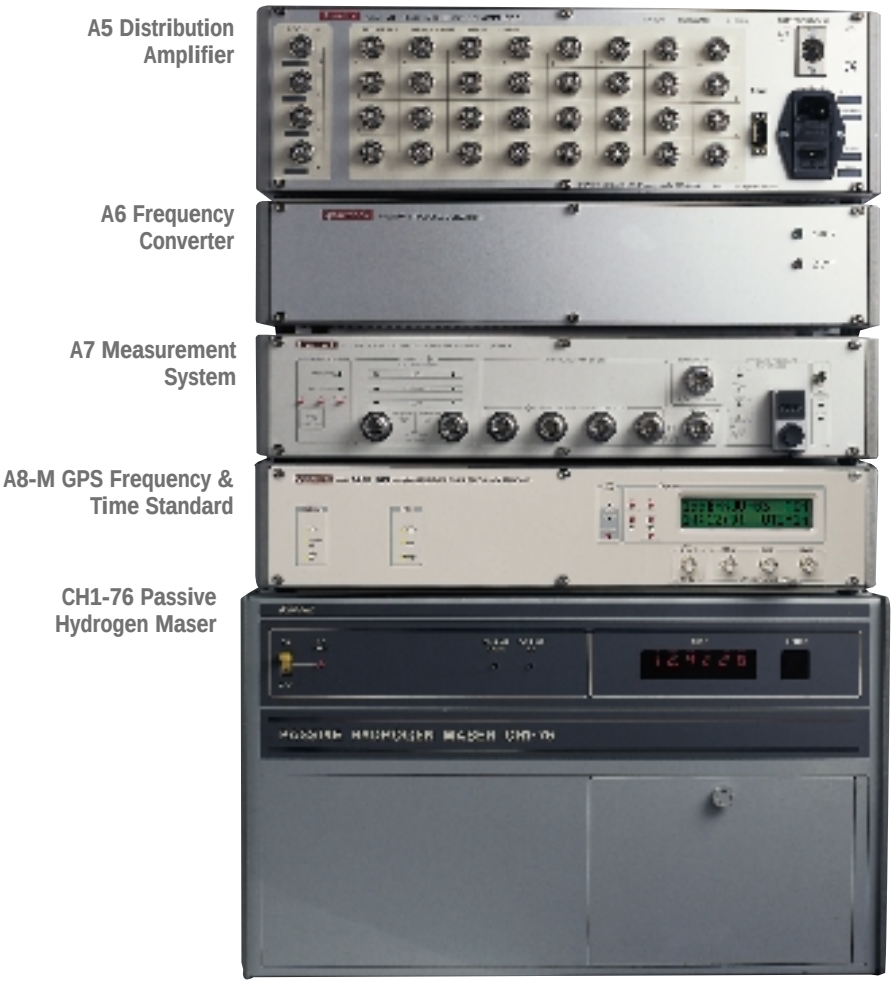
Quartzlock.com

PRECISE TIME & FREQUENCY FOR TELECOMS, METROLOGY & CALIBRATION

GENERATION • DISTRIBUTION • MEASUREMENT



A5-12
Distribution Amplifier

A8-B GPS
Frequency & Time Standard

A10-B Rubidium
Frequency Standard

2001 PRODUCT GUIDE

New Active Hydrogen Maser • New OCXO • New GPS • New Rubidium Oscillator

Quartzlock

The Company

Since its inception 40 years ago Quartzlock (UK) limited has established itself as one of the worlds leading manufacturers of time and frequency generation, distribution and measurement instrumentation. World-class technology has provided the basis for Quartzlock's continued success and the company's philosophy of technical excellence and quality has ensured that it retains an international name for excellence and customer care. A strong commitment to R&D and a focus on innovative solutions to measurement problems has helped Quartzlock achieve a global reputation.

Largest Global Installed Base (>400)

Hydrogen Maser Frequency & Time Standards

AO Frequency Standard Measurement & Distribution System

- H maser or *GPS* + A5, A6, A7 & A8-M.

A8 ■ Stability 1 x 10^{-14}/day - guaranteed. (Passive Maser) 5x10^{-14}/5...33 days (GPS Rb)

A1 ■ σy(2,τ) stability 1....9x10^{-14} 10^{2}....10^{5}s.

A7 ■ 1.5x10^{-15} resolution (100 seconds) measurement

A5 ■ 12, 24 or 32 outputs.
■ 130dB isolation
■ <10ps/°C

A6 ■ 1MHz 5MHz 10MHz

AO

1 Active Hydrogen Maser

CH1-75A autonomous autotune version for 2001
CH1-75B & CH1-75 version

- 5 x 10^{-15}/100s short term stability - 2001 Spec. Simply the best available.
- 3 x 10^{-16}/day guaranteed. (Drift)
- Inbuilt 100MHz frequency comparator.
- <5x10^{-16}/°C temperature co-efficient.
- 20 year lifetime. ■ NEW LOW PRICE

For more information go to: **quartzlock.com/CH1-75**

APPLICATIONS:

- Reference/flywheel for fountain cesium.
- GNS ground control
- Short term stability measurements of Cesium, Rubidium & BVA Quartz .
- VLBI.
- National Standard Lab.
- A cost effective 100x better stability alternative to cesium

CH1-75

B

1 Passive Hydrogen Maser

CH1-76

- Stability 1x10^{-14}/d, 3x10^{-14}/h, 5x10^{-14}/1000s.
- Lower cost than high performance Cesium.
- 10 times more stable than high performance cesium.

CH1-76

- No Cesium wear-out physics package.
- 5MHz & 1pps outputs (10MHz / 10.23MHz / 2.048MHz / Mb options).
- Low cost of ownership.

TELECOM & SATCOM

B

APPLICATIONS

- National time & frequency standard.
- Defence — Fast missile tracking.
- GPS Monitoring. ■ Production test.
- Calibration. ■ TV TX reference.
- Stratum 1 SDH network synchronisation

For more information go to: **quartzlock.com/CH1-76**
or request **ANQL1-01 / ANQL1-03**

Typical Allan Variance Frequency Stability Comparison

	KVARZ HYDROGEN MASERS						QUARTZLOCK
τ	1xAHM	1xAHM Autonomous Autotune	2xAHM Cavity Autotune	PHM	CESIUM HIGH PERF	CESIUM STD	GPS-Rb
	CH1-75	CH1-75A	CH1-75B	CH1-76			A8-M
1	1.5x10^{-13}	3x10^{-13}	3x10^{-13}	1x10^{-12}	5x10^{-12}	5.6x10^{-11}	1x10^{-11}
10	2x10^{-14}	1x10^{-13}	3x10^{-14}	3x10^{-13}	3.5x10^{-12}	2.3x10^{-11}	2x10^{-12}
100	3x10^{-15}	1x10^{-14}	1x10^{-14}	8x10^{-14}	8.5x10^{-13}	5.6x10^{-12}	6x10^{-13}
1000	2.5x10^{-15}	5x10^{-15}	5x10^{-15}	3x10^{-14}	2.7x10^{-13}	1.8x10^{-13}	2x10^{-13}
1d	3x10^{-15}	3x10^{-15}	2x10^{-15}	5x10^{-15}	4x10^{-14}	2x10^{-13}	8x10^{-14}
1yr	3x10^{-12}	1x10^{-12}	5x10^{-13}	1.5x10^{-12}			5x10^{-14}

Quartzlock

LF Tracking Receiver Frequency Standard

NOT AVAILABLE OUTSIDE EUROPE AT THIS TIME

2A-X/Y Frequency Standard and Calibration References

These frequency standards operate on LF or VLF frequencies, within the reception range of suitably stable, high-power, long wave transmitters. This range often exceeds 1500 km. The 198 kHz (Droitwich Radio 4) and 162 kHz (France Inter) transmitters are locked, and/or are traceable, to well recognised national frequency standards via published data "post facto". The 198 kHz and 162 kHz versions are standard. Other LF transmissions will be considered.

- All models contain a dedicated receiver system with a very sharp band pass crystal filter to extract the transmitter carrier (and reject all of the sidebands).

2A-X x 10^{-11}

- Model 2A-X uses a VCXO, running at 10 MHz, to provide phase locked loop (PLL) inputs and also to provide output signals-after appropriate processing.

2A-X

2A-Y x 10^{-12}

- The Model 2A-Y has a fast warm-up, directly heated crystal OCXO. This results in a lower phase noise - beyond the much reduced loop bandwidth, hence improving all of the noise performance figures.
- Models 2A-X and 2A-Y have 1 & 10 MHz sine waves as standard, in addition to 1, 5 & 10 MHz square waves. A 5 MHz sine wave is optional.
- Low Cost from €1000
- 'No' drift corrected by NPL to <5E-12/day
- Directly traceable to NPL

2A-Y

- Stability & Accuracy <3E-11 with low phase noise (-155 dBc @ 10 kHz)
- 25 years of experience + Year 2000 design
- Strategically independent
- Excellent start up product ideal for spectrum analysers, microwave network analysers, counter timers, synth radio communication monitors, Tetra radio test system, GSM and CDMA BTS commissioning and VHF/UHF PMR base station referencing
- Active loop antenna ('H' field active indoor 1m ø gives excellent temp. performance and improves stability, time and ability to stay in lock (also available as separate product).

For more information go to: **www.quartzlock.com/2A** or request **ANQL2-01 / ANQL2-02.**

A3 Bench Instrument & Rack 19" Quartz Frequency Standard

(5 models)

The Quartzlock A3 series consists of bench and rack mount Quartz Frequency Standard Instruments. The Instruments consist of a specified Oven Controlled Quartz Oscillator (OCXO). The user can choose optional OCXO's with differing levels of stability and phase noise. This applies to both the bench (A3-B) and rack mount (A3-RT) instruments.

A3-B

Features of both A3-B and A3-R

- 13 outputs (1, 5 & 10MHz sine and square waves on front panel, 1pps on front panel and 6 x 1, 5 or 10 MHz on back panel-user configurable)
- 1 PPS sync lock input to adjust start position of 1PPS to external reference pulse
- Output Power level +12dBm
- BBU XLR Input

A3-B

- Bench top instrument
- 12 V DC External Power Supply (90...240Vac adaptor supplied)

A3-R (EI or TI options)

- 19" 1U Rack Mount instrument (internal PSU)

TELECOM

A3-RT

Performance of 'standard' OCXO — A3-2001

- STS 5E-12 @ τ= 1s
- SC cut OCXO @ 10 MHz
- Ageing 1E-10/day, 1E-8/month & 5E-8/year
- Phase Noise -130 dBc/Hz @10 Hz & -158 dBc/Hz @10kHz
- Thermal Stability +/- 5E-8 over -60°C...+70°C

Optional OCXO's

Low Phase Noise	-165dBc@10kHz	A3-2007
100MHz BT cut		A3-3005
Fast Warm Time	15 seconds	A3-2008
Low power	150mW	A3-2008
Excellent STS	1 x 10^{-12}/s	A3-2007

For more information go to: **quartzlock.com/A3**

Quartzlock

Hydrogen Maser Compatible Peripheral Instruments

For use with all types of frequency source

A5 Distribution Amplifiers

(4 model)

The Quartzlock range of distribution amplifiers are intended for use when multiple outputs from a single frequency standard/generator are required. This may be encountered in engineering labs, national standards labs, research and development, calibration labs and production. Vital for the distribution of signals from precision frequency standards like Hydrogen Masers, Cesium oscillators, GPS disciplined Oscillators, Rubidium Oscillators and Quartz Crystal Oscillators.

All Quartzlock distribution amplifiers feature high isolation between inputs and outputs, low harmonic distortion, low phase noise and exceptional temperature stability.

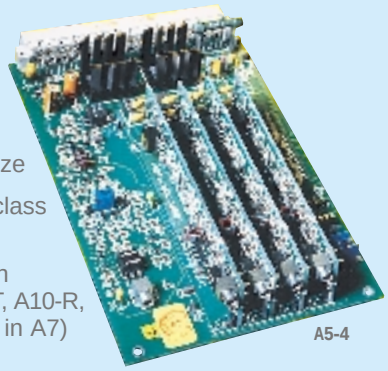
The Quartzlock range is adaptable and configurable offering the user the possibility of obtaining up to 32 outputs from between 1 to 4 RF sine wave reference signals. When combined with the CH1-75 active hydrogen maser, the A5 enables probably the most accurate method in the world of procuring multiple stable outputs for use in the laboratory.

- 1.... 100MHz frequency input range (sine)
- Phase Noise -130 dBc/Hz @1 Hz and -160 dBc/Hz @ >100Hz
- Temperature Stability <10ps/°C
- Hydrogen Maser Compatible Performance
- STS 1E-13/τ= 1s
- Low Harmonic Distortion and High input/input and input/output isolation.
- Bipolar junction amplifier design gives low 1/f AM and PM noise

For more information go to **quartzlock.com/A5** or request copies of **ANQL5-01**

A5-4 EUROCARD

- 1 input and 4 outputs
- Standard 100mm*160mm size
- DIN4162 64 way class A/C connector
- May fit as option in A3-R, A8-M, A8-RT, A10-R, A10-RT (standard in A7)



A5-4

A5-12 Rear

A5-12

- 1 input on front panel and 12 outputs on back panel (BNC)
- Output power 13 dBm into 50Ω (adjustable to 17 dBm max.)

A5-24

A5-24 Rear

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- Primary and Secondary inputs on back panel
- 24 outputs (BNC) on back panel (12 output option)
- User afforded either 1 input with 24 outputs or 2 inputs with 12 outputs / each input. Specify upon order

A5-PSQ

- 1 input and 12 output
- 1pps to 20 MHz Square Wave
- Made to order

A6 Frequency Convertor

TELECOM & SATCOM

- Provides 100kHz, 1MHz, 5MHz, 10MHz, (2048kHz & 13MHz options) from Maser 5MHz input or 10MHz from Rb.
- Sinewave > -50dBc all harmonics & spurious.
- 1pps & 1Hz outputs. ■ 1pps sync input.

For more information go to **quartzlock.com/A6**

A6

Quartzlock

Very High Resolution

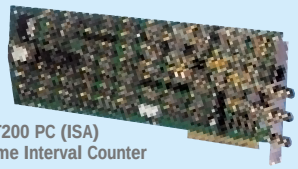
A7 Frequency and Phase Comparator/Calibrator

(with time interval counter)

The A7 consists of a 19" 2U rack mount instrument connected via 3 BNC leads to a PC through an ISA card Time Interval Counter (TIC). The A7 is controlled via front panel controls whilst the TIC is remotely controlled through a PC display. This automates data acquisition and enables storage of large quantities of raw phase data. Through industry specific Stable 32 Frequency Stability Analysis Software, the user is able to analyse the data in the most appropriate and useful way.

A7

B



GT200 PC (ISA)
Time Interval Counter

A7 System Virtual Front Panel

A7

- Complete system consisting of Phase Comparator, Time interval counter and Analysis Software.
- World's best single-shot rms resolution of 0.3ps (i.e. 300fs) Permits frequency offset's of 3E-13 (or greater)(τ=1s to be removed instantaneously)
- Worlds lowest noise floor in a commercial measurement system (5E-14 @ 1s and 3E-17 @ 10000s). Enables full characterisation of Active Hydrogen Masers at all averaging times (τ1s).
- Operates on both 5 MHz and 10 MHz input signals (measurement and reference input with seamless switching)
- Measurements may be made of either the frequency or phase of the input 5 or 10 MHz signal.
- A5-4 distribution card included as standard, enabling 4 way distribution through front panel (N-Type connectors)
- Optional Internal Rubidium Oscillator (interface already provided) providing high stability 10 MHz reference output signal. A7 is then a complete generation, measurement and distribution system
- Stable 32 Frequency Stability Analysis Software supplied to enable calculation of Allan, Modified Allan, Time, and Hadamard Variances.
- Telecoms users have access to MTIE and TIErms statistics

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- Optional Full and Extensive On-site Training from experienced Quartzlock Personnel to familiarise user with system
- Easy to follow documentation provided enables world class measurement system to be functional within 1 hour of installation

Applications

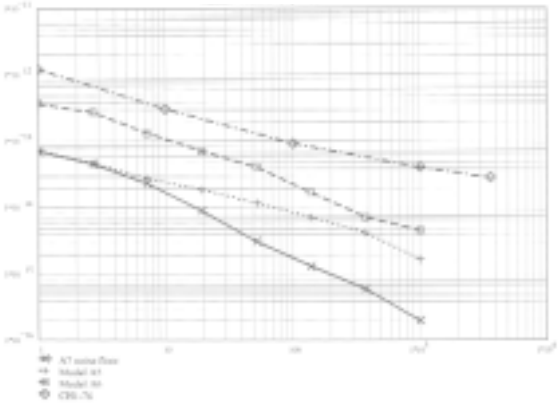
- National standards and calibration laboratories for detecting differences between Hydrogen Maser, Cesium Beam, Rubidium & GPS Frequency Standards
- Research into latest Cesium and Rubidium fountains, cryogenic hydrogen masers and trapped ion frequency standards
- Short-term characterisation of ultra-stable OCXO's for Satellites and Telecoms
- Production and characterisation of Cesium, Rubidium and Quartz frequency standards
- Test and calibration of Rubidium VXI modules

Options (non-essential for operation)

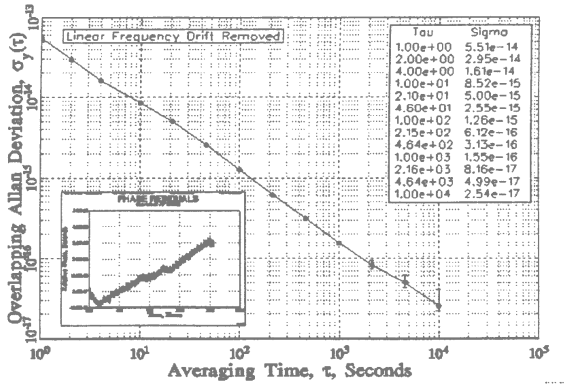
- Internal Rubidium Oscillator
- Internal High Stability Rubidium Oscillator (HSRO)
- Onsite Installation and Training
- User Configurable MathCAD Frequency stability/offset routines and copy of MathCAD 8.0
- PC and Colour Inkjet Printer

For more information: **www.quartzlock.com/A7** or request copies of **ANQL7-01, ANQL7-02, ANQL7-03, SPQL7-01** and **SPQL7-02.**

A5/A6/A7 & Passive H.Maser



Stable 32 plot of A7 noise floor



GPS Time & Frequency Standards

Unique Carrier Phase Tracking

The Quartzlock A8 series are unique within their price range because they perform extremely high-resolution carrier phase measurements for each satellite being tracked. The A8 series can operate with 1 satellite only. This enables the extraction of stable and accurate frequency information from the complex signal format. This leads to a frequency resolution, which is better than the C/A code tracking - used in all normal equipment- by a factor of 10,000.

The resolution of the A8-M is so high that the frequency of the local oscillator can be measured to 1 x 10^{-11} in less than 1s. This allows ultra precise tracking of the reference. A typical output stability in 10s measurement time is 1 x 10^{-12}.

Due to the world class accuracy of the Quartzlock model A8, there exist many applications: The calibration of counters, timers, radio test equipment and all quartz based instrumentation within standards laboratories, time transfer, OEM, the referencing of radio transmitter frequency including quasi-sync systems, the synchronisation of telecom systems including Stratum I and II GSM, PCN base station commissioning and reference unit, time scale correction to UTC, Digital Audio Broadcasting (DAB), Digital TV & GSM 2000

A8-B GPS Frequency & Time Standard

BENCH

Second generation (Replaces 8, 8A & 8A+)

- Available with XO or OCXO Local Oscillator
- Sine and square wave outputs at 1, 5 and 10 MHz and square wave at 100 kHz (option)
- 1pps output synchronised to UTC/GPS
- Serial data output in NMEA 0183 format for remote monitoring
- STS (varies according to LO) 2E-11@ 1s, 8E-11 @1000s & 1E-12 @ 1day for standard version
- Time Accuracy <100ns wrt UTC from May 00
- 5 ns between A8's typ.

A8-RT GPS Frequency Standard

Second generation (Replaces 8-R)

B

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- Available in standard OCXO, low cost XO and rubidium versions
- 1, 5 and 10 MHz sine waves & 1pps from front panel and square wave outputs & (sine wave option) plus alarms on rear panel.
- 1pps synchronised to UTC/GPS
- Optional A5-4 distribution card (4 outputs) See p3.
- Serial data output in NMEA 0183 format for remote monitoring
- STS (varies according to LO) 3E-11@ 1s, 6E-13 @ 1000s & 2E-13 @ 1 day for Rubidium

A8-M GPS Frequency & Time Standard

METROLOGY

Second generation (Replaces 8A-Rb & A8-Rb)

Opt. 8-04 version

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B

- Available in rubidium or high spec rubidium (HSRO)
- 1, 5 & 10 MHz sine wave via front panel (option rear)
- 1, 5 & 10 MHz square outputs via rear panel
- Optional A5-4 distribution card (4 outputs)
- Optional E1, T1 & 13 MHz outputs also A8-RT
- 1pps synchronised to UTC/GPS
- Thermostatic temperature controlling of Rubidium to ensure ultra high stability
- Serial data output in NMEA 0183 for monitoring.
- Cesium compatible stability at fraction of price with no costly wear-out physics package
- STS 2E-11@1s, 2E-13 @1000s & 1E-13 @ 1 day.
- Time accuracy <5ns between two 'identical' co-located receivers
- 1u rackmount large quantity TELECOM option
- E1 T1 or 13 MHz outputs options

For more information: **www.quartzlock.com/A8** or request copies of **ANQL8-01, ANQL8-02, ANQL8-03, ANQL8-04, ANQL8-05, SPQL8-04, SPQL8-05**

STOP PRESS...

...NEW Eurocard Rb 100 x 160mm & VME Pack Rb (LCRO spec) 89 x 76 x 18/22 (3.5" x 3" x 0.7/0.8") will be available mid-2001

Rugged milspecs for 2001 - all models

Rubidium Frequency Standards

A Rubidium frequency standard owes its outstanding accuracy and superb stability to a unique frequency control mechanism. The resonant transition frequency of the Rb87 atom (6,834,682,614 Hz) is used as a reference against which an OCXO output is compared. The OCXO output is multiplied to the resonance frequency and is used to drive the microwave cavity where the atomic transition is detected by Electro-optical means. The detector is used to lock the OCXO output ensuring its medium and long-term stability

Quartzlock has developed a range of Rubidium components and also complete instruments. One of the advantages conferred to the user is the ability to be able to mix and match component with instrument, ensuring the correct quality oscillator is married into a suitably sized instrument, with the appropriate number of outputs.

Advantages of Rubidium as a Frequency Standard

- *High accuracy* ■ *Small size* ■ *Low weight*
- *Lower power consumption* ■ *Environmentally tolerant*
- *Ideal for mobile applications*
- *No antenna - strategically independent*

Applications

- *Frequency calibration*
- *Telecom network synchronisation*
- *Cellular base station* ■ *TV broadcasting*
- *Satellite navigation and GPS receivers*
- *Radio transmitters* ■ *Radio navigation*
- *Ground and satellite communications*
- *Secure communication and spread spectrum*

For more information: quartzlock.com/A10
or request copies of ANQL10-01 / ANQL10-02

A10 Rubidium Oscillators (Components)

P400 (FRS)

- Form, fit and function as FRS
- 400cc
- Size 51mm x 76mm x 102mm (2" x 3" x 4")
- Mixed 'D' connector with RF coaxial connector
- Options: P400-01/D (Low Cost)
  P400-02/B (Standard)
  P400-03/A (High Performance)
- STS of standard P400 is 3E-11/τ=1s
- Freq. Offset upon shipment <5E-11
- Drift of standard P400 is 4E-11 per month
- 24V DC power required (15V upon request)
- Phase noise -148dBc/Hz (-160dBc opiton) @ 10 kHz offset

P450 (LPRO)

- Form, fit and Function as LPRO
- 450cc low profile unit ■ 38mm*94mm*127mm
- Standard 'D' connector for power with RF signal output through adjacent SMA female
- Options: P450-01/D (Low Cost)
  P450-02/B (Standard)
  P450-03/A (High Performance)
- STS of standard P450 is 3E-11/τ=1s
- Freq. Offset upon shipment <5E-11
- Drift of standard P450 is 4E-11 per month
- 24V DC power required (15V option)
- SSB phase noise of standard is -148dBc/Hz @ 10 kHz offset

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HSRO and P1000

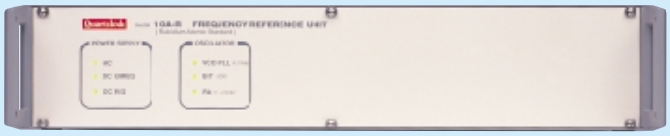
- 1000cc high stability rubidium oscillators
- 75mm x 87mm x 157mm
- STS of P1000 is 5E-12/$\tau^{1/2}$ HSRO 3E-12/$\tau^{1/2}$
- Freq. Offset upon shipment <2E-11
- Drift of standard P1000 is 2E-11 per month
- SSB phase noise -155 dBcHz @10 kHz

A10-B Bench Instrument Rubidium Standard

- 1, 5 & 10 MHz sine and square wave via front panel (power level +12dBm - adjustable)
- 1pps output and 1pps input for synchronisation to external 1pps
- 6* any of 1, 5 or 10 MHz sinewave via back panel (user configurable)
- Powered by ext. PSU (supplied)
- Bench top instrument
- GPS sync with A8-B makes world's smallest primary reference clock
- 14 outputs

Rubidium Frequency Standards

10A-R Rackmount Rubidium Standard



- 1 core +8dBm 10 MHz output via back panel
- GPS disciplining interface as standard
- Optional 19" 1U Telecoms unit with E1 or T1 outputs A10-RT
- Optional 13MHz outputs
- Standard Spec
- Optional A5-4 distribution card (4 outputs)
- Available with any P400, P450, P1000 or HSRO
- Nato stock no
- Milspec

TELECOM & SATCOM

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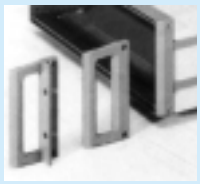


- Rackmount & bench trim options A5, A6,A7,A8 & A10.

B

Seamless switching to and from an external battery backup unit in the event of a.c supply glitch or failure.

Battery current is only taken when the internal line voltage drops below a preset threshold, even if the float battery voltage is higher than this internal line supply output. For example, the external supply may be 24V, and the float battery voltage 28V. When this supply drops below the threshold, say 23V, the battery is connected without switching glitches. When the power line is restored, the internal power supply will seamlessly take over the load.

If the battery voltage is below a preset threshold, say 22V, the above sequence is inhibited and the battery will not be connected to the equipment. This is intended to protect discharged batteries from excessive discharge.

The board is protected from reverse polarity connection of the battery whether or not the line power supply is on.

A "Battery Available" LED monitor is provided to indicate to the user that the battery is connected and above the switching threshold. It does not indicate the state of charge of the battery. A "Battery in Use" LED monitor is also provided to indicate to the user that the battery is supplying current to the equipment and that the ac supply has failed.

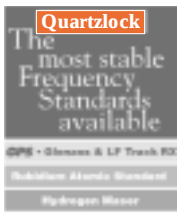
A3* / A5 / A6 / A7 / A8^{-M} */ A10$^{-B/R}$*

***option**

Represented Locally By

STABILITY RESULTS COMPARISON TABLE (Typical Results)

	Time and Frequency Standards						Passive distribution, conversion and measurement instruments		
Standard	**PHM CH1-76**	**A3 2000**	**A3 2007**	**A8-M**	**A8-B / A8-RT**	**A10-B / A10-R**	**A5 Series**	**A6**	**A7**
Measurement Time τ sec	Passive Hydrogen Maser	OCXO	OCXO	(Metrology) GPS disciplined Rubidium	(Bench) (Rack) (Telecoms) GPS with standard	(Bench) (Rack) Rubidium Frequency Standard	Distribution Amplifiers	Frequency Converter	Frequency and Phase Comparator
1	1.0×10^{-12}	3×10^{-12}	1×10^{-12}	1.4×10^{-11}	3.0×10^{-11}	2.4×10^{-11}	7.0×10^{-14}	4.0×10^{-13}	5.5×10^{-14}
10	2.5×10^{-13}	3×10^{-12}		2.4×10^{-12}	6.7×10^{-12}	8.1×10^{-12}	2.5×10^{-14}	1.0×10^{-13}	8.5×10^{-15}
100	8.4×10^{-14}	1×10^{-11}		5.6×10^{-13}	2.4×10^{-11}	2.5×10^{-12}	9.0×10^{-15}	2.5×10^{-14}	1.2×10^{-15}
1000	2.1×10^{-14}	8×10^{-11}		1.7×10^{-13}	7.0×10^{-11}	8.6×10^{-13}	2.0×10^{-15}	5.0×10^{-15}	1.6×10^{-16}
10000	4.9×10^{-15}			8.5×10^{-14}	5.0×10^{-12}	3.0×10^{-13}			2.5×10^{-17}



ISO 9001

Craft Award 2000/2 CE

NIST Traceable Standard

NPL Referenced

5x dti Smart Awards

Quartzlock UK ltd
Gothic, Plymouth Road,Totnes, Devon TQ9 5LH, England
Fax +44 (0)1803 867 962 Tel +44 (0)1803 862 062
Web: **quartzlock.com** e-mail: **quartzlock@quartzlock.com**

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