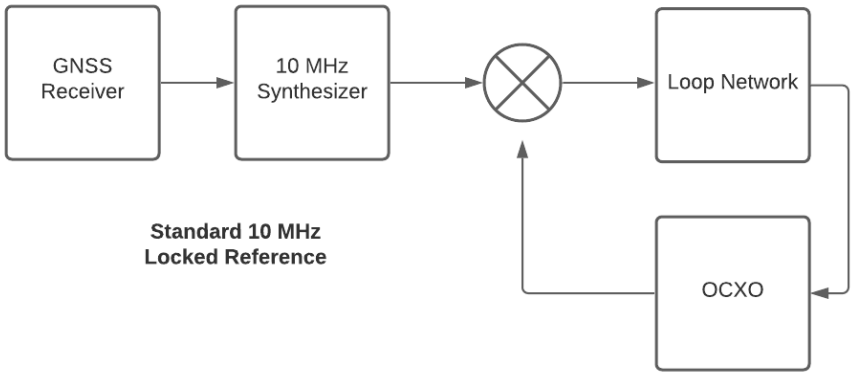
# Novus Stability Options

As a result of years of research, Novus offers several stability options for many of the standard platforms. Each of the various options addresses a range of variables that compromise reference performance- receiver characteristics, power conditioning, timing resolution, vibration, etc. Addressing these environmental factors involves cost and we have developed the following stability performance options that are available on our various platforms. Not all stability options are available on all products – contact the factory to assist.

HS0 Analog Loop
HS1 Digital loop using basic radio
HS2 Digital loop, basic radio, adding picosecond timing
HS3 Digital loop, Gaussian radio, picosecond timing and thermal stabilization, Allan Deviation

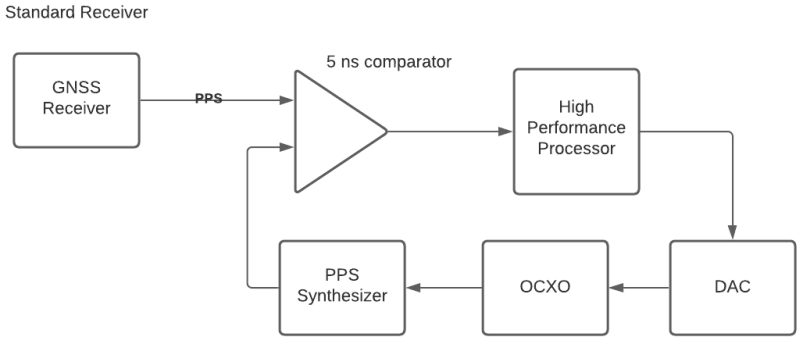
| Method | Option | GNSS Locked PLL | Pulse Stabilization | Temperature Control | Vibration Isolation | ADEV (1s) | ADEV (100s) | ADEV (1ks) | ADEV(100ks) |
|---|---|---|---|---|---|---|---|---|---|
| Analog Loop PLL | HSO | ✔ | | | | 3.00E-10 | 5.00E-10 | 8.00E-12 | |
| Digital Loop PLL | HS1 | ✔ | | | | 3.00E-12 | 2.00E-11 | 5.00E-12 | 5.00E-12 |
| | HS2 | ✔ | ✔ | | Option | 3.00E-12 | 1.00E-11 | 4.00E-12 | 9.00E-13 |
| | HS3 | ✔ | ✔ | ✔ | Option | 3.00E-12 | 7.00E-12 | 4.00E-12 | 7.00E-14 |

**HS0- Analog Loop:**
In the case of a basic reference, which is acceptable for many applications, the OCXO is controlled using a loop as indicated below:



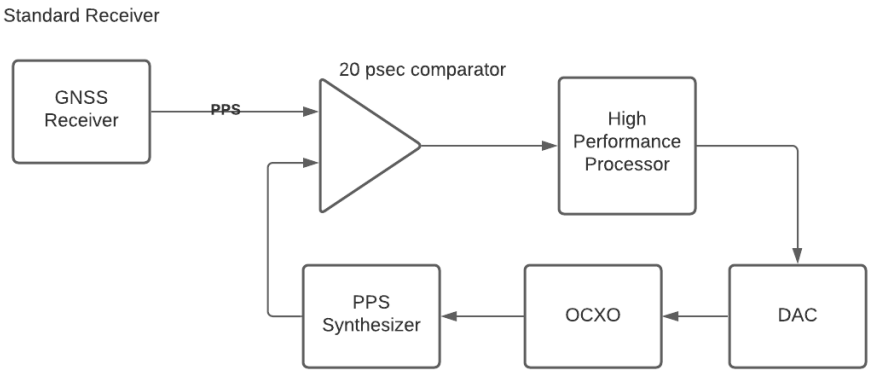

The standard loop does an outstanding job of controlling an OCXO. Components such as GaAs mixers provide excellent phase measurement performance, but close-in phase noise is difficult due to the size of the filtering components required and attendant leakage currents which are limited by the mixer drive currents.

**HS1- Digital Loop**



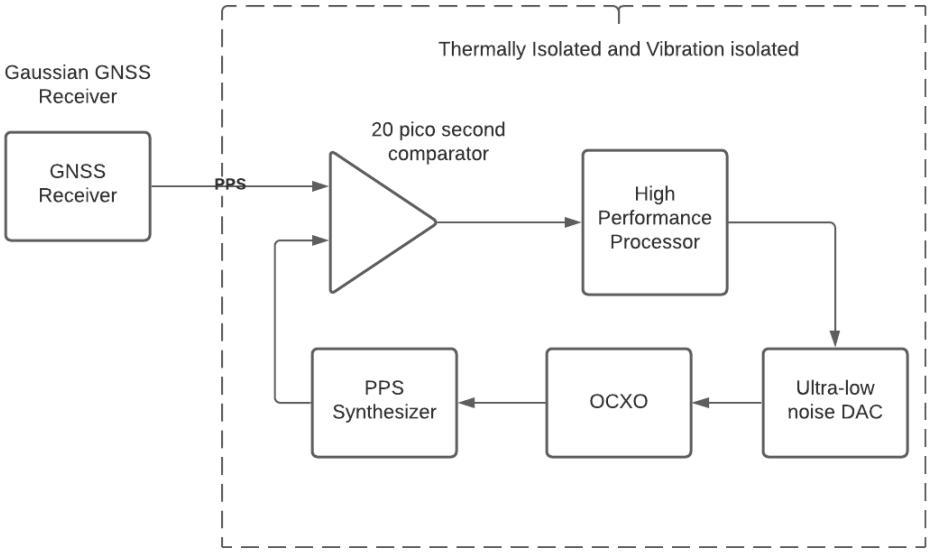

The basic digital loop moves from the analog loop by controlling the OCXO with a processor rather than conventional analog components such as mixers and complex networks. By using a microprocessor, much longer time constants can be used, and they can also be adaptive. This configuration offers improved Allan Deviation and improved close in phase over the analog loop.

**HS2 – Improved Pulse Stabilization:**




This implementation of a digital control loop advances the resolution of the control loop from 5 ns to 20 psec. This further improves Allan Deviation and close-in phase noise. PPS pulse-to-pulse jitter is also reduced.

**HS3- Advanced Stabilization**




This is our most advanced control loop. It features picosecond resolution, a GNSS receiver with a capability of over 50 channels, ultra-low noise DAC. The entire control electronics assembly is thermally isolated and held at a fixed temperature. This assembly may also be vibration-isolated as an option. The vibration isolation attenuates shock and vibration from other equipment such as fans.