GPS-12/12R & GPS-12R/HS

pendulum

GPS-Controlled Frequency Standards

- **GPS-controlled OCXO or 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**
- **1, 5 & 10 MHz optional low-noise sine outputs for general lab use (rear panel)**
- **GPS-12 Monitor, Control and Monitoring SW**

The Pendulum GPS-12, GPS-12R and the top-of-line High-Stability GPS-12R/HS Portable Frequency Reference clocks are ultra-stable, low-noise, GPS-disciplined OCXO/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.

Metrolology & Telecom Applications

The GPS-12 series consist of very precise GPS-controlled OCXO or Rubidium reference clocks 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 can be used as a permanent reference clock in the telecom network, as per PRC specifications, in GPS-lock, or in hold-over mode during 24 h. The optional -48 VDC operation adds redundant power supply possibility. 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 GPS-12 family can accommodate two additional rear-panel option boards with the following I/O characteristic:

- ***Option 70B:*** One 5MHz and three 10 MHz low-noise outputs for test systems or metrology applications. This option is mounted as standard in the GPS-12R/HS model.
- ***Option 71B:*** Four sine wave outputs of 10 MHz, 5MHz, 1MHz and 0.1 MHz.
- ***Option 72B:*** Two 2.048 MHz plus two 2.048 Mbps (E1) for telecom applications.
- ***Option 73B:*** Four 13 MHz outputs for GSM radio base station tests.
- ***Option 74B:*** Two 1.544 MHz and two 1.544 Mbps (T1) outputs for telecom applications (SONET).
- ***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-12 family models are compact, lightweight and has 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.

When ordered with the low-noise 5/10 MHz outputs (standardly included in GPS-12R/HS), 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 six languages, and the optional GPS-12 Monitor allows full remote control and monitoring of the instrument. The GPS-12R and GPS-12R/HS are excellent metrology references for calibration of test equipment such as Wandermeters, SDH/SONET network analyzers, and general test and measurement equipment time bases.

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Frequency Stability

Locked to GPS

	GPS-12	GPS-12R	GPS-12R/HS
ADEV at 20° to 26°C:			
(τ =24 h)	$<5\times10^{-12}$	$<2\times10^{-12}$	$<1\times10^{-12}$
(τ =100 s)	$<2\times10^{-11}$	$<5\times10^{-12}$	$<3\times10^{-12}$
(τ =10 s)	$<2\times10^{-11}$	$<1.5\times10^{-11}$	$<1\times10^{-11}$
(τ =1 s)	$<2\times10^{-11}$	$<3\times10^{-11}$	$<2\times10^{-11}$
Phase noise dBc/Hz (typ.):			
Offset: 1Hz 10 Hz 100 Hz 1kHz 10 kHz	-90 -120 -130 -140 -140	-75 -95 -125 -140 -140	-90 -125 -135 -145 -145
Warm up (+25°C):	15 min to 5×10^{-8}	12 min to 1×10^{-9}	
1-pps timing:			
accuracy vs UTC (after 72h of cont. operation)	±120 ns	±120 ns	30 ns rms
1-pps time correction	N/A	N/A	1ns steps

Hold-Over

Frequency stability - Hold-over			
Aging/ month:	$<1.5\times10^{-9}$	$<5\times10^{-11}$	$<5\times10^{-11}$
Temp. (0°C to 50°C):	$<5\times10^{-10}$	$<1\times10^{-10}$	$<1\times10^{-10}$
1-pps timing - Hold-over			
24 h drift	<20 µs	<1µs	<1µs

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 ±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): <1ns 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

(This option is standard in GPS-12R/HS)
Frequency: 3x 10 MHz, 1x 5MHz
Output level: Sine wave, >1Vrms in 50 Ω

Option 71B Outputs

Frequency: 0.1, 1, 5, 10 MHz
Output level: Sine wave, >1Vrms in 50 Ω

Option 72B

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

Option 73B

Frequency: 4x13 MHz
Output level: square wave, approx. 0V to +2.0 V in 50 Ω load

Option 74B

2x 1.544 MHz and 2x 1.544 Mbps outputs (G.703)

Option 77

-48 VDC supply for external power source

Option 78

Internal rechargeable NiMH battery for GPS-12 and GPS-12R. Charging via AC mains
Operation time: 3h (GPS-12), 2h (GPS-12R)
Stand-by time: 5h (GPS-12), 2.5h (GPS-12R)
Ext. +12 VDC inlet: No

Option 78/HS

Internal rechargeable NiMH battery for GPS-12R/HS. As option 78 plus an additional inlet for +12 VDC external power supply/charging
Operation time: 2h (GPS-12R/HS)
Stand-by time: 2.5 h (GPS-12R/HS)
Ext. +12 VDC inlet: Yes

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)

Antenna (Option 01)

Type: active L1
Height: 81 mm (3.2")
Weight: 230 g (8 oz.)
Gain: >30 dB

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 (±10%); 50 Hz to 400 Hz (±10%)
GPS-12: <40 W during warm-up, <30 W during normal operation
GPS-12R, GPS-12R/HS: <60 W (warm-up), <35 W (normal operation)
Optional external DC supply:
-48 VDC (option 77), +12 V nominal (+10.5 to +18 V), 5A (option 78/HS only)
Internal Battery: See option 78 and 78/HS
Freq. Stability: GPS-12R/HS: $<2\times10^{-12}$ 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-12: GPS-controlled OCXO Frequency Standard with 2x 1.544/2.048 MHz outputs and 1x 1-pps/10 MHz output
GPS-12R: GPS-controlled Rubidium Frequency Standard with 2x 1.544/2.048 MHz outputs and 1x 1-pps/10 MHz output
GPS-12R/HS:
GPS-controlled High-Stability Rubidium Frequency Standard with 2x1.544/2.048 MHz outputs, 1x 1-pps/10 MHz output, 1x 5MHz sine and 3x10 MHz sine outputs
Included with Shipment: User manual on CD, Calibration certificate, 18 months warranty

Built-In Options

Option 70B: 3x 10 MHz plus 1x 5MHz extra outputs, sine, 1Vrms (Included as standard in GPS-12R/HS)
Option 71B: Multiple reference outputs 0.1/1/5/10 MHz, sine, 1Vrms
Option 72B: 2x 2.048 MHz outputs plus 2x 2.048 Mbps outputs
Option 73B: 4x 13 MHz outputs, square 0V to +2V
Option 74B: 2x 1.544 MHz outputs plus 2x 1.544 Mbps outputs
Option 77: -48 VDC supply (for external power source)
Option 78: Internal rechargeable Battery
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 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 01: GPS Antenna
Option 01/50: GPS Antenna Mounting Kit
Option 02: Antenna cable, 20 m
Option 02/50: Antenna cable, 50 m
Option 02/130: Antenna cable, 130 m
Option 90/10: Calibration certificate with protocol
Option 90/00: Calibration certificate hold-over aging/week
Option 95/03: Extended warranty to 3 years
Option 95/05: Extended warranty to 5 years
OM-12: Printed Users Manual (PDF-file is included as standard)

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