GPS-Disciplined Rubidium Clock

AR51A-08-01

Full Military Qualifications

Key Features

- *Frequency Accuracy : ≤2E-12*
- *1PPS Accuracy: ≤100ns RMS, 30ns typical*
- *Outputs: 2x10MHz, 6x 1PPS (1xTTL, 5xRS-422), 2x1KPPS (RS-422), 1x100KPPS (RS-422)*
- *TOD Outputs: 5xReshef*
- *Disciplined to GPS or Ext 1PPS.*
- *Communication:RS-232, RS-422*
- *Operating Temperature: -40°C to +71°C*
- *Holdover (without GPS): 1µs/24 hours, 5E-11/month*
- *1 hour rechargeable battery back-up*
- *Power remote control*
- *Supply Voltage: 22-32 VDC per MIL-STD-704A*
- *Full MIL-STD qualification for military airborne and seaborne applications*

Description

The AR51A-08-01 offers militarized **Rubidium Atomic Clocks,** which is synchronized to the **Global Positioning System (GPS)**, thereby providing extremely accurate time & frequency.
The AR51A-08-01 incorporates numerous features into a single box, including a Rubidium Standard, an internal GPS receiver a Rubidium-GPS DPLL (disciplining) circuit, time codes, multiple outputs. The Rubidium clock is phase locked to the GPS or other external inputs (as a back-up to GPS system). All outputs are derived from the Rubidium clock which maintains time and frequency when GPS or other inputs are interrupted.
The AR51A-08-01 has been fully qualified for operation in harsh stressed environments on ground mobile, airborne, fighter aircraft, Helicopter and ship borne platforms.

Applications

- Communication
- Naval, airborne and ground applications
- Field calibration

Any other applications which requires accurate source of frequency & time

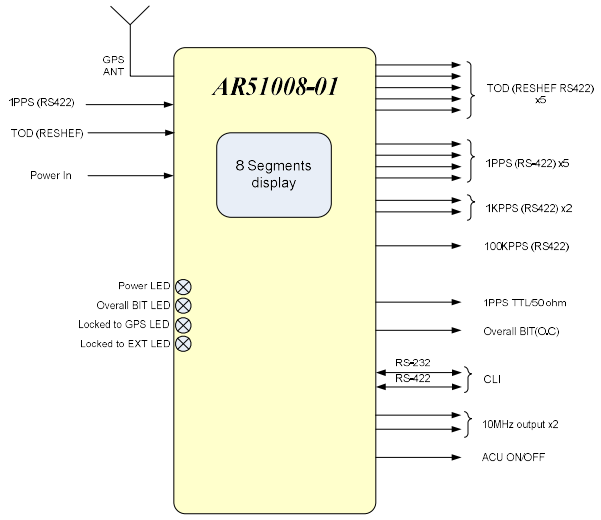
ES France - Département RF & Hyperfréquences - 127 rue de Buzenval BP 26 - 92380 Garches
Tél. 01 47 95 99 60 - Fax. 01 47 01 16 22 - e-mail: hyper@es-france.com - Site Web: www.es-france.com

SPECIFICATIONS

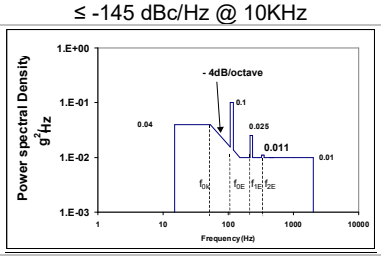
All specs are @ 25°C, quiescent conditions and sea level ambient unless otherwise specified

Input & Outputs

Outputs	2x 10MHz, Sine wave / 50Ω
	1x 1PPS, TTL / 50 ohm
	5x 1PPS (RS-422)
	2x 1KPPS (RS-422)
	1x 100KPPS (RS-422)
	5x Reshef (RS-422)
Display	8 alphanumeric characters
Input	GPS Antenna
	Ext. 1PPS (RS-422)
	1x Reshef
Communication	RS232 (CLI) (input/output)
	RS422 (CLI) (input /output)
	GUI for PC is available :Time, Date, Position, Status, BIT (Built in test) etc.



Performance

	Mode of operation:	**Disciplined to GPS or to Ext. 1PPS**		**Free running Rubidium-Standard (holdover)**
Time (1PPS)	**Accuracy (RMS)**	≤100ns (30ns Typ.) RMS @ 25°C		≤ 1µs/day (typical), 5µs/week (typical)
Frequency	**Power level** (10MHz - J5)	11±3 dBm		
	Long Term Stability	<2E-12		≤5E-11 / month drift in holdover
	Short Term Stability	≤3E-11 @ 1sec; ≤3E-12 @ 100sec		
	Temperature Stability	±3E-10 over -40°C to +65°C		
	Phase Noise (10MHz)	Frequency	Quiescent Spec	Quiescent Typical / Vibration (including Shock Mount)
		10	≤-100 dBc/Hz	≤-104 dBc/Hz / ≤ -83 dBc/Hz @ 10Hz
		100	≤-130 dBc/Hz	≤-136 dBc/Hz / ≤ -118 dBc/Hz @ 100Hz
		1KHz	≤-140 dBc/Hz	≤-145 dBc/Hz / ≤ -112 dBc/Hz @ 1KHz
		10KHz	≤-145 dBc/Hz	≤-152 dBc/Hz / ≤ -145 dBc/Hz @ 10KHz
				
	Harmonics (10MHz)	≤-40 dBc (-45dBc Typ.)		
	Spurious (10MHz)	≤-75 dBc ± 100KHz (-98dBc Typ.)		
	Warm-up	5E-10 within <7 min, 5E-11 within < 60 min, 1E-11 within <4hrs, 2E-12 within <24 hrs.		
Serial Time & Location Protocol (CLI)		**RS-232 / RS-422** Inputs should not be connected simultaneously		19,200 bps, Full duplex for command, control and data: setting time/date, delay correction for 1PPS 100ns steps, mode of operation (disciplining GPS, to Ext 1PPS, holdover, UTC time, GPS Time, Local Time, Day Light Saving) etc....(see CLI document for more information)

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SPECIFICATIONS *(continue)*

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Power Supply	
Input Voltage	22-32 VDC per MIL-STD-704A <56 Watt @ Warm-Up (10 Min), <26 Watt @ Steady-state
Battery Back-Up	1 hour operation @ 25°C, Ex Factory, 18 hours charge Charging voltage 26-32 VDC

GPS Receiver	
Tracking	L1 frequency 1575 MHz C/A code (SPS) 12 parallel tracking channels
Position	Lat., long., alt.
Position Accuracy	<6m CEP (50%) w/o SA
GPS Antenna DC Voltage	5V
Acquisition Time	Warm start 5 min., Cold start < 13 min (worst case)

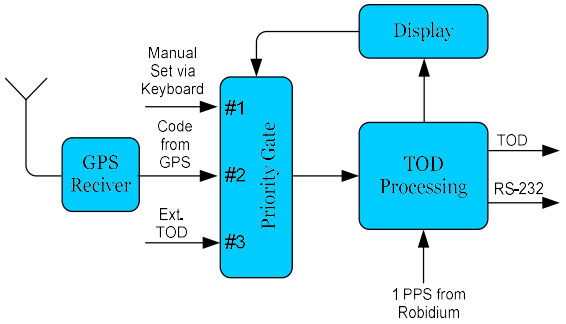
Dimensions & Weight		
W/O shock-tray	Dimensions (±1mm)	206mm (w) x 123mm (h) x 220mm (d)
	weight	3.3±0.03 Kg
With shock-tray	Dimensions (±1mm)	210mm (w) x 164mm (h) x 274mm (d)
	weight	5 Kg±0.1 Kg

Environmental	
Temperature	Operating :-40°C to +71°C (startup at -40°C) Storage: -40°C to +71°C
Altitude	45,000 ft
Humidity	Up to 95%
Random Vibration	MIL-STD-810D, Method 514.3 cat. 6 level
Transportation Vibration	MIL-STD-810F, Method 514.5, Category 4
Drip	MIL-STD-810F, Method 506.4, Procedure III
Salt Atmosphere	MIL-STD-810F, Method 509.4
Mechanical Shock	MIL-STD-810C, Method 516.2, Proc. 1 (20g / 11mSec / Half sine/ 3 axis CRASH)
Bench Handling Shock	MIL-STD-810F, Method 516.5, Procedure VI
EMI / RFI	CE102, CS101, CS114, CS115, CS116, RE102, RS101, RS103

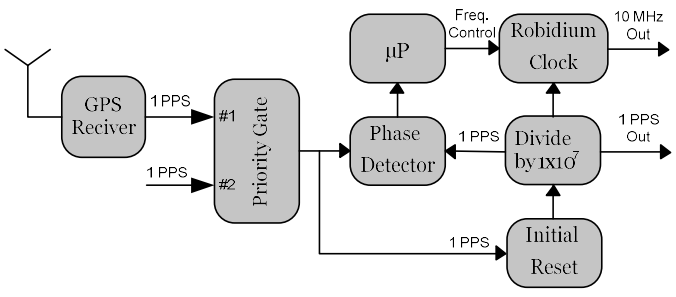
Reliability, Maintainability, Testability	
MTBF	> 20,000 hours @ 30°C, ARW, 7000 Hours @ 55°C, AUC
MTTR – O Level	12 min. to replace failed unit
MTTR – I Level	34 min. to replace failed module
BIT (Built In Test)	On-line BIT – Automatic, Covers 87% of all failures

Principles of Operation

The following block diagrams depict the operation of the AR-51A. The unit includes Rubidium Standard and accepts Input from either internal GPS receiver, or external GPS, or external 1PPS or external IRIG B. All outputs are derived from the internal Rubidium Clock, which is phase locked via a digital PLL to the internal GPS receiver or to one of the external inputs. Thus, the Rubidium Clock - frequency and time - follows the GPS on average. If GPS reception is lost for short or long periods of time the Rubidium Clock continues to maintain accurate time and frequency without phase interruption.



Data flow & Inputs Selection



Rubidium-GPS D-PLL and Inputs

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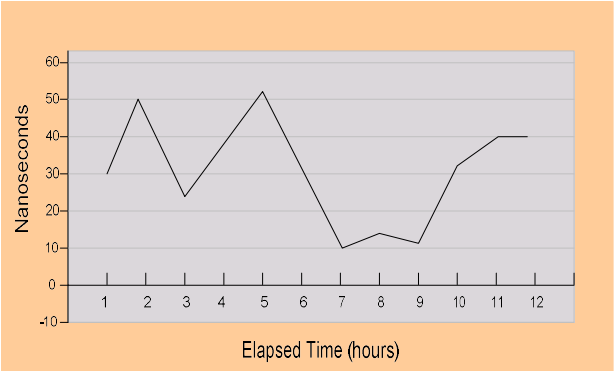
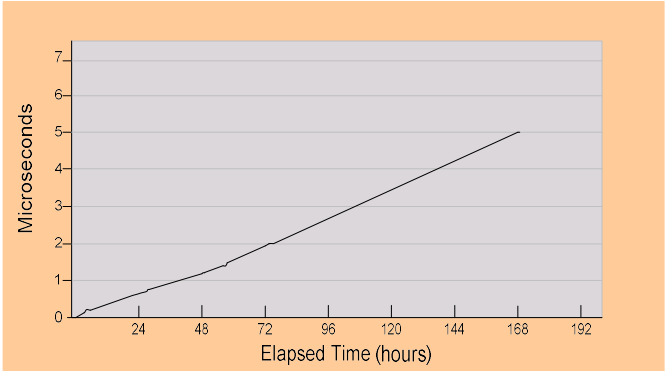
Typical Performance Plots

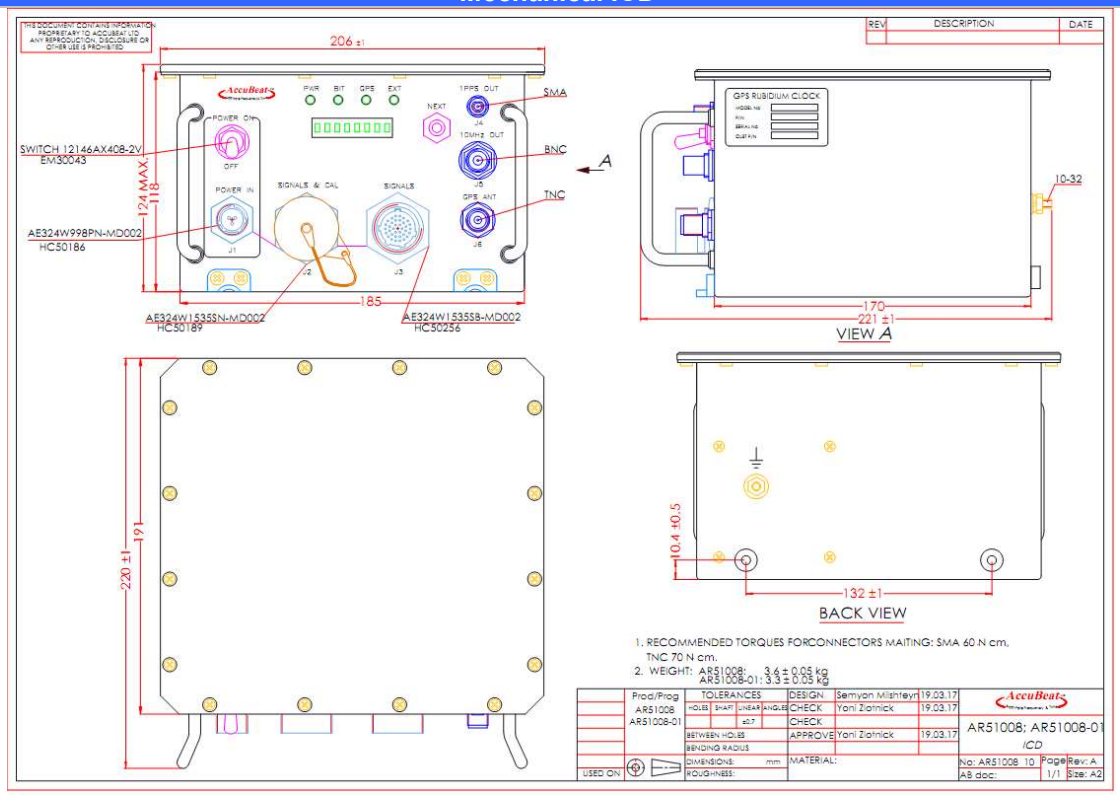


Typical time error fluctuations when disciplined to GPS



Typical time error in Holdover (without GPS)

Mechanical ICD



HOW TO ORDER

ACCESSORIES	AccuBeat P/N:
AR51A-08-01	AR51008-01
Vibration Isolator	AA50119
Airborne GPS Antenna 36 dB	EM30083
Ground GPS Antenna 35 dB	EM30064
Antenna Cable 5 meter	AC50526
Antenna Cable 16 meter	AC50526-01

AccuBeat Ltd, 5 Ha'Marpeh St., Har Hotzvim, P.O.Box 45012, Jerusalem 91450, Israel
Tel: +972-2-5868330, Fax: +972-2-5868550, E-Mail: marketing@accubeat.com
http://www.accubeat.com