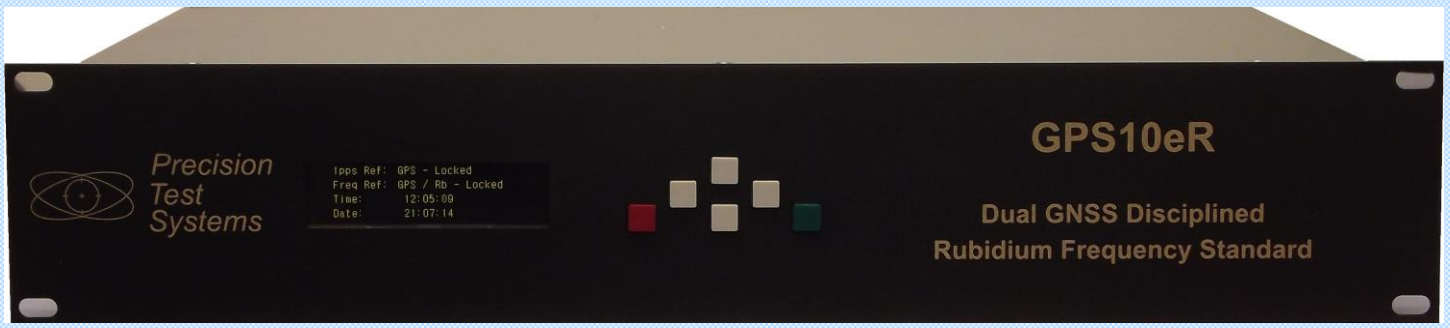
GPS10eR: 10 MHz Ultra Low Noise Rubidium Frequency Standard (GPSDO). With GPS, GLONASS, Galileo GNSS Satellite Receivers



GPS10eR 2U version. There are 1U and 2U versions. The 2U version has more space for options.

Key Features

- Completely self-contained unit. No extra P.C needed. Full information available via LCD.
- Rubidium Oscillator locked to GNSS satellite signal. Accuracy to parts in 10^{-14} (Stratum 1 performance)
- Two satellite receives receive GPS, GLONASS and Galileo satellite signals. Auto switchover.
- Optional BeiDou reception
- Free run mode. Rubidium still gives an accurate output without a GNSS satellite signal (Stratum 1)
- 1 pps time output. Typical error < 20 ns compared to UTC
- Multiple 10 MHz and 0-10 MHz Pulse Outputs
- Optional 1.544 or 2.048 MHz G.703.10 Outputs
- Low Phase Noise, e.g. -103 dBc/Hz at 1Hz
- Ultra low phase noise option: e.g. -113 dBc/Hz at 1 Hz
- Low Allan Deviation 2.5 $x10^{-12}$ in 1 second
- Optional ultra-low Allan Dev of 8.5 x 10^{-13} in 1 second
- Optional locking to an external 1 pps or 10 MHz
- Optional IRIG-B time code output (AM or DC level shift) and NTP server function.
- Traceability log stores historical information enabling traceability to be maintained for over 7 years.
- Windows software with full control and monitoring of the GPS10eR via RS232, USB, Ethernet or the web.
- 19" 1U or 2U high rack mountable case.
- Very Low Microphonics and High Quality construction
- Custom built options available upon request

General Description

The GPS10eR is a 10 MHz, GNSS (Global Navigation Satellite System) disciplined, ultra low phase noise, rubidium frequency standard. It combines the short-term stability of a rubidium oscillator with the long-term stability and traceability of a global navigation satellite system. The GPS10eR is able to receive signals from most of the world's satellite systems including GPS (USA), GLONASS (Russia) and Galileo (Europe), and BeiDou as an option. The GPS10eR achieves short and long-term frequency accuracy of parts in 10^{-14}. Thus, the GPS10eR exceeds the requirements of Stratum 1.

Options for the GPS10eR include 5 to 15 isolated sinewave outputs, an antenna amplifier or fiber optic GPS link, various fixed high frequency outputs, alarm relay outputs, redundancy, battery backup supply, time code outputs and a variable frequency sinewave output. The GPS10eR comes standard with a RS232, USB and Ethernet interfaces. Free Console software is supplied with the unit. Also, there is an embedded web page so it can easily be monitored and controlled via any web browser. It is also possible to control the GPS10eR over the web.

Ultra Low Phase Noise

The GPS10eR has very low phase noise as a standard unit. But there are also low and ultra low options for the GPS10eR. A plot of the GPS10eR's phase noise is shown below, under the section headed **The GPS10eR versus the competition**

Ultra Low Allan Deviation

The Allan Deviation of the GPS10eR is one of the lowest in the industry. The plot below, under the section headed **The GPS10eR versus the competition** shows the typical Allan Deviation for the standard unit. As can be seen from the graph, the Allan Deviation at 50k seconds (14 hours) is less than 7×10^{-14}.

Accurate Timing Outputs

The 1 pps (pulse per second) output can be derived straight from the GNSS receiver or from the rubidium oscillator. The leading edge of the GNSS 1 pps signal is typically aligned to UTC time ± 20 ns. The GPS 1 pps has typically 2 to 20 ns jitter, while the Rb 1pps output signal has very low jitter of < 300 ps. These outputs can drive TTL levels into 50Ω.

Optional Time Code and NTP or PTP Server

The GPS10eR has the option of an IRIG-B time code output and NTP server function. Other time codes are optional available such as 48 bit BCD time code. Also the new precise timing standard (PTP) is now supported.

Keyboard Control and LCD Display

A simple six way keyboard is used to monitor and control the GPS10eR. The LCD displays various different menus. These menus show all the relevant information including time, position, number of satellites tracked, health of each satellite, the status of the rubidium oscillator as well as the status of all power supplies and alarms.

Multiple Frequency Outputs

The GPS10eR has many different output options. These outputs are:

- Buffered 10 MHz sinewave outputs. Each output is fully isolated from each other. The amplitude of each output can be individually adjusted from 0 dBm to > 13 dBm. Reverse isolation of each output is 130 dB and channel to channel isolation is typically 90 dB. Five outputs as standard. Up to 15 outputs can be optionally installed in the 2U version. Optional output level to +20 dBm is available. By connecting more distribution amplifiers, up to 1000 outputs can be realized, all delivering a low phase noise output. Five outputs as standard.
- TTL 10 MHz outputs. Two fitted as standard. Options for a further ten outputs.
- A programmable pulse output is also available. This can be adjusted in frequency and pulse width. The leading edge is always synchronized to UTC. The pulse can be set to repletion rates from 1 Hz to 10 MHz. The pulse length can be set in 1 us increments and can be positive or negative. Fitted as standard.
- One pulse per second outputs aligned to UTC. Two fitted as standard. Up to ten outputs can be optionally fitted.
- Optional high frequency outputs can be specified at the time of ordering. These fixed high frequency outputs can be as high at 18GHz (higher frequencies available upon special request) and are phase locked to the main frequency reference. An example output is a 1 to 18 GHz programmable PLL in 10 kHz steps.
- Optional DDS Output enables the GPS10eR to produce a sinewave and squarewave output that is locked to the GPS10eR. The frequency range of this output is 1 µHz to 80 MHz (1 µHz steps).

Free Run Mode. Ideal for portable applications

The GPS10eR is normally operated with the Rubidium oscillator's 10 MHz output, locked to the GNSS satellite system. In the event of a failure of the GNSS signal for any reason, the GPS10eR will automatically switch over to free run mode. In this mode, the GPS10eR's Rubidium Oscillator still achieves Stratum 1 performance over a 72 hour period.

Also, the GPS10eR can be used for portable applications where a satellite signal is not available, or the time required to lock the GPS10eR is not available. When the GPS10eR is powered up it can be set to the free run mode. The Rubidium

Oscillator "remembers" the last known good frequency setting and adjusts itself to this frequency. Thus, an accurate 10 MHz is available within a few minutes of switch on. This mode is ideal for setting up GSM base stations that require an accurate time base for frequency measurement.

Dual GNSS Receivers

The GPS10eR has two GNSS receivers that can receive most of the worlds GNSS systems, including GPS, GLONASS and Galileo with BeiDou as an option. Should the active receiver fail, the second receiver is automatically switched in. If that fails, then automatic switchover to free run occurs.

Historical Log

The GPS10eR records a log of all the adjustments made to the rubidium oscillators as well as its current status, what GPS satellites are being received etc. This log is updated once per hour and will go back over 7 years. This allows traceability back to the GNSS system. Below is an example of the log that is generated as a CSV file:

Date	Time	Rb State	FC Value	Time Loop Constant	PPSREF-PPSOUT	PPSREF-PPSOUT	Active GPS	Sat[1].ID	Sat[1].SNR	Sat[2].ID	Sat[2].SNR	Sat[3].ID	Sat[3].SNR	Sat[4].ID	Sat[4].SNR
03/12/2015	16:51:00	Sync to 1pps Ref	351	1000	-67	0	GPS1	2	47	30	47	7	46	13	44
03/12/2015	17:51:00	Sync to 1pps Ref	348	1000	-67	0	GPS1	5	48	30	46	13	44	15	43
03/12/2015	18:51:00	Sync to 1pps Ref	349	1000	-67	0	GPS1	15	47	5	45	13	44	20	44
03/12/2015	19:51:00	Sync to 1pps Ref	346	4750	-67	-9	GPS1	13	43	20	43	24	42	15	41
03/12/2015	20:51:00	Sync to 1pps Ref	337	7633	-67	-11	GPS1	18	44	13	43	10	43	24	43
03/12/2015	21:51:00	Sync to 1pps Ref	329	7380	-67	-16	GPS1	12	48	24	47	15	46	10	43
03/12/2015	22:51:00	Sync to 1pps Ref	328	6500	-67	-18	GPS1	10	46	12	46	25	46	24	45
03/12/2015	23:51:00	Sync to 1pps Ref	334	6756	-67	0	GPS1	12	46	14	46	31	46	22	43
04/12/2015	00:51:00	Sync to 1pps Ref	331	7751	-67	0	GPS1	25	48	31	47	29	44	14	42
04/12/2015	01:51:00	Sync to 1pps Ref	325	8759	-67	-27	GPS1	25	46	31	45	29	43	14	40
04/12/2015	02:51:00	Sync to 1pps Ref	315	9132	-67	-34	GPS1	31	47	29	45	21	42	26	42
04/12/2015	03:51:00	Sync to 1pps Ref	310	9009	-67	-34	GPS1	26	48	31	47	16	45	27	45
04/12/2015	04:51:00	Sync to 1pps Ref	304	8759	-67	-26	GPS1	16	48	26	47	21	43	27	42
04/12/2015	05:51:00	Sync to 1pps Ref	299	8510	-67	-25	GPS1	16	47	26	45	22	43	8	42
04/12/2015	06:51:00	Sync to 1pps Ref	290	8510	-67	-39	GPS1	8	47	22	46	11	43	16	43
04/12/2015	07:51:00	Sync to 1pps Ref	286	8510	-67	-38	GPS1	27	47	11	44	16	44	8	44
09/02/2016	18:22:00	Free Run	149	100	6533	488	GPS1	12	47	14	45	24	45	10	44
09/02/2016	19:22:00	Free Run	149	100	6800	488	GPS1	25	45	12	43	14	40	29	39
09/02/2016	20:22:00	Free Run	149	100	7066	488	GPS1	14	45	25	45	29	45	31	43
09/02/2016	21:22:00	Free Run	149	100	7333	488	GPS1	29	47	25	43	31	43	26	42
09/02/2016	22:22:00	Free Run	149	100	7600	488	GPS1	29	44	31	43	21	42	26	42
09/02/2016	23:22:00	Free Run	149	100	7866	488	GPS1	31	46	9	45	26	45	4	45
10/02/2016	00:22:00	Free Run	149	100	8066	488	GPS1	26	45	16	44	4	44	27	42
10/02/2016	01:22:00	Free Run	149	100	8333	488	GPS1	16	44	26	44	7	43	27	43
10/02/2016	02:22:00	Free Run	149	100	8600	488	GPS1	27	45	8	44	11	42	16	42
10/02/2016	03:22:00	Free Run	149	100	8800	488	GPS1	22	46	27	45	8	43	30	42
10/02/2016	04:22:00	Free Run	149	100	9066	488	GPS1	1	47	11	46	8	45	22	44
10/02/2016	05:22:00	Free Run	149	100	9333	488	GPS1	3	47	22	45	17	44	8	44
10/02/2016	06:22:00	Free Run	149	100	9533	488	GPS1	3	48	1	47	17	45	11	44
10/02/2016	07:22:00	Free Run	149	100	9800	488	GPS1	3	47	17	46	23	45	6	44

- Date and Time: Date and Time of when the record was made.
- Rb State: Shows the state of the rubidium at the time the log was made. In the above example we have two states, Sync to 1 pps and Free Run. Sync to 1 pps means the rubidium was being disciplined by the GPS system and that there were no errors. Free Run means the unit was in FreeRun, either because the satellite signal had been lost, or the user had manually set the GPS10eR to FreeRun
- Time Loop Constant: The time loop constant of the rubidium's PLL is normally automatically set by the GPS10eR. Or it can be manually set. This column shows the current loop constant in seconds.
- PPS – PPSOUT. Two columns show the time difference between the 1 pps signal derived from the GPS or GNSS receiver and the 1pps derived from the rubidium. The first column is a course value with a resolution of 67 ns. The second column is a fine value with 1 ns resolution. This information is very useful in showing how the rubidium is being disciplined to the satellite signal. This information is even available in Free Run mode.
- Active GPS: Shows whether the GPS 1 or GPS2 GPS/GNSS receiver was being used.
- Sat (X) ID and SNR. These columns show the four satellites with the strongest signal strength. The ID is the satellite SVN number and the SNR represents the signal strength.

RS232, USB, Ethernet Interfaces and Embedded Web page

The different interfaces allow complete control and interrogation of the GPS10eR. The Ethernet interface includes a three port switch. The RS232/USB interface can be used with the Ethernet interface at the same time. An embedded web page

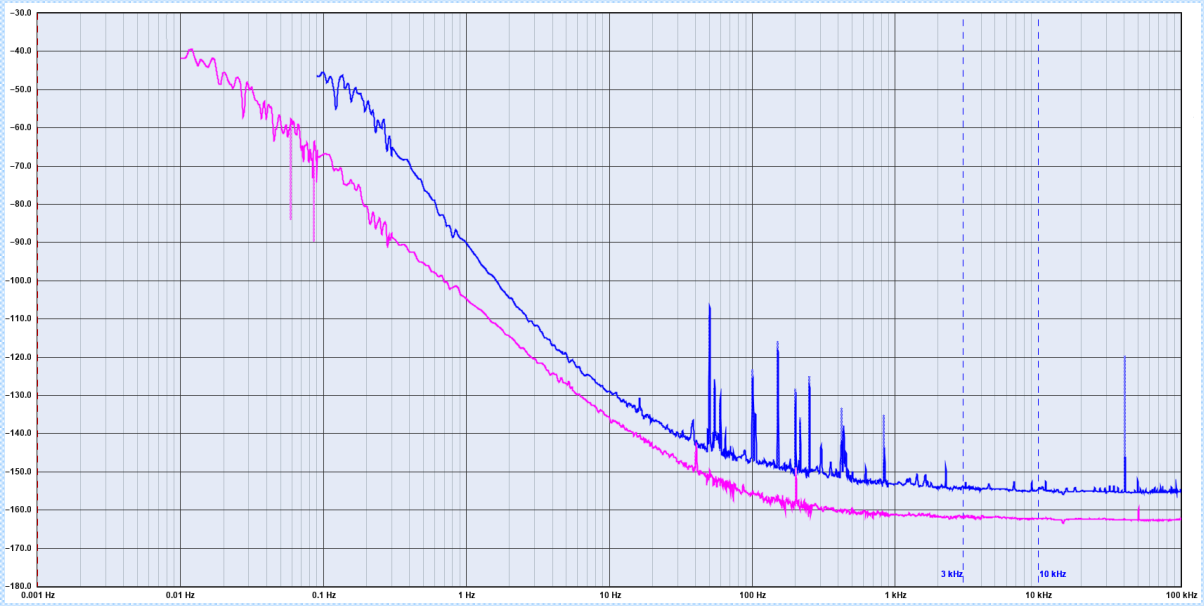
makes it simple to connect a PC to the GPS10eR using a normal web browser. This allows monitoring of the GPS10eR and many functions can also be changed. Thus, this is a simple way of controlling the GPS10eR anywhere in the world.

The GPS10eR versus the competition

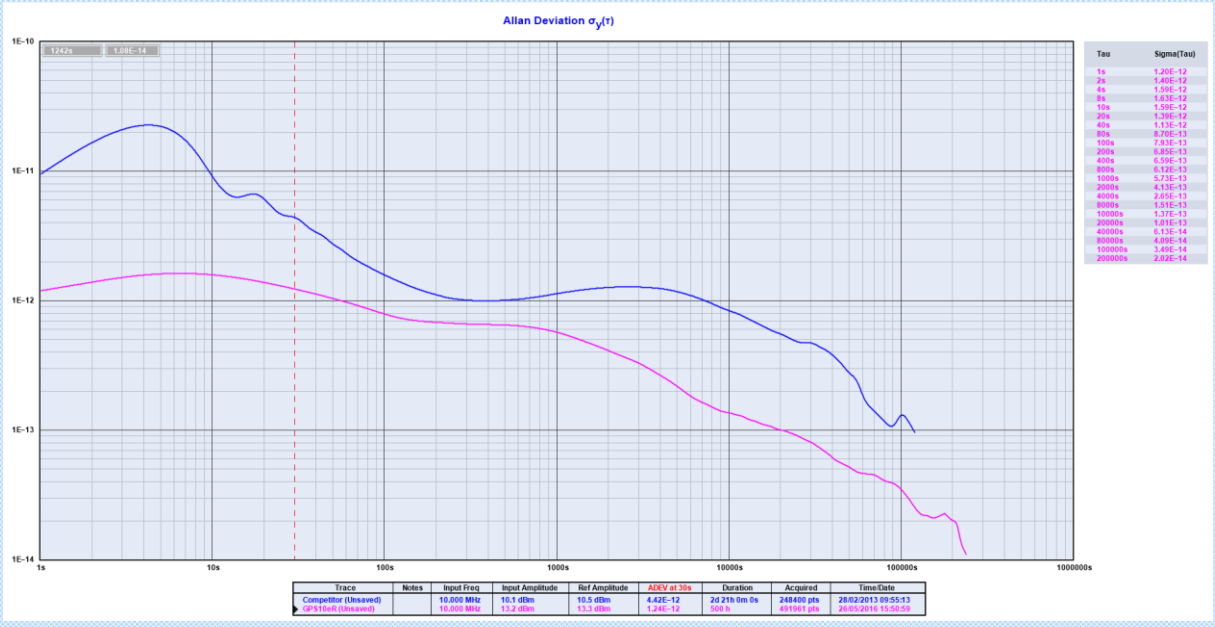
Below is a comparison of the GPS10eR to a good quality competitive product. These are real measurements. Three parameters are compared, namely Phase Noise, Allan Deviation and Instantaneous Frequency Difference. Phase Noise and Allan Deviation are quoted by most competitors, but one thing that is rarely talked about is Instantaneous Frequency Difference. This is the peak to peak differences in the frequency output. The reason this is rarely quoted is that the figures are much higher than Allan Deviations figures.

In the three pictures below, the GPS10eR results are shown in pink, while the competitive product is shown in blue.

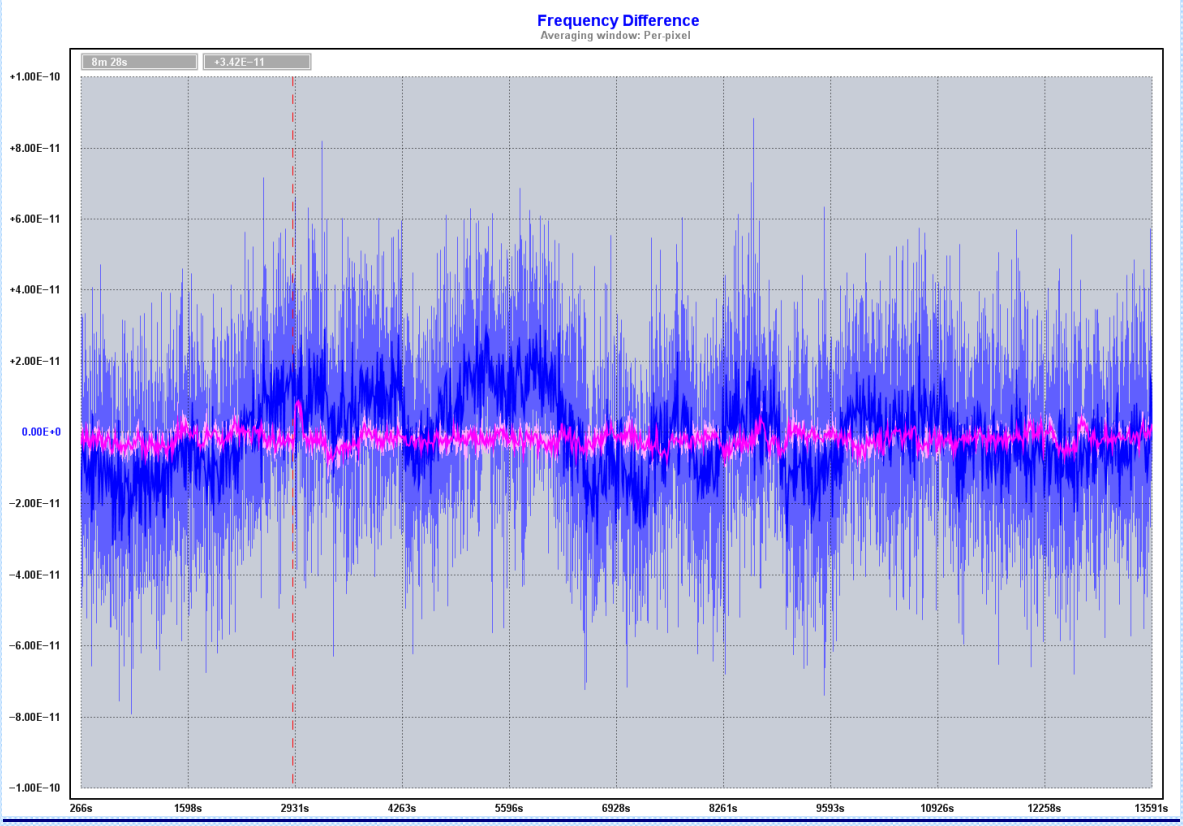
Phase Noise of the GPS10eR (pink) versus a competitive product (blue) is shown below. The GPS10eR's phase noise is significantly lower than the competitive product. Even lower phase noise is available as an option.



Allan Deviation of the GPS10eR (pink) versus a competitive product (blue) is shown below. The GPS10eR's Allan deviation is significantly lower than the competitive product. Also available is an option that reduces this plot further.



Frequency Difference plots of the GPS10eR (pink) versus a competitive product (blue) is shown below. The GPS10eR's peak to peak frequency variations are ten times lower than the competition.



Options

The GPS10eR has many options enabling it to work in varied applications. Not all options can be installed at the same time. Some options require a separate case. Some of the options are listed below:

Option 01 and 02: Second Frequency Output, 0 to 500 MHz spot frequency and 500 to 1 GHz spot frequency
This option gives a second frequency output. The frequency is fixed and cannot be changed. The spot frequency must be advised by the customer prior to manufacture. The frequency can be in the range 0 to 1 GHz. Some examples are shown below:

01A	500 MHz Square	01F	8.0 MHz Sine x 5	01L	100 kHz Sine x5	01R	13 MHz x 5
01B	100 MHz Sine x 5	01G	100 MHz Sine ULN	01M	5 MHz x 5 LN	01S	75 MHz x5
01C	10.23 MHz Sine x5	01H	16 MHz Sine ULN	01N	5 MHz Sine x1	01T	5,2,1 MHz
01D	10.24 MHz Sine x1	01J	5 MHz Sine x 5	01P	75 MHz x1	01U	50 MHz x 5
01E	10.24 MHz Sine x 5	01K	1 MHz Sine x 5	01Q	75 MHz x5 ULN		

Option 02Aand option 02B. : Second Variable Frequency Output, 780 to 820 MHz or 800 to 1200 MHz.
This option gives a second frequency output. The frequency is variable and can be changed from 780 MHz to 820 MHz or 800 - 1200 MHz in 100 kHz steps. The frequency output has good phase noise and low spurious.

Option 03: Second Frequency Output, 1 GHz to 3.2 GHz spot frequency
This option gives a second frequency output. The frequency is fixed and cannot be changed. The spot frequency must be advised by the customer prior to manufacture. The frequency can be in the range 1 GHz to 3.2 GHz.

Option 03A: Second Variable Frequency Output, 2.25 GHz to 2.65 GHz
This option gives a second frequency output. The frequency is variable and can be changed from 2.25 GHz to 2.65 GHz in 100 kHz steps. The frequency output has good phase noise and low spurious.

Option 04 and Option 35: Antenna Amplifier /Fiber Optic Link
These options can be used to extend the range between the GNSS antenna and the GPS10eR. Up to 300 m (1000 feet) can be realized with a cable and amplifier, up to 1 km (3200 feet) with a fiber optic GNSS link.

Option 05 and 05E: DDS Signal Generator
Option 05 adds a DDS (direct digital synthesis) signal output to the GPS10eR. The DDS output has a squarewave and sinewave output. The frequency of this output is adjustable from 1 µHz to 80 MHz in steps of 1 µHz. Option 05E adds a 1-18 GHz DDS controlled output switchable in 10 kHz steps. All outputs are phase locked to the main rubidium.

Option 07, 07A and 07B: Alarm Relay/TTL Output
This option adds an alarm output. Option 07 and 07A add a dual changeover relay that is activated in the event of an alarm. Each relay contact is rated at 30 VDC and 1 Amp (5A for Option 07A). Option 07B is a TTL output signal only.

Option 08: Redundancy

Option 08 adds redundancy. With this option, two GPS10eR's can be configured into a redundancy set-up with five main 10 MHz outputs (up to 15 outputs optionally available). Normally one unit will supply the 10 MHz outputs (locked to the GNSS satellite). In the event of failure of this unit, the 10 MHz outputs will be automatically switched to the second GPS10eR unit. The second GPS10eR unit will then supply the 10 MHz outputs, locked to the GNSS system.

Even if both GNSS antennas are disconnected, and one unit completely fails, there will still be a 10 MHz from the second unit running from the rubidium oscillator. Both units are identical; there is no master or slave. Simply, whatever unit is healthy will supply the 10 MHz output. System status is available via the three interfaces. This option is ideal for applications that require extra security. Extra 10 MHz outputs can be added if required.

Option 09, Option 09A, Option 09B: IRIG-B & SMPTE Time codes.

Option 9 adds a time code output to the GPS10eR. Option 09 is an IRIG-B with typically 10 ms accuracy, option 09B is an IRIG-B with better than 1 us accuracy (typically 150 – 500 ns) and option 09A is a SMPTE time code. All time codes are fully configurable for the different types of formats such as AM type or DC level shift.

Option 11: Clock / Date Display Unit

Option 11 provides a remote Clock / Date display. The display consists of a 6 digit 25 mm high digital LED display that can be read from a distance of 10 meters.

Option 12: Additional sinewave outputs
The GPS10eR has five isolated 10 MHz sinewave outputs. Option 12 adds further outputs up to 15 in total.

Option 12A: 10.23 MHz Outputs
This option changes the five sinewave outputs to 10.23 MHz. A rear panel input connector allows the DDS option (option 05) to generate 10.230 MHz and be available on these five isolated outputs.

Option 13: Mute Sinewave Outputs in the event of an alarm
This option disables all the sinewave outputs in the event of an alarm or error.

Option 14: Service manual. The service manual has service information and realignment procedures.

Option 16: BCD Time Code Output
This option gives a 48 bit BCD time code output. The time output is in the format HH:MM:SS.sssssss. The fractional seconds have a resolution of 100 ns. The output is updated every 100 ns and is accurate to UTC to within 200 ns.

Option 19: +24VDC Input or Option 19B: +12 VDC input
This option allows the GPS10eR to be externally powered by a +12 or +24 VDC supply. In the event of AC power being lost, the GPS10eR will instantly switch over to the external DC supply.

Option 20: 2.048 MHz G703:10 output. Option 20C: 1.544 MHz G703:10 output
These options give the popular 2.048 MHz or 1.544 MHz outputs. The output is a squarewave with amplitude of ± 1.2 V into 75 Ω

Option 23: GSM Interface
This option enables the GPS10eR to send a SMS (short message service) or text to ten GSM mobile phones in the event of an error.

Option 24: Frequency Change to 5 MHz (also requires option 12 additional 5 outputs to be installed)
This option changes all sinewave outputs to 5 MHz instead of 10 MHz. A 10 MHz output is still available.

Options 26, 26D and 46:
Option 26 is the ultra low phase noise option, option 26D the low phase noise option and option 46 is the low Allan Deviation option. Option 26 or 26D can be ordered with or without option 46.

Option 30, 30A, 30B: Squarewave and Pulse Outputs
Opt 30: Squarewave Output. Gives a TTL output switchable in frequency to 10, 5, 2, 1, 0.1 MHz and 1 pps.
Opt 30A: 5 x squarewave outputs at 1 MHz (other frequencies available)
Opt 30B: Pulse Output. 5 x pulse outputs, each can be individually set to 1 PPS, 10 PPS, 100 PPS, 1k PPS or 10k PPS

Option 34: High Power Outputs. The 10 MHz output levels are increased to a maximum of +20 dBm.

Option 35: Fiber Optic Link for Antenna: Allows GNSS Antenna to be located up to 1 km away from GPS10eR.

Option 36: Fiber Optic 10 MHz Output
This option adds a fiber optic output together with a fiber optic receiver. This allows the 10 MHz output to be routed over very long distances using fiber optic cable.

Option 37: Guaranteed Phase Noise Specifications: Phase noise plots of every output included.

Option 38, 38A and 38B: NTP and PTP options

These options add NTP (network time protocol) or PTP (Precision Time Protocol) servers to the GPS10eR. They are fully configurable using supplied windows software.

Option 40A or B: Allows GPS10eR to be locked to external reference signal (10 MHz or 1 pps).

Option 42: Different Connectors: The standard BNC connectors can be replaced with TNC, SMA or other types. Also ground isolated connectors are available.

Applications

Applications of the GPS10eR include, but are not limited to, the following examples:

- Reference frequency source in a calibration or standards laboratory
- Portable frequency standard
- Calibration of GSM Base Station Clocks
- Reference Frequency and Time source for the electricity generating industry
- Synchronizing of telecommunication and computer networks
- Space and Observatories'.

High Quality of Construction

The GPS10eR is made to the highest standards. A purpose built aluminum 19" rack mount case houses all the circuits inside the GPS10eR. The GPS10eR is CE marked for sale within the EEC.

Active Antenna Supplied as Standard

The GPS10eR is supplied with an active antenna with build in lightening protection.. This antenna includes a pole mount adapter making installation simple.

GPS10eR Specifications

Description	Specification	Remarks
10 MHz Outputs		
Connector	Rear panel BNC socket	Five Outputs as standard
Frequency	10 MHz	Other frequencies optionally available.
Accuracy	Refer to Allan Deviation section below	Refer to Allan Deviation section below
Signal Type / Amplitude	Sine wave @ 0 dBm to + 13 dBm	Other levels optionally available
Harmonic Distortion / Spurious	-30 dBc / - 120 dBc (> 0.5 MHz)	
Return Loss	> 23 dB @ 10 MHz	
Reverse / Channel to Channel Isolation	> 130 dB / 90 dB	
1 PPS Outputs		
Connector	Rear panel BNC socket	Two available as standard
Frequency	1 pulse per second	
Amplitude (open circuit)	0 to 5 V, TTL Compatible	
Amplitude (50 ohm)	0 to > 3 V, TTL Compatible	0 to 2.7 V on GPS 1 pps output
Accuracy to UTC time (GPS 1 pps output)	< 20 ns (typical	After cable delays taken into account
Jitter of Rubidium Osc. 1 pps output	< 300 ps	
Typical Phase Noise Response (Standard / Low Noise / Ultra-Low Noise Options): 10 MHz Outputs		
At 1 Hz Offset	-103 / -105 / -113 dBc/Hz	Standard / Low Noise / Ultra low noise
At 10 Hz Offset	-135 / -137 / -140 dBc/Hz	Standard / Low Noise / Ultra low noise
At 100 Hz Offset	-153 / -155 / -156 dBc/Hz	Standard / Low Noise / Ultra low noise
At 1 kHz Offset	-156 / -159 / -164 dBc/Hz	Standard / Low Noise / Ultra low noise
At 10 kHz Offset	-160 / -161 / -168 dBc/Hz-	Standard / Low Noise / Ultra low noise
At 100 kHz Offset	-160 / -161 / -168 dBc/Hz	Standard / Low Noise / Ultra low noise
Allan Deviation when locked to GNSS Satellites (Standard / Low Allan Deviation Option		
Observation Time 1 & 10 seconds	$<2.5 \times 10^{-12}$ / $< 1.5 \times 10^{-12}$	GPS10eR in full lock for > 1 week. > 3
Observation Time 100 & 1000 seconds	$< 2 \times 10^{-12}$ / $< 1.2 \times 10^{-12}$	satellites in view. Ambient temperature
Observation Time 10k & 100k seconds	$< 7 \times 10^{-13}$ / $< 3 \times 10^{-13}$	0 °C to +50 °C. Temperature change less
Observation Time 1 week	$< 3 \times 10^{-13}$ / $< 2 \times 10^{-13}$	than 3 °C per hour
Rubidium Drift when GPS10eR NOT Locked to GPS Satellites		
Drift due to aging (freerun mode only)	$< 5 \times 10^{-11}$ per month	After 30 days operation
Drift due to temperature (freerun mode only)	$< 5 \times 10^{-11}$	0 °C to +50 °C
GNSS Receivers (Two as standard)		
Number of Channels	32 or 50 channel	
GNSS systems available	GPS, Galileo, GLONASS, BeiDou (option)	Galileo may require firmware upgrade
Acquisition Time / Sensitivity (cold start)	< 32 s. / -143 dBm.	
Antenna (GPS/GLOSNASS/Galileo – L1)	Pole mount with lightening protection	-160 dBm tracking mode
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	Power supplied by GPS10eR
Environmental		
Operating Temperature	0 °C to +50 °C	
Storage Temperature	-20 °C to +60°C	
Magnetic Field	$< 2 \times 10E^{-10}$ for 1 Gauss field reverse	
Humidity	GR-63 CORE, Section 5.1.2	
Operation Vibration	GR-63 CORE, section 5.4.2, Random & Sinusoidal MIL-PRF-28800F, Class 3,4	Phase noise may be impaired during vibration
G-Tip Over Test	< 2 x 10 /g in worst axis	

Miscellaneous		
AC Power Inlet with switch	IEC320 power cord	Rear Panel
AC Voltage Range	100 - 240 VAC (usable 90-260 VAC)	Automatic switchover
Power consumption (standard unit)	50 watts typical operating, 65W warm-up	Warm up period is < 12 minutes at +20 °C
Fuse rating	3.15A, 250 VAC slow blow type	
Dimensions Width x Depth	482.6 mm x 380 mm	
Height and weight	88 mm and 7 kg	1U version also available, 44 m high
Supplied Accessories		
Antenna	Active type, 5V @ 40 mA	With built in lightening protection.
Power cord	IEC320 type	
Instruction manual	Supplied	
Option 05: DDS Generator Output		
Overall Frequency Range / Step Size	1 µHz to 80 MHz in 1 µHz steps	Usable to 90 MHz
Frequency Accuracy	± 300 µHz plus main 10 MHz error	Subject to jitter specification
Sinewave Frequency Range	10 kHz to 80 MHz	
Sinewave Output level	> 0 dBm into 50 Ω	
Spurious and Harmonic Output	-40 dBc and -20 dBc respectively	Option > +10 dBm available (opt 05A)
Squarewave Frequency Range	1 µHz to 80 MHz	
Squarewave Output Level	0V to 3V nominal into open circuit	Use 50 ohm termination above 1 MHz
Allan deviation (100 second)	2.5×10^{-12}	> 0 dBm into 50 Ω (10 kHz – 80 MHz)
Option 01B and 01G: 100 MHz Output Phase Noise (typical)		
Option 01B Phase Noise (1/10/100/1k/10k)	-65 / -100 / -125 / -150 / 163 (five outputs)	Offsets dBc/Hz. Opt 26D must also be fitted
Option 01G Phase Noise (1/10/100/1k/10k)	-84 / -118 / -140 / -154 / -166 (five outputs)	Offsets dBc/Hz.. Opt 26 must also be fitted
All other options		
Consult Precision Test Systems for further details of other options. Not all options can be fitted at the same time.		

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Specifications and features subject to change without notice (240616)