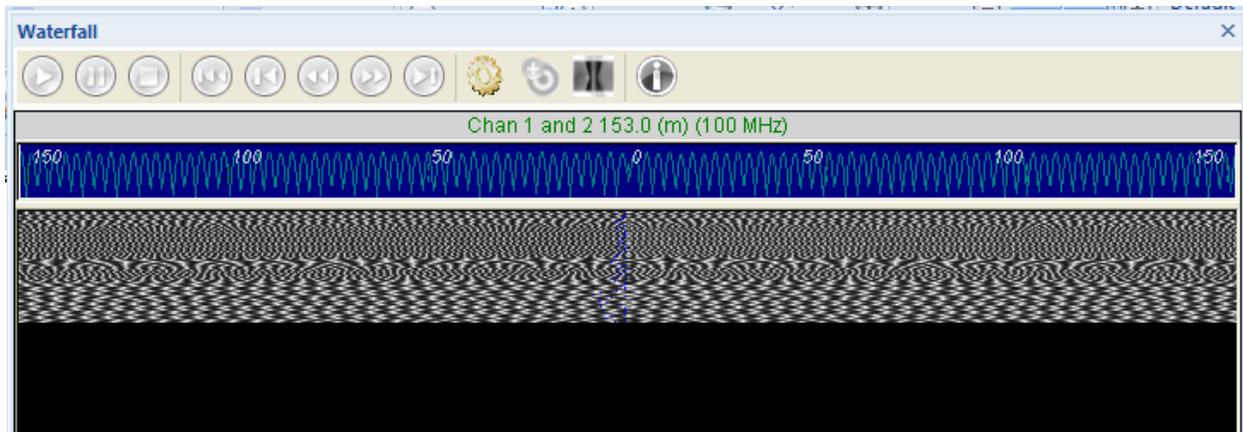
Then the incoming data may be viewed in the WATERFALL display, after selecting the (1) GEAR icon to choose (2) sidescan display:

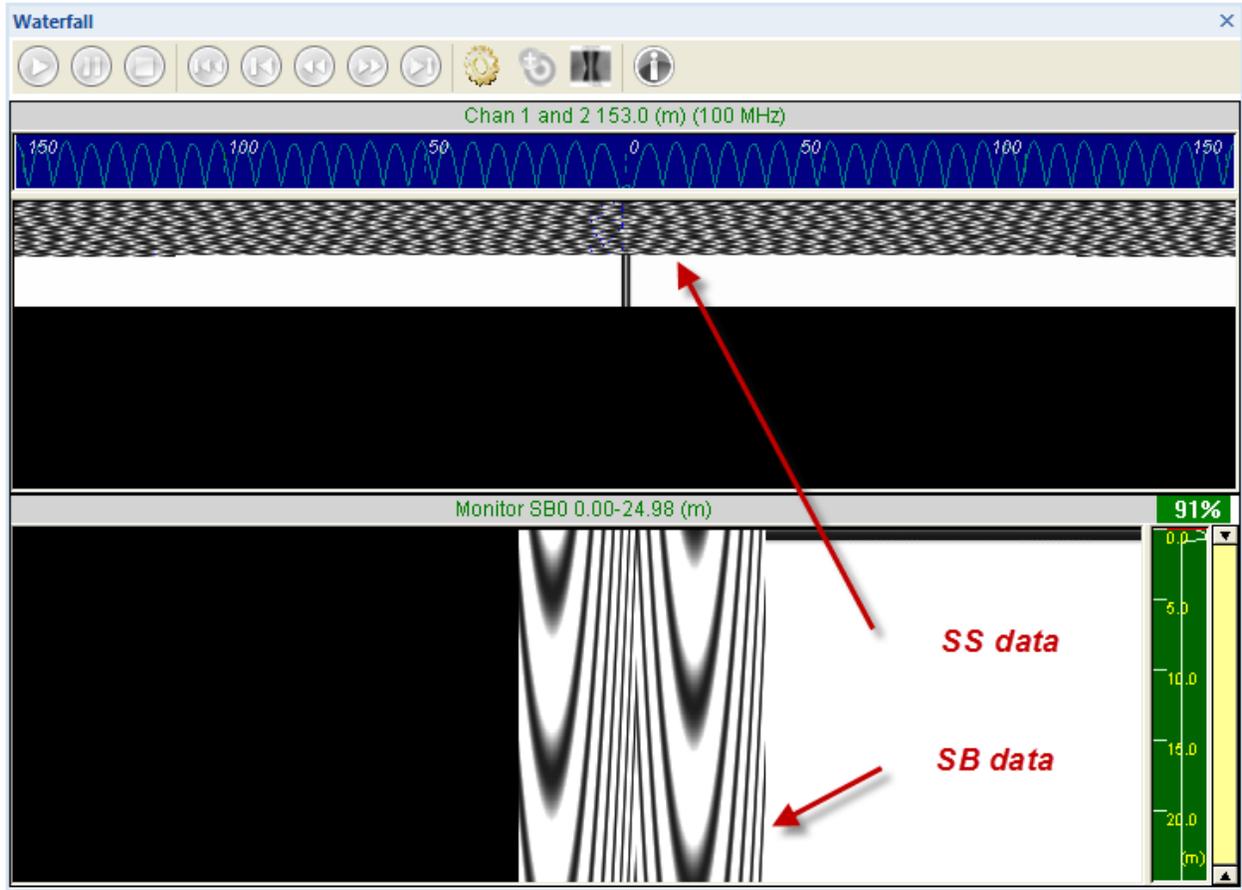


This is simulated data so it does not appear realistic – no worries.
To then generate simultaneous incoming sub-bottom data, start the second server and read from the other device:

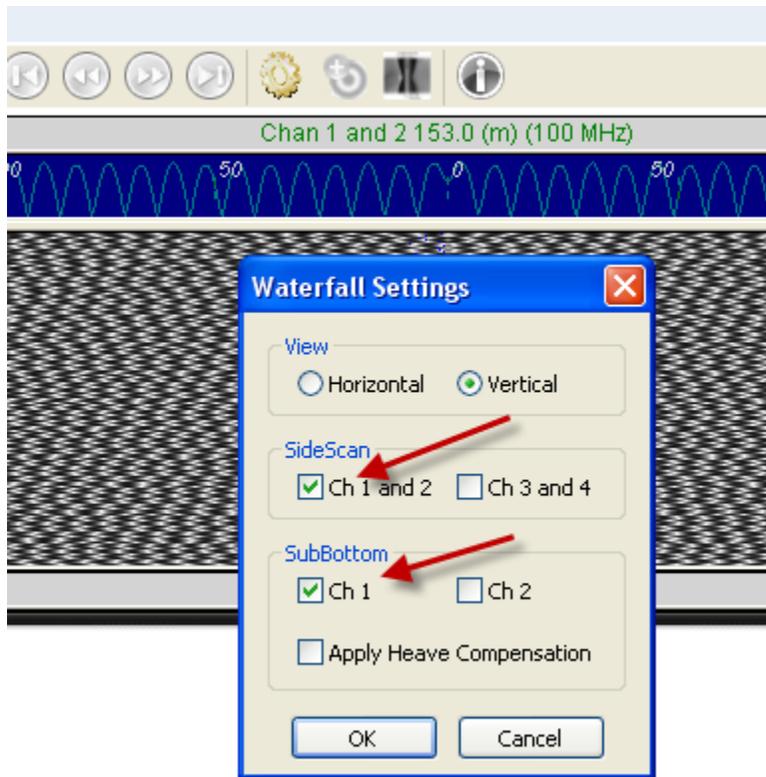


Then the incoming data from both may be seen in a single waterfall:

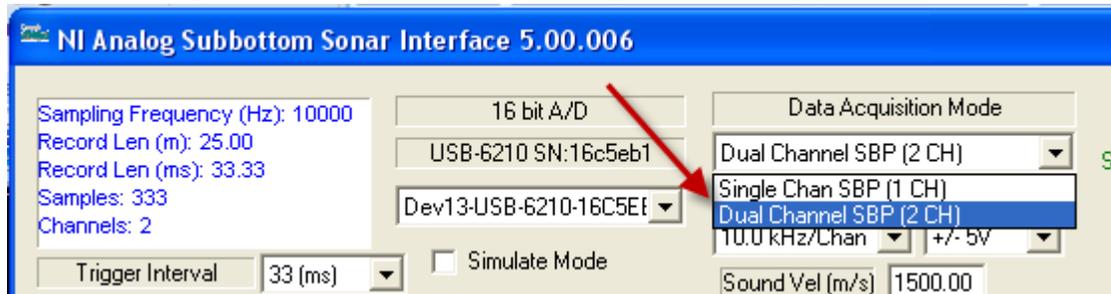




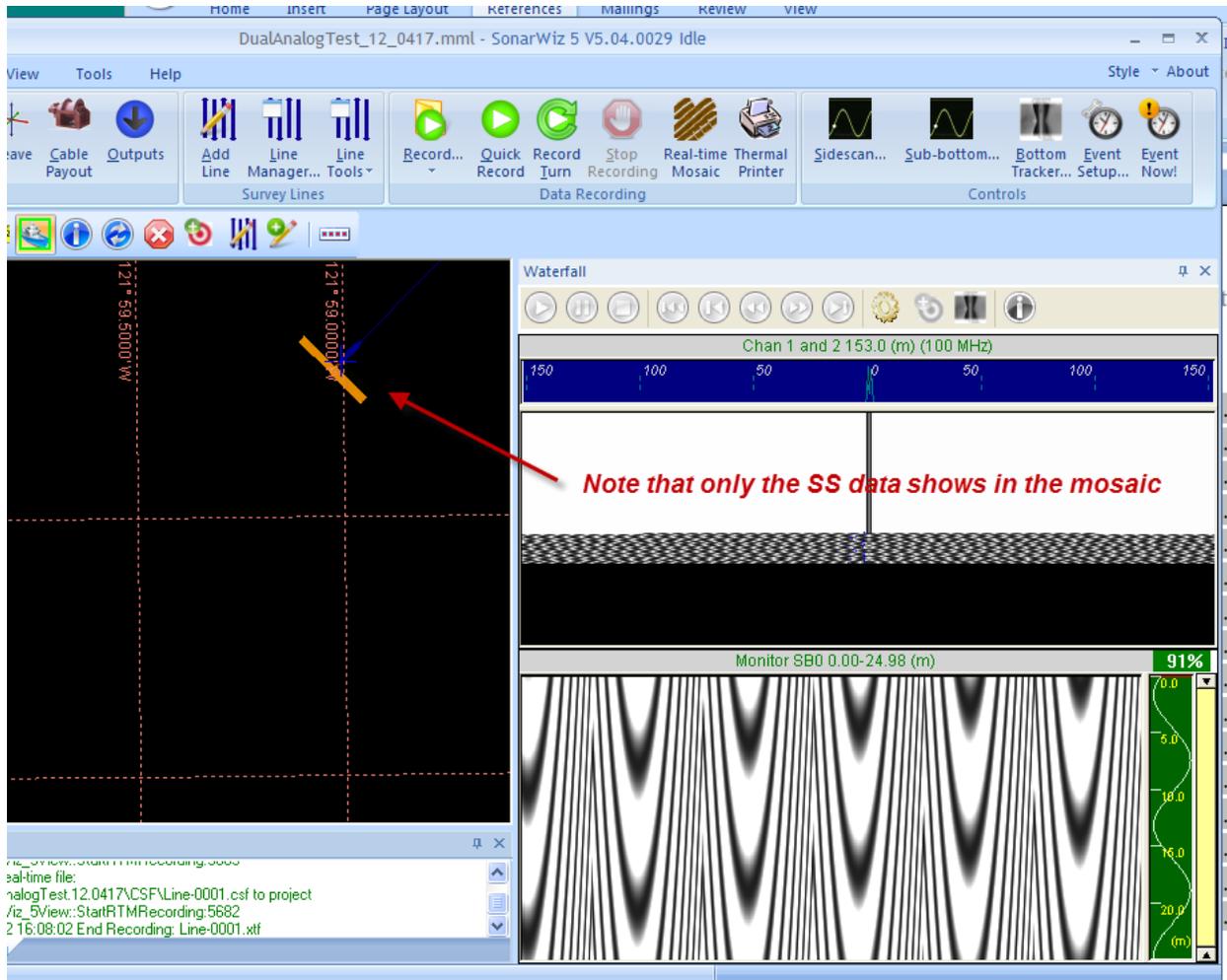
After configuring the waterfall to display both at once, like this:



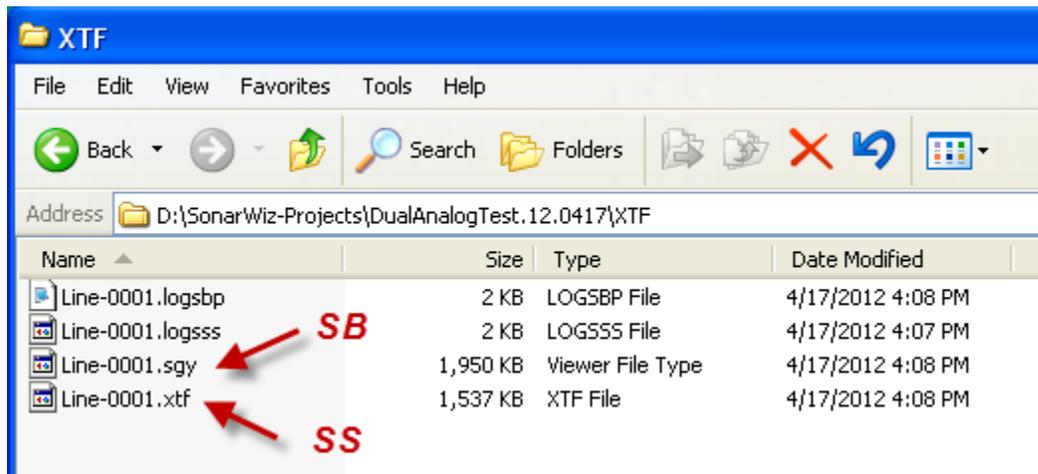
The NI Analog SB server has less recording modes, simply 1 or 2-ch input:



When you then click on QuickRecord, both an XTF (sidescan) and sub-bottom (SEG) file start to get recorded, though only the sidescan data shows in the mosaic:



In the XTF folder of the project, you will see two recorded files formed – XTF for the sidescan input, and SGY for the sub-bottom input:



These may then be imported and post-processed.

5.6.1 Recording Modes Channel Summary Table

MODE	Data Acquisition Mode	BNC Connectors					Active Channels
		TRIG IO	CH1	CH2	CH3	CH4	
	Buffer IDX	0	1	2	3	4	5
1	Single Freq SSS	TRIG	PORT1	STBD1			3
2	Single Freq SSS + SBP	TRIG	PORT1	STBD1	SB0		4
3	Dual Freq SSS	TRIG	PORT1	STBD1	PORT2	STBD2	5
4	Dual Freq SSS + SBP	TRIG	PORT1	STBD1	PORT2	STBD2	6
5	Single Channel SBP	TRIG	SB0				2
6	Dual Channel SBP	TRIG	SB0	SB1			3

NI Analog SS server: MODE 1,2,3,4 (yellow highlight) are the options. In each case, a single XTF file is recorded at the time. In modes 2 or 4, the XTF file will contain both SS and SB data. You can see this in PLAYBACK PEEK at the XTF file in SonarWiz:

EXAMPLE NI Analog SS Server Mode selection:

PLAYBACK peek at the recorded XTF file: Single XTF file records from NI Analog SS server in Dual-freq SS +SB (5 CH) recording mode

Line-0005
 File Size: 1536 KB
 # Sonar Channels: 5, SSS:4, SBP:1
 # Bathy Channels: 0
 Bits/Sample: 16
 Samples/Channel: 1024
 CH:1 Range (m): 506.0 Center Freq: 100.0
 CH:2 Range (m): 506.0 Center Freq: 100.0
 CH:3 Range (m): 506.0 Center Freq: 500.0
 CH:4 Range (m): 506.0 Center Freq: 500.0
 CH:5 Range (m): 506.0 Center Freq: 100.0

NI Analog SB server: Supports recording modes 5,6 (pink highlight) and only SEG files are recorded. The SEG file would have 1 or 2 SB channels recorded.

Running both servers at once, you would record 1 XTF file and 1 SEG file at the same time.

5.7 Input Analog Signal Characteristics and Recording Mode Choices

5.7.1 Recording – Ground Reference Choices

Starting in release 5.00.007, the recording modes support features on the NI USB-6210 card described in this input diagram from the NI manual:

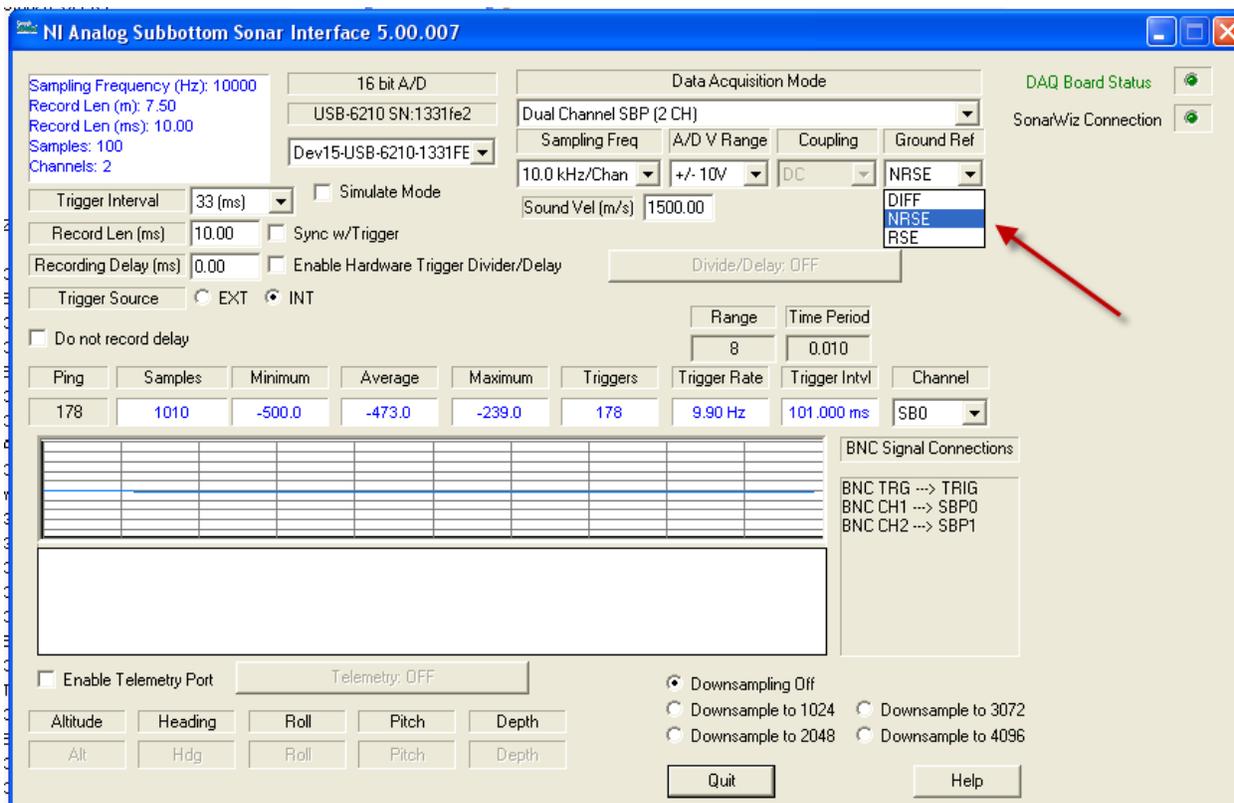
Chapter 4 Analog Input

Table 4-2. USB-6210/6211/6212 Analog Input Configuration

AI Ground-Reference Setting*	Floating Signal Sources (Not Connected to Building Ground)	Ground-Referenced Signal Sources†
	Examples: <ul style="list-style-type: none"> • Ungrounded thermocouples • Signal conditioning with isolated outputs • Battery devices 	Example: <ul style="list-style-type: none"> • Plug-in instruments with non-isolated outputs
Differential (DIFF)		
Non-Referenced Single-Ended (NRSE)		
Referenced Single-Ended (RSE)		<p>NOT RECOMMENDED for the USB-6210/6211/6212</p>

* Refer to the *Analog Input Ground-Reference Settings* section for descriptions of the RSE, NRSE, and DIFF modes and software considerations.

RSE mode is not recommended by NI, but you have a great choice of using DIFF or NRSE modes of recording, as controlled on the server dialog in the GROUND REF field choices here:



Choosing DIFF versus NRSE can make a difference, so experiment with your input signal and see which you prefer, before committing to this in a survey.

5.7.2 Analog Input Impedance Recommendation

To eliminate noise, cross-talk, and DC drift in your signal, NI recommends a 1kohm resistor to GND in the input signal path:

(Adapted from the NI_manual_370503k.PDF , pp. 2-10)

Use Low Impedance Sources to Minimize Inter-channel Crosstalk

To ensure fast settling times, your signal sources should have an impedances of <1 k(Ohm). The settling time specifications for your (USB-6210 A/D card) device assume a 1 k(Ohm)□source.

Large source impedances increase the settling time of the PGIA (processing chip) , and so decrease the accuracy at fast scanning rates. Settling times increase when scanning high-impedance signals due to a phenomenon called charge injection. Multiplexers contain switches, which are usually made of switched capacitors.

When one of the channels, for example channel 0, is selected in a multiplexer, those capacitors accumulate charge. When the next channel, for example channel 1, is selected, the accumulated charge leaks backward through that channel. If the output impedance of the source connected to channel 1 is high enough, the resulting reading of channel 1 can partially reflect the voltage on channel 0. This is referred to as ghosting, or crosstalk.

5.8 Edgetech 460 – Analog Recording Set-up Example

This advice sequence gives an idea of start-to-finish set-up of an analog sidescan recording scenario, where the user recorded from an Edgetech 260 top-side unit, with analog outputs, interfaced to and controlling an Edgetech 272 towfish.

- 1) Download Install SonarWiz.
- 2) Download and install NI Analog Sidescan Server from our support site.
- 3) Install the National Instruments NIDaqMx driver. This would have been shipped with the analog interface hardware.
- 4) After everything is installed, connect the USB cable from the analog interface box to the SonarWiz PC and wait for the Windows plug-and-play software to recognize the device.
- 5) Connect the Trigger BNC cable from the Edgetech 260 to the TRIGIO connector on the analog interface box .
- 6) Connect the port channel data BNC cable from the Edgetech 260 to the CH1 connector on the analog interface box.
 - 7) Connect the starboard channel data BNC cable from the Edgetech 260 to the CH2 connector on the analog interface box.
- 8) Start SonarWiz and create a new project.
- 9) Under the Data Acquisition tab, click on the Sonar button.
- 10) Highlight the NI Analog Sidescan Interface item and press Start Configure button.
- 11) Set the Trigger to External.
- 12) Set the range to match the same range to which the Edgetech 260 recorder is set.
- 13) Set up and enable Navigation
- 14) Click QuickRecord to start recording the sonar data.

5.9 Simultaneous SS / SB Recording Scenarios

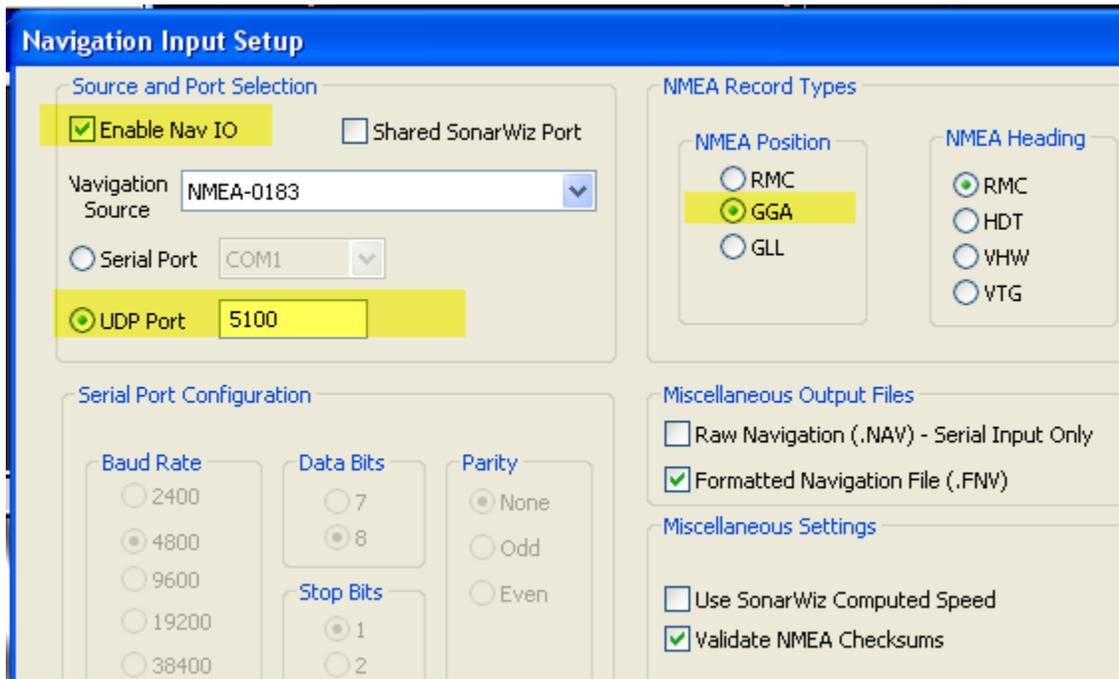
Two servers may execute simultaneously and independently, and an XTF (sidescan) and SEG (sub-bottom) file will be recorded simultaneously by SonarWiz into the XTF sub-folder of the project. Here are two examples of how to do it, with:

- 1) Digital sidescan / Analog sub-bottom case 1, then
- 2) Analog sidescan / Analog sub-bottom case 2

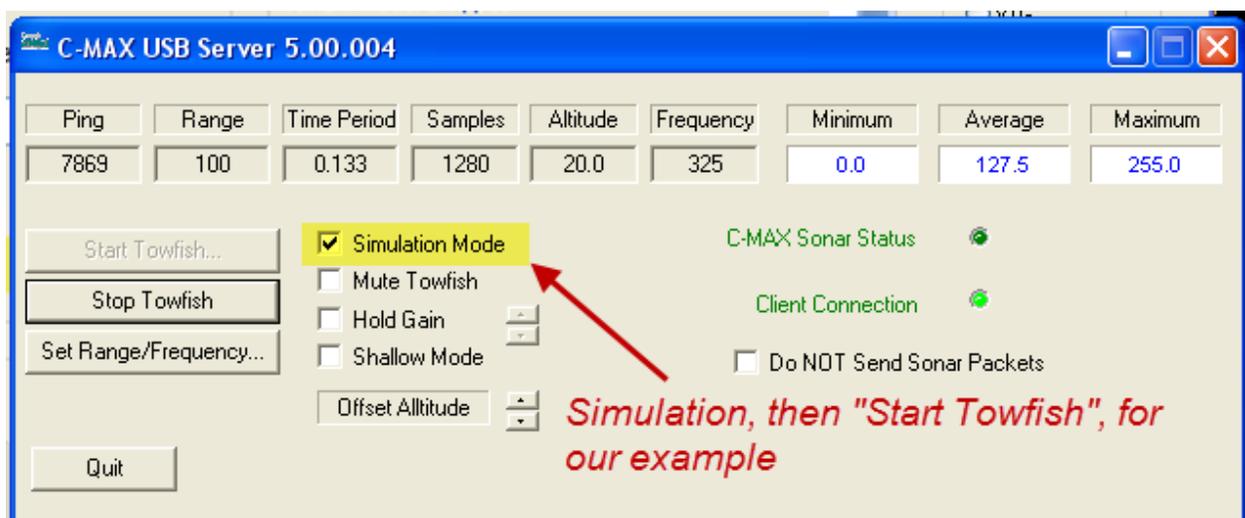
5.9.1 Digital Sidescan and Analog Sub-bottom Recording Example

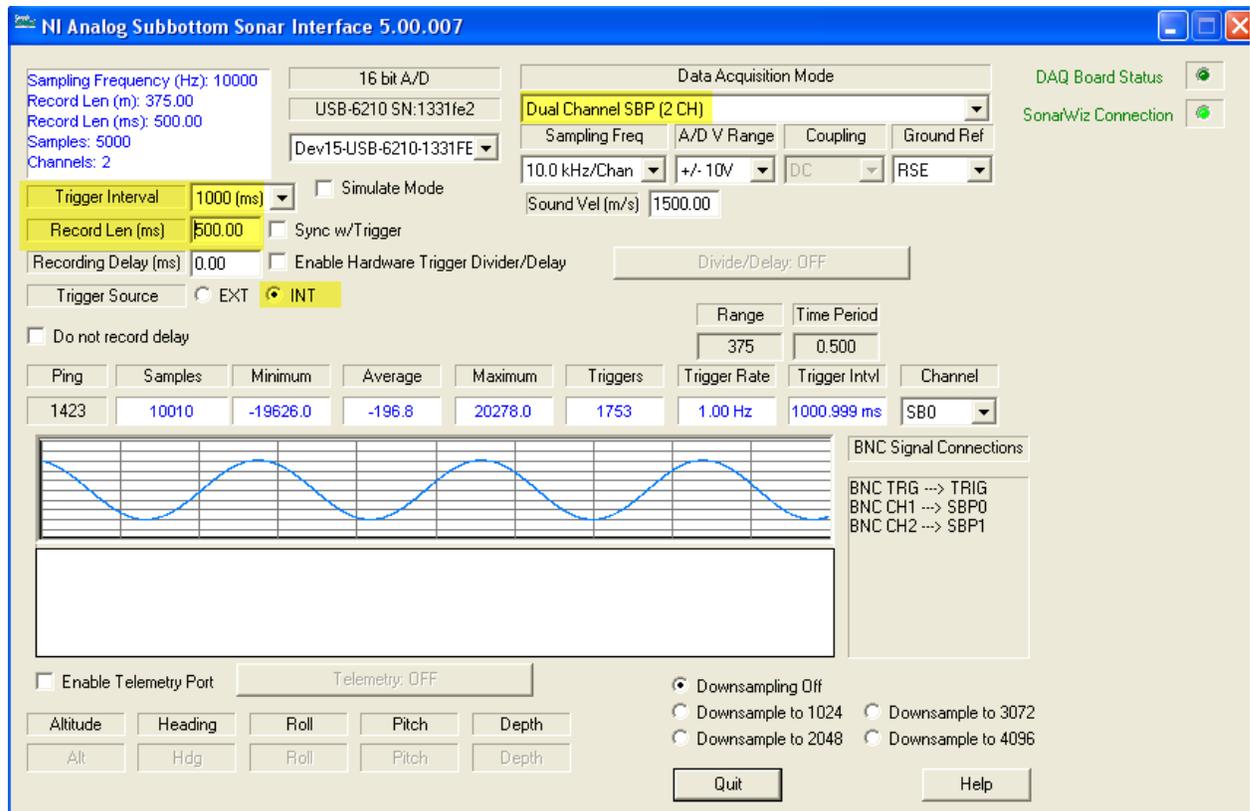
This example shows how to set up and record CMAX CM-2 digital sidescan at the same time as you record Analog sub-bottom data.

1. First set up the Navigation, enable it, and verify that the message port and format will match that coming in from your GPS. In my case below, we are expecting UDP messages on port 5100, NMEA-0183 GGA format:



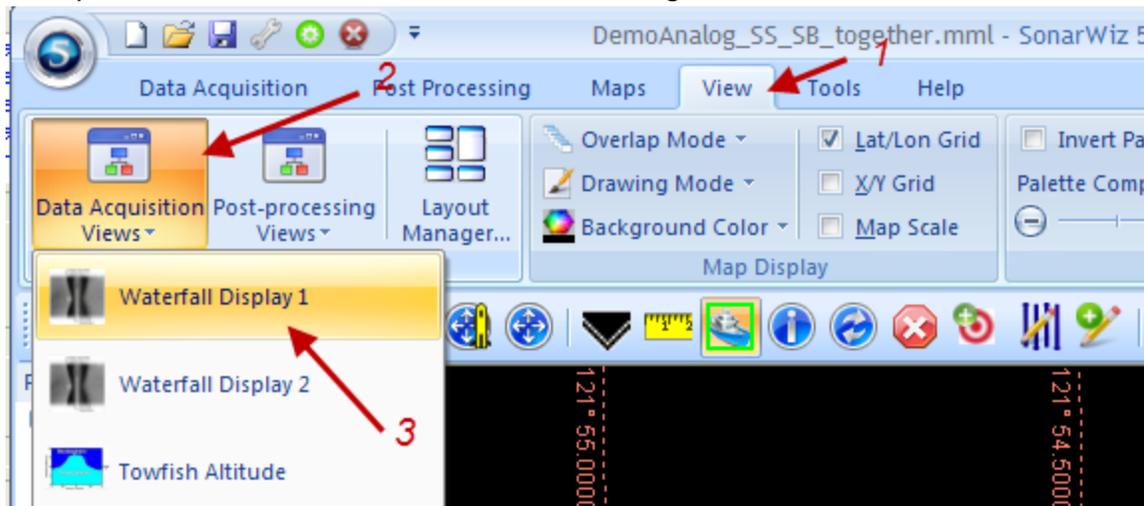
2. Next, select Sonar and start each of the two servers, and configure the trigger as needed, and recording epoch, etc. in the NI Analog sub-bottom server. In the CMAX example, we are just simulating the input:

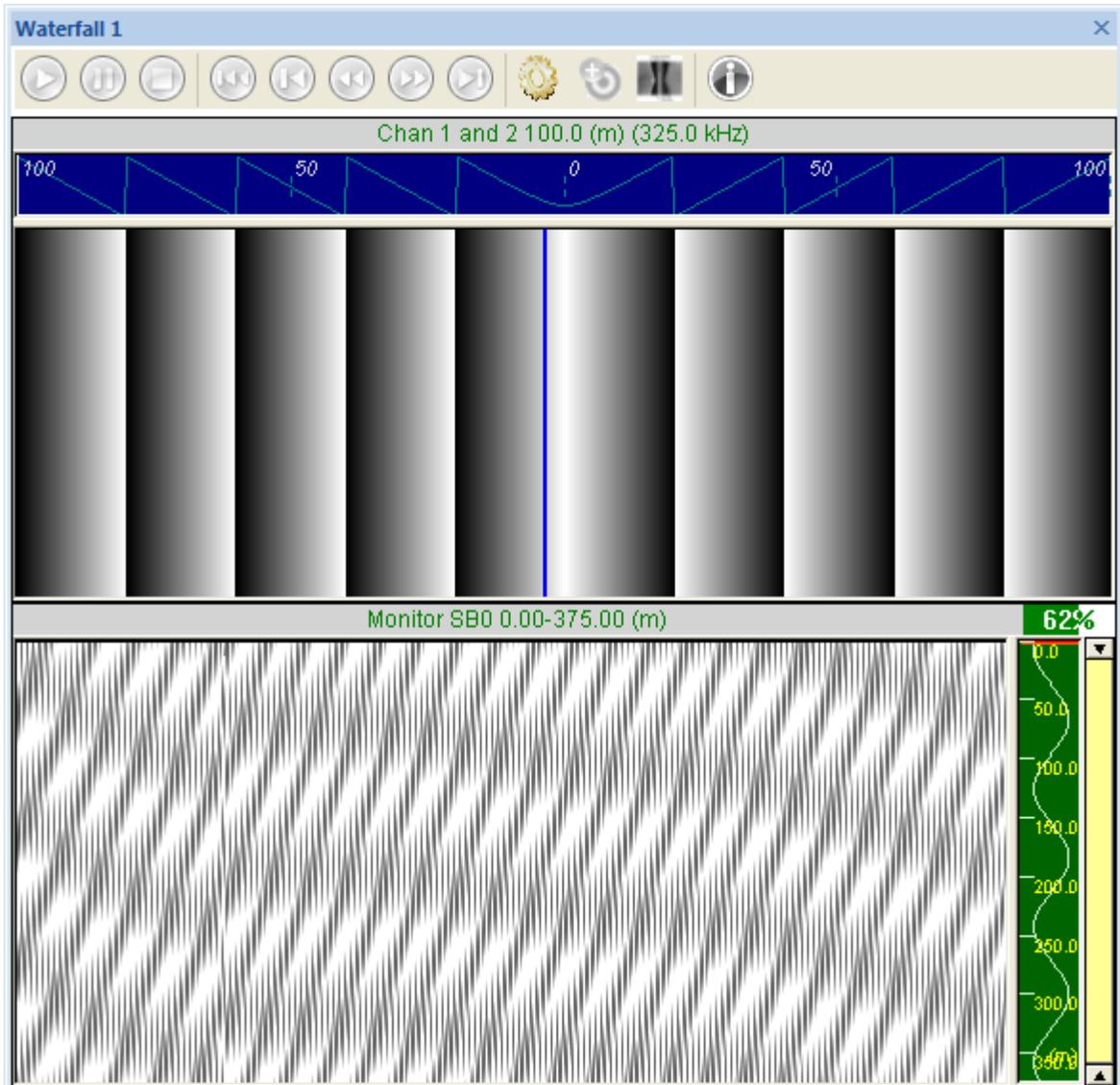




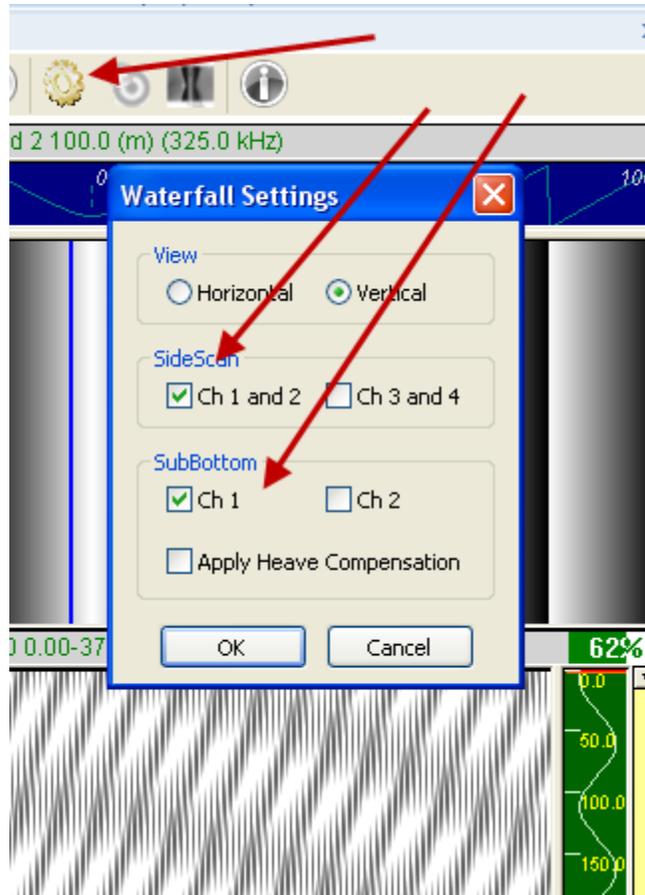
The NI Analog SB recording is 2-channel, internal trigger, 1 Hz ping rate, 500 msec recording epochs, just for the sake of example.

3. Set up a View -> Waterfall 1 to see the incoming data like this:

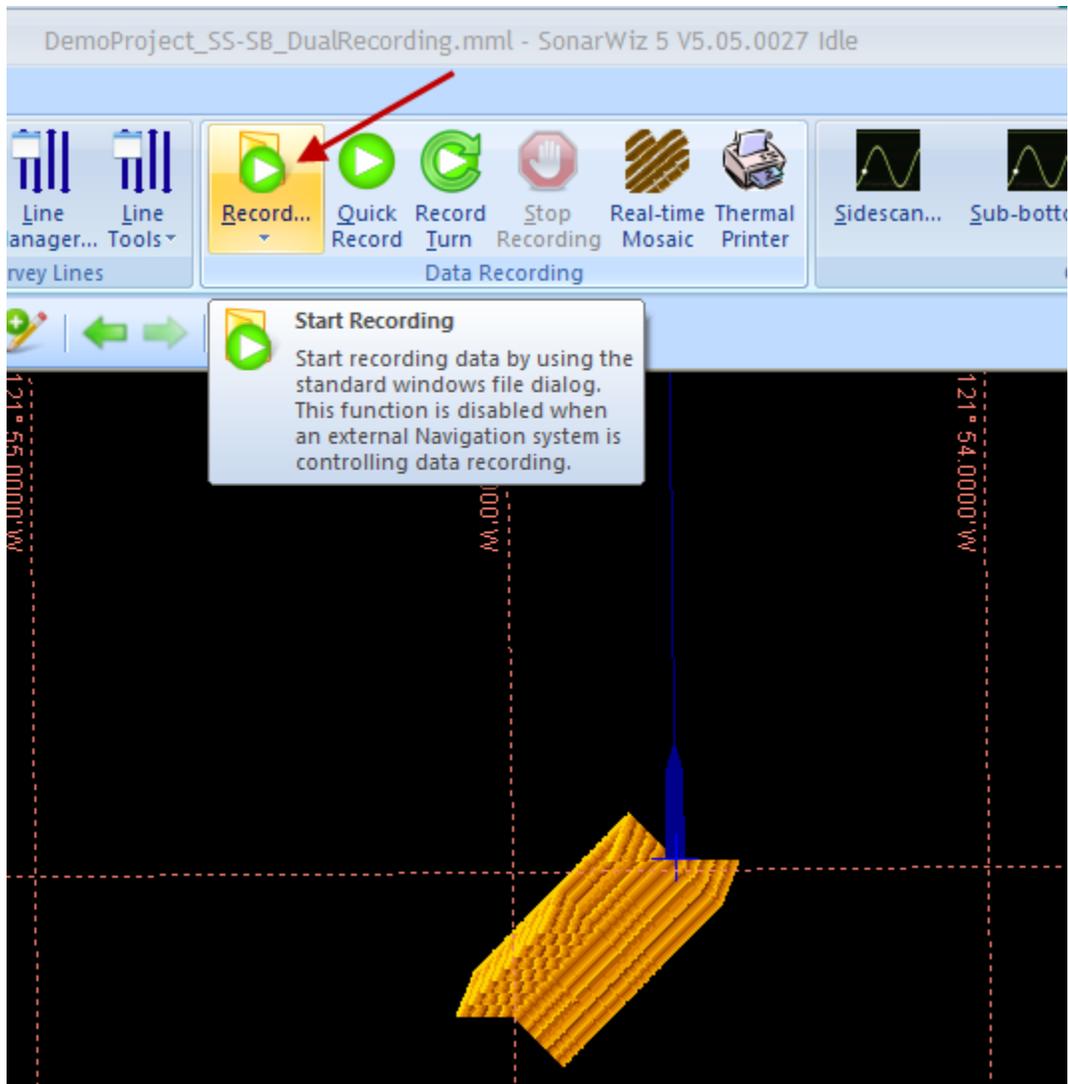




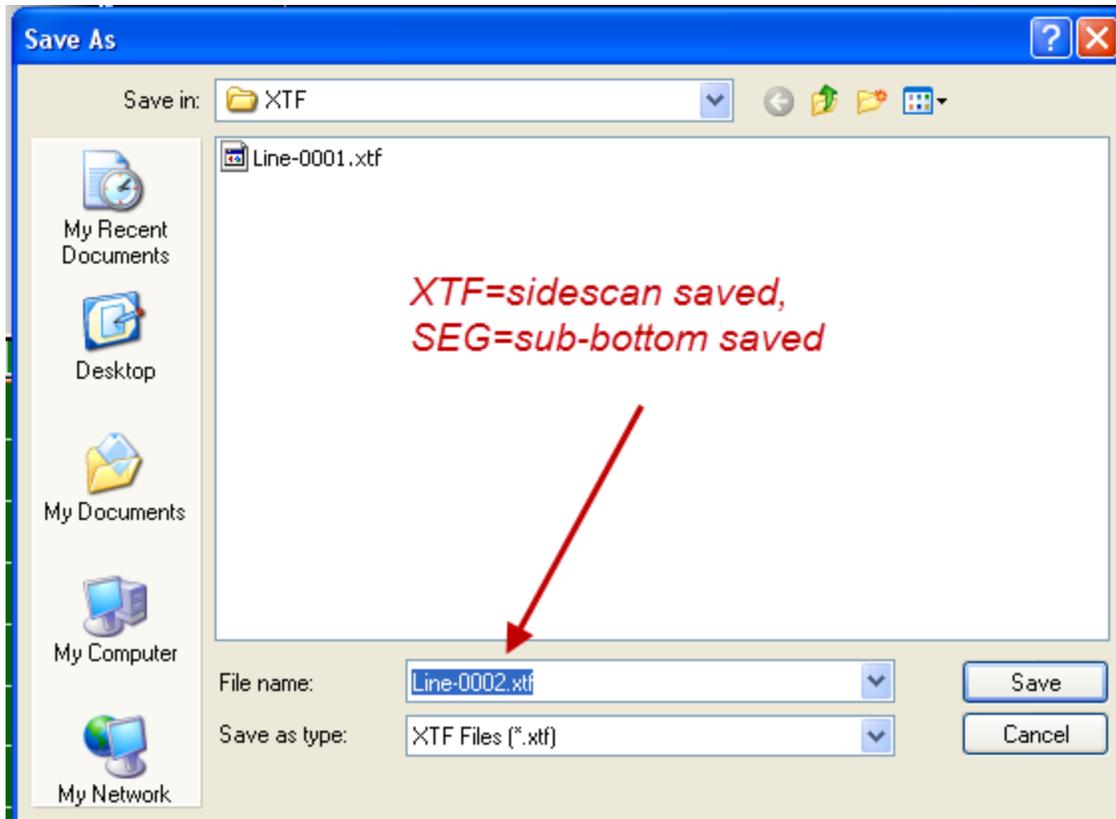
The GEAR icon controls settings, and in our case we chose to display sidescan channels 1,2 (port, stbd), and 1 channel of sub-bottom data:



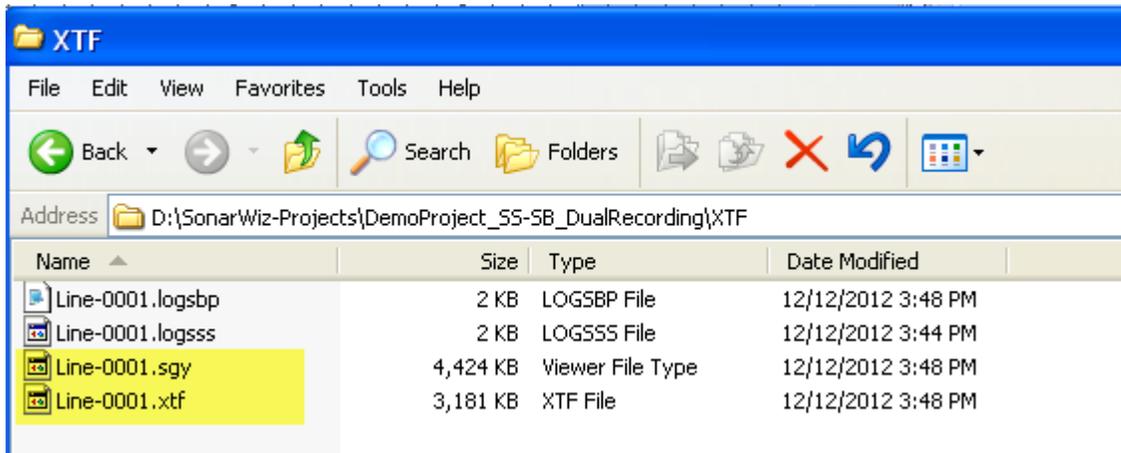
4. Finally, the mosaic is showing the incoming sidescan data and you are ready to click RECORD, and specify a line name:



When you click RECORD, it offers the option of changing the file name:

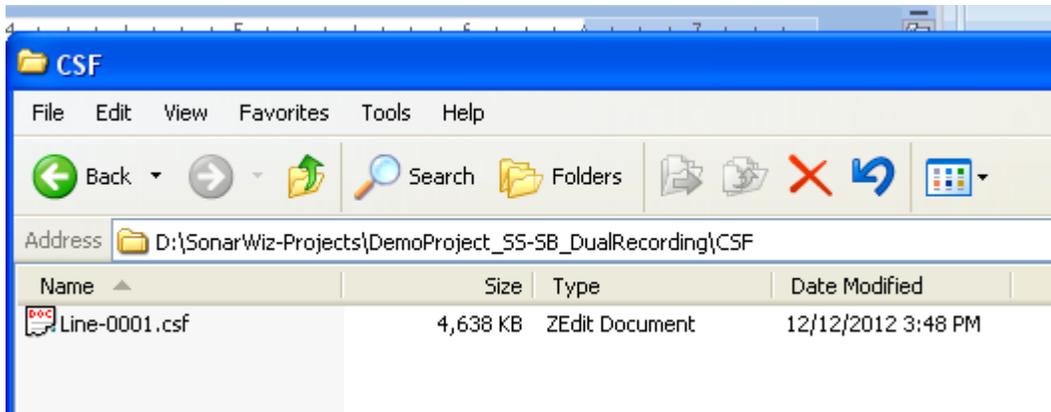


Two files will be created when there are two servers running. The sidescan server data will be recorded in Line0001, Line0002... XTF file series, and the sub-bottom data will be saved in the same series names, but the file extension will be SGY. Both files will be saved to the XTF folder of the project:

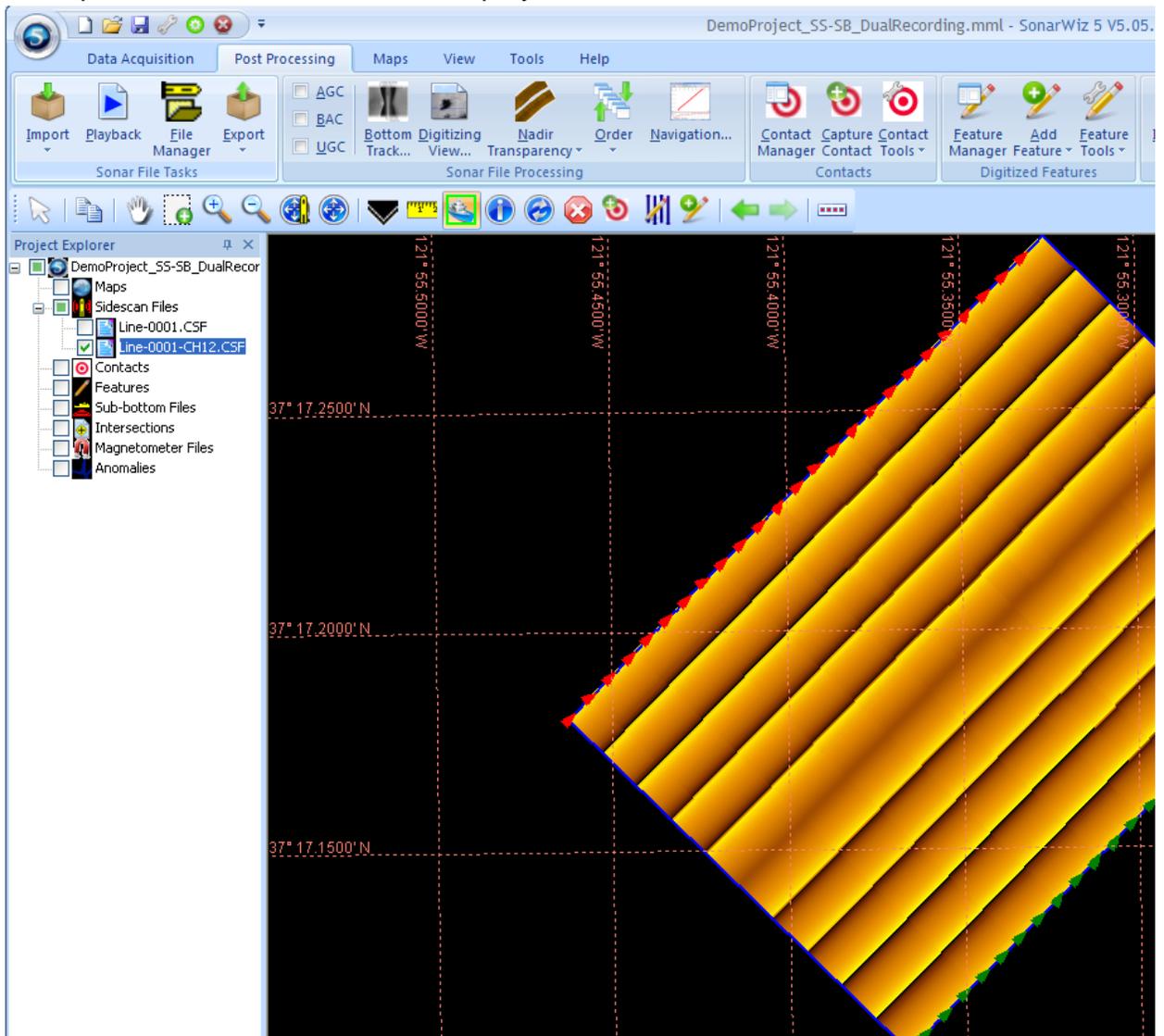


The *.logsss and *.logsbp files are descriptive text files explaining the recording settings used in the recording of their respective SSS and SBP files.

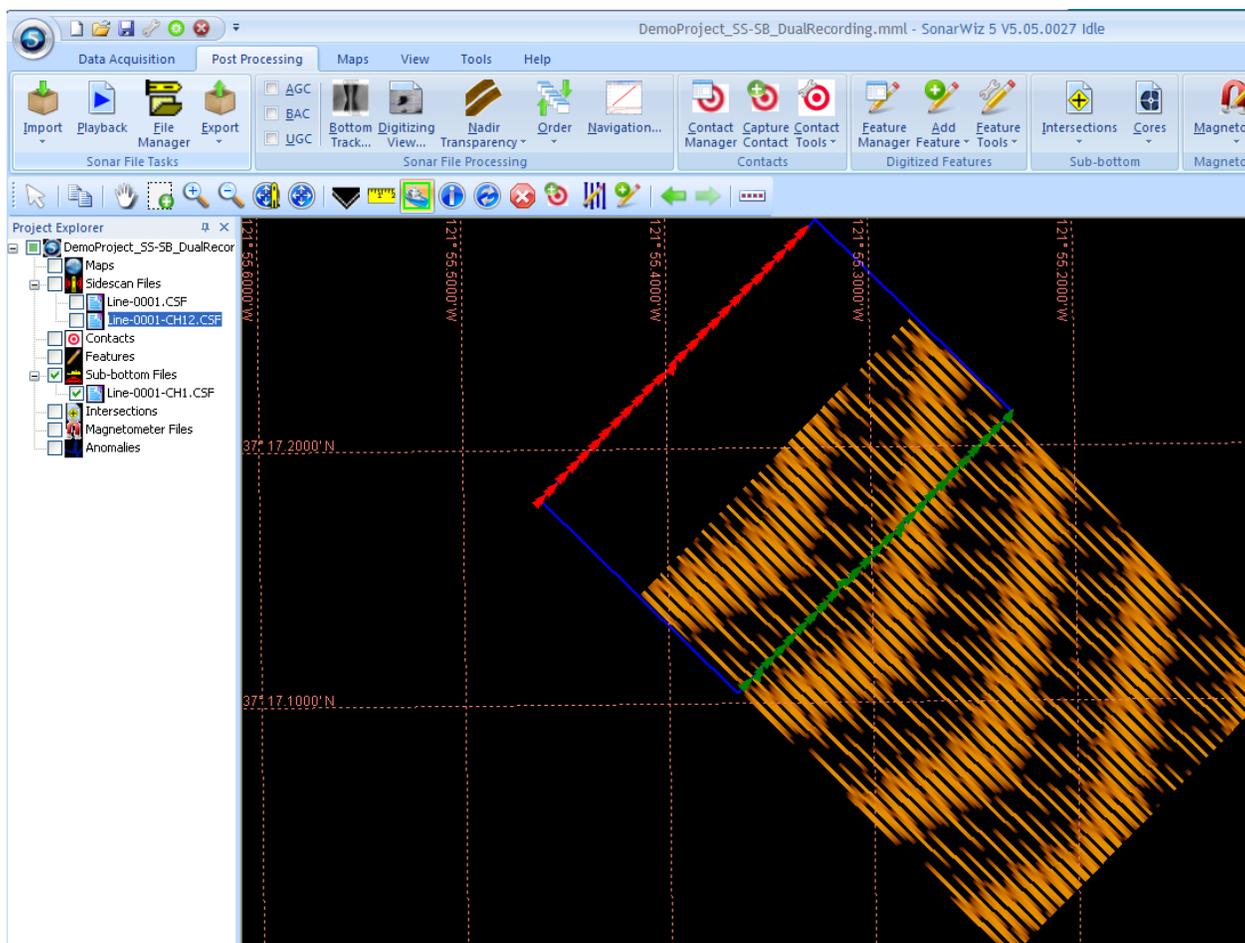
- When you finally click STOP, the data files will be saved, and you can start post-processing the files. The CSF file created during the recording is saved in the CSF file, and represents the sidescan data:



6. Re-import the XTF file then and it displays as Line-0001-CH-12.CSF:



7. The SGY file imports too and displays like this:

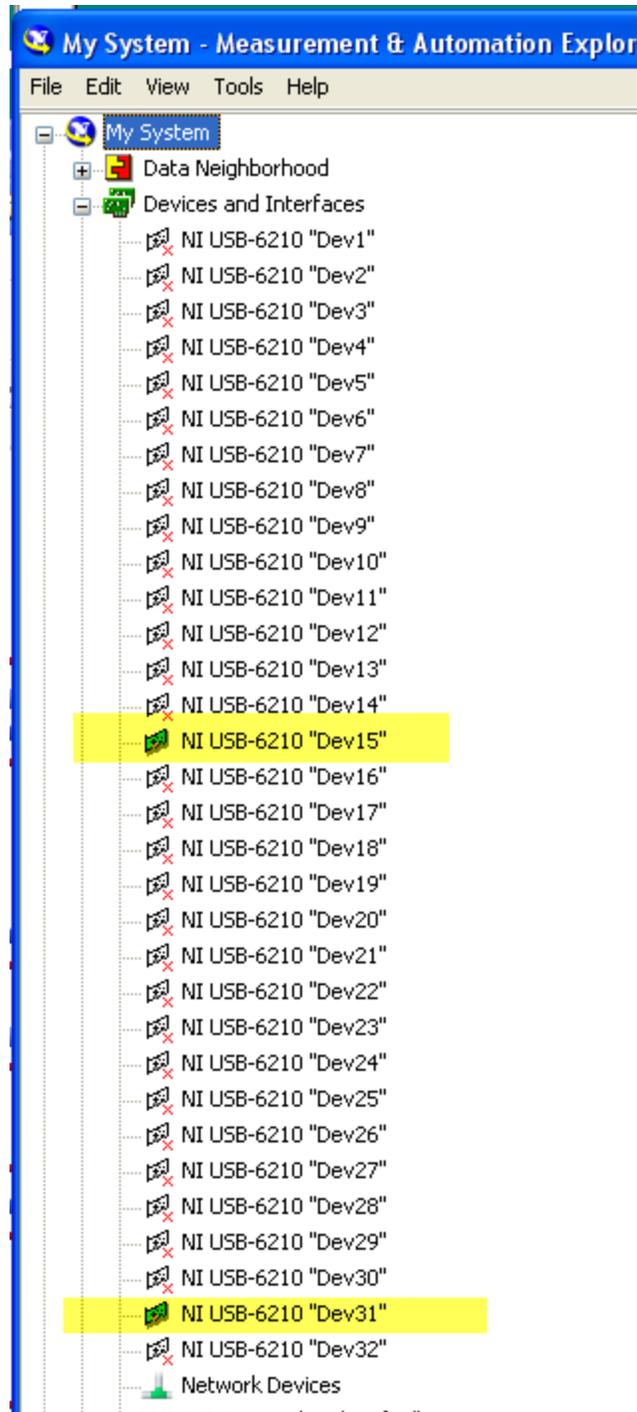


8. This display shows that the same navigation going into a 2-ch sidescan has the navigation plot down the central nadir region, and this will be the top of the sub-bottom displayed mosaic.

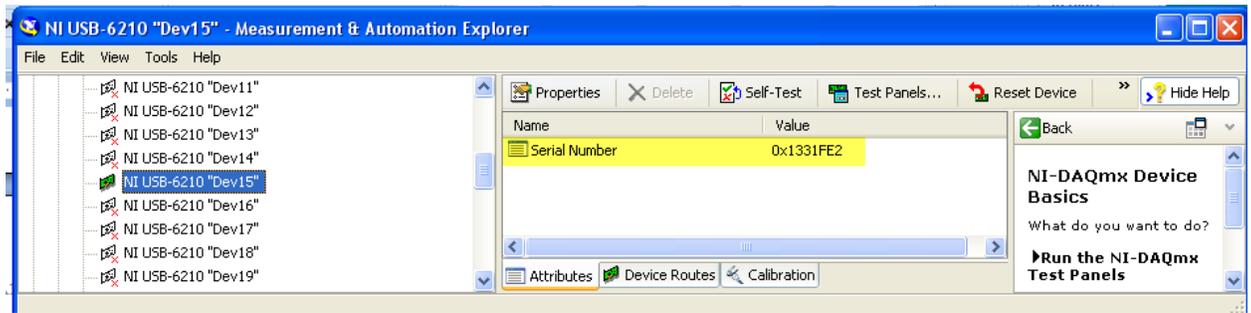
5.9.2 Analog Sidescan / Analog Sub-bottom Recording Example

Using a pair of CTI 5-BNC boxes, and a KDD box to provide trigger output division / delay between the SS and SB pings, one can record from both interfaces. Simultaneously n XTF (sidescan) and SEG (sub-bottom) file would be recorded. Here's how to do that.

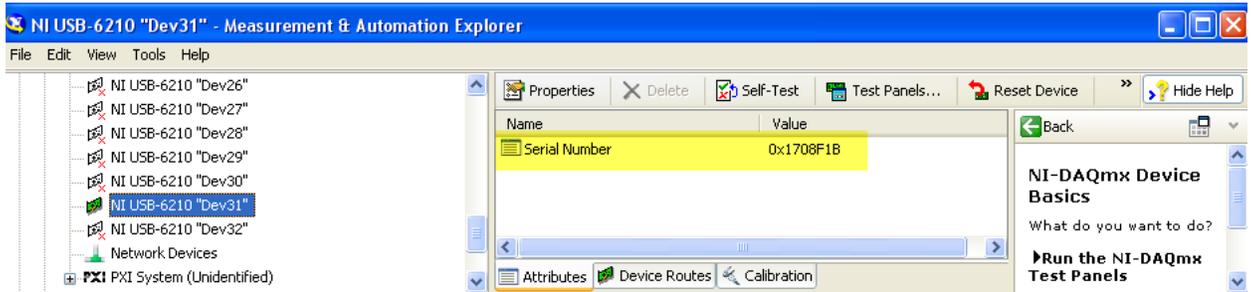
First attach both CTI 5-BNC boxes to the PC using 2 separate USB ports. The National Instruments Measurement 7 Automation Explorer is a great way to check these units out, independent of the SonarWiz software. Selecting DEVICES in this software, you will see two separate devices connected, and can read their serial numbers:



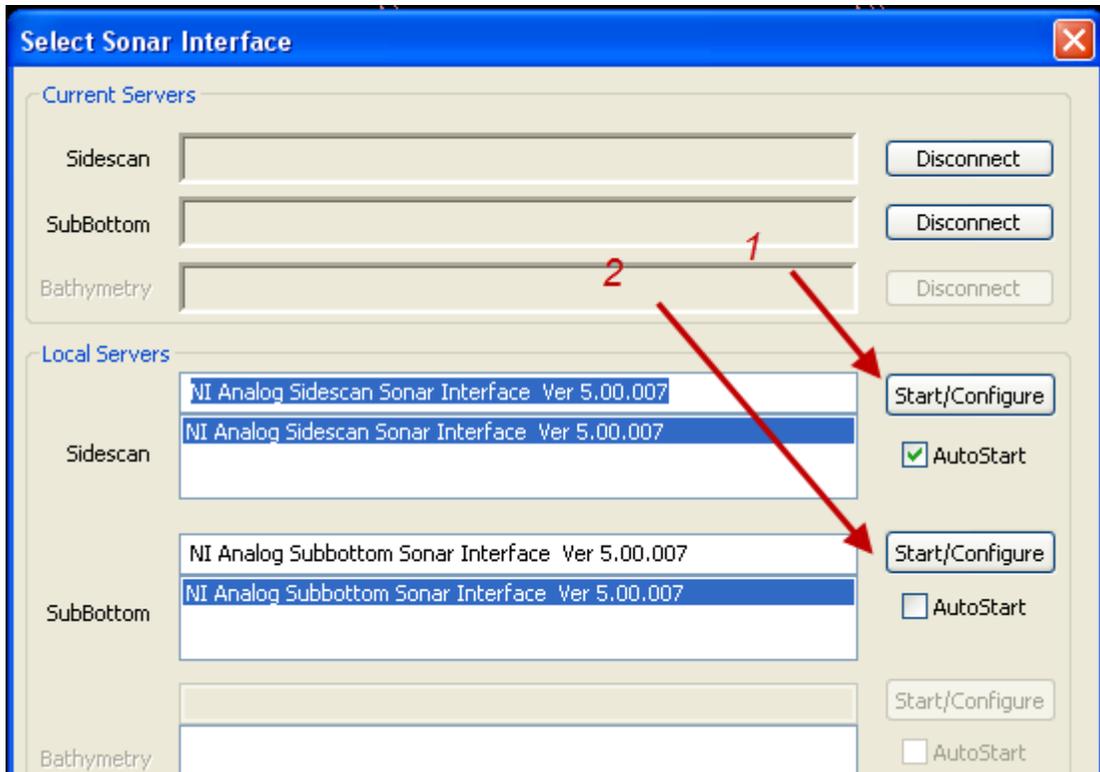
The first Dev15 shows a serial number:



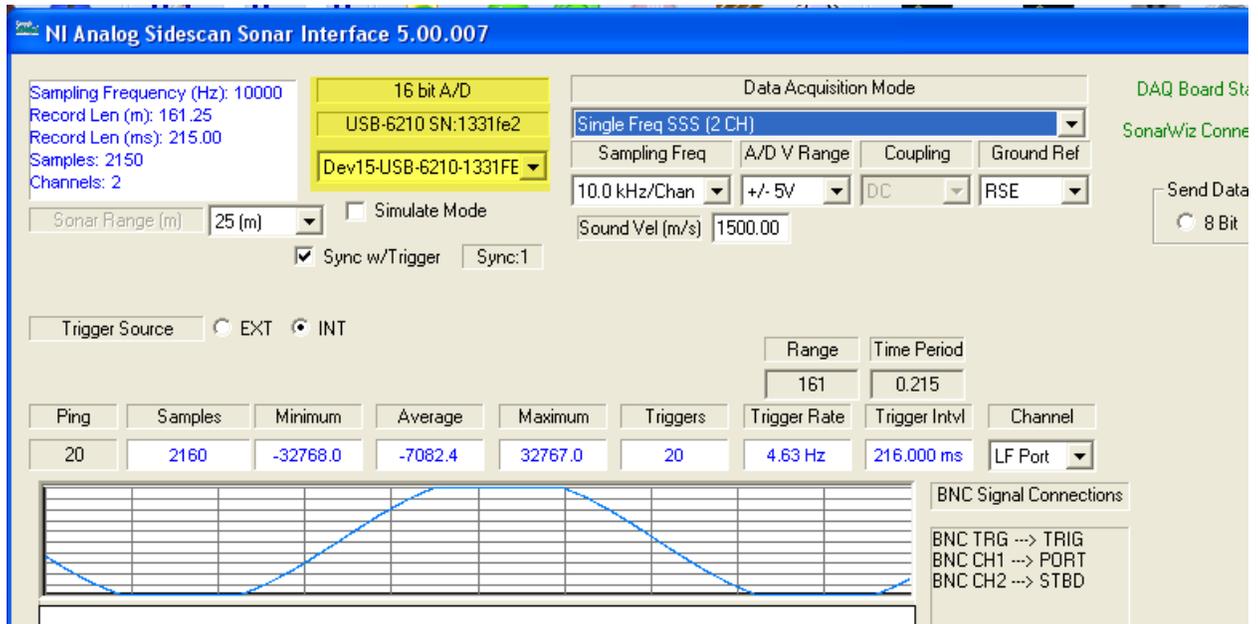
And the second Dev31 shows its own unique serial number:



Next, install and start each server, and start them running. You can do this after starting SonarWiz, by selecting each server under Data Acquisition-> Sonar, in turn:

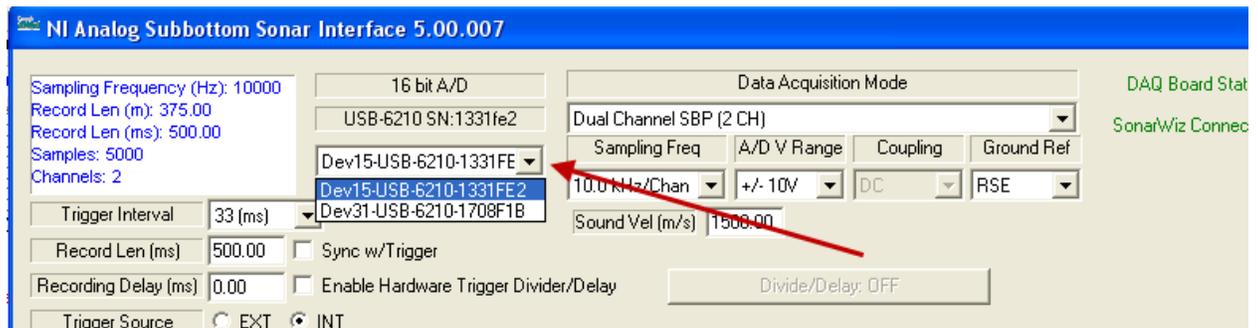


The analog sidescan server starts first, and in this case is the Dev15 unit:



You can see a sample simulation signal, and the serial number 0x1331FE2 identified the unit. Look on the bottom of the box to see the numbered tape ID tag on the CTI 5-BNC box.

Then start the next server and select the other USB line. You will need to select the USB port and device so as to use a different one than the default, so both SS and SB can record at the same time:



When you do this, you can have both active at one, and would typically select EXT trigger for the sidescan server, and use a KDD box to isolate and divide the triggers down, so the sub-bottom is say 3 Hz, sidescan is 6 or 9 Hz, and there is some delay between the sidescan and sub-bottom triggers, so their returns do not interfere with one another. In this example we simply set it like so:

NI Analog Sidescan Sonar Interface 5.00.007

Sampling Frequency (Hz): 10000
 Record Len (m): 25.73
 Record Len (ms): 34.30
 Samples: 343
 Channels: 2

16 bit A/D
 USB-6210 SN:1331fe2
 Dev15-USB-6210-1331FE

Data Acquisition Mode: Single Freq SSS (2 CH)
 Sampling Freq: 10.0 kHz/Chan
 A/D V Range: +/- 5V
 Coupling: DC
 Ground Ref: RSE
 Sound Vel (m/s): 1500.00

Trigger Source: EXT INT

Ping	Samples	Minimum	Average	Maximum	Triggers	Trigger Rate	Trigger Intvl	Channel
4955	353	-32768.0	3856.8	32767.0	4955	28.33 Hz	35.300 ms	LF Port

12/12/12 16:59:50: The specified operation cannot be performed because a task has been aborted or a device has been removed from the system. Handle this situation as required by the application and then, if appropriate, attempt to perform the operation again. Task Name: ALTASK Status Code: -98709

NI Analog Subbottom Sonar Interface 5.00.007

Sampling Frequency (Hz): 10000
 Record Len (m): 25.00
 Record Len (ms): 33.33
 Samples: 333
 Channels: 2

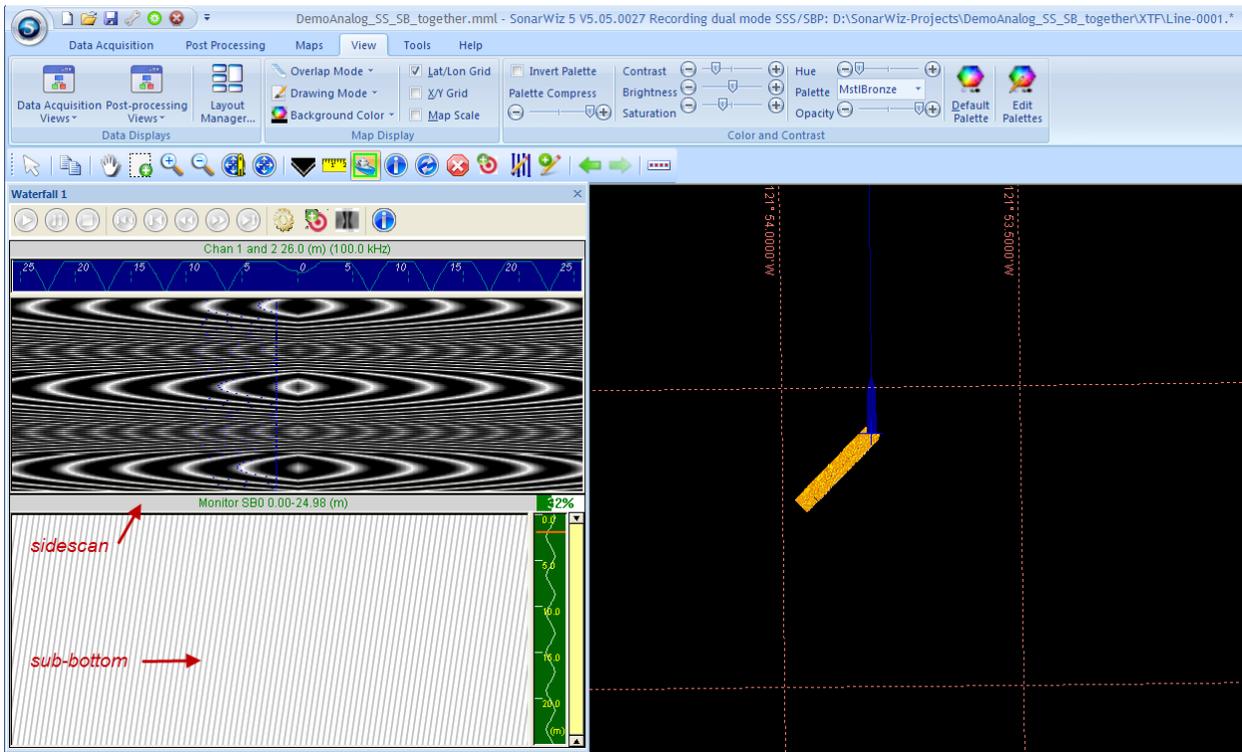
16 bit A/D
 USB-6210 SN:1708f1b
 Dev31-USB-6210-1708F1

Data Acquisition Mode: Dual Channel SBP (2 CH)
 Sampling Freq: 10.0 kHz/Chan
 A/D V Range: +/- 10V
 Coupling: DC
 Ground Ref: RSE
 Sound Vel (m/s): 1500.00

Trigger Interval: 200 (ms)
 Record Len (ms): 33.33
 Recording Delay (ms): 0.00
 Trigger Source: EXT INT

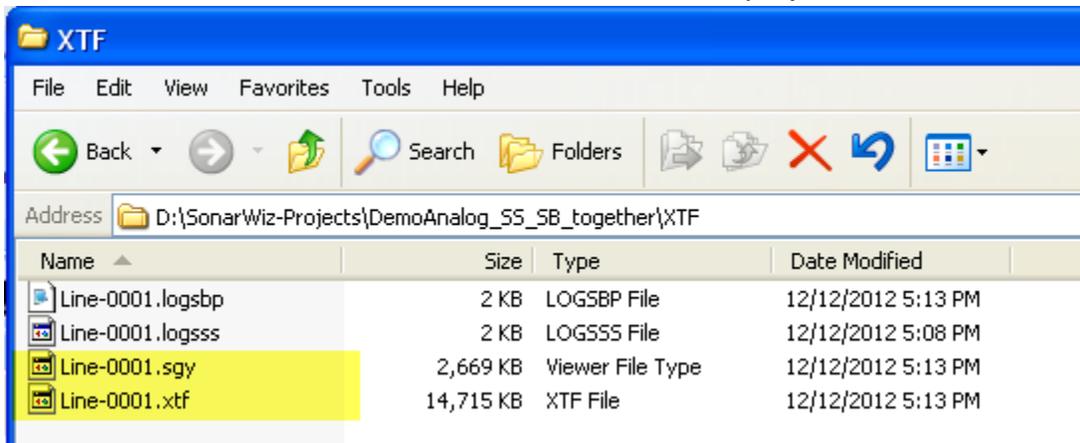
Ping	Samples	Minimum	Average	Maximum	Triggers	Trigger Rate	Trigger Intvl	Channel
2291	2010	-10498.0	-1030.5	8462.0	2291	4.98 Hz	201.000 ms	SB0

Finally, like in the case with a digital sidescan and analog sub-bottom, get the navigation going, and a waterfall view, and verify that you like the incoming nav and signals, then start recording:

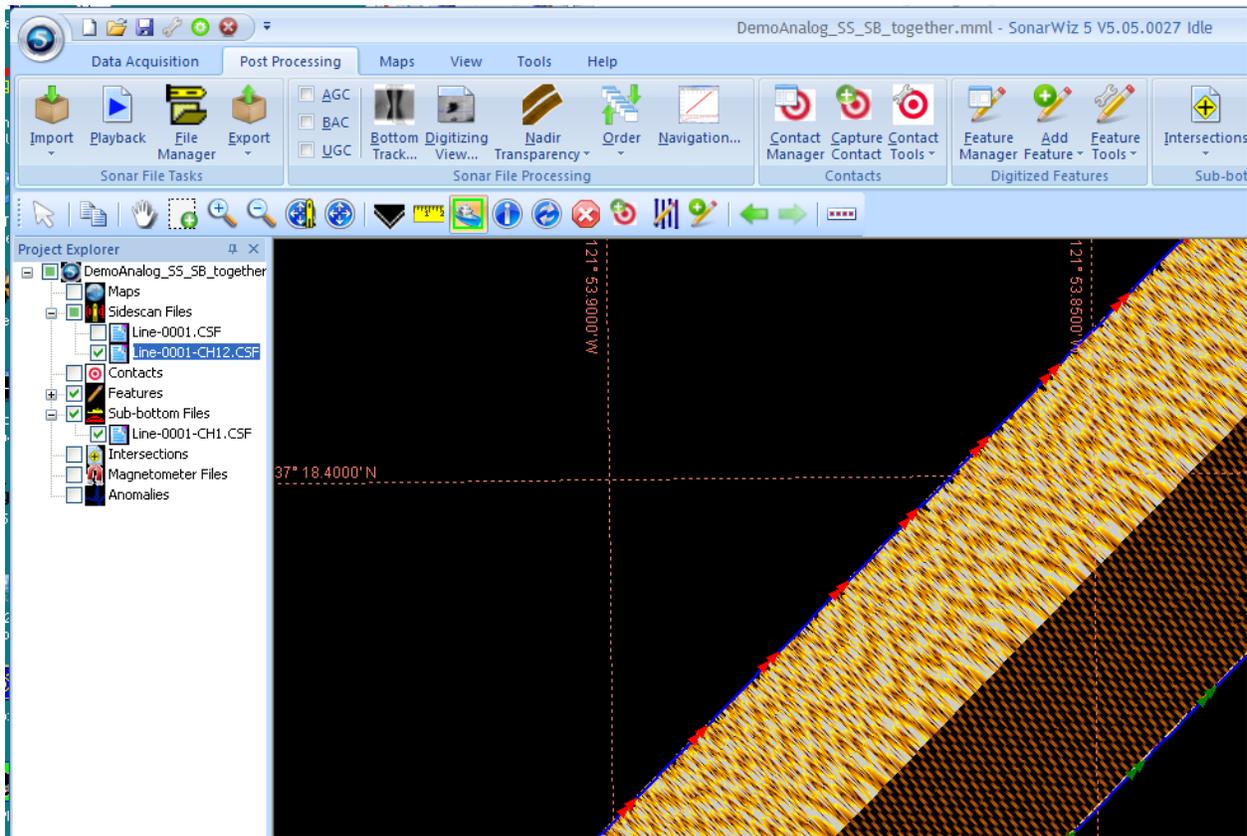


In this example, the incoming data are 60 Hz sine wave (sidescan) and 180hz sine wave (sub-bottom).

The recorded files are saved in the XTF folder of the project:

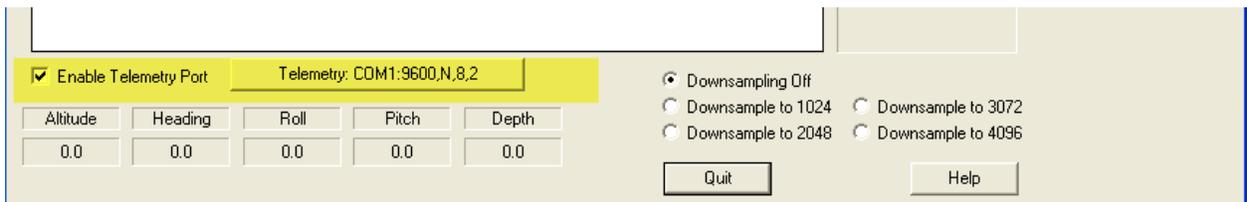


The XTF file is the sidescan, and the SGY file is the sub-bottom. Next, import the files and start post-processing your new data!



5.9.3 Telemetry Recording options: New HEAVE sensor input

Both the sidescan and sub-bottom servers have a TELEMETRY input option here:



The TELEMETRY input purpose and format is described well in the main SonarWiz User Guide, in Section 8 under each of the respective Analog sidescan and sub-bottom sections.

New in Analog sub-bottom server version 5.00.008 is a dedicated HEAVE sensor telemetry option here:



6 Installation Scenarios

Ordinarily you will install the software for analog real-time acquisition at the office on a PC with plenty of time and a great Internet connection, and perhaps the original installation CDs that came with your dongle purchase and the analog interface box (CTI 5-BNC box). We'll explain this sort of optimal install sequence first, then help you get everything you need in case you are in the field and have NO installation CDs

6.1 Optimal Set-up Protocol - Edgetech 460 – Analog Recording Set-up Example

This advice sequence gives an idea of start-to-finish set-up of an analog sidescan recording scenario, where the user recorded from an Edgetech 260 top-side unit, with analog outputs, interfaced to and controlling an Edgetech 272 towfish, and you have INTERNET or the INSTALLATION CDs set with your original purchase.

- 1) Download Install SonarWiz, [or INSTALL YOUR SonarWiz CD. If you have the CD, it will have the Analog Server on it too.](#)
- 2) Download and install NI Analog Sidescan Server from our support site, [or install it from the SonarWiz installation CD you received when you bought the software.](#)
- 3) Install the National Instruments NIDaqMx driver, [using the NI factory CD.](#) This would have been shipped with the analog interface hardware. [Alternatively you can search the www.ni.com site for current version drivers download for the NI USB-6210 card, and install it.](#)
- 4) After everything is installed, connect the USB cable from the analog interface box to the SonarWiz PC and wait for the Windows plug-and-play software to recognize the device.
- 5) Connect the Trigger BNC cable from the Edgetech 260 to the TRIGIO connector on the analog interface box .
- 6) Connect the port channel data BNC cable from the Edgetech 260 to the CH1 connector on the analog interface box.
- 7) Connect the starboard channel data BNC cable from the Edgetech 260 to the CH2 connector on the analog interface box.
- 8) Start SonarWiz and create a new project.
- 9) Under the Data Acquisition tab, click on the Sonar button.
- 10) Highlight the NI Analog Sidescan Interface item and press Start Configure button.

- 11) Set the Trigger to External.
- 12) Set the range to match the same range to which the Edgetech 260 recorder is set.
- 13) Set up and enable Navigation
- 14) Click QuickRecord to start recording the sonar data.

6.2 Field Installation of SonarWiz, Analog Server, NI Drivers - sans CDs

Without the installation CDs, even in the field, you can install everything you need using the following instructions.

1. Log into www.chestech-support.com and access Download > SonarWiz area, and download and install the [SonarWiz](#) full-installation software first, from here:

The screenshot shows a web browser window at www.chestech-support.com/ctisupport/sonarWiz6Downloads.asp. The user is logged in as 'ctistaff'. The page title is 'Currently Available SonarWiz Downloads'. On the left, there is a 'Downloads' menu with links for SonarWiz, SonarWiz 5, SonarWiz.MAP 4, SonarWiz Servers, SonarWeb, Utilities, Tutorials, Evaluations, and Sample Data. Below this is a 'Version History' section with links for SonarWiz, SonarWiz 5, SonarWiz.MAP 4, SonarWeb, and Servers. The main content area is a table titled 'Software' with columns for Name, Description, Ver, Format, and Posted. The table contains one entry for SonarWiz 6, with a description of features like sidescan, sub-bottom, bathymetry, magnetometry, and a new GUI. The version is V6.01.0027, the format is Self-installing EXE, and it was posted on 9/18/2015. A 'Download' link is provided for this entry. A red arrow points to this 'Download' link.

Name	Description	Ver	Format	Posted
SonarWiz 6	SonarWiz 6, with sidescan, sub-bottom, bathymetry and magnetometry feature sets, and new GUI color-scheme and button icons, and introductory CUBE bathy processing for you to try!	V6.01.0027	Self-installing EXE	9/18/2015

2. At the same download site, download your analog server, which as of September, 2015, are one of these two choices (Click [SonarWiz Servers](#) and scroll down to find them):

ANALOG SIDESCAN:

Analog Subbottom Server	<i>Self-installing Analog Subbottom Server for NI12-16-24 bit A/D PCI, PCMCIA and USB devices. Compatible with SonarWiz 5 and SonarWiz 6. With real-time heave compensation, telemetry interfaces, DC OFFSET control, and now 2-ch recording delay.</i>	<i>Self installing EXE 3/27/2015</i> Download
Analog Sidescan Server	<i>Self-installing Analog Sidescan Server for NI 12-16-24 bit A/D PCI, PCMCIA and USB devices. Compatible with SonarWiz 5 and SonarWiz 6. Now with DIFF/ NRSE grounding mode options, and serial port parsing.</i>	<i>Self-installing EXE 3/26/2015</i> Download

NI AnalogSB server



NI Analog SSS server



3. The National Instruments drivers are needed, and you can download these easiest in a 140MB download for version 9.0.2 here:

Download the drivers from [www.NI.com](http://www.ni.com) at:

<http://joule.ni.com/nidu/cds/view/p/lang/en/id/1450>

and select the NI-DAQmx Run-Time Engine (Core) Downloader, This is a really great link to a 140MB download, because the current (December, 2013) download link for the general NI USB-6210 drivers is 1.5GB and may take you FOREVER, on a slow Internet connection on a boat.

Once all 3 are downloaded, you should be good to go! Then follow the Edgetech 460 set-up example in section 6.1 above and it'll get you going.

7 Bill of Materials - Software and Equipment Purchases

This section describes what is, and what is not delivered, with the purchase of analog real-time acquisition software and hardware.

7.1 16-bit Analog Server / Interface Box Combination

When you buy a 16-bit analog acquisition license, either sidescan or sub-bottom, you will receive the following items. If it's a new first-time purchase, you will also receive the dongle (license key), a SafeNet Sentinel USB SuperPro key that plugs into a USB port on your PC. If you already have a license key, the licensing may be delivered electronically via a DUK file, with update instructions. In addition, you will receive:

1. Software CD - Chesapeake Technology

With a purchase of the real-time acquisition server for 16-bit analog sidescan or sub-bottom, a software CD is included. The CD contains a current version of SonarWiz, and the real-time server(s) purchased.

2. National Instruments Driver CD

The driver CD comes straight from National Instruments, and contains the current driver set available for the NI DAQMux drivers (supports 16-bit or 24-bit NI hardware units)

3. 16-bit CTI 5-BNC Analog Interface Box / USB-cable

This unit comes with the following 2 hardware items:

3.1. CTI 5-BNC analog interface box.

This box contains the NI USB-6210 16-bit hardware card, and other custom circuitry, to provide 1 channel of trigger I/O, and up to 5 channels of analog A/D acquisition (hence 5 BNC). This box connects to the computer via a mini-USB jack on its front panel, and item 3.2 below.

3.2 National Instruments - USB to mini-USB interface cable

This cable is necessary to connect the 16-bit CTI 5-BNC box to your computer. The USB-connector end plugs into a USB hub, or a USB port, and connects to the computer. The mini-USB connector end connects to the 16-bit CTI 5-BNC box. The cable is typically 3' in length.

7.2 16-bit Analog Interface Box - stand-alone

If you purchase only a replacement or additional 16-bit CTI 5-BNC box, you will receive 3 items 2, 3.1, and 3.2 listed above in section 7.1 - e.g. (1) NI CD, (2) CTI 5-BNC box, and (3) USB-to-mini-USB interface cable.

7.3 24-bit Analog Sub-bottom Server / Interface Box Combination

When you buy a 24-bit analog acquisition license (sub-bottom only), you will receive the following items. If it's a new first-time purchase, you will also receive the dongle (license key), a SafeNet Sentinel USB SuperPro key that plugs into a USB port on your PC. If you already have a license key, the licensing may be delivered electronically via a DUK file, with update instructions. In addition, you will receive:

1. Software CD - Chesapeake Technology

With a purchase of the real-time acquisition server for 24-bit analog sub-bottom, a software CD is included. The CD contains a current version of SonarWiz, and the real-time server purchased.

2. National Instruments Driver CD

The driver CD comes straight from National Instruments, and contains the current driver set available for the NI DAQMux drivers (supports 16-bit or 24-bit NI hardware units)

3. 24-bit National Instruments NI-4431 Analog Interface Box and interface cables kit

This unit comes with the following 4 hardware items:

3.1. NI USB-4431 analog interface box.

This box is a factory stock version of the NI USB-4431 unit, integration tested and functionally verified at CTI. This box connects to the computer via a mini-USB jack.



3.2 National Instruments - USB to mini-USB interface cable

This cable is necessary to connect the NI USB-4431 box to your computer. The USB-connector end plugs into a USB hub, or a USB port, and connects to the computer. The mini-USB connector end connects to the NI USB-4431 box. The cable is typically 3' in length.



3.3 12" RG-58 M-M BNC patch cable

This cable is necessary to use internal trigger option, and its use is described in the separate 24-bit analog interface document. Chesapeake supplies one with each NI USB-4431 unit sold. It has M-M type connectors (male ends).



3.4 F-M-F BNC tee connector

This Tee is necessary to use internal trigger option, and its use is described in the separate 24-bit analog interface document. Chesapeake supplies one with each NI USB-4431 unit sold. It has F-F type (female ends) connectors available after plugging it into AI 0, so that you can connect two things:

- (1) The BNC patch cable connects it, so that AI 0 and AO 0 are connected, and the internal trigger you generate on AO 0 is received on AI 1.
- (2) On the free F end of the Tee, you will probably connect your own BNC patch cable to your sonar equipment, so that the "internal" trigger drives the ping rate on your sonar equipment.



This photo shows the BNC F-M-F Tee connector plugged into the AI 0 (trigger input) channel, with the 12" RG-58 BNC patch cable connected to one female end

7.4 24-bit Analog Interface Box - stand-alone

If you purchase only a replacement or additional 24-bit CTI 5-BNC box, you will receive 5 items 2, 3.1, 3.2, 3.3, and 3.4 listed above in section 7.3 - e.g. (1) NI CD, (2) NI USB-4431 box, (3) USB-to-mini-USB interface cable, (4) 12" M-M BNC patch cable, and (5) F-M-F BNC Tee connector.

7.5 User-Supplied Equipment - Accessory Cables

Chesapeake Technology, Inc. does not sell BNC cables, other than the 12" cable supplied with each NI USB-4431 unit. You must supply your own BNC connector cables

to link the analog interface box data lines(s) and trigger, to your own equipment. Please purchase these cables elsewhere, as needed.

8 Document Change History

Rev 18, 5/22/2018 - Section 5.1.2 added describing the SB24Server issue when INTERNAL trigger is selected.

Rev 17, 3/2/2016 - Detailed example of the XTF and SEG files recorded, using various recording modes, for both the NI Analog SS server, and NI Analog SB server, described in enhanced section 5.6.1.

Rev 16, 9/23/2015 - Typos corrected, font changed to Arial 12, cover page added with new corporate logo - no semantic changes.

Rev 15, 11/26/2014 - Section 2.2.1.2 added to help user realize the importance of meeting the NI.com recommendations on input impedance for TRIGGER and SIGNAL lines, using the USB-4431 24-bit hardware.

Rev 14, 3/4/2014 Rev 14 - Bill of Materials section added, per customer request, to clarify what equipment is delivered with a purchase of the 16-bit or 24-bit analog servers, or stand-alone 16 or 24-bit hardware interface boxes.

Rev 13, 2/14/2014 Rev 13 - Many sections revised to clarify 16-bit vs 24-bit offerings, and new features since April, 2013.

Rev 12, 12/11/2013 Rev 12 - Sections 6.1, 6.2 revised - field installation example with no CDs, only Internet access, explained.

Rev 11, 10/24/2013 – Changed KDD diagram for dual SS/SB recording; Added voltage range example.

Rev 10, 4/29/2013 – Updated new Heave sensor telemetry in Analog sub-bottom