

## GPS-Rubidium Clock AR51A-06 Series

### Main Features:

- Frequency Accuracy : 2E-12
- 1PPS Accuracy: 1µs relative to GPS  
Option: 50 nSec
- Outputs: 10MHz, 1PPS, RS232  
Options: IRIG B, Have Quick, LAN
- Inputs: 1PPS, IRIG B (Opt.)
- Display of Time (UTC), Date, Status & BIT
- Operating Temperature: -25 °C to +65 °C  
(71 °C for 30 min.)
- Holdover (no GPS): 1µs/24hours, 5E-11/month
- 1 hour rechargeable battery back-up



- GPS disciplined Rubidium clock
- Full MIL-STD qualification for military Applications

### Description:

The AR51A Series of products offers militarized **Rubidium Atomic Clocks**, which are synchronized to the **Global Positioning System (GPS)**, thereby providing extremely accurate time & frequency.

The AR51A family incorporates numerous features into a single box, including a Rubidium Standard, an internal GPS receiver a Rubidium-GPS DPLL (disciplining) circuit, time codes, different output frequencies and display. 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 family has been fully qualified for operation in harsh stressed environments on ground mobile, airborne, fighter aircraft, Helicopter and ship borne platforms.

The AR51A may include numerous other unique options denoted as Additional Options.

### Applications

❖ Communication

❖ Telemetry test fields

❖ Field calibration

Any other applications which requires  
accurate source of frequency & time

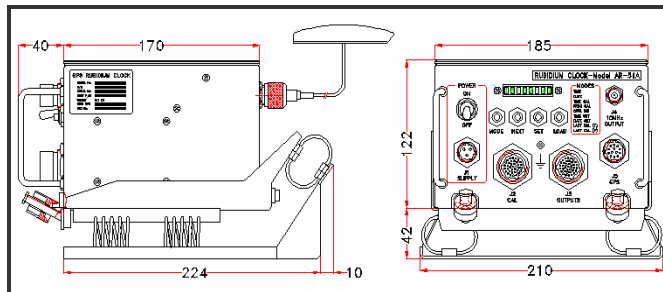


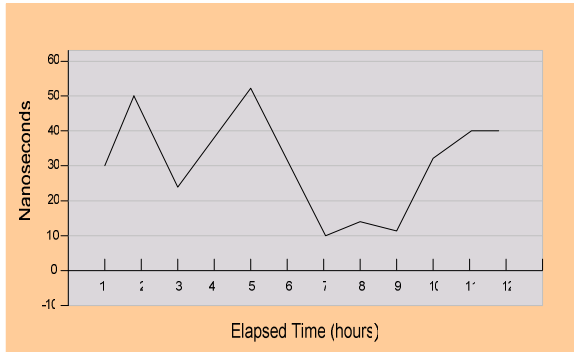
	Specifications	Available in the following versions:	
		06	Add. Opt.
<b>Outputs</b>	10MHz	•	
	Other frequencies		•
	1 PPS (TTL 50 ohm), 1 PPS (RS-422)	•	
	1K PPS		•
	IRIG B		•
	IRIG A		•
	Serial Time & Location Protocol (RS-232, RS-422)	•	
	LAN – NTP		•
<b>Inputs</b>	Have-Quick (ICD-GPS-060)		•
	GPS Antenna	•	
	1 PPS & data from external GPS receiver		•
	Ext. 1 PPS	•	
	Ext. Time of Day (TOD)	•	
	IRIG B		•
	Manual setting of data via display keypad	•	
Have-Quick (ICD-GPS-060)		•	
<b>Inputs Priorities for sync.</b>	(1) Ext.1 PPS, (2) IRIG B, (3) 1 PPS from GPS	•	
<b>10MHz Output</b>			
<b>Waveform &amp; Level</b>	Sine wave (9±2)dBm / 50Ω	•	
	Square wave		•
<b>Accuracy</b>	<2E-12 when tracking GPS (24 hour average, const temp.)	•	
	5E-11 / month drift in Holdover (no GPS)		
<b>Short Term Stability</b>	3E-11 @ 1sec, 3E-12 @ 100sec	•	
<b>Temperature Stability</b>	±3E-10 over -25°C to +65°C	•	
<b>Phase Noise</b>	<-100dBc/Hz @ 10Hz	•	
	<-130dBc/Hz @ 100Hz		
	<-140dBc/Hz @ 1KHz		
	<-145dBc/Hz @ 10KHz		
	Improved phase noise is available		•
<b>Harmonics</b>	-40dBc	•	
	-50dBc		•
<b>Spurious</b>	-75dBc ±100KHz	•	
	Improved Spurious is available		•
<b>Warm-Up Stability</b>	5E-10 within <7 min	•	
	5E-11 within < 60 min		
	1E-11 within <4hrs		
	2E-12 within <24 hrs.		
<b>1 PPS Output</b>			
<b>Accuracy when disciplined to GPS</b>	< 1µs relative to GPS @ 25°C without S/A	•	
	< 100ns RMS relative to another AR51A unit	•	
	< 50ns RMS relative to another AR51A unit		•
<b>Accuracy when disciplined to Ext. 1PPS</b>	±100ns RMS @ 25°C relative to external input	•	
<b>Time Drift without GPS (Hold-Over)</b>	< 1µs/day (typical), 5µs/week (typical)	•	
<b>IRIG B Output</b>			
<b>Accuracy</b>	±10µs	•	
<b>Time Format</b>	Day of year, Hour, Min., Sec – 1 KHz modulated	•	
<b>Display</b>			
<b>Display</b>	- Time, Date, Position, BIT (Built in test)	•	



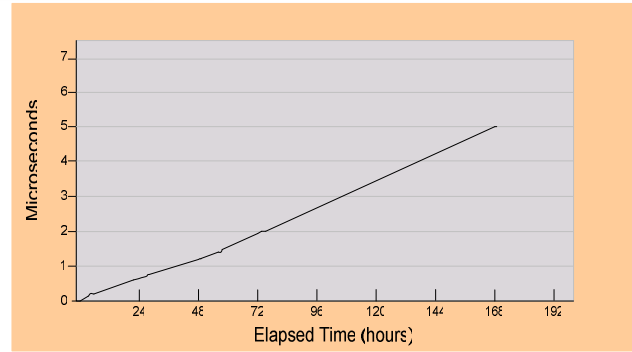
Specifications - continued		Available in the following versions:	
		06	Add. Opt.
<b>Serial Time &amp; Location Protocol</b>			
<b>Format</b>	Time & Date, Location & Status, 19,200 bps, 1 Frame/Sec 10 Frame/Sec	•	•
<b>GPS Receiver</b>			
<b>Tracking</b>	L1 frequency 1575 MHz C/A code (SPS) 8 parallel tracking channels	•	
<b>Position</b>	Lat., long., alt. (more GPS data available).	•	
<b>Position Accuracy</b>	<6m CEP (50%) w/o SA	•	
<b>GPS Antenna DC Voltage</b>	5V	•	
<b>Acquisition Time</b>	Warm start 5 min., Cold start 13 min	•	
<b>Accessory Kit</b>	GPS Antenna 26 dB + Antenna Cable RG-142, 5m		•
<b>Power Supply</b>			
<b>Input Voltage</b>	22-32 VDC per MIL-STD-704D +60V 100ms <42 Watt @ Warm-Up (10 Min), <30 Watt @ Steady-state	•	
<b>Battery Back-Up</b>	1 hour operation @ 25°C, 18 hours charge	•	
<b>Mechanical</b>			
<b>Dimensions</b>	185mm (w) x 122mm (h) x 210mm (d) 210mm (w) x 164mm (h) x 274mm (d) with shock-tray	•	
<b>weight</b>	3.1 Kg 4.5 Kg with shock-tray	•	
<b>Environmental</b>			
<b>Temperature</b>	Operating :-25°C to +65°C (71°C for 30 min) Storage: -40°C to +75°C	•	
<b>Temp. / ALT</b>	MIL-STD-810C, Method 504.1, Cat. 3, 78,000 feet.	•	
<b>Humidity</b>	Up to 95% including condensation, 288 Hr. MIL-STD-810C, Method 507.2, Proc. 1	•	
<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-810D, Method 514.3 cat. 1, Fig. 514.3-1,2,3 (1 Hours/axis)	•	
<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-810C, Method 516.2, Proc. 5	•	
<b>EMI / RFI</b>	MIL-STD-461/462, CE01, CE03, CE07, RE02, CS01, CS02, CS06, RS02, RS03	•	
<b>Reliability, Maintainability, Testability</b>			
<b>MTBF</b>	> 20,000 hours @ 30°C, ARW	•	
<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>	<b>On-line BIT</b> – Automatic, Covers 80% of all failures, <b>Off-line BIT</b> – Manual, 93% <b>Power-on BIT</b> – Self test @ Power on 95% (without IRIG B option)	•	

- All specifications are at 25°C at quiescent conditions unless specified otherwise.





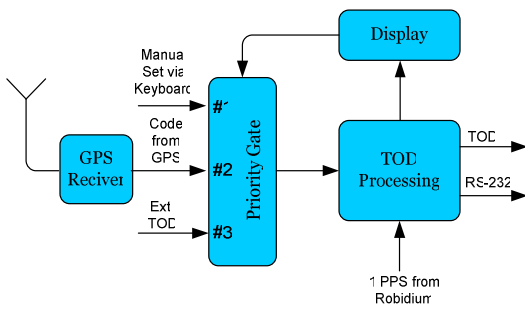
**Figure 1: Typical Time Error & Stability under Lock Condition**



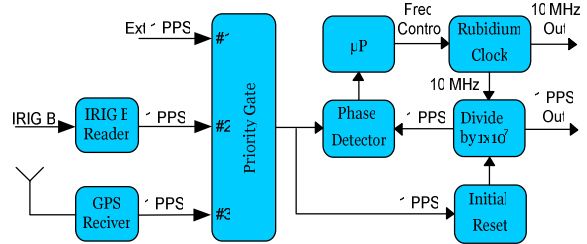
**Figure 2: Typical Time Error In Hold-Over Mode (without GPS)**

### Principles of Operation

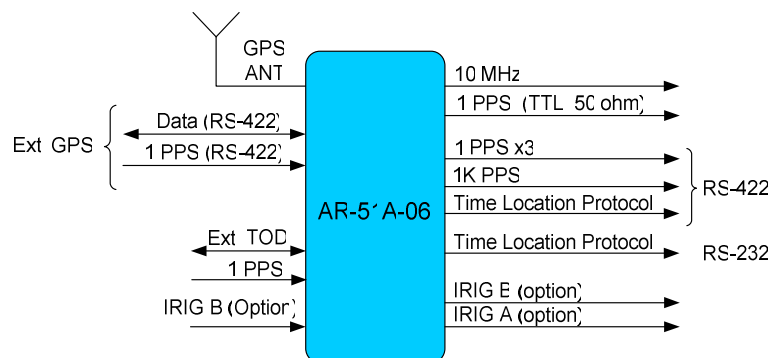
The following block diagrams depict the operation of the AR51A. The unit includes Rubidium Standard and accepts Input from either internal GPS receiver, or external GPS, or external 1PPS or external IRIG B. All outputs are derived from the internal Rubidium Clock, which is phase locked via a digital 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.



**Fig. 1: Data flow & Inputs Selection**



**Fig. 2: Rubidium-GPS D-PLL and Inputs**



**Fig. 3: AR51A Inputs/Outputs**