

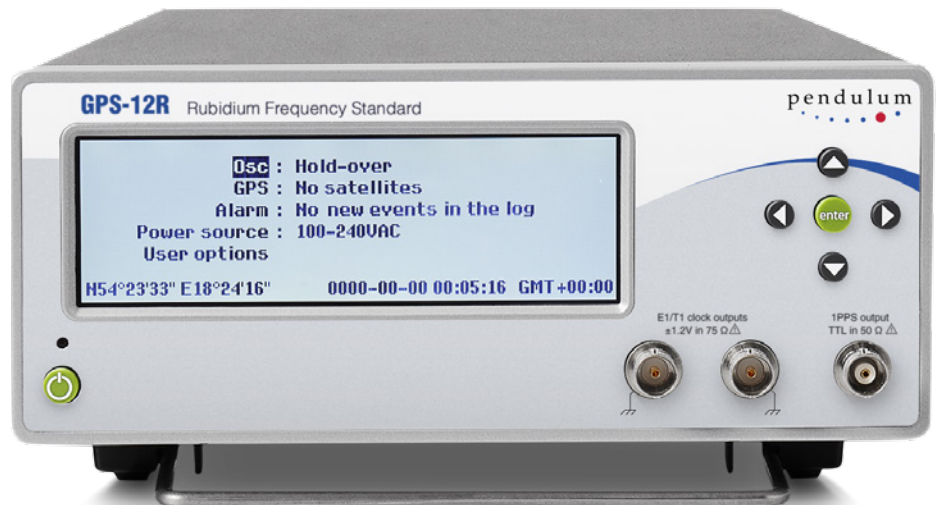
GPS-12R/HS

GPS-Controlled Frequency Standards

pendulum

DATA SHEET

- GPS-controlled Rubidium clock for near-Cesium stability
- Internal battery option for transportation and mains-free field use
- Switchable 1.544 MHz (T1) or 2.048 MHz (E1) front-panel outputs for telecom
- 1 PPS/10 MHz square wave front-panel output
- 3x 10 MHz and 1x 5MHz sine rear-panel outputs for lab bench and test systems (house standard)
- 1, 5 & 10 MHz optional low-noise sine outputs for general lab use (rear panel)
- GPS-12 Monitor, Control and Monitoring SW



The Pendulum High-Stability GPS-12R/HS Portable Frequency Reference clocks are ultra-stable, low-noise, GPS-disciplined Rubidium references, and ideal reference sources and calibrators for both telecom instrumentation and general lab equipment. Thanks to the internal battery option, you can transport near-Cesium frequency stability to the field without losing accuracy.

Metrology & Telecom Applications

The GPS-12R/HS consists of very precise GPS-controlled Rubidium reference clock for various telecom applications. In its standard configuration, the two front-panel outputs can be set to either 1.544 MHz (T1) or 2.048 MHz (E1) reference clock outputs, for calibration or synchronization of test instruments and network elements. The 1 PPS front-panel output provides an ultra-stable timing reference, with excellent hold-over specifications. This is useful in applications where timing is critical, like synchronization of DAB, DVB or WCDMA transmitters or for synchronization of radar antenna array systems.

GPS-12R/HS can be used as a permanent reference clock in the telecom network, as per PRC specifications, in GPSlock, or in hold-over mode during 24 h. The High-Stability GPS-12R/HS model is targeted for metrology applications with its low noise 5/10 MHz sine outputs, and its ability to phase step the 1 PPS timing output.

Optional Configurations

In addition to the standard E1/T1 and 1 PPS/10 MHz square wave outputs, the 3x10 MHz and 1x 5 MHz outputs, the GPS-12R/HS can accommodate two additional rearpanel option boards with the following I/O characteristic:

- **Option 71B:** Four sine wave outputs of 10 MHz, 5 MHz, 1 MHz and 0.1 MHz.
- **Option 79/01:** Two 10 MHz and one 1 PPS outputs, together with an 1 PPS input for external disciplining.

Truly Portable and More

The GPS-12R/HS models are compact, lightweight and have an internal battery option to maintain stability during transportation or to allow field use without access to AC mains. For the first time, it is possible to transport an atomic frequency standard into the field and have instant access to the full stability, with zero warm-up time.

These models provide a portable reference clock for ALL kinds of instrumentation. They can also be used as ultra-stable in-house frequency reference for R&D, test systems, or manufacturing. User settings and display are selectable for eight languages, and the optional GPS-12 Monitor allows full remote control and monitoring of the instrument. The GPS-12R/HS is excellent metrology references for calibration of test equipment such as Wandermeters, SDH/SONET network analyzers, and general test and measurement equipment time bases.

Frequency Stability

Locked to GPS

GPS-12R/HS	
ADEV at 20° to 26°C:	
($\tau = 24$ h)	$<1 \times 10^{-12}$
($\tau = 100$ s)	$<3 \times 10^{-12}$
($\tau = 10$ s)	$<1 \times 10^{-11}$
($\tau = 1$ s)	$<2 \times 10^{-11}$
Phase noise dBc/Hz (typ.):	
Offset: 1Hz	-90
10 Hz	-125
100 Hz	-135
1kHz	-145
10 kHz	-145
Warm up (+25°C):	12 min to 1×10^{-9}
1 PPS timing:	
accuracy vs UTC (after 72h of cont. operation)	30 ns rms
1 PPS time correction	1 ns steps

Hold-Over

Frequency stability - Hold-over	
Aging/month	$<5 \times 10^{-11}$
Temp. (0°C to 50°C)	$<1 \times 10^{-10}$
1 PPS timing - Hold-over	
24 h drift	$<1 \mu\text{s}$

Standard Outputs

1.544 MHz or 2.048 MHz (2 Front-Panel Outputs)

Choice of 2.048 or 1.544 MHz from front panel menu

Connectors: BNC female (2x)

Frequency: 1.544 MHz (T1) or 2.048 MHz (E1) square wave

Output level:

-1.2 V to +1.2 V $\pm 10\%$ in 75 Ω (G.703:10)

1 PPS or 10 MHz pulse (1 Front-Panel Output)

Choice of 1 PPS (default) or 10 MHz from front panel menu

Connector: BNC female

Output level: approx. 0V to +2.0 V in 50 Ω load

Duty cycle: 1 PPS: approx. 20 ppm;
10 MHz: approx. 50%

Jitter (1 PPS): <1 ns rms

Alarm outputs (rear):

One urgent and one non-urgent alarm output

Signal coding:

Relay open: alarm mode

Relay closed: normal mode

Max switch voltage: 60 VDC

Max switch current: 200 mA

GPS Antenna Input (rear)

Connector: Type 'N', female

DC Antenna Supply: +5VDC, center-pin positive, through 'N' connector

Options Available

Option 70B Outputs

One option 70B output module is standard in GPS-12R/HS. A second optional 70B can be installed

Frequency: 3x 10 MHz, 1x 5 MHz

Output level: Sine wave, >1 Vrms in 50 Ω

Option 71B Outputs

Frequency: 0.1, 1, 5, 10 MHz

Output level: Sine wave, >1 Vrms in 50 Ω

Option 72B Outputs

2x 2.048 MHz and 2x 2.048 Mbps outputs (G.703)

Output level: -1.2V to +1.2V $+10\%$ in 75 Ω

Option 78/HS

Internal rechargeable NiMH battery for GPS-12R/HS.

Operation time: 2h (GPS-12R/HS)

Stand-by time: 2.5h (GPS-12R/HS)

Ext. +12 VDC inlet: Yes (+10.5 to +18 V, 5A)

Option 79/01

1x External 1 PPS disciplining input (TTL-levels in 50 Ω)

1x 1 PPS output (TTL-levels in 50 Ω)

2x 10 MHz outputs (1Vrms sine)

Environmental

Temperature: 0°C to +50°C (operating)

-40°C to +70°C (storage)

Internal temperature controlled fan

Safety: Compliant to CE: EN61010-1 2nd edition, Cat II, Pollution degree 2

EMI: Compliant to CE: EN61326-1 (1997), A1 to A3 (2003), EN55022B, EN50082-2

Power Supply

Line voltage: 100 V to 240 Vrms ($\pm 10\%$);

50 Hz to 400 Hz ($\pm 10\%$)

GPS-12R, GPS-12R/HS: <60 W (warm-up),

<35 W (normal operation)

Internal Battery: See option 78/HS

Freq. Stability: GPS-12R/HS: $<2 \times 10^{-12}$ switching between any power source; AC mains, internal battery, or external +12 VDC.

Mechanical Data

WidthxHeightxDepth:

210 x 108 x 395 mm (8.25" x 3.6" x 15.6")

Weight: Net 3,1 kg (6.6 lbs); excl batteries

Shipping 4.1 kg (8.8 lbs); excl batteries

Ordering information

Basic Models

GPS-12R/HS:

GPS-controlled High-Stability Rubidium Frequency Standard with 2x1.544/2.048 MHz outputs, 1x 1 PPS/10 MHz output, 1x 5 MHz sine and 3x10 MHz sine outputs

Included with Shipment: User manual on CD, Calibration certificate, 2-year product warranty¹

Built-In Options

NOTE: Only one of options 70B, 71B, 72B, and 79/01 can be installed at a time

Option 70B: 3x 10 MHz plus 1x 5 MHz extra outputs, sine, 1 Vrms (Included as standard in GPS-12R/HS)

Option 71B: Multiple reference outputs 0.1/1/5/10 MHz, sine, 1Vrms

Option 72B: Multiple reference outputs 2x 2.048 MHz and 2x 2.048 Mbps outputs (G.703)

Option 78/HS: Internal rechargeable Battery plus inlet for +12 VDC external power supply

Option 79/01: 1x ext. 1 PPS disciplining input, 1x1 PPS out, 2x 10 MHz sine out

Optional accessories

Option 01/90: GNSS antenna, 40 dB gain, N connector, includes mounting kit

Option 22/90: 19" rack mount kit

Option 27: Soft carrying case

Option 27H: Heavy-duty transport case

Option 29/12: GPS-12 Monitor, Control and Monitoring SW (via USB)

Option 02: Antenna cable, 20 m

Option 02/50: Antenna cable, 50 m

Option 02/130: Antenna cable, 130 m

Option 90/07: Calibration certificate with protocol, Rubidium oscillator

Option 90/00: Calibration certificate hold-over aging/week

Option 95/05: Extended warranty with 2 extra years

OM-12: Printed Users Manual (PDF-file is included as standard)

¹ Warranty period can be extended to 3 years by registering the product <https://pendulum-instruments.com/support/online-product-registration/>