Single Beam Latency Calibration in HYPACK

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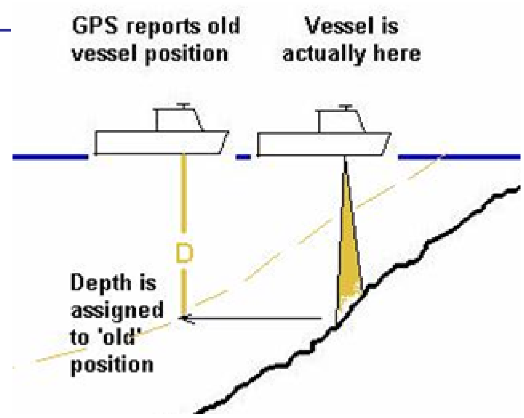
While the HYPACK® LATENCY TEST program is pretty easy for the single beam surveyor to use, there always seems to be quite a bit of confusion as to how a latency value is derived and how to enter it during hardware setup or post-processing.

In short, latency is the time from when a piece of equipment computes a value until it is actually transmitted to your computer. This was most evident in older GPS receivers (see Figure 1), but as technology improves you see smaller and smaller latency values.

FIGURE 1. GPS Latency



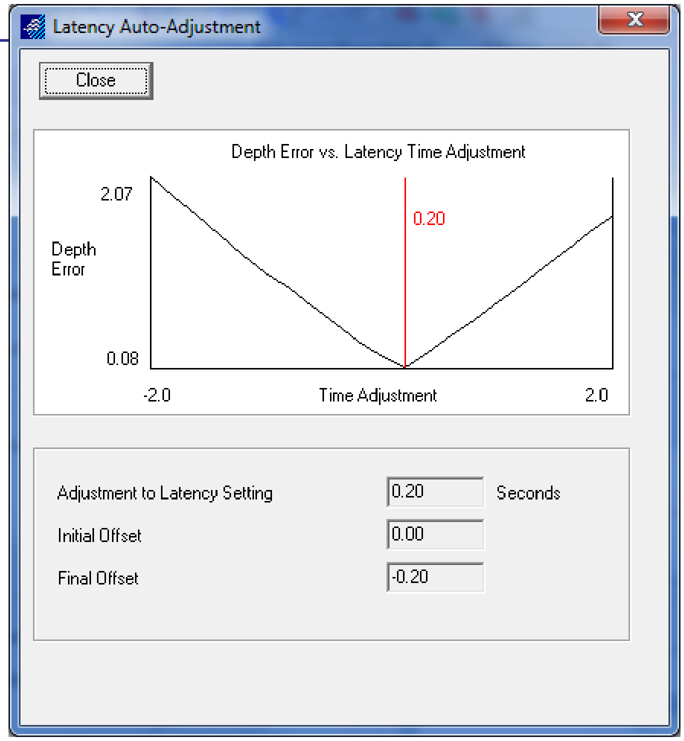
To run a latency test, you need to run reciprocal lines perpendicular to a slope or some sort of feature. Once you overlay these profiles, you can determine if there is a latency issue by how well these profiles line up. If your profiles look like Figure 2, where they don't line up, you have a latency issue.

FIGURE 2. Sample LATENCY TEST

What is my Latency Value?

Although the LATENCY TEST program is thoroughly described in the manual, there is always confusion as what the latency value actually is! Look at Figure 3:

FIGURE 3. Latency Test Results



- **Adjustment To Latency** setting is the time applied in order to calculate the correct latency value.
- **Initial Offset** is the value that was initially entered in HYPACK Hardware (This offset is stored in the header of the *.raw file).
- **Final Offset** is simply the adjustment value subtracted from the initial offset. The FINAL OFFSET value (-0.20) is the latency value we are interested in.

What do I do with this value?

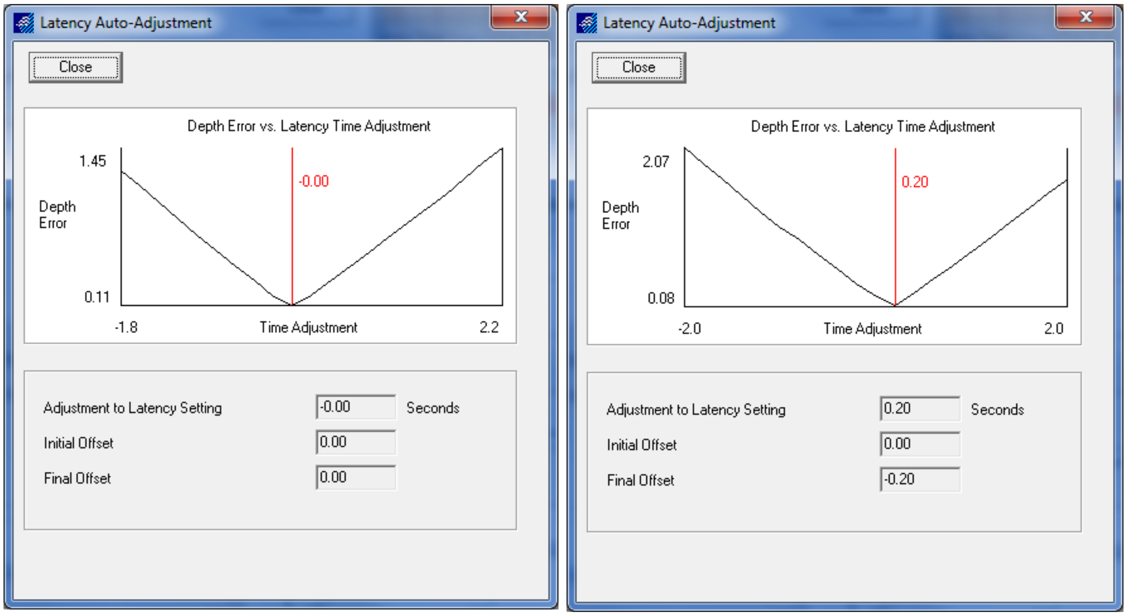
This value should be entered in HYPACK® HARDWARE or in the SINGLE BEAM EDITOR (SBMax). Remember that the latency is a combined latency between the GPS and the echosounder, and should ALWAYS be entered in the GPS device offsets section of either program. If the latency value was entered in HYPACK® HARDWARE, it will automatically populate the SBMax Read Parameters with the same value.

Why do I get this value?

That is the toughest question lately, because there are so many variables that can affect the final result. For example, as I mentioned earlier, newer GPS receivers should have really low latency values, and when using ZDA or PPS time synchronization the latency value should be close to nil. Notice that I said “close”! Here are a couple examples:

- **Example 1 –** The customer had 2 different receivers on board. Both latency tests produced a nice “V” shaped graph as shown below:

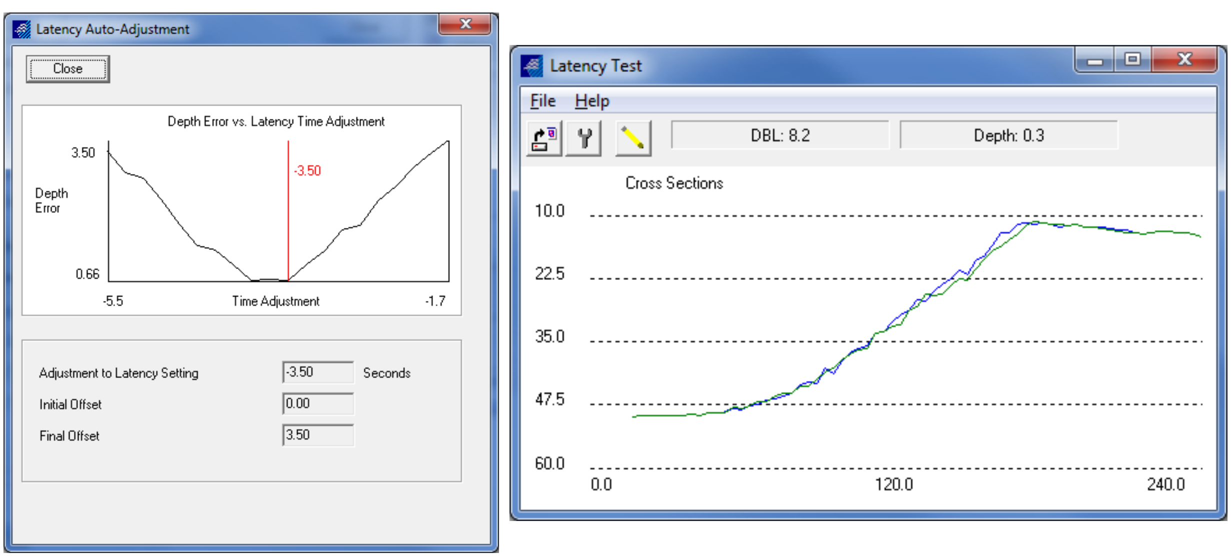
FIGURE 4. Beware of Negative Final Offset Values



Both graphs really pinpoint the depth error vs time adjustment, but the second graph shows a FINAL OFFSET of -0.20 seconds! Either the GPS is "predicting" its position or perhaps a horizontal offset was not entered in the driver setup.

- **Example 2 –** This customer had a newer model GPS receiver. The latency value calculated was a -3.5 seconds! Quite a high value for a new GPS, and also the latency value should be a positive value. In this example either the GPS is either "predicting" its position, or there is a huge latency in the sounder (See Figure 5). Besides the surveyor was synching the PC to ZDA so theoretically the latency should be close to nil.

FIGURE 5. Probable Large Sounder Latency

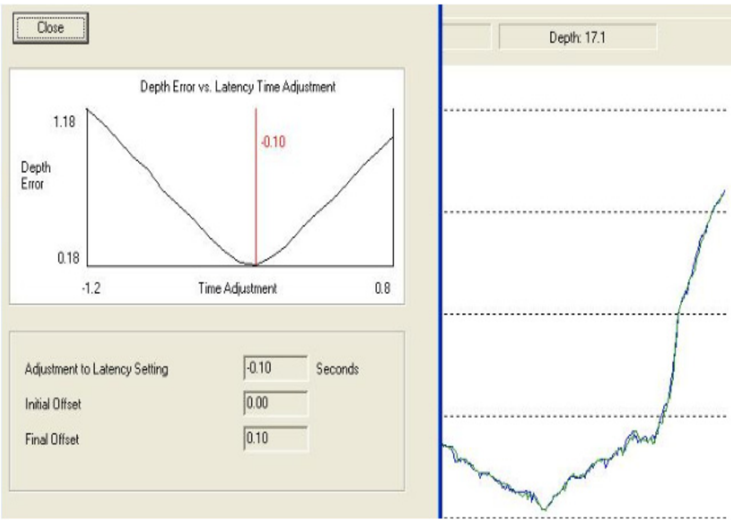


Notice the slope appears to line up pretty nicely in the profile, but look at the graph. A good latency test should display a well-defined "V" shape in the graph display.

We spent a couple days trying to duplicate and troubleshoot the problem and could really find nothing at fault. The customer finally switched computers and the bogus latency magically disappeared.

- **Example 3 –** This customer had a 1PPS Box hooked up to a brand new DGPS. Again, theoretically the latency value should be zero, but the value came out to be 0.10 seconds as shown here:

FIGURE 6. *DGPS LATENCY TEST*



Notice that the "V" shape is not as well –defined as the first example. Notice that the profiles overlay on the slope pretty well, but it does not appear to be well defined along the bottom. I would attribute this to the DGPS positioning. Differential GPS is probably good within a couple feet, so that could very well introduce some "slop" during the test.

Conclusion:

Many factors are going to affect the outcome of your latency test, as you can see with some of these examples. GPS position quality, offsets, survey conditions, offline distance and even computer ports can influence your results. (By the way, friends DO NOT let friends use USB to serial adapters – NEVER USE THEM!!).

Also, don't base your latency value on one test! Run as many lines as possible and take an average. Run your lines as close to the planned line as you can and really scrutinize those graphs and profiles!