Low Cost, Profile & Rugged Frequency Rubidium Standard (LPFRS) for Avionics Applications

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High Precision & Performance Source

Designed for

Defense | MIL | AVIONICS

Applications

Product Characteristics:

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

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

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>

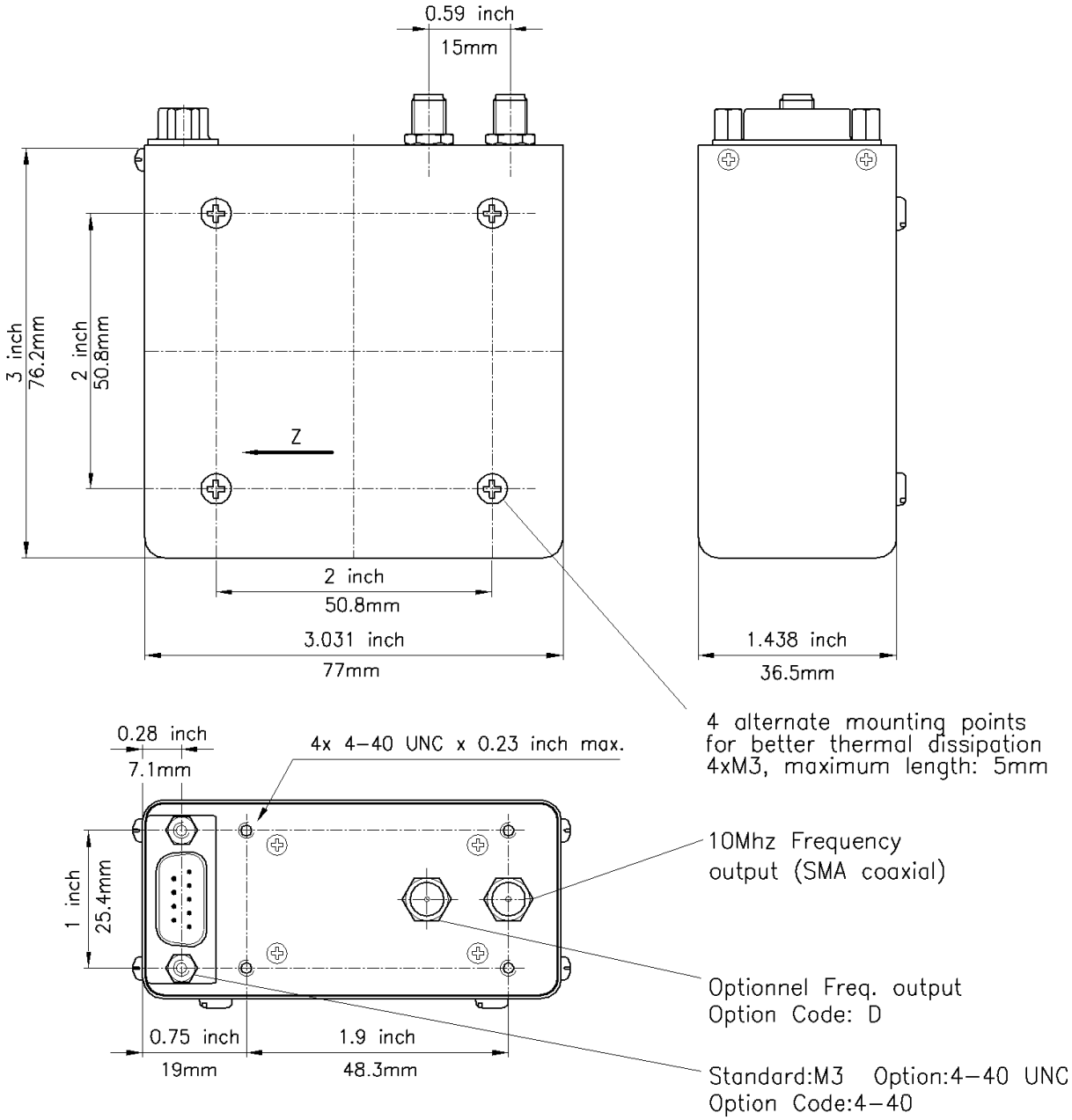
Where each returned byte is an ASCII coded hexadecimal value, separated by a <Space> character. All parameters are coded at full scale.

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 x 10^{-9} , where xx is a signed 8 bits word. This value is automatically stored in a EEPROM.

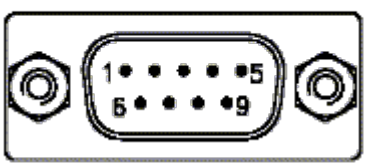
Fxx: output frequency correction through C-field, by steps of 1 x 10^{-11} , where xx is a signed 8 bits word.

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.) or no connected (**option code NOREF**)
5	GND
6	TxD (RS232 transmit,TTL)
7	GND
8	Frequency adjust (0 to 5V)
9	RxD (RS232 receive,TTL)

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)	<= ± 1 x 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)	< 5x10^{-11} / month (typical: 3x10^{-11} / month)	< 3x10^{-11} / month < 2x10^{-10} /year (**option code A**) (typical: ±1x10^{-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 -153 dBc/Hz at 100 kHz (**option code Q3/X**)
Frequency retrace (in stable temperature, gravity, pressure and magnetic field conditions)	< 5 x 10^{-11} within 1 h after 24 h off		
Warm-up time [minutes]	standard version 5 x 10^{-10} after 15' at +25°C	fast warm-up (**option code F**) 5 x 10^{-10} after 7' at +25°C fast warm-up (**option code FE**) 5 x 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 x 10^{-9} ±20% Precise analog frequency tuning (**option code GI1**) 2.5 to 3 x 10^{-9}	
Digital frequency adjustment through serial RS-232 port.	±1.2 x 10^{-7} (resolution: 1 x 10^{-9}) 2.5 x 10^{-9} (resolution: 1 x 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 f_0 ± 100kHz	< -80dBc	< -110 dBc (**option code X**)	
Sub-harmonics	< -60dBc	< -100 dBc (**option code X**)	
Conformal coating	Yes		
Supply voltage Max Power Supply Ripple	**28V option** : 18 to 32 V	**12V option** : 11.2 to 17 V < 50 mV peak to peak (from 1Hz to 1 MHz frequency band)	
Supply voltage sensitivity	< 2 x 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			
Lock Indicator (pin 3) L = open collector locked B = TTL unlocked	Standard Open Closed	Option LR Closed Open	Option B < 0.4V 5V	Option BR 5V < 0.4V

ENVIRONMENTAL OPERATING

Magnetic field sensitivity	< 2 x 10^{-11} / Gauss in X and Y axis < 1 x 10^{-10} / 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)	Possible extended operating temp. Up 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^{-10} per ppm of Helium concentration change	
g-tip-over test	2 x 10^{-10} / g on worst sensitive axis	Low magnetic sensitivity **(Option code LM)** < 5 x 10^{-11} / 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 **(Option code 4-40)**
Mounting Drill	Standard M3 mating	

Ordering Information:

LPFRS / AV1 / 10 M / 28

Type Option Frequency Supply voltage