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Sounding Better!

Setting Up Analog Sub-bottom & Side Scan Systems in HYPACK® Using A NI-DAQ

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INTRODUCTION

Analog systems are still very common in sub-bottom profiling. All boomers, sparkers, airguns & bubble pulsers are analog systems. Analog side scan sonars are still made by Kongsberg GeoAcoustics and JW Fisher and, in addition to these, there are still a lot of older side scan analog systems such as EG&G 260, Klein 595 still in use. HYPACK® has supported the acquisition of analog side scan and sub-bottom profiling for many years using a variety of National Instruments digital acquisition (NI-DAQ) devices.

For analog acquisition HYPACK currently recommends the NI USB-6221 BNC DAQ (16-bit), but this product is nearing the end of its design life and a replacement will become necessary due the future availability of the NI USB-6221 BNC.

NEW NATIONAL INSTRUMENTS DEVICES

HYPACK has new recommendations for a USB 16-bit National Instruments digital acquisition device:

- USB-6341 with BNC connectors
- USB-6212 BNC (slightly cheaper)

See Table 1 for the basic technical specifications of the USB-6221, USB-6341 & USB-6212.

TABLE 1. NI-DAQ comparisons for HYPACK analog SBP & SSS.

PRODUCT	ANALOG INPUT				ANALOG OUTPUT		TIMERS/ COUNTERS	FIFO SIZE SAMPLES		SCAN LIST MEMORY	TRIGGERING	CONNECTIVITY *
	Max Num. Ch	Simul.	Sample Rate	Resolution	Num. Ch	Update Rate		Input	Output			
USB-6221 BNC	8 diff	No	250 kS/s	16 bits	2	833 kS/s	2	4,095	8,191 shared	4,095	Digital	BNC/ST
USB-6341	8 diff	No	500 kS/s	16 bits	2	900 kS/s	4	2,047/4,095	8,191 shared	4,095	Digital	BNC/ST
USB-6212 BNC	8 diff	No	400 kS/s	16 bits	2	250 kS/s	2	4,095	8,191 shared	4,095	Digital	BNC/ST

* ST = Screw Terminals | MT = Mass Termination | BNC = BNC Terminals

The NI USB-6210 is a much cheaper system, but it does not support internal triggering from HYPACK®. The NI USB-6210 can be used in HYPACK® with external trigger sources. The trigger source can be generated from the NI-DAQ software (Measurement & Automation Explorer).

INSTALLING THE NI-DAQ SOFTWARE

The NI-DAQ devices are supplied with controller software (NIDAQ951f1.exe). This needs to be installed and updated on the acquisition computer.

NOTE: The NI software installation can take an hour or more!

It is necessary to disable some of the unnecessary NI services as the NI driver installs ten services, most of which are started automatically. Only two (flagged in **RED**) are required for actually using the NI-DAQ device.

The services installed are as follows:

- Lookout Citadel Server
- NI Domain Service
- NI PSP Server Locator
- NI Time Synchronizing
- NI Variable Engine
- NI Configuration Manager
- ***NI DEVICE LOADER**
- ***NI PXI RESOURCE MANAGER**
- NI Service Locator
- NILM License Manager

IMPORTANT: Of these services, *only the two red highlighted services must be running* for the driver to work.

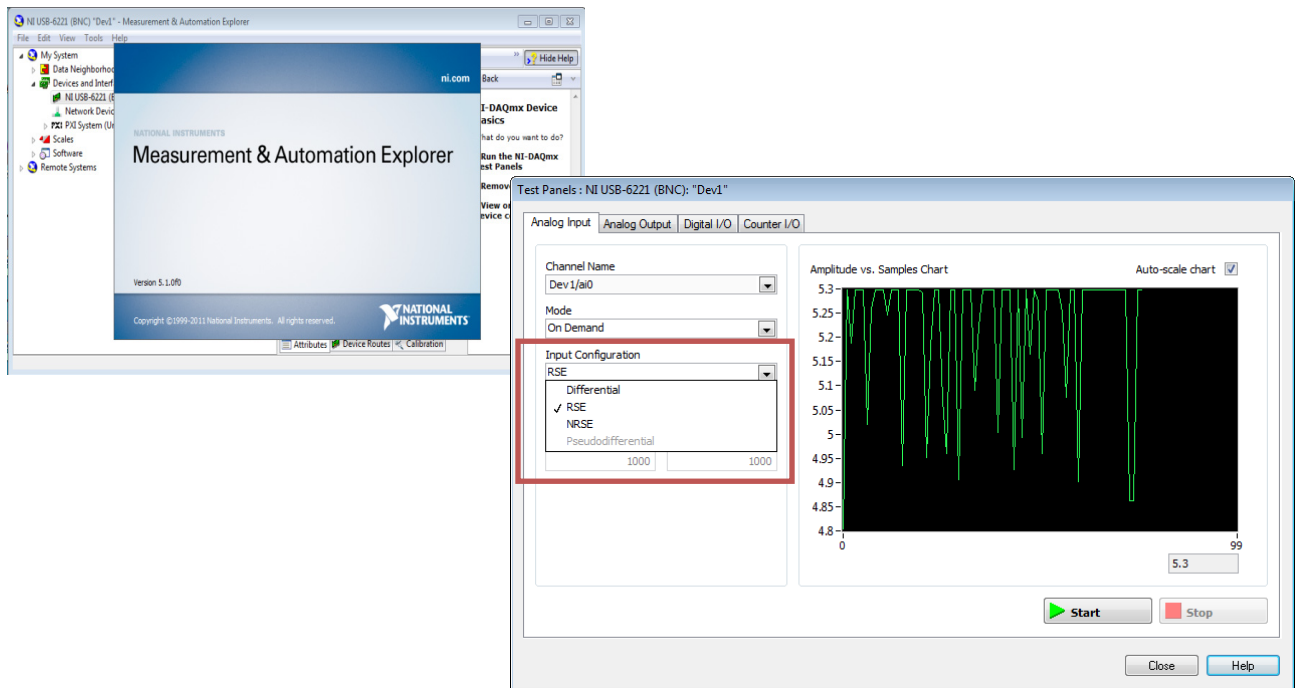
In the Windows® Control Panel, select Administrative Tools->Services and disable the unneeded services to avoid potential port conflicts with other devices.

Once the NI-DAQ software has been installed, connect NI-USB device a USB port on the computer and start the NI-DAQ software.

Select the relevant NI-DAQ you have installed and open the Test Panel.

Make sure the Input Configuration is set to RSE floating signal source (Reference Signal Ended - see Figure 1). The NI-DAQ software has to be installed on the computer, but does not have to be running for HYPACK® to work with the NI-DAQ.

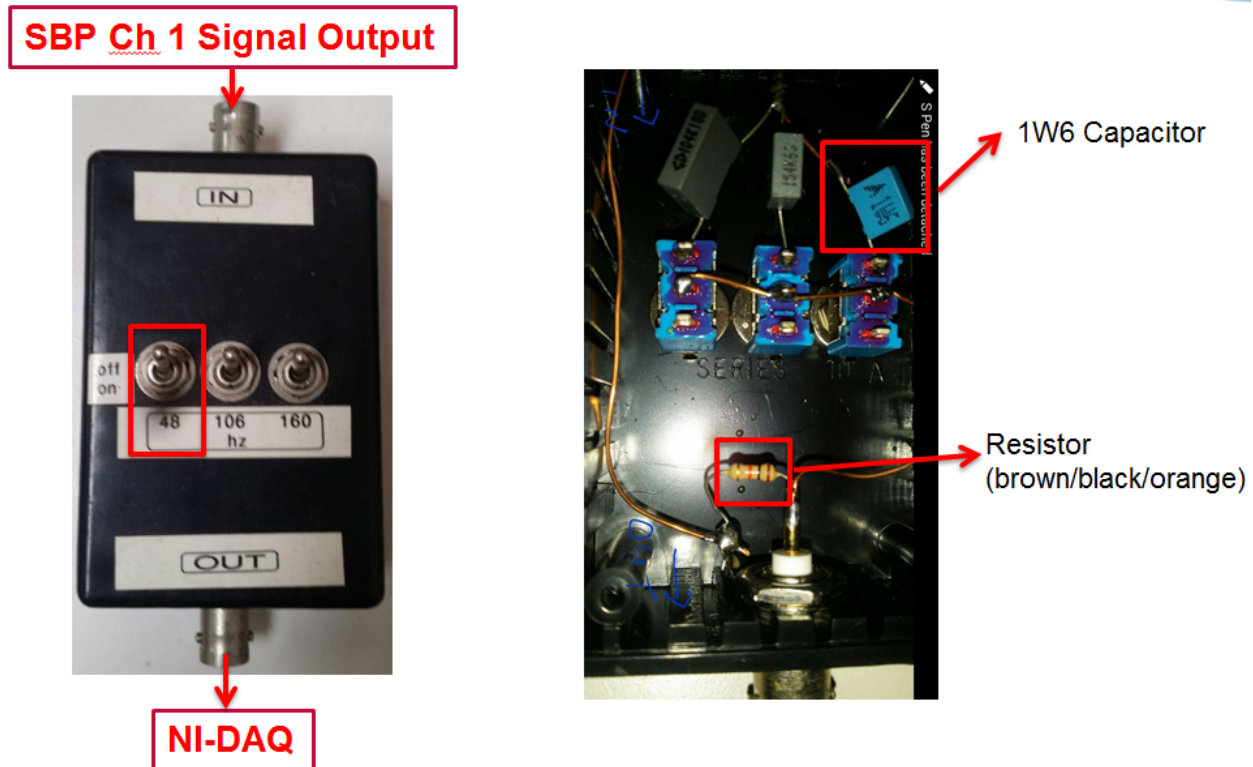
FIGURE 1. Start the NI software, select the NI-DAQ installed and go to Test Panel. Select RSE in the Input Configuration.



MAKING A PASSIVE HIGH-PASS FILTER

If one is using a towed hydrophone array to acquire sub-bottom profiling data, then an inline 48 Hz passive high-pass filter (PHPF) can be useful to remove the characteristic hydrostatic “swell” (wiggle) associated with towed hydrophone array. The filter is installed between the Signal Output from the sub-bottom profiler and the NI-DAQ analog input. The filter can be switched on or off using the toggle switch. Refer to Figure 2 to build a 48 Hz passive high-pass filter box.

FIGURE 2. *How to Build a 48 Hz PHPF.*



CONFIGURING & WIRING THE NI-DAQ

We will now see how to configure the NI-DAQ for a variety of sub-bottom profiling and side scan sonar surveys. HYPACK® has a single program, the Analog Monitor, which talks directly to the NI USB device and acts as an intermediary between it and the HYPACK® SURVEY drivers. All configuration of the NI USB device (I/O ports, voltage levels, etc.) is handled by the Analog Monitor; therefore, the HYPACK® drivers need very minimal setup themselves. By default, the first analog SBP (sub-bottom profiler) device is allocated to Channel 1, but for the second one the “Use Channel 2” option must be selected in the Analog (NI USB) Setup. The Analog Monitor is accessed from the Test Device button for the Sub-Bottom driver in HYPACK HARWARE or it will automatically start in SURVEY if an Analog device is chosen in the Sub-Bottom driver setup.

Most of the possible NI-DAQ acquisition configurations are covered below:

- Configuring a Single Channel SBP with an Internal Trigger
- Configuring a Single Channel SBP with an External Trigger
- Configuring Two Channels of SBP with an Internal Trigger
- Configuring Two Channels of SBP and Two Channels of SSS with an Internal Trigger

CONFIGURING A SINGLE CHANNEL SBP WITH AN INTERNAL TRIGGER

In this configuration the Analog Output 0 is sent to Analog Input 0. On Analog Input 0 there must be a BNC T so that the trigger can be sent to the SBP. Analog Input 1 is connected to the SBP signal output. Set the signal source to Floating Source (FS) *.

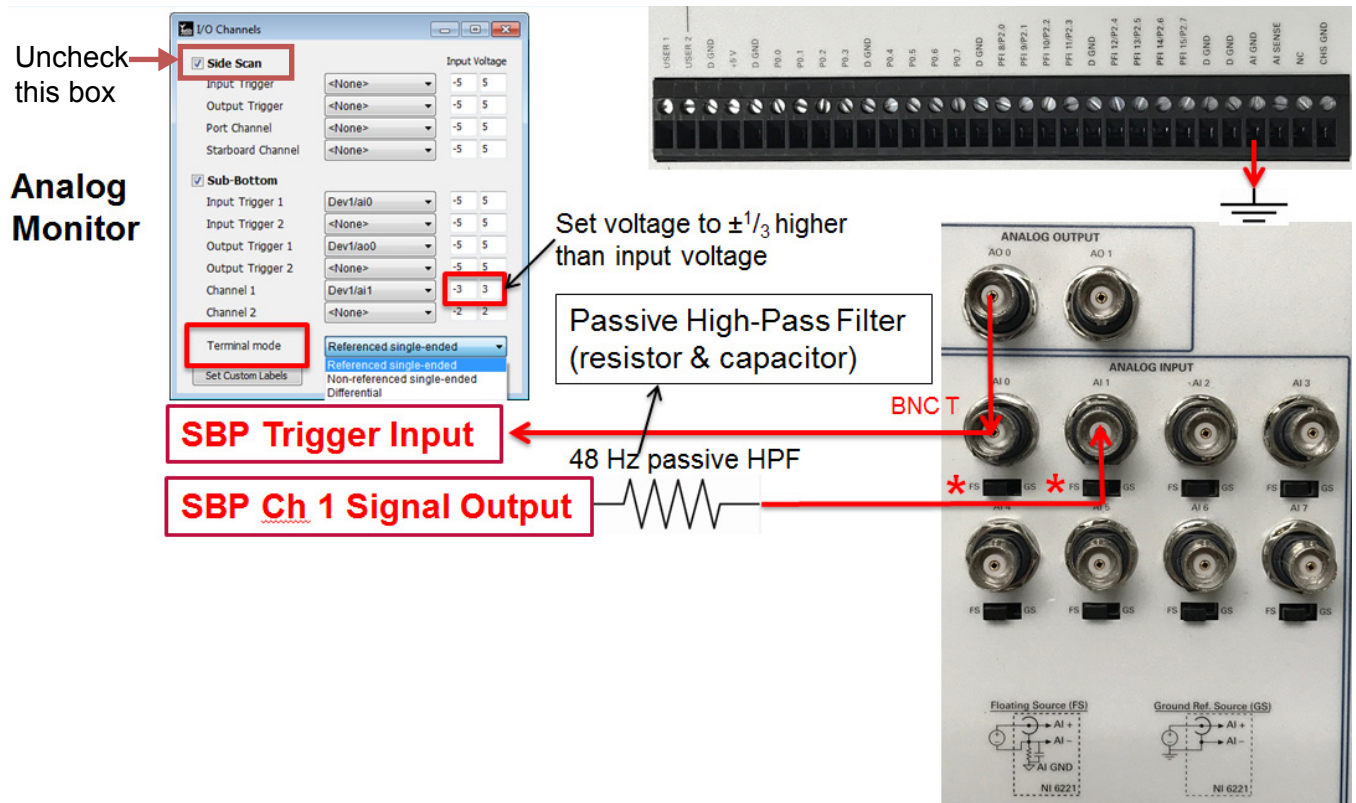
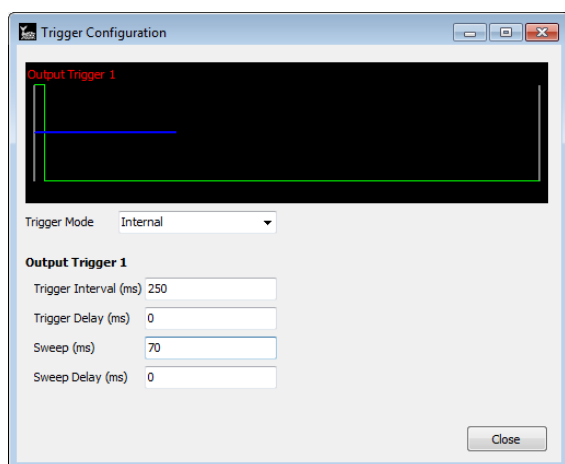


FIGURE 3. . Configuring a Single Channel SBP with an Internal Trigger.



In this example, a Pinger (Ch 1) is being used for the survey.

- Set the Trigger Mode to Internal.
- Set the Pinger trigger to 250 ms
- Set the sweep rate to 70 ms (52 m).

CONFIGURING A SINGLE CHANNEL SBP WITH AN EXTERNAL TRIGGER

In this configuration the Trigger from the SBP or external trigger box is sent to Analog Input 0. Analog Input 1 is connected to the SBP signal output. Set the signal source to Floating Source (FS) *.

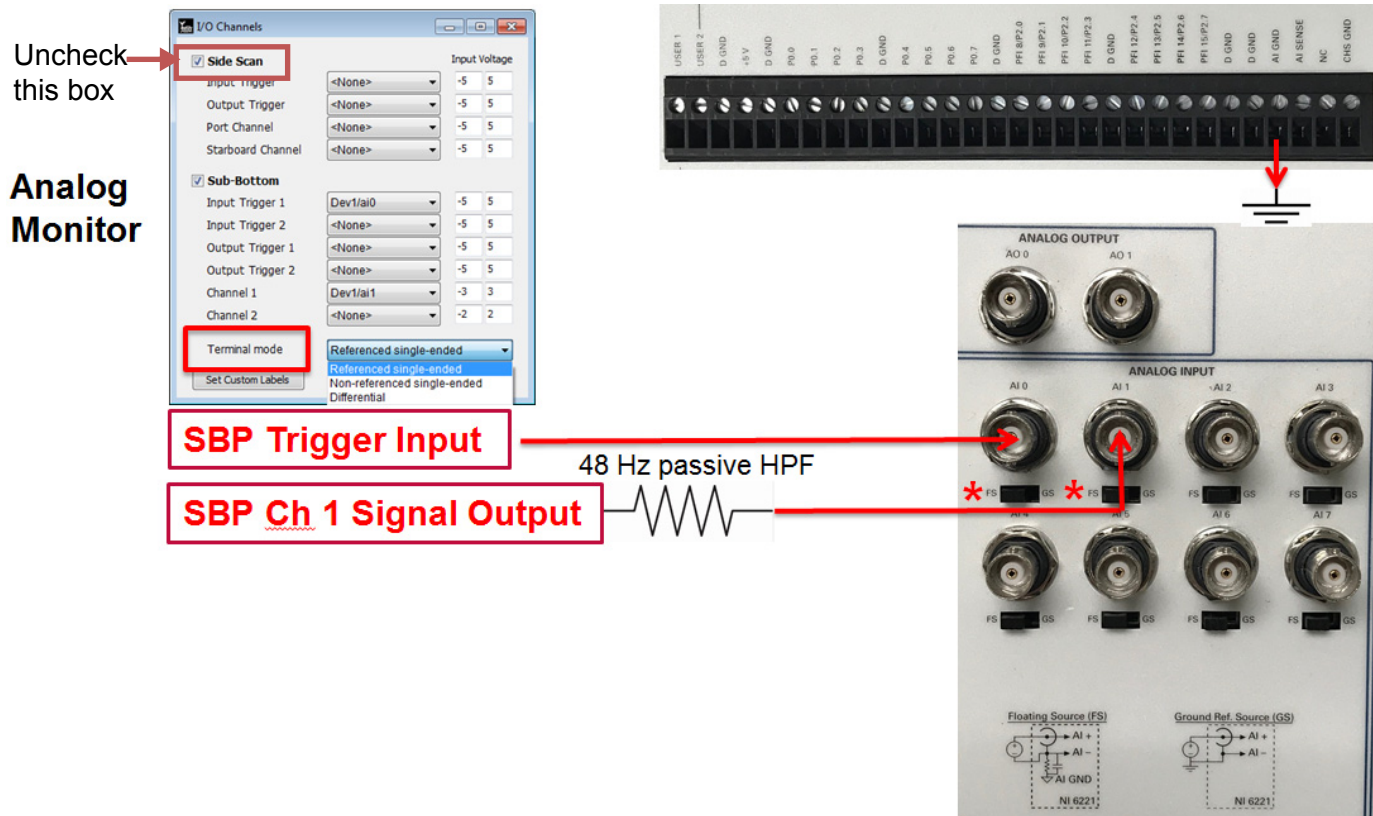
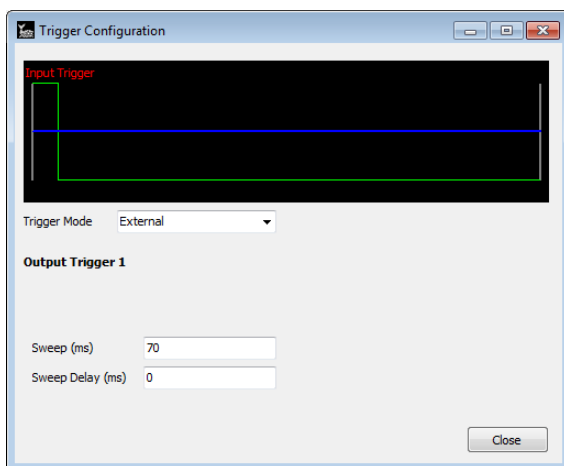


FIGURE 4. Configuring a Single Channel SBP with an External Trigger.



In this example a Pinger (Ch 1) is being used for the survey.

- Set the Trigger Mode to External.
- Set the Pinger trigger to 250 ms & the sweep rate to 70 ms (52 m).

CONFIGURING TWO CHANNELS OF SBP WITH AN INTERNAL TRIGGER

In this configuration the Analog Output 0 is sent to Analog Input 0. Analog Output 1 is sent to Analog Input 1. On Analog Input 0 & 1 there must be a BNC T so that the triggers can be sent to the two SBP systems. Analog Input 2 is connected to the SBP signal output Ch 1 & Analog Input 3 to Ch 2.

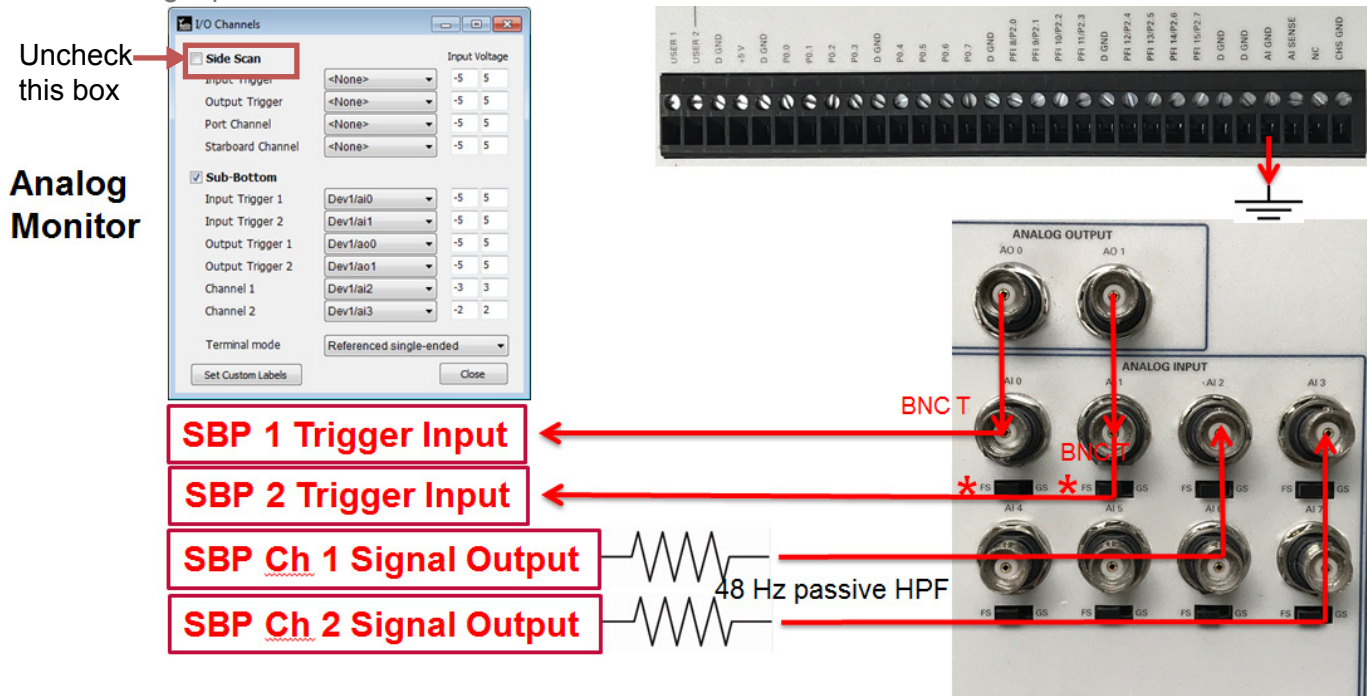
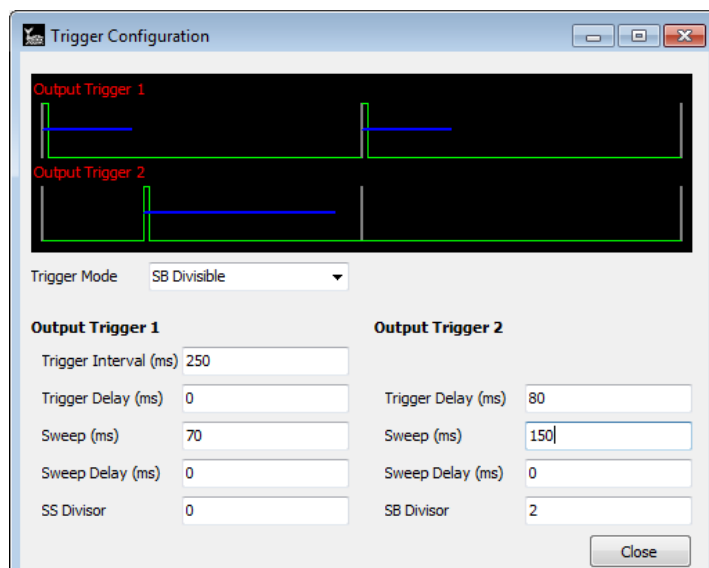


FIGURE 5. Configuring a Two Channel of SBP with an Internal Trigger.



In this example a Pinger (Ch 1) & Sparker (Ch 2) are being used for the survey.

- Set the Pinger trigger to 250 ms & the sweep rate to 70 ms (52 m).
- Divide the Trigger 1 (250 ms) by two to make Trigger 2 500 ms.
- Delay Trigger 2 by 80 ms so there is no interference with the Pinger (Ch1).
- Set the Sparker (Ch 2) sweep rate to 150 ms (112 m) for no interference with the Pinger (Ch1).

CONFIGURING TWO CHANNELS OF SBP & TWO CHANNELS OF SSS WITH AN INTERNAL TRIGGER

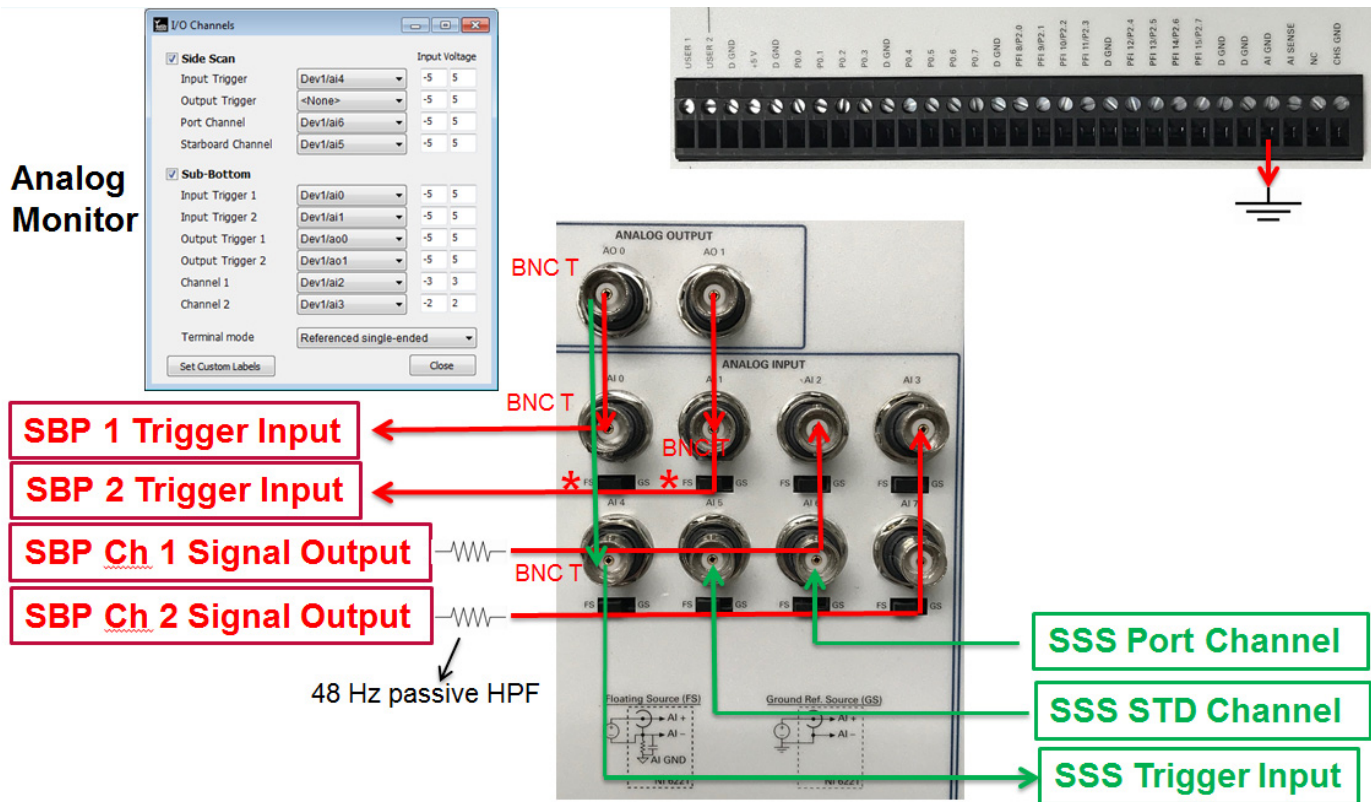
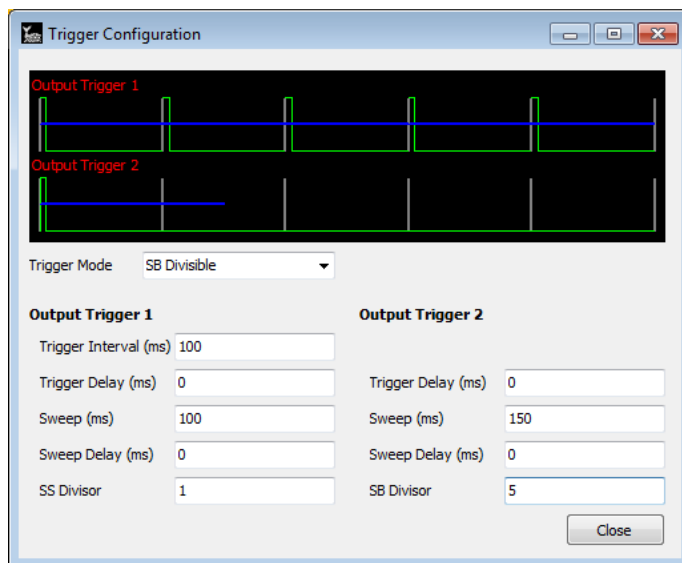


FIGURE 6. Configuring a Two Channel of SBP & Two Channels of SSS with an Internal Trigger.



In this example a SSS, Pinger (Ch 1) & Sparker (Ch 2) are being used for the survey.

- Set the SSS & Pinger trigger to 100 ms & the sweep rate to 100 ms (75 m).
- Divide the Trigger 1 (100 ms) by five to make Trigger 2 500 ms.
- Trigger delay will not help with interference between the systems.
- Set the Sparker (Ch 2) sweep rate to 150 ms (112 m).

CONCLUSION

These guidelines should enable you to setup and configure a NI-DAQ for analog sub-bottom profiling and/or analog side scan acquisition. Please refer to the HYPACK *Sounding Better!* articles in [March](#) & [May](#) 2017 for further tips on sub-bottom profiling.