

# LPFRS/AV1 AIRBORNE RUBIDIUM OSCILLATOR

High Precision & Performance Source



## Main Features

- Very low temperature sensitivity
- Excellent short term stability
- Low power consumption
- Fast warm-up
- Small volume / low profile
- Rb lamp extended life expectancy (20 years)
- Industry standard pin out
- RS 232 interface for centre frequency adjustment and monitoring of the working parameters

## Applications

Defense  
MIL  
Avionics

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## Product Characteristics

- Small volume :13 in<sup>3</sup>
- Freq. offset over temp. range : $\pm 1 \times 10^{-10}$
- Stability : $1 \times 10^{-12}/100$  sec.
- Long term stability : $< 5 \times 10^{-10}/\text{year}$
- Low warm-up current : $< 0.9\text{A}$

## Main Applications

- Military radio systems
- Navigation instruments
- Cockpit Instrumentation
- Tracking and guidance control
- Timing instrument

## PARAMETERS ACCESSIBLE THROUGH RS232

The working and monitoring parameters of the LPFRS are accessible for read and write operations through the serial RS-232 port (1200 bits/sec., no parity, 1 start bit, 8 data bits, 1 stop bit).

There are three different commands, which are:

M, Cxx and Fxx followed by a carriage return.

M: monitors the basic factory adjustments of the atomic clock.

The returned answer looks like

HH GG FF EE DD CC BB AA <CR>

Where each returned byte is an ASCII coded hexadecimal value, separated by a <Space> character. All parameters are coded at full scale.

HH: DC-Voltage of the photocell (5V to 0V)

GG: peak voltage of Rb-signal (0 to 5V)

FF: not used

EE: varactor control voltage (0 to 5V)

DD: Read-back of the user provided frequency adjustment voltage on pin 2 (0 to 5V)

CC: Rb-lamp heating current (500mA to 0mA)

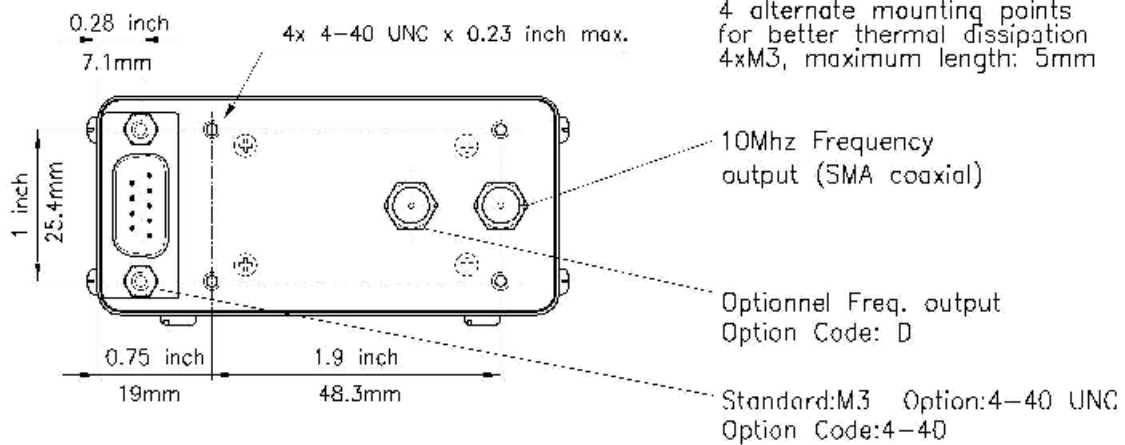
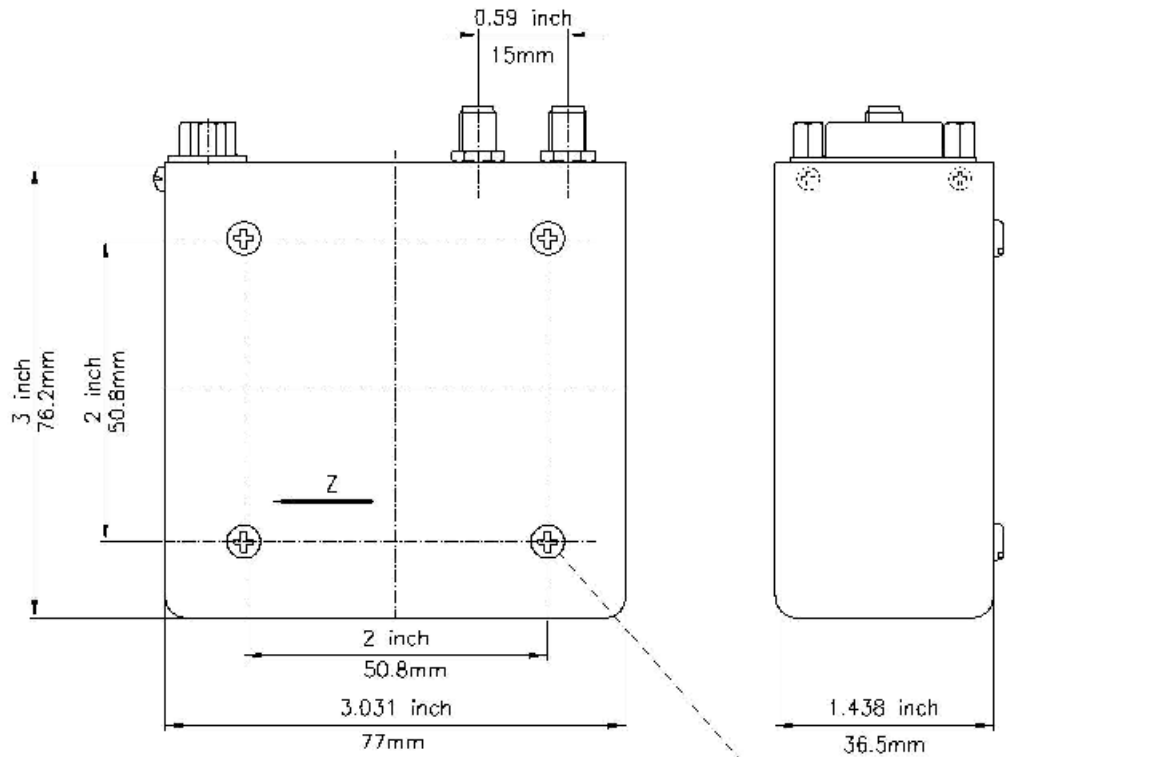
BB: Rb-cell heating current (500mA to 0mA)

AA: 90MHz power control signal (0 to 5V)

Cxx: output frequency correction through the synthesizer, by steps of  $1 \times 10^{-9}$ , where xx is a signed 8 bits word. This value is automatically stored in a EEPROM.

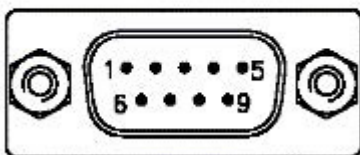
Fxx: output frequency correction through C- field, by steps of  $1 \times 10^{-11}$ , where xx is a signed 8 bits word.

**PACKAGE:** (all dimensions in inch)



**Connector front view:**

**D-Sub 9 pins male**



PIN	FUNCTION
1	+24V (+12V)
2	0V (GND)
3	Lock indicator (open coll.)
4	Vref (5V hi-stability ref.)
5	or no connected (option code NOREF) GND
6	TxD (RS232 transmit,TTL)
7	GND
8	Frequency adjust (0 to 5V)
9	RxD (RS232 receive,TTL)

# Technical Specifications

## ELECTRICAL

Type	LPFRS/AV1		
	Standard version		Options
Frequency	10 MHz		Optional 20 MHz, 15 MHz, 5 MHz
Frequency change within operating temperature range (Thermal chamber with air flow)	<= $\pm 1 \times 10^{-10}$ over -5°C to +55°C		-30 to 70°C (option code E70) -30 to 60°C (option code E)
Frequency Accuracy @ Shipment	< $5E^{-11}$ (+25°C), typical		
Long term stability (Measured after 3 months of continuous operation)	< $5 \times 10^{-11}$ / month (typical: $3 \times 10^{-11}$ / month)		< $3 \times 10^{-11}$ / month < $2 \times 10^{-10}$ /year (option code A) (typical: $\pm 1 \times 10^{-11}$ / month)
Short term stability	2 x $10^{-11}$ / 1 s 7 x $10^{-12}$ / 10 s 2 x $10^{-12}$ / 100 s		Improved short term stability (option code S) 1 x $10^{-11}$ / 1 s 3 x $10^{-12}$ / 10 s 1 x $10^{-12}$ / 100 s
Phase noise (10 MHz)	-70 dBc/Hz at 1 Hz -80 dBc/Hz at 10 Hz -115 dBc/Hz at 100 Hz -135 dBc/Hz at 1kHz -140 dBc/Hz at 10 kHz	@10 MHz -80 dBc/Hz at 1 Hz -100 dBc/Hz at 10Hz -130 dBc/Hz at 100 Hz -145 dBc/Hz at 1kHz -153 dBc/Hz at 10 kHz (option code Q3)	@10 MHz -80 dBc/Hz at 1 Hz -100 dBc/Hz at 10Hz -130 dBc/Hz at 100 Hz -145 dBc/Hz at 1kHz -153 dBc/Hz at 10 kHz (option code Q3/X)
Frequency retrace (in stable temperature, gravity, pressure and magnetic field conditions)	< $5 \times 10^{-11}$ within 1 h after 24 h off		
Warm-up time [minutes]	standard version $5 \times 10^{-10}$ after 15' at +25°C	fast warm-up (option code F) $5 \times 10^{-10}$ after 7' at +25°C fast warm-up (option code FE) $5 \times 10^{-10}$ after 6' at +25°C	
Analog frequency adjustment For stable operation, an external voltage adjust. value shall be applied (DC voltage of 0 to 5V) to pin 8. Typically: the cursor pin of a 10kΩ variable resistor connected between pins 4 and 5 can provide this adjustment voltage.	2.5 x $10^{-9}$ ±20%		Large analog frequency tuning (option code O) $5 \times 10^{-9}$ ±20% Precise analog frequency tuning (option code G11) 2.5 to 3 x $10^{-9}$
Digital frequency adjustment through serial RS-232 port.	$\pm 1.2 \times 10^{-7}$ (resolution: $1 \times 10^{-9}$ ) $2.5 \times 10^{-9}$ (resolution: $1 \times 10^{-11}$ ) ±20%		
Output level	Sine wave 0.5 Vrms ±10%, 50 Ω		7-11dbm/50Ω (option code 9DB) 12-15dbm/50Ω (option code 13DB)
>Number of output (s)	Single output		Dual output (option code D)
Return loss	-20 dB		
Harmonics	< -25dBc		< -40 dBc (option code X)
Spurious f0 ± 100kHz	< -80dBc		< -110 dBc (option code X)
Sub-harmonics	< -60dBc		< -100 dBc (option code X)
Conformal coating	Yes		
Supply voltage	28V option : 18 to 32 V		12V option : 11.2 to 17 V
Max Power Supply Ripple	< 50 mV peak to peak (from 1Hz to 1 MHz frequency band)		
Supply voltage sensitivity	< $2 \times 10^{-11}$ for 10% voltage change		
Input power	warm up: typical <20 W at 12 V typical <25 W at 28 V -5°C: <13 W +25°C: <10 W +50°C: <7 W		warm up: <32 W (with option code F or E) warm up: <36 W (with option code FE)

Type		LPFRS/AV1			
		Standard version		Options	
Electrical Protection	power +24V (12V) RF output TxD output 5V (Vref) output RxD input Frequency adjust input Lock indicator	An internal diode protects against reverse polarity connection ESD and short-cut protected ESD and short-cut protected ESD and short-cut protected ESD protected ESD protected Over current protected			
<u>Lock Indicator (pin 3)</u>		<u>Standard</u>	<u>Option LR</u>	<u>Option B</u>	<u>Option BR 5V</u>
L = open collector B = TTL	locked unlocked	Open Closed	Closed Open	< 0.4V 5V	< 0.4V

## ENVIRONMENTAL OPERATING

Magnetic field sensitivity	< 2 x 10 <sup>-11</sup> / Gauss in X and Y axis < 1 x 10 <sup>-10</sup> / Gauss in Z axis		
Low pressure (altitude)	MIL-STD-810F method 500.4 Limited to 30'000m altitude	Other test method on request	
Operating Temperature	-25°C to +60°C (60°C is the maximal temperature of the thermal chamber with air flow around the unit)	-25°C to +70°C (option E70)	
Vibration random	MIL STD 810F method 514.5C-8	Other vibration profile on request	
Humidity	RTCA/DO-160C hot humidity, 35°C, 95% relative humidity	Other test method on request	
Helium concentration sensitivity	< 1 x 10 <sup>-10</sup> per ppm of Helium concentration change		
g-tip-over test	2 x 10 <sup>-10</sup> / g on worst sensitive axis	Low magnetic sensitivity (Option code LM) < 5 x 10 <sup>-11</sup> / g / all axis	

## ENVIRONMENTAL NON OPERATING

Storage Temperature	Any temperature from -55°C to +85°C		
Shocks	MIL STD 810 + 516.2 /160g, 4ms, half sinus	Other tests method on request	
Humidity	RTCA/DO-160C hot humidity, 35°C, 95% relative humidity	Other tests method on request	
Acceleration	MIL STD 810 method 513.5 procedure I *		

\* pending for approval

## PHYSICAL

Size	76 × 77 × 36.5mm. (3.0 × 3.03 × 1.44 inches)
Weight	290 g max. (0.64 Lbs. max)
Volume	1/5 liter (13 cubic inches)
Connector	9 male contacts Mate with ITT Cannon Series DB9 + SMA coaxial M3 mating UNC mating <b>(Option code 4-40)</b>
Mounting Drill	Standard M3 mating

## Ordering Information:

**LPFRS / AV1 / 10 M / 28**

Type      Option      Frequency      Supply voltage

**POWERED  
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