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Precision Test Systems

GPS10e5: GPS Disciplined Frequency Standard

Key Features

- **LCD Display and Keyboard**
- **10 MHz Sine & Square Outputs**
- **1 pps Output aligned to UTC**
- **All outputs locked to GNSS / GPS Satellites**
- **Accuracy to parts in 10^{-12} (1 week)**
- **Never needs calibration**
- **19" Rack Mount Case or bench mount**
- **Supplied with small GNSS antenna**
- **Low Price and High-Quality Construction**
- **1, 5 or 10 sinewave outputs**
- **Locking to GPS, external 1 pps or 10 MHz**
- **GPS, GLONASS, Galileo or Beidou systems**
- **Free windows software included**
- **USB and Ethernet ports as standard**
- **Many Options Available**

General Description

The GPS10e5 is a low cost 10 MHz, GNSS disciplined, frequency standard. It is supplied in a 19" rack mount case or a bench mount unit. The GPS10e5 uses the Global Navigate Satellite System (GNSS) to discipline an OXCO crystal oscillator. Long-term frequency accuracy of parts in 10^{-13} is achieved. The user can select what satellite service to use. 1, 2 or 3 systems can be simultaneously used from GPS (USA), GLONOSS (Russian), Galileo (Europe) or Beidou (China) systems.

Applications

- Calibration of Frequency Counters and other test equipment
- Frequency Reference for DTV, DAB, VHF, UHF, CDMA, Tetra etc.
- Production frequency reference
- Network Time Protocol in Banks, Financial companies, utilities, 2-way radio workshops, TV studios.

Outputs

There are three 10 MHz, sinewave outputs, a 10 MHz TTL squarewave output, a 1 pps (pulse per second) output derived from either the GNSS receiver or the internal OXCO. The 1 pps from the GNSS receiver is aligned to UTC time within ± 20 ns (typical). Options to increase the number of outputs is available together with time code outputs (IRIG-B, NTP, SMPTE etc.).

USB and Ethernet Interfaces

There is a USB or Ethernet interface allowing interrogation of the GPS10e5. The GPS10e5 also have an embedded software page allowing the status of the unit to be monitored on a PC using a standard browser. Alternatively, windows software is supplied along with optional Telnet commands can be used to monitor and control the GPS10e5.

External Locking

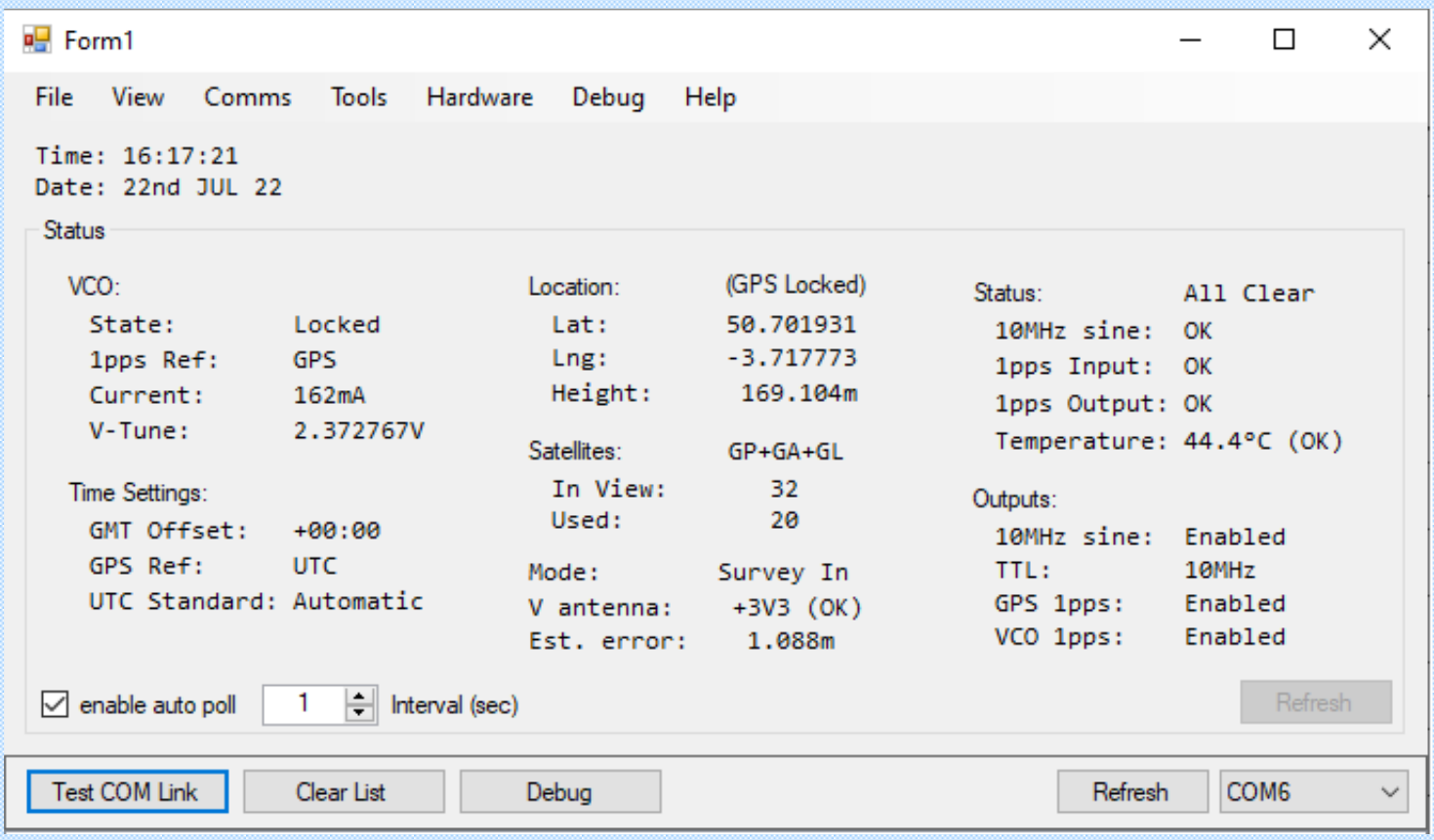
The GPS10e5 can either lock to the GNSS satellite system, or an optional external 1 pps signal. Options to lock to other frequencies, such a 1,5,10 MHz are available.

Options

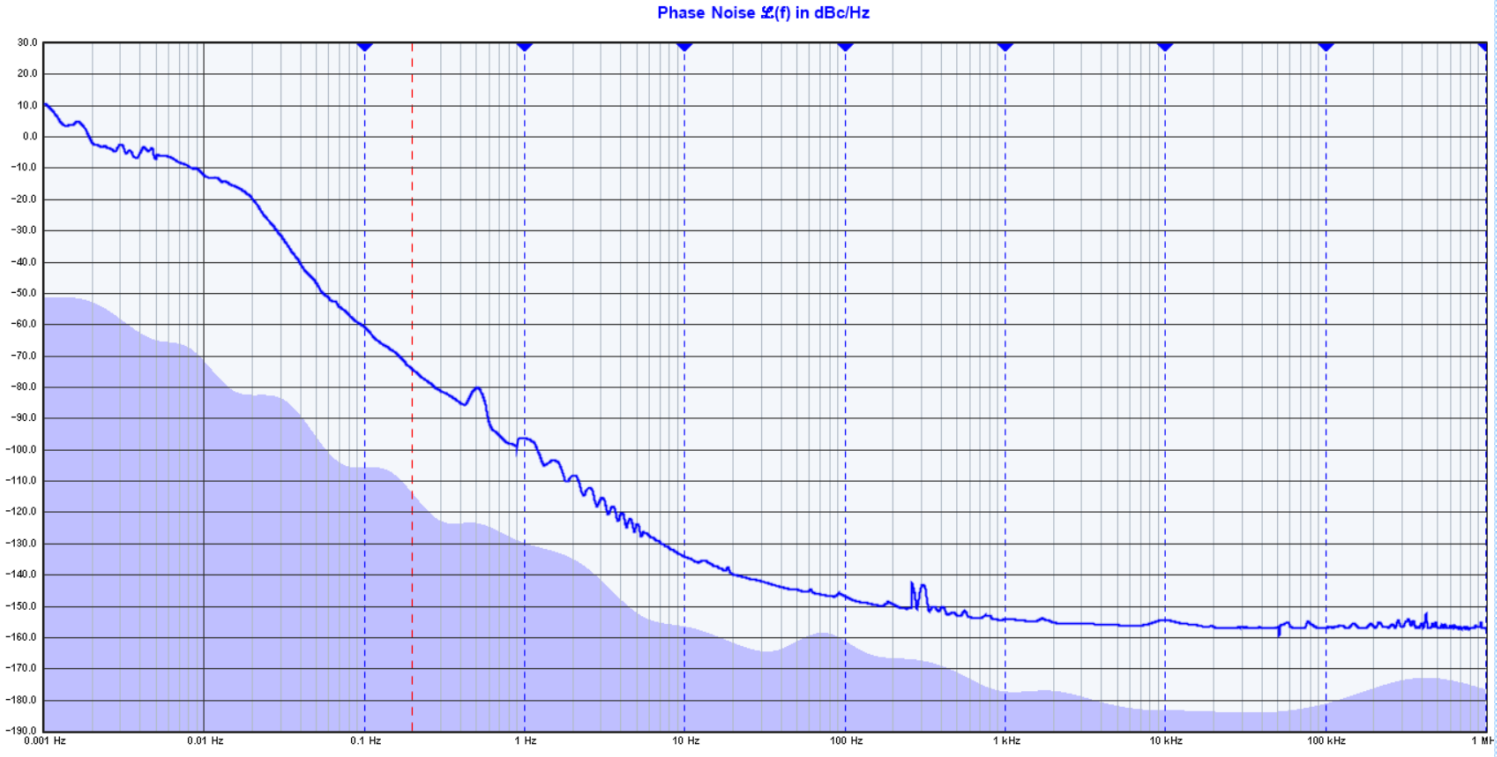
- Antenna Amplifier allowing the GPS antenna to be placed up to 350 m away from the GPS10e5.
- Fixed or variables frequency outputs, up to 10 GHz. E.g. 0 – 1640 MHz in 0.01 Hz steps.
- Alarm Relay Output.
- Redundancy. Two units operate together with automatic switchover if one unit fails.

Software

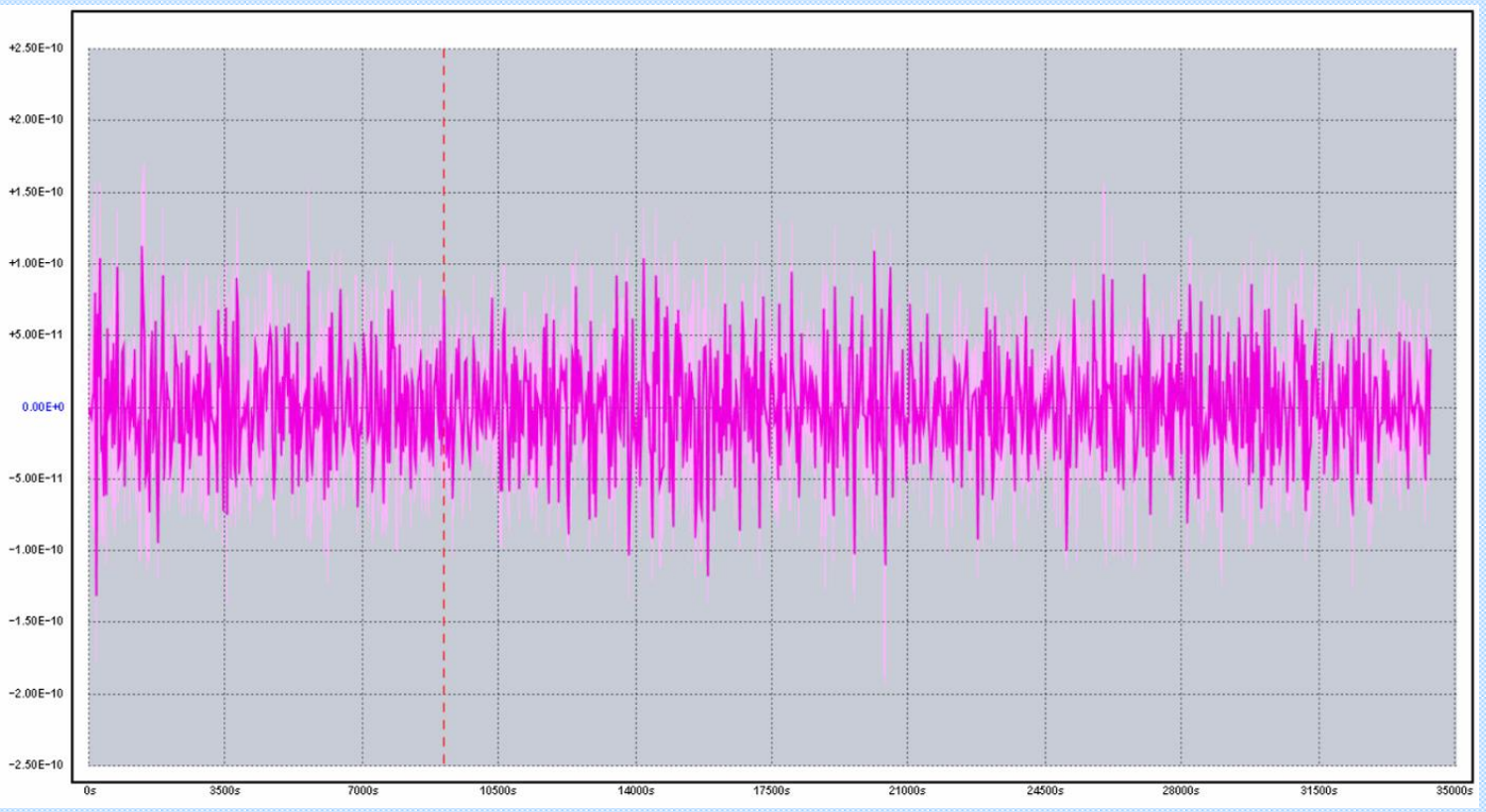
Free window software is included to continuously monitor the GPS10e5. A screen print-out of the software is shown below



Two plots below show the typical phase noise and peak to peak frequency variations of the GPS10e5.
The phase noise is better than -95 dBc @ 1 Hz with a -153 dBc/Hz floor noise.
The peak-to-peak frequency error is typically < ±1.5E-10. This is comparable to a ubidium frequency standard



Above plot shows the typical Phase Noise. Below plot is the peak to peak frequency variations



GPS10e5 Specifications

Description	Specification	Remarks
Outputs		
Sinewave Output Frequency	10 MHz	Other frequencies optionally available
Squarewave Output Frequency 1	Programmable frequencies.	Other frequencies optionally available
Squarewave Output Frequency 2	1 pps derived from GNSS receiver or OXCO	Aligned to UTC time ± 20 ns.
Allan Deviation & Frequency Accuracy - locked to GPS Satellites		
Observation Time 1 seconds	$< 5 \times 10^{-12}$	GPS10e5 in full lock for > 1 week. > 3 satellites in view. Ambient temperature 0 °C to +40 °C. Temperature changes less than 1 °C per hour.
Observation Time 10 seconds	$<3 \times 10^{-11}$	
Observation Time 100 seconds	$< 2.5 \times 10^{-11}$	
Observation Time 10k seconds	$< 6 \times 10^{-13}$	
Frequency Accuracy (Tau=10/1k/10k secs)	$< 3 \times 10^{-11} / < 5 \times 10^{-12} / < 5 \times 10^{-13}$	
Frequency Accuracy (Worse case peak)	$< \pm 2.5 \times 10^{-10}$	
Phase Noise		
1 Hz offset (dBc/Hz)	-95 dBc	
10 Hz offset (dBc/Hz	-133 dBc	
100 Hz offset (dBc/Hz)	-146 dBc	
1 kHz offset (dBc/Hz)	-153 dBc	
10 kHz offset (dBc/Hz)	-153 dBc	
100 kHz offset (dBc/Hz)	-153 dBc	
Output Drift when GPS10e5 NOT Locked to GPS Satellites (Holdover TXCO / OXCO)		
Drift due to aging	$< 5 \times 10^{-10}$ per day, $< 2 \times 10^{-6}$ per year	Optional to 2×10^{-10} per day available
Drift due to temperature (when unlocked)	$< 5 \times 10^{-7}$ / $< 2 \times 10^{-8}$	Relative to 25 °C
GNSS / GPS Receiver		
Number of Channels	72 channels	
GNSS systems available	GPS, Galileo, GLONASS, BeiDou	
Acquisition Time / Sensitivity (cold start)	< 29 s. / -148 dBm.	Sensitivity -160 dBm (GPS & Galileo)
Antenna (GPS/GLOSNASS/Galileo – L1)	Pole mount with lightening protection	
Antenna Frequency / Gain / Noise Figure	1560 – 1620 MHz / 38 dB / 2.5 dB	
Antenna Out Of Band Filtering	-60 dB @ f < 1530 MHz or < 1660 MHz	
Antenna Power Supply / Current	3.3 – 9.0 VDC @ < 40 mA	
Antenna Lightening Protection	90 V, 20 kA, 8/20 S	
Miscellaneous		
Connectors	BNC standard. SMA optionally available	The antenna connector is either BNC or SMA
Operating Temperature	0 °C to +50 °C	
Storage Temperature	-20 °C to +60°C	
Power Inlet	9 - 15 VDC	
Interface	USB or Ethernet	Battery backup optionally available
Dimensions (rack mount version)	483 mm wide x 300 mm deep x 44 mm high	19” Rack Mount Case, 1U height
Dimensions (Bench Mount Case)	230 mm x 190 mm x 50 mm	
Supplied Accessories	Antenna, AC Power Adapter, Manual	
Options		
Option 01B	Additional five sinewave outputs	Many other options available. Please just ask if you need an option not listed here.
Option 03:	Redundancy	
Option 04:	Upgrade oscillator from TXCO to OXCO	
Option 09A/ Option 09B	IRIG-B Output / IRIG-B Input	
Option 26 and 26B	Ultra-low and low phase noise options	
Option 38:	NTP Server	

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Full specifications available from www.ptsyst.com. Specifications and features subject to change without notice (160922)