

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

High Precision & Performance Source



Designed for
Defense | MIL | AVIONICS
Applications

Product Characteristics:

- Small volume : 13 in³.
- 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)

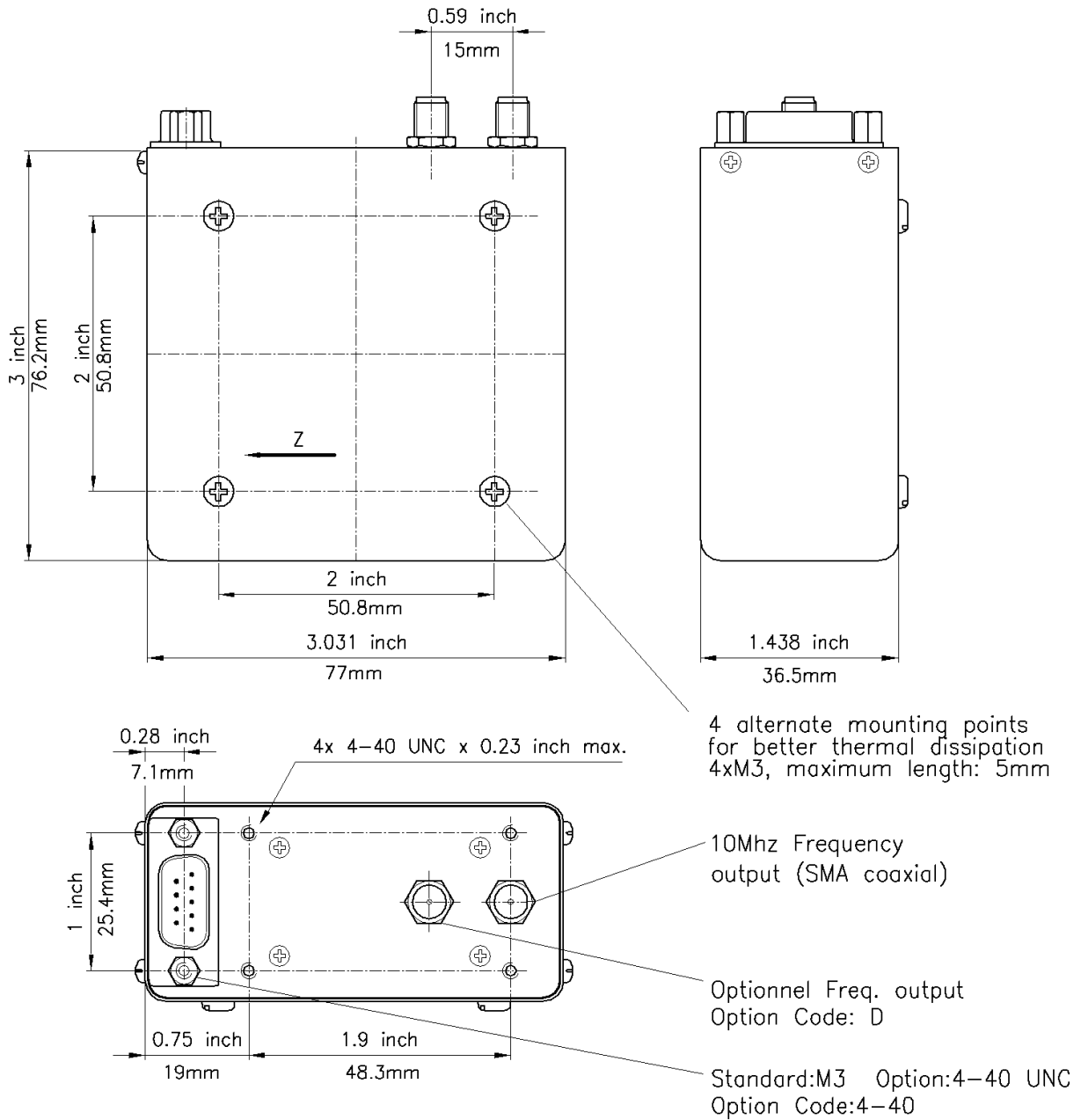
BB: Rb-cell heating current (500mA to 0mA)

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

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

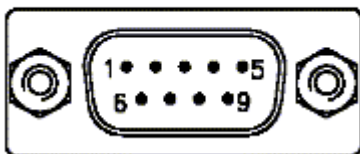
Fxx: output frequency correction through C-field, by steps of 1×10^{-11} , where *xx* is a signed 8 bits word.

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)	$\leq \pm 1 \times 10^{-10}$ 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: 3×10^{-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	2×10^{-11} / 1 s 7×10^{-12} / 10 s 2×10^{-12} / 100 s	Improved short term stability (option code S) 1×10^{-11} / 1 s 3×10^{-12} / 10 s 1×10^{-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 1 kHz -140 dBc/Hz at 10 kHz	@10 MHz -80 dBc/Hz at 1 Hz -100 dBc/Hz at 10 Hz -130 dBc/Hz at 100 Hz -145 dBc/Hz at 1 kHz -153 dBc/Hz at 10 kHz (option code Q3)
Phase noise (10 MHz)		@10 MHz -80 dBc/Hz at 1 Hz -100 dBc/Hz at 10 Hz -130 dBc/Hz at 100 Hz -145 dBc/Hz at 1 kHz -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 5×10^{-10} after 15' at +25°C	fast warm-up (option code F) 5×10^{-10} after 7' at +25°C fast warm-up (option code FE) 5×10^{-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.	$2.5 \times 10^{-9} \pm 20\%$	Large analog frequency tuning (option code O) $5 \times 10^{-9} \pm 20\%$ Precise analog frequency tuning (option code GI1) 2.5 to 3×10^{-9}
Digital frequency adjustment through serial RS-232 port.	$\pm 1.2 \times 10^{-7}$ (resolution: 1×10^{-9}) 2.5×10^{-9} (resolution: 1×10^{-11}) $\pm 20\%$	
Output level	Sine wave 0.5 Vrms $\pm 10\%$, 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	< -25 dBc	< -40 dBc (option code X)
Spurious $f_0 \pm 100$ kHz	< -80 dBc	< -110 dBc (option code X)
Sub-harmonics	< -60 dBc	< -100 dBc (option code X)
Conformal coating	Yes	
Supply voltage Max Power Supply Ripple	28V option : 18 to 32 V < 50 mV peak to peak (from 1Hz to 1 MHz frequency band)	12V option : 11.2 to 17 V
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> L = open collector locked B = TTL unlocked	<u>Standard</u> Open Closed	<u>Option LR</u> Closed Open	<u>Option B</u> < 0.4V 5V	<u>Option BR</u> 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 x 77 x 36.5mm. (3.0 x 3.03 x 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:

