

## GPS-Disciplined Rubidium Clock

### AR51A-05

#### Full Military Qualifications, Including MIL-STD-1553 Communication

#### Key Features

- ❖ Frequency Accuracy : 2E-12
- ❖ 1PPS Accuracy: 100ns (RMS)
- ❖ 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 °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
- ❖ 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.

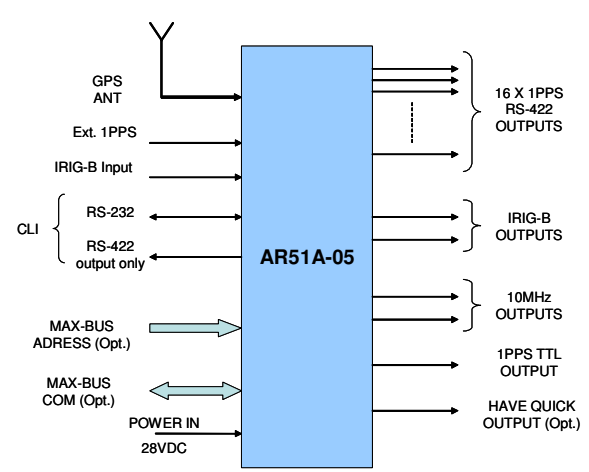
#### Applications

- |   |  |   |
|---|--|---|
| <ul style="list-style-type: none"> <li>❖ Secure Communication</li> <li>❖ ELINT Receivers</li> <li>❖ Electronic warfare</li> </ul> | <ul style="list-style-type: none"> <li>❖ Radar, Bi-static Radar</li> <li>❖ Field calibration</li> <li>❖ Telemetry test fields</li> </ul> | <ul style="list-style-type: none"> <li>❖ C4I (Command, Control, Communications, Computer &amp; Intelligence)</li> </ul> |
|---|--|---|

## SPECIFICATIONS

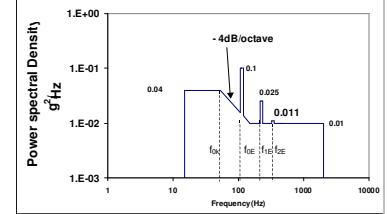
All specs are at room temperature, quiescent conditions, sea level ambient unless otherwise specified

### Input & Outputs

<b>Outputs</b>	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.) <i>(replaces one of the IRIG B outputs)</i>	
<b>Input</b>	GPS Antenna Ext. 1 PPS (TTL 50 ohm) IRIG B	
<b>Communication</b>	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

		Disciplined to GPS or to Ext. 1PPS	Free running Rubidium-Standard (holdover)	
<b>Time (1PPS)</b>	<b>Accuracy (RMS)</b>	±100ns (30ns Typ.) RMS @ 25°C	< 1µs/day (typical), 5µs/week (typical)	
<b>Frequency</b>	<b>Long Term Stability</b>	<2E-12	5E-11 / month drift in holdover	
	<b>Short Term Stability</b>	<3E-11 @ 1sec; <3E-12 @ 100sec		
	<b>Temperature Stability</b>	±3E-10 over -40°C to +65°C		
	<b>Phase Noise (10MHz)</b>	Quiescent	Under Vibration (including Shock Mount)	
		<-100 dBc/Hz @ 10Hz <-130 dBc/Hz @ 100Hz <-140 dBc/Hz @ 1KHz <-145 dBc/Hz @ 10KHz	< -83 dBc/Hz @ 10Hz < -118 dBc/Hz @ 100Hz < -112 dBc/Hz @ 1KHz < -145 dBc/Hz @ 10KHz	
		<b>Harmonics (10MHz)</b>	-40 dBc	
<b>Spurious (10MHz)</b>		-75 dBc ± 100KHz		
<b>Warm-up</b>		5E-10 within <7 min, 5E-11 within < 60 min, 1E-11 within <4hrs, 2E-12 within <24 hrs.		
<b>IRIG B Output</b>	<b>Accuracy</b>	±10µs		
	<b>Time Format</b>	Day of year, Hour, Min., Sec – 1 KHz modulated		
<b>MIL-STD-1553 MUX BUS (Opt.)</b>	<b>Time Update</b>	1ms		
	<b>Network Definition</b>	Remote Terminal		
<b>Serial Time &amp; Location Protocol (CLI)</b>		<b>RS-232 / RS-422</b> 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)	



### Power Supply

<b>Input Voltage</b>	22-32 VDC per MIL-STD-704A <40 Watt @ Warm-Up (10 Min), <24 Watt @ Steady-state
<b>Battery Back-Up</b>	1 hour operation @ 25°C, Ex Factory, 18 hours charge Charging voltage 26-32 VDC

## SPECIFICATIONS *(continue)*

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GPS Receiver	
<b>Tracking</b>	L1 frequency 1575 MHz C/A code (SPS) 8 parallel tracking channels
<b>Position</b>	Lat., long., alt.
<b>Position Accuracy</b>	25m CEP (50%) w/o SA
<b>GPS Antenna DC Voltage</b>	5V
<b>Acquisition Time</b>	Warm start 5 min., Cold start < 13 min (worst case)

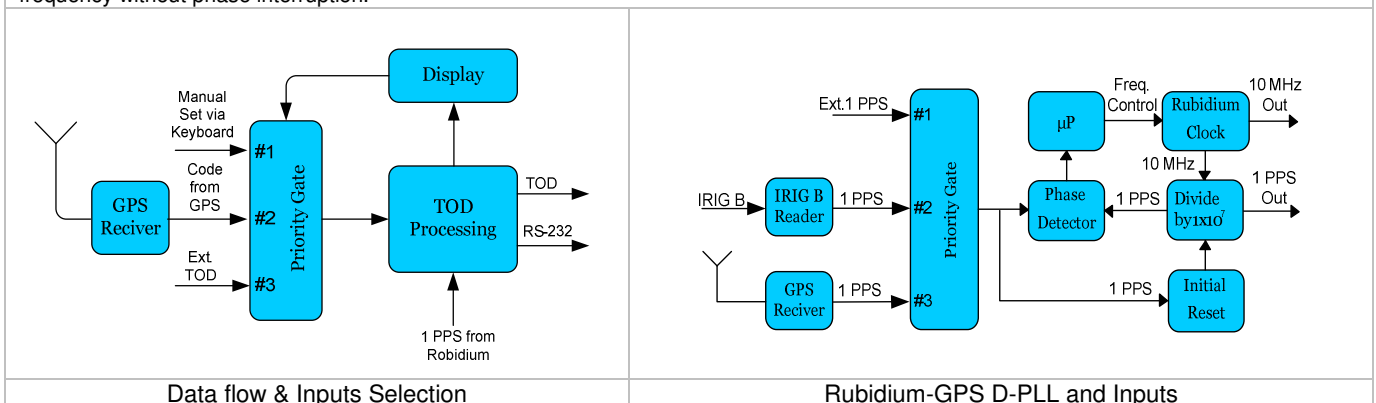
Dimensions & Weight		
<b>W/O shock-tray</b>	Dimensions	206mm (w) x 122mm (h) x 210mm (d)
	weight	3.1 Kg
<b>With shock-tray</b>	Dimensions	210mm (w) x 164mm (h) x 274mm (d)
	weight	4.5 Kg

Environmental	
<b>Temperature</b>	Operating : -40 °C to +71 °C (startup at -40 °C) Storage: -40 °C to +71 °C
<b>Altitude</b>	45,000 ft
<b>Humidity</b>	Up to 95% including condensation @ +35 °C
<b>Random Vibration</b>	MIL-STD-810D, Method 514.3 cat. 6 level (0.01 g <sup>2</sup> /Hz, 2 Hours/axis)
<b>Transportation Vibration</b>	MIL-STD-810F, Method 514.5, Category 4
<b>Drip</b>	MIL-STD-810F, Method 506.4, Procedure III
<b>Salt Atmosphere</b>	MIL-STD-810F, Method 509.4
<b>Mechanical Shock</b>	MIL-STD-810C, Method 516.2, Proc. 1 (30g / 11mSec / Half sine/ 3 axis)
<b>Bench Handling Shock</b>	MIL-STD-810F, Method 516.5, Procedure VI
<b>EMI / RFI</b>	MIL-STD-461, CE01, CE03, CE07, RE02, CS01, CS02, CS06, RS02, RS03 CE102, CS101, CS114, CS115, CS116, RE102, RS101, RS103

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

## Principles of Operation

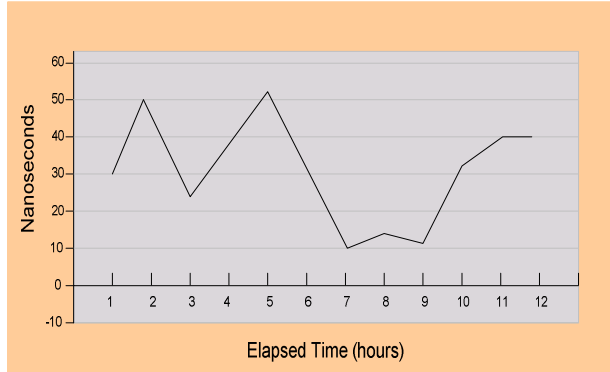
The following block diagrams depict the operation of the AR-51A. The unit includes Rubidium Standard and accepts Input from either internal GPS receiver, or external GPS, or external 1PPS or external IRIG B. All outputs are derived from the internal Rubidium Clock, which is phase locked via a digital 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.



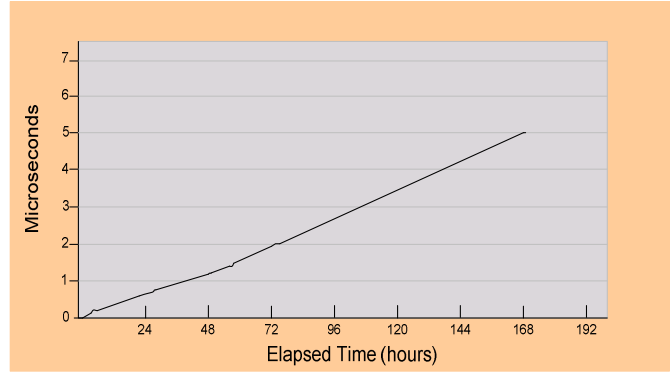
**SPECIFICATIONS (continue)**

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**Typical Performance Plots**

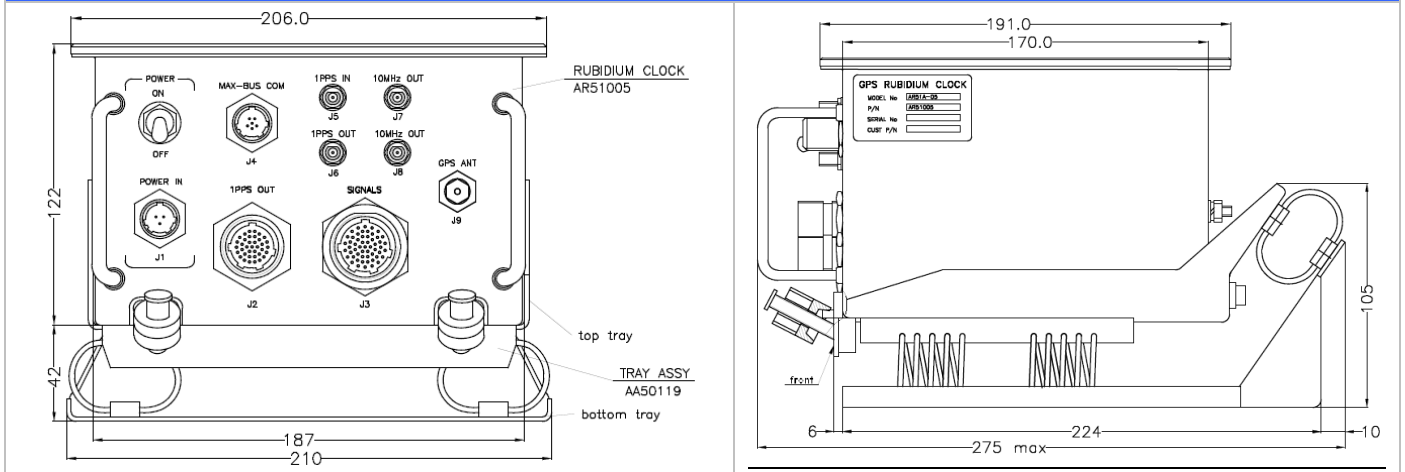


Typical time error fluctuations when disciplined to GPS



Typical time error in Holdover (without GPS)

**Mechanical ICD**



**HOW TO ORDER**

ACCESSORIES	AccuBeat P/N:
AR51A-05	AR51005
Vibration Isolator	AA50119
Airborne GPS Antenna 26 dB	EM30056
Ground GPS Antenna 35 dB	EM30039
Antenna Cable	Contact Factory
GUI for PC is available	Contact Factory

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