NI Analog SSS SB Real-time Data Acquisition Application Note

Revision 18.0, 5/22/2018

Chesapeake Technology, Inc.

eMail: <u>support@chesapeaketech.com</u> Main Web site: <u>http://www.chesapeaketech.com</u> Support Web site: <u>http://www.chestech-support.com</u>

> 1605 W. El Camino Real, Suite 100 Mountain View, CA 94040

> > Tel: 650-967-2045 Fax: 650-450-9300



Table of Contents

1	NI A	Anal	log Data Acquisition – 16-bit and 24-bit options	4
	1.1	Inst	tallation / Set-up Caveats: Errors You May See	4
	1.1	.1	NI Software Not Installed – Error Message	4
	1.1	.2	CTI 5-BNC Box Not Connected yet – Error Message	5
	1.1	.3	NI CD Software Not Installed – Error message	6
	1.1	.4	Disconnected Analog Interface USB Cable - What you will see	7
2	All	Syst	tems Go! What it Looks Like When It Works!	8
	2.1	No	Errors and a Green Blinking LED	8
	2.2	BN	C Connections Impedance Recommendation	8
	2.2	.1	Use Low Impedance Sources to Minimize Inter-channel Crosstalk	8
	2.3	Sar	mple 16-bit Analog Sidescan Server – current release April, 2013	10
	2.4	Sar	mple 16-bit Analog Sub-bottom Server – current release February, 2014	11
	2.5	Sar	mple 24-bit Analog Sub-bottom Server – current release February, 2014	12
3	Sin	gle :	5-BNC box Use in 16-bit SSS / SB Data Collection Configuration	12
4	Sai	me-F	Ping-Rate SSS / SB Data Dual-Collection Configuration	13
	4.1	Sin	gle CTI 5-BNC Box Set-up	13
	4.2	Ind	ependent Ping-Rate SSS / SB Analog Dual-Collection Configuration	14
	4.3	Syr	nchronized Dual-Interface SS / SB / KDD recording Set-up	17
	4.4	24-	bit Analog Sub-bottom recording Set-up	18
5	Ana	alog	Recording Advice Section	19
	5.1	Trig	gger Interval	19
	5.1	.1	Internal Trigger – Output Signal Characteristics - CTI 5-BNC	19
	5.1	.2	Internal Trigger – Output Signal Characteristics - SB24 NI USB-4431unit	20
	5.1	.3	External Trigger – Input Requirements	21
	5.1	.4	Synchronizing a dual-trigger – dual CTI-5BNC Box plus KDD box	21
	5.2	Red	cord Len / Sound Vel / Sampling Freq / Recording Delay Values	22
	5.3	Opt	timizing your Voltage Range	22
	5.4	Dov	wnsampling	23
	5.5	Sou	und Vel(ocity)	23
	5.6	Red	cording Modes: Sidescan/Sub-bottom Recording Scenario Example	23
	5.6	.1	Recording Modes Channel Summary Table	30
	5.7	Inp	ut Analog Signal Characteristics and Recording Mode Choices	31
	5.7	.1	Recording – Ground Reference Choices	31
	5.7	.2	Analog Input Impedance Recommendation	32
	5.8	Edg	getech 460 – Analog Recording Set-up Example	33
	5.9	Sim	nultaneous SS / SB Recording Scenarios	33
	5.9	.1	Digital Sidescan and Analog Sub-bottom Recording Example	34
	5.9	.2	Analog Sidescan / Analog Sub-bottom Recording Example	41
	5.9	.3	I elemetry Recording options: New HEAVE sensor input	47

6	Ins	tallation Scenarios	. 48
	6.1	Optimal Set-up Protocol - Edgetech 460 - Analog Recording Set-up Example	e48
	6.2	Field Installation of SonarWiz, Analog Server, NI Drivers - sans CDs	. 49
7	Bill	of Materials - Software and Equipment Purchases	. 51
	7.1	16-bit Analog Server / Interface Box Combination	. 51
	7.2	16-bit Analog Interface Box - stand-alone	. 52
	7.3	24-bit Analog Sub-bottom Server / Interface Box Combination	. 52
	7.4	24-bit Analog Interface Box - stand-alone	. 55
	7.5	User-Supplied Equipment - Accessory Cables	. 55
8	Do	cument Change History	. 56

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 NIAnalogServer or NIAnalogSBServer 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 subbottom real-time acquisition, new in 2014 is the availability of the new 24-but 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 NIAnalogServer or NIAnalogSBServer, 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 <u>www.NI.com</u> 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 NIAnalogSBServer.exe software, you will see one of these two errors:

NIAnaloį	NIAnalogServer.exe - Unable To Locate Component 🛛 🗙								
This application has failed to start because nicaiu.dll was not found. Re-installing the application may fix this proble									
	ОК								
or									

 NIAnalogSBPServer.exe - Unable To Locate Component

 Image: State of the state of the

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:

Ping	Samples	Minimum	Average	Maximum	Triggers	Trigger Rate	Trigger Intvl Channel		
1792	4010	-2.0	-0.2	2.0	1792	2.49 Hz	401.000 ms SB0 💌		
							BNC Signal Connections		
							BNC TRG> TRIG BNC CH1> SBP		
02/14/14 controller. Name: AIT	02/14/14 17:05:25: NI Platform Services: A USB transfer failed due to a transaction error reported by the USB host controller. This may be due to a fault in the system's USB host controller, a USB cable, or a USB device.Task Name: AlTaskStatus Code: -50808								
🔲 Enable	Heave Port		Heave: OFF						

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) \Box 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: <u>http://www.ni.com/pdf/manuals/372485e.pdf</u>

NI USB-4431 User Manual × 🌾 NI USB-443x Specifications × +									
♦ The second									
🔲 🕇 🖡 Page: 2	of 11 -	- +	Automatic Zoom	\$			5.7 K 3	₽	
Inp FIF Inp	Input range NI USB-4431±10 V _{pk} NI USB-4432±40 V _{pk} FIFO buffer size								
Input Impe	selectable								
	Terminal NI USB-4431 Input Impedance NI USB-4432 Input Impeda								
B	Between positive input and negative input				800 kΩ	1 120 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

🐃 NI Analog Sidescan Sonar Interface 5.00.007		
Sampling Frequency (Hz): 10000 16 bit A/D Record Len (m): 245.40 USB-6210 SN:1331fe2 Samples: 3272 Dev15-USB-6210.1331FE ▼ Channels: 2 Simulate Mode Sonar Range (m) 25 (m) Simulate Mode	Data Acquisition Mode Single Freq SSS (2 CH) Sampling Freq A/D V Range Coupling Ground Ref 10.0 kHz/Chan +/- 5V Sound Vel (m/s) 1500.00	DAQ Board Status SonarWiz Connection Send Data as 8 Bit 16 Bit
Trigger Source	Range Time Period num Triggers Trigger Rate Trigger Intvl Channel um Triggers Trigger Rate Trigger Intvl LF Port Image: Channel Image: Comparison of the state of th	ons
Image: Second system Telemetry: COM1:9600,N,8,2 Altitude Heading Roll Pitch 0.0 0.0 0.0 0.0	O Downsampling Off O Downsample to 1024 C Downsample to 2 O Downsample to 2048 C Downsample to 2 Quit Help	3072 4096

Figure 2.3

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

🐡 NI Analog Subbottom Son	ar Interface 5.00.010			- • • 🔀
NI Analog Subbottom Son Sampling Frequency (Hz): 1000 Record Len (ms): 401.00 Samples: 4010 Channels: 1 Trigger Interval 400 (ms) Record Len (ms) 400 (ms) Record Len (ms) 0.00 Trigger Source Do not record delay Ping 356 4010	ar Interface 5.00.010 10 16 bit A/D USB-6210 SN:18e675c Dev1-USB-6210-18E675c s) Simulate Mode I Simulate Mode I Sync w/Trigger Enable Hardware Trigger Divide I INT	Data Acqu Single Chan SBP (1 CH) Sampling Freq 10.0 kHz/Chan Sound Vel (m/s) 1500.00 er/Delay Divide/I Rang 300 num Triggers Trigger Rang 356 2.49 Hz	isition Mode rge Coupling Ground Ref Coupling Ground Ref Coupling Ground Ref Coupling Ground Ref Coupling Reserved Coupl	BAQ Board Status SonarWiz Connection
Enable Heave Port Enable Telemetry Port Altitude Heading 0.0 0.0	Heave: OFF Telemetry: OFF Roll Pitch D 0.0 0.0	epth Heave (cm) 0.0 0.00	 Downsampling Off Downsample to 1024 Downsample to 2048 Quit 	C Downsample to 3072 C Downsample to 4096

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

🚧 24-bit Analog Subbottom Sonar Interface 5.00.003		- • 🔀
A/D Converter NI Device Sampling Freq A/D V Range Dev2-USB-4431-1905AE6 10.0 kHz/Chan +/- 5V Data Acquisition Mode Coupling DC Offset (V) Single Chan SBP (1 CH) A/C 0.000	Trigger External Trigger O Internal Trigger • Trigger Interval (ms) 200.00	Record Length Record Length (ms) 133.33 Recording Delay (ms) 0.00 Sync Record Len w/Trigger Sound Vel (m/s) 1500.00
Ping Monitor Minimum Average Maximum 52 1333/2000 -6.1100 -0.3791 6.0779 Trigger Intvl Range Time Period 200.000 ms 100 0.133	Triggers Trigger Rate 52 5.00 Hz Channel AI 1	SonarWiz 🌾 Help Quit

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 or 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 SEGY 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 autodiscovered 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:

🚟 NI Analog Sidescan Sonar	Interface 5.00.006	
Sampling Frequency (Hz): 10000	16 bit A/D	Data Acquisition
Record Len (m): 151.50 Record Len (ms): 202.00	USB-6210 SN:1673879	Single Chan SBP (1 CH
Samples: 2020 Channels: 1	Dev4-USB-6210-1673875	Sampling Freq /
Sonar Range (m) 150 (m)	Dev4-USB-6210-1673879 Dev13-USB-6210-16C5EB1	Sound Vel (m/s) 1500
Г	Sync w/Trigger Sync:1	from the first from the first

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:

🐃 NI Analog Sidescan Sonar Interface 5.00.006
Sampling Frequency (Hz): 10000 Record Len (m): 151.50 Record Len (ms): 202.00 Samples: 2020 Channels: 1 16 bit A/D USB-6210 SN:1673879 Dev4-USB-6210 SN:1673879 Dev4-USB-6210-1673879 Single Chan SBP (1 CH) DAQ Board Status Image: Connection (Image: Connection (
Trigger Source EXT INT Range Time Period 152 0.202 Ping Samples Minimum Average Maximum Triggers Trigger Rate Trigger Intvl Channel 1125 2030 -30350.0 -1385.8 28451.0 1125 4.93 Hz 203.000 ms \$B0
BNC Signal Connections BNC TRG> TRIG BNC CH1> SBP
Image: Constraint of the state of the s

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:

Rev 18, 5/22/2018 support@chesapeaketech.com 650-967-2045

🚟 NI Analog Subbottom	Sonar Interface 5.00.006			
Sampling Frequency (Hz): 100 Record Len (m): 25.00 Record Len (ms): 33.33 Samples: 333 Channels: 2 Trigger Interval 33 (ms) Record Len (ms) 33.33 Recording Delay (ms) 0.00	000 16 bit A/D USB-6210 SN:16c5eb1 Dev13-USB-6210-16C5Et ▼ s) ▼ Simulate Mode Sync w/Trigger Enable Hardware Trigger Div	Data Acquisi Dual Channel SBP (Sampling Freq 10.0 kHz/Chan Sound Vel (m/s)	tion Mode 2 CH) A/D V Range +/- 5V 500.00 Divide/Delay: (DAQ Board Status SonarWiz Connection
Trigger Source C EX Do not record delay Ping Samples	(T 🗭 INT Minimum Average Ma	ximum Triggers	Range 1 25 Trigger Rate	Time Period 0.033 Trigger Intvl Channel
04/17/12 15:48:31: NI Platfic	-23000.0 -053.2 20	is reserved. The operation		BNC Signal Connections BNC TRG> TRIG BNC CH1> SBP0 BNC CH2> SBP1
completed as specified.IT ask Enable Telemetry Port Altitude Heading Alt	Name: AlTask@Status Code: -50103 Telemetry: DFF Roll Pitch Roll	Depth Depth	Downsampling Downsample to Downsample to Quit	Off o 1024 C Downsample to 3072 o 2048 C Downsample to 4096 Reset Help

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.

🕮 NI Analog Subbottom Son	ar Interface 5.00.006		
Sampling Frequency (Hz): 10000 Record Len (m): 75.00 Record Len (ms): 100.00 Samples: 1000 Channels: 2 Trigger Interval 100 (ms) Record Len (ms) 100.00	16 bit A/D USB-6210 SN:146057f Dev1-USB-6210-146057F ▼ Simulate Mode Sync w/Trigger	Data Acquisition Mode Dual Channel SBP (2 CH) Sampling Freq A/D V Range 10.0 kHz/Chan +/- 5V Sound Vel (m/s) 1500.00	DAQ Board Status SonarWiz Connection
Trigger Source C EXT Do not record delay Ping Samples Mi 99 2010 -2'	INT Average Maxim Maxim Model Average Maxim Maxim Average Max	Range 75 num Triggers Trigger Rate 0.0 99 4.98 Hz	Time Period 0.100 Trigger Intvl Channel 201.000 ms SB0 ▼ BNC Signal Connections BNC TRG> TRIG BNC CH1> SBP0
Enable Telemetry Port Altitude Heading Alt Hdg	Telemetry: OFF Roll Pitch D Roll Pitch D	epth epth Quit	BNC CH2> SBP1 ing Off e to 1024 C Downsample to 3072 e to 2048 C Downsample to 4096 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 x 1.5 = 75m 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 meters / 1500 m/sec = 666 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:

🌥 NI Analog Sidescan Sonar	Interface 5.00.006		
Sampling Frequency (Hz): 10000 Record Len (m): 152.25 Record Len (ms): 203.00 Samples: 2030 Channels: 1 Sonar Range (m) 25 (m)	16 bit A/D USB-6210 SN:1673879 Dev4-USB-6210-1673875 ▼ Simulate Mode	Data Acquisition Mode Single Chan SBP (1 CH) Sampling Freq 10.0 kHz/Chan +/- 6V Sound Vel (m/s)	DAQ Board Status (* SonarWiz Connection (* Send Data as (* 8 Bit (* 16 Bit
Trigger Source C EXT	Sync w/Trigger Sync:1	Not default	recording mode

Here are the recording options in this server:

Data Acquisition Mode	
Single Chan SBP (1 CH)	-
Single Freq SSS (2 CH) Single Freq SSS + SBP (3 CH) Single Freq SSS + 2 SBP (4 CH) Dual Freq SSS (4 CH) Dual Freq SSS + SBP (5 CH)	
Single Chan SBP (1 CH)	
[Dual Channel SBP (2 CH)	

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

🌥 NI Analog Side	escan Sonar Interface 5.00.006		
Sampling Frequency Record Len (m): 15 Record Len (ms): 21 Samples: 2030 Channels: 2 Sonar Range (m)	y (Hz): 10000 2.25 03.00 Dev4-USB-6210 SN:1673879 Dev4-USB-6210-1673875 ▼ 25 (m) ▼ Simulate Mode ⊽ Sync w/Trigger Sync:1	Data Acquisition Mode Single Freq SSS (2 CH) Sampling Freq A/D V Range 10.0 /Hz/Chan + +/- 5V Sound Vel (m/s) 1500.00	DAQ Board Status SonarWiz Connection Send Data as 8 Bit 6 16 Bit
Trigger Source Ping Sau (731 20	C EXT INT 2-ch sides mples Minimum Average Maxi 040 -29816.0 -605.3 2875	Can mode Range 152 mum Triggers Trigger Rate 51.0 731 4.90 Hz	Time Period 0.203 Trigger Intvl Channel 204.000 ms LF Port
			BNC Signal Connections BNC TRG> TRIG BNC CH1> PORT BNC CH2> STBD
Enable Teleme Altitude Alt Alt	Atry Port Telemetry: OFF Heading Roll Pitch I Hdg Roll Pitch I	Opepth Opepth	ng Off e to 1024 C Downsample to 3072 e to 2048 C Downsample to 4096
		Quit	Help

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:

The NI Analog Subbotton	1 Sonar Interface 5.00.006			
Sampling Frequency (Hz): 1 Record Len (m): 25.00 Record Len (ms): 33.33 Samples: 333 Channels: 2 Trigger Interval 33 (Record Len (ms) 33.3 Recording Delay (ms) 0.00 Trigger Source C Do not record delay Ping Samples 544 343	0000 16 bit A/D USB-6210 SN:16c5eb1 Dev13-USB-6210-16C5EF ✓ ms) ✓ Simulate Mode 3 Sync w/Trigger Enable Hardware Trigger Divide XT ♥ INT 2-ch SE Minimum Average Maxin -29838.0 75.5 2879	Data Acquisition Dual Channel SBP (2 Cl Sampling Freq A 10.0 kHz/Chan + Sound Vel (m/s) 1500 /Delay mode mm Triggers 1 5.0 544	Mode DAQ H) /D V Range /- 5V Divide/Delay: OFF Range Time Pe 25 0.033 Trigger Rate Trigger I 29.15 Hz 34.300	Board Status
Enable Telemetry Port	Telemetry: OFF	•	Downsampling Off	
Altitude Heading	Roll Pitch D	epth C	Downsample to 1024 Downsample to 2048	C Downsample to 3072 C Downsample to 4096
Alt Hdg	Roll Pitch D	epth	Quit	Help

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

Waterfall	×
0 0 0 0 0 0 0 0 0 0	
Chan 1 and	2 153.0 (m) (100 MHz)
<u>1999</u>	****



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

	😳 🐌 💵 🚯	
	Chan 1 and 2 153.0 (m) (100	MHz)
°	$(\mathcal{M}(\mathcal{M}))$	
	Waterfall Settings	
	View O Horizontal O Vertical	
	SideScan Ch 1 and 2 Ch 3 and	4
******	SubBottom	
	Apply Heave Compensatio	n
	OK Cancel	

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

🐃 NI Analog Subbottom Sonar Interface 5.00.006					
Sampling Frequency (Hz): 10000	16 bit A/D	Data Acquisition Mode			
Record Len (m): 25.00 Record Len (ms): 33.33	USB-6210 SN:16c5eb1	Dual Channel SBP (2 CH) 🗾 S			
Samples: 333	Dev13-USB-6210-16C5EE	Single Chan SBP (1 CH) Dual Channel SBP (2 CH)			
Trigger Interval 33 (ms)	Simulate Mode	10.0 kHz/Chan +/- 5V Sound Vel (m/s) 1500.00			

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:

😂 XTF		
File Edit View Favorite:	s Tools Help	
🕞 Back 🔹 🕥 🕤 🥬	Search 陵 Folders 🕼 🕻	» 🗙 🍤 💷·
Address 🛅 D:\SonarWiz-Proj	ects\DualAnalogTest.12.0417\XTF	
Name 🔺	Size Type	Date Modified
🖹 Line-0001.logsbp	2 KB LOGSBP File	4/17/2012 4:08 PM
🖬 Line-0001.logsss	SB 2 KB LOGSSS File	4/17/2012 4:07 PM
🖬 Line-0001.sgy 🔺	1,950 KB Viewer File Type	4/17/2012 4:08 PM
🖬 Line-0001.xtf 🚤	1,537 KB XTF File	4/17/2012 4:08 PM
	2.2	

These may then be imported and post-processed.

MODE	Data Acquisition Mode	BNC Connectors						Active
		TRIG IO	CH1	CH2	CH3	CH4	CH5	Channels
	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	SBP0	6
5	Single Channel SBP	TRIG	SB0					2
6	Dual Channel SBP	TRIG	SB0	SB1				3

5.6.1 Recording Modes Channel Summary Table

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:

EXAMPL Analog S Server M selection	E NI S ode	Data Acquisition Mode Dual Freq SSS + SBP (5 CH) Sampling Freq A/D V Range Coupling Ground Ref 20.0 kHz/Chan +/- 20mV Sound Vel (m/s) 1500.00	
Desktop	📄 Line-00	005.xtf	1,501 KB
Steve	PLAYE Single	BACK peek at the recorded XTF file: XTF file records from NI Analog SS so	erver
	in Dua	1-freq SS +SB (SCH) recording mode	
Computer			
Network	•		Þ
	File name:	Line-0005.xt	Open
	Files of type:	: XTF Files (*xtf)	Cancel
Line-0005 File Size: 1536 K # Sonar Channel Bits/Sample: 16 Samples/Channe CH:1 F CH:2 F CH:2 F CH:3 F CH:4 F	B s: 5, SSS:4, S s: 0 el: 1024 Range (m): 506 Range (m): 506 Range (m): 506 Range (m): 506	BP:1 6.0 Center Freq: 100.0 6.0 Center Freq: 100.0 6.0 Center Freq: 500.0 6.0 Center Freq: 500.0 6.0 Center Freq: 500.0 6.0 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

	Floating Signal Sources (Not Connected to Building Ground)	Ground-Referenced Signal Sources [†]
AI Ground-Reference Setting*	 Examples: Ungrounded thermocouples Signal conditioning with isolated outputs Battery devices 	Example:Plug-in instruments with non-isolated outputs
Differential (DIFF)	Signal Source DAQ Device	Signal Source DAQ Device
Non-Referenced Single-Ended (NRSE)	Signal Source DAQ Device	Signal Source DAQ Device
Referenced Single-Ended (RSE)	Signal Source DAQ Device	NOT RECOMMENDED for the USB-6210/6211/6212 Signal Source DAQ Device AI + V _B U U U V _B U U U U U U U U U U U U U U U U U U U

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

* 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:

🚟 NI Analog Subbottom Sona	ar Interface 5.00.007			
Trigger Interval 33 (ms) Record Len (ms): 10.00 33 (ms) Record Len (ms): 10.00 10.00 Samples: 100 Channels: 2 Trigger Interval 33 (ms) Record Len (ms) 10.00 Trigger Source EXT (ms)	ar Interface 5.00,007 16 bit A/D USB-6210 SN:1331fe2 Dev15-USB-6210-1331FE ▼ ■ Simulate Mode Sync w/Trigger Enable Hardware Trigger Divide INT	D. Dual Channel SBP (2 CH Sampling Freq A. 10.0 kHz/Chan • +, Sound Vel (m/s) 1500. sr/Delay	Ata Acquisition Mode 4) /D V Range Coupling Ground Ref /- 10V CO DIFF NRSE RSE Divide/Delay: OFF Range Time Period	DAQ Board Status SonarWiz Connection
Do not record delay Ping Samples Mir 178 1010 -5	nimum Average Maxin 00.0 -473.0 -239	num Triggers T .0 178	8 0.010 rigger Rate Trigger Intvl Channel 9.90 Hz 101.000 ms SB0 BNC Signal Conne BNC TRG> TRIG BNC CH1> SBP BNC CH2> SBP1	- Lions
Enable Telemetry Port Altitude Heading Alt Hdg	Telemetry: OFF Roll Pitch D Roll Pitch D	epth C	Downsampling Off Downsample to 1024 C Downsample Downsample to 2048 C Downsample Quit Hel	to 3072 to 4096 P

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) \Box 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 en 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:

Navigation Input Set	tup			
Source and Port Sele	ection		NMEA Record Types	
Enable Nav IO	Shared	SonarWiz Port	NMEA Position	NMEA Heading
Navigation NMEA-0	183	~		● RMC
Serial Port COM	11 🗸		GLL	
OUDP Port 510	0			O VTG
Serial Port Configur	ation		Miscellaneous Output Fil	es
-Baud Rate	- Data Bits	- Parity	Raw Navigation (.NA	V) - Serial Input Only
2400	07	None	Formatted Navigation	n File (.FNV)
• 4800	0 8	Odd	-Miscellaneous Settings -	
0 9600	Stop Bits	OEven	Use SonarWiz Compu	uted Speed
○ 19200	① 1		Validate NMEA Check	sums
38400	02			

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:

			L DVD-	
🛎 C-MAX USB Server	5.00.004			
Ping Range	Time Period Samples Altitude Frequency	Minimum	Average	Maximum
7869 100	0.133 1280 20.0 325	0.0	127.5	255.0
Start Towfish Stop Towfish Set Range/Frequency	✓ Simulation Mode C-M □ Mute Towfish □ □ Hold Gain □ □ Shallow Mode □	1AX Sonar Status Client Connection Do NOT Send So	© © nar Packets	
		then "Star	t Towfish	", for
Quit	our exampl	e		

🐃 NI Analog Subbottom Sonar Interface 5.00.007	
Sampling Frequency (Hz): 10000 Record Len (ms): 500.00 Samples: 5000 Channels: 2 Trigger Interval 1000 (ms) Simulate Mode Sound Vel (m/s) 1500.00 Record Len (ms): 500.00 Samples: 2 Trigger Interval 1000 (ms) Simulate Mode Sound Vel (m/s) 1500.00 Record Len (ms) 500.00 Record Len (ms) 500.00 Sync w/T rigger Record Ing Delay (ms) 0.00 Enable Hardware Trigger Divider/Delay Trigger Source EXT INT Do not record delay Ping Samples Minimum Average Maximum Triggers Trigger Rate Trigger Intvl Channel 1423 10010 -19626.0 -196.8 20278.0 1753 1.00 Hz 1000.999 ms SB0 INC Signal Connection BNC Signal Connection BNC Signal Connection BNC Signal Connection BNC Signal Connection BNC CH2> SBP1	DAQ Board Status SonarWiz Connection
Altitude Heading Roll Pitch Depth Alt Hdg Roll Pitch Depth Quit Help	1072 1096

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:

	>
)	
d 2 100.0	(m) (325.0 kHz)
;°	Waterfall Settings
	View O Horizontal O Vertical
	SideScan ✓ Ch 1 and 2 Ch 3 and 4
	SubBottom Ch 1 Ch 2
	Apply Heave Compensation
0.00-37	OK Cancel 62%
	0.0

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:

Save As				? 🗙
Save in:	🚞 XTF	G Ø	• 🖽 对	
My Recent Documents Desktop	ात्र Line-0001.xtf	XTF=sidescan saved, SEG=sub-bottom saved		
My Documents				
My Computer	File name:	Line-0002.xtf	*	Save
S	Save as type:	XTF Files (*.xtf)	~	Cancel
My Network				

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:

🗀 XTF			
File Edit View Favorites	Tools Help		
🕒 Back 🔹 🕥 🕤 🏂	🔎 Search 🛛 🞼	Folders	َ» × ٩
Address 🛅 D:\SonarWiz-Projec	cts\DemoProject_SS-	-SB_DualRecording\X	TF
Name 🔺	Size	Туре	Date Modified
🕒 Line-0001.logsbp	2 KB	LOGSBP File	12/12/2012 3:48 PM
🖬 Line-0001.logsss	2 KB	LOGSSS File	12/12/2012 3:44 PM
🖬 Line-0001.sgy	4,424 KB	Viewer File Type	12/12/2012 3:48 PM
🔤 Line-0001.xtf	3,181 KB	XTF File	12/12/2012 3:48 PM

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

5. When you finally click STOP, the data files will be saved, and you can start postprocessing 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 subbottom 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:

S 1	۸y Sy	stem ·	Meas	urement &	Auton	nation	Explo
File	Edit	View	Tools	Help			
	🗿 My	System	n				
	÷ -	Data N	Jeighbo	rhood			
	🗆 👹	Device	es and I	nterfaces			
		- 🕰 NI	USB-62	210 "Dev1"			
		- 🕵 NI	USB-62	210 "Dev2"			
		- 🕰 NI	USB-62	210 "Dev3"			
		- 🕰 NI	USB-62	210 "Dev4"			
		NI	USB-62	210 "Dev5"			
		⊔ 🕰 NI	USB-62	210 "Dev6"			
		⊔ <mark>B∛</mark> NI	USB-62	210 "Dev7"			
		- [3¥] NI ⊷al wa	USB-62	210 "Dev8"			
		- [two international for the second	USB-62	210 DeV9"			
		-p≫_iNI ⊮≲INT	USD-02	210 Devio			
		rpsvy ivit es⊚l ivit	USB-62	210 Devii			
		raz∑ na .ra⊴ ni	USB-62	210 Dev12			
		ະ⊯∼ <mark>×</mark> เഷ . ⊮ສ2 NT	USB-62	210 "Dev14"			
		NI	USB-62	210 "Dev15"			
		😡 NI	USB-62	210 "Dev16"			
		🛱 NI	USB-62	210 "Dev17"			
		🛛 🖾 NI	USB-62	210 "Dev18"			
	-	🛛 🖾 NI	USB-62	210 "Dev19"			
		- 🎣 NI	USB-62	210 "Dev20"			
		- 🍕 NI	USB-62	210 "Dev21"			
		- 🕰 NI	USB-62	210 "Dev22"			
		- 🕵 NI	USB-62	210 "Dev23"			
	-	- 🕵 NI	USB-62	210 "Dev24"			
		- 🕰 NI	USB-62	210 "Dev25"			
		NI	USB-62	210 "Dev26"			
		NI	USB-62	210 "Dev27"			
		NI	USB-62	210 "Dev28"			
		- Javy NI ⊷al ••••	USB-62	210 "Dev29"			
		- Dev NI ⊯an∎ NI	USB-62	210 "Dev30"			
	-	IVI 🥪 IVI	USB-62	210 Dev31"			
		∼µ∞, NI Na	000-02	LIU DEVJZ			
			SCANOLK F	26 VILES			

The first Dev15 shows a serial number:

e Edit View Tools Help							
	<u>^</u>	Properties 🗙	Delete 🔀 Self-Test	🔚 Test Panels	🔁 Reset I	Device	👋 💦 Hide (
		Name	Value		K	Back	
		Serial Number	0×1331F	E2			
					N	I-DAQr	nx Device
NI USB-6210 "Dev16"					E	asics	
😥 NI USB-6210 "Dev17"					V	/hat do y	ou want to do
— 🞣 NI USB-6210 "Dev18"		<				Run the	NI-DAfims
- 😥 NI USB-6210 "Dev19"	~	📃 Attributes 💋 De	vice Routes 🔌 Calibration		Ť	est Pan	els

And the second Dev31 shows its own unique serial number:

🛿 NI USB-6210 "Dev31" - Measurement & Automation Explorer								
File Edit View Tools Help								
	^	Properties 🗙 Delete	Self-Test	Test Panels	🔁 Re	set Device	» , Hide He	elp
		Name	Value			Back		~
🛱 NI USB-6210 "Dev29"		Serial Number	0×1708F1	IB			Device	^
						Basics	INX DEVICE	
						What do	you want to do?	
- 🕌 Network Devices		<			>	▶Run th	e NI-DAQmx	
PXI PXI System (Unidentified)	~	Attributes 🗭 Device Route	es 💐 Calibration			Test Par	nels	¥

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:

Select Sonar	Interface	
Current Serve	rs	
Sidescan		Disconnect
SubBottom	1	Disconnect
Bathymetry	2 /	Disconnect
Local Servers		
Sidescan	NI Analog Sidescan Sonar Interface Ver 5.00.007 NI Analog Sidescan Sonar Interface Ver 5.00.007	Start/Configure ✓ AutoStart
	NI Analog Subbottom Sonar Interface Ver 5.00.007	Start/Configure
SubBottom	NI Analog Subbottom Sonar Interface Ver 5.00.007	AutoStart
		Start/Configure
Bathymetry		AutoStart

🚟 NI Analog Sidescan Sonar I	Interface 5.00.007		
Sampling Frequency (Hz): 10000 Record Len (m): 161.25 Record Len (ms): 215.00 Samples: 2150 Channels: 2 Sonar Range (m) 25 (m) Trigger Source C EXT C	16 bit A/D USB-6210 SN:1331fe2 Dev15-USB-6210-1331FE ▼ Simulate Mode Sync w/Trigger Sync:1	Data Acquisition Mode Single Freq SSS (2 CH) Sampling Freq A/D V Range Coupling Ground Ref 10.0 kHz/Chan +/- 5V C RSE Sound Vel (m/s) 1500.00	DAQ Board Sta SonarWiz Conne Send Data 8 Bit
Ping Samples Mini	imum Average Maxir 768.0 -7082.4 3276	161 0.215 mum Triggers 7.0 20 4.63 Hz 216.000 ms LF Port BNC Signal Connection BNC TRG> TRIG BNC CH1> PORT BNC CH2> STBD	ons

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:

🏧 NI Analog Subbottom Sonar Interface 5.00.007							
Sampling Frequency (Hz): 10000 Record Len (m): 375.00 Record Len (ms): 500.00 Samples: 5000 Channels: 2	16 bit A/D USB-6210 SN:1331fe2 Dev15-USB-6210-1331FE ▼ •	Data Acquisition Mode Dual Channel SBP (2 CH) Sampling Freq A/D V Range Coupling Ground Ref 10.0 KHz/Chan + +/- 10V + DC RSE +	DAQ Board Stat SonarWiz Connec				
Trigger Interval 33 (ms)	✓ Dev31-USB-6210-1708F1B	Sound Vel (m/s) 1508-00					
Record Len (ms) 500.00	Sync w/Trigger						
Recording Delay (ms) 0.00	Enable Hardware Trigger Divide	er/Delay Divide/Delay: OFF					
Trigger Source C EXT @	€ INT						

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 16 bit A/D	Data Acquisition Mode						
Record Len (m): 25.73 USB-6210 SN:1331fe2	Single Freq SSS (2 CH)						
Samples: 343 Dev15-USB-6210-1331FE -	Sampling Freq A/D V Range Coupling Ground Ref						
Channels: 2	10.0 kHz/Chan 🗨 +/- 5V 💽 DC 💽 RSE 💌						
Sonar Hange (m) 50 (m)	Sonar Range (m) 50 (m) Simulate Mode Cound Vel (m/s) 1500.00						
I♥ Sync w/Trigger Sync:3	\mathbf{X}						
Trigger Source C EXT @ INT	\mathbf{X}						
	Range Time Period						
	26 0.034						
Ping Samples Minimum Average Maxi	imum Triggers Trigger Rate Trigger IntvI Channel						
4955 353 -32768.0 3856.8 3276	67.0 4955 28.33 Hz 35.300 ms LF Port 💌						
	BNC Signal Connec						
	BNC TRG> TRIG BNC CH1> POBT						
	BNC CH2> STBD						
12/12/12 16:59:50: The specified operation cannot be performed be	ecause 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,						
🏝 NI Analog Subbottom Sonar Interface 5.00.007							
Complete Francisco (Hz): 40000	Data Acquisition Mode						
Record Len (m): 25.00	Dual Channel SBP (2 CH)						
Record Len (ms): 33.33	Sampling Freq A/D V Range Coupling Ground Ref						
Channels: 2	10.0 kHz/Chan 💌 +/- 10V 💌 DC 📝 RSE 💌						
Trigger Interval 200 (ms) - Simulate Mode	Sound Vel (m/s) 1500.00						
	Record Len (ms) 33.33 Sync w/Trigger						
Record Len (ms) 33.33 Sync w/Trigger							
Record Len (ms) 33.33 Sync w/Trigger Recording Delay (ms) 0.00 Enable Hardware Trigger Divide	n/Delay Divide/Delay: OFF						
Record Len (ms) 33.33 Sync w/Trigger Recording Delay (ms) 0.00 Enable Hardware Trigger Divide Trigger Source C EXT INT	r/Delay Divide/Delay; OFF						
Record Len (ms) 33.33 Sync w/Trigger Recording Delay (ms) 0.00 Enable Hardware Trigger Divide Trigger Source EXT INT Do not record delay	r/Delay Divide/Delay: OFF Range Time Period 25 0.033						
Record Len (ms) 33.33 Sync w/Trigger Recording Delay (ms) 0.00 Enable Hardware Trigger Divide Trigger Source EXT INT Do not record delay Ping Samples Minimum Average Maxim	n/Delay Divide/Delay: OFF Range Time Period 25 0.033 num Triggers Trigger Rate Trigger Intvl Channel						
Record Len (ms) 33.33 Sync w/Trigger Recording Delay (ms) 0.00 Enable Hardware Trigger Divide Trigger Source EXT INT Do not record delay Ping Samples Minimum Average Maxim 2291 2010 -10498.0 -1030.5 8462	r/Delay Divide/Delay: OFF Range Time Period 25 0.033 num Triggers Trigger Rate Trigger Intvl Channel .0 2291 4.98 Hz 201.000 ms SB0 -						
Record Len (ms) 33.33 Sync w/Trigger Recording Delay (ms) 0.00 Enable Hardware Trigger Divide Trigger Source EXT INT Do not record delay Ping Samples Minimum Average Maxim 2291 2010 -10498.0 -1030.5 8462	r/Delay Divide/Delay: OFF Range Time Period 25 0.033 num Triggers Trigger Rate Trigger Intvl Channel .0 2291 4.98 Hz 201.000 ms SB0						
Record Len (ms) 33.33 Sync w/Trigger Recording Delay (ms) 0.00 Enable Hardware Trigger Divide Trigger Source EXT INT Do not record delay Ping Samples Minimum Average Maxim 2291 2010 -10498.0 -1030.5 8462	n/Delay Divide/Delay: OFF Range Time Period 25 0.033 num Triggers Trigger Rate Trigger Intvl Channel 0 2291 4.98 Hz 201.000 ms SB0 ▼ BNC Signal Connection BNC TRG> TRIG						
Record Len (ms) 33.33 Sync w/Trigger Recording Delay (ms) 0.00 Enable Hardware Trigger Divide Trigger Source EXT INT Do not record delay Ping Samples Minimum Average Maxim 2291 2010 -10498.0 -1030.5 8462	r/Delay Divide/Delay: OFF Range Time Period 25 0.033 num Triggers Trigger Rate Trigger Intvl Channel .0 2291 4.98 Hz 201.000 ms SB0 ▼ BNC Signal Connection BNC TRG> TRIG BNC CH1> SBP0 BNC CH2> SBP1						

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:

🗢 XTF						
File Edit View Favorites	Tools Help					
🕞 Back 🔹 🕥 🕤 🏂	🔎 Search <table-cell></table-cell>	Folders	» 🗙 🍤 💷•			
Address 🛅 D:\SonarWiz-Projects\DemoAnalog_SS_SB_together\XTF						
Name 🔺	Size	Туре	Date Modified			
🕒 Line-0001.logsbp	2 KB	LOGSBP File	12/12/2012 5:13 PM			
🖬 Line-0001.logsss	2 KB	LOGSSS File	12/12/2012 5:08 PM			
🔤 Line-0001.sgy	2,669 KB	Viewer File Type	12/12/2012 5:13 PM			
🖾 Line-0001.xtf	14,715 KB	XTF File	12/12/2012 5:13 PM			

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:

	💌 Enable Te	lemetry Port	Teleme	try: COM1:9600,N	N,8,2	ΘD	ownsampling Off	
[Altitude	Heading	Roll	Pitch	Depth	C D C D	ownsample to 1024	 Downsample to 3072 Downsample to 4096
	0.0	0.0	0.0	0.0	0.0		-ownsample to 2040	Cownsample to 4000
							Quit	Help

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:

🔽 Enable Heave Port	Heave: COM2:9600,N,8,2	
🔽 Enable Telemetry Port	Telemetry: COM1:9600,N,8,2	Downsampling Off
Altitude Heading	Roll Pitch Depth Heave	m) O Downsample to 1024 O Downs
0.0 0.0	0.0 0.0 0.0 0.0	Downsample to 2048 C Downs
		Quit

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 en 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 <u>SonarWiz</u> full-installation software first, from here:



 At the same download site, download your analog server, which as of September, 2015, are one of these two choices (Click <u>SonarWiz Servers</u> and scroll down to find them):

ANALOG SIDESCAN:

	controis:		
Analog Subbottom Server	Self-installing Analog Subbottom Server for NI12-16-24 bit A/D PCI, PCMCLA and USB devices. Compatible with SonarWiz 5 and SonarWiz V5.00.012 6. With real-time heave compensation, telemtry interfaces, DC OFFSET control, and now 2-ch recording delay.	Self installing EXE Download	NI AnalogSB server
Analog Sidescan Server	Self-installing Analog Sidescan Server for NI 12-16-24 bit A/D PCI, PCMCIA and USB devices. Compatible with SonarWiz5 and SonarWiz5 and SonarWiz 6. Now with DIFF/ NRSE grounding mode options, and serial port parsing.	Self-installing 3/26/2015 Download EXE	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 <u>www.Nl.com</u> 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 subbottom, 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