

Accurate Time & Frequency Ruggedized System

GPS - Disciplined Rubidium Clock
Ruggedized, Rack mounted

The **AR133** series are AccuBeat's Standard and high performance atomic clocks, where the accuracy and stability are derived from a quantum transition that occurs in a free rubidium atom. The units utilizes a unique advanced technology, which allows a high-performance component with several options for adjusting the clocks to the different customer requirements. AR133 series are one of the best stable, robustness and accurate atomic clocks in the world.

Key Features

- Long-term-stability: 1E-11/month
- Short term stability: 1E-12 @ 1000s (Typ.)
- Phase noise: -158 dBc/Hz @10kHz
- Spurious: < -110 dBc
- Time Accuracy (1PPS): 15ns (7ns typical) RMS
- Holdover – 1us / 24 Hours
- Outputs: 10 MHz and 1PPS
- Supply voltage: 15 VDC / 12 VDC (option)
- Steady state power < 7.5W
- Power-saving mode < 1.8W Steady State (option)
- Size: 77 x 77 x 25.4 mm (3" x 3" x 1")



AR133 is available in various configurations

Description

The **AR133** 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.

Applications

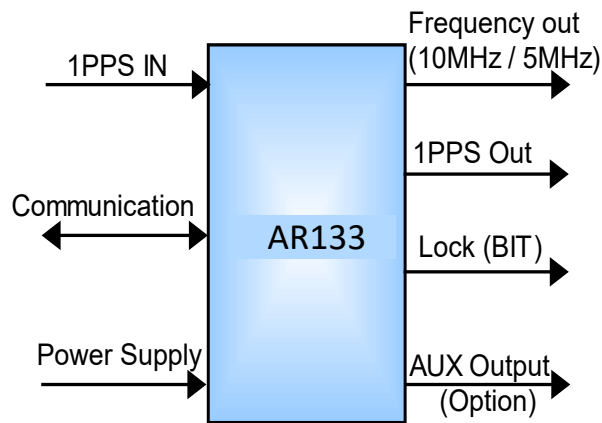
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|--------------------------|----------------------------|------------------------|
| ➤ Secure Communication | ➤ Telecommunication | ➤ TV Stations, HDTV |
| ➤ Cellular Base Stations | ➤ Critical Infrastructures | ➤ Scientific Equipment |
| ➤ Defense | ➤ Test Equipment | ➤ Calibration |
| ➤ Data Center | | |

All specs are @ 25°C, quiescent conditions and sea level ambient unless otherwise specified

Specifications

Input & Outputs		
	Standard	Option(s)
Outputs	10MHz sine wave +12 ± 2 dBm into 50Ω	- 5MHz - 1MHz, Square wave - 2.048MHz, Square wave - Other Frequencies (contact factory)
	1PPS, 3V TTL into 50Ω	
	Rise time < 30nSec Pulse width <20uSec	
Input	1PPS TTL 50Ω	
Monitor & Control	RS-232	CMOS level
	Control and monitor interface provide: ID, Status, frequency adjustment.	
	Protocol: 9600, 1, 8, 1, No parity	
Digital frequency adjustment: 7.6E-13 steps over > 5E-7 range		

For more information about the communication channel, please contact AccuBeat.



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Performance (Rubidium Mode)			
		Standard	Option(s)
Frequency	Short Term Stability (ADEV)	< 3E-11 @ 1s	<1.5E-11 @ 1s / <5E-12 @ 1s
		< 1E-11 @ 10s	
		< 5E-12 @ 100s	< 2.5E-12 @ 100s
		< 2E-12 @ 1000s (Typ.)	< 1.5E-12 @ 1000s (Typ.)
	Phase Noise	<-102 dBc/Hz @ 10Hz	<-116 dBc/Hz @ 10Hz (Typ.)
		<-135 dBc/Hz @ 100Hz	< -142 dBc/Hz @ 100Hz (Typ.)
		<-145 dBc/Hz @ 1kHz	< -154 dBc/Hz @ 1kHz (Typ.)
		<-150 dBc/Hz @ 10kHz	< -158 dBc/Hz @ 10kHz (Typ.)
	Harmonics	< -44 dBc (up to 70MHz)	< -50 dBc (up to 70MHz)
	Spurious	< -80 dBc in the range	< -110 dBc in the range
		10Hz to 100kHz from carrier	10Hz to 100kHz from carrier
	Warm-up	< 5E-8 (Lock) within 4 minutes @ 25°C ±5E-10 within 5 minutes @ 25°C	
	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 (Free run)	<±1E-10 / month (after 3 months of operation)	<±5E-11 / month (at shipment) <±1E-11 / month (at shipment)	
Long Term Stability (Disciplined to external 1PPS)	<±2E-12 (24 hrs average)		
Temperature Stability and Range	±3E-10 over -20°C to +65°C	±3E-10 over -40°C to +74°C (Base Plate) ±5E-11 over -20°C to +65°C (Base Plate)	
	1µs / 24 hours (after disciplining/calibration) typical @ 25°C		
Time Accuracy (1PPS)	Long- Term Accuracy	Disciplined to external 1PPS - 40ns (20ns typical) RMS @ 25°C	Disciplined to external 1PPS - 15ns (7ns typical) RMS @ 25°C
		1µs / 24 hours (after disciplining/calibration) typical @ 25°C	
Power Consumption (standard Rubidium mode)	@ 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.

AR133-20 (all other parameters are as AR133-00 specification)		
Frequency	Short Term Stability (ADEV)	<5E-12 @ 1s
Spectral purity	Phase Noise (Typical)	< -95 dBc/Hz @ 1Hz
		< -128 dBc/Hz @ 10Hz
		< -143 dBc/Hz @ 100Hz
		< -152 dBc/Hz @ 1kHz
		< -157 dBc/Hz @ 10kHz
	Harmonics	< -48 dBc (up to 70MHz)
	Spurious	< -125 dBc (10Hz - 100Hz from carrier)
		< -120 dBc (100Hz – 1kHz from carrier)
		< -100 dBc (1kHz – 100kHz from carrier)
G sensitivity of the internal OCXO		±3E-10 / g

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Power Supply, Dimensions & Weight

	Standard	Option(s)
DC	15 ± 0.3 VDC	12 ± 0.3 VDC
Size	mm x 25.4 mm (3" x 3" x 1") 7 mm x 777	
Weight	≤ 295 g	

BIT and Remote Control

Built In Test (BIT):

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.
 The BIT result is also reported via the serial communication channel.

Mode of Operation

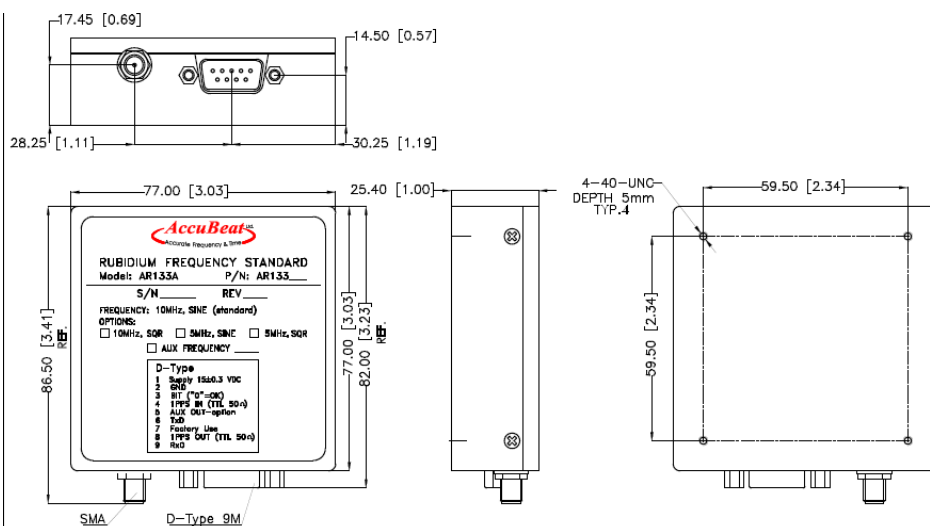
Modes of Operation

Rubidium Free-run
 OCXO disciplining to Ext. 1PPS - Option (For more information contact factory)

Environmental

	Standard	Option
G sensitivity of the internal OCXO	±1E-9 / g	±3E-10 / g
Operating Temperature	-20°C to +65 °C	-40°C to +74°C (Base Plate) A plate with 1.2 °C/W should be used
Storage Temperature	-40°C to +80°C	
Humidity	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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AR133 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 AR133 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

HOW TO ORDER:

AccuBeat P/N	Output Frequency	Wave Form	1PPS Input & Output	Operating Voltage	Special Features
AR13300	10MHz	Sine	√	15V	Standard
AR13323	10MHz	Sine	√	15V	High Stability (ADEV) Improved time accuracy (1PPS)
AR13304-02	10MHz	Sine	√	15V	Wide operating temperature range
AR13311	10MHz	SQR	√	12V	10MHz SQR Output Temperature range: -30°C to 65°C
AR13318	10MHz	Sine	√	15V	1PPS input high impedance
AR13326	10MHz	Sine	√	12V	Improved phase noise Wide operating temperature range
AR13327	10MHz	Sine	√	12V	Improved phase noise. Improved Aging Wide operating temperature range
AR13320	10MHz	Sine	√	15V	Ultra-High Stability (ADEV) Improved time accuracy (1PPS) Ultra-Low phase noise, low g sensitivity

For other customized configurations - please contact factory

Developer KIT

Name	AccuBeat P/N	Description
GUI	SW50029	GUI for AR133
Interface cable	AC50549	OPERATIONAL CABLE FOR AR133A WITH RS232 COM
RS232/USB	ZE00314	RS232 to USB Converter Cable

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