

GPS-Rubidium Clock AR-51A Series

Main Features:

- Frequency Accuracy : $2E-12$
- 1PPS Accuracy: $1\mu s$ 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: $-25^{\circ}C$ to $+65^{\circ}C$
($71^{\circ}C$ for 30 min.)
- Holdover (no GPS): $1\mu s/24$ hours, $5E-11$ /month
- 1 hour rechargeable battery back-up



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

Description:

The AR-51A Series of products offers militarized **Rubidium Atomic Clocks**, which are synchronized to the **Global Positioning System (GPS)**, thereby providing extremely accurate time & frequency.

The AR-51A 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 AR-51A family has been fully qualified for operation in harsh stressed environments on ground mobile, airborne, fighter aircraft, Helicopter and ship borne platforms.

The AR-51A may include numerous other unique options denoted as Additional Options.

Applications

- Secure Communication
- ELINT Receivers
- Electronic warfare
- Field Calibration
- Telemetry Test Fields
- Radar, Bi-Static Radar
- C4I (Command, Control, Communications, Computer & Intelligence)

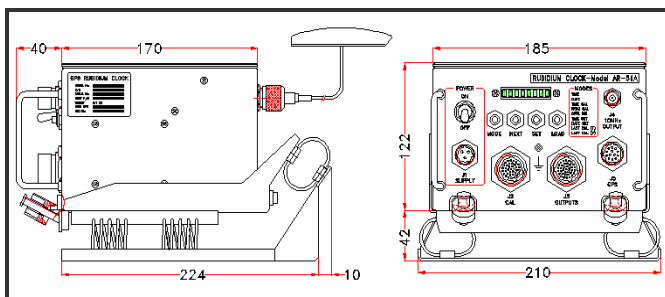
Specifications - AR-51A Family

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

Specifications - AR-51A Family

		Specifications - continued		Available in the following versions:	
				06	Add. Opt
Serial Time & Location Protocol					
Format	Time & Date, Location & Status, 19,200 bps, 1 Frame/Sec	•			
	10 Frame/Sec			•	
GPS Receiver					
Tracking	L1 frequency 1575 MHz C/A code (SPS) 8 parallel tracking channels	•			
Position	Lat., long., alt. (more GPS data available).	•			
Position Accuracy	25m CEP (50%) w/o SA	•			
GPS Antenna DC Voltage	5V	•			
Acquisition Time	Warm start 5 min., Cold start 13 min	•			
Accessory Kit	GPS Antenna 26 dB + Antenna Cable RG-142, 5m			•	
Power Supply					
Input Voltage	22-32 VDC per MIL-STD-704D +60V 100ms	•			
	<42 Watt @ Warm-Up (10 Min), <30 Watt @ Steady-state				
Battery Back-Up	1 hour operation @ 25 °C, 18 hours charge	•			
Mechanical					
Dimensions	185mm (w) x 122mm (h) x 210mm (d)	•			
	210mm (w) x 164mm (h) x 274mm (d) with shock-tray	•			
weight	3.1 Kg	•			
	4.5 Kg with shock-tray	•			
Environmental					
Temperature	Operating :-25 °C to +65 °C (71 °C for 30 min)	•			
	Storage: -40 °C to +75 °C				
Temp. / ALT	MIL-STD-810C, Method 504.1, Cat. 3, 78,000 feet.	•			
Humidity	Up to 95% including condensation, 288 Hr. MIL-STD-810C, Method 507.2, Proc. 1	•			
Random Vibration	MIL-STD-810D, Method 514.3 cat. 6 level (0.01 g ² /Hz, 2 Hours/axis)	•			
Transportation Vibration	MIL-STD-810D, Method 514.3 cat. 1, Fig. 514.3-1,2,3 (1 Hours/axis)	•			
Mechanical Shock	MIL-STD-810C, Method 516.2, Proc. 1 (30g / 11mSec / Half sine/ 3 axis)	•			
Bench Handling Shock	MIL-STD-810C, Method 516.2, Proc. 5	•			
EMI / RFI	MIL-STD-461/462, CE01, CE03, CE07, RE02, CS01, CS02, CS06, RS02, RS03	•			
Reliability, Maintainability, Testability					
MTBF	> 20,000 hours @ 30 °C, ARW	•			
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 80% of all failures,				
	Off-line BIT – Manual, 93%	•			
	Power-on BIT – Self test @ Power on 95% (without IRIG B option)				

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



Specifications - AR-51A Family

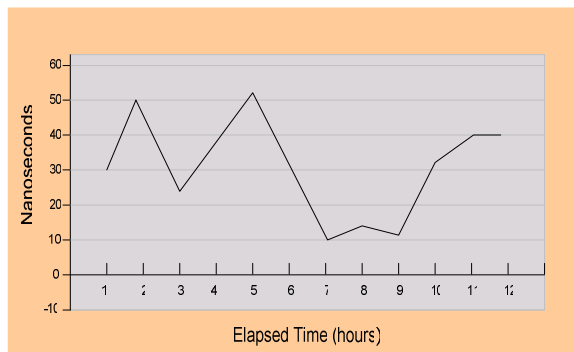


Figure 1: Typical Time Error & Stability under Lock Condition

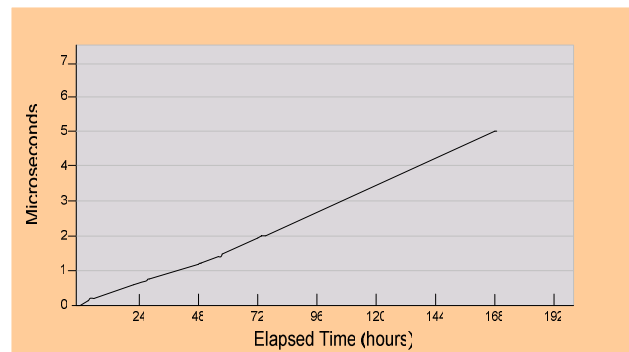


Figure 2: Typical Time Error In Hold-Over Mode (without GPS)

Principles of Operation

The following block diagrams depict the operation of the 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.

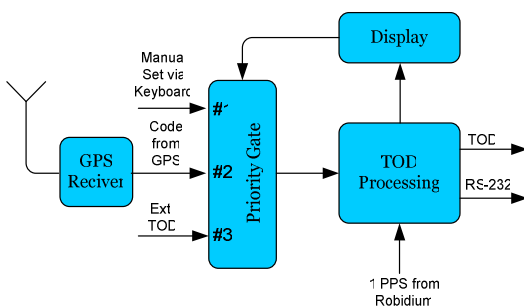


Fig. 1: Data flow & Inputs Selection

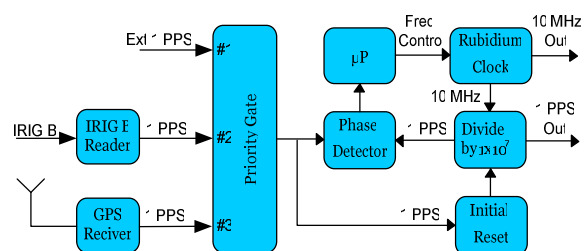


Fig. 2: Rubidium-GPS D-PLL and Inputs

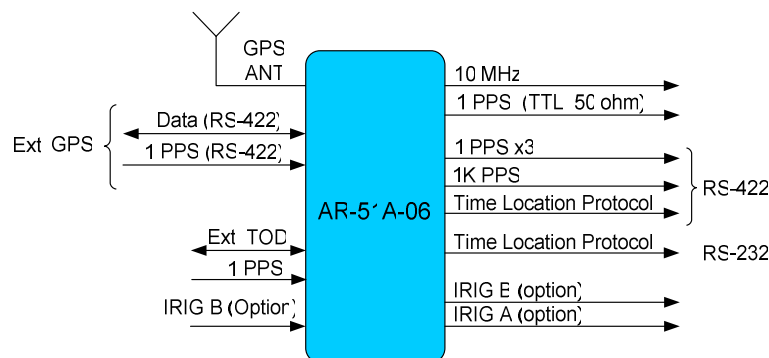


Fig. 3: AR-51A Inputs/Outputs