SYNERGY SYSTEMS, LLC

Specializing in the quality and power of Motorola ONCORE GPS products

START UP TIMES FOR VP RECEIVERS

At first glance, it probably seems a little strange for me to be writing an application note for the Motorola VP Oncore™ series of GPS receivers fully six months after they were phased out due to parts procurement problems, but I am getting enough calls, emails, and receivers returned due to extended Time To First Fix (TTFF) to warrant a quick note.

HISTORY - One result of the impending phase out is that Synergy Systems purchased quantities of VP receivers from other Motorola distributors world-wide in order to support our customers for as long as possible. These receivers included 6 channel B1's and 8 channel B3's/B8's. Some of these receivers have been in distributor stock for up to five years after the original date of manufacture. The receivers themselves are in perfect condition, but what can cause problems with many of them is aging of the oscillator components.

Unlike the newer GT+, UT+, and M12 receivers, the VP used a "pendulum oscillator" that was much more complicated to stabilize than the newer units. During the board manufacturing process the oscillator on every board is characterized, and the appropriate oscillator characteristics are stored in EEPROM. The next time the board is powered on (usually by you) the oscillator characteristics are downloaded from EEPROM during initialization and used to set the oscillator output frequency.

THE REAL WORLD – OK, that sounds great. What's the problem? Well, normally this all works fine, but what can slow things down is if the receiver has been sitting around for a while in an un - powered state. In this case, when the receiver is powered up, the stored oscillator characteristics are all wrong, the receiver runs off frequency, and as a result it cannot acquire satell ites.

This will continue for some time (an hour or more in some cases) as the receiver tries to lock onto satellite carriers: searching for SVs, adjusting oscillator frequency, etc. Finally, the receiver hits on the right combination and BANG, things return to normal.

This is best illustrated with the following graph. This graph shows the start-up progression of an old 6 channel VP that has been sitting in a box since 1995. The receiver was initialized using our SynTAC control program, which initialized the receiver and loaded in correct time and position at time "0". Note that the receiver variously tracks 0, 1, 2, or 3 SVs for approximately 5000 seconds (over an hour and twenty minutes!) without ever acquiring a fix. We do get three SVs a couple of times at around the 3300 second mark, but the Dilution of Precision (DOP) never gets low enough for the receiver to declare a valid 2D fix.

Note also that the "SVs Visible" trace goes from 0 to 7 at about the 3400 second mark, indicating that a valid almanac has been successfully downloaded. Well, you say, this simply cannot be. It only takes 15 minutes or so to download an almanac. Well, yes, and no. What the graph does not show is that during the time that the receiver was trying to download the almanac, satellites were being acquired and lost with great regularity. Maybe a page of the almanac got through here or there, but it took almost an hour for the entire almanac to be successfully transferred.

Things get even stranger when we look at the period between 3400 and 5000 seconds. Here we have a receiver with time, position, AND a valid almanac, and it still takes almost another half

hour before it starts tracking satellites properly and delivers a valid 3D fix. Note that at the 5000 second mark the number of tracked SVs jumps from 2, to 5, to 6, in a matter of a few seconds. Guess what? The receiver has finally discovered the magic combination of oscillator parameters.

At this point the receiver can be considered "cured", and will operate in a more normal manner. Even so, I usually let the receiver remain powered up for at least another half hour to allow the new oscillator characteristics to be transferred to EEPROM. This is accomplished as a background task by the microprocessor, and as such can take some time. If you disconnect power before this task is complete, you might just get to go through the whole process over again.

Old VP Cold Start
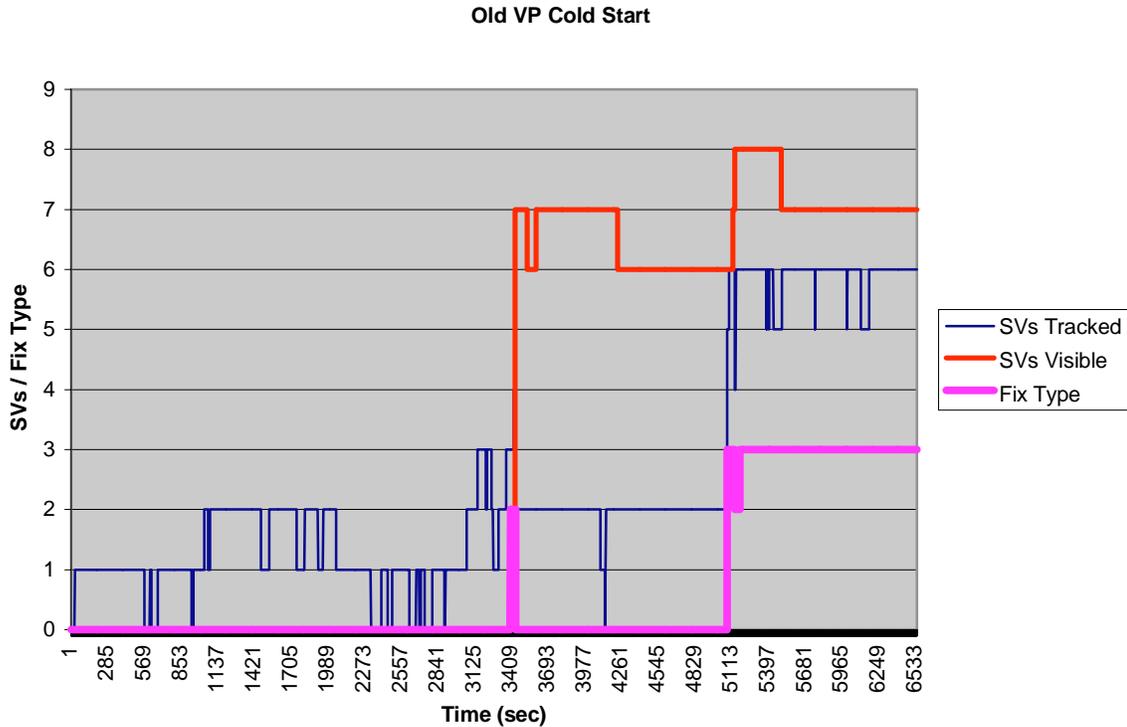
That's about it. Bear in mind that your receiver does not need to be five years old in order for this problem to occur. It all depends upon the oscillator aging characteristics of the specific receiver. This could conceivably happen to a brand new B8 that has been sitting in your stock room for as little as six months. Just don't give up on it too soon. Once things have been recalibrated the start-up times will return to normal.

Randy Warner
Senior Applications Engineer
Synergy Systems, LLC
randy@synergy-gps.com