Rubidium Frequency Standard

AR133A

Ruggedized Low Profile

Key Features

- *Long-term-stability: 5E-11/month*
- *2E-12 frequency accuracy & 100nSec 1PPS accuracy relative to 1PPS input when disciplined (option)*
- *Short term stability: 5E-12 @ 100s*
- *Phase noise: -150dBc/Hz @10kHz*
- *Outputs: 10 MHz and 1PPS*
- *Supply voltage: 15 VDC / 12 VDC (option)*
- *Steady state power < 8.25W*
- *Power-saving mode – < 1.8W Steady State (option)*
- *Size: 77 x 77 x 25.4 mm (3" x 3" x 1")*

Description

The AR133A is AccuBeat's new generation *multifunctional Rubidium Frequency Standard*. It is one of the smallest atomic standards available today, where the accuracy and stability are derived from *a quantum transition* that occurs in a *free rubidium atom*. The unit utilizes a unique advanced technology, which allows reducing the unit's size without sacrificing performance.

The AR133A is comprised of a unique *DFLL (Digital Frequency Lock Loop)* where a high performance crystal oscillator is locked to the rubidium atomic line using an embedded microprocessor and a special patented algorithm.
The algorithm optimizes the performance vs. external disturbances, improves temperature stability, and enables very fine digital frequency control.

AR133A special modes of operation:

- **Disciplined to an external 1PPS** *(option):* this improves the long-term-stability, the accuracy, and synchronizes the phase of the 1PPS output to the 1PPS input.
- **Power-saving modes** *(options):* for applications where power is limited, the AR133A offers several power saving modes to be selected by the user.
  - *Mixed Mode (Option)* - in this mode the physics package, which is the main power consumer, is turned on and off periodically, allowing lower average power consumption. In this mode the internal OCXO supplies accurate frequency calibrated to the atomic clock frequency. Although performance is slightly reduced, power consumption is significantly lower in this mode.
  - *OCXO Disciplined Mode (Option)* – this mode implements an OCXO disciplining to external 1PPS (with Physics Package shut-down) and consumes even lower power of about 1.8 W

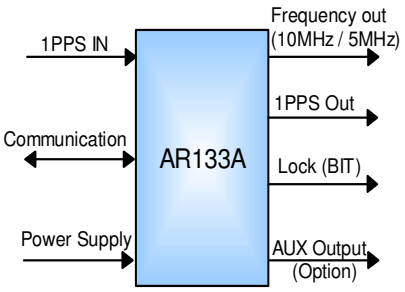
Applications

- Secure Communication
- Telecommunication
- Software Radio
- Test Equipment
- Cellular Base Stations
- TV Stations, HDTV
- Scientific Equipment
- Calibration

STANDARD PRODUCT SPECIFICATIONS

Input & Outputs

	Standard	Option
Outputs	- 10MHz sine wave +12±2 dBm into 50Ω - (*) In AR133A-01 output level is +7±2 dBm	- 5MHz - 1MHz, Square wave - 2.048MHz, , Square wave - Other Freq., SQR/Sine wave
	1PPS, 3V TTL into 50Ω Rise time < 30nSec Pulse width <20uSec	
	AUX OUT: auxiliary frequency output in range 0Hz – 5MHz, like 1.544MHz (T1) and 2.048MHz (E1) – option For more information contact factory	
Input	1PPS TTL 50Ω	
Monitor & Control	RS-232 control and monitor interface provide: ID, Status, frequency adjustment. Protocol: 9600, 1, 8, 1, No parity	CMOS level
	Digital frequency adjustment: 7.6E-13 steps over > 5E-7 range	



For more information about the communication channel contact factory.

Performance (Rubidium Mode)

		Standard	Option
Frequency	**Short Term Stability**	< 3E-11 @ 1s < 5E-12 @ 100s	
	Phase Noise	<-102 dBc/Hz @ 10Hz <-135 dBc/Hz @ 100Hz <-145 dBc/Hz @ 1kHz <-150 dBc/Hz @ 10kHz	<-118 dBc/Hz @ 10Hz < -145 dBc/Hz @ 100Hz < -155 dBc/Hz @ 1kHz < -159 dBc/Hz @ 10kHz (typical)
	Harmonics	< -44 dBc (up to 70MHz)	< -50 dBc (up to 70MHz)
	Spurious	< -80 dBc in the range 10Hz to 100kHz from carrier	< -110 dBc in the range 10Hz to 100kHz from carrier
	Warm-up	< 5E-8 (Lock) within 4 minutes @ 25℃ ±5E-10 within 5 minutes @ 25℃	
	Retrace	< 5E-11 with on-off-on cycle: 24 hours, 48 hours, 12 hours	
	Accuracy @ Shipment	< 5E-11	
	Magnetic Field Sensitivity	< 8E-11 / gauss up to 3 gauss DC (worst direction)	
	Long Term Stability	<±1E-9 / year (after 3 month operation)	<±5E-10 / year (at shipment) Disciplined to external 1PPS - <±2E-12 (24 hrs average)
	Temperature Stability and Range	±3E-10 over -20℃ to +65℃	-40℃ to +70℃
Time Accuracy (1PPS)	**Long- Term Accuracy**	1µs / 24 hours (after disciplining/calibration)	Disciplined to external 1PPS - 100ns (50ns typical.) RMS @ 25℃
Power Consumption *(standard Rubidium mode)*	@ Steady-state	< 8.25W @ 25℃	
	@ Warm-up	< 16W@ 25℃	< 14W @ 15VDC, room temp. (Time to Lock < 8 min) (**)

(*) Unless specified, all parameters relate to 10MHz main output.
(**) Low Power at Warm Up (option) - the internal ovens are activated in sequence thereby reducing the warm-up consumption.

Power Supply, Dimensions & Weight

DC	15±0.3 VDC / 12±0.3 VDC
Size	77 mm x 77mm x 25.4 mm (3" x 3" x 1")
Weight	≤ 295 g

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

BIT and Remote Control

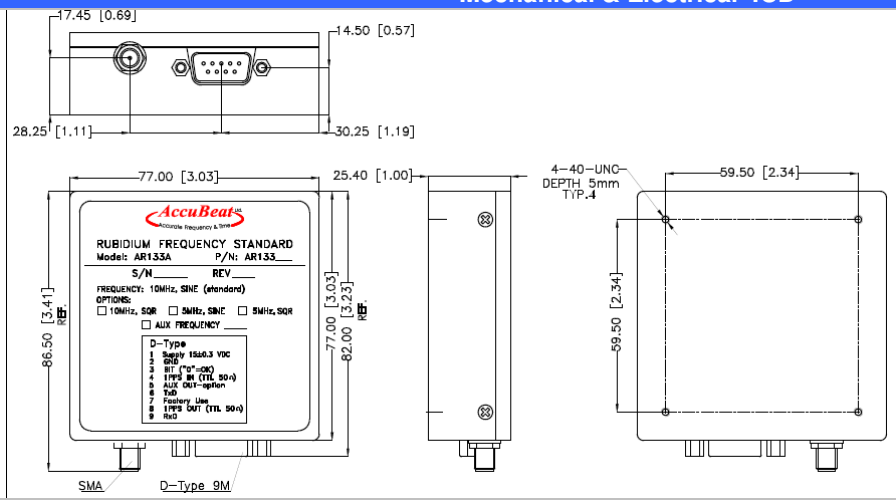
Built In Test (BIT):	The built in test detects > 95% of all failures. Receive by hardware (pin number 3 in the D Type connector), open collector (10mA max). High impedance = BIT Fail; short to ground = BIT Pass & Lock. BIT result receives also by serial communication.

Mode of Operation		
Modes of Operation	Standard Rubidium Free-run	Standard
	Rubidium disciplining to Ext. 1PPS - Option	Excellent performance in Holdover.
	OCXO disciplining to Ext. 1PPS - Option (*)	Medium performance in Holdover.
	Mixed mode - option (*)	Low average power consumption, good performance

(*) For more information contact factory

Environmental	
Operating Temperature	-20℃ to +65 ℃ (for wide temperature contact factory)
Storage Temperature	-40℃ to +80℃
Humidity	Up to 95% at 35℃, non-condensed

Mechanical & Electrical ICD



D-Type subminiature 9 pins (male):

Pin 1 – Supply
Pin 2 – GND
Pin 3 – Lock (BIT)
Pin 4 – 1PPS IN
Pin 5 – AUX OUT - Option
Pin 6 – TxD
Pin 7 – Factory Use
Pin 8 – 1PPS OUT
Pin 9 – RxD

SMA: RF OUT

HOW TO ORDER

Description	AccuBeat P/N	Note
Standard	AR13300	RB FREQ STD, (15 VDC, 10MHz, Sine)
12V Input Option	AR13302	RB FREQ STD ,12 VDC, 10MHz, Sine
Wide Temperature	AR13304-02	RB FREQ STD, -40℃ TO +74℃ BASE PLATE
1MHz, SQR Output	AR13305	RB FREQ STD, 1Mhz SQR WAVE
2.048MHz Output	AR13306	RB FREQ STD, 2.048MHz SQR WAVE
EMI PROTECT, 10MHz sine wave	AR13307	RB FREQ STD, EMI PROTECT, 12V
5MHz sine wave	AR13309	RB FREQ STD, 5MHz sine WAVE
10MHz SQR/50OHM	AR13310	RB FREQ STD, 10MHz SQR/50OHM
10MHz SQR/50Ω, 12V	AR13311	RB FREQ STD, 12V, 10MHz SQR/50Ω
Improved Phase noise	AR13313	RB FREQ STD,HIGH STAB.IMPROVED PHASE NOISE