

# Passive Hydrogen Maser

PRECISE TIME & FREQUENCY STANDARD



Better short & long term stability combined than Cesium □ No wear out physics package □ Half Lifetime COA of Cesium □ Long Lifetime □ Unique - the only Passive Hydrogen Maser available IEM Kvarz - world's largest producer of Hydrogen Masers

## TIME & FREQUENCY STANDARD

## **APPLICATIONS**

Astro Laser rangefinding • Geodesy • Space Navigation • Glacial Movement • Defence • GPS Satellite monitoring • Intelligence • Navigation • Gravity prospecting • Climatology • Position fixing • Support of radar imaging • Calibration • Determination of Earth rotation • National frequency standards • Geo-dynamics • Earthquake research • Heat transport • Calibration of Cesium, Rubidium & Quartz • Telecommunications • VBLI • Fast missile tracking • Astronomy • Baseline definition • Plate tectonics • National timekeeping • Secure telecommunications • Company Laboratory Standard

## **TECHNOLOGY**

The CH1-76 principle of operation is based on a 5 MHz quartz crystal oscillator, frequency locked to the hyperfine transition of the hydrogen atom. The basic block diagram of a Passive Hydrogen Maser is shown in Figure 1.

The Passive Maser is specifically designed to provide an alternative technology to the high performance option cesium oscillators. As shown in Figure 2, the Maser's stability specification is factor of 10 better than the best commercial cesium. Unlike Cesium, the Passive Maser does not have an expensive wear out physics package. In light of the above, the Passive Maser may be the number one choice over high performance option cesium oscillators when better stability and competitive accuracy are needed at comparable price, while at the same time reducing the 10 year life cycle cost.

Applications include: laboratory standard; Stratum 1 primary reference clock; satellite ground station standard, especially valuable for testing GPS disciplined oscillators/syne systems in telephone networks; VLBI; time scales; and others.

## **GENERAL INFORMATION**

The Passive and Active Hydrogen Maser Frequency Standards, and associated instruments are available through a teaming relationship between Quartzlock and The Institute of Electronic Measurements KVARZ of Nizhny Novgorod, Russia, These units have been built in substantial quantities for the last 30 years. The instruments are produced in Russia and exported to Quartzlock. Additionally, by special request, the performance of the instruments can be independently certified by the NIST, USA. PTB Germany or NPL, UK. The relationship makes this very excellent technology available worldwide.

Complete customer service and support is provided at the customer's installation site, or, when necessary, the equipment can be returned to Quartzlock, or your local Quartzlock agent.

Both Passive and Active Masers have been in use at various institutes including: NIST, Boulder, Co; NRL, Washington, D.C; Smithsonian Astrophysical Observatory, Cambridge, MA; USNO, Washington, D.C; PTB, Braunschweig, Germany; DLR, Stuttgart, Germany, Royal Belgian Observatory, Radio Observatory, Yebes, Spain & NPL's in Japan, S.Korea, UK, Brazil, and elsewhere.

## Other Products:

CH1-75 Active Hydrogen Maser Oscillator; Stability at 1 hour ≤1.0E-15

1 day <1E-15

1 day <3E-16>1yr Temperature Coefficient <5E-16/°C

H Maser compatible

periferal instruments

GPS disciplined rubidium frequency & time standard, can provide GPS sync to 5ns and satellite time transfer facilities to H Masers

Α7 6 66666

Frequency/Phase Measurement system Resolution 1E15 Drift 300fs/h

Frequency Converter Provides 1Hz & 1pps & 0.1, 1, 5 & 10 MHz sinewave & squarewave outputs from CH1-76

**A**5 Distribution amplifiers (4, 12, 24 or

32 outputs) Stability 1E-13/s. Phase noise -165dBc at 100Hz. Isolation 130dB@5MHz

# FIGURE 1 - BLOCK DIAGRAM - CH1-76 PASSIVE HYDROGEN MASER

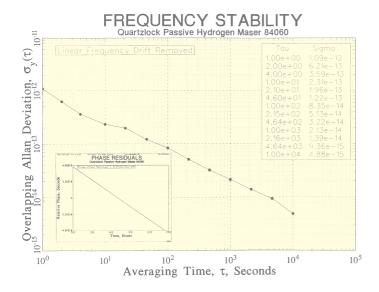
## FIGURE 2 - ALLAN VARIANCE COMPARISON OF CESIUM AND PASSIVE MASER σy (τ) E-12 HIGH PERF. Cs 1/2, 0 VARIANCE) E-14 (2) CH1-75's IN CAVITY AUTO TUNING MODE ALLAN CH1-75 ACTIVE E-15 CH1-75 ACTIVE E-16 109 AVERAGING TIME. T (SEC)

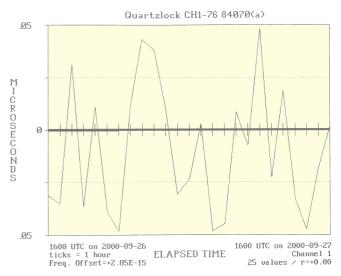


## **TIME & FREQUENCY STANDARD**

## **ELECTRICAL PERFORMANCE**

Frequency Outputs	(2) 5MHz, sine, 50 ohms, 1±0.2 (2) 1Hz, (1 pps), 50 Ohms, >2.5 Pulse Width: 10 to 20ms Rise Time: ≤30 ns Jitter: ≤100ps		
Clock Synchronisation	Automatic within 200 ns of ref. pulse Amplitude: 2.5 to 5V		
Stability, 5MHz Outputs		Allan Variance, $\sigma$ y(2, $\tau$ ) ≤1.5E-12 ≤5E-13 ≤1.5E-13 ≤5E-14 ≤2E-14 ≤1E-14 Iment which operates within +5 to 40°C ambient, the quoted strument is confined to a ±1°C ambient temperature change)	
Temperature/Frequency Coefficient	≤2E-14/°C	≤2E-14/°C	
Drift	≤1E-15/Day		
Accuracy	≤1.5E-12 over 5 years		
Frequency Trim Range	At least 1E-10		
Setting Resolution	1E-14 Steps		
Retrace	≤3E-14 after 24 hours of operation		
Phase Noise 5MHz	Offset from Carrier (Hz)  1  10  100  1000  10000	Phase Noise (dBc) -100 -120 -140 -150	
Spurs	Harmonics: ≤-30 dBc Non-Harmonics: ≤-100 dBc		
Power Input - ac	220 VAC, ±10%, 100, 120 V±10%, 240 V+5-10%; 45-65 Hz		
Power Input- dc	As an alternative to ac the unit can be powered by an external 22-30 Vdc supply.		
Automatic Battery Backup	In case of ac failure the instrument switches to the dc input line.		
Power Consumption	ac - <140 VA, dc - <90 watts		
Warm-up Time	≤10 hours to lock. (typ 6 hrs)		
Operating Temperature	+5 to +35°C		
Storage Temperature	-50°C to +50°C		
Magnetic Field Sensitivity	≤2.5E-14/ Gauss		
Pressure	630 to 795 mm Hg (84 TO 106 kPA)		
Humidity	Up to 80% at 25°C		
Size	11"H x 19"W x 22"D (28cm x 48cm x 56cm)		
Weight	120 lbs (55 kg)		
Warranty	1 year. (25 year options)		
Service Life	15 years		







## 50 SALES REPRESENTATIVES WORLDWIDE

Service & Sales Facilities in CIS, EU, PRC, SE ASIA and USA



Quartzlock UK ltd (Worldwide)

Gothic, Plymouth Road, Totnes, Devon TQ9 5LH England Tel:+44 (0)1803 862062 • Fax:+44 (0)1803 867962 Web site: http://www.quartzlock.com e-mail: quartzlock@quartzlock.com



Guildline Instruments Inc.

103 Commerce St., Suite 160, Lake Mary, FL 32746
Tel (407) 333-3327 • Fax (407) 333-3309

www.guildline.com











5x dti Smart Awards