Analog Sonar Server User Guide

Version 7.07.02

4906 El Camino Real, Los Altos, CA 94022
Phone 650 967-2045 • Fax 650 903-4500
Web: www.chesapeaketech.com
Email: support@chesapeaketech.com

Table of contents

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

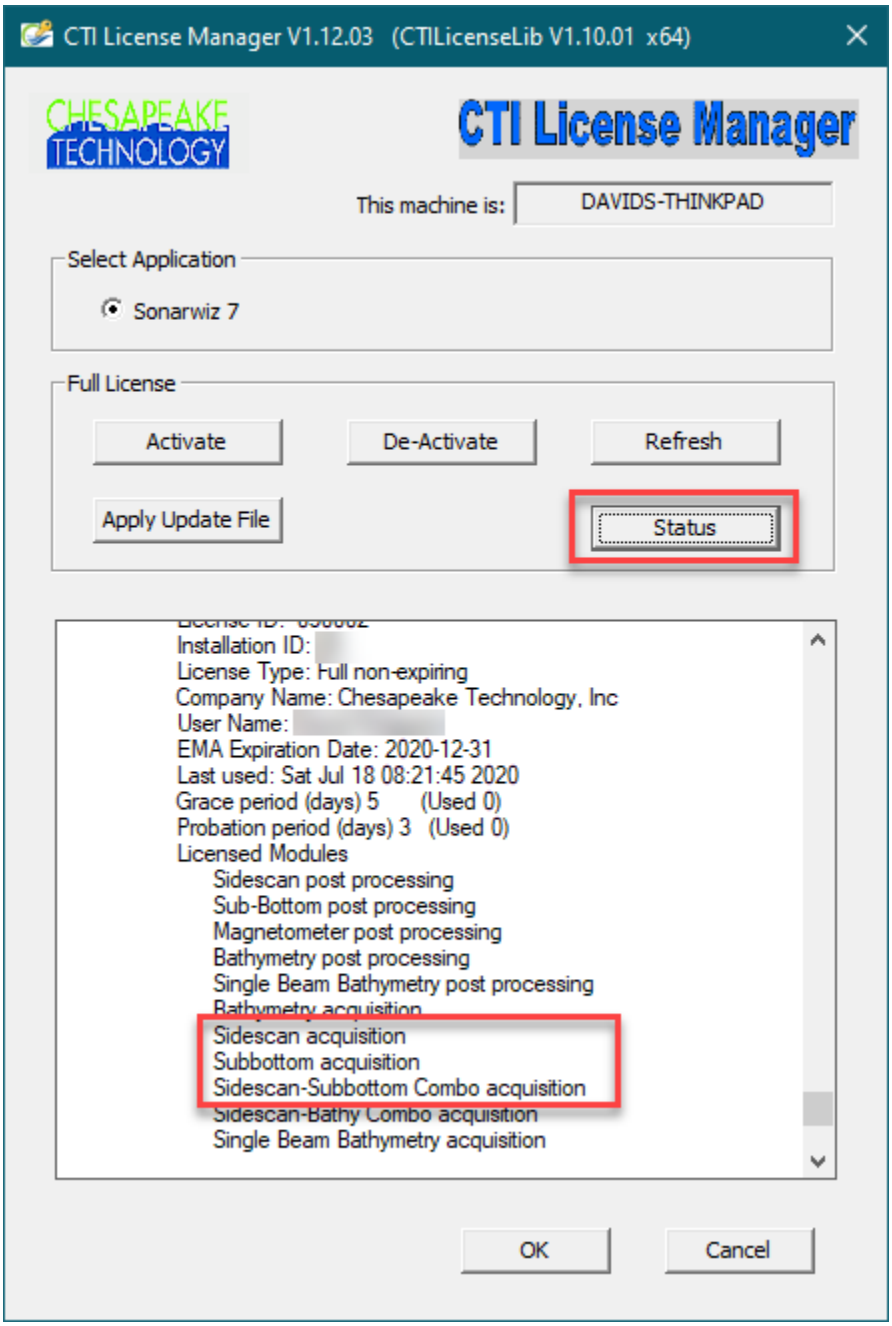
A SonarWiz 7 data acquisition license is required for operating and recording analog sonar data. Install SonarWiz 7 and verify that your software license allows Sidescan Acquisition or Sub-bottom Acquisition as follows:

To install SonarWiz 7:

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



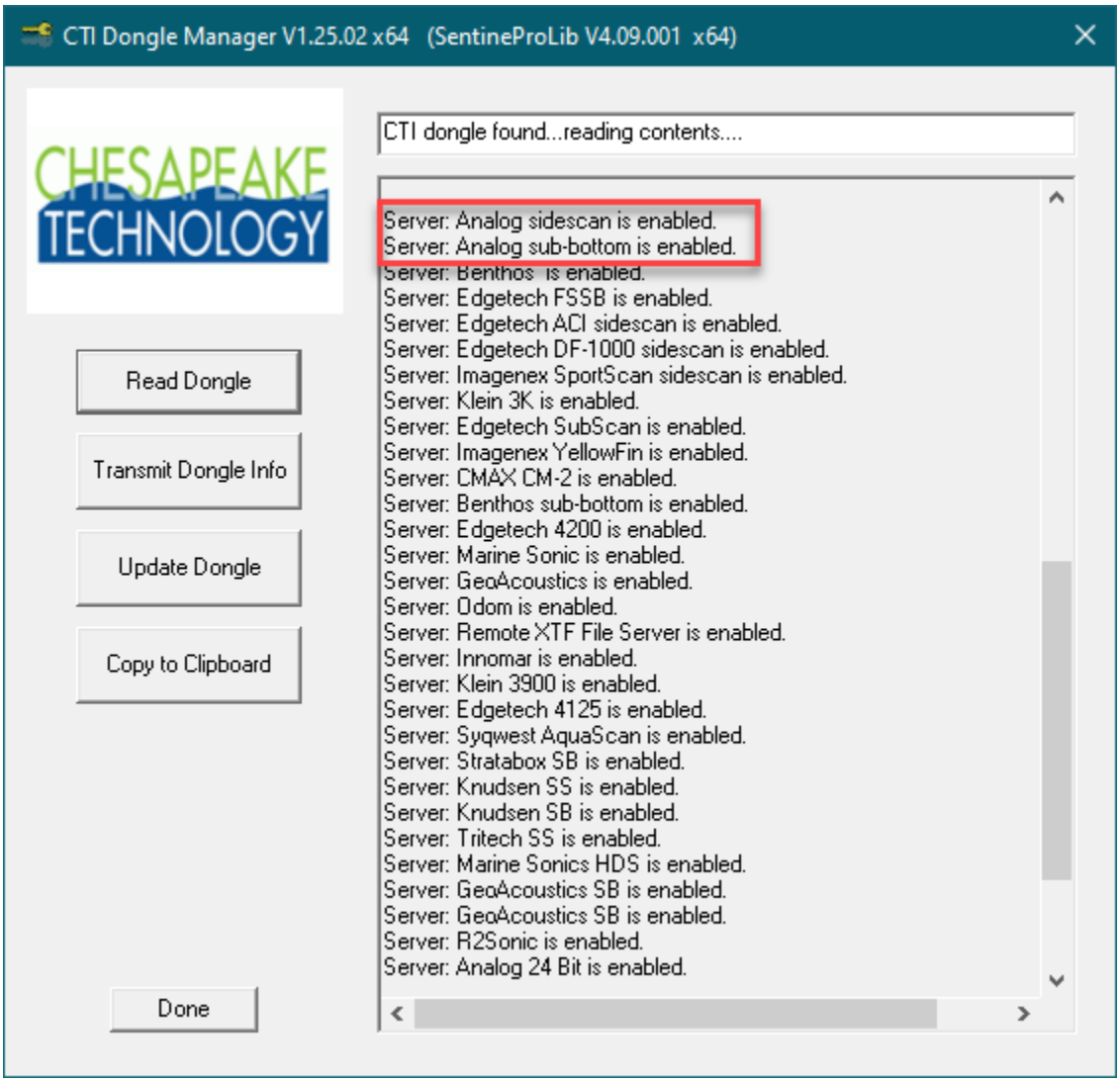
Verify that one of **sidescan acquisition**, **subbottom acquisition** or the **sidescan-subbottom combo acquisition** modules are licensed as shown in the image above.

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

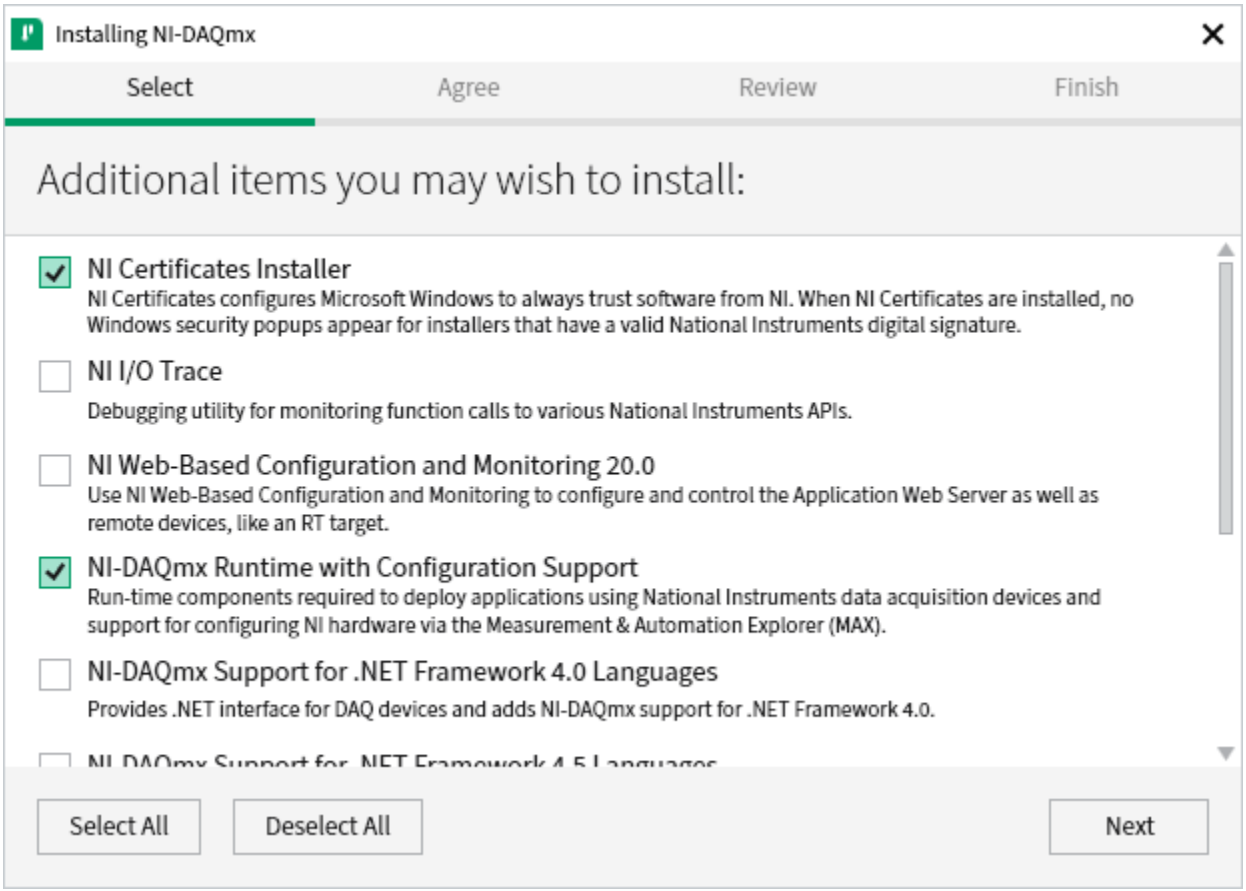
The 5-BNC Interface box sold by CTI contains a National Instruments (NI) signal analysis board. The 16-bit box contains the (NI) USB-6210 digital acquisition (DAQ) board, while the 24-bit box contains the (NI) USB-4431 dynamic signal analysis (DSA) board. In both cases, these boards require the NI-DAQmx 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**: https://www.ni.com/en-us/support/downloads/drivers/download.ni-daqmx.html#348669
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



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:

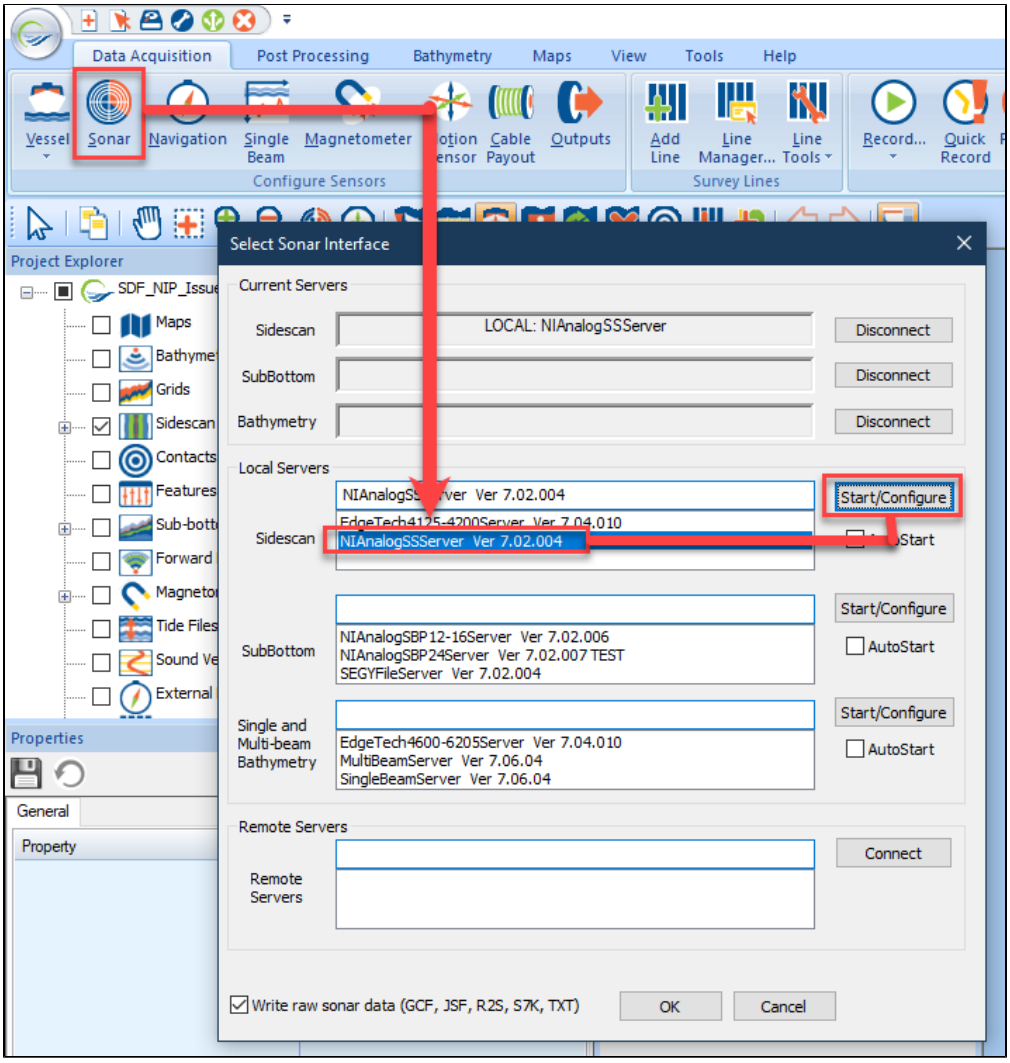
5-BNC Interface Model	Supported Analog Sonars	Analog Server	Required SonarWiz License
16-bit	Multi-channel sidescan and sidescan with sub-bottom	NIAnalogSSServer	Sidescan acquisition Sidescan + sub-bottom acquisition
	Multi-channel sub-bottom	NIAnalogSBP12-16Server	Sub-bottom acquisition
24-bit	Multi-channel 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**


Data Acquisition
Post Processing
Bathymetry
Maps
View
Tools
Help
Vessel
Sonar
Navigation
Single Beam
Magnetometer
Cable Payout
Outputs
Add Line
Line Manager...
Line Tools
Record...
Quick Record
Configure Sensors
Survey Lines
Project Explorer
Maps
Grids
Sidescan
Contacts
Features
Forward
Tide Files
External
Properties
General
Property
Select Sonar Interface
Current Servers
Sidescan
LOCAL: NIAnalogSSServer
SubBottom
Bathymetry
Disconnect
Local Servers
NIAnalogSSServer Ver 7.02.004
Start/Configure
Sidescan
NIAnalogSSServer Ver 7.02.004
AutoStart
SubBottom
NIAnalogSBP12-16Server Ver 7.02.006
NIAnalogSBP24Server Ver 7.02.007 TEST
SEGYFileServer Ver 7.02.004
Single and Multi-beam Bathymetry
EdgeTech4600-6205Server Ver 7.04.010
MultiBeamServer Ver 7.06.04
SingleBeamServer Ver 7.06.04
Remote Servers
Connect
Write raw sonar data (GCF, JSF, R2S, S7K, TXT)
OK
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.

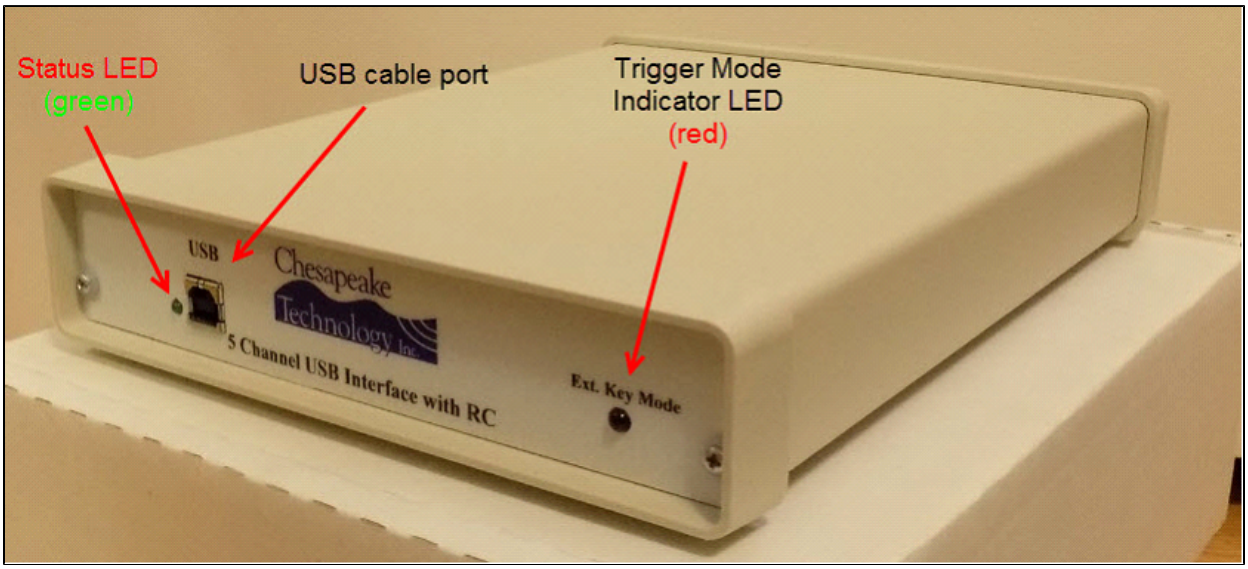
Installation involves the following steps:

1. Install the NI DAQmx runtime 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 24-bit 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:



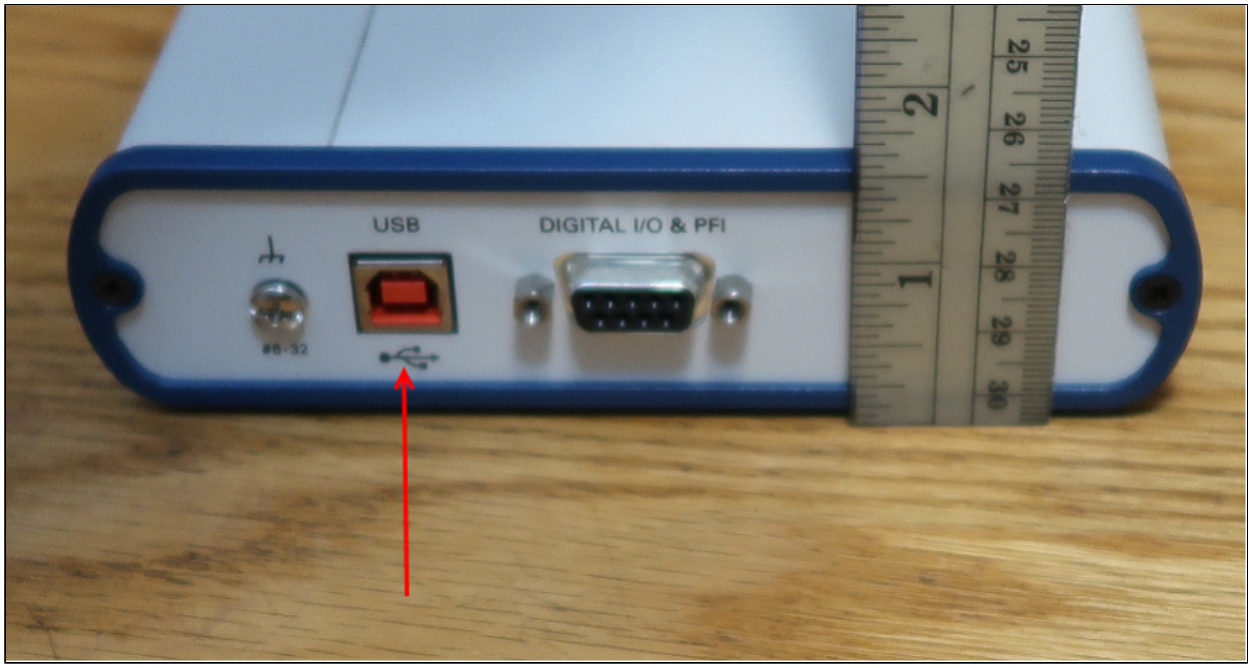
The rear of the box has 6 BNC connectors: 5 data channels plus a trigger I/O connector:

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 trigger-mode 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.

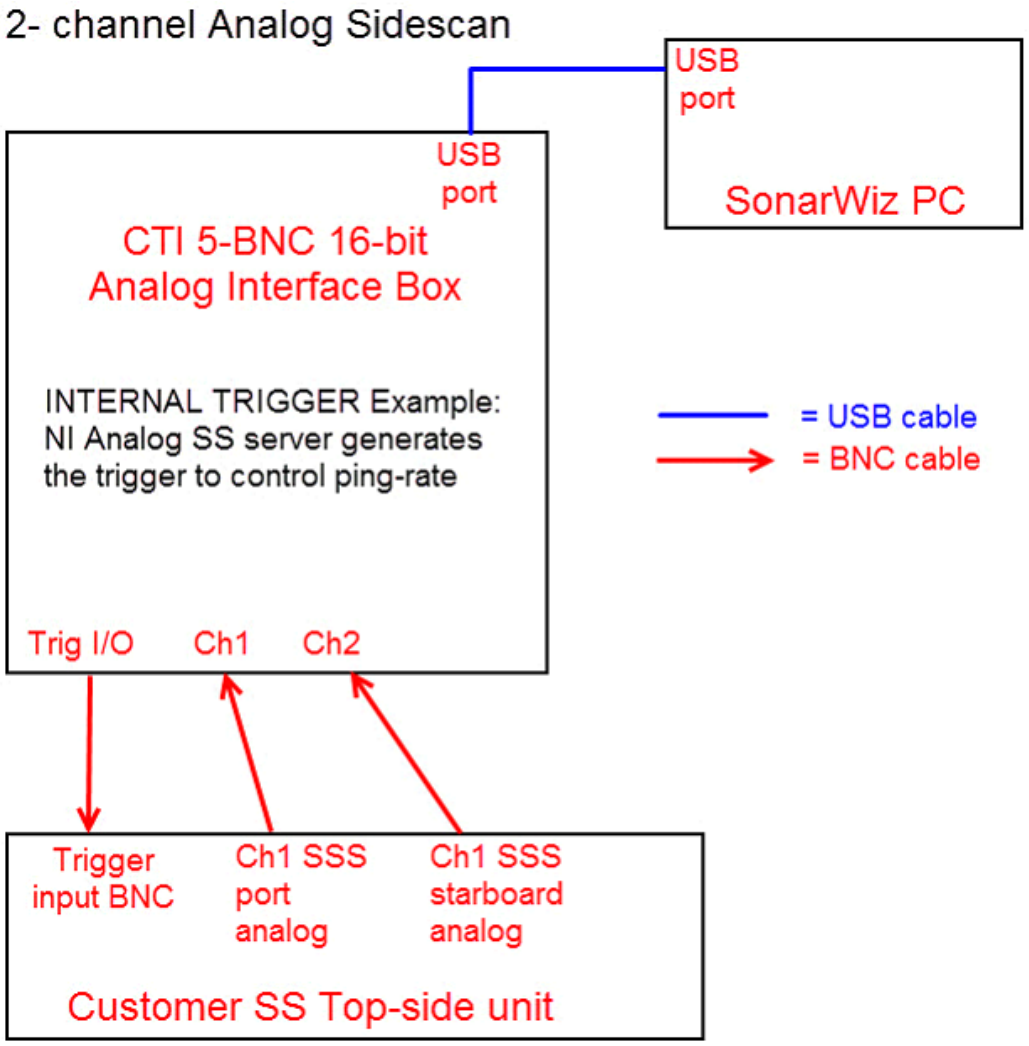


CTI only uses the USB port on this end of the box.

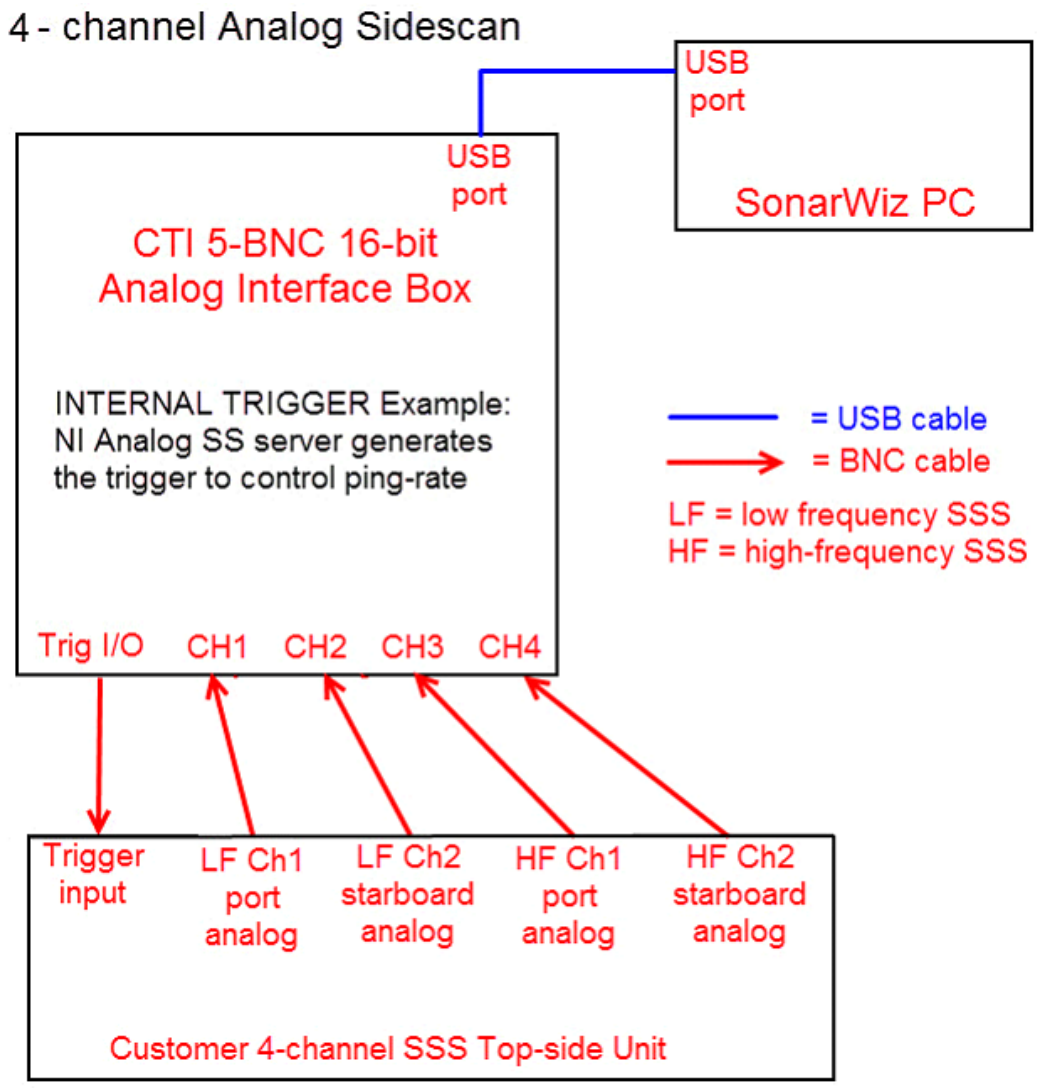
Example Hardware Configurations

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.

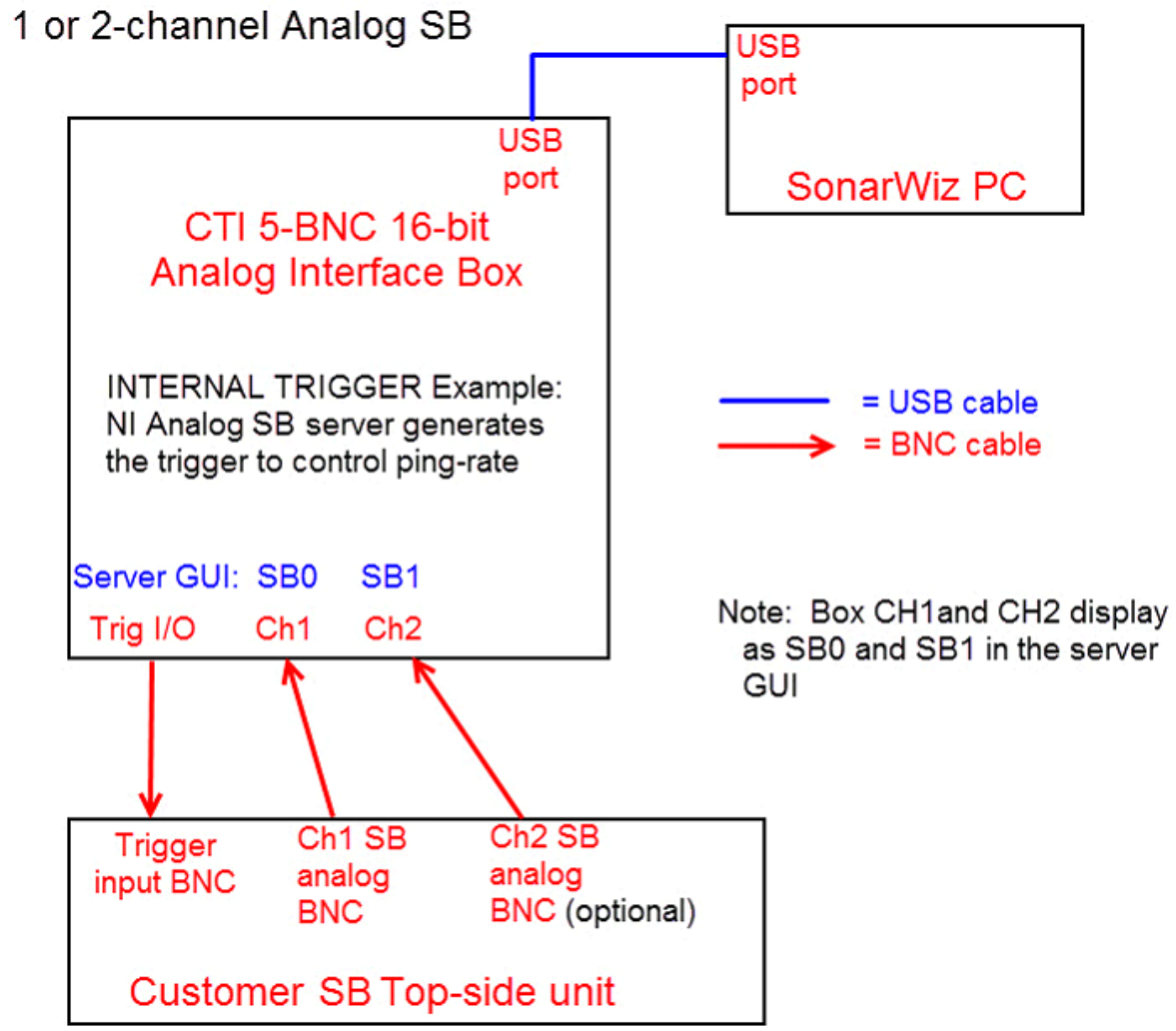


In the second example, a single towfish might generate 4 channels of data - e.g. low-frequency and high-frequency, each having a starboard and port channel, for a total of 4 channels. Here's how to configure that using the analog interface box.


4 - channel Analog Sidescan
USB port
SonarWiz PC
USB port
CTI 5-BNC 16-bit Analog Interface Box
INTERNAL TRIGGER Example:
NI Analog SS server generates the trigger to control ping-rate
= USB cable
= BNC cable
LF = low frequency SSS
HF = high-frequency SSS
Trig I/O
CH1
CH2
CH3
CH4
Trigger input
LF Ch1 port analog
LF Ch2 starboard analog
HF Ch1 port analog
HF Ch2 starboard analog
Customer 4-channel SSS Top-side Unit

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.

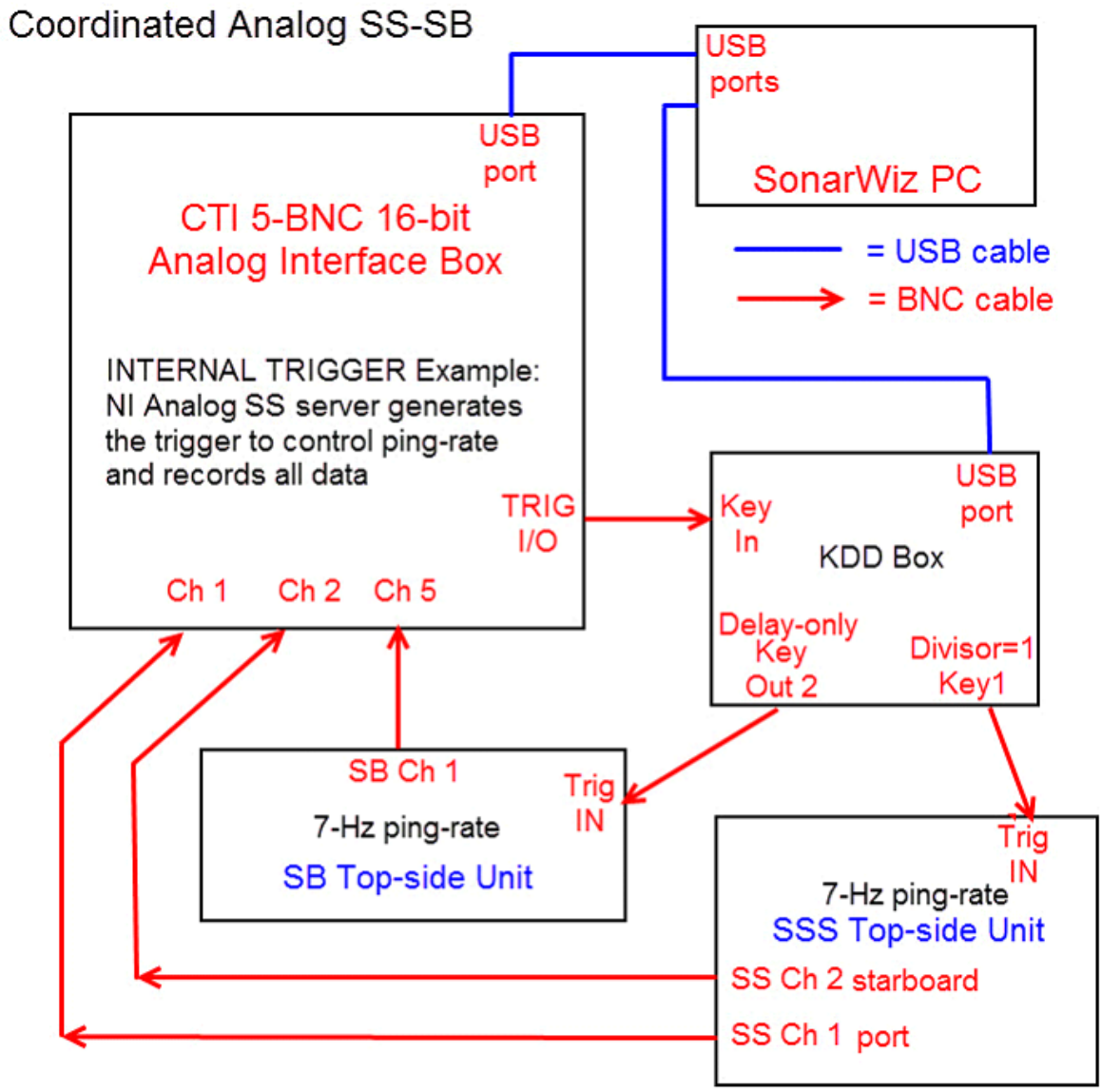


This would be the simplest equipment scenario for analog recording, with one or two BNC cables connecting the CTI 5-BNC box to the analog outputs of the top-side sonar unit, and a single trigger output BNC connected to trigger-in on the top-side unit.

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



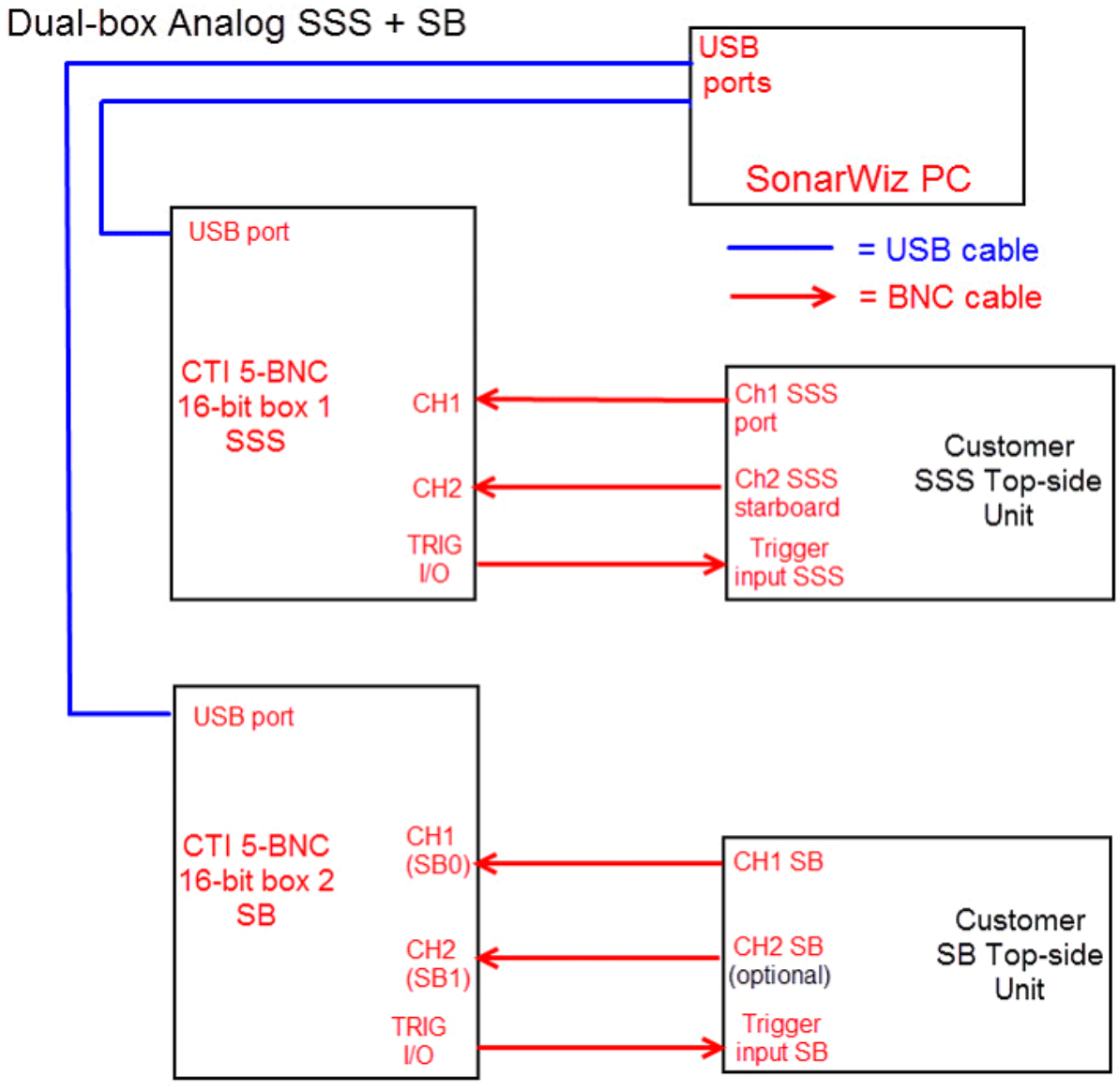
The NI Analog SS server can manage this dual-mode recording with a single CTI 5-BNC box

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.

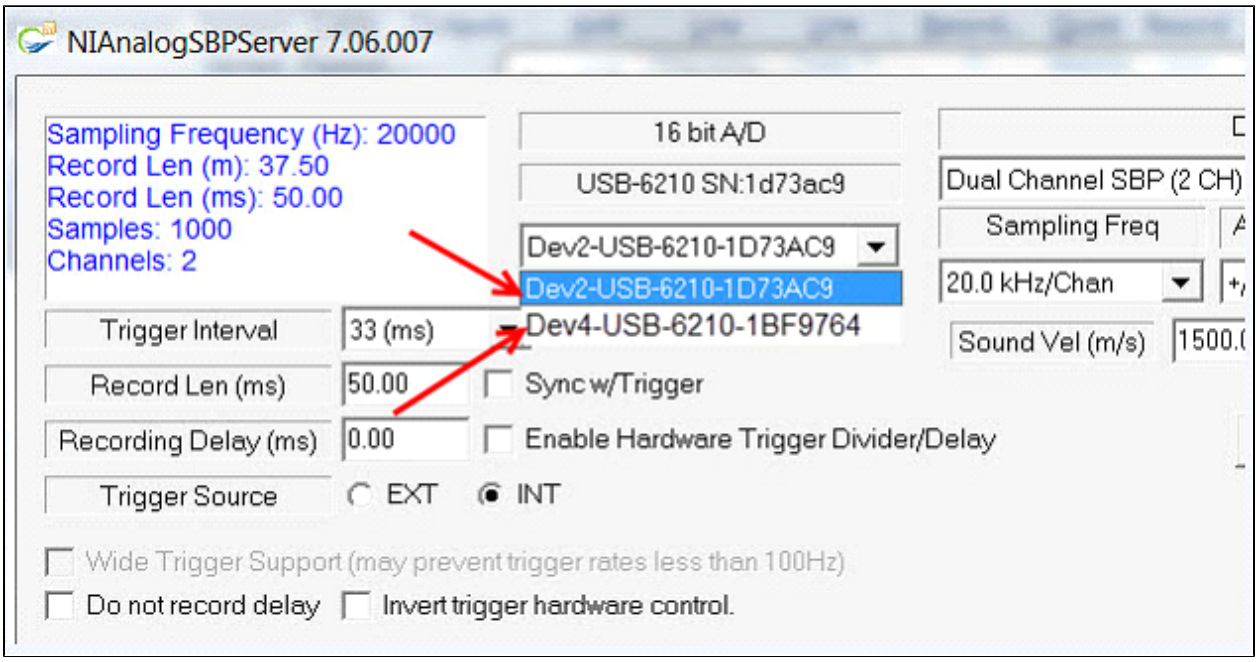
The advantages are:
1. SSS ping-rate can be 10-15 Hz for perfect XTF file recording, driven by the **NIAnalogSSServer**
2. SB ping-rate is independently triggered by the **NIAnalogSBP12-16Server** and data is simultaneously saved in a SEGY file.
3. No KDD box is used so there is no coordination between the SSS and SB pings or ping-rates.



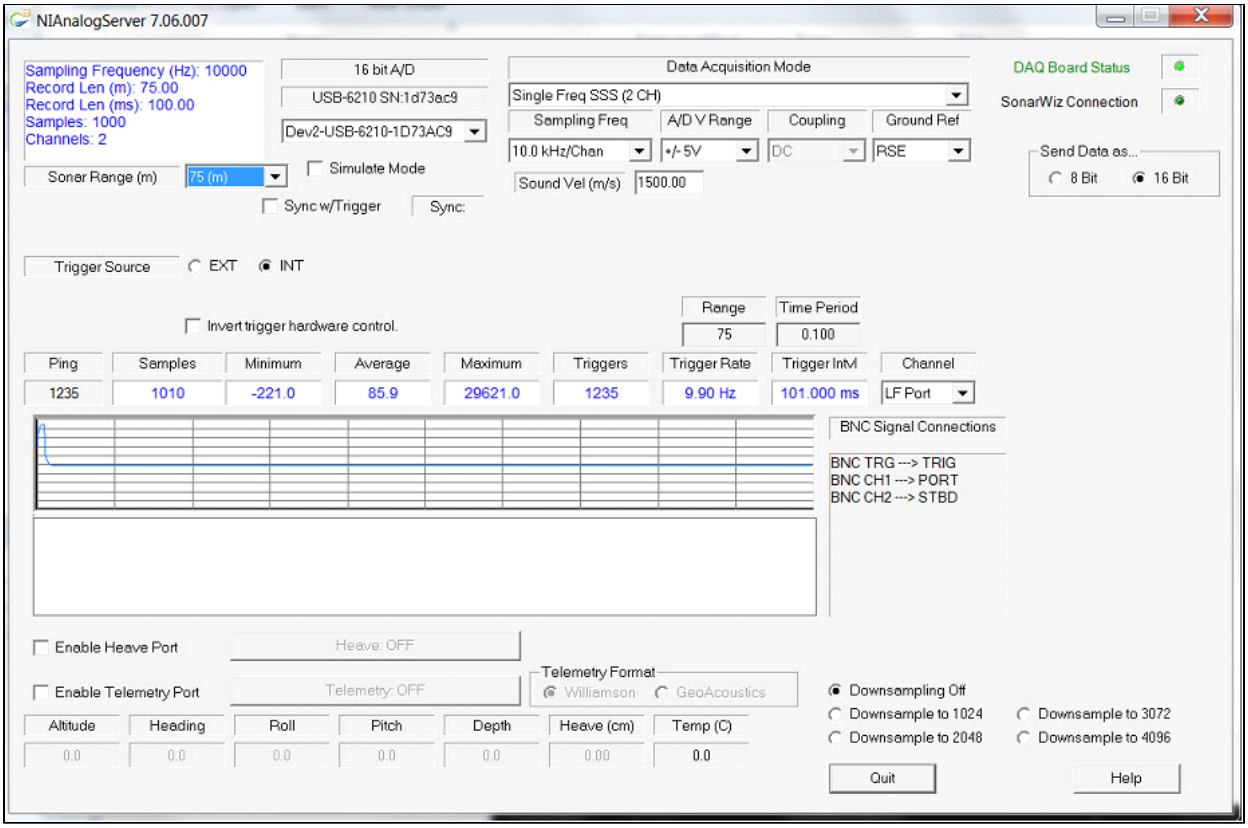
NOTE: Each server generates INTERNAL TRIGGER to drive ping-rates in this example

Setting up this dual-recording scenario is easy, as you simply plug each USB cable from the 2 CTI 5-BNC boxes into separate USB ports on the PC, and they get auto-discovered by Windows.

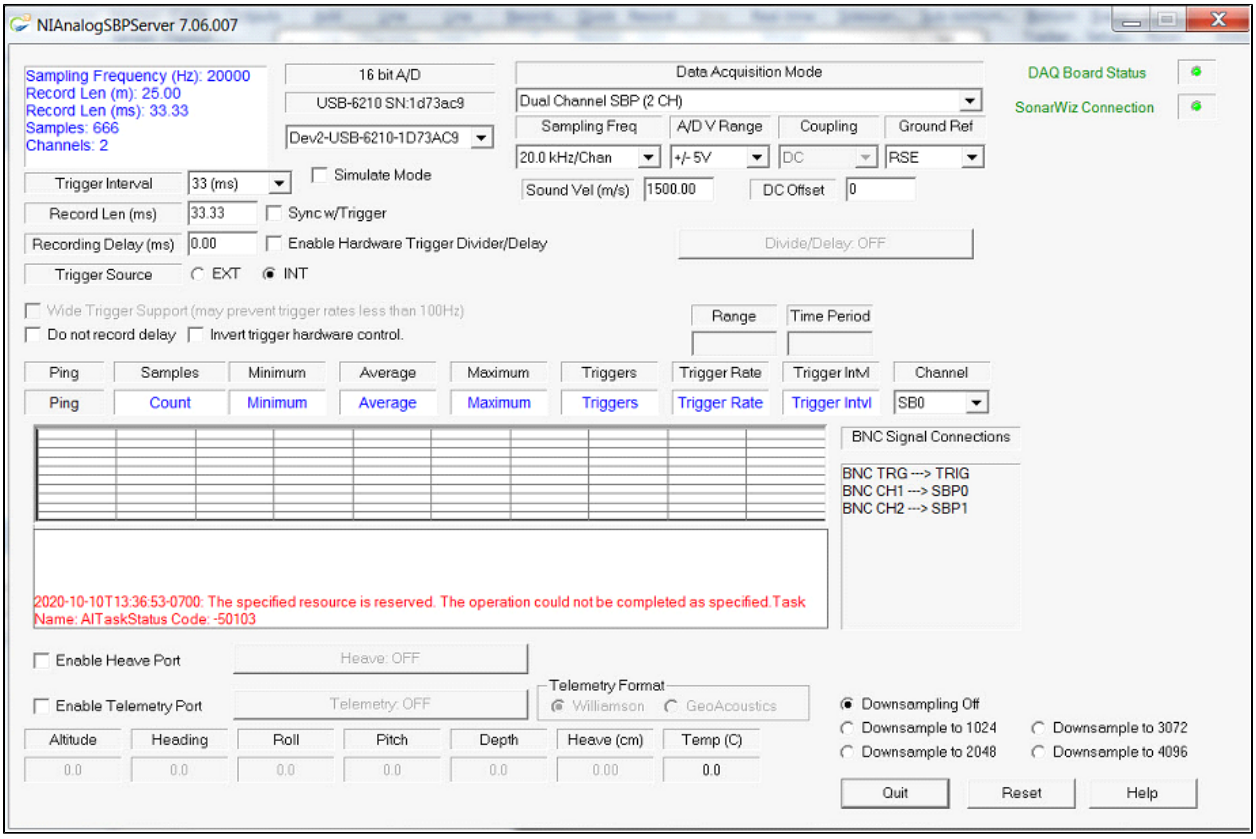
In the NI analog servers, of which you are allowed to run one sidescan, and one sub-bottom at the same time, you simply select DEVICE to be different on the two servers. You will see the serial number presented as the identifier of the device, and the serial number of the NI USB-6210 card is marked in tape on the bottom of the CTI 5-BNC box, and also labeled on the card itself inside the box, should you need to correlate which box is which:



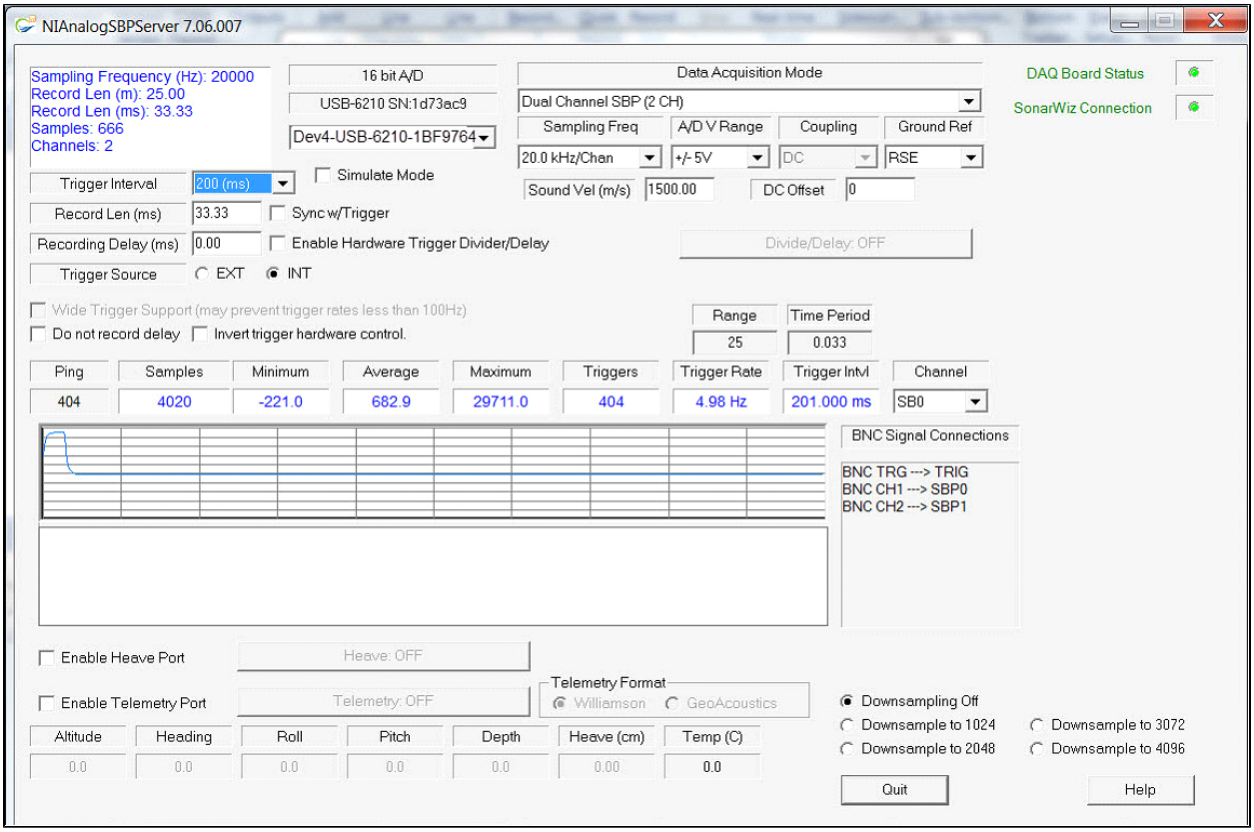
In each of the **NIAnalogSSServer** and **NIAnalogSBP12-16Server**, select only one (and different ones) of the available devices. e.g. use Dev4 as sidescan, and Dev13 as sub-bottom. Then they can run
concurrently, like so:



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



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.

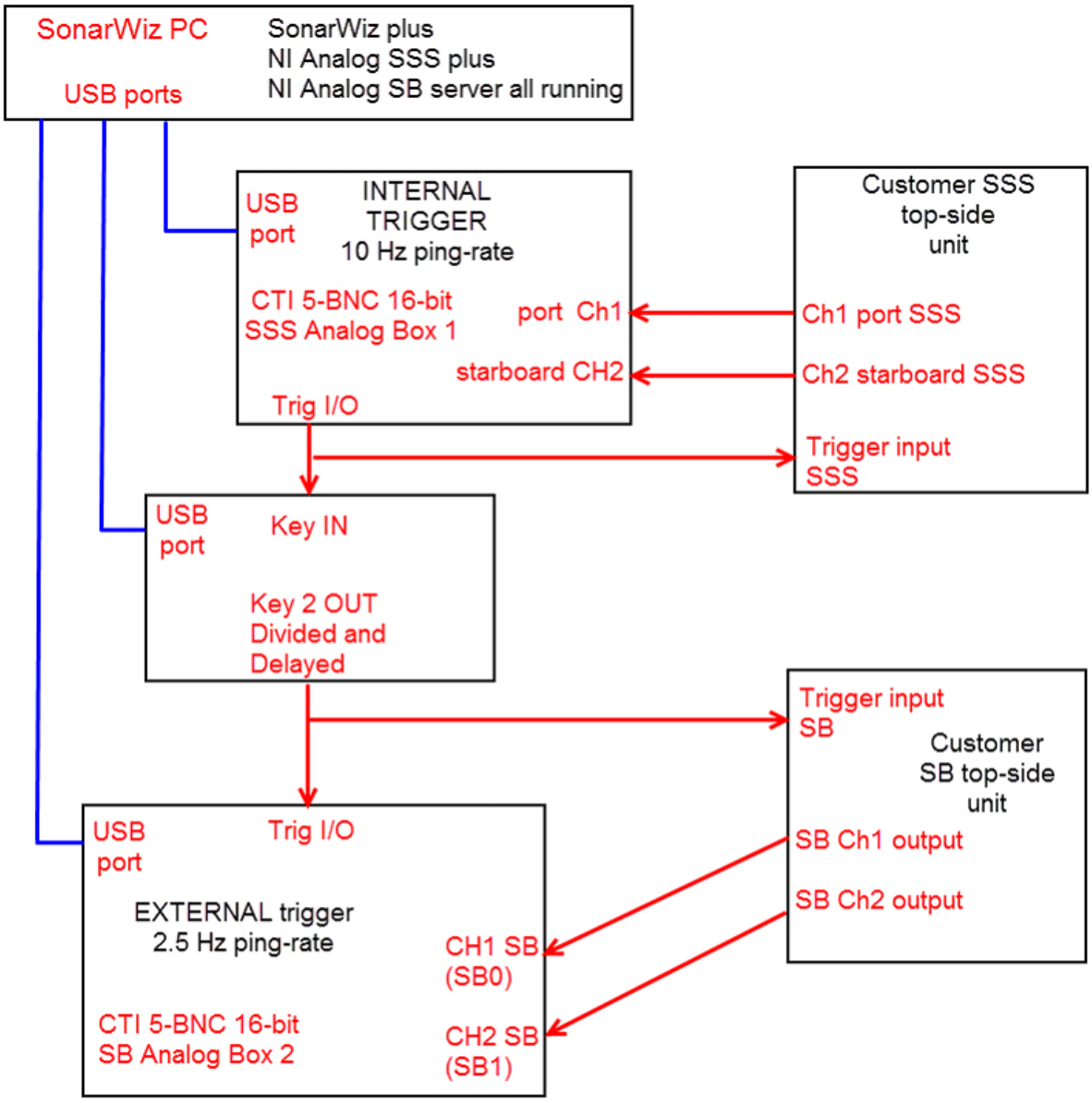

NIAnalogSBPServer 7.06.007
Sampling Frequency (Hz): 20000
Record Len (m): 25.00
Record Len (ms): 33.33
Samples: 666
Channels: 2
16 bit A/D
USB-6210 SN:1d73ac9
Dev4-USB-6210-1BF9764
Data Acquisition Mode
Dual Channel SBP (2 CH)
Sampling Freq
A/D V Range
Coupling
Ground Ref
20.0 kHz/Chan
+/- 5V
DC
RSE
DAQ Board Status
SonarWiz Connection
Trigger Interval
200 (ms)
Simulate Mode
Sound Vel (m/s)
1500.00
DC Offset
0
Record Len (ms)
33.33
Sync w/Trigger
Recording Delay (ms)
0.00
Enable Hardware Trigger Divider/Delay
Divide/Delay: OFF
Trigger Source
EXT
INT
Wide Trigger Support (may prevent trigger rates less than 100Hz)
Do not record delay
Invert trigger hardware control.
Range
Time Period
25
0.033
Ping
Samples
Minimum
Average
Maximum
Triggers
Trigger Rate
Trigger Intvl
Channel
404
4020
-221.0
682.9
29711.0
404
4.98 Hz
201.000 ms
SB0
BNC Signal Connections
BNC TRG ---> TRIG
BNC CH1 ---> SBP0
BNC CH2 ---> SBP1
Enable Heave Port
Heave: OFF
Enable Telemetry Port
Telemetry: OFF
Telemetry Format
Williamson
GeoAcoustics
Downsampling Off
Downsample to 1024
Downsample to 2048
Downsample to 3072
Downsample to 4096
Altitude
Heading
Roll
Pitch
Depth
Heave (cm)
Temp (C)
0.0
0.0
0.0
0.0
0.0
0.00
0.0
Quit
Help

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

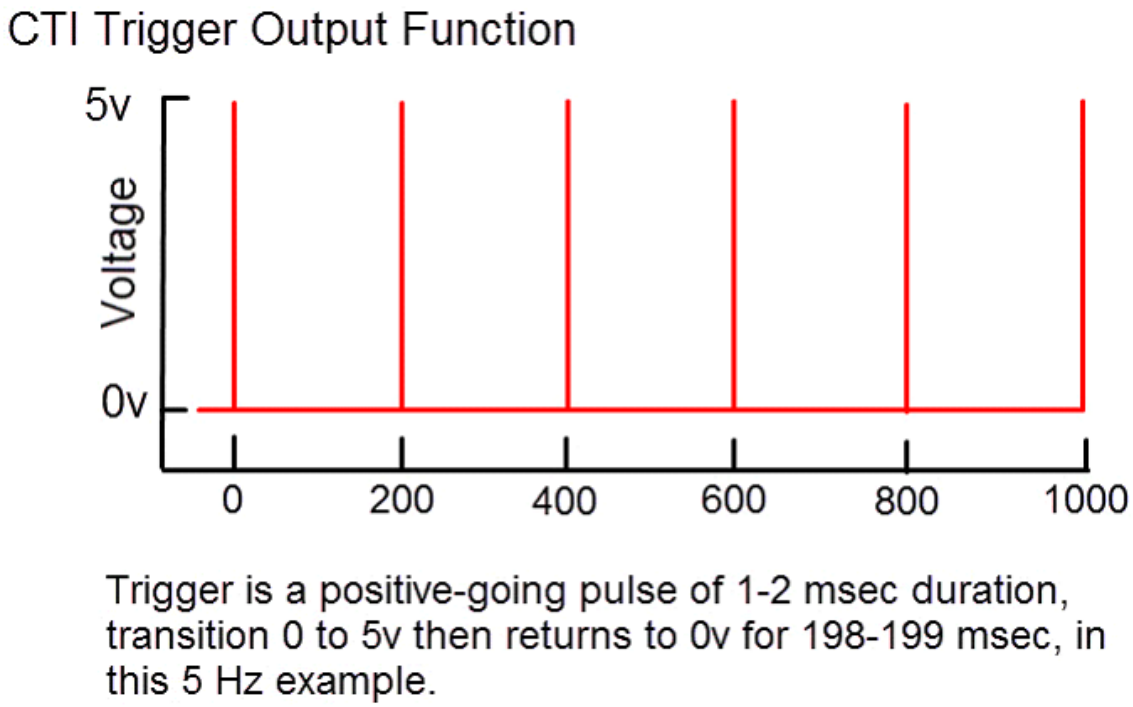


NOTE: Example dual-box scenario with Box1 set for INTERNAL trigger, driving the synchronized ping-rates. Box2 receives a divided, delayed trigger and is set for EXTERNAL trigger.

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 1-msec 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.



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.

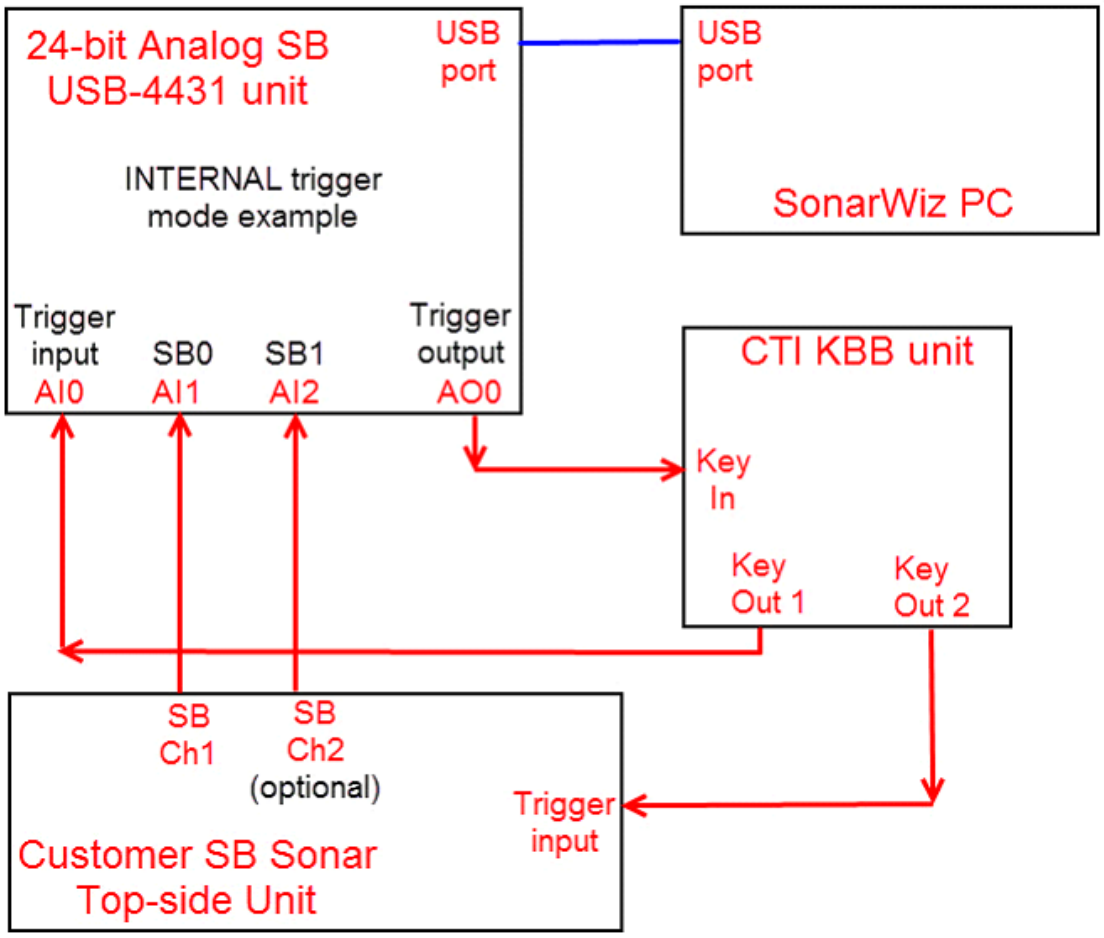
When set for INTERNAL trigger, the 24-bit box AO0 sends a 1-msec TTL-compatible pulse out at the designated ping-rate, and this needs to be sent 2 places:

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

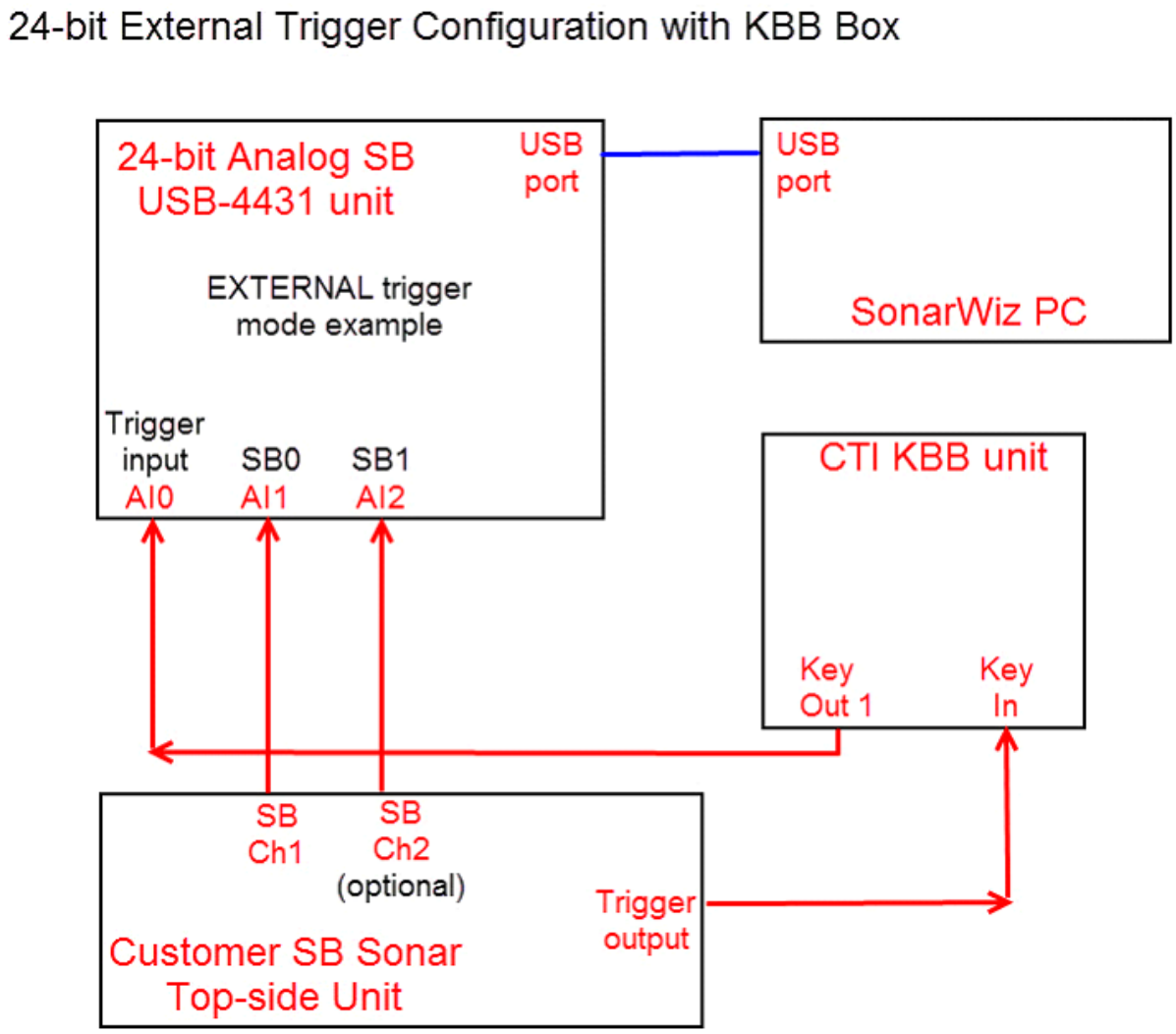
(2) input 2 - to the customer sonar top-side unit TRIGGER INPUT BNC connection.

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:



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

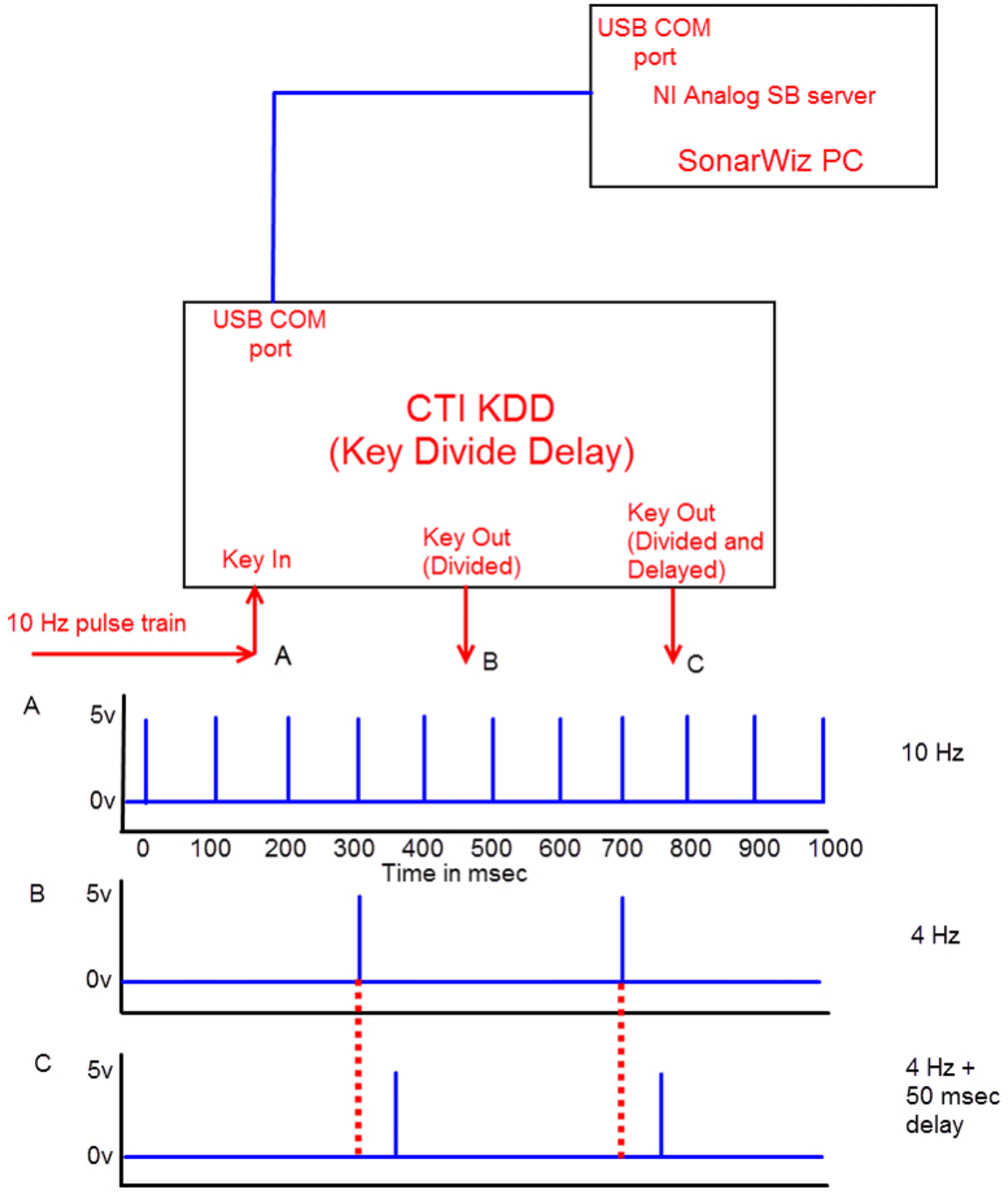
The general principle here is to get good empirical results such that the SS and SB triggers and ping returns do not interfere with each other. The CTI 5-BNC box 1 could be set for internal trigger, and serve to feed the KDD box master trigger input. Then the divided, delayed output (DELAY connector 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)

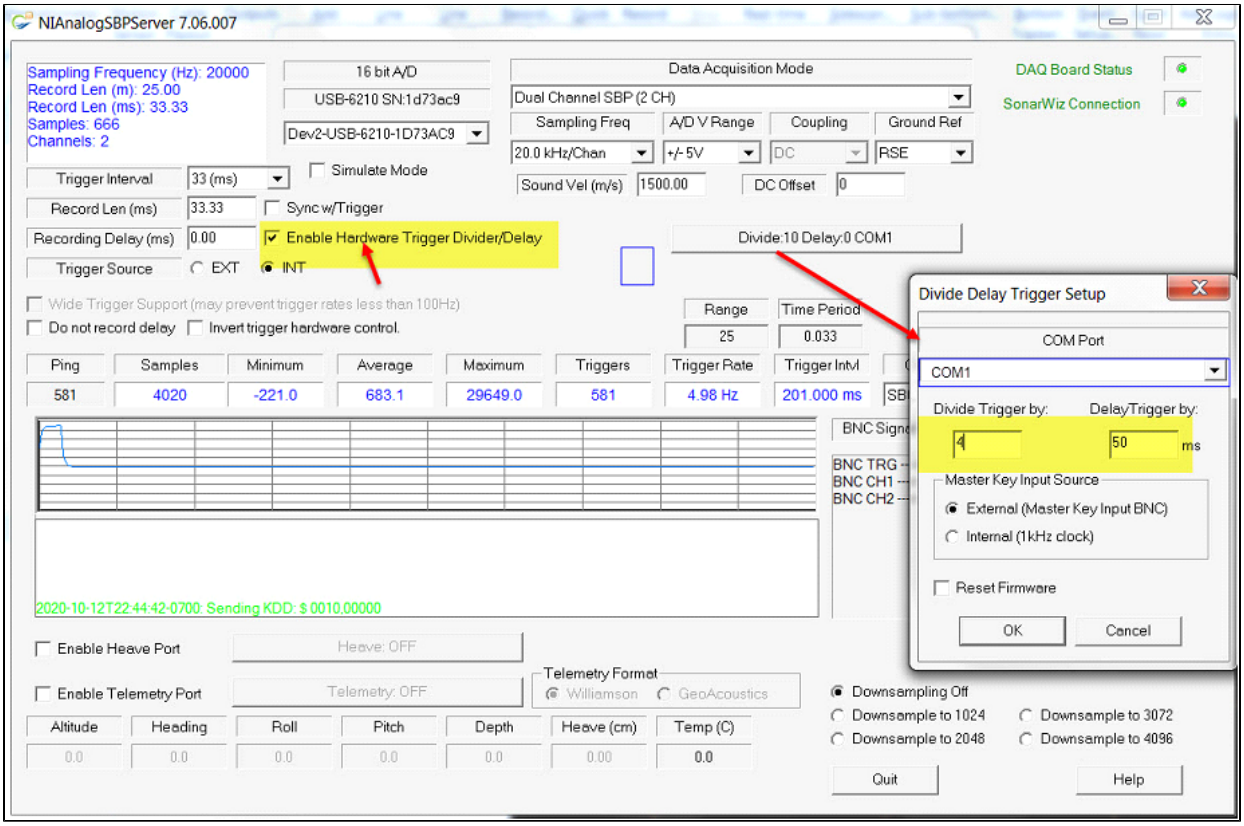
The main function of the CTI KDD (Key Divide Delay) box is to manage a multiple-sonar scenario by synchronizing the two ping-rates. The KDD creates 2-ping-rates ratio, like 5:1 or 4:1 such that the SSS ping rate of say 10 Hz id DIVIDED 4:1 so that the SB ping-rate is 2.5 Hz. The KDD can also stand as 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:

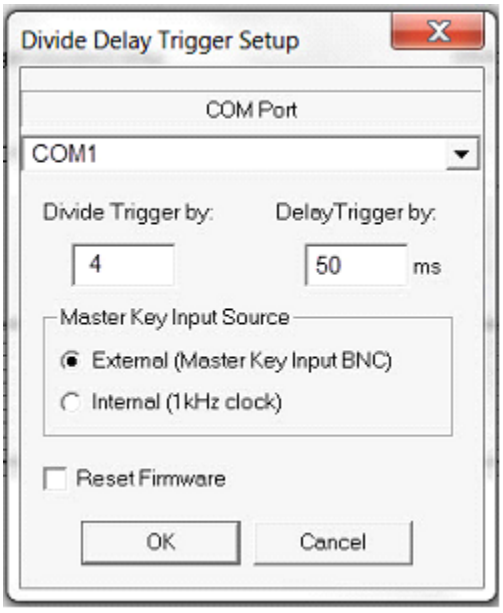
KDD 4:1 Divide plus 50 msec Delay example



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

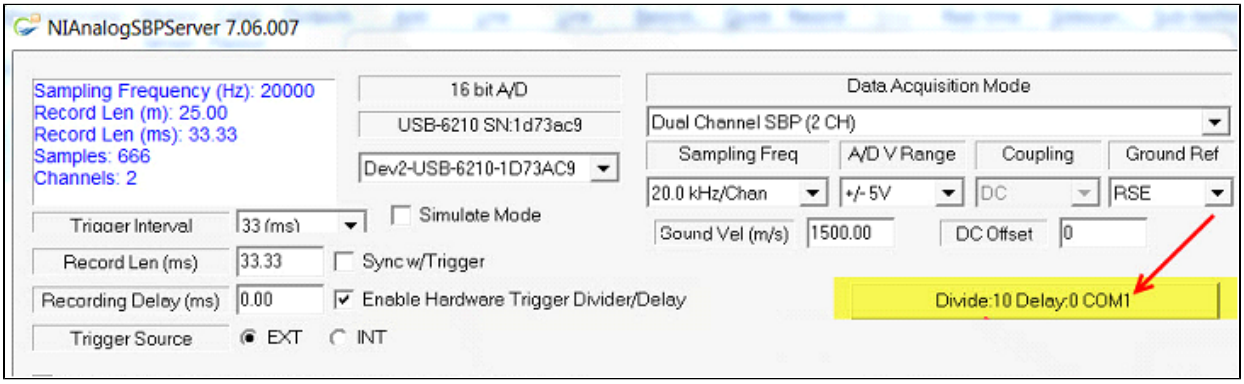


When you have checked that check-box, then you can click on the button with the DIVIDE / DELAY values on it, and it opens the dialog shown above in the right side of the graphic. Here is that dialog in more detail, which is used to control the KDD box settings:



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:



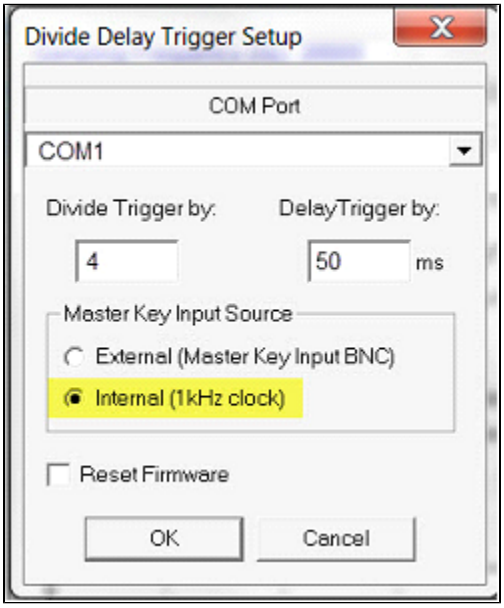
The DIVIDE number is a counter to define how many input pulses (triggers) are needed to create a single output pulse (trigger). For example, with a 10 Hz input trigger rate, and a DIVIDE setting of 4, 4 triggers are counted then a single output trigger is set on the DIVIDE output BNC. At 100 msec per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



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.

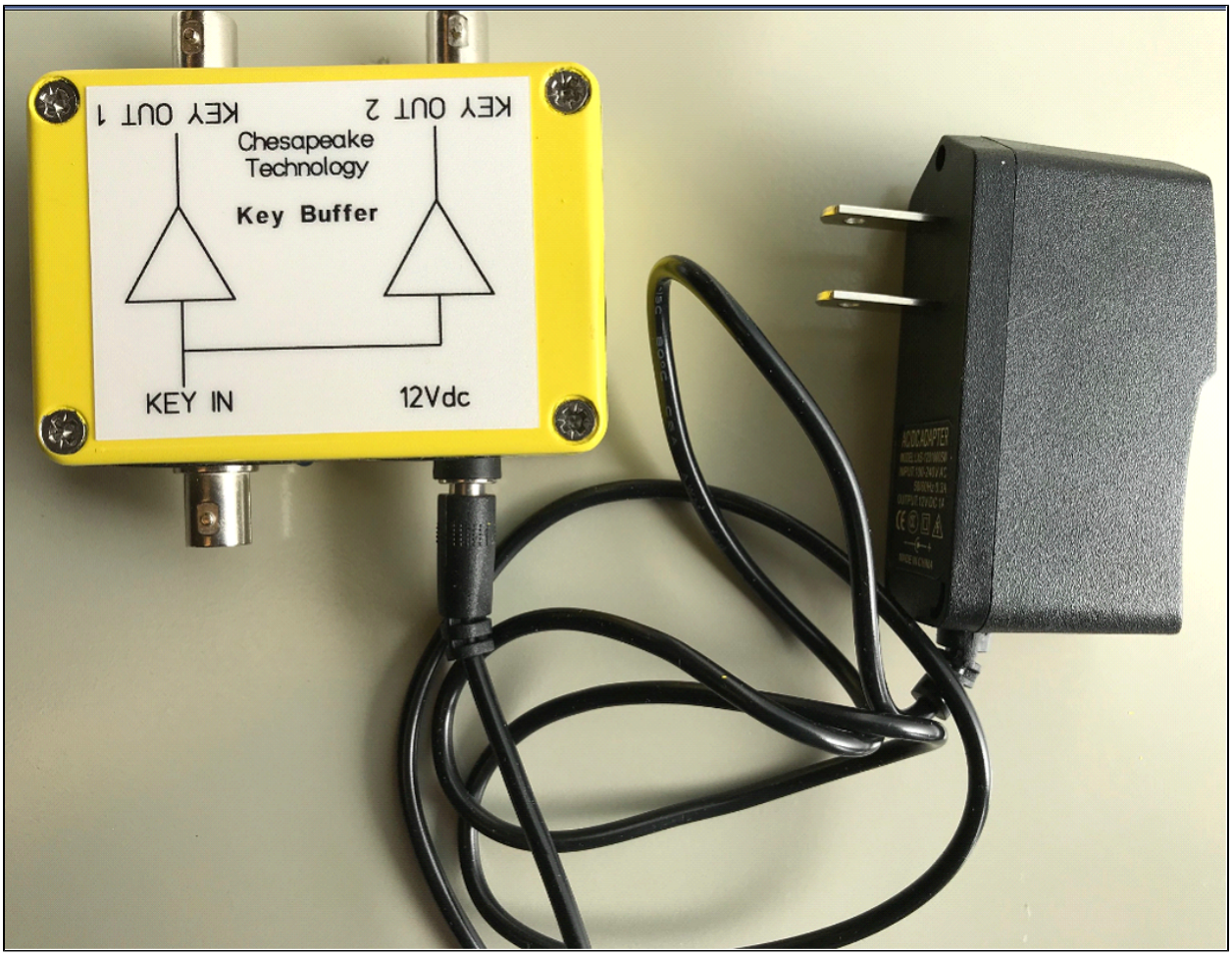
Key Buffer Box (KBB)

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 AI0 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.

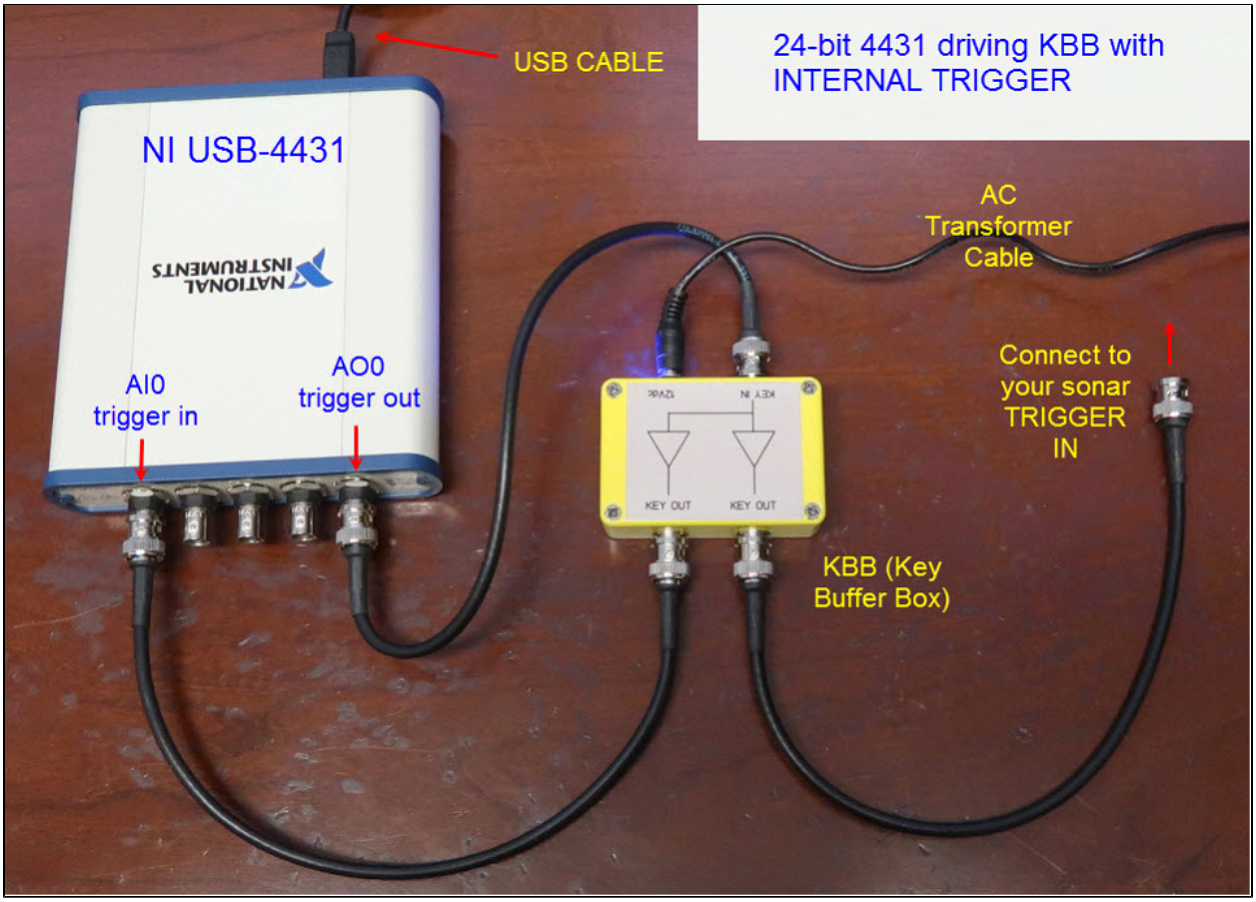
A second solution became available too though: turning a non-conformant external trigger (e.g. square-wave), into a conformant 1-2 msec duration trigger pulse. So the KBB helps in that case too, where customer-premise trigger sources are square-wave or extended-duration, rather than 1-2 msec pulses. 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:



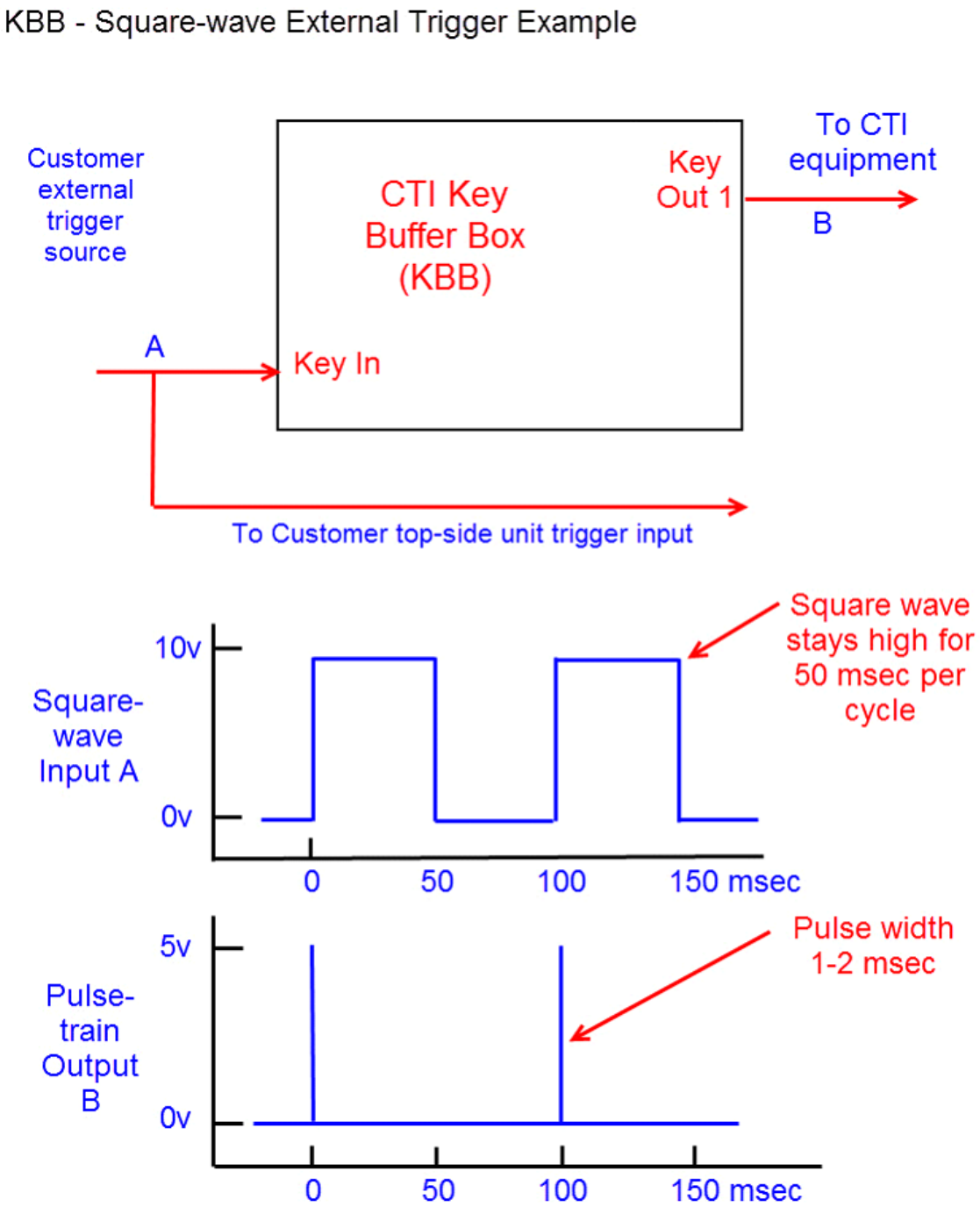
The photo below shows the KBB in the context of an internal trigger situation, transforming the singular 4431 AO0 internal trigger output into a pair (Key Out 1, Key Out 2) of powerful trigger-pulse outputs, one for the 4431 itself, and one for the customer top-side unit trigger input:



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:

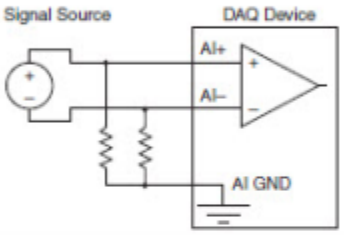
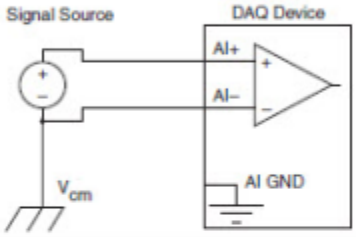
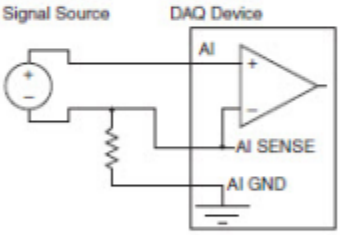
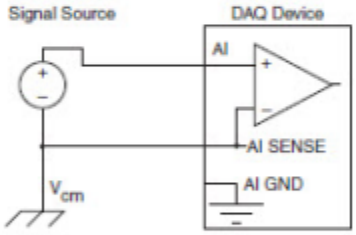
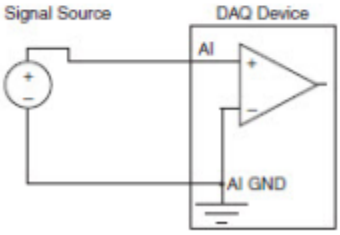
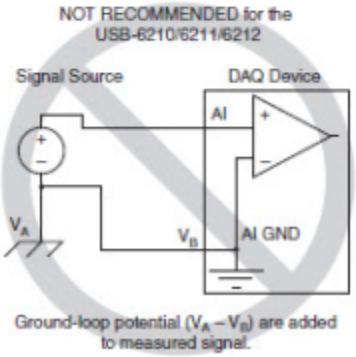


The KBB cleans up a non-pulse, perhaps excessive-voltage trigger pulse, into a TTL-compatible output pulse-train.

Ground Reference

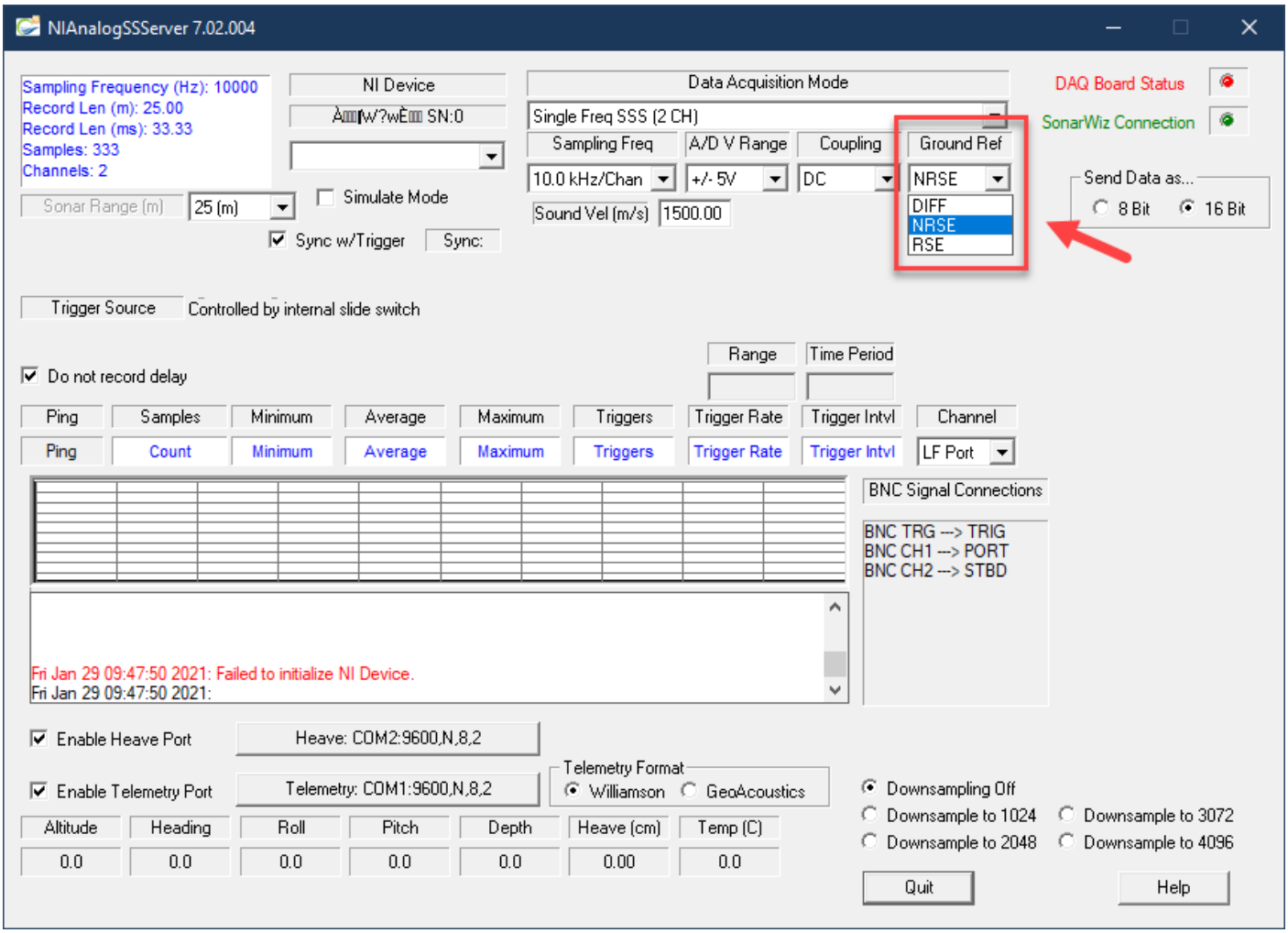
The National Instruments USB-62XX User Manual presents electronic configuration diagrams of the 2 "grounding mode" options which are available as choices in the NI Analog SB Server GUI, as shown below:

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

AI Ground-Reference Setting*	Floating Signal Sources (Not Connected to Building Ground) Examples: • Ungrounded thermocouples • Signal conditioning with isolated outputs • Battery devices	Ground-Referenced Signal Sources† Example: • Plug-in instruments with non-isolated outputs
Differential (DIFF)		
Non-Referenced Single-Ended (NRSE)		
Referenced Single-Ended (RSE)		

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

In the server GUIs, these choices are available in the Ground Ref drop-down:


NIAnalogSSServer 7.02.004
Sampling Frequency (Hz): 10000
Record Len (m): 25.00
Record Len (ms): 33.33
Samples: 333
Channels: 2
NI Device
Data Acquisition Mode
Single Freq SSS (2 CH)
DAQ Board Status
SonarWiz Connection
Sampling Freq
A/D V Range
Coupling
Ground Ref
10.0 kHz/Chan
+/- 5V
DC
NRSE
DIFF
NRSE
RSE
Send Data as...
8 Bit
16 Bit
Sonar Range (m)
25 (m)
Simulate Mode
Sync w/Trigger
Sync:
Sound Vel (m/s)
1500.00
Trigger Source
Controlled by internal slide switch
Do not record delay
Range
Time Period
Ping
Samples
Minimum
Average
Maximum
Triggers
Trigger Rate
Trigger Intvl
Channel
LF Port
BNC Signal Connections
BNC TRG ---> TRIG
BNC CH1 ---> PORT
BNC CH2 ---> STBD
Fri Jan 29 09:47:50 2021: Failed to initialize NI Device.
Fri Jan 29 09:47:50 2021:
Enable Heave Port
Heave: COM2:9600,N,8,2
Enable Telemetry Port
Telemetry: COM1:9600,N,8,2
Telemetry Format
Williamson
GeoAcoustics
Downsampling Off
Downsample to 1024
Downsample to 2048
Downsample to 3072
Downsample to 4096
Altitude
Heading
Roll
Pitch
Depth
Heave (cm)
Temp (C)
0.0
0.0
0.0
0.0
0.0
0.00
0.0
Quit
Help

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 Software Installation first.

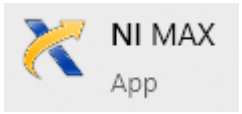
CTI runs 3 test protocols on the 16-bit and 24-bit analog interface boxes before they are shipped to customers. Our testing procedure is outlined here so that you can repeat the process yourself while testing and troubleshooting your hardware in the field:

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

Measurement and Automation tests

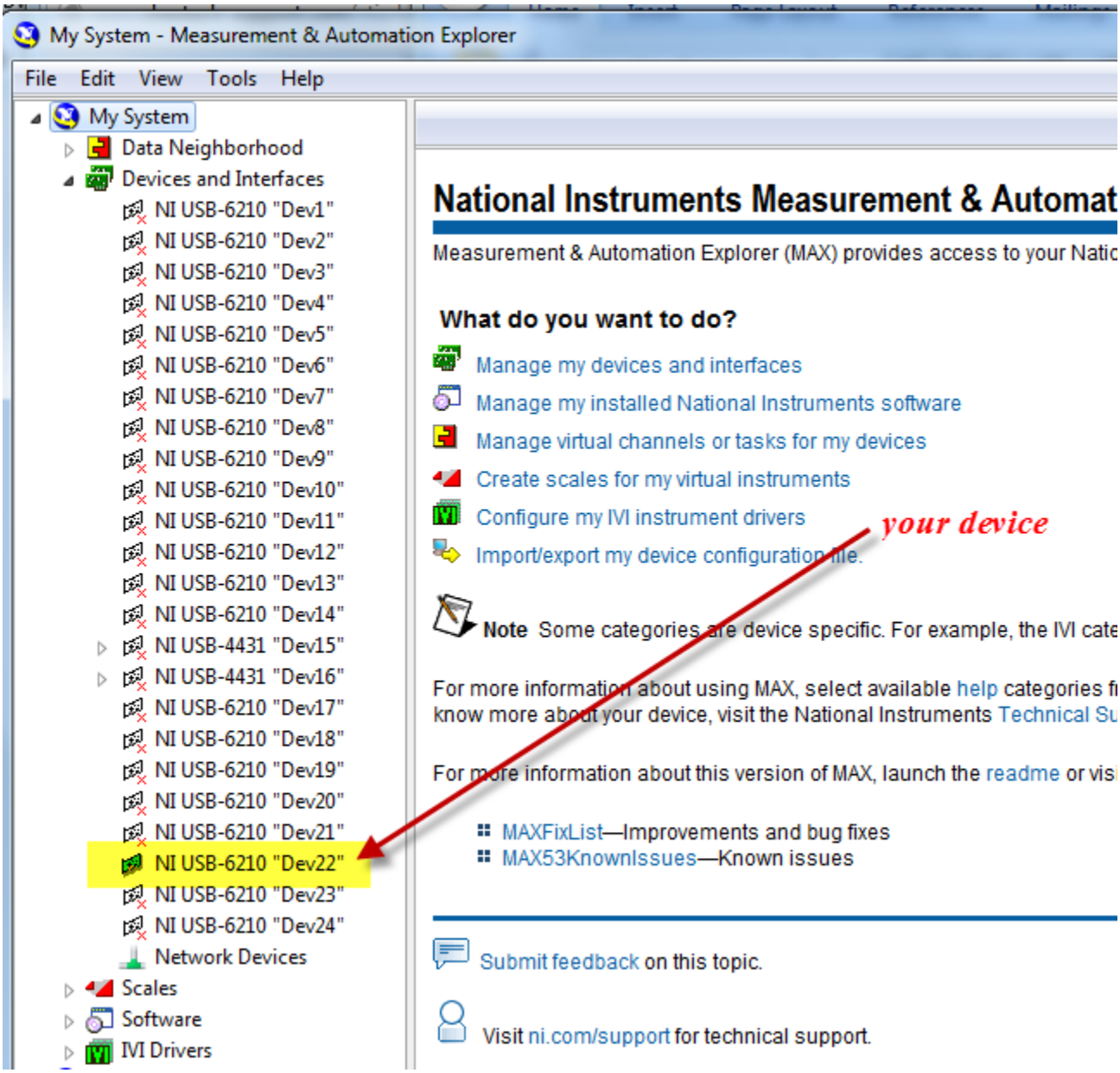
The Measurement and Automation tests utilize the NI Measurement & Automation (NI-MAX) software package available when installing the NI-DAQmx Runtime installation. You may need to re-run the package manager to install *NI Measurement & Automation Explorer* if you performed a minimum installation previously.

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

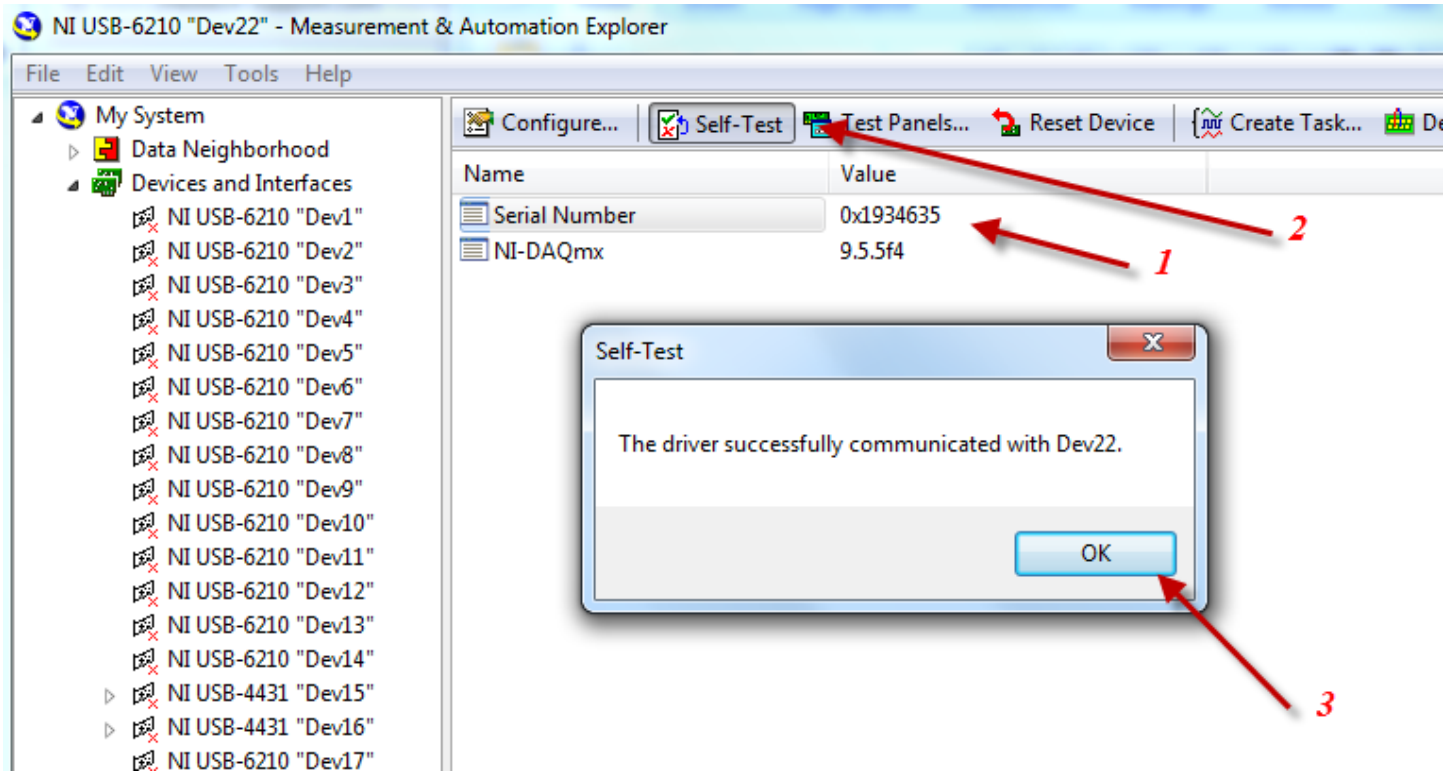
1. Launch NI-Max 

from the Windows Start Menu

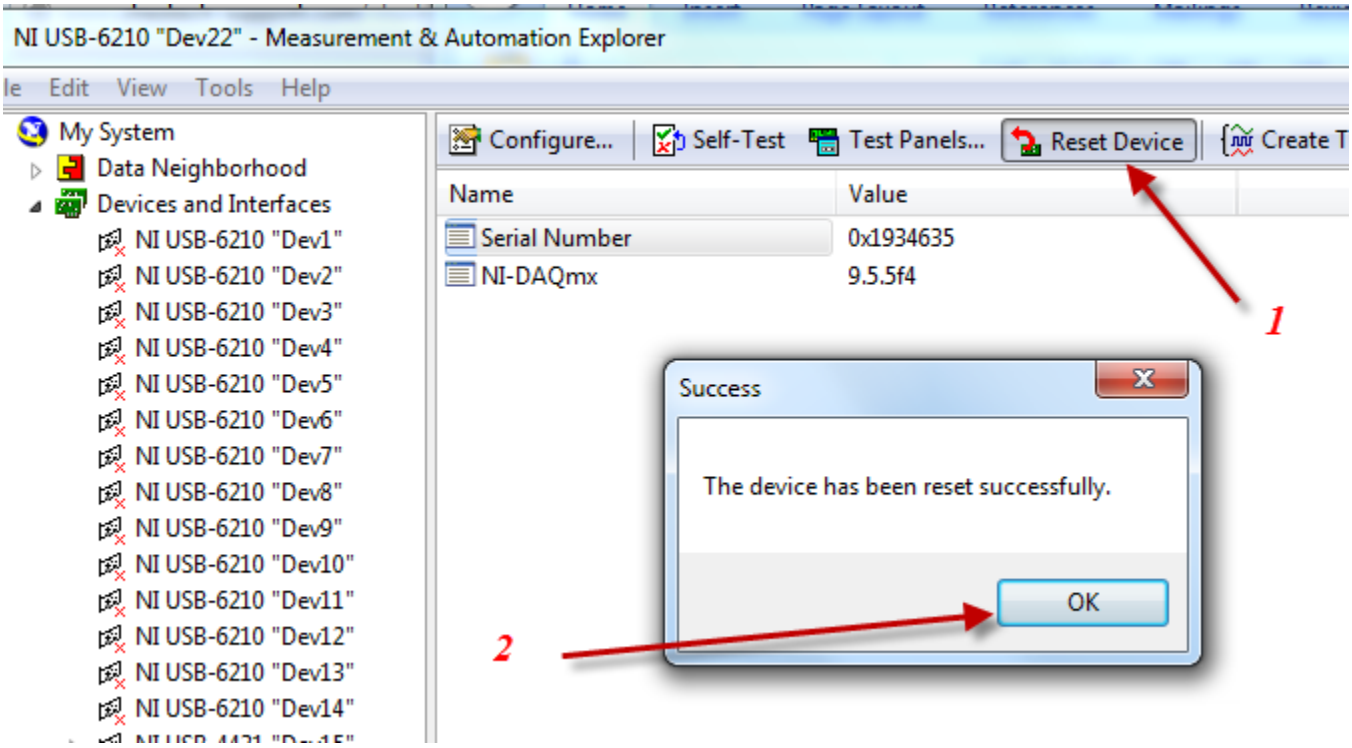
2. Open the Devices and Interfaces branch and locate the active branch for your device



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

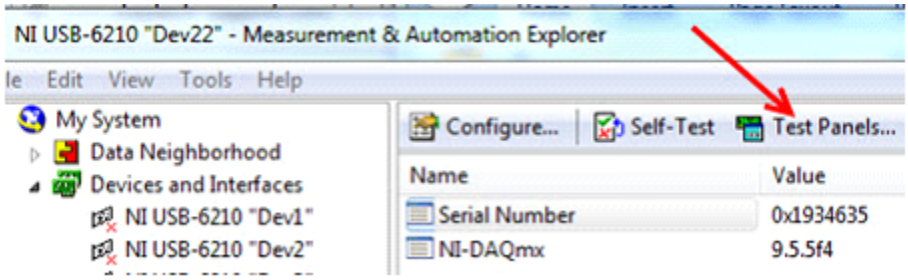


4. Select the device and click the Reset Device button

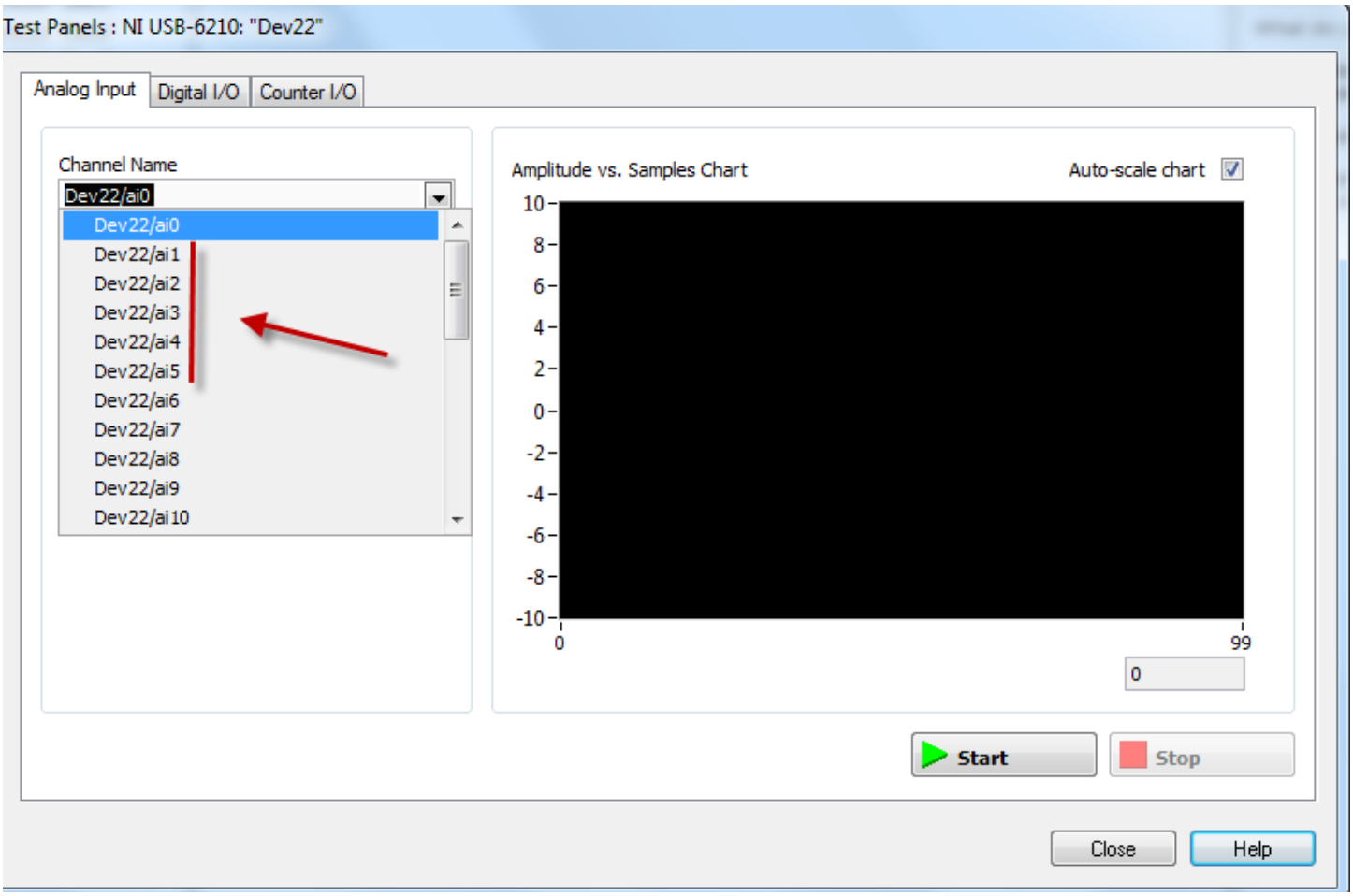


5. After these have successfully completed, we recommend testing the individual channels AI1 through AI5, sending in a +/- 5V signal and verify good signal quality
on each of channels ai1, ai2, ai3, ai4, and ai5, one at a time.

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

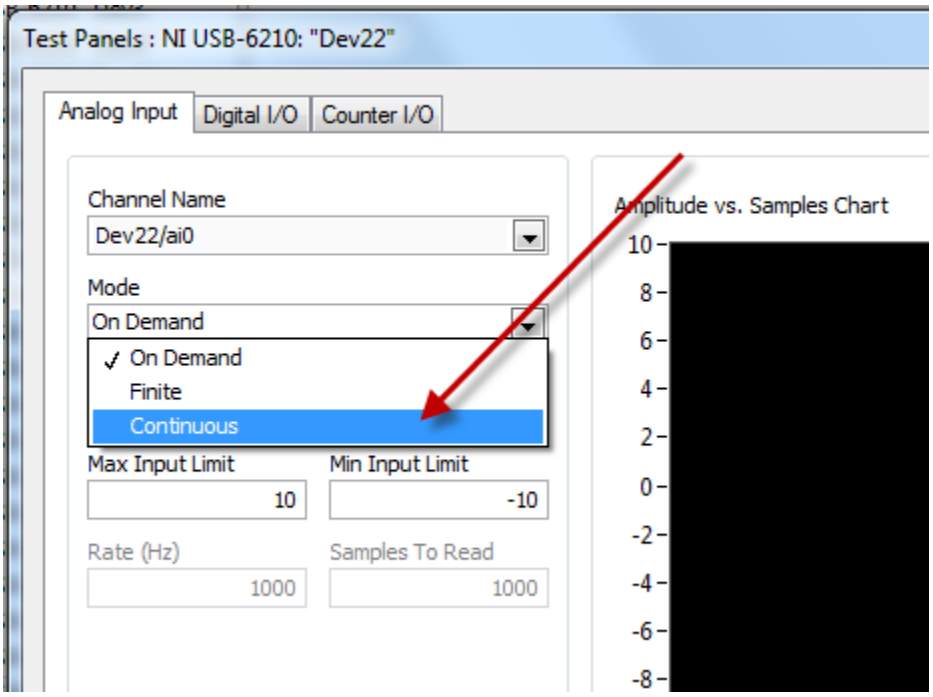


Then select the "channel" to first test - e.g. on a 16-bit device. CH1 corresponds to ai1:

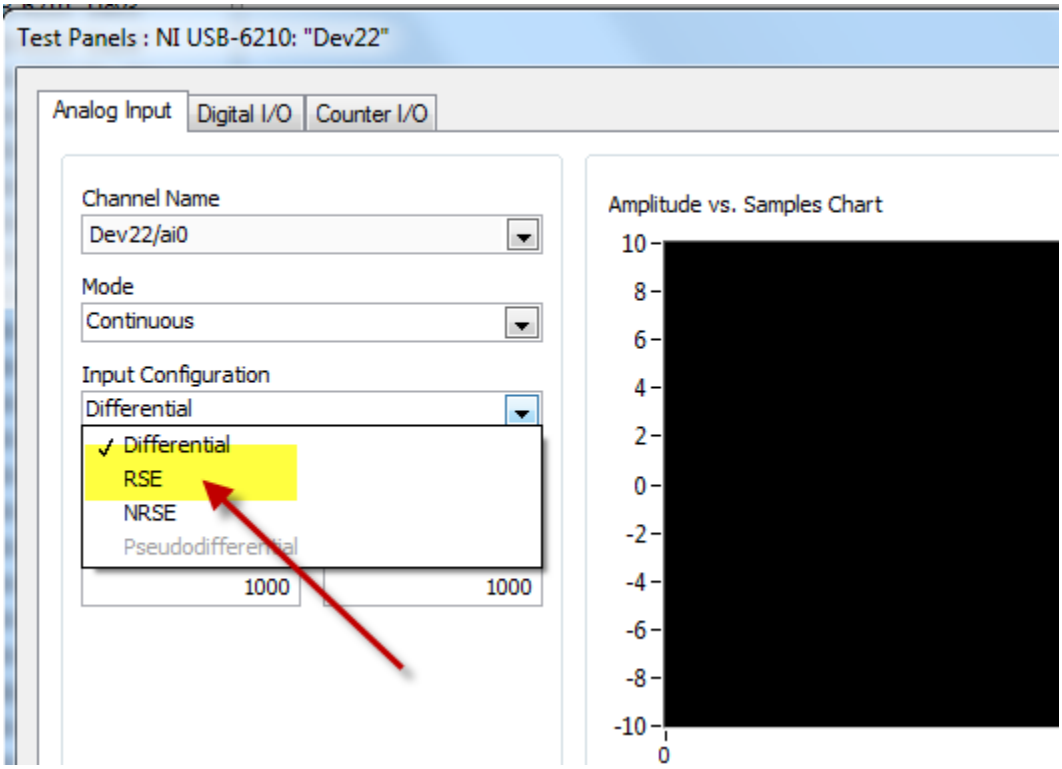


On a 24-bit device, you'll test ai0 - ai3 (4 channels) and the front-panel name silk-screened onto the 4431 box matches the channel name in Test Panels.

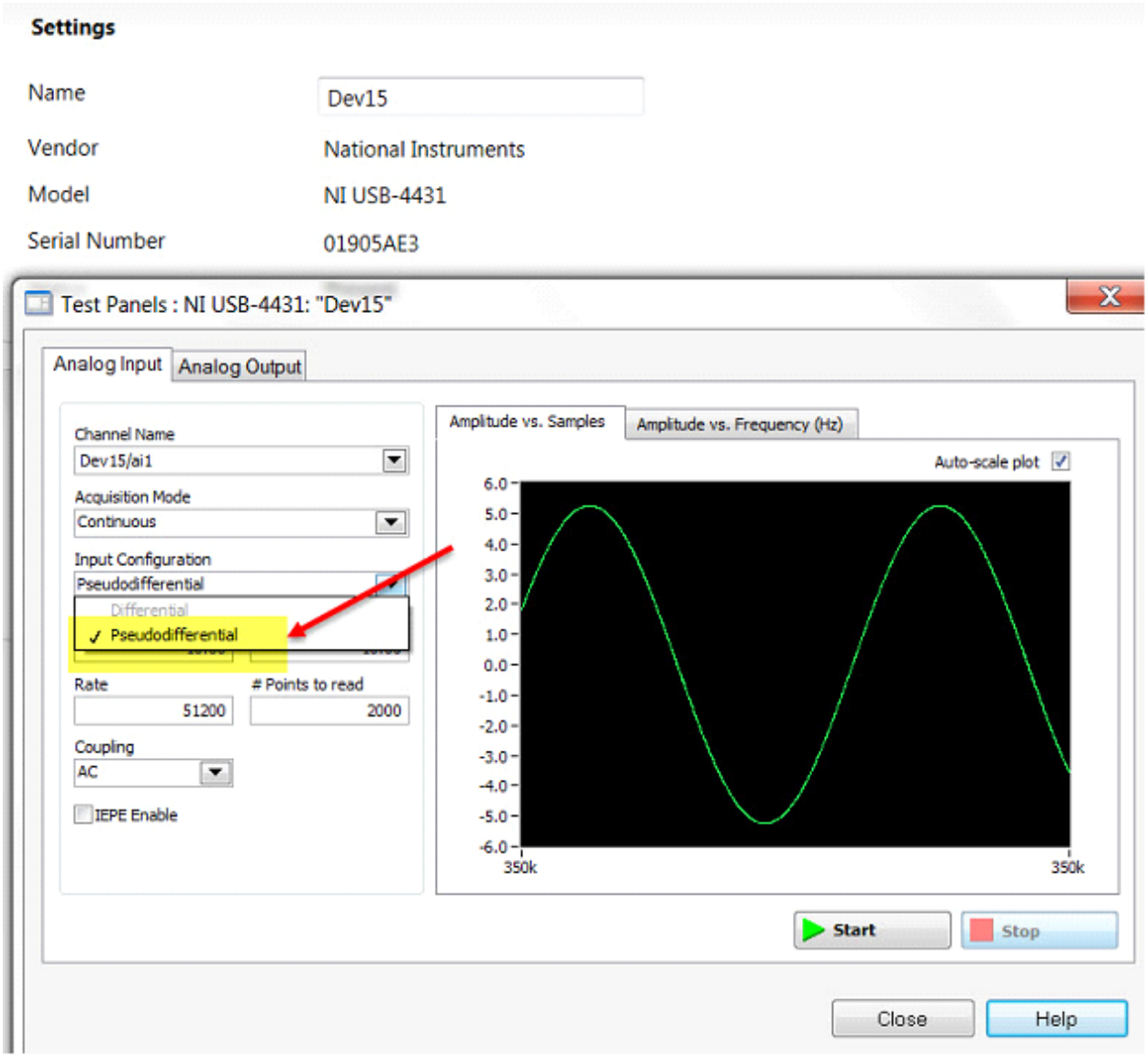
Select the input channel to test (ai1 through ai5 for the 16-bit boxes, or ai0 - ai3 for 24-bit boxes), then select CONTINUOUS mode:



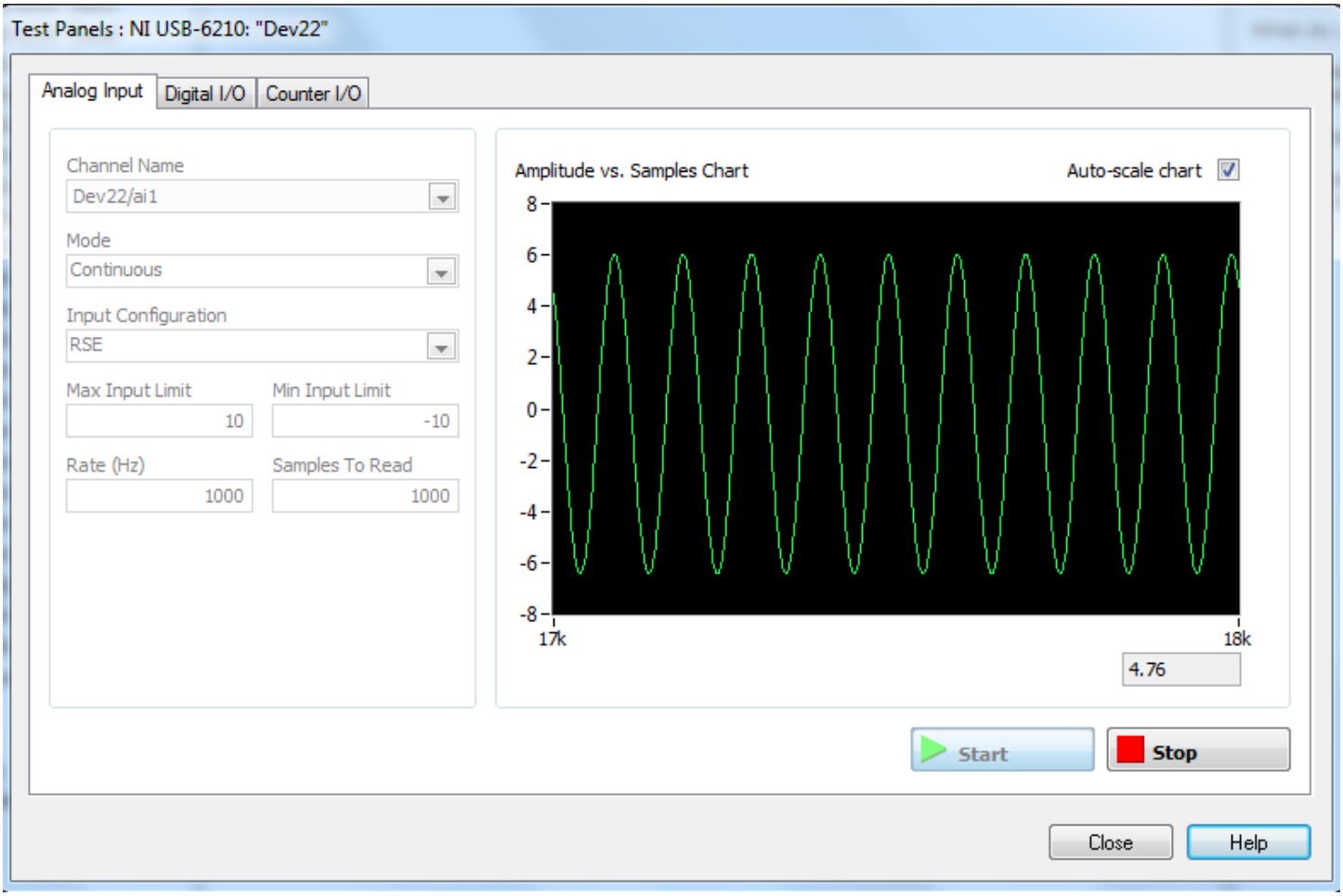
For the individual 16-bit channel tests, we use CONTINUOUS mode, RSE input coupling, a 1Khz sampling rate, and display 1s of 5v p-p data. We vary the input signal frequency and watch the live view of the data to be sure it has good quality, and comes in at full 5v p-p amplitude (or whatever full amplitude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



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.

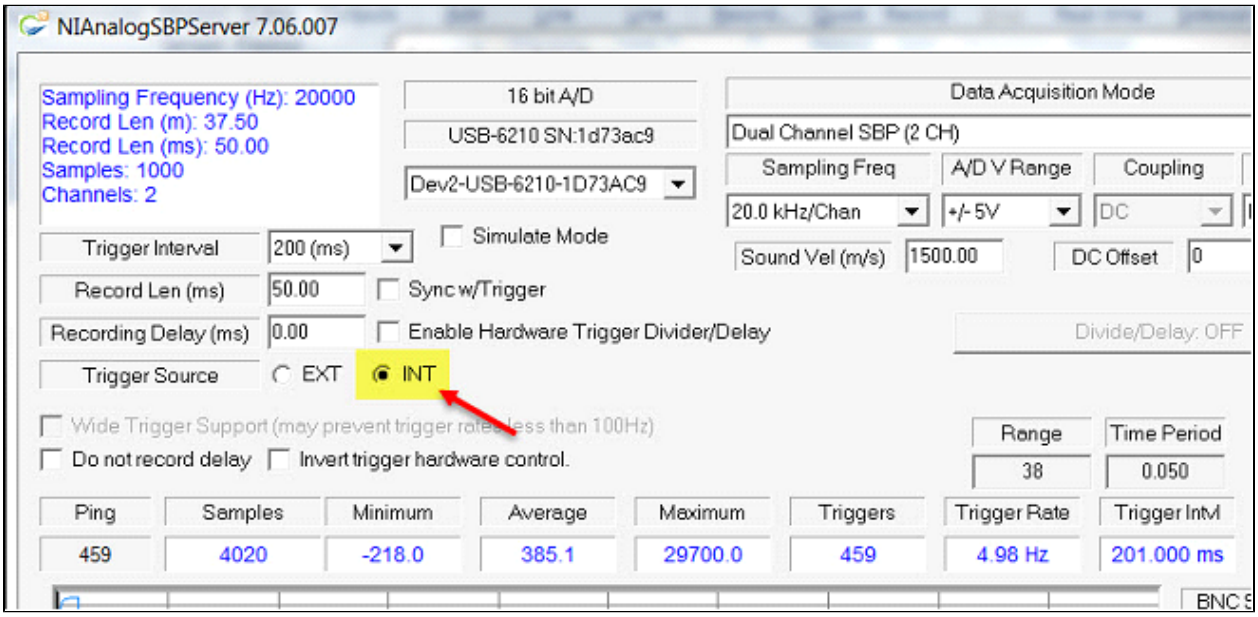
Channel and Trigger Tests

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

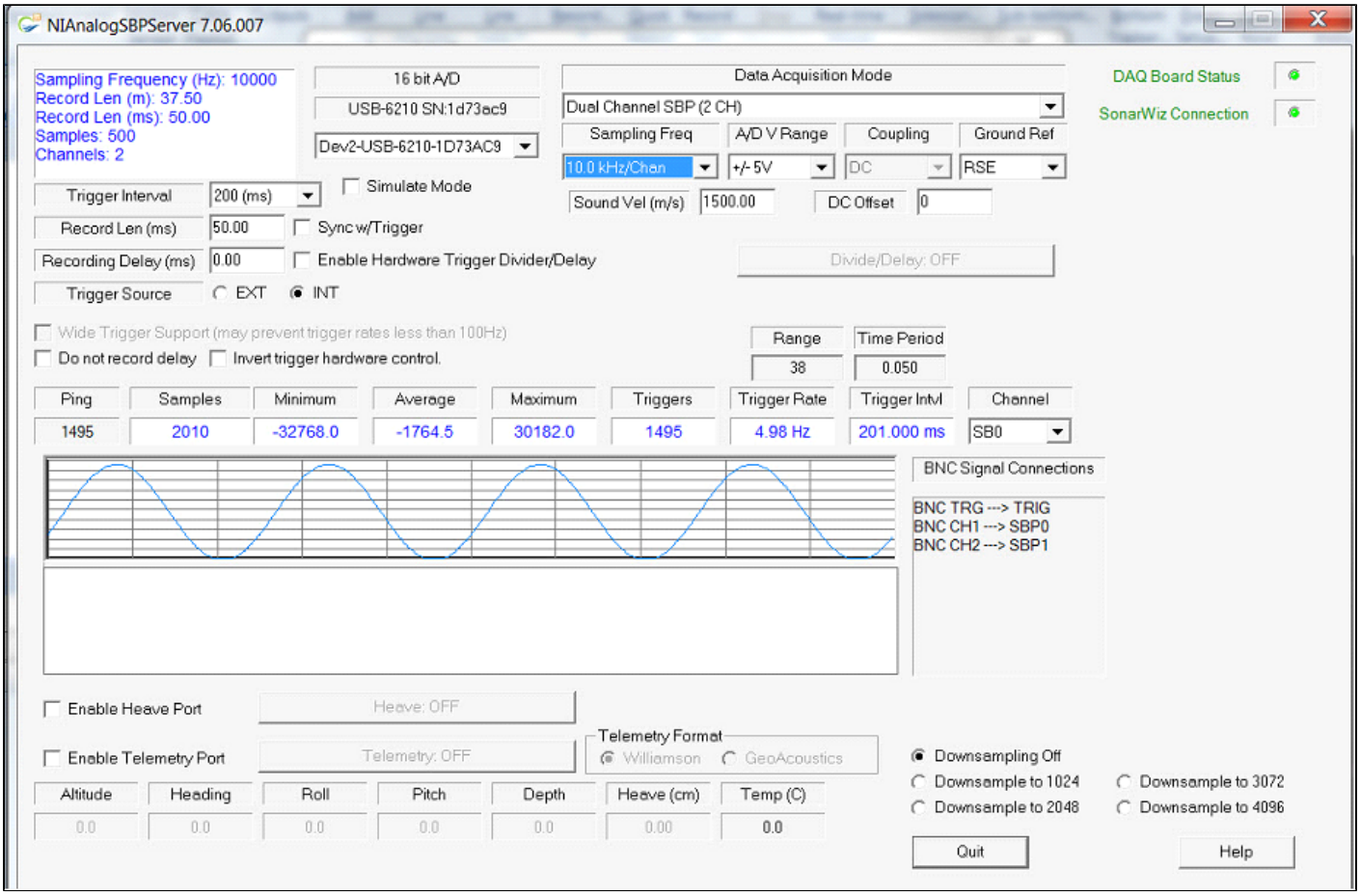
2. Verify trigger **INT mode** and front-panel EXT KEY MODE red-light is **OFF** on the box - e.g. Set 5 Hz internal trigger rate (200 msec interval)

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

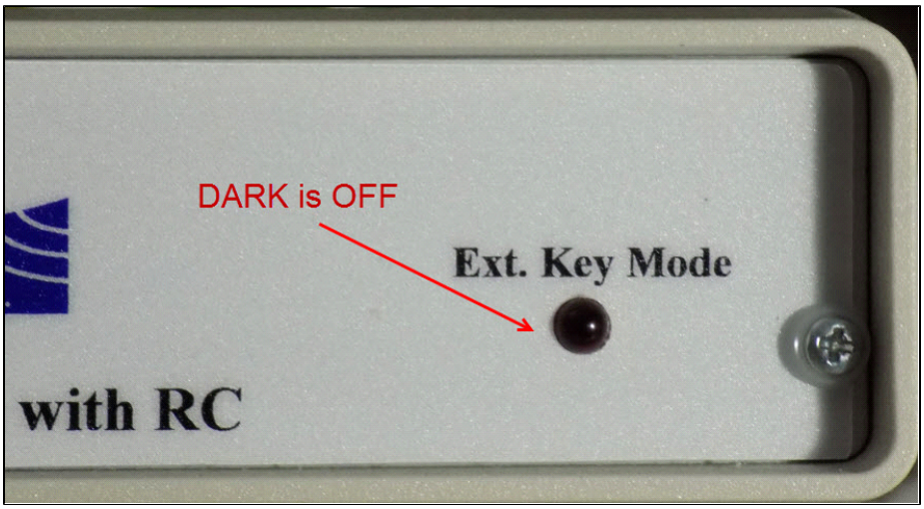


- Verify that the ping-count is incrementing in the GUI left-side display field (count shown as 459 in the graphic above). This should auto-increment in INT trigger mode, with no BNC cable attached to the TRIG I/O connector on the box.

- 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:

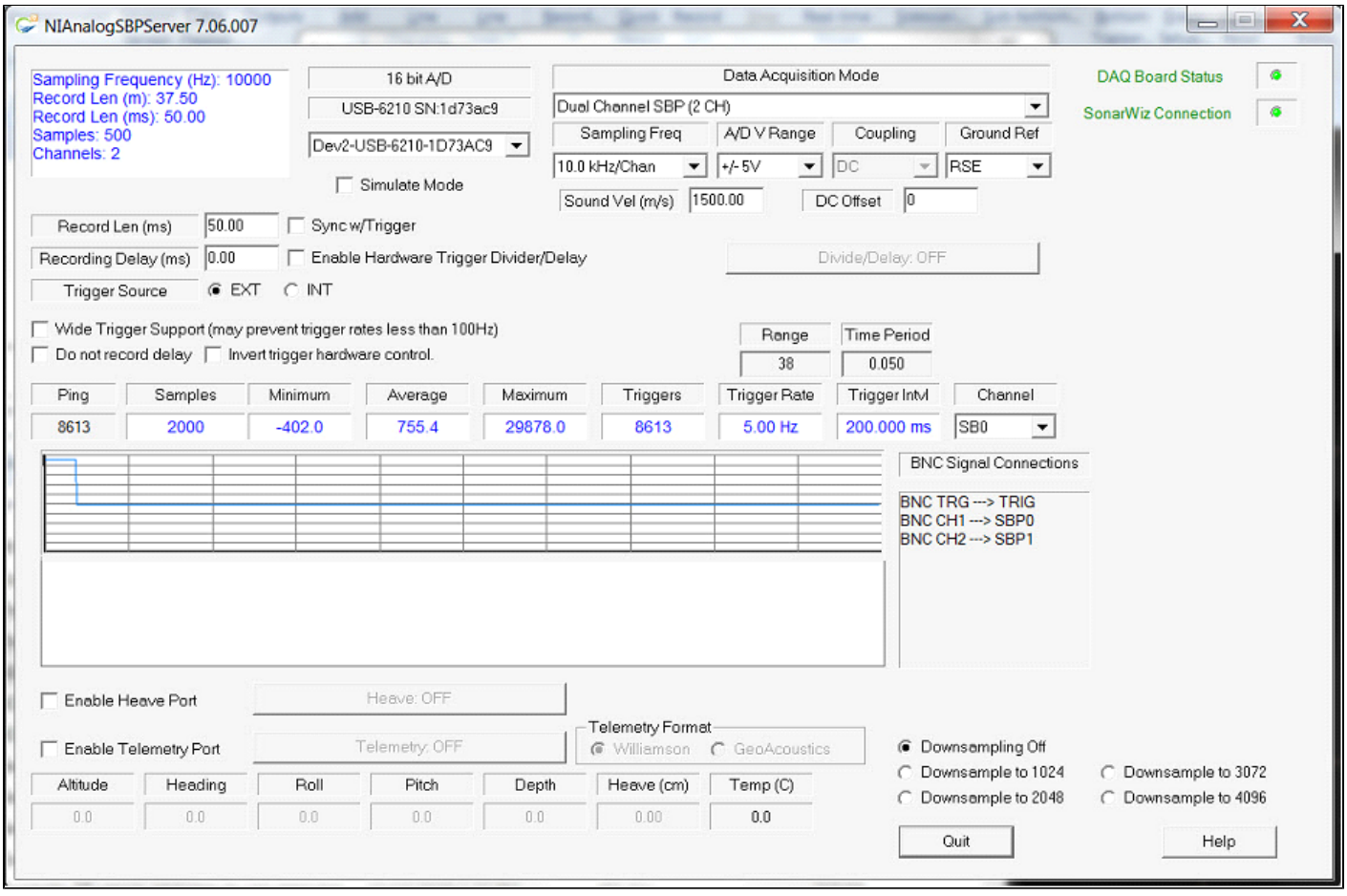


- Here's an example of the EXT TRIG MODE LED being OFF



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:



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).

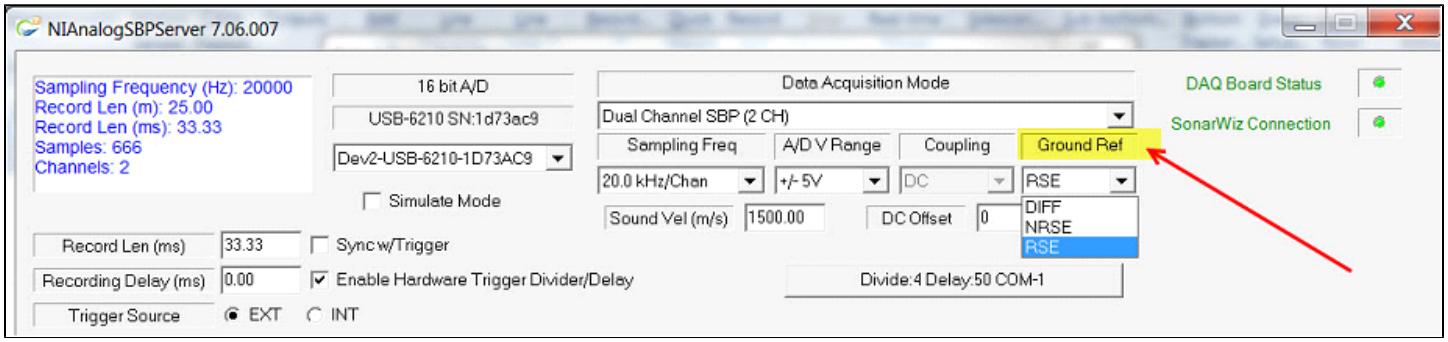
4. Verify both SB0 and SB1 input view of the input data, whether it's the KBB output signal, or function-generator sine-wave input data 5v p-p in the server signal-display window. Just remove the BNC cable from CH1 and move it to CH2 on the 16-bit box, and verify the data display.

SonarWiz View of the Input Signals Tests

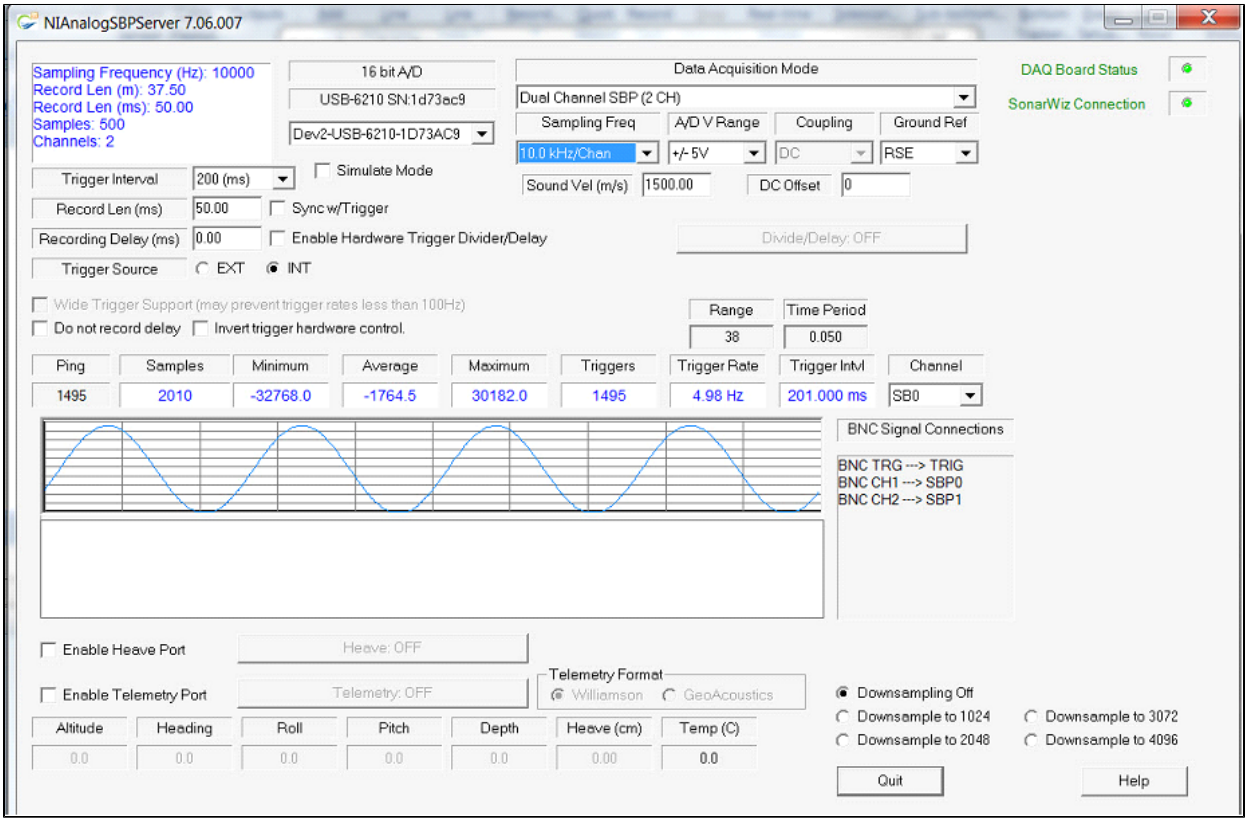
To verify that the 5-BNC interface box is communicating through the Analog Server with SonarWiz, we do the following:

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):



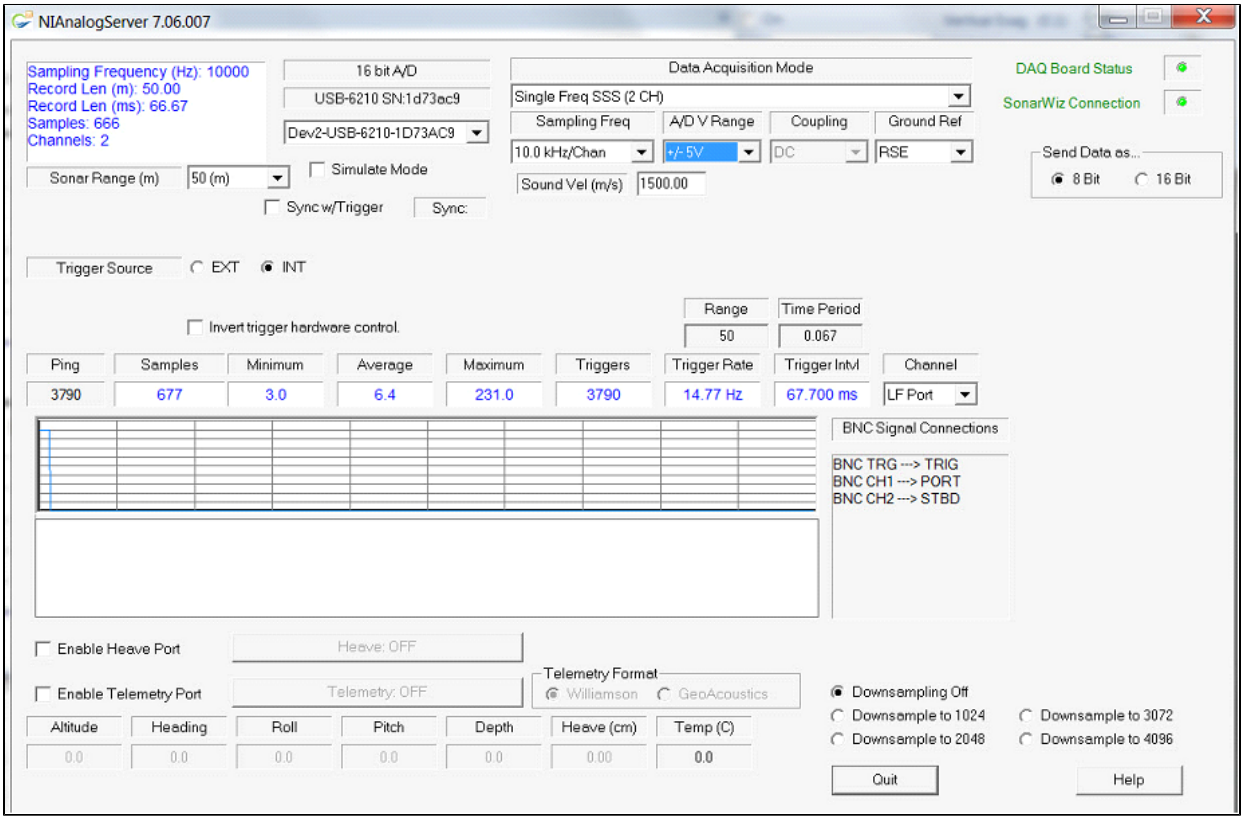
Connect a function generator to CH1 on the 5-BNC box and enable a sine-wave output at about 5v p-p amplitude, at 80 Hz to get a nice signal display going in the server like this, with 4 full sine-wave cycles displayed in the server data-view window:



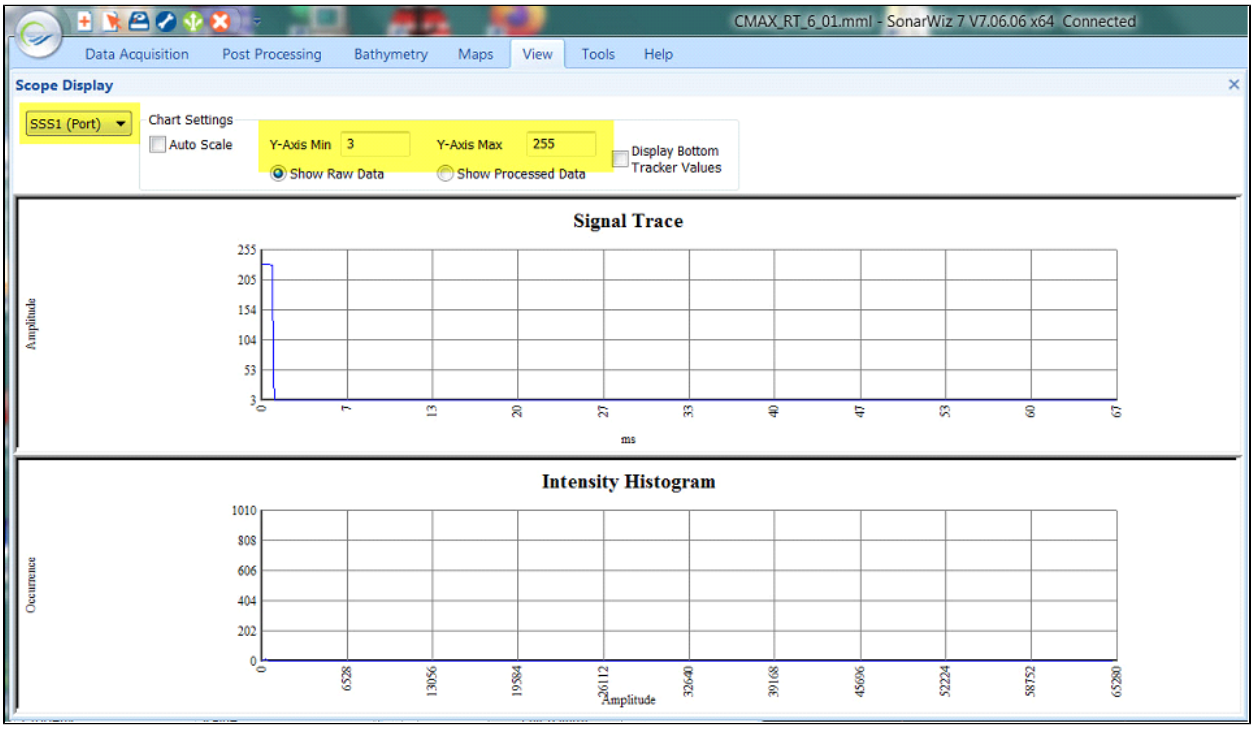
In SonarWiz, click Views > Data Acquisition > SCOPE DISPLAY:

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:



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:

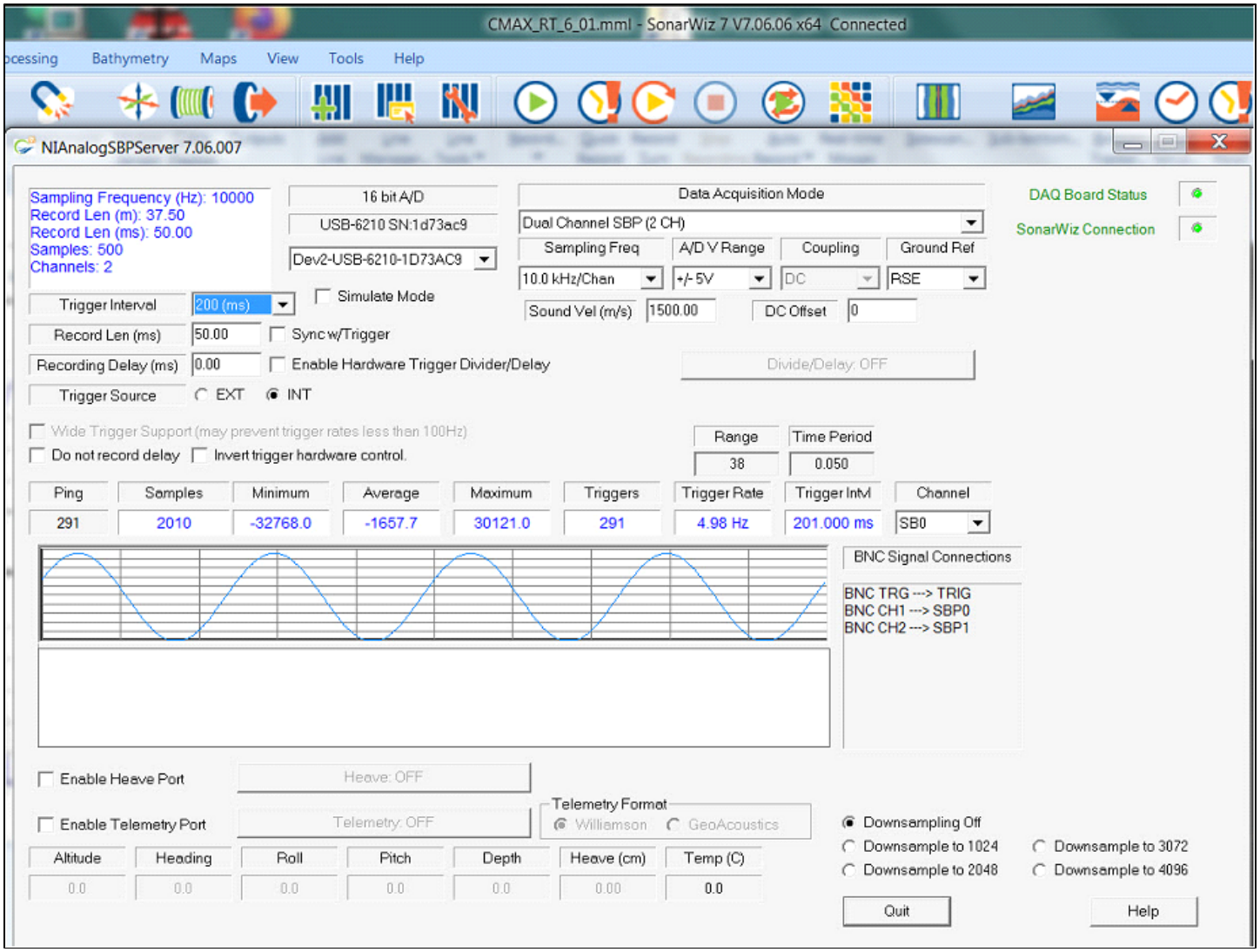


SonarWiz View of the Waterfall Display

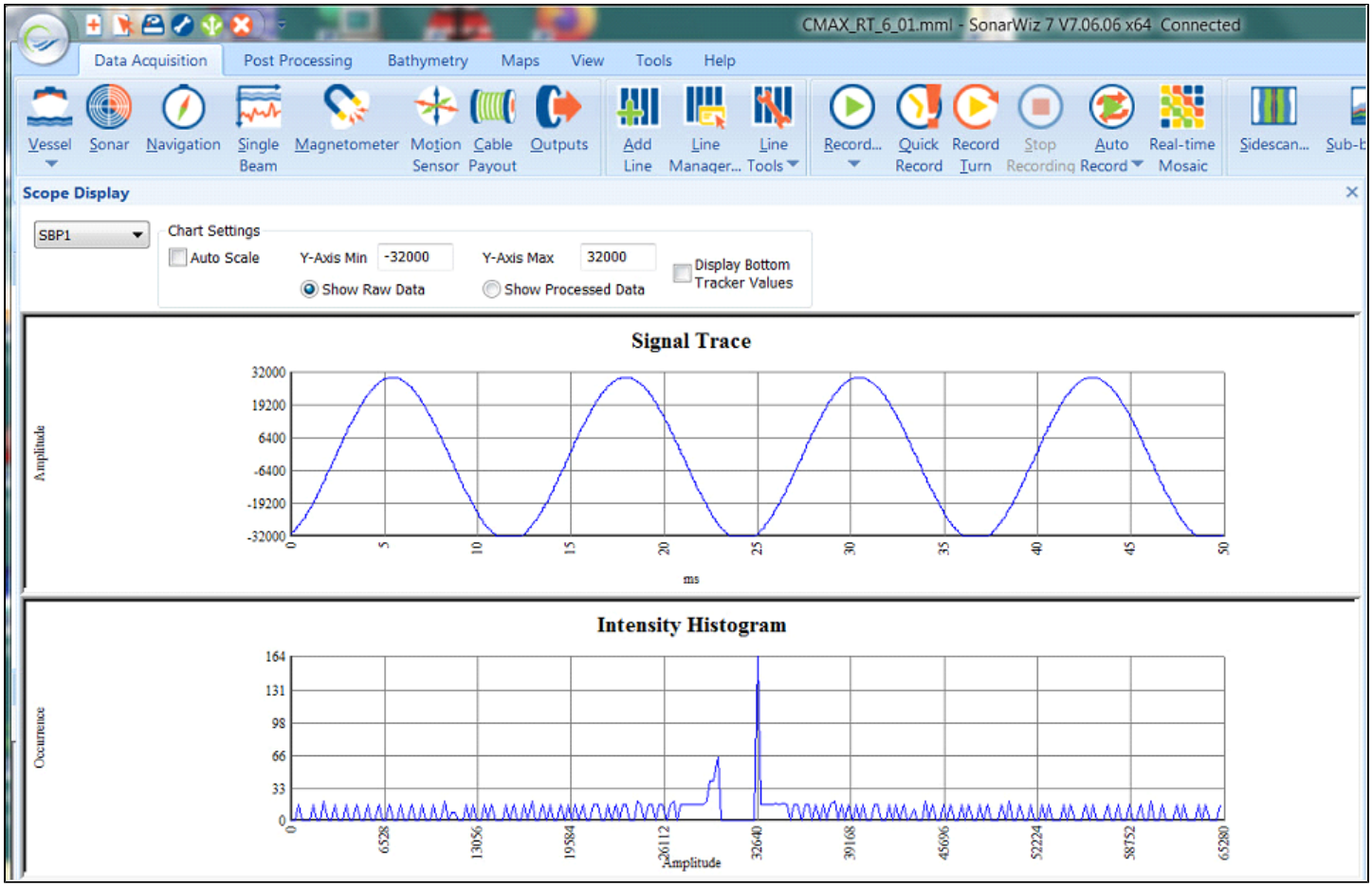
This test verifies recording and playback of the SB0 sub-bottom (CH1 on the 5-BNC box) analog signal through the system.

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:



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:

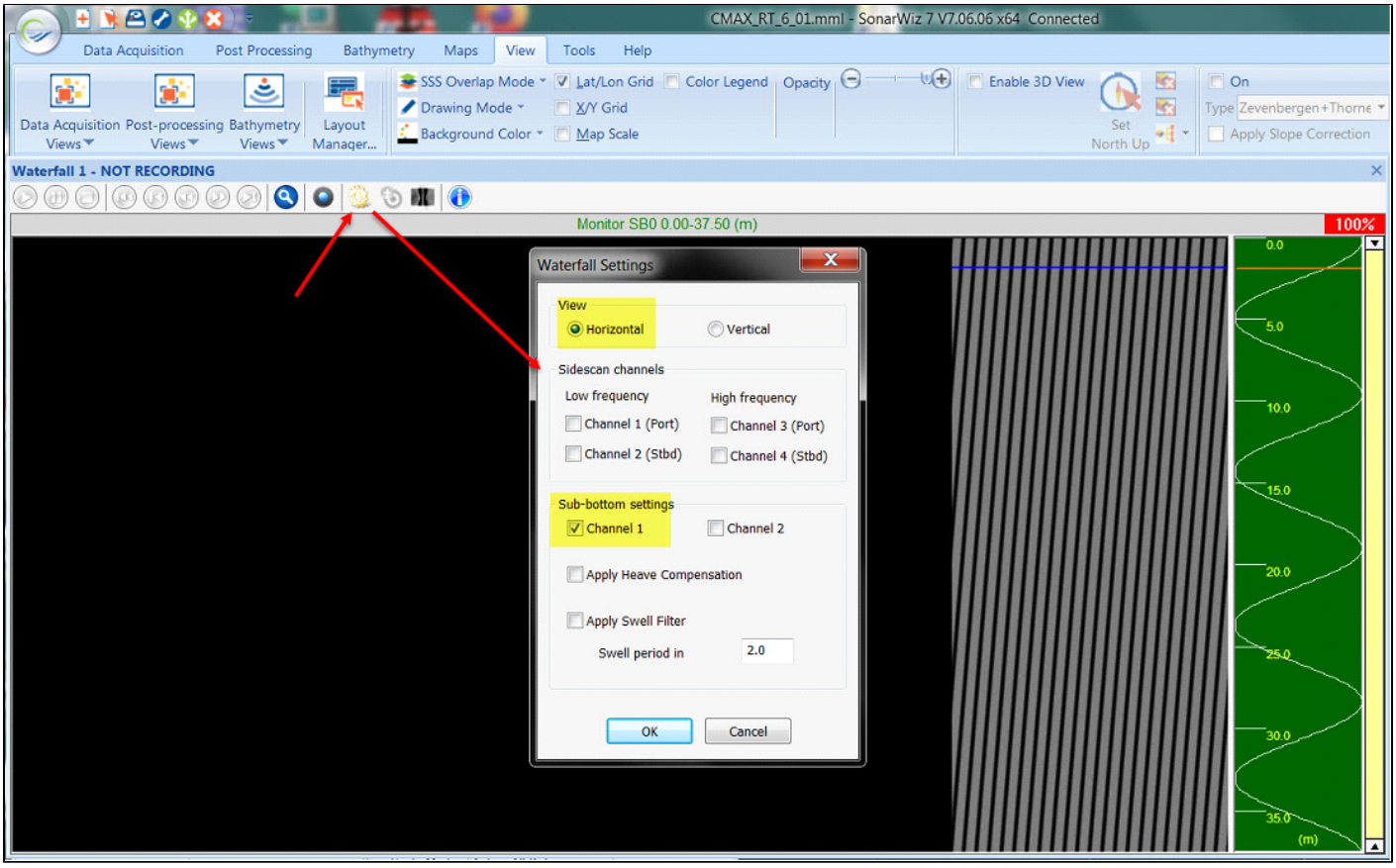


Note that SB0 (CH1 on the box) display in the server becomes SBP1 choice in this SCOPE DISPLAY.

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

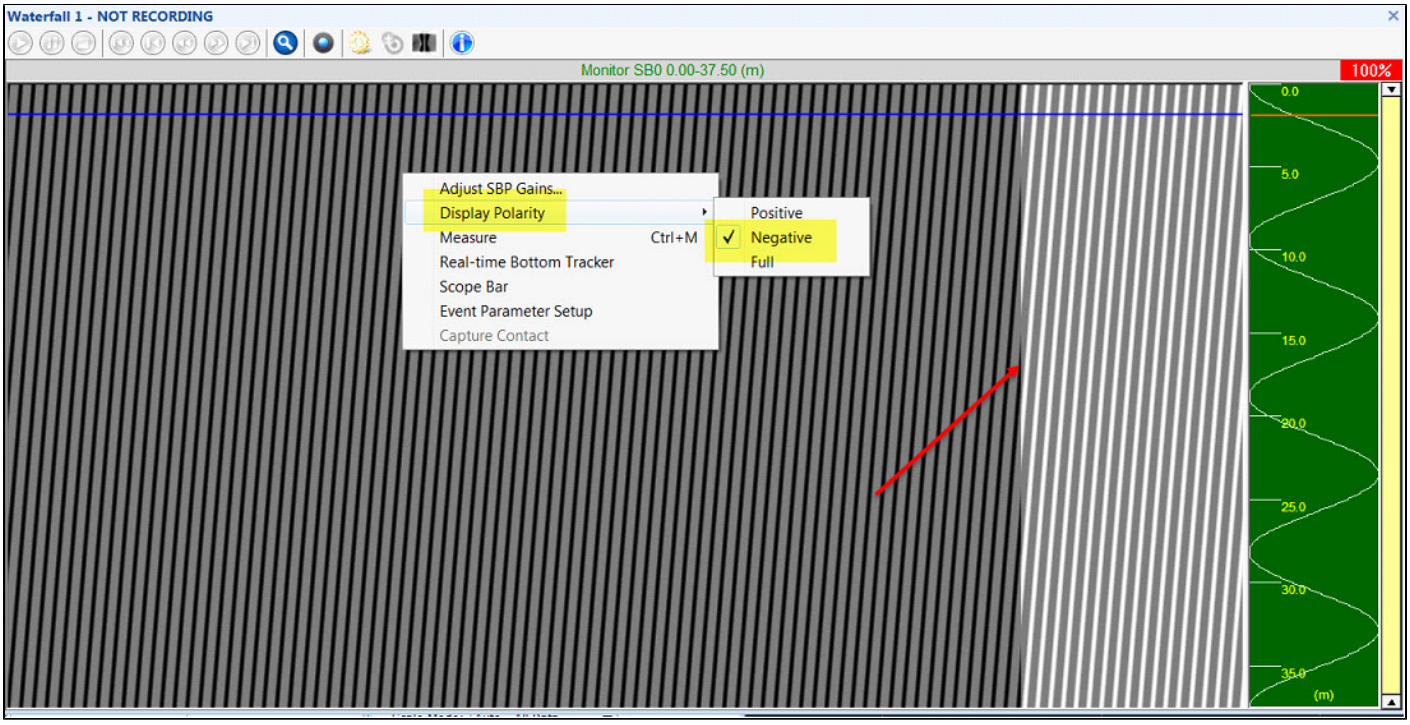
Use the Gear icon to open the Settings for the waterfall and select SB channel 1 data. it should come in like this:

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



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

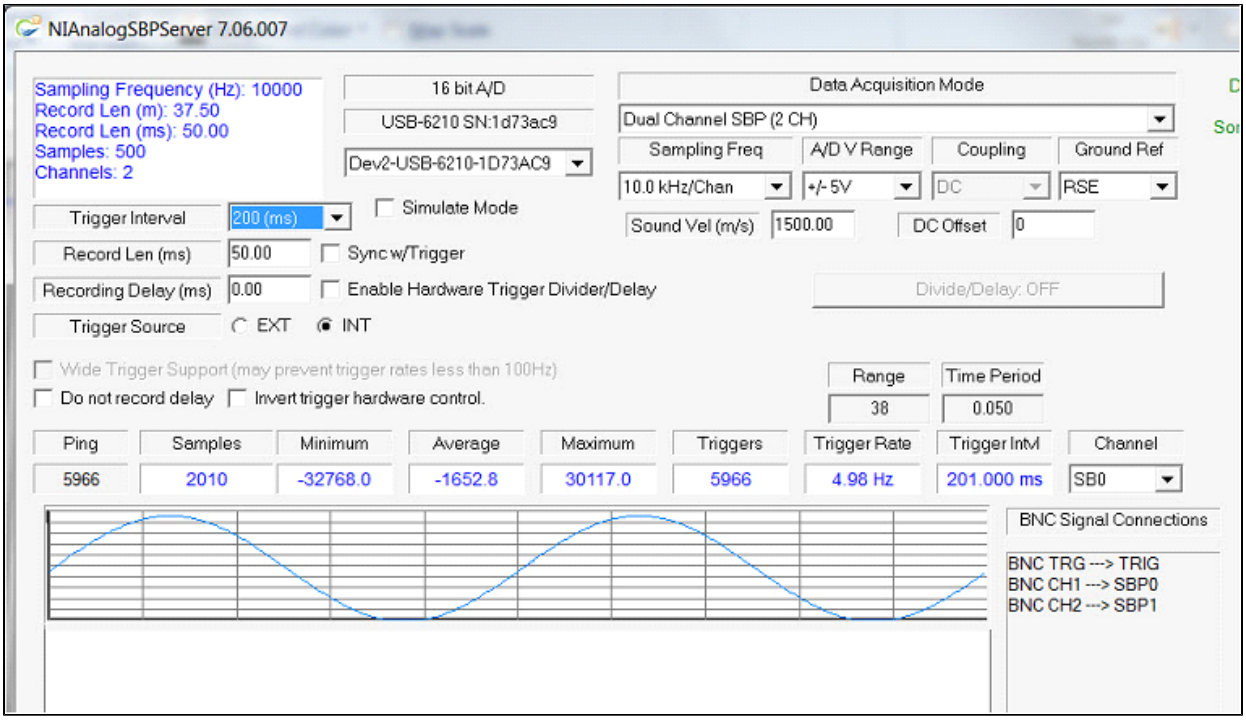
Change the display POLARITY using the right-click anywhere in the main waterfall display, then hover the cursor over the DISPLAY POLARITY choice and select NEGATIVE:



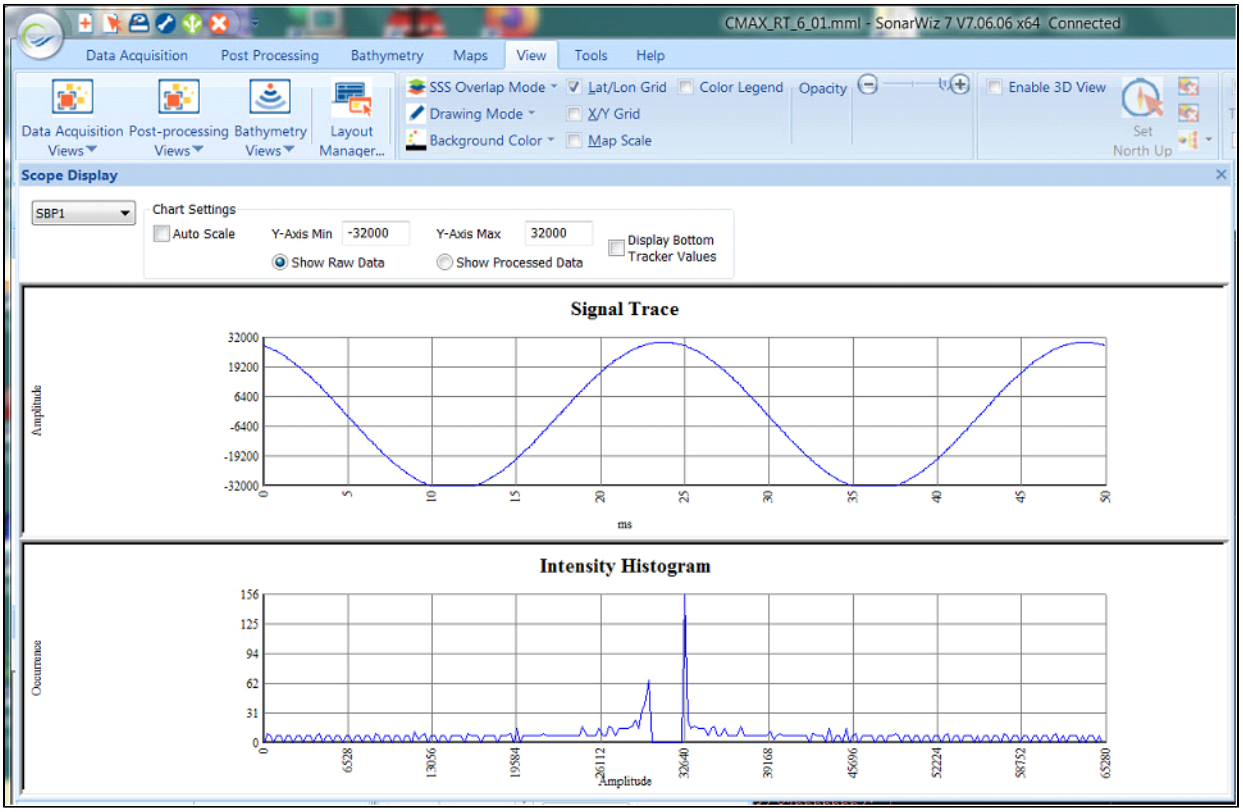
You can see the dark pattern transition to a light pattern in my case - though for you it will depend upon your group color window settings.

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.

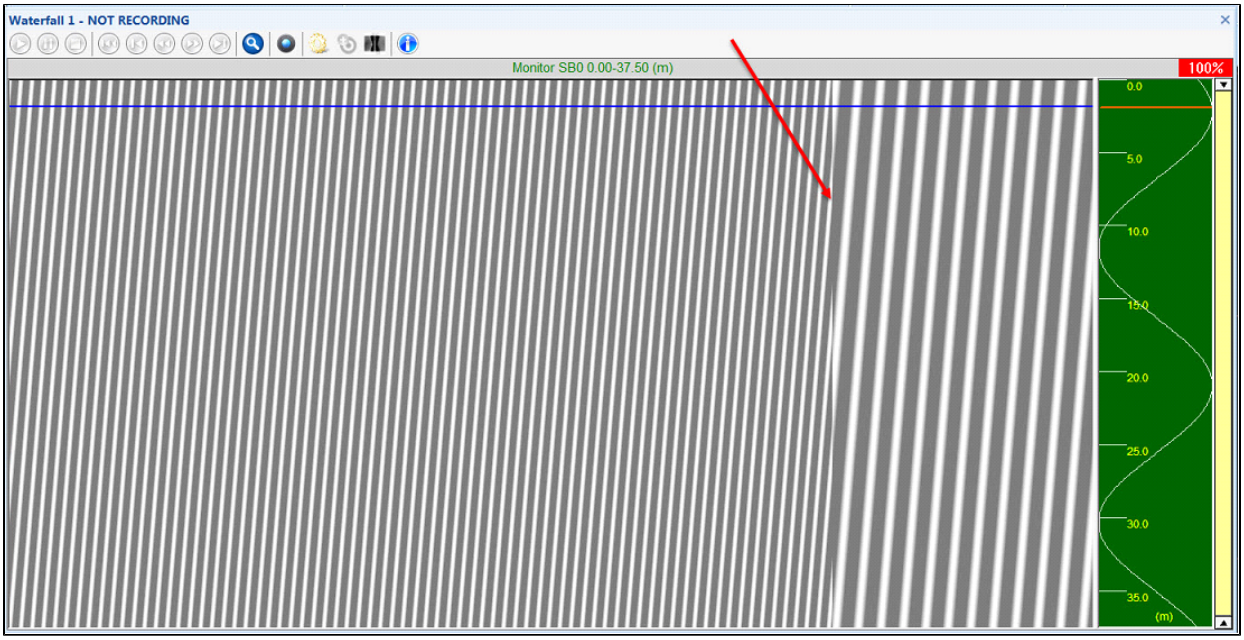
Here's an example of the 40 Hz NEGATIVE input - see the transition to a half-as-frequent striping zone in the server display, SonarWiz SCOPE display, and in the SonarWiz waterfall display:



and



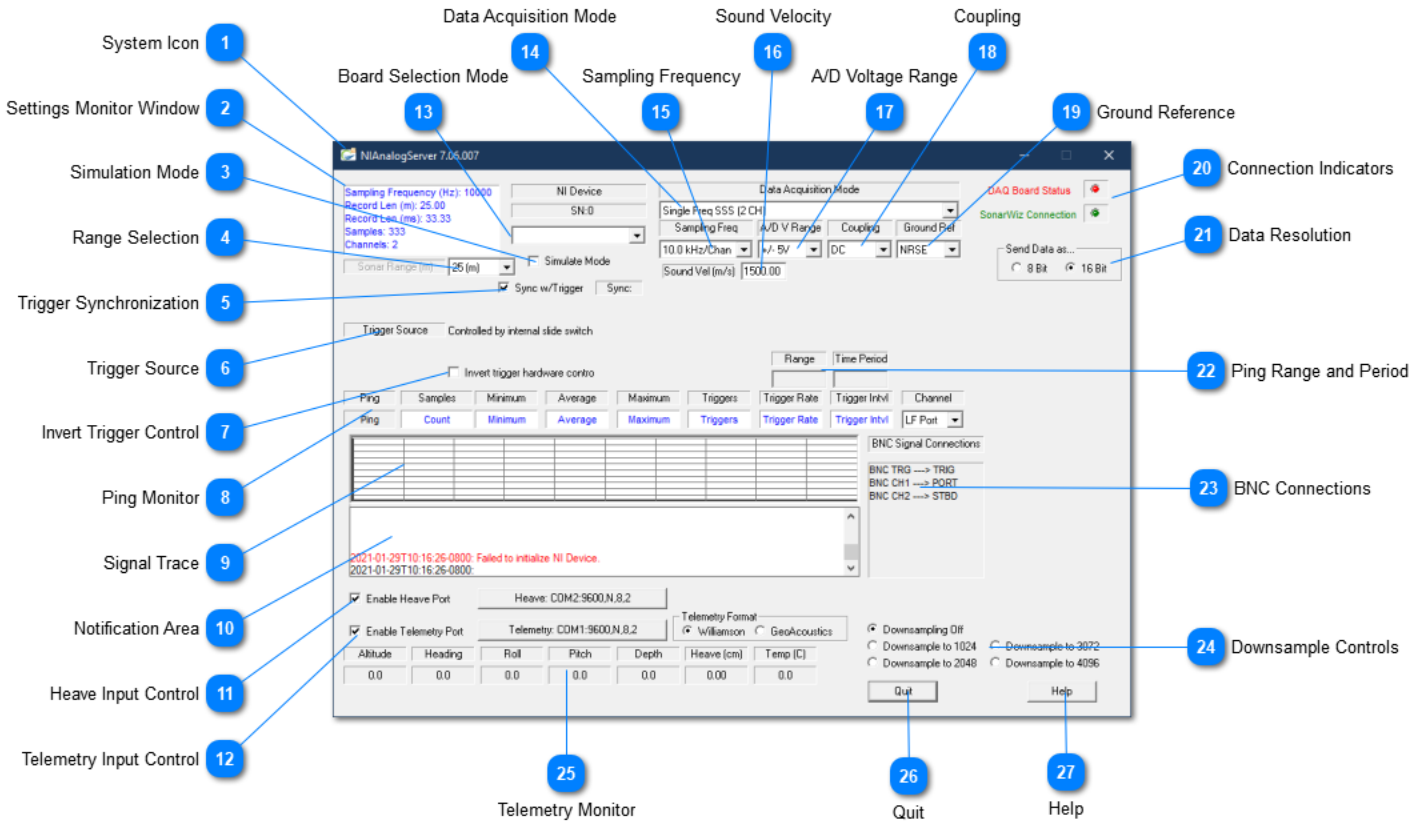
and then the 80-to-40 Hz input transition shows in the waterfall too:


Waterfall 1 - NOT RECORDING
Monitor SB0 0.00-37.50 (m)
100%
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
(m)

CTI Analog Servers

NIAnalogSSServer

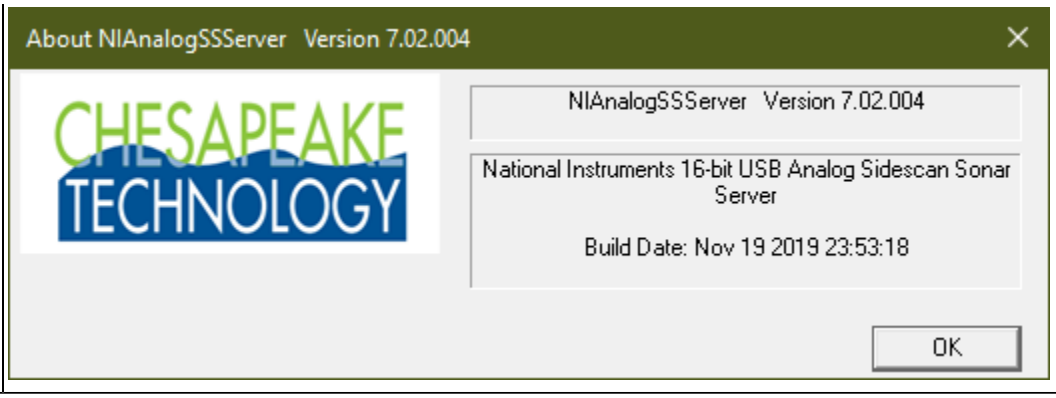
The SonarWiz 16-bit analog sidescan server (**NIAnalogSSServer**) is a small interface program that controls the National Instruments (NI) USB-6210 data acquisition (DAQ) device. The combination of the USB-6210 and this dedicated software interface provides high resolution sampling of analog sidescan 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.



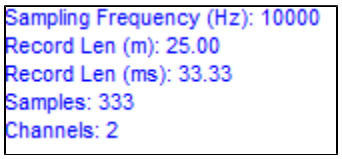
1 System Icon

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 Advanced Settings window
Rest Stats...	Rest the Channel Monitor Statistics
About NIAnalogSSSServer...	Shows the Analog Server version and build information panel:

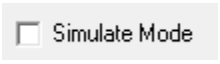


2 Settings Monitor Window



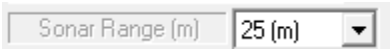
The **Settings Monitor Window** displays the computed ping record settings based on the Sonar Range Selection and Sampling Frequency selected by the user. Compare these settings to the statistics displayed in the Data Monitor to see what the system is actually able to achieve.

3 Simulation Mode



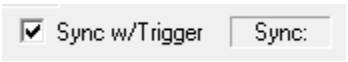
The **Simulate Mode** is useful for testing the system connectivity when no signals are available. The simulate mode will send fabricated data to SonarWiz without using the A/D board.

4 Range Selection



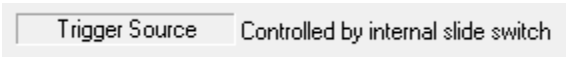
The sonar **Range Selection** MUST match the range setting in the analog sonar system or data will be lost. Use the range selection drop down box to select the range in meters that matches your current sonar setting

5 Trigger Synchronization



When the **Sync w/Trigger** checkbox is checked, the server will make the record length the same as the external trigger interval. The Range Selection 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.

6 Trigger Source

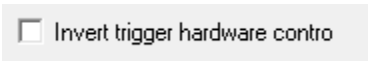


Sonar triggering options:

Control	Description
INT	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.
EXT	Setting to EXTERNAL trigger means you will send in a trigger pulse.

7 Invert Trigger Control

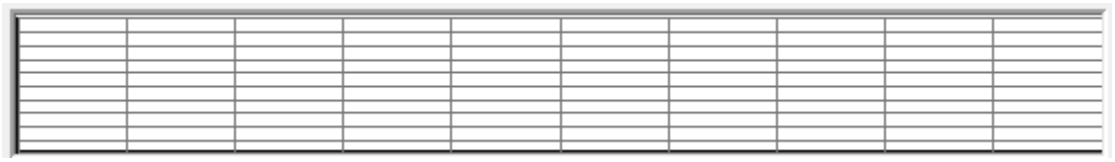


If the red EXT KEY MODE LED is ON when INT trigger is selected, then check this check-box to reverse the internal hardware control bits for internal / external trigger, to correct for what may happen sometimes as a hardware anomaly.

8 Ping Monitor

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.

9 Signal Trace

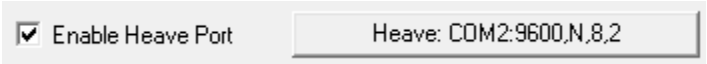


The chart display is an autoscaling graph that shows the relative strength of the incoming analog signal. The channel displayed is selected by the Channel Monitor drop-down.

10 Notification Area

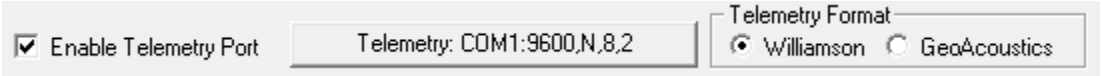
The Notification Area is reserved for various status and error messages to alert the user to problems in the system.

11 Heave Input Control



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

12 Telemetry Input Control

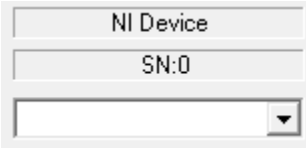


Some analog sonars provide telemetry information of the vehicle attitude via a serial port. Use the Enable check box and click the Telemetry Input Control button to open the COM Port Settings dialog. Currently, the only telemetry datagrams supported are from Williamson and Associates AMS sonars and GeoAcoustics.

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.

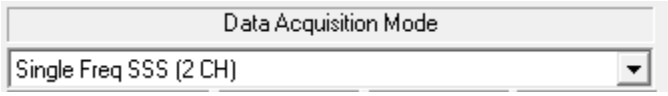
3457.48,1203.60,12.9,-16.4,214.7
3357.48,1213.60,13.3,-16.4,215.1

13 Board Selection Mode



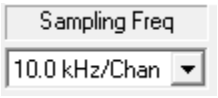
The **Board Selection Mode** indicates which National Instruments card the server is communicating with. If your system contains more than one National Instruments card, use the drop-down selection box to select to the appropriate board. This selection is not available in Simulation Mode.

14 Data Acquisition Mode



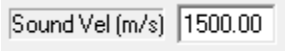
Select the number of channels that are appropriate for your sonar. If you are operating a dual frequency sidescan sonar, you would want to select both the LF and HF channels to record low and high frequency data. If you also have a sub-bottom attachment enable the SBP checkbox to record the sub-bottom.

15 Sampling Frequency



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.

16 Sound Velocity



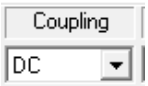
Set the sound velocity to the appropriate value for your working area. The interface program uses sound velocity to convert between distance and time. It's probably best to use the nominal 1500.0 m/s (meters /second) for this, unless you have some valid local data on water temp, salinity, etc. with a more valid measurement.

17 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, if you have selected a Data Resolution 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 Channel Monitor and Signal Trace window to adjust your voltage range until the signal minimum and maximum values fill the available range without clipping.

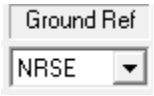
18 Coupling



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

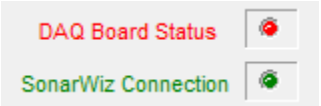
Coupling Setting	Description
DC	Raw voltage is recorded
AC	Removes weak gound voltage from signal and zeros voltage at 0.0 (recommended)

19 Ground Reference



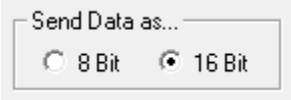
The NI USB-6210 card supports three ground reference settings. RSE mode is not recommended, but you have a choice of using DIFF or NRSE modes of recording. Choosing DIFF versus NRSE can make a difference, so experiment with your input signal and see which you prefer, before committing to this in a survey. See Ground Reference for more information.

20 Connection Indicators



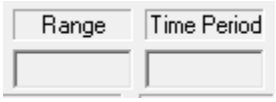
The Connection Status indicator lights will turn green when the server makes a successful connection to the DAQ board in the Analog to Digital interface box, and when the server makes a successful connection to SonarWiz 7. The status indicator lights will turn red if the connection has not been established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

21 Data Resolution



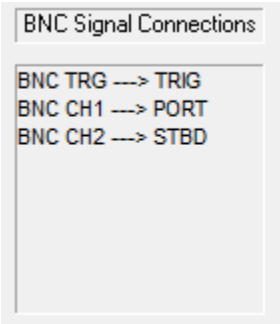
The data resolution recorded is controlled by the 8 or 16-bit radio buttons. The A/D converter provides 16 bits of resolution however most analog sidescans provide less than 8 bits of dynamic range. The 16-bit option doubles the disk space required for a given survey compared to the 8-bit option.

22 Ping Range and Period



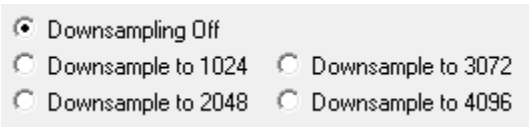
Ping range in meters and ping period in seconds.

23 BNC 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.

24 Downsample Controls



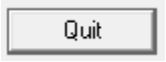
The downsample option provides a means of compressing long records. This function works by downsampling records that contain more than 4096 samples which at the current sampling frequency is just over 300m in length. The downsample option has no effect on records shorter than 300m. When the downsampling 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).

25 Telemetry Monitor

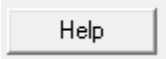
The **Telemetry Monitor** displays the parsed telemetry fields received via the Telemetry Input.

26 Quit



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

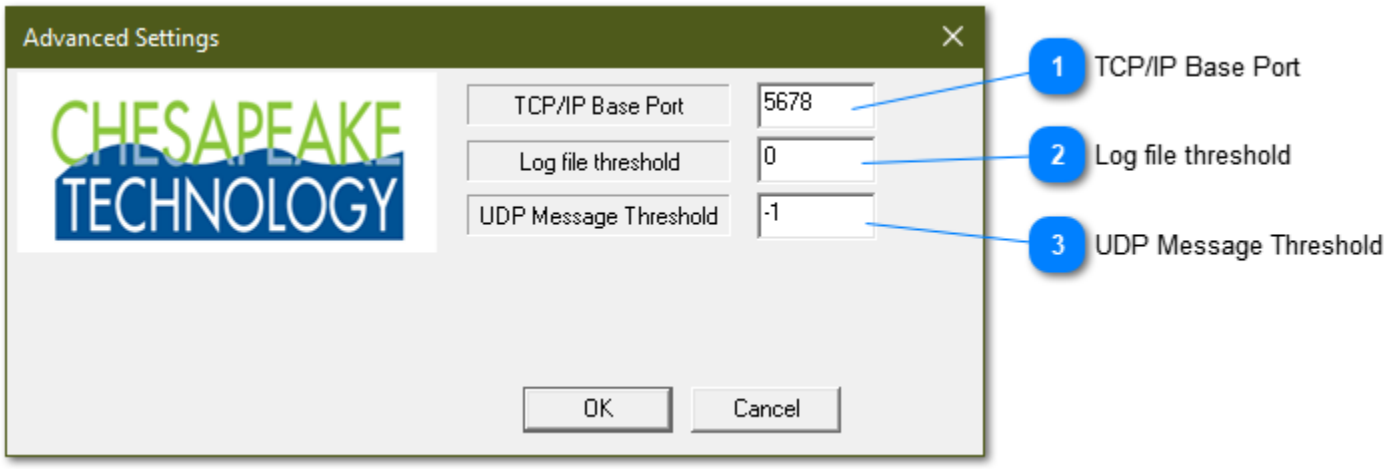
27 **Help**



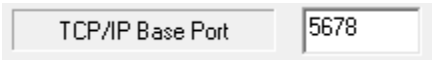
Open this document.

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.

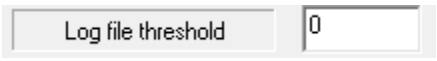


1 TCP/IP Base Port



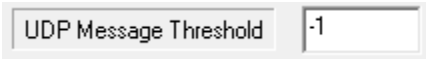
TCP/IP Base Port is where the real-time diagnostic messages are sent and viewed by SonarWiz. Please do not change the TCP-/IP Base Port address unless instructed to do so by a Chesapeake support engineer.

2 Log file threshold



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.

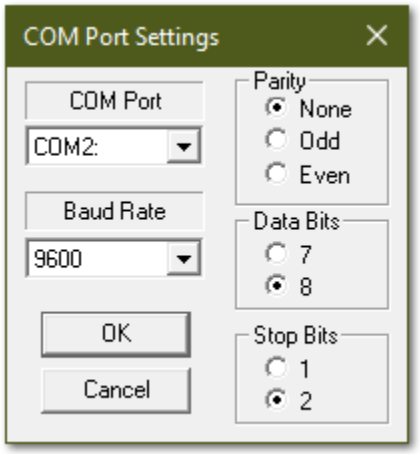
3 UDP Message Threshold



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.

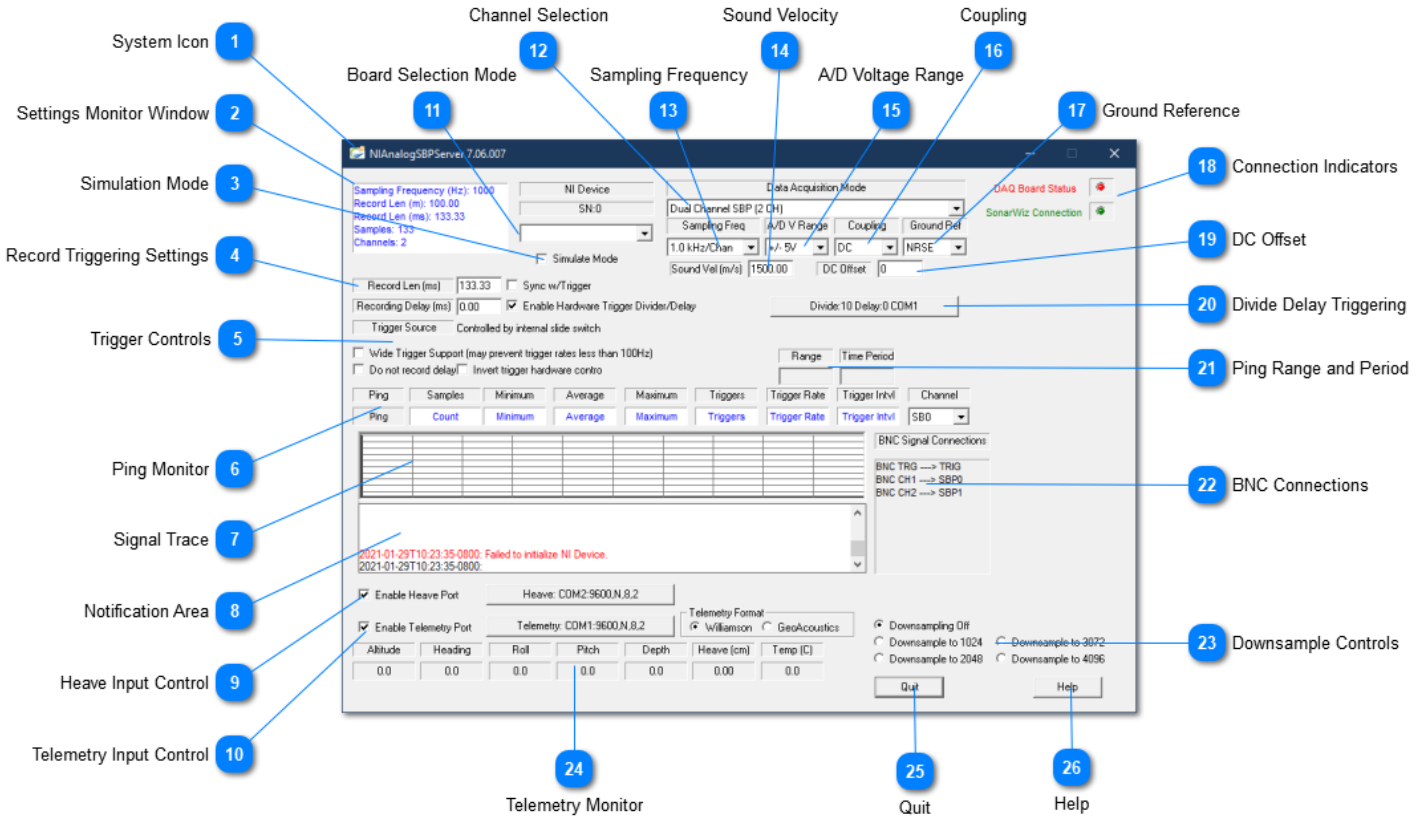
COM Port Settings

The Heave Input Control Button and Telemetry Input Control Button 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.



NIAnalogSBP12-16Server

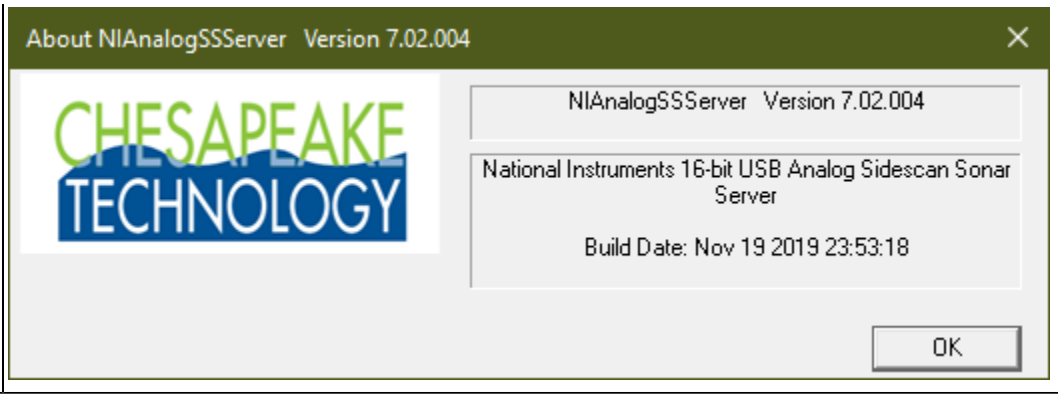
The SonarWiz 16-bit analog sidescan server (**NIAnalogSBP12-16Server**) is a small interface program that controls the National Instruments (NI) USB-6210 data acquisition (DAQ) device. The combination of the USB-6210 and this dedicated software interface provides high resolution sampling of analog sub-bottom 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.



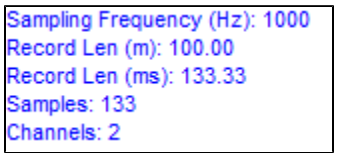
1 System Icon

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 Advanced Settings window
Rest Stats...	Rest the Channel Monitor Statistics
About NIAnalogSSSServer...	Shows the Analog Server version and build information panel:



2 Settings Monitor Window

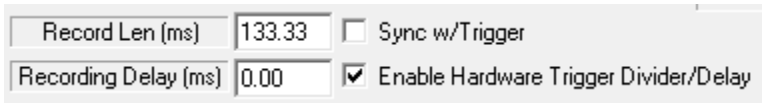


The **Settings Monitor Window** displays the computed ping record settings based on the Record Triggering Controls selected by the user. Compare these settings to the statistics displayed in the Data Monitor to see what the system is actually able to achieve.

3 Simulation 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.

4 Record Triggering Settings

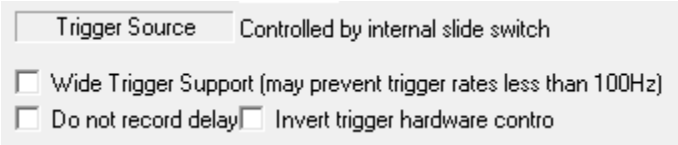


The Record Triggering Settings control the sub-bottom ping:

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.
Enable Hardware Trigger Divider/Delay	When checked, use the Harware Trigger Divider/Delay box. See Divide Delay Triggering button.

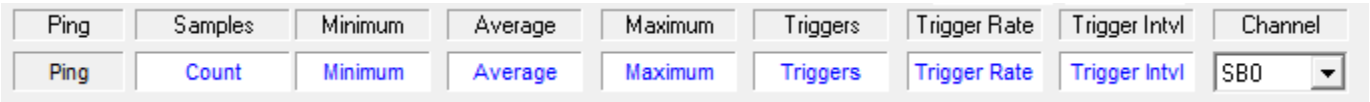
5 Trigger Controls



Sonar triggering options:

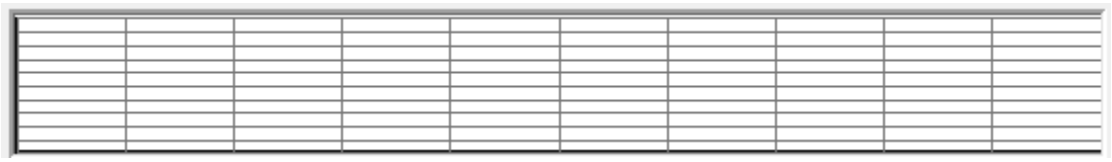
Control	Description
Trigger Source	Setting to INTERNAL (INT) trigger generates an output trigger, which appears as a 0v to +5V squarewave pulse 1-msec wide on the TRIG I/O output BNC connector of the CTI 5-BNC box connected to your SonarWiz PC. Setting to EXTERNAL (EXT) trigger means you will send in 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.

6 Ping Monitor



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.

7 Signal Trace

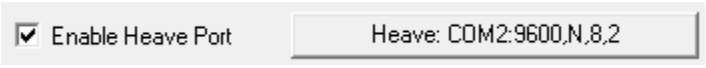


The chart display is an autoscaling graph that shows the relative strength of the incoming analog signal. The channel displayed is selected by the Channel Monitor drop-down.

8 Notification Area

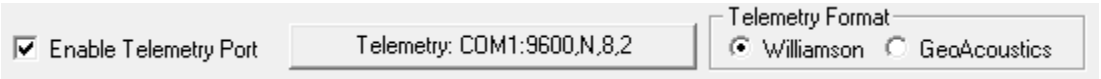
The Notification Area is reserved for various status and error messages to alert the user to problems in the system.

9 Heave Input Control



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

10 Telemetry Input Control

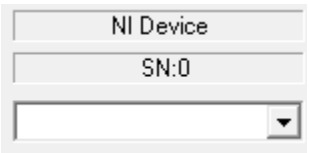


Some analog sonars provide telemetry information of the vehicle attitude via a serial port. Use the Enable check box and click the Telemetry Input Control button to open the COM Port Settings dialog. Currently, the only telemetry datagrams supported are from Williamson and Associates AMS sonars and GeoAcoustics.

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.

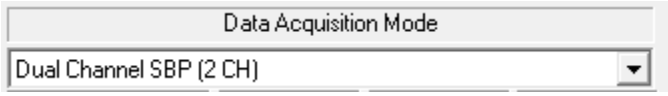
3457.48,1203.60,12.9,-16.4,214.7
3357.48,1213.60,13.3,-16.4,215.1

11 Board Selection Mode



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 Simulation Mode.

12 Channel Selection



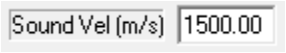
Select the number of channels that are appropriate for your sonar.

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)	

13 Sampling Frequency

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.

14 Sound Velocity



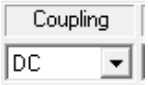
Set the sound velocity to the appropriate value for your working area. The interface program uses sound velocity to convert between distance and time. It's probably best to use the nominal 1500.0 m/s (meters /second) for this, unless you have some valid local data on water temp, salinity, etc. with a more valid measurement.

15 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 Channel Monitor and Signal Trace window to adjust your voltage range until the signal minimum and maximum values fill the available range without clipping.

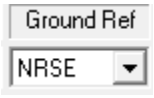
16 Coupling



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

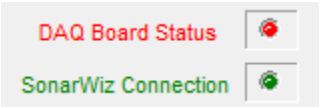
Coupling Setting	Description
DC	Raw voltage is recorded
AC	Removes weak ground voltage from the signal and zeros voltage at 0.0

17 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 Ground Reference for more information.

18 Connection Indicators

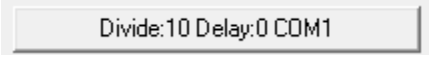


The Connection Status indicator lights will turn green when the server makes a successful connection to the DAQ board in the Analog to Digital interface box, and when the server makes a successful connection to SonarWiz 7. The status indicator lights will turn red if the connection has not been established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

19 DC Offset

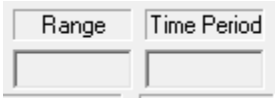
If your input signal contains a bias voltage (the Channel Monitor Average field) you may use the DC Offset control to add a positive or negative voltage to the digitized signal to center that signal about the 0 VDC level.

20 Divide Delay Triggering



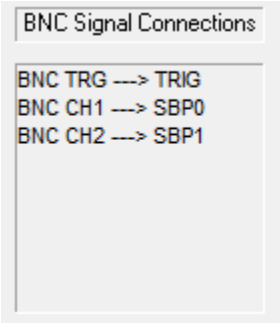
Chesapeake sells an optional hardware trigger delay and divider USB interface box that can be used to accept a master trigger input, optionally divide it down to a lower rate and also to optionally delay it. Use this button to configure open the Divide Delay Trigger Setup dialog.

21 Ping Range and Period



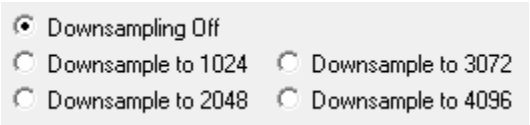
Ping range in meters and ping period in seconds.

22 BNC Connections



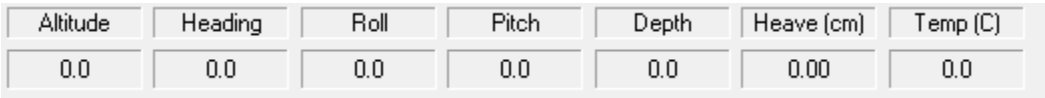
The BNC connections display updates based on the Board Selection Mode and Trigger Source settings. The display should assist you in properly connecting the BNC connectors to your hardware.

23 Downsample Controls



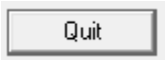
The downsample option provides a means of compressing long records. This function works by downsampling records that contain more than 4096 samples which at the current sampling frequency is just over 300m in length. The downsample option has no effect on records shorter than 300m. When the downsampling 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).

24 Telemetry Monitor



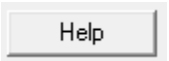
The **Telemetry Monitor** displays the parsed telemetry fields received via the Telemetry Input.

25 Quit



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

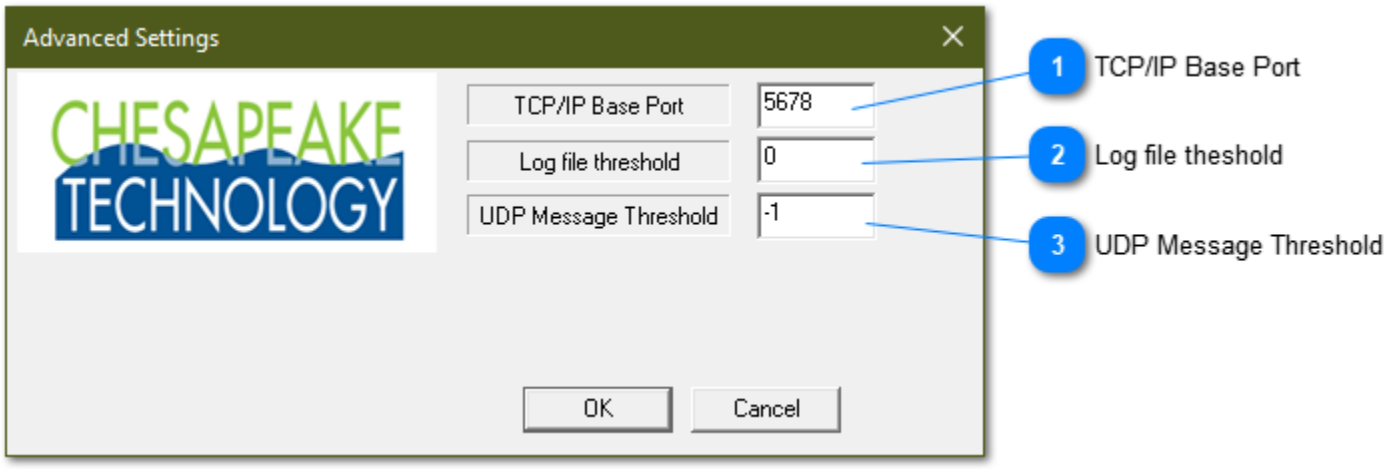
26 Help



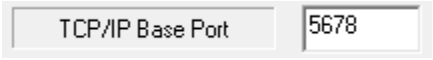
Open this document.

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.

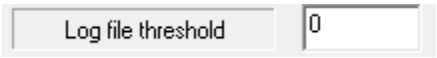


1 TCP/IP Base Port



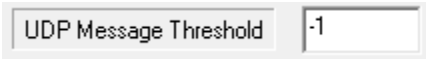
TCP/IP Base Port is where the real-time diagnostic messages are sent and viewed by SonarWiz. Please do not change the TCP-/IP Base Port address unless instructed to do so by a Chesapeake support engineer.

2 Log file theshold



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.

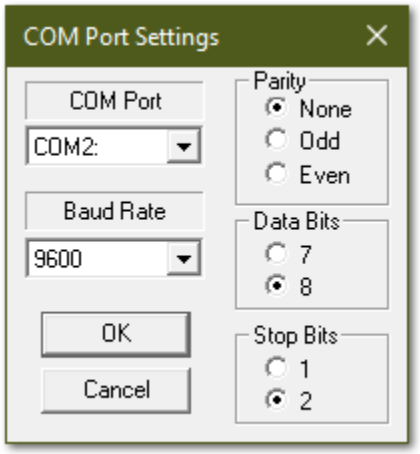
3 UDP Message Threshold



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.

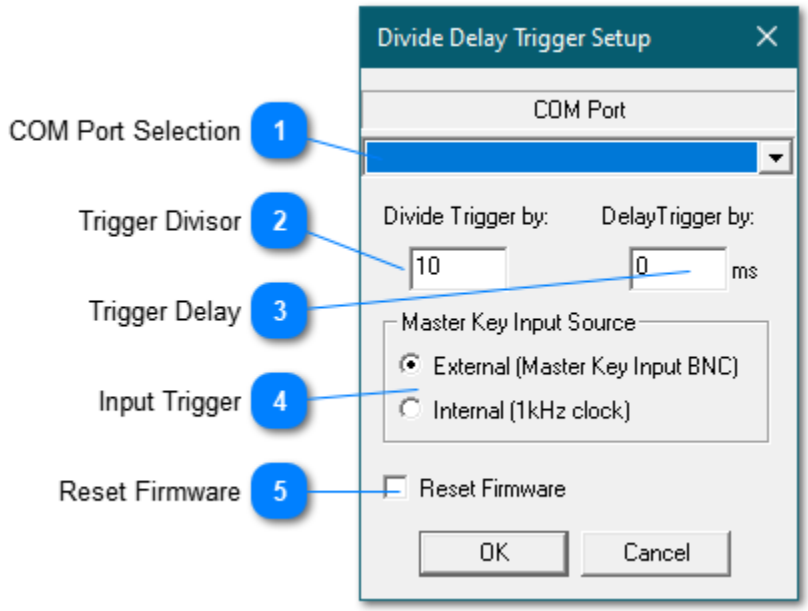
COM Port Settings

The Heave Input Control Button and Telemetry Input Control Button 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.

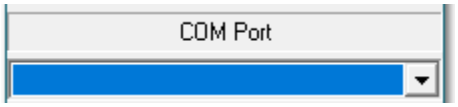


Divide Delay Trigger Setup

The Divide Delay Trigger Setup is used to control the CTI KDD box. The KDD box is used to control multiple-sonars 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 Key Divide and Delay (KDD) section.

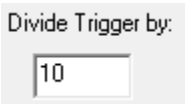


1 COM Port Selection



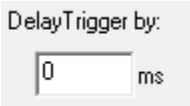
Select the COM port the KDD box is configured to use from the drop-down. The COM port selected needs to be available for use on the SonarWiz PC. It is managed by the NI Analog SB server after being selected, and the selected COM port displays in the KDD control button label, along with the current DIVIDE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

2 Trigger Divisor



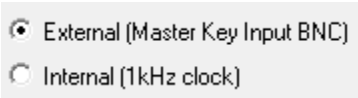
The DIVIDE number is a counter to define how many input pulses (triggers) are needed to create a single output pulse (trigger). For example, with a 10 Hz input trigger rate, and a DIVIDE setting of 4, 4 triggers are counted then a single output trigger is set on the DIVIDE output BNC. At 100 msec per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

3 Trigger Delay



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.

4 Input Trigger



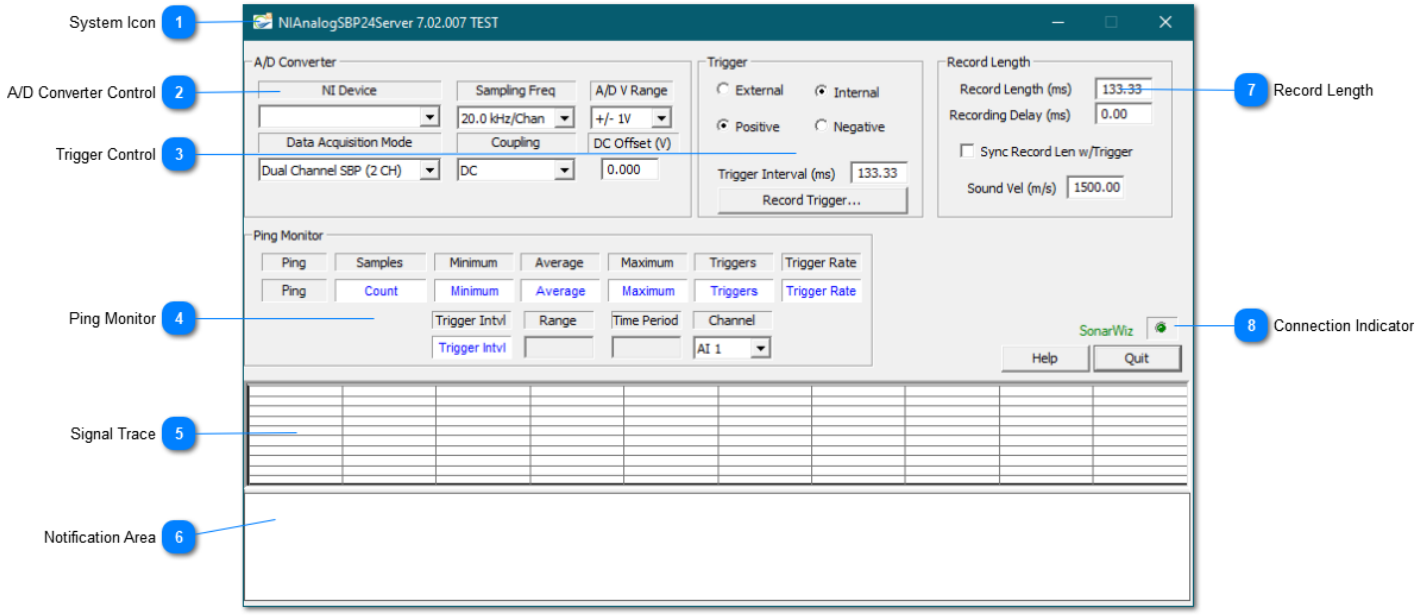
The **External / Internal** radio button control dialog allows you to select division from either an external trigger set in on the KEY in BNC (select **EXTERNAL** for this), or you can use the KDD as an trigger source itself, by selecting **Internal** as the radio-button choice.

5 Reset Firmware

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

NIAnalogSBP24Server

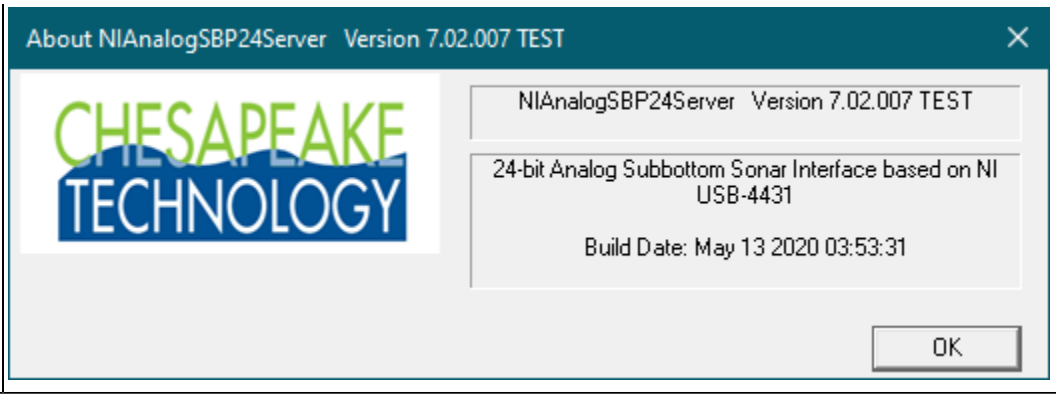
The SonarWiz 24-bit analog sub-bottom server (**NIAnalogSBP24Server**) is a small interface program that controls the National Instruments (NI) USB-4431 dynamic signal analysis (DSA) device. The combination of the USB-4431 and this dedicated software interface provides extremely high resolution sampling 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.



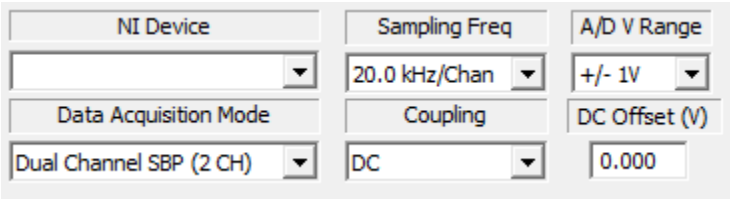
1 System Icon

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 Advanced Settings window
Rest Stats...	Rest the Ping Monitor Statistics
About NIAnalogSSSServer...	Shows the Analog Server version and build information panel:



2 A/D Converter Control

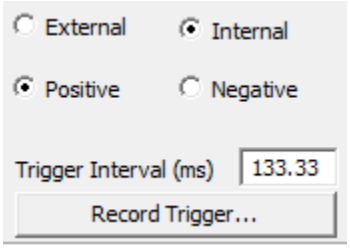


The A/D Converter Control section is used to control how the analog signal is digitized.

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.

3 Trigger Control

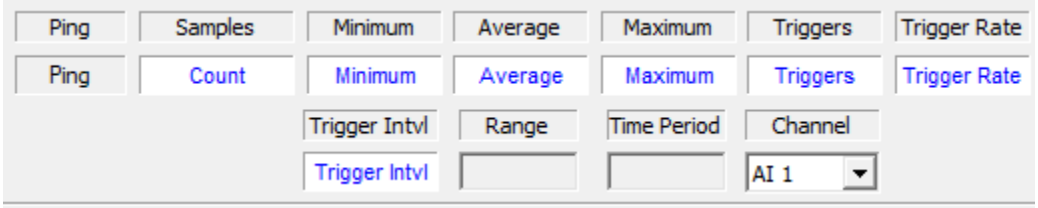


The trigger control section provides options for triggering the pulse

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:  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

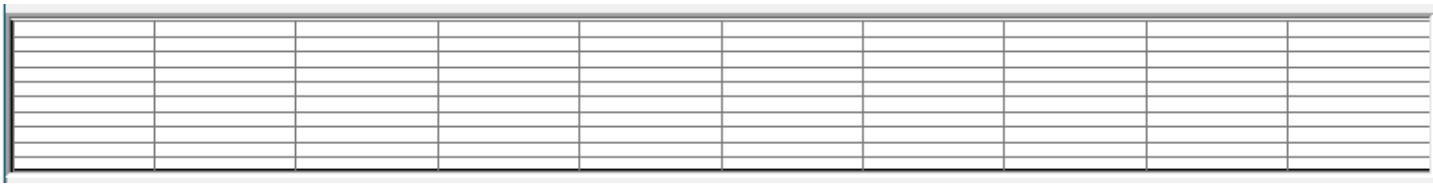
	the sum of the delay and the record length. BNC AO0 needs to be looped to connect to BNC AI0 to internal trigger.
Record Trigger...	This button will allow the server to record the trigger pulse to a file for diagnostic purposes.

4 Ping Monitor



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.

5 Signal Trace

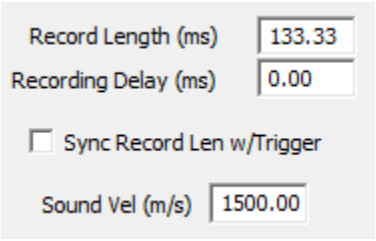


This simple graph displays an auto-scaled graphical representation of the input signal selected in the channel s down. The choices for channels to monitor are channel AI 1 or AI 2 which represents the SBP data signals app connectors labeled AI 1 and AI 2, respectively.

6 Notification Area

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

7 Record Length

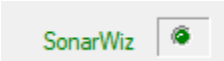


Record Length controls ping recording time

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.

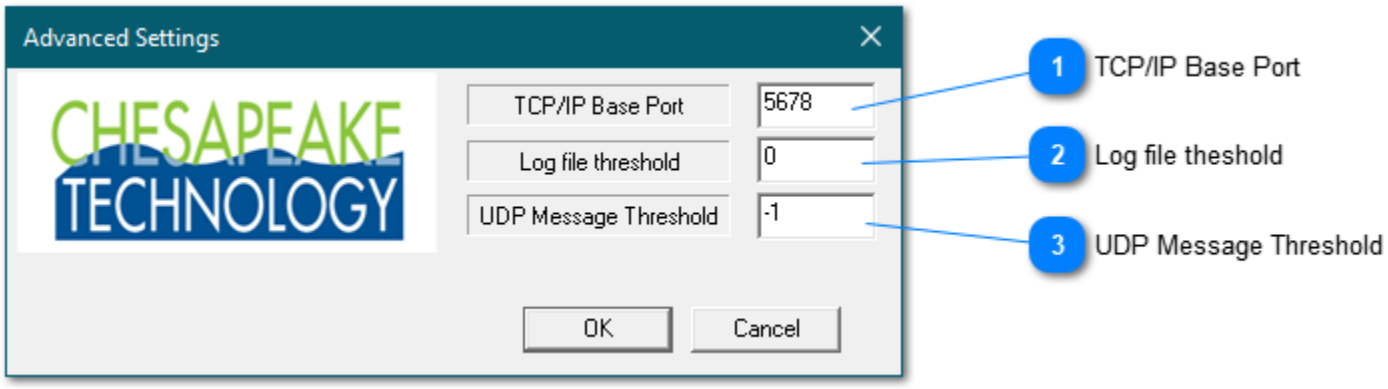
8 Connection Indicator



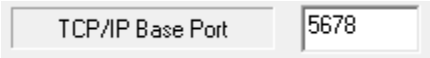
The Connection Status indicator lights will turn green when the server makes a successful connection to the DAQ board in the Analog to Digital interface box, and when the server makes a successful connection to SonarWiz 7. The status indicator lights will turn red if the connection has not been established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

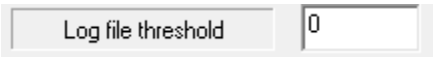


1 TCP/IP Base Port



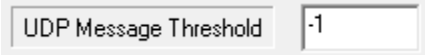
TCP/IP Base Port is where the real-time diagnostic messages are sent and viewed by SonarWiz. Please do not change the TCP-/IP Base Port address unless instructed to do so by a Chesapeake support engineer.

2 Log file theshold



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.

3 UDP Message Threshold

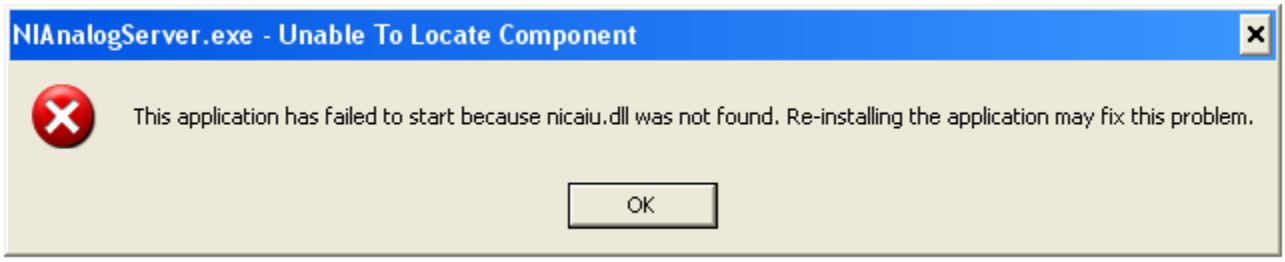


Control the level of detail broadcast over UDP. A value of 0 will only record error messages. A value of 9 will report all diagnostic messages.

Tips and Trouble Shooting

Nicaiu.dll was not found

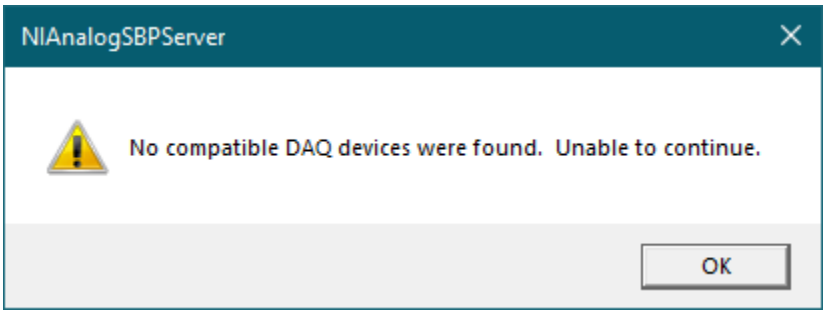
If the NI-DAQmx runtime has not been installed and you try to run the Analog Server, you will encounter an error message similar to this:



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:

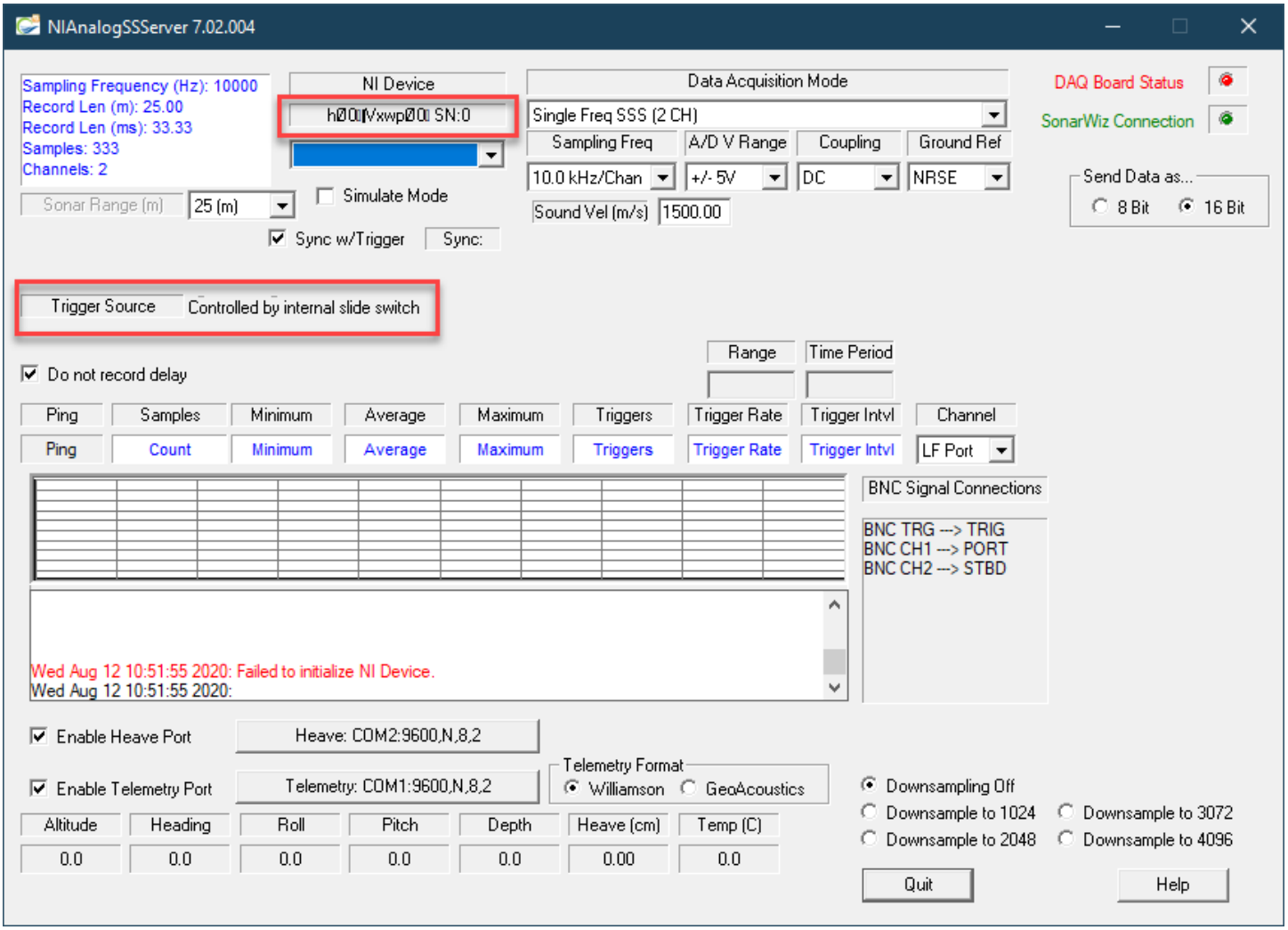


Verify that the USB connector is securly attached to the CTI 5-BNC box and PC USB ports.

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.



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