

## Anti Spoofing Rubidium Frequency Standard

### Model AS133A

### Ruggedized Low Profile

#### Key Features

- ❖ Long-term-stability:  $5E-11$ /month
- ❖  $2E-12$  frequency accuracy & 100nSec 1PPS accuracy relative to 1PPS input when disciplined
- ❖ Short term stability:  $5E-12$  @ 100s
- ❖ Phase noise:  $-150\text{dBc/Hz}$  @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")
- ❖ Anti-Spoofing Capabilities



#### Description

The AS133A is AccuBeat's new generation *multifunctional Rubidium Frequency Standard* based on the AR133 series and with added *Anti Spoofing capabilities*. 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. For further information regarding Anti-Spoofing capabilities, please contact AccuBeat directly.

The AR133A is comprised of a unique *DPLL (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:** 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
- ❖ TV Stations, HDTV
- ❖ Software Radio
- ❖ Scientific Equipment
- ❖ Test Equipment
- ❖ Calibration
- ❖ Cellular Base Stations

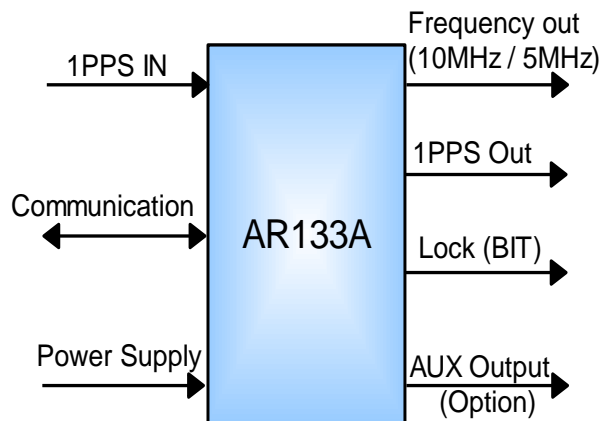
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### Input & Outputs

	Standard	Option
<b>Outputs</b>	<ul style="list-style-type: none"> <li>- 10MHz sine wave +12±2 dBm into 50Ω</li> <li>- (*) In AR133A-01 output level is +7±2 dBm</li> </ul>	<ul style="list-style-type: none"> <li>- 5MHz</li> <li>- 1MHz, Square wave</li> <li>- 2.048MHz, Square wave</li> <li>- Other Frequencies (contact factory)</li> </ul>
<b>Input</b>	<ul style="list-style-type: none"> <li>1PPS, 3V TTL into 50Ω</li> <li>Rise time &lt; 30nSec</li> <li>Pulse width &lt;20uSec</li> </ul>	
<b>Monitor &amp; Control</b>	<ul style="list-style-type: none"> <li>1PPS TTL 50Ω</li> <li>RS-232</li> <li>Control and monitor interface provide: ID, Status, frequency adjustment.</li> <li>Protocol: 9600, 1, 8, 1, No parity</li> <li>Digital frequency adjustment: 7.6E-13 steps over &gt; 5E-7 range</li> </ul>	<ul style="list-style-type: none"> <li>CMOS level</li> </ul>

For more information about the communication channel contact factory.





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<b><u>Performance (Rubidium Mode)</u></b>				
		<b>Standard</b>	<b>Option</b>	
<b>Frequency</b>	<b>Short Term Stability</b>	$< 3E-11$ @ 1s $< 5E-12$ @ 100s		
	<b>Phase Noise</b>	$< -102$ dBc/Hz @ 10Hz $< -135$ dBc/Hz @ 100Hz $< -145$ dBc/Hz @ 1kHz $< -150$ dBc/Hz @ 10kHz	$< -116$ dBc/Hz @ 10Hz $< -142$ dBc/Hz @ 100Hz $< -154$ dBc/Hz @ 1kHz $< -158$ dBc/Hz @ 10kHz ( typical )	
	<b>Harmonics</b>	$< -44$ dBc (up to 70MHz)	$< -50$ dBc (up to 70MHz)	
	<b>Spurious</b>	$< -80$ dBc in the range 10Hz to 100kHz from carrier	$< -110$ dBc in the range 10Hz to 100kHz from carrier	
	<b>Warm-up</b>	$< 5E-8$ (Lock) within 4 minutes @ 25°C $\pm 5E-10$ within 5 minutes @ 25°C		
	<b>Retrace</b>	$< 5E-11$ with on-off-on cycle: 24 hours, 48 hours, 12 hours		
	<b>Accuracy @ Shipment</b>	$< 5E-11$		
	<b>Magnetic Field Sensitivity</b>	$< 8E-11$ / gauss up to 3 gauss DC (worst direction)		
	<b>Long Term Stability</b>	$< \pm 1E-9$ / year (after 3 month operation)		$< \pm 5E-10$ / year (at shipment)
				Disciplined to external 1PPS - $< \pm 2E-12$ (24 hrs average)
<b>Temperature Stability and Range</b>	$\pm 3E-10$ over -20°C to +65°C		-40°C to +74°C (BP) A plate with 1.2 °C/W should be used	
<b>Time Accuracy (1PPS)</b>	<b>Long- Term Accuracy</b>	1µs / 24 hours (after disciplining/calibration)	Disciplined to external 1PPS - 100ns (50ns typical.) RMS @ 25°C	
<b>Power Consumption</b> <i>(standard Rubidium mode)</i>		@ Steady-state	$< 8.25W$ @ 25°C	
		@ Warm-up	$< 18W$ @ 25°C	
			$< 16W$ @ 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.

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### 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

### BIT and Remote Control

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

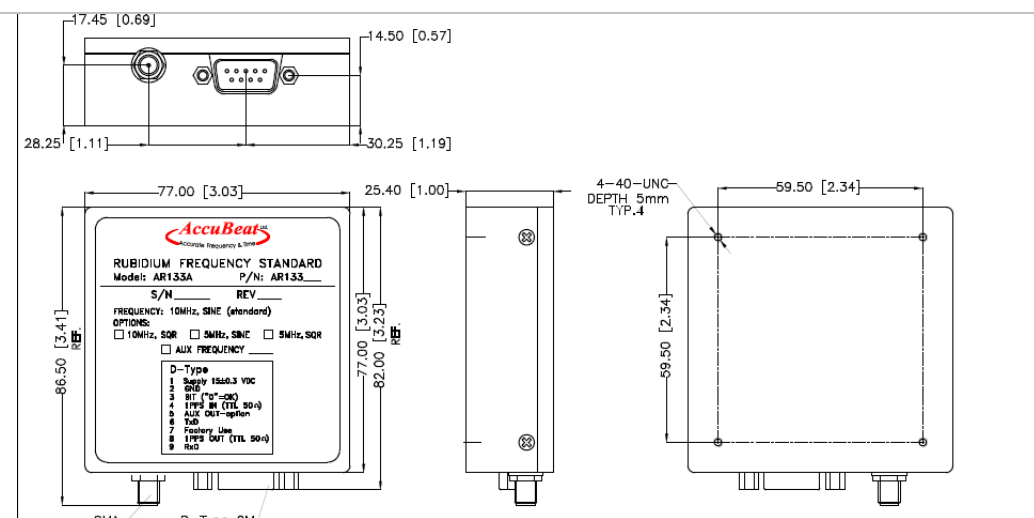
<b>Modes of Operation</b>	Standard Rubidium Free-run	Standard
	Rubidium disciplining to Ext. 1PPS - Option	Excellent performance in Holdover.
	OCXO disciplining to Ext. 1PPS - Option (*)	Medium performance in Holdover.
	Mixed mode - option (*)	Low average power consumption, good performance

(\*) For more information contact factory

### Environmental

<b>Operating Temperature</b>	-20°C to +65 °C (for wider temperature range contact factory)
<b>Storage Temperature</b>	-40°C to +80°C
<b>Humidity</b>	Up to 95% at 35°C, 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**

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#### HOW TO ORDER

AccuBeat P/N	Options description				
	Output Frequency	Wave Form	1PPS Input & Output	Operating Voltage	Special Features
AS13300	10MHz	Sine	√	15V	Standard
AS13302	10MHz	Sine	√	12V	10MHz Sine 12VDC
AS13304-02	10MHz	Sine	√	15V	Wide operating temperature rage (-40°C TO +74°C BASE PLATE)
AS13305	1MHz	SQR	√	15V	1MHz SQR
AS13306	2.048MHz	SQR	√	15V	2.048MHz OUTPUT
AS13307	10MHz	Sine	---	12V	Improved EMI protection
AS13309	5MHz	Sine	√	15V	5MHz output
AS13310	10MHz	SQR	√	15V	10MHz SQR
AS13311	10MHz	SQR	√	12V	10MHz SQR 12VDC
AS13312	10MHz	Sine	---	15V	CLI com format: CMOS Protocol: AR60A format
AS13313	10MHz	Sine	√	15V	Improved phase noise
AS13314	10MHz	Sine	√	15V	High stability. Improved phase noise
AS13317	10MHz	Sine	√	15V	Improved phase noise. Wide operating temperature rage (-40°C TO +74°C BASE PLATE)
AS13318	10MHz	Sine	√	15V	1PPS input high impedance
AS13319	10MHz	Sine	√	12V	Redundant 1PPS input (see more details in the AR133A-19 specifications)
AS13320	10MHz	Sine	√	15V	Low phase noise, low g sensitivity
<b>For other customized configuration - contact factory</b>					