Do I Need a 1PPS Box for my Multibeam System?

By Mike Kalmbach

We get this question a quite lot. Often the answer is yes or no, without a satisfying explanation. Most people are OK with that. (I'm a surveyor!) Others like to know why.

The Short Answers:

- **Short answer (1):** When in doubt, use the 1PPS box! It may or may not be required, but there's no harm in using the 1PPS box even when it's unnecessary.
- **Short answer (2):** Contradicts answer 1. Multibeam configurations using a network do not require 1PPS. Almost always, but there are exceptions.
- **Short answer (3):** If MRU data is received over the network, there's no need for a 1PPS. The POS/MV, F180 and some multibeam network drivers use this method. Unless … if you include devices in your configuration not normally associated with multibeam survey, you *will* need the 1PPS. (For example, a single beam echosounder.)

The long answer follows. It gets pretty detailed. You may see why the short answers are often preferred.

1PPS Introduction

1PPS stands for "One Pulse Per Second". The GPS device pulses an output line once a second. Simple enough. The time at which the pulse occurs is the important thing. It occurs *exactly* at every UTC second tick. Given the 1PPS and additional information on *which* second (from COM port or network), HYPACK® is able to run an internal clock that mirrors UTC time with accuracy of better than one millisecond. The internal clock is called Veritime.

Veritime also works without 1PPS. In this case, time is synchronized only to COM or network messages. Accuracy is not nearly as good – perhaps +/- 10 milliseconds.

This is what 1PPS does for HYPACK®. It provides a clock synchronized to UTC time with accuracy of better than one millisecond. This is good enough to correlate multibeam data with motion (pitch, roll and heave) data.

One might now ask, "Why do I need a special HYPACK® 1PPS box when the GPS provides the pulse?" Good question! The answer is that the GPS pulse may be too short for us to read. The 1PPS box converts the pulse to a toggle - the line changes state (low to high or high to low) every second, eliminating the problem of the short pulse.

Veritime Clock vs. Computer Clock

When Veritime is used, the computer clock is set to Veritime. When you see things like "Synchronize the Computer Clock" in HYPACK® HARDWARE, it means synchronizing Veritime as well.

Regardless of 1PPS or not, the computer clock should *always* be synchronized for multibeam!

DO I NEED A 1PPS BOX?

Now that we know what the 1PPS box does, we get on with the original question - do I need one? To answer, it's necessary to identify all of your input devices--Multibeam, motion, heading, position and other-- and the *time source* of each. Then a decision can be made.

- **If all device data comes in with UTC time tags**, a 1PPS box is not needed. This is the typical case where Hypack gets all time tags from the devices.
- **If some device data comes in with UTC time tags, and some without**, a 1PPS box is needed. This is sometimes the case.
- **If none of the device data has UTC time tags,** a 1PPS box is not needed. Uncommon.

That's easy! Now lets identify the time source of common input devices. See which provide UTC time and which do not.

Position Devices:

If the HYPACK® HARDWARE setup synchronizes the computer clock (Veritime), position time tags are UTC. Otherwise, they are not. Because we always synchronize the clock in multibeam configuration, *positions will always come with UTC time tags*.

Heading Devices:

Devices transmitting NMEA-0183 heading messages are not UTC time tagged. Devices transmitting network messages are.

TABLE 1. *Time tagging for some common heading devices*

Device Message	UTC Time Tags
NMEA-0183 (COM Port)	No
POS/MV and F180 network messages.	Yes
Heading messages passed through the multibeam	Yes

MRU Devices:

Devices transmitting TSS1 heave, pitch and roll messages are not UTC time tagged. Devices transmitting network messages are.

TABLE 2. *Time tagging for some common motion reference units.*

Device Message	
TSS1 (COM Port)	No
POS/MV and F180 network messages	Yes
MRU messages passed through the multibeam	Yes

Multibeam Devices:

Rule of thumb: If data is received over the network, the data contains a UTC time tag. If received over a COM port it does not.

Note: There are no modern, survey quality multibeam systems without the network interface.

Other Devices:

It's safe to assume other devices will not provide data with UTC time tags.

SUMMARY:

- It never hurts to use the 1PPS box with HYPACK®.
- It's usually not necessary for multibeam configurations.
- The guideline for using 1PPS or not depends on time tags.
- Answers to some specific questions will tell you if the 1PPS box is required with your system.