

Analog Sonar Server User Guide

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About This Manual

This document contains instructions for using the Chesapeake Technology, Inc (CTI) 5-BNC analog interface box for collection of 1 and 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 software runtime, which provides USB drivers to process the incoming A/D data from the data acquisition card inside the CTI 5-BNC box

2. Attach the CTI 5-BNC box to the SonarWiz PC using the USB cable

- 3. Verify connections and test the CTI 5-BNC box using the NI software; then finally
- 4. Configure and start the Analog Server.

The sections below help you through this setup process and explain some common error messages which users have encountered during the setup process.

Software Installation

The CTI Analog Sonar Recording system requires three software items, which should be installed in the following order:

- 1. Install SonarWiz 7
- 2. Install the National Instruments (NI) NI-DAQmx Runtime
- 3. Install the appropriate Analog Server

Installing SonarWiz 7

A SonarWiz 7 data acquisition license is required for operating and recording analog sonar data. Install SonarWiz 7 and verify that your software license allows Sidescan Acquisition or Sub-bottom Acquisition as follows:

To install SonarWiz 7:

1. Download the installer for the latest version of SonarWiz 7 from: <u>https://chesapeaketech.com/download-sonarwiz/</u>

2. Run the installation program to completion.

3. Verify that your SonarWiz 7 license includes either Sidescan Acquisition or Sub-bottom Acquisition: For Dongle Free License (DFL) users:

Start **CTI License Manager** from the Windows 10 Start Menu Click the **Status** button.

🧭 CTI License Manager V1.12	.03 (CTILicenseLib V	/1.10.01 x64)	×
	CTI L	icense Manago	P
	This machine is:	DAVIDS-THINKPAD	
Select Application			1
Sonarwiz 7			
-Full License]
Activate	De-Activate	Refresh	
Apply Update File		Status	
User Name: EMA Expiration D Last used: Sat Ju Grace period (day Probation period (Licensed Module: Sidescan pos Sub-Bottom p Magnetomete Bathymetry po Single Beam I Bathymetry ac Sidescan acq Subbottom ac Sidescan-Sub Sidescan-Bati	I non-expiring Chesapeake Technolog ate: 2020-12-31 I 18 08:21:45 2020 rs) 5 (Used 0) (days) 3 (Used 0) s t processing ost processing post processing post processing bat processing Bathymetry post process quisition	sing	
	ОК	Cancel	

Verify that one of **sidescan acquisition**, **subbottom acquisition** or the **sidescan-subbottom combo acquisition** modules are licensed as shown in the image above.

For USB Dongle Key users:

Insert the USB Dongle into your computer.

Start the **CTI Dongle Manager** from the Windows Start Menu Click the **Read Dongle** button.



Verify that you are licensed to run either the **analog sidescan** or **analog sub-bottom** servers as shown in the image above.

Installing NI NI-DAQmx Runtime

The 5-BNC Interface box sold by CTI contains a National Instruments (NI) signal analysis board. The 16bit box contains the (NI) USB-6210 digital acquisition (DAQ) board, while the 24-bit box contains the (NI) USB-4431 dynamic signal analysis (DSA) board. In both cases, these boards require the NI-DAQmx Runtime to be installed on your computer to function properly.

To Install the NI-DAQmx Runtime

1. Download the NI Package Manager program **ni-daqmx_20.1_online.exe**: <u>https://www.ni.com/en-us/</u> <u>support/downloads/drivers/download.ni-daqmx.html#348669</u>

2. Run ni-daqmx_20.1_online.exe package manager and select the packages to install.

The default installation (over 3 Gb) will install a full National Instruments environment. Some of these utilities are useful for debugging purposes, but the complete package set is not necessary for operation of the board. To reduce the size of the download, the required packages are:

- NI Certificates Installer
- NI-DAQmx Runtime with Configuration Support
- NI-DAQmx Support for C

Installing NI-DAQmx			×
Select	Agree	Review	Finish
Additional items	you may wish to	install:	
Windows security popups	dicrosoft Windows to always tru	st software from NI. When NI Certi valid National Instruments digital	
NI I/O Trace Debugging utility for moni	toring function calls to various I	National Instruments APIs.	
	0 0	20.0 ure and control the Application We	eb Server as well as
Run-time components req	vith Configuration Suppo uired to deploy applications usi hardware via the Measurement	ng National Instruments data acq	uisition devices and
	or .NET Framework 4.0 La r DAQ devices and adds NI-DAQr	nguages nx support for .NET Framework 4.0	0.
MI DAOmy Support f	or NET Eramowork 4.5 La	induador	V
Select All Desel	ect All		Next

You can deselect all packages and just select the above 3 packages as shown in the image above.

3. Click **Next** and finish the installation.

Installing the Analog Server

In order to interface and control the 5-BNC Interface box, you must install the appropriate analog server interface software. The analog server software is a small interface program that controls the National Instruments (NI) card embedded in the 5-BNC box and provides the bridge between your analog sonar and SonarWiz 7.

The analog interface box is available in two models: 16-bit 5-BNC box and 24-bit box. There are separate servers for sidescan and sub-bottom acquisition. Use the following table to find the appropriate server:

5-BNC Interface Model	Supported Analog Sonars	Analog Server	Required SonarWiz License
16-bit	Multi-channel sidescan and sidescan with sub-bottom	NIAnalogSSServer	Sidescan acquisition Sidescan + sub-bottom acquisition
	Multi-channel sub-bottom	NIAnalogSBP12-16Serve	Sub-bottom acquisition
24-bit	Multi-channel sub-bottom (high definition)	NIAnalogSBP24Server	Sub-bottom acquisition (DFL) or Analog 24 sub-bottom (hard key)

To Install the analog server software

1. Identify the appropriate server based on your analog box model and the analog sonar system you are interfacing.

2. Download the server from: https://chesapeaketech.com/download-real-time-servers-2/

3. Run the server installation program.

By default, the server installer will place the server binary and associated documentation files in the **Servers** folder found in your SonarWiz 7 program folder. (usually: C:\Program Files\Chesapeake Technology\SonarWiz 7\Servers).

4. Verify that the server is properly installed by launching SonarWiz and starting the server from the **Data Acquisition | Sonar dialog**

👝 🕒 🖹 🖴 🔗 🔇	8) -								
Data Acquisition	Post Proce	ssing Ba	athymetry	Maps	View	Tools	Help		
Vessel Sonar Navigation	Single Mag Beam Configure		o <u>t</u> ion <u>C</u> al ensor Pay		uts Ac		ger Tools *	Record	Quick Record
🕞 🖗 📄 🖉 😧	Select Sonar lı	nterface	~~				19 / 5 r		×
Project Explorer	Current Serve	ers							
Maps	Sidescan		LOC	AL: NIAnalo	gSSServer			Disconnect	
🗌 逵 Bathyme' 🗋 💓 Grids	SubBottom							Disconnect	
🗉 🖂 🚺 Sidescan	Bathymetry							Disconnect	
Contacts	Local Servers							,	
□ ∰ Features □ 🚅 Sub-bott 	Sidescan	NIAnalogSt EdgeTech41 NIAnalogSSS	25-4200Serv	er Ver 7.04	.010			Start/Configu	
Magnetor Magnetor Tide Files	SubBottom	NIAnalogSBP NIAnalogSBP						Start/Configu	
Sound Ve		SEGYFileServ						Start/Configu	re
Properties	Single and Multi-beam Bathymetry	EdgeTech460 MultiBeamSer SingleBeamS	rver Ver 7.0	6.04	.010			AutoStart	
General Property	Remote Serve	ers						Connect	
	Remote Servers							Connect	
	☑ Write raw so	onar data (GC	F, JSF, R2S,	s 7 к, тхт)	C	К	Cancel		

Hardware Installation

The NI Analog Sonar Interface is written to support the NI DAQMx interface. The NI NI-DAQmx runtime must be installed before attempting to install the National Instruments hardware.

Installation involves the following steps:

1. Install the <u>NI DAQmx runtime</u> software, which provides USB drivers to process the incoming A/D data from the National Instruments card inside the CTI 5-BNC box;

2. Attach the CTI analog box to the SonarWiz PC using the USB cable

3. Verify connections and test the CTI analog box using the NI software; then finally

4. Configure and start the Analog 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.

CTI Analog Interface Boxes

CTI sells 2 different analog interface boxes, a 16-bit unit for sidescan and sub-bottom recording, and a 24bit unit which is only for sub-bottom use. Here's the 16-bit analog interface box, named the CTI 5-BNC box because of its 5-channel capability:



The rear of the box has 6 BNC connectors: 5 data channels plus a trigger I/O connector:



Inside this 16-bit box is a National Instruments USB-6210 card, plus 2 custom PCB (printed circuit board) assemblies, which provide control options for internal or external trigger modes, and which control the triggermode indicator LED.

In contrast, the 24-bit analog interface box is smaller, has only 4 data channels, and uses separate BNC connectors for trigger output and input:



The BNC-end of the box has analog INPUTS 0, 1, 2, and 3, plus analog OUTPUT 0, and 2 indicator LEDs (both blue).



The opposite end of the box is where you connect the USB cable.



CTI only uses the USB port on this end of the box.

Example Hardware Configurations

Single 5-BNC box Use in SSS Data Collection

This section describes an example configuration for collection of sidescan (SSS) data from the CTI analog interface. The diagram below shows 2-channel (e.g. starboard and port from a sidescan towfish) SSS data recording with an analog interface, using a single 5-BNC box to sample 2 channels of input analog SS data.



In the second example, a single towfish might generate 4 channels of data - e.g. low-frequency and high-frequency, each having a starboard and port channel, for a total of 4 channels. Here's how to configure that using the analog interface box.



Single 5-BNC box Use in SB Data Collection

This section describes an example configuration for collection for sub-bottom (SB) sonar data from an analog interface. The diagram below shows how one might collect SB data with an analog interface, using a single 5-BNC box to sample 1 or 2 channels of input analog data.



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.

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

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

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



The NI Analog SS server can manage this dual-mode recording with a single CTI 5-BNC box One problem with this is that SB sonar typically runs slower than SSS, as the SB "boomer" capacitors have to charge. SB max ping-rate is sometimes 8 Hz for a 125 msec period, though 3-4 Hz are more typical. 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, if you used the slower ping-rate for both SSS and SB survey. To record both with the same server like this, the ping-rate divisor needs to be 1 (one) in the KDD, but you can add a delay offset the SB pings in time.

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

This configuration uses two 5-BNC boxes as a means of simultaneous SSS and SB analog recording.

The advantages are:

1. SSS ping-rate can be 10-15 Hz for perfect XTF file recording, driven by the NIAnalogSSServer

2. SB ping-rate is independently triggered by the NIAnalogSBP12-16Server and data is simultaneously saved in a SEGY file.

3. No KDD box is used so there is no coordination between the SSS and SB pings or ping-rates.



NOTE: Each server generates INTERNAL TRIGGER to drive ping-rates in this example

Dual-box Analog SSS + SB

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:

Sampling Frequency (I			16 bit A/D	
Record Len (m): 37.50 Record Len (ms): 50.0			USB-6210 SN:1d73ac9	Dual Channel SBP (2 CH)
Samples: 1000	`		Dev2-USB-6210-1D73AC9 -	Sampling Freq A
Channels: 2		1	Dev2-USB-6210-1D73AC9	20.0 kHz/Chan 🔻 +/
Trigger Interval	33 (ms)	2	Dev4-USB-6210-1BF9764	Sound Vel (m/s) 1500.0
Record Len (ms)	50.00	Г	Sync w/Trigger	, , , , ,
Recording Delay (ms)	0.00		Enable Hardware Trigger Divide	r/Delay
Trigger Source	C EXT		INT	-

In each of the **NIAnalogSSServer** and **NIAnalogSBP12-16Server**, 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:

	equency (Hz): 10000		16 bit A/D			Data Acc	uisitior	n Mode			DAQ Board Status	۵
ecord Len	(m): 75.00 (ms): 100.00	US	SB-6210 SN:1d73	ac9 S	ingle Freq SSS (2	: CH)				-	SonarWiz Connection	۵
amples: 10		Dev/2-I	JSB-6210-1D73A	() ·	Sampling Freq	A/D V Ra	nge	Coupling	Ground	Ref		
hannels: 2					0.0 kHz/Chan	▼ +/-5V	-	DC 👻	RSE	•	Send Data as	
Sonar Ra	nge (m) 75 (m)	-	Simulate Mode		Sound Vel (m/s)	1500.00					C 8 Bit @	16 Bit
Trigger S				Sync:		Ra	ige	Time Period				
	∏ Invertti	rigger hardw	are control.			7	5	0.100				
Ping	Samples N	/inimum	Average	Maximum	Triggers	Trigger F	Rate	Trigger Int/	Chan	nel		
1235	1010	-221.0	85.9	29621.0	1235	9.90 H	z	101.000 ms	LF Port	•		
0							-	BNO	C Signal Co	nnections		
								DNG	TRG> TF			
` <u> </u>								BNC	CH1> PC	RT		
								BNC	CH2> ST	BD		
Enable H	leave Port		Heave: OFF									
	elemetry Port		Telemetry: OFF		Telemetry For	mat n C GeoAct	oustics		ownsamplin	-		
Enable I	Line Prov	Roll	Pitch	Depth	Heave (cm) Temp (0)		ownsample ownsample		C Downsample to 3 C Downsample to 4	
Altitude	Heading											

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

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

ampling Fre	equency (Hz): 20000	16 bit A/D			Data Ac	quisition	n Mode		DAQ Board Status
ecord Len	(m): 25.00 (ms): 33.33	USB-6210 SN:1d73ac		ual Channel SBP (2	CH)			•	SonarWiz Connection
amples: 66		Dev2-USB-6210-1D73AC9	-	Sampling Freq	ADVR	ange	Coupling	Ground Ref	
Channels: 2		1. And the second).0 kHz/Chan 💌	+/-5V	•	DC 💌	RSE 💌	
Trigger li	nterval 33 (ms)	 Simulate Mode 	5	Sound Vel (m/s)	500.00	DO	C Offset		
Record L	en (ms) 33.33	Sync w/Trigger					,		
Recording D	elay (ms) 0.00	🔲 Enable Hardware Trigger (Divider/Del	ay		Di	ivide/Delay: OFI	=	
Trigger S	ource C EXT								
		ent trigger rates less than 100Hz			Re	nge	Time Period		
Do not rec	ord delay 🥅 Invert tri	gger hardware control.							
Ping	Samples M	inimum Average	Maximum	Triggers	Trigger	Rate	Trigger Intvl	Channel	
Ping	Count M	inimum Average	Maximum	Triggers	Trigger	Rate	Trigger Intvl	SB0 💌	
-					-		BNC	Signal Connectio	ns
							DNIG 3	rrg> Trig	
						_		CH1> SBP0	
							BNC	CH2> SBP1	
4									
		cified resource is reserved. The	e operation	could not be comp	leted as spe	ecified. I	ask		
	skStatus Code: -50103								
Name: AlTa	skStatus Code: -50103	11							
Name: AlTa	skStatus Code: -50103	Heave: OFF		Telemetry					
Name: AlTa	skStatus Code: -50103	Heave: OFF		- Telemetry Form		oustics	(@ Do	wnsampling Off	
Name: AlTa	skStatus Code: -50103 feave Port felemetry Port	Telemetry: OFF	Denth	G Williamson	C GeoAd			wnsampling Off wnsample to 1024	C Downsample to 3072
Name: AlTa	skStatus Code: -50103 leave Port		Depth				C Do		

Choose a free device and the server will restart and can then run in parallel on the same PC where the Analog SS server is currently running.

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

	quency (Hz): 20000		16 bit A/D			Data Acquisitio	on Mode		DAQ Board Status
ecord Len (m): 25.00 ms): 33.33	USB-6	5210 SN:1d73a	ac9	Dual Channel SBP (2	CH)		-	SonarWiz Connection
amples: 66		Dev4-USF	B-6210-1BF9	764	Sampling Freq	A/D V Range	Coupling	Ground Ref	
hannels: 2 Trigger Ir		-	nulate Mode	_	20.0 kHz/Chan Sound Vel (m/s)		DC <u>-</u> DC Offset	RSE	
Record Le	en (ms) 33.33	Sync w/Trig	gger						
Recording D	elay (ms) 0.00	🦳 Enable Ha	rdware Trigge	er Divider/D	Delay	[Divide/Delay: OF	F.	
	ger Support (may preve ord delay	ger hardware		Hz)	ım Triggers	Range 25 Trigger Rate	Time Period 0.033 Trigger Intvl	Channel	
404		221.0	682.9	29711		4.98 Hz	201.000 ms		
1							BNC	C Signal Connection TRG> TRIG CH1> SBP0 CH2> SBP1	8
	leave Port		ave: OFF		Telemetry Forma			9	
	leave Port		eave: OFF emetry: OFF		Telemetry Forma		1. State 1.	ownsampling Off	C Downsample to 3072
				Depti	Williamson		C D	ownsampling Off ownsample to 1024 ownsample to 2048	 Downsample to 3072 Downsample to 4096

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: Synchronized Dual-Box Analog SS-SB recording



NOTE: Example dual-box scenario with Box1 set for INTERNAL trigger, driving the synchronized ping-rates. Box2 receives a divided, delayed trigger and is set for EXTERNAL trigger.

Trigger Interval

Internal Trigger – Output Signal Characteristics

Setting to INTERNAL trigger generates an output trigger, which appears as a 0v to +5V square wave pulse 1msec wide on the TRIG I/O output BNC connector of the CTI 5-BNC box connected to your SonarWiz PC. 100 msec here means a 10hz "ping" rate.

CTI Trigger Output Function



Trigger is a positive-going pulse of 1-2 msec duration, transition 0 to 5v then returns to 0v for 198-199 msec, in this 5 Hz example.

Trigger intervals and ping rates tested at CTI include these:

Internal Trigger Interval (ms)	Empirical Ping Rate (Hz)
2000.00	0.5
1000.00	1
500.00	2
333.33	3
250.00	4
200.00	5
166.66	6
142.85	7
125.00	8
111.11	9
100.00	10

If you are unable to achieve these ping rates with equipment connected, chances are that your external load and capacitance is pulling down the TRIG I/O (16-bit box) or Aout0 line (24-bit box), which you will have Tee-ed to Ain0 and the external equipment. Try using an opto-isolator between your external equipment, and the CTI 5BNC output trigger signal, or using an external trigger instead, or try a slower ping rate, or use a CTI KBB (key buffer box) to create a stronger, buffered trigger output - described in more detail below).

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 2.5-3.5 knots may be fine and maybe a 4-5 hs ping rate is best, especially if you have boomer/sp[arker or unit with condensers that take time to charge and you don't want to overdrive them

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.

16-bit model

Normally the input would expect a TTL signal - 0V = 0 and 5V = 1, ideally exactly like the CTI output trigger function described above. The change over voltage is typically around 2 to 3 V, so an approx 5V input signal amplitude for the positive-going 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 1 usec is fine, and a 1-2 msec duration square-wave pulse is optimal. The rising edge of this input signal triggers the trigger-detection circuitry.

The hazard of sending in a longer-duration pulse, like a square-wave, is that double-triggering or skipped pings can happen. If you need to use an unusual trigger pulse shape like that, please consider purchasing the CTI KBB box to transform your square-wave input into a conforming pulse-train of trigger pulses.

24-bit model

The NIAnalogSBP24Server is expecting a 1-2 millisecond wide, positive-going square-wave pulse to be applied to the BNC connector labeled AI 0 on the front panel of the USB-4431 device.

When set for INTERNAL trigger, the 24-bit box AO0 sends a 1-msec TTL-compatible pulse out at the designated ping-rate, and this needs to be sent 2 places:

(1) input 1 - back into the AI0 BNC connection, and

(2) input 2 - to the customer sonar top-side unit TRIGGER INPUT BNC connection.

Due to fan-out, this weak output pulse is usually not strong enough to power both inputs, and we strongly recommend using a KBB box in series with the AO0 output signal, like so:

24-bit Internal Trigger Configuration with KBB Box



When using the 24-bix box set for EXTERNAL trigger, if you use a positive-going TTL-compatible 1-2 msec pulse for the incoming trigger, it should work fine. If your trigger pulse is not conforming to those requirements, please consider purchase of the CTI KBB box, to create a conforming incoming pulse-train of trigger pulses from your external trigger source. This will ensure that the USB-4431 input trigger works best. Here is an example of that configuration:

24-bit External Trigger Configuration with KBB Box



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 fee 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.

Key Divide and Delay (KDD)

The main function of the CTI KDD (Key Divide Delay) box is to manage a multiple-sonar scenario by synchronizing the two ping-rates. The KDD creates 2-ping-rates ratio, like 5:1 or 4:1 such that the SSS ping rate of say 10 Hz id DIVIDED 4:1 so that the SB ping-rate is 2.5 Hz. The KDD can also stand as an independent source for external trigger, if you need that to drive sonar equipment plus the SonarWiz server, and choose not to use internal trigger.



A secondary significant feature of your KDD controls is to add a DELAY in addition to the divided ping-rate, e.g. 50 msec or 100 msec. Adding a delay allows you to off-set the SSS and SB pings by some amount of time to reduce interference between the SSS and SB pings and returns. Here's a graphic example of a 4:1 division plus 50 msec delay:





The KDD box, once connected, is controlled via a graphic user interface (GUI), from the NI Analog SB server, using a check-box:

	quency (Hz): 20000		16 bit A/D			Data Acquisitio	n Mode		DAQ Board Status
ecord Len (I ecord Len (I			US	B-6210 SN:1d73	ac9 Du	al Channel SBP (2			-	SonarWiz Connection
mples: 666 nannels: 2				SB-6210-1D73A		Sampling Freq 0 kHz/Chan 🔻	A/D V Range	Coupling Gi	round Ref	1. (1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.
Trigger Int	terval :	33 (ms)	•	Simulate Mode	S	ound Vel (m/s)	00.00 D	C Offset 0	-	
Record Le	n (ms)	33.33	Sync w/	Trigger	1.00	(, , ,				
ecording De	elay (ms)	0.00	 Enable 	Hardware Trigg	er Divider/Dela	y	Divi	de:10 Delay:0 COM1		
Ping 581	Sample: 4020		221.0	Average 683.1	Maximum 29649.0	Triggers 581	Trigger Rate 4.98 Hz	Trigger Intvi 201.000 ms BNC Sign BNC TG BNC CH1 BNC CH2	Divide 4 	Trigger by: DelayTrigger by: 50 m er Key Input Source xternal (Master Key Input BNC) ternal (1kHz clock)
020-10-12T2 Enable H	eave Port			Heave: OFF elemetry: OFF		Telemetry Forma	t C GeoAcoustics			OK Cancel
		ng	Roll	Pitch	Depth	Heave (cm)	Temp (C)	C DOWING	subje to the	· · · · · · · · · · · · · · · · · · ·

When you have checked that check-box, then you can click on the button with the DIVIDE / DELAY values on it, and it opens the dialog shown above in the right side of the graphic. Here is that dialog in more detail, which is used to control the KDD box settings:

CON	M Port
COM1	
Divide Trigger by:	DelayTrigger by:
Master Key Input So External (Master C Internal (1kHz cl	r Key Input BNC)
Reset Firmware	
Using the KDD Dialog - External Trigger Source Examples

The COM port selected needs to be available for use on the SonarWiz PC. It is managed by the NI Analog SB server after being selected, and the selected COM port displays in the KDD control button label, along with the current DIVIDE and DELAY settings:

Sampling Frequency (H	z): 20000	16 bit A/D		Data Acquisition	n Mode	
Record Len (m): 25.00 Record Len (ms): 33.33		USB-6210 SN:1d73ac9	Dual Channel SBP (2	CH)		-
Samples: 666		Dev2-USB-6210-1D73AC9 -	Sampling Freq	A/D V Range	Coupling	Ground Ref
Channels: 2		-	20.0 kHz/Chan 💌	+/- 5V 💌	DC 👻	RSE 💌
Triader Interval	33 (ms)	▼ Simulate Mode	Sound Vel (m/s) 15	500.00 D	COffset 0	- /
Record Len (ms)	33.33	Sync w/Trigger				
Recording Delay (ms)	0.00	🔽 Enable Hardware Trigger Divide	r/Delay	Divid	de:10 Delay:0 C0	ом1
Trigger Source	@ EXT	CINT				

The DIVIDE number is a counter to define how many input pulses (triggers) are needed to create a single output pulse (trigger). For example, with a 10 Hz input trigger rate, and a DIVIDE setting of 4, 4 triggers are counted then a single output trigger is set on the DIVIDE output BNC. At 100 msec per input trigger, that means a $10/4 \times 100 \text{ msec} = 2.5 \text{ Hz}$ (400 msec per trigger) output trigger rate.

The DIVIDE key out BNC provides this divided trigger rate output with no delay.

The second Key out option is the Divided/Delayed Key out, where you can add a delay if needed, to help de-synchronize SSS and SB triggers, and reduce interference. So adding a DELAY value of 50 (units are msec) lets you provide a delayed, divided KEY OUT trigger pulse-train on the second BNC output, which will be 2.5 Hz and an added delay of 50 msec.

Using the KDD as a trigger source itself

The **External / Internal** radio button on the KDD control dialog allows you to select division from either an external trigger set in on the KEY in BNC (select **EXTERNAL** for this), or you can use the KDD as an trigger source itself, by selecting **Internal** as the radio-button choice.

Divide Delay Trigger	Setup X
CON	/ Port
COM1	
Divide Trigger by:	DelayTrigger by:
Master Key Input So C External (Master	ource
Internal (1kHz cl	ock)
🔲 Reset Firmware	
ОК	Cancel

When you have selected Internal, your DIVIDE choice is used to divide into a 1000 msec internal oscillator. For example, **Internal** selected and DIVIDE=4 means your triggers would be 1000 / 4 = 250 msec apart for a 4 Hz rate.

Finally, you can RESET the KDD unit at any time and wait a few seconds and start again, setting up your trigger-control paradigm.

When you have set up the settings you need, click on the OK button to complete the operation and resume the survey work.

Key Buffer Box (KBB)

The CTI Key Buffer Box (KBB) is a small stand-alone unit which is used to condition an incoming pulse or square-wave and create a buffer set of two output server-ready trigger pulse trains. This has a few advantages. With the 24-bit CTI analog interface box, the USB-4431 sends out a single, fairly weak trigger pulse on A0O, but it needs to be received 2 places - (1) the USB-4431 Al0 BNC, and (2) the customer sonar top-side unit trigger input BNC. Our solution was to use the KBB to provide a strong, buffered trigger-pulse in two places at once, reliably.

A second solution became available too though: turning a non-conformant external trigger (e.g. square-wave), into a conformant 1-2 msec duration trigger pulse. So the KBB helps in that case too, where customer-premise trigger sources are square-wave or extended-duration, rather than 1-2 msec pulses. The second issue can happen with the 16-bit CTI analog interface boxes too - where a non-conformant external trigger source can cause double-ping and missed ping errors, but is easily corrected by putting a KBB in series with the external trigger source.

KBB used with 24-bit 4431 and INTERNAL TRIGGER

Here's a view of the KBB (yellow box) and its power-supply transformer unit:



The photo below shows the KBB in the context of an internal trigger situation, transforming the singular 4431 AO0 internal trigger output into a pair (Key Out 1, Key Out 2) of powerful trigger-pulse outputs, one for the 4431 itself, and one for the customer top-side unit trigger input:



When used like this, the KBB overcomes the weakened output "fan-out" problem with the 4431 AO0 output, as the KBB dual-outputs are both strong.

KBB Used with a non-conformant EXTERNAL TRIGGER

The required input positive trigger pulses for 16-bit of 24-bit CTI analog interface boxes is a TTL-compatible (0v to 5v transition) positive-going trigger-pulse only 1-2 msec in duration, but some sonar top-side units accept, or require, a longer-duration positive phase. The KBB helps in this situation by accepting the non-conformant external trigger output, but generating a conformant trigger pulse fro the CTI equipment. So the same source can provide trigger to 2 sets of requirements - (1) the customer equipment, and (2) the CTI equipment, in the case where they are different requirements. Here's a graphic example:

KBB - Square-wave External Trigger Example



The KBB cleans up a non-pulse, perhaps excessive-voltage trigger pulse, into a TTL-compatible output pulse-train.

Ground Reference

The National Instruments USB-62XX User Manual presents electronic configuration diagrams of the 2 "grounding mode" options which are available as choices in the NI Analog SB Server GUI, as shown below:

	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	NOT RECOMMENDED for the USB-6210/6211/6212 Signal Source DAQ Device AI + AI GND VA VB AI GND Ground-loop potential (VA - Va) are added to measured signal.

Table 4-2.	USB-6210/6211/621	2 Analog	Input Configuration
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In the server GUIs, these choices are available in the Ground Ref drop-down:

Ground Reference

SServer 7.02.0	04			– 🗆 X
Sampling Frequency (Hz): 100 Record Len (m): 25.00 Record Len (ms): 33.33 Samples: 333 Channels: 2 Sonar Range (m) 25 (m) Trigger Source Control	Àmnfw?wÈm SN:0 Simulate Mode	Data Acquisition Mode Single Freq SSS (2 CH) Sampling Freq A/D ∨ Range Cou 10.0 kHz/Chan ▼ +/-5V ▼ DC Sound Vel (m/s) 1500.00		DAQ Board Status SonarWiz Connection Send Data as C 8 Bit 16 Bit
✓ Do not record delay Ping Samples Ping Count ✓ ✓	Minimum Average Maximur Minimum Average Maximur Average Maximur Average Maximur Minimum Average Maximur Minimum Average Maximur Maxim Maximur		Period er IntvI Channel er IntvI LF Port ▼ BNC Signal Connections BNC TRG> TRIG BNC CH1> PORT BNC CH2> STBD	
Enable Heave Port Enable Telemetry Port Altitude Heading 0.0 0.0	Heave: COM2:9600,N,8,2 Telemetry: COM1:9600,N,8,2 Roll Pitch Depth 0.0 0.0 0.0	Telemetry Format Villiamson C GeoAcoustics Heave (cm) Temp (C) 0.00 0.0	Downsampling Off Downsample to 1024 Downsample to 2048 Quit	C Downsample to 3072 Downsample to 4096

BNC Impedance Recommendations

In order to minimize cross-talk in multi-channel recording situations, use Low Impedance sources (National Instruments information PDF file, NI manual 370503k.pdf pp. 2-10).

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 highimpedance 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

Testing

This section contains tips about testing your Chesapeake Technology, Inc (CTI) analog interface box, to verify that the hardware is working right. The be sure the software for these units is all set up and installed properly, please refer to <u>Software Installation</u> first.

CTI runs 3 test protocols on the 16-bit and 24-bit analog interface boxes before they are shipped to customers. Our testing procedure is outlined here so that you can repeat the process yourself while testing and troubleshooting your hardware in the field:

- Measurement and Automation tests
- Channel and trigger tests
- SonarWiz Views of the Input Signals

Measurement and Automation tests

The Measurement and Automation tests utilize the NI Measurement & Automation (NI-MAX) software package available when installing the <u>NI-DAQmx Runtime installation</u>. You may need to re-run the package manager to install *NI Measurement & Automation Explorer* if you performed a minimum installation previously.

These tests verify the integrity of the NI board in the 5-BNC box and do not involve any CTI source code.



2. Open the Devices and Interfaces branch and locate the active branch for your device



3. Select the device and Click the SELF-TEST button.



4. Select the device and click the Reset Device button



5. After these have successfully completed, we recommend testing the individual channels Al1 through Al5, sending in a +/- 5V signal and verify good signal quality on each of channels ai1, ai2, ai3, ai4, and ai5, one at a time.

Click on the visible TEST PANELS button, to pen the Test Panels dialog :



Then select the "channel" to first test - e.g. on a 16-bit device. CH1 corresponds to ai1:



On a 24-bit device, you'll test ai0 - ai3 (4 channels) and the front-panel name silk-screened onto the 4431 box matches the channel name in Test Panels.

Select the input channel to test (ai1 through ai5 for the 16-bit boxes, or ai0 - ai3 for 24-bit boxes), then select CONTINUOUS mode:

Test Panels : NI USB-6210: "	Dev22"	
Analog Input Digital I/O	Counter I/O	
Channel Name Dev22/ai0 Mode On Demand ✓ On Demand Finite Continuous		Amplitude vs. Samples Chart 10 - 8 - 6 - 4 - 2 -
Max Input Limit	Min Input Limit	
10	-10	0 -
Rate (Hz)	Samples To Read	-2-
1000	1000	-4 -
		-6 -
		-8 -

For the individual 16-bit channel tests, we use CONTINUOUS mode, RSE input coupling, a 1Khz sampling rate, and display 1s of 5v p-p data. We vary the input signal frequency and watch the live view of the data to be sure it has good quality, and comes in at full 5v p-p amplitude (or whatever full amplitude you are sending in).

Test Panels : NI USB-6210: "Dev22"	
Analog Input Digital I/O Counter I/O	
Channel Name Dev22/ai0 Mode Continuous Input Configuration Differential RSE NRSE Pseudodifferential 1000 1000	Amplitude vs. Samples Chart 10 - 8 - 6 - 4 - 2 - 0 - -2 - -4 - -6 - -8 -
	-10-

For the 4431 unit tests, the only "input configuration" option is "pseudodifferential", so you should choose that:



Verify the signal is properly received:



Repeat this test for each channel ai1 through ai5 for a 16-bit box, or ai0 - ai3 for a 24-bit box.

Then close the Measurement and Automation software, to release the device, so that it can be used by SonarWiz and the NI server.

Channel and Trigger Tests

There are 4 types of test we run on the CTI 5-BNC analog interface box, using SonarWiz 7 and the **NIAnalogSBP12-16Server** server. These test verify that the 5-BNC box is receiving command and control from both the CTI Server application and an external trigger.

1. Verify GREEN LED blinking on the front-panel of the 16-bit CTI 5-BNC analog interface box (slow blink) after Windows detects the plug-in on the USB port



2. Verify trigger **INT mode** and front-panel EXT KEY MODE red-light is **OFF** on the box - e.g. Set 5 Hz internal trigger rate (200 msec interval)

- Setting INT trigger mode on the NI Analog SB GUI is by using this radio-button:

Sampling Fr	equency (Hz)	20000		16 bit A/D					Data Acc	quisitio	n Mode	
Record Len	(m): 37.50 (ms): 50.00		U	SB-6210 SN:1d73	ac9	Dual Ch	annel SBR	> (2 Cl	H)			
Samples: 10			Dev 2-	USB-6210-1D73A		Sam	pling Free		A/DVR	ange	Coup	ling
Channels: 2			IDev2-	036-6210-10734		20.0 kH	z/Chan	•	+/- 5V	-	DC	
Trigger I	Interval 2	:00 (ms)	-	Simulate Mode		Sound	Vel (m/s)	150	0.00		C Offset	0
Record L	E	0.00	Sync w	w/Trigger		Joodina	v or (irit o)	1	0.00		0 0 1000	1-
Record L Recording D	.en (ms) 5		_	w/Trigger e Hardware Trigg	ıer Divider/I	1	(103)	1		1	livide/De	1-
	.en (ms) 5 Delay (ms) 0	0.00	_		jer Divider/I	1	Y OI (III (O)	1		1		1-
Recording D	en (ms) 5 Delay (ms) 0 Source (0.00 .00 C EXT	Enable			1	vor(into)	1		1		lay: (
Recording D Trigger S Wide Trig	en (ms) 5 Delay (ms) 0 Source (0.00 .00 C EXT	Enable INT ent trigger r	e Hardware Trigg		1	Y 61 (11(9)	1	Re	D	livide/De	lay: (Perio
Recording D Trigger S Wide Trig	en (ms) 5 Delay (ms) 0 Source (gger Support (r	0.00 .00 EXT May preve	Enable INT ent trigger r	e Hardware Trigg		'Delay	Triggers		Re	D nge 38	livide/De	lay: C Period

- Verify that the ping-count is incrementing in the GUI left-side display field (count shown as 459 in the graphic above). This should auto-increment in INT trigger mode, with no BNC cable attached to the TRIG I/O connector on the box.

- Use a function generator to send in a +/- 5V amplitude sine wave and verify that this data displays. Example settings for the GUI and example sine-wave data view are shown below. Input in this case is an 80 Hz sine-wave:

ecord Len (m): 37:50 ecord Len (ms): 50:00 mannels: 2 USB-6210 SN:1d73ac9 Dual Channel SBP (2 CH) Sampling Freq AD V Range Coupling Ground Ref Dev2-USB-6210-1D73AC8 Simulate Mode Sound Vel (m/s) Sound Vel (m/s) Dio KHz/Chan +/- 5V DC RESE SonarWiz Connection Record Len (ms) Simulate Mode Sound Vel (m/s) IS00.00 Dev2-USB-6210-1D73AC8 Record Len (ms) Simulate Mode Sound Vel (m/s) IS00.00 Dev2-USB-6210-ID73AC8 Sound Vel (m/s) Note: Do C RESE Record Len (ms) Sound Vel (m/s) Do C Offset 0 Record Len (ms) 0.00 Enable Hordware Trigger Divider/Delay Divide/Delay: OFF OFF Trigger Support (may prevent trigger rates less than 100Hz) Range Trigger Rate Trigger IntM Channel 1495 2010 -32768.0 -1764.5 30182.0 </th <th></th> <th>uency (Hz): 10000</th> <th></th> <th>16 bit A/D</th> <th></th> <th></th> <th>Data Acquisit</th> <th>ion Mode</th> <th></th> <th>DAQ Board Status</th>		uency (Hz): 10000		16 bit A/D			Data Acquisit	ion Mode		DAQ Board Status
Image: 1 Image: 1 <td< th=""><th></th><th></th><th>USB-</th><th>6210 SN:1d73</th><th>ac9 C</th><th>)ual Channel SBP (2</th><th></th><th></th><th></th><th>SonarWiz Connection</th></td<>			USB-	6210 SN:1d73	ac9 C)ual Channel SBP (2				SonarWiz Connection
Trigger Interval 200 (ms) Simulate Mode Sound Vel (m/s) DC RSE Record Len (ms) 50.00 Sync w/Trigger Recording Deley (ms) 0.00 Enable Hardware Trigger Divider/Delay Divide/Delay: OFF Trigger Source EXT INT Wide Trigger Support (may prevent trigger nardware control. 38 0.050 Ping Samples Minimum Average Maximum Triggers 1495 2010 -32768.0 -1764.5 30182.0 1495 4.98 Hz 201.000 ms SB0 BNC Signal Connections BNC TRG> TRIG BNC CH1> SBP0	amples: 500 hannels: 2		Dev2-USE	B-6210-1D73A						
Record Len (ms) Suc w/Trigger Record Len (ms) Suc w/Trigger tecording Delay (ms) 0.00 Enable Hardware Trigger Divider/Delay Divide/Delay: OFF Trigger Source C EXT Wide Trigger Support (may prevent trigger nates less than 100Hz) Range Do not record delay Invert trigger hardware control. Ping Samples Minimum Average Maximum Triggers Trigger Rate Trigger IntM Channel 30182.0 1495 2010 -32768.0 -1764.5 30182.0 1495 BNC Signal Connections BNC TRG> TRIG BNC CH1> SBP0		erval 200 (ms)	Ţ Sin	nulate Mode					RSE	
Recording Delay (ms) 0.00 Enable Hardware Trigger Divider/Delay Trigger Source C EXT INT Wide Trigger Support (may prevent trigger rates less than 100Hz) Do not record delay Invert trigger hardware control. Ping Samples Minimum Average Maximum Triggers 1495 2010 -32768.0 -1764.5 30182.0 1495 4.98 Hz 201.000 ms SBD BNC Signal Connections BNC TRG> TRIG BNC CH1> SBP0			_	iqqer		Sound ver(m/s) i	500.00	DC Offiset 0		
Wide Trigger Support (may prevent trigger rates less than 100Hz) Range Time Period Do not record delay Invert trigger hardware control. 38 0.050 Ping Samples Minimum Average Maximum Triggers Trigger Rate Trigger Intvl Channel 1495 2010 -32768.0 -1764.5 30182.0 1495 4.98 Hz 201.000 ms SB0 Image Minimum Average Maximum Triggers Trigger Rate Trigger Intvl Channel 1495 2010 -32768.0 -1764.5 30182.0 1495 4.98 Hz 201.000 ms SB0 Image Minimum Average Image I			_		er Divider/De	lay		Divide/Delay: OF	F	
Do not record delay Invert trigger hardware control. Ping Samples Minimum Average Maximum Triggers Trigger Rate Trigger Intv Channel 1495 2010 -32768.0 -1764.5 30182.0 1495 4.98 Hz 201.000 ms SB0 BNC Signal Connections BNC Signal Connections BNC TRG> TRIG BNC CH1> SBP0	-		INT							
Do not record delay Invert trigger hardware control. Ping Samples Minimum Average Maximum Triggers Trigger Rate Trigger Intv Channel 1495 2010 -32768.0 -1764.5 30182.0 1495 4.98 Hz 201.000 ms SB0 BNC Signal Connections BNC Signal Connections BNC TRG> TRIG BNC CH1> SBP0			vent trinner reter	: loss than 100	Hz)					
Ping Samples Minimum Average Maximum Triggers Trigger Rate Trigger Int/ Channel 1495 2010 -32768.0 -1764.5 30182.0 1495 4.98 Hz 201.000 ms SB0 Image: SB0 <					(,12)					
1495 2010 -32768.0 -1764.5 30182.0 1495 4.98 Hz 201.000 ms SB0 ▼ BNC Signal Connections BNC TRG> TRIG BNC CH1> SBP0	Ping	Samples	Minimum	Average	Maximum	Triggers			Channel	
BNC Signal Connections BNC TRG> TRIG BNC CH1> SBP0										
BNC TRG> TRIG BNC CH1> SBP0								-	,	ns
BNC CH1> SBP0			\bigwedge						-	
BNC CH2> SBP1		\rightarrow /				\setminus /		BNC	CH1> SBP0	
				$\Delta \Delta$				BNC	CH2> SBP1	
			Н	eave: OFF		p.				
Enable Heave Port Heave: OFF	Enable He	ave Port				I . — Telemetry Form	at			
☐ Telemetry Format	Enable He	eave Port						0.0	Contraction of the second	
Enable Telemetry Port Telemetry: OFF Telemetry Format		_		emetry: OFF		Williamson	C GeoAcousti			C D
Telemetry Format	Enable Te	lemetry Port	Tel		Depth			C Do	ownsample to 1024	

- Here's an example of the EXT TRIG MODE LED being OFF



3. **EXT trigger** mode test: Use input SQUARE wave fed through a CTI KBB approx 5v p-p, or a pulse-generator, if you have one, to generate a 5 Hz (approx) input trigger on TRIG I/O (16-bit box), and see that triggering "ping" count follows trigger pulses - same rate - and the RED EXT KEY MODE trigger-mode indicator LED is ON on the 16-bit box



Here's an example set of NI Analog SB server GUI settings to use in a test scenario like this:

ampling Frequency (Hz): 10000							
Recording Delay (ms) 0.00 [Trigger Source • EXT (Wide Trigger Support (may prever Do not record delay Invert trig Ping Samples Mir		C9 [10.0 So		A/D V Range +/- 5V • 00.00 D	Coupling DC R: C Offset Mide/Delay: OFF Time Period 0.050 Trigger IntM	Ground Ref	DAQ Board Status
Enable Heave Port	Heave: OFF Telemetry: OFF Roll 0.0 0.0 0.0	Depth	Telemetry Forme Williamson Heave (cm) 0.00	C GeoAcoustics Temp (C)	BNC TRO BNC CH1 BNC CH2	sampling Off sample to 1024 sample to 2048	 C Downsample to 3072 C Downsample to 4096

In this example, the one function generator is used to create the KBB input 5 Hz square-wave, so we are recording the KBB output of Key 2, plugged into CH1 on the 5-BNC box, which shows the 2-msec-duration square pulse, instead of the function generator output, on SB0 (first of optionally 2 channels you can record).

4. Verify both SB0 and SB1 input view of the input data, whether it's the KBB output signal, or function-generator sine-wave input data 5v p-p in the server signal-display window. Just remove the BNC cable from CH1 and move it to CH2 on the 16-bit box, and verify the data display.

SonarWiz View of the Input Signals Tests

To verify that the 5-BNC interface box is communicating through the Analog Server with SonarWiz, we do the following:

1. Start SonarWiz

2. Start the NIAnalogSBP12-16Server server and set your INT trigger set to 200 msec

3. 50 msec Record Len is good because it's short and you can test trigger intervals down to 66 msec easily without the record-length over-running the inter-trigger duration.

You should probably set the input GROUND REF coupling choice the same as you plan to use in your survey. So choose amongst these 3 options DIFF, NRSE and RSE (they are described above in the earlier GROUND REFERENCE section within this document):

Sampling Frequency (Hz): 20000	16 bit A/D	Dat	a Acquisition Mode		DAQ Board Status	۵
Record Len (m): 25.00 Record Len (ms): 33.33	USB-6210 SN:1d73ac9	Dual Channel SBP (2 CH)		•	SonarWiz Connection	6
Samples: 666 Channels: 2	Dev2-USB-6210-1D73AC9	Sampling Freq A/D 20.0 kHz/Chan 💌 +/- 5	V Range Coupling	Ground Ref	-	
	Simulate Mode	Sound Vel (m/s) 1500.00	DC Offset 0	DIFF		
Record Len (ms) 33.33	🕅 Syncw/Trigger	to another to		RSE		
Recording Delay (ms) 0.00	 Enable Hardware Trigger Divider 	r/Delay	Divide:4 Delay:50 Cl	OM-1		

Connect a function generator to CH1 on the 5-BNC box and enable a sine-wave output at about 5v p-p amplitude, at 80 Hz to get a nice signal display going in the server like this, with 4 full sine-wave cycles displayed in the server data-view window:

	uency (Hz): 10000		16 bit A/D			Data Acquisiti	on Mode		DAQ Board Status
cord Len (m cord Len (m		USB-6	210 SN:1d73a	ac9 D	ual Channel SBP (2			-	SonarWiz Connection
mples: 500 annels: 2		Dev2-USB	-6210-1D73A		Sampling Freq	A/DVRange	Coupling	Ground Ref	
Trigger Inte	rval 200 (ms)	▼ 「Sim	ulate Mode	,			DC Offset 0		
Record Len	(ms) 50.00	Sync w/Trig	gger						
ecording Dela	ay (ms) 0.00	Enable Ha	rdware Trigge	er Divider/Del	ay		Divide/Delay: OFI	F	
Trigger Sou	irce C EXT	INT							
Wide Trigge	r Support (may preve	nt trigger rates	less than 100	Hz)		Range	Time Period		
Do not record	d delay 🥅 Invert tri	gger hardware (control.			38	0.050		
Ping	Samples M	nimum	Average	Maximum	Triggers	Trigger Rate	Trigger Intvl	Channel	
1495	2010 -3	2768.0	-1764.5	30182.0	1495	4.98 Hz	201.000 ms	SB0 V	
							BNC	TRG> TRIG CH1> SBP0 CH2> SBP1	
Enable Hea	ave Port	He	ave: OFF		- Telemetry Forma	ıt			
	emetry Port	Tele	metry: OFF		Williamson			wnsampling Off	
Enable Tel					Line of Anna	Temp (C)		wnsample to 1024	C Downsample to 3072
Enable Tel	Heading	Roll	Pitch	Depth	Heave (cm)	Temp (C)	C Dr	wnsample to 2048	C Downsample to 4096

In SonarWiz, click Views > Data Acquisition > SCOPE DISPLAY:



Verify the input sine-wave signal is coming all the way in (via the USB cable, as digitized data) from the CTI 5-BNC analog interface box, to SonarWiz.

For a second example, here is an SCOPE DISPLAY in SonarWiz, with a square-wave trigger-pulse recording from the NI Analog Sidescan server. Just loop TRIG I/O and the INT trigger will be sent out - and connect the other end of the BNC cable to CH1 to record it. This example uses 8-bit data and a 50 msec sonar range, for an approximate 15 Hz trigger-rate:

	equency (Hz): 10000		16 bit A/D			Data Acquisitio	in Mode		DAQ Board Status		
cord Len ((m): 50.00 (ms): 66.67	US	SB-6210 SN:1d73	lac9 S	ingle Freq SSS (2	CH)		-	SonarWiz Connection		
mples: 66è		Dev/2-I	JSB-6210-1D73A	AC9 -	Sampling Freq	A/D V Range	Coupling	Ground Ref	-		
annels: 2		,			0.0 kHz/Chan	▼ +/-5∨ ▼	DC 💌	RSE 💌	Send Data as		
Sonar Range (m) 🛛 🕤 (m) 💌 🔽 Simulate Mode			5	Sound Vel (m/s)	1500.00			🖲 8 Bit 🔿 16 Bi			
		Sync w/	/Trigger	Sync:							
Trigger S		 INT rigger hardwa 	are control.			Range 50	Time Period				
Ping	Samples M	dinimum	Average	Maximum	Triggers	Trigger Rate	Trigger Intvl	Channel			
3790	677	3.0	6.4	231.0	3790	14.77 Hz	67.700 ms	LF Port 🔻			
							BNC	C Signal Connectio	ons		
				=				-			
			+	=			BNC	TRG> TRIG CH1> PORT			
							BNC	CH2> STBD			
	leave Port		Heave: OFF								
Enable H	alamata (Davi	7	Telemetry: OFF		Telemetry Form Williamson	C GeoAcoustics		ownsampling Off			
Enable H Enable T	elemetry Pon					T (0)	C Do	ownsample to 1024	4 C Downsample to 3072		
	Heading	Roll	Pitch	Depth	Heave (cm)	Temp (C)	C Do	ownsample to 2048	B C Downsample to 4096		

In SonarWiz, the SCOPE display shows the data well, if you adjust the Y-MIN and Y-MAX as follows, and select the SSS PORT (CH1 input BNC) to display:



SonarWiz View of the Waterfall Display

This test verifies recording and playback of the SB0 sub-bottom (CH1 on the 5-BNC box) analog signal through the system.

1. Generate an 80 Hz 5v p-p sine wave using a function generator into the 5-BNC analog interface box, connected to CH1.

2. Set up the NI Analog SB server to look like this, displaying SB0, INT trigger at a 200 msec period, 50 msec record length:

	CMAX_RT_6_01.mml - SonarWiz 7 V7.06.06 x64 Connected
cessing Bathymetry Map	View Tools Help
S * 📖	🜔 🐘 🖳 🕟 💽 💽 💿 鱫 🦉 🔟 🛛 🚘 ੱ 🛇 🔇
Server 7.06.00	
Sampling Frequency (Hz): 100 Record Len (m): 37.50 Record Len (ms): 50.00 Samples: 500 Channels: 2 Trigger Interval 200 (m Record Len (ms) 50.00 Recording Delay (ms) 0.00 Trigger Source C EX Wide Trigger Support (may 1) Do not record delay Inv Ping Somples 291 2010	USB-6210 SN:1d73ac9 Dual Channel SBP (2 CH) SonarWiz Connection Dev2-USB-6210-1D73AC9 Sampling Freq A/D V Range Coupling Ground Ref 10.0 kHz/Chan +/- 5V DC RSE Image: SonarWiz Connection Image: SonarWiz Connection Simulate Mode Sound Vel (m/s) 1500.00 DC Offset Image: SonarWiz Connection Image: SonarWiz Connection Sync w/Trigger Sound Vel (m/s) 1500.00 DC Offset Image: SonarWiz Connection Image: SonarWiz Connection Image: Time Period SonarWiz Connection Image: Time Period Image: Time Period
Enable Heave Port	Heave: OFF
Enable Telemetry Port	Telemetry: OFF GeoAcoustics Downsampling Off
Altitude Heading	Roll Pitch Depth Heave (cm) Temp (C) C Downsample to 1024 C Downsample to 3072 C Downsample to 2048 C Downsample to 2048 C Downsample to 4096
0.0 0.0	0.0 0.0 0.0 0.0 0.0 Quit Help

In SonarWiz, open the realtime SCOPE DISPLAY. **View > Data Acquisition Views >SCOPE** and set the Y-MIN and Y-MAX to allow positive and negative full-range 16-bit numbers:



Note that SB0 (CH1 on the box) display in the server becomes SBP1 choice in this SCOPE DISPLAY.

Next, in SonarWiz, open the real-time waterfall display: View -> Data Acquisition Views -> Waterfall Display 1.

Use the Gear icon to open the Settings for the waterfall and select SB channel 1 data. it should come in like this:

5. Turn off the SS channels so you can see just the single SB channel you want, SB0 or SB1:

Data Acquisition Post Processing Bathymetry Maps View Tools Help Data Acquisition Post Processing Bathymetry Layout Towing Mode * LaYou Grid Color Legend Opacity Tools Post Processing Data Acquisition Post Processing		CMAX_RT_6_01.mml - SonarWiz 7 V7.06.06 x64 Connected
Data Aquidition Port-processing Bathymetry Views * Views * Vie	Data Acquisition Post Processing Bathymetry Maps View	Tools Help
Image: Construct of the set of th	Data Acquisition Post-processing Bathymetry Layout	X/Y Grid Type Zevenbergen+Thorne * Set 4 Annual
Monitor SB0 0.00-37.50 (m) Waterfall Settings 0.0 T Wew Wertical 51descan channels Low frequency High frequency 6.0 Channel 1 (Port) Channel 3 (Port) 10.0 Channel 2 (Stbd) Channel 4 (Stbd) 15.0 Sub-bottom settings Q.0 20.0 Sub-bottom settings Sub-bottom settings 20.0 Apply Heave Compensation 20.0 24.0		×
Waterfall Settings View Image: Waterfall Settings Sidescan channels Low frequency High frequency Channel 1 (Port) Channel 2 (Stbd) Channel 2 (Stbd) Sub-bottom settings Image: Channel 1 Channel 2 Apply Heave Compensation Apply Swell Filter Swell period in 2.0		Namine CD0.0.0.07.50 (m)
View Horizontal Vertical Sidescan channels Low frequency Channel 1 (Fort) Channel 3 (Port) Channel 2 (Stbd) Channel 4 (Stbd) Sub-bottom settings Channel 1 Channel 1 Channel 2 Apply Heave Compensation Apply Swell Filter Swell period in 2.0		
		Waterfall Settings View Horizontal Vertical Sidescan channels Low frequency High frequency Channel 1 (Port) Channel 3 (Port) Channel 2 (Stbd) Channel 4 (Stbd) Sub-bottom settings ✓ Channel 1 Channel 2 Apply Heave Compensation Apply Swell Filter Swell period in 20.0

Turn off the SS channels if they were selected, so you can see just the single SB channel you want, SB0 or SB1.

Change the display POLARITY using the right-click anywhere in the main waterfall display, then hover the cursor over the DISPLAY POLARITY choice and select NEGATIVE:



You can see the dark pattern transition to a light pattern in my case - though for you it will depend upon your group color window settings.

Vary the input sine-wave frequency (e.g.go to 40 Hz) and confirm a change in the waterfall display pattern. If you're satisfied with CH1 then try CH2 and do a bit of testing to confirm you'll have 2 channels working for your survey.

Here's an example of the 40 Hz NEGATIVE input - see the transition to a half-as-frequent striping zone in the server display, SonarWiz SCOPE display, and in the SonarWiz waterfall display:

Sampling Frequency (Hz): 10000 Record Len (m): 37.50 Record Len (ms): 50.00 Samples: 500 Channels: 2)	16 bit A/D		Data Acquisition Mode							
		US	USB-6210 SN:1d73ac9			Dual Channel SBP (2 CH)					-	
		Dev2-f	USB-6210-1D73.	Sampling Fr	eq	A/D V R	ange	Coupli	ing	Ground	Ref	
		,			10.0 kHz/Chan	-	+/-5V	-	DC	-	RSE	•
Trigger Ir	Interval 200 (ms)	•	Simulate Mode		Sound Vel (m/	s) 15	00.00	D	C Offset	0		
Record L	.en (ms) 50.00	Syncw	v/Trigger							,		
Recording D	Delav (ms) 0.00	Enable	e Hardware Trig	aar Dividar	Delevi			0	a data ima ta		_	
	Source C EXT gger Support (may pre cord delay Invert		ates less than 10		Delay			nge 18	Time Pe	eriod		
Wide Trig	gger Support (may pre cord delay 🥅 Invert	vent trigger re	ates less than 10			ers		nge 18	Time Pe	eriod 0	Char	inel
Wide Trig	gger Support (may pre cord delay	vent trigger n trigger hardw	ates less than 10 vare control.	00Hz)	num Trigg		3	nge 18 Rate	Time Pe	eriod 0 r Intvl		inel
Wide Trig Do not rec Ping	gger Support (may pre cord delay	vent trigger n trigger hardw Minimum	ates less than 10 vare control.	00Hz)	num Trigg		Trigger	nge 18 Rate	Time Pe 0.050 Trigger	eriod 0 r Intvl 0 ms	Char	•
Wide Trig Do not rec Ping	gger Support (may pre cord delay	vent trigger n trigger hardw Minimum	ates less than 10 vare control.	00Hz)	num Trigg		Trigger	nge 18 Rate	Time Pe 0.050 Trigger 201.000	eriod 0 Intvl 0 ms BNC	Char SB0	•nnectio
Wide Trig Do not rec Ping	gger Support (may pre cord delay	vent trigger n trigger hardw Minimum	ates less than 10 vare control.	00Hz)	num Trigg		Trigger	nge 18 Rate	Time Pe 0.050 Trigger 201.000	eriod 0 Int 0 ms BNC BNC BNC	Char SB0 Signal Co	•nnectio RIG 3P0

and



and then the 80-to-40 Hz input transition shows in the waterfall too:



CTI Analog Servers

NIAnalogSSServer

The SonarWiz 16-bit analog sidescan server (**NIAnalogSSServer**) is a small interface program that controls the National Instruments (NI) USB-6210 data acquisition (DAQ) device. The combination of the USB-6210 and this dedicated software interface provides high resolution sampling of analog sidescan signals for transmission to the SonarWiz data acquisition software for recording into the XTF data format. This interface is capable of digitizing each channel from 10kHz to 30kHz per channel. Each channel has its own dedicated delta signal A/D converter providing samples at 16-bit resolution. **NIAnalogSSServer** can be configured to generate its own trigger signal at user specified rates or it can accept an external 1ms wide positive going TTL pulse as the trigger source.



1 System Icon

Click the System Icon to access the following commands:

Command	Description
Keep on top	When checked, always keep the server on top of other windows
Advanced Settings	Open the <u>Advanced Settings window</u>
Rest Stats	Rest the Channel Monitor Statistics
About NIAnalogSSSServer	Shows the Analog Server version and build information panel:





Settings Monitor Window

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

The **Settings Monitor Window** displays the computed ping record settings based on the <u>Sonar</u> <u>Range Selection</u> and <u>Sampling Frequency</u> selected by the user. Compare these settings to the statistics displayed in the <u>Data Monitor</u> to see what the system is actually able to achieve.



Simulation Mode

🔲 Simulate Mode

The **Simulate Mode** is useful for testing the system connectivity when no signals are available. The simulate mode will send fabricated data to SonarWiz without using the A/D board.



Range Selection

		_
Sonar Range (m)	25 (m)	

The sonar **Range Selection** MUST match the range setting in the analog sonar system or data will be lost. Use the range selection drop down box to select the range in meters that matches your current sonar setting



Trigger Synchronization

Sync w/Trigger Sync:

When the **Sync w/Trigger** checkbox is checked, the server will make the record length the same as the external trigger interval. The <u>Range Selection</u> is not editable when this check box is set. When the Sync checkbox is unchecked, the Range Selection field becomes editable and the user may enter a sonar range.



Trigger Source

Trigger Source Controlled by internal slide switch

Sonar triggering options:

Control	Description
	Setting to INTERNAL trigger generates an output trigger, which appears as a 0v to +5V squarewave pulse 1-msec wide on the

TRIG I/O output BNC connector of the CTI 5-BNC box connected to your SonarWiz PC.	
Setting to EXTERNAL trigger means you will send in a trigger pulse.	

Invert Trigger Control

Invert trigger hardware contro

If the red EXT KEY MODE LED is ON when INT trigger is selected, then check this check-box to reverse the internal hardware control bits for internal / external trigger, to correct for what may happen sometimes as a hardware anomaly.

Ping Monitor

Ping	Samples	Minimum	Average	Maximum	Triggers	Trigger Rate	Trigger Intvl	Channel
Ping	Count	Minimum	Average	Maximum	Triggers	Trigger Rate	Trigger Intvl	LF Port 💌

The ping monitor window displays the minimum and maximum and average values for the selected channel. The detected trigger interval and trigger rate as well as the number of samples digitized between trigger pulses is isplayed for each channel. This tool allows one to select the channel to monitor in the text fields as well as the Signal Trace chart display.

Signal Trace

 	-	-	-	-	-	-	-	-

The chart display is an autoscaling graph that shows the relative strength of the incoming analog signal. The channel displayed is selected by the Channel Monitor drop-down.

Notification Area 10



The Notification Area is reserved for various status and error messages to alert the user to problems in the system.



When checked, the server will record heave information over the specified COM connection. Click the Heave Input Control button to open the <u>COM Port Settings</u> dialog.

Telemetry Input Control

		Telemetry Format
Enable Telemetry Port	Telemetry: COM1:9600,N,8,2	Williamson C GeoAcoustics
Some analog sonars provide telemetry information of the vehicle attitude via a serial port. Use the Enable check box and click the Telemetry Input Control button to open the <u>COM Port Settings</u> dialog. Currently, the only telemetry datagrams supported are from Williamson and Associates AMS sonars and GeoAcoustics.

The Williamson and Associates AMS telemetry format is a comma separated ASCII text messages consisting of towfish depth, altitude, roll, pitch, heading as shown in the following sample output.

3457.48,1203.60,12.9,-16.4,214.7 3357.48,1213.60,13.3,-16.4,215.1

13	Board Selection Mode	2
	MI Deuiee	-

NI Device	
SN:0	
	-

The **Board Selection Mode** indicates which National Instruments card the server is communicating with. If your system contains more than one National Instruments card, use the drop-down selection box to select to the appropriate board. This selection is not available in <u>Simulation Mode</u>.

Data Acquisition Mode

Data Acquisition Mode	
Single Freq SSS (2 CH)	-

Select the number of channels that are appropriate for your sonar. If you are operating a dual frequency sidescan sonar, you would want to select both the LF and HF channels to record low and high frequency data. If you also have a sub-bottom attachment enable the SBP checkbox to record the sub-bottom.

Sampling Frequency

Sampling Free	1
10.0 kHz/Chan	•

The sampling frequency controls the rate at which the analog to digital converter samples and digitizes the analog input signal. Higher sampling frequencies produce more samples per unit of time but also demand more system bandwidth. Typically the highest sampling frequencies are used to produce high resolution records for very short record lengths. The lower sampling frequencies are better suited to longer record lengths.



Sound Velocity

Sound Vel (m/s) 1500.00

Set the sound velocity to the appropriate value for your working area. The interface program uses sound velocity to convert between distance and time. 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.

A/D V Range			
+/· 5V	·		

The NI 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. If you are digitizing data directly from a hydrophone streamer you may need to use one of the lower voltage settings. Be sure to consult your equipment manufacturers interface specifications to select the best voltage range for your instrument.

It is best to maximize the dynamic range of the numbers you record. For example, if you have selected a <u>Data Resolution</u> of 16-bit, then voltage values can translate from -32767 to +32868 (for 8-bit Data Resolution, the signal range is limited to -127 to +128). Use the <u>Channel Monitor</u> and <u>Signal Trace</u> window to adjust your voltage range until the signal minimum and maximum values fill the available range without clipping.

Coupling

Coupling

Coupling controls how voltage will be recorded. <TODO>: Is this still needed? More to say here?

Coupling Setting	Description
DC	Raw voltage is recorded
AC	Removes weak gound voltage from signal and zeros voltage at 0.0 (recommended)



Ground Reference



The NI USB-6210 card supports three ground reference settings. RSE mode is not recommended, but you have a choice of using DIFF or NRSE modes of recording. 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. See <u>Ground Reference</u> for more information.



Connection Indicators

DAG Doard Status	
SonarWiz Connection	۲

The Connection Status indicator lights will turn green when the server makes a successful connection to the DAQ board in the Analog to Digital interface box, and when the server makes a successful connection to SonarWiz 7. The status indicator lights will turn red if the connection has not been established or the connection is lost.

21	Data Resolution
ے	Send Data as

C 8 Bit 🤇	🖲 16 Bit
-----------	----------

The data resolution recorded is controlled by the 8 or 16-bit radio buttons. The A/D converter provides 16 bits of resolution however most analog sidescans provide less than 8 bits of dynamic range. The 16-bit option doubles the disk space required for a given survey compared to the 8-bit option.

Ping Range and Period

Range	Time Period			

Ping range in meters and ping period in seconds.



BNC Signal Connections

The BNC connections display updates based on the Data Aquisition Mode and Trigger Source settings. The display should assist you in properly connecting the BNC connectors to your hardware.



Downsample Controls

Downsampling Off

O Downsample to 1024 O Downsample to 3072

O Downsample to 2048 O Downsample to 4096

The downsample option provides a means of compressing long records. This function works by downsampling records that contain more than 4096 samples which at the current sampling frequency is just over 300m in length. The downsample option has no effect on records shorter than 300m. When the downsampling is set and the record length is greater than 300m, the record will be downsampled to a maximum of 4096 samples per channel. The downsampling is done by taking the maximum value in a 'window' of samples to be downsampled thereby preserving the brighter amplitude samples even in the downsampled record.

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).

Telemetry Monitor

Altitude	Heading	Roll	Pitch	Depth	Heave (cm)	Temp (C)
0.0	0.0	0.0	0.0	0.0	0.00	0.0

The **Telemetry Monitor** displays the parsed telemetry fields received via the **Telemetry Input**.



Close the connection to the Analog to Digitial interface and shut down the server.

27	Help	
2	Help	
	Open this do	ocument.

Advanced Settings

The **Advanced Settings** dialog is opened by clicking on the <u>System Icon</u> on the main server display. The advanced settings dialog includes control settings that specify the level of diagnostic information recorded by the interface. Typically, these messages are sent to a log file.

Advanced Settings		×	TCP/IP Base Port
CHESAPEAKE TECHNOLOGY	TCP/IP Base Port 5 Log file threshold 0 UDP Message Threshold -		2 Log file threshold UDP Message Threshold
	OK Can	icel	

тс	P/IP Base Port	
	TCP/IP Base Port	5678

TCP/IP Base Port is where the real-time diagnostic messages are sent and viewed by SonarWiz. Please do not change the TCP-/IP Base Port address unless instructed to do so by a Chesapeake support engineer.

2	Log file threshold
0	Log file threshold

Control the level of detail recorded in the log file. A value of 0 will only record error messages. A value of 9 will report all diagnostic messages.



UDP Message Threshold

UDP Message Threshold -1

0

Control the level of detail broadcast over UDP. A value of 0 will only record error messages. A value of 9 will report all diagnostic messages.

COM Port Settings

The <u>Heave Input Control Button</u> and <u>Telemetry Input Control Button</u> both open a serial connection to their respective interface. The COM Port Settings dialog allows you to configure the Port, Baud Rate, Parity/Data/ Stop bits for serial connections.

COM Port Settings	×
COM Port COM2: Baud Rate 9600	Parity None C Odd C Even Data Bits C 7 • 8
OK Cancel	Stop Bits C 1 • 2

NIAnalogSBP12-16Server

The SonarWiz 16-bit analog sidescan server (**NIAnalogSBP12-16Server**) is a small interface program that controls the National Instruments (NI) USB-6210 data acquisition (DAQ) device. The combination of the USB-6210 and this dedicated software interface provides high resolution sampling of analog sub-bottom signals for transmission to the SonarWiz data acquisition software for recording into the SEG-Y data format. This interface is capable of digitizing each channel from 1kHz to 100kHz per channel. Each channel has its own dedicated delta signal A/D converter providing samples at 16-bit resolution. **NIAnalogSBP12-16Server** can be configured to generate its own trigger signal at user specified rates or it can accept an external 1ms wide positive going TTL pulse as the trigger source.



System Icon

/ 💕

Click the System Icon to access the following commands:

Command	Description
Keep on top	When checked, always keep the server on top of other windows
Advanced Settings	Open the Advanced Settings window
Rest Stats	Rest the Channel Monitor Statistics
About NIAnalogSSSServer	Shows the Analog Server version and build information panel:





Settings Monitor Window

Sampling Frequency (Hz): 1000 Record Len (m): 100.00 Record Len (ms): 133.33 Samples: 133 Channels: 2

The **Settings Monitor Window** displays the computed ping record settings based on the <u>Record</u> <u>Triggering Controls</u> selected by the user. Compare these settings to the statistics displayed in the <u>Data</u> <u>Monitor</u> to see what the system is actually able to achieve.

Simulation Mode

🔲 Simulate Mode

The **Simulate Mode** is useful for testing the system connectivity when no signals are available. The simulate mode will send fabricated data to SonarWiz without using the A/D board.



3

Record Triggering Settings

Record Len (ms)	133.33		Sync w/Trigger
Recording Delay (ms)	0.00	•	Enable Hardware Trigger Divider/Delay

The Record Triggering Settings control the sub-bottom ping:

Control	Description
Record Len (ms)	The record length is the amount of data that is recorded for each trigger pulse. The amount of data recorded may be offset from the trigger time by using the Recording Delay setting described below. The record length may be set independent of the trigger interval when the Sync w/Trigger checkbox is unchecked.
Recording Delay (ms)	The recording delay field delays the amount of data recorded by the specified time in milliseconds. For example if a 5ms delay is entered, the server will send the requested record length beginning at the 5ms after the trigger pulse. The delay field is useful for eliminating water column in sub-bottom applications in deep water.
Sync w/ Trigger	When the Sync w/Trigger checkbox is checked, the server will make the record length the same as the trigger interval and the delay will be set to zero. The record length and delay fields are

not editable when the check box is set. When the Sync checkbox is unchecked, the Record Length and Delay fields become editable controls and the user may enter any combination of delay and record length such that the sum of the two values is less than or equal to the trigger interval.
When checked, use the Harware Trigger Divider/Delay box. See
Divide Delay Triggering button.
i c l

Trigger Controls

Trigger Source Controlled by internal slide switch

Wide Trigger Support (may prevent trigger rates less than 100Hz)

Do not record delay

Sonar triggering options:

Control	Description
Trigger Source	Setting to INTERNAL (INT) trigger generates an output trigger, which appears as a 0v to +5V squarewave pulse 1- msec wide on the TRIG I/O output BNC connector of the CTI 5-BNC box connected to your SonarWiz PC. Setting to EXTERNAL (EXT) trigger means you will send in a trigger pulse.
Wide Trigger Support	Allow wider trigger pulse, note this will prevent rates less than 100 Hz
Do not record delay	When selected, the upper portion of the record (set by the Recording Delay) will not be recorded. The purpose of this setting is to reduce record length in deep water situations where the first portion of the record in the water column is not needed. This setting must be less than the total Record Length.
Invert trigger hardware control	If the red EXT KEY MODE LED is ON when INT trigger is selected, then check this check-box to reverse the internal hardware control bits for internal / external trigger, to correct for what may happen sometimes as a hardware anomaly.

Ping Monitor

6

Ping	Samples	Minimum	Average	Maximum	Triggers	Trigger Rate	Trigger Intvl	Channel
Ping	Count	Minimum	Average	Maximum	Triggers	Trigger Rate	Trigger Intvl	SBO 💌

The ping monitor window displays the minimum and maximum and average values for the selected channel. The detected trigger interval and trigger rate as well as the number of samples digitized between trigger pulses is isplayed for each channel. This tool allows one to select the channel to monitor in the text fields as well as the <u>Signal Trace</u> chart display.

Signal Trace

	1				

The chart display is an autoscaling graph that shows the relative strength of the incoming analog signal. The channel displayed is selected by the Channel Monitor drop-down.

Notification Area



The Notification Area is reserved for various status and error messages to alert the user to problems in the system.



Heave Input Control

Enable Heave Port	Heave: COM2:9600,N,8,2
-------------------	------------------------

When checked, the server will record heave information over the specified COM connection. Click the Heave Input Control button to open the <u>COM Port Settings</u> dialog.



Telemetry Input Control

		, Telemetry Format
Enable Telemetry Port	Telemetry: COM1:9600,N,8,2	Williamson C GeoAcoustics

Some analog sonars provide telemetry information of the vehicle attitude via a serial port. Use the Enable check box and click the Telemetry Input Control button to open the COM Port Settings dialog. Currently, the only telemetry datagrams supported are from Williamson and Associates AMS sonars and GeoAcoustics.

The Williamson and Associates AMS telemetry format is a comma separated ASCII text messages consisting of towfish depth, altitude, roll, pitch, heading as shown in the following sample output.

3457.48,1203.60,12.9,-16.4,214.7 3357.48,1213.60,13.3,-16.4,215.1

-

44	Board	Se

oard	Selection Mode
	NI Device
	SN:0

The **Board Selection Mode** indicates which National Instruments card the server is communicating with. If your system contains more than one National Instruments card, use the drop-down selection box to select to the appropriate board. This selection is not available in <u>Simulation Mode</u>.

Channel Selection

Data Acquisition Mode
Dual Channel SBP (2 CH)

Select the number of channels that are appropriate for your sonar.

Mode	Description
Single Channel SBP (Ch 1)	Single channel mode records CH1 BNC input into the SEG file
Dual Channel SBP (Ch 2)	Dual channel mode records CH2 BNC input into the SEG file
Single Channel SBP with second Heave (2 CH)	



Sampling Frequency

Sampling Freq

The sampling frequency controls the rate at which the analog to digital converter samples and digitizes the analog input signal. Higher sampling frequencies produce more samples per unit of time but also demand more system bandwidth. Typically the highest sampling frequencies are used to produce high resolution records for very short record lengths. The lower sampling frequencies are better suited to longer record lengths.

Sound Velocity

Sound Vel (m/s) 1500.00

Set the sound velocity to the appropriate value for your working area. The interface program uses sound velocity to convert between distance and time. 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.

A/D Voltage Range



The NI 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. If you are digitizing data directly from a hydrophone streamer you may need to use one of the lower voltage settings. Be sure to consult your equipment manufacturers interface specifications to select the best voltage range for your instrument.

It is best to maximize the dynamic range of the numbers you record. For example, 16-bit data values can translate from -32767 to +32868. Use the <u>Channel Monitor</u> and <u>Signal Trace</u> window to adjust your voltage range until the signal minimum and maximum values fill the available range without clipping.

Coupling

Couplin	g
DC	-

Coupling controls how voltage will be recorded. This control is currently greyed-out, so DC-coupling mode is selected.

Coupling Setting	Description
DC	Raw voltage is recorded
AC	Removes weak ground voltage from the signal and zeros voltage at 0.0



Ground Reference

Ground Ref

NRSE 💌

The NI USB-6210 card supports three ground reference settings. RSE mode is not recommended, but you have a choice of using DIFF or NRSE modes of recording. 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. See <u>Ground Reference</u> for more information.

10

Connection Indicators

DAQ Board Status	۲
SonarWiz Connection	۲

The Connection Status indicator lights will turn green when the server makes a successful connection to the DAQ board in the Analog to Digital interface box, and when the server makes a successful connection to SonarWiz 7. The status indicator lights will turn red if the connection has not been established or the connection is lost.

DC Offset

DC Offset 0

If your input signal contains a bias voltage (the <u>Channel Monitor</u> Average field) you may use the DC Offset control to add a positive or negative voltage to the digitized signal to center that signal about the 0 VDC level.

20

Divide Delay Triggering

Divide:10 Delay:0 COM1

Chesapeake sells an optional hardware trigger delay and divider USB interface box that can be used to accept a master trigger input, optionally divide it down to a lower rate and also to optionally delay it. Use this button to configure open the <u>Divide Delay Trigger Setup</u> dialog.

Range	Time Period

Ping range in meters and ping period in seconds.

B	NC Connections
2	BNC Signal Connections
	BNC TRG> TRIG BNC CH1> SBP0
	BNC CH2> SBP0

The BNC connections display updates based on the <u>Board Selection Mode</u> and <u>Trigger Source</u> settings. The display should assist you in properly connecting the BNC connectors to your hardware.

23

Downsampling Off

Downsample Controls

- C Downsample to 1024 C Downsample to 3072
- C Downsample to 2048 C Downsample to 4096

The downsample option provides a means of compressing long records. This function works by downsampling records that contain more than 4096 samples which at the current sampling frequency is just over 300m in length. The downsample option has no effect on records shorter than 300m. When the downsampling is set and the record length is greater than 300m, the record will be downsampled to a maximum of 4096 samples per channel. The downsampling is done by taking the maximum value in a 'window' of samples to be downsampled thereby preserving the brighter amplitude samples even in the downsampled record.

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).

Telemetry Monitor

4	Altitude	Heading	Roll	Pitch	Depth	Heave (cm)	Temp (C)
	0.0	0.0	0.0	0.0	0.0	0.00	0.0

The Telemetry Monitor displays the parsed telemetry fields received via the Telemetry Input.



Close the connection to the Analog to Digitial interface and shut down the server.

26	Help
-	Help
	Open this document.

Advanced Settings

The **Advanced Settings** dialog is opened by clicking on the <u>System Icon</u> on the main server display. The advanced settings dialog includes control settings that specify the level of diagnostic information recorded by the interface. Typically, these messages are sent to a log file.

Advanced Settings			×		TCP/IP Base Port
CHESAPEAKE	TCP/IP Base Port	5678 0		2	Log file theshold
TECHNOLOGY	UDP Message Threshold	.1		3	UDP Message Threshold
	OK	Cancel]		

	TCP/IP Base Port	
9	TCP/IP Base Port	5678

TCP/IP Base Port is where the real-time diagnostic messages are sent and viewed by SonarWiz. Please do not change the TCP-/IP Base Port address unless instructed to do so by a Chesapeake support engineer.

2	Log file theshold
-	Log file threshold

Control the level of detail recorded in the log file. A value of 0 will only record error messages. A value of 9 will report all diagnostic messages.



UDP Message Threshold

UDP Message Threshold -1

0

Control the level of detail broadcast over UDP. A value of 0 will only record error messages. A value of 9 will report all diagnostic messages.

COM Port Settings

The <u>Heave Input Control Button</u> and <u>Telemetry Input Control Button</u> both open a serial connection to their respective interface. The COM Port Settings dialog allows you to configure the Port, Baud Rate, Parity/Data/ Stop bits for serial connections.

COM Port Settings	×
COM Port COM2: Baud Rate 9600	Parity None C Odd C Even Data Bits C 7 • 8
OK Cancel	Stop Bits C 1 • 2

Divide Delay Trigger Setup

The Divide Delay Trigger Setup is used to control the CTI KDD box. The KDD box is used to control multiplesonars by synchronizing the two ping-rates. The KDD box is also used to add a DELAY in addition to the divided ping-rate allowing you to offset the SSS and SB pings by some amount of time to reduce interference between the SSS and SB pings and returns. For more information see <u>Key Divide and Delay (KDD)</u> section.





Select the COM port the KDD box is configured to use from the drop-down. The COM port selected needs to be available for use on the SonarWiz PC. It is managed by the NI Analog SB server after being selected, and the selected COM port displays in the KDD control button label, along with the current DIVIDE and DELAY settings.



The DIVIDE number is a counter to define how many input pulses (triggers) are needed to create a single output pulse (trigger). For example, with a 10 Hz input trigger rate, and a DIVIDE setting of 4, 4 triggers are counted then a single output trigger is set on the DIVIDE output BNC. At 100 msec per input trigger, that means a $10/4 \times 100 \text{ msec} = 2.5 \text{ Hz}$ (400 msec per trigger) output trigger rate.



Trigger Delay

DelayTrigger by:	
0	ms

Add a delay if needed, to help de-synchronize SSS and SB triggers, and reduce interference. So adding a DELAY value of 50 (units are msec) lets you provide a delayed, divided KEY OUT trigger pulse-train on the second BNC output, which will be 2.5 Hz and an added delay of 50 msec.

nput Trigger

External (Master Key Input BNC)

Internal (1kHz clock)

The **External / Internal** radio button control dialog allows you to select division from either an external trigger set in on the KEY in BNC (select **EXTERNAL** for this), or you can use the KDD as an trigger source itself, by selecting **Internal** as the radio-button choice.



🔲 Reset Firmware

RESET the KDD unit at any time and wait a few seconds and start again, setting up your triggercontrol paradigm.

NIAnalogSBP24Server

The SonarWiz 24-bit analog sub-bottom server (NIAnalogSBP24Server) is a small interface program that controls the National Instruments (NI) USB-4431 dynamic signal analysis (DSA) device. The combination of the USB-4431 and this dedicated software interface provides extremely high resolution sampling of analog subbottom signals for transmission to the SonarWiz data acquisition software for recording into the SEG-Y floating point data format. This interface is capable of digitizing each channel from 10kHz to 100kHz per channel. Each channel has its own dedicated delta signal A/D converter providing samples at 24-bit resolution. NIAnalogSBP24Server can be configured to generate its own trigger signal at user specified rates or it can accept an external 1ms wide positive going TTL pulse as the trigger source.





Svstem Icon

Click the System Icon to access the following commands:

Command	Description
Keep on top	When checked, always keep the server on top of other windows
Advanced Settings	Open the <u>Advanced Settings window</u>
Rest Stats	Rest the Ping Monitor Statistics
About NIAnalogSSSServer	Shows the Analog Server version and build information panel:

NIAnalogSBP24Server



A/D Converter Control

2

NI Device	Sampling Freq	A/D V Range
•	20.0 kHz/Chan 💌	+/- 1V 🔹
Data Acquisition Mode	Coupling	DC Offset (V)
Dual Channel SBP (2 CH)	DC 🔹	0.000

The A/D Converter Control section is used to control how the analog signal is digitized.

Control	Description
NI Device	Used to select the active NI Device when more than one are installed.
Data Acquisition Mode	Use this to select either single or dual channel acquisition mode
Sampling Freq	The sampling frequency controls the rate at which the analog to digital converter samples and digitizes the analog input signal. Higher sampling frequencies produce more samples per unit of time but also demand more system bandwidth. Typically the highest sampling frequencies are used to produce high resolution records for very short record lengths. The lower sampling frequencies are better suited to longer record lengths.
Coupling	If you select DC coupling, any DC offset present in the source signal is passed to the ADC. The DC-coupling configuration is usually best if the signal source has only small amounts of offset voltage or if the DC content of the acquired signal is important. If the source has a significant amount of unwanted offset, select AC coupling to take full advantage of the input dynamic range. (source: NI Dynamic Signal Acquisition User Manual November 2010
A/D V Range	Set the Voltage range to expected range of your input signal. The NIAnalogSBP24Server system can accept inputs from +/- 10VDC.

DC Offset (V)	If your input signal contains a bias voltage you may use the	
	DC Offset control to add a positive or negative voltage to	
	the digitized signal to center that signal about the 0 VDC	
	level.	

Trigger Control

3

C External	Internal
Positive	C Negative
Trigger Interval	(ms) 133.33
Record Trigger	

The trigger control section provides options for triggering the pulse

00	
Control	Description
External	Use External Trigger. When this mode is selected, the NIAnalogSBP24Server is expecting a 1 millisecond wide, positive going square-wave pulse to be applied to the BNC connector labeled AI 0 the front panel of the USB-4431 device.
Internal	Use Internal Trigger: When internal triggering is selected, the NIAnalogSBP24Server software will generate a square-wave trigger signal on the BNC output connector labeled AO 0 on the front pane the USB-4431 device. This signal must be physically connected to both the BNC connector AI 0 as below:
	Trigger Signal
	SBP Data Signals
	NI USB-4431 AI 0 AI 1 AI 2 AI 3 AO 0
	ACTIVE BOWER
	Note: Please be sure to test trigger use with your actual equipment before a survey, as it may not be TTL-compatible voltage range, though it is a square-wave signal output. If you will need an intermed pre-amp stage to make this perfectly TTL-compatible, better to find this out in a lab test, before disc at the boat.
Positive	Trigger is detected on the rising-edge of a trigger pulse transitioning from 0v DC to 5v DC, a should be held high @ 5V DC no more than 2 msec.
Negative	Trigger is detected on the falling-edge of a trigger pulse transitioning from 0v DC to -5v DC, should be held low @ -5V DC no more than 2 msec.
Trigger Interval (ms)	Trigger Interval (ms): When using an internally generated trigger, this control specifies the time inter of the square-wave trigger signal. Note that the trigger interval must always have a longer duration t
· /	92

	the sum of the delay and the record length. BNC AO0 needs to be looped to connect to BNC AI0 to internal trigger.
Record	This button will allow the server to record the trigger pulse to a file for diagnostic purposes.

Ping Monitor

Trigger...

Ping	Samples	Minimum	Average	Maximum	Triggers	Trigger Rate
Ping	Count	Minimum	Average	Maximum	Triggers	Trigger Rate
		Trigger Intvl	Range	Time Period	Channel	
		Trigger Intvl			AI 1 💌	

The ping monitor window displays the minimum and maximum and average values for the selected channel. The detected trigger interval and trigger rate as well as the number of samples digitized between trigger pulses is isplayed for each channel. This tool allows one to select the channel to monitor in the text fields as well as the <u>Signal Trace</u> chart display.

Signal Trace

_					

This simple graph displays an auto-scaled graphical representation of the input signal selected in the channel s down. The choices for channels to monitor are channel AI 1 or AI 2 which represents the SBP data signals app connectors labeled AI 1 and AI 2, respectively.

Notification Area



The Notification Area is reserved for various status and error messages to alert the user to problems in the system.

Record Length

Record Length (ms)	133.33			
Recording Delay (ms)	0.00			
Sync Record Len w/Trigger				
Sound Vel (m/s) 150	00.00			

Record Length controls ping recording time Control Description

Record Length (ms)	This is the duration in milliseconds of the digitized data that will be sent to SonarWiz for recording.
Recording Delay (ms)	This is the amount of time in milliseconds after the trigger detection to delay the recording. For example, if the internal triggering is enabled and set at an interval of 2000ms, the record length is set at 500ms and the delay is set at 1400ms then SonarWiz will record a shot every 2000ms that will contain the data samples from 1400-1900ms. The recording delay is typically used in deep water application, to avoid digitizing large areas of the water column.
Sync Record Len w/ Trigger	This checkbox forces the record length in milliseconds to match the actual observed trigger interval. For example, if the trigger interval is 100 ms then if the user enables the Sync Record Len w/Trigger checkbox then the record length will be forced to be 100ms also.
Sound Vel (m/s)	Set the sound velocity to the appropriate value for your working area. The interface program uses sound velocity to convert between distance and time. 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.

Connection Indicator

SonarWiz 🛛 🏾 🖗

8

The Connection Status indicator lights will turn green when the server makes a successful connection to the DAQ board in the Analog to Digital interface box, and when the server makes a successful connection to SonarWiz 7. The status indicator lights will turn red if the connection has not been established or the connection is lost.

Advanced Settings

The Advanced Settings dialog is opened by clicking on the System Icon on the main server display. The advanced settings dialog includes control settings that specify the level of diagnostic information recorded by the interface. Typically, these messages are sent to a log file.

Advanced Settings	>	TCP/IP Base Port
	TCP/IP Base Port 5678 Log file threshold 0 UDP Message Threshold -1	2 Log file theshold
	OK Cancel	3 UDP Message Threshold



5678

0

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Control the level of detail recorded in the log file. A value of 0 will only record error messages. A value of 9 will report all diagnostic messages.



UDP Message Threshold

UDP Message Threshold -1

Control the level of detail broadcast over UDP. A value of 0 will only record error messages. A value of 9 will report all diagnostic messages.

Tips and Trouble Shooting

Nicaiu.dll was not found

If the NI-DAQmx runtime has not been installed and you try to run the Analog Server, you will encounter an error message similar to this:

NIAnalog	gServer.exe - Unable To Locate Component 🛛 🗙
8	This application has failed to start because nicaiu.dll was not found. Re-installing the application may fix this problem.
	ОК

Please reinstall the NI-DAQmx Runtime. See Installing NI NI-DAQmx Runtime.

No compatible DAQ devices were found

If you have not connected the CTI 5-BNC box to the USB port of your computer, you may encounter an error similar to this:



Verify that the USB connector is securly attached to the CTI 5-BNC box and PC USB ports.

No serial number shown

If the 5-BNC box is not installed, you will not see NI device serial number in the NI DEVICE field of the server GUI.

The TRIGGER SOURCE description should show EXT or INT as options. If instead, it shows "**Controlled by internal slide switch**" - there may be hardware trouble, and it is best to verify the external and internal trigger functions in the test lab, before trying to use the 5-BNC box in a survey work.

SServer 7.02.0	04			– 🗆 🗙
Sampling Frequency (Hz): 100 Record Len (m): 25.00 Record Len (ms): 33.33 Samples: 333 Channels: 2 Sonar Range (m) 25 (m)	hØ00(VxwpØ00 SN:0	Data Acquisition Mode Single Freq SSS (2 CH) Sampling Freq A/D V Range 10.0 kHz/Chan +/- 5V Sound Vel (m/s) 1500.00		DAQ Board Status SonarWiz Connection Send Data as 0 8 Bit 16 Bit
✓ Do not record delay Ping Samples Ping Count ✓ ✓<	Minimum Average Maxin Minimum Average Maxin		er Intvl Channel	-
Enable Heave Port Enable Telemetry Port Altitude Heading 0.0 0.0	Heave: COM2:9600,N,8,2 Telemetry: COM1:9600,N,8,2 Roll Pitch 0.0 0.0		Downsampling Off Downsample to 1024 Downsample to 2048 Quit	C Downsample to 3072 Downsample to 4096 Help

A correctly functioning trigger board in your 5-BNC box will produce this "Trigger Source" view in the GUI:

		D.T	~	15.1T
Trigger Source	C	EXT	(•	INT