

**GPS-Controlled Frequency Standard**

- GPS-disciplined 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 applications
- 1-pps front-panel output
- 1, 5 & 10 MHz optional low-noise outputs for general lab use (rear panel)
- Optional -48 VDC option for stationary use in telephone exchange stations



The Pendulum GPS-12R Portable Reference clock is an ultra-stable GPS-disciplined Rubidium reference, targeted for both telecommunications and laboratory applications. The GPS-12R's high-stability, low-noise outputs make it the ideal reference source for both telecom instrumentation and SDH/PDH/SONET Analyzers. When locked to GPS, its Cesium-like performance makes the GPS-12R an ideal calibrator for metrology and test systems.

**Ideal for telecom applications**

The GPS-12R is a 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 (less than 1  $\mu$ s after 24h hold-over). 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.

An internal battery option makes the GPS-12R an excellent portable reference, since the internal Rubidium standard is continuously powered during transports.

The optional -48 VDC operation makes the GPS-12R equally suited for permanent use as local frequency standard in telephone exchange stations, via this redundant power supply possibility.

GPS-12R can be used as a permanent reference input to SSUs, per PRC specifications, as long as GPS lock, or hold-over mode, is maintained.

**Optional configurations**

The GPS-12R is equipped with two user selectable front-panel telecom outputs (1.544 MHz/T1 or 2.048 MHz/E1), plus a 1-pps (1-pulse-per-second) output, standard. There are also additional output frequency possibilities.

The GPS-12R will accommodate two additional rear-panel output options from the five available. Each option has four BNC outputs.

- *Option 70B:* One 5 MHz and three 10 MHz low-noise outputs for test systems or metrology applications.
- *Option 71B:* Four sine wave outputs of 10 MHz, 5 MHz, 1 MHz and 0.1 MHz.
- *Option 72B:* Two 2.048 MHz plus two 2.048 Mbps (E1) for use in telecom applications (SDH).
- *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 use in telecom applications (SONET).

**Truly portable**

The GPS-12R is 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 ever, it is now 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 5/10 MHz outputs, the GPS-12R provides a portable reference clock for ALL kinds of instrumentation. It can also be used as a permanent ultra-stable in-house frequency reference for R&D, test systems, or manufacturing.

Its configurable alarm outputs give urgent or non-urgent alarms for hardware failures, loss of antenna connection, loss of GPS contact, and more.

User settings and display are selectable for six languages.

The GPS-12R is an excellent metrology reference for calibration of test equipment such as Wandermeters (WM-11 from Pendulum Instruments), SDH/SONET network analyzers, and general test and measurement equipment time bases.

# GPS-12R Technical Specifications

## GPS-12R Frequency stability

### Frequency stability

(Allan dev.), at temperature 20° - 26° C:

$<2 \times 10^{-12}$  ( $\tau = 24\text{h}$ ), locked to GPS

$<5 \times 10^{-12}$  ( $\tau = 100\text{s}$ )

$<1.7 \times 10^{-11}$  ( $\tau = 10\text{s}$ )

$<5 \times 10^{-11}$  ( $\tau = 1\text{s}$ )

Phase noise: -140 dBc/Hz @ 10 kHz offset

Warm up (+25°C): 7 minutes to  $1 \times 10^{-9}$

### Frequency stability - Hold-over

Aging/month:  $<5 \times 10^{-11}$

Temp. (0°C - 50°C):  $<1 \times 10^{-10}$

## Standard Outputs

### 1.544 MHz or 2.048 MHz (2 front-panel outputs, user selectable):

Connectors: BNC female (2)

Frequency: 1.544 MHz (T1) or 2.048 MHz (E1) square wave, 20% duty cycle, user selectable on the front panel

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

### 1 pps (1 front-panel output):

Connector: BNC female

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

Duty cycle: approx. 20% (GPS-locked)

Jitter (GPS-locked):  $<1\text{ ns}$  rms relative to UTC or GPS (position hold)

Hold-over accuracy: approx. 1  $\mu\text{s}$  drift after 1 day of Hold-over

### Alarm output (rear):

Signal coding: relay open: alarm mode;

relay closed: normal mode

1 urgent output

1 non-urgent output

Max switching voltage: 60 Vdc

Max switching current: 200 mA

## GPS Antenna Input

Connector: Type 'N', female

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

## Options Available

### Option 70B outputs

Frequency: 3x 10 MHz, 1x 5 MHz

Output level: Sine wave,  $>1\text{V rms}$  in 50 W

### Option 71B outputs

Frequency: 0.1, 1, 5, 10 MHz

Output level: Sine wave,  $>1\text{V rms}$  in 50 W

### Option 72B

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

### Option 73B

Frequency: 4x 13 MHz

Output level: square wave, approx. 0 V to +2.0V in 50 W load

### Option 74B

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

### Option 77

-48 VDC supply for external power source

### Option 78

Internal battery (2h) and an inlet for +12 VDC external power supply/charging

### Antenna (option 01)

Type: active L1

Height: 81 mm (3.2")

Weight: 230 g (8 oz.)

Gain:  $>30\text{ dB}$

### Environmental

Temperature: 0°C to +50°C (operating)

-40°C to +70°C (storage)

Internal temperature controlled fan

Safety: Compliant to CE: EN 61010-1 2:nd edition, Cat II, Pollution degree 2

EMI: Compliant to CE: EN61326-1 (1997)

### Power consumption

Line voltage: 100V to 240Vrms ( $\pm 10\%$ ); 50 Hz to 400 Hz ( $\pm 10\%$ )

$<60\text{W}$  during warm-up,  $<35\text{W}$  during normal operation

Optional external DC supply:

-48 VDC (option 77)

+12 VDC (option 78)

Optional Battery: Via internal NiMH battery, capacity 19.2 Wh, 12 VDC connector

Backup: for charging and continuous operation (option 78)

### Mechanical Data

WxHxD: 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

GPS-12R: GPS-controlled Rubidium Frequency Standard with 2x 1.544 MHz or 2.048 MHz outputs (user selectable) and 1x 1 pps output

### Included with shipment

User manual on CD

Calibration certificate

18 months warranty

### Built-in options

Option 70B: 3x 10MHz plus 1x 5MHz extra outputs, sine, 1Vrms

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

Option 72B: 2x 2.048 MHz outputs plus 2 x 2.048 Mbps outputs

Option 73B: 4x 13 MHz outputs, square 0V to +2V

Option 74B: 2x 1.544 MHz outputs plus 2 x 1.544 Mbps outputs

Option 77: -48 VDC supply (for external power source)

Option 78: Internal Battery (2h) + inlet for +12 VDC external power supply/charging.

Frequency Stability:  $<2 \times 10^{-12}$  when switching between any power source; AC MAINS, internal battery, or external +12 VDC.

### Optional accessories

Option 22/90: 19" rack mount kit

Option 27: Soft carrying case

Option 27H: Heavy-duty transport case

Option 01: GPS Antenna

Option 01/50: GPS Antenna Mounting Kit

Option 02: Antenna cable, 20m

Option 02/50: Antenna cable, 50 m

Option 90/10: Calibration certificate with protocol

Option 90/00: Calibration certificate hold-over ageing/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)

Specifications subject to change without notice

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- Experts in time & frequency calibration, measurement and analysis

Pendulum Instruments is a company of the Orolia Group