

GPS-Disciplined Rubidium Clock

AR51A-05

Full Military Qualifications, Including MIL-STD-1553 Communication

Key Features

- ❖ Frequency Accuracy : $2E-12$
- ❖ 1PPS Accuracy: 100ns (RMS), 30ns typical
- ❖ Outputs: 2x10MHz, 17x 1PPS (1xTTL & 16xRS-422), 2xIRIG B, Have Quick (Opt.)
- ❖ IRIG B Reader / Generator
- ❖ Disciplined to GPS or Ext 1PPS or ext IRIG B
- ❖ Communication: MUX-BUS - MIL-STD-1553 (Opt.) RS-232, RS-422
- ❖ Operating Temperature: -40°C to $+71^{\circ}\text{C}$
- ❖ Holdover (without GPS): $1\mu\text{s}/24$ hours, $5E-11/\text{month}$
- ❖ 1 hour rechargeable battery back-up
- ❖ Power remote control
- ❖ Supply Voltage: 22-32 VDC per MIL-STD-704A
- ❖ GPS disciplined Rubidium clock
- ❖ Full MIL-STD qualification for military Airborne Applications



Description

The AR51A-05 offers militarized **Rubidium Atomic Clocks**, which is synchronized to the **Global Positioning System (GPS)**, thereby providing extremely accurate time & frequency.

The AR51A-05 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-05 has been fully qualified for operation in harsh stressed environments on ground mobile, airborne, fighter aircraft, Helicopter and ship borne platforms.

Applications

- | | | |
|---|-------------------------|---------------------|
| ❖ Communication | ❖ Telemetry test fields | ❖ Field calibration |
| Any other applications which requires accurate source of frequency & time | | |

SPECIFICATIONS

All specs are at room temperature, quiescent conditions, sea level ambient unless otherwise specified

Input & Outputs		
Outputs	2 x 10MHz, Sine wave (5±2)dBm SMA / 50Ω	
	1 PPS (TTL SMA 50 ohm)	
	16 x 1 PPS (RS-422)	
	1K PPS (Optional)	
	2 x IRIG B	
	Have Quick (Opt.) (replaces one of the IRIG B outputs)	
Input	GPS Antenna	
	Ext. 1 PPS (TTL 50 ohm)	
	IRIG B	
Communication	RS232 (CLI) (input/output)	
	RS422 (CLI) (for monitoring only)	
	MIL STD 1553 (MUX-BUS) (Opt.)	
	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	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	Typical
		10	≤-100 dBc/Hz	≤-103 dBc/Hz
		100	≤-130 dBc/Hz	≤-135 dBc/Hz
		1KHz	≤-140 dBc/Hz	≤-148 dBc/Hz
		10KHz	≤-145 dBc/Hz	≤-150 dBc/Hz
		Under Vibration (including Shock Mount)		
	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.		
IRIG B Output	Accuracy	±10µs		
	Time Format	Day of year, Hour, Min., Sec – 1 KHz modulated		
MIL-STD-1553 MUX BUS (Opt.)	Time Update	1ms		
	Network Definition	Remote Terminal		
Serial Time & Location Protocol (CLI)		RS-232 / RS-422 Not 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)	

SPECIFICATIONS (continue)

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Power Supply

Input Voltage	22-32 VDC per MIL-STD-704A <40 Watt @ Warm-Up (10 Min), <24 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) 8 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	206mm (w) x 122mm (h) x 210mm (d)
	weight	3.1 Kg
With shock-tray	Dimensions	210mm (w) x 164mm (h) x 274mm (d)
	weight	4.5 Kg

Environmental

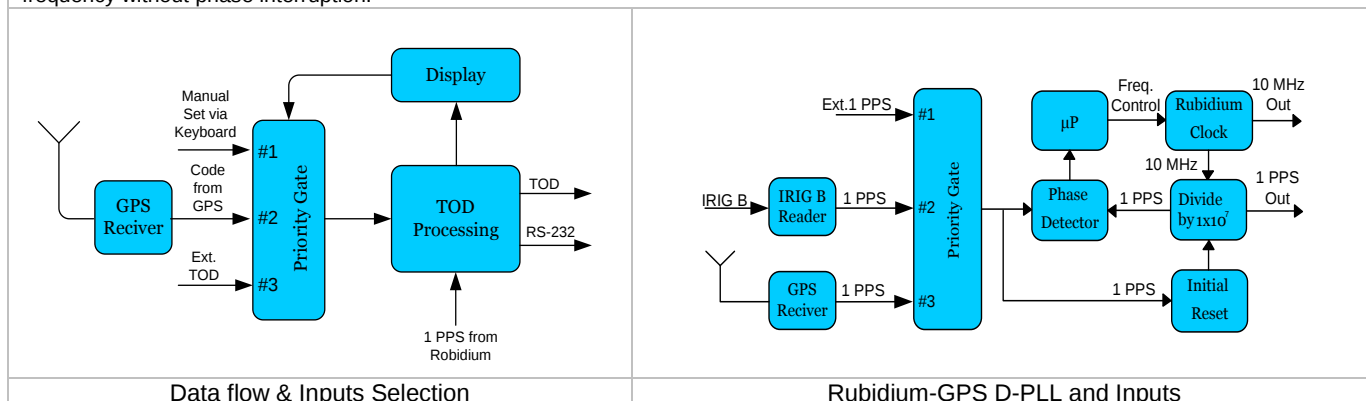
Temperature	Operating : -40°C to +71°C (startup at -40°C) Storage: -40°C to +71°C
Altitude	45,000 ft
Humidity	Up to 95% including condensation @ +35°C
Random Vibration	MIL-STD-810D, Method 514.3 cat. 6 level (0.01 g ² /Hz, 2 Hours/axis)
Transportation Vibration	MIL-STD-810F, Method 514.5, Category 4
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 (30g / 11mSec / Half sine/ 3 axis)
Bench Handling Shock	MIL-STD-810F, Method 516.5, Procedure VI
EMI / RFI	MIL-STD-461, CE01, CE03, CE07, RE02, CS01, CS02, CS06, RS02, RS03 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.



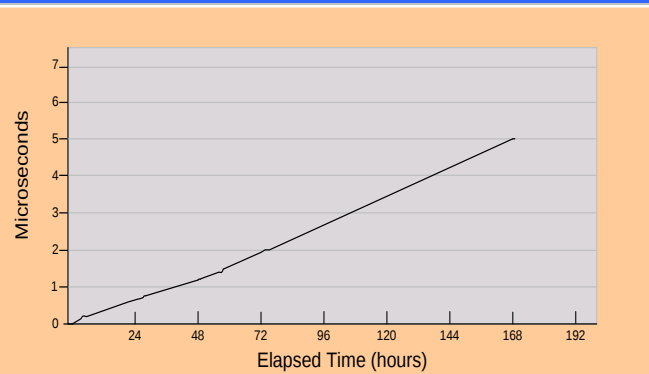
SPECIFICATIONS (continue)

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Typical Performance Plots

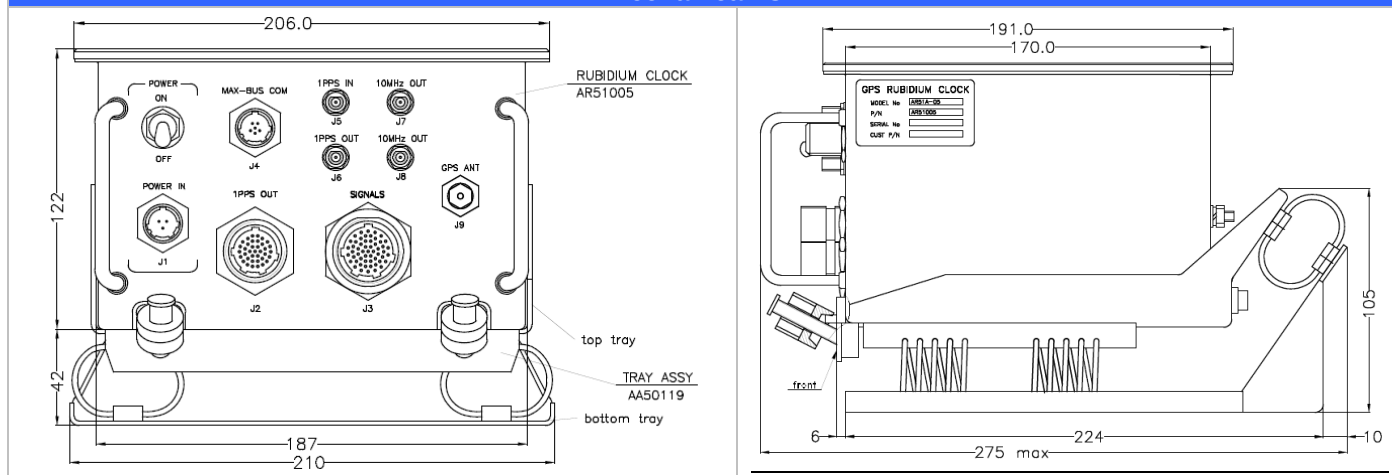


Typical time error fluctuations when disciplined to GPS



Typical time error in Holdover (without GPS)

Mechanical ICD



HOW TO ORDER

ITEM	AccuBeat P/N
AR51A-05 with muxbus	AR51005-02
AR51A-05 without muxbus	Contact AccuBeat

Accessories	
ITEM	AccuBeat P/N
Vibration Isolator	AA50119
Airborne GPS Antenna 36 dB	EM30056
Ground GPS Antenna 35 dB	EM30039
Antenna Cable 5m	AC50526
Antenna Cable 16m	AC50526-01
GUI for PC is available	SW50010

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