

## Low Cost & Profile Frequency Rubidium Standard (LPFRS)

# High Precision & Performance Source



**Telecom | Navigation | Broadcast | Defense | Instrument**

## Applications

**Product Characteristics:**

- Small volume : 13 in<sup>3</sup>.
- 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:**

- Synchronisation telecommunications (SDH, SONET, SS7, GSM, TETRA)
- Digital Audio Broadcast
- TV transmissions (analog & digital)
- Military communications
- Navigation
- Instrumentation
- Tracking and guidance control

**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)

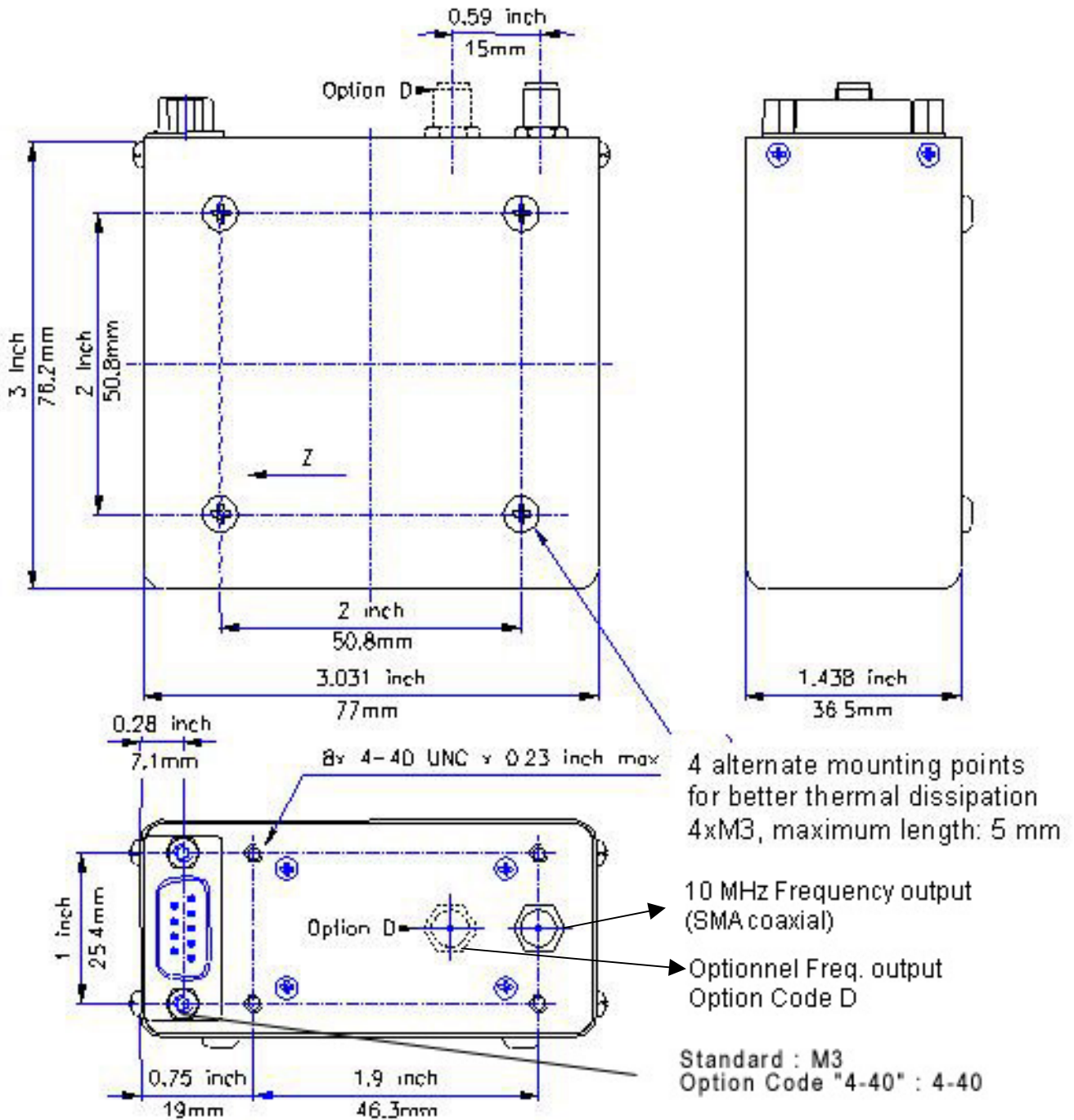
*BB*: Rb-cell heating current (500mA to 0mA)

*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.

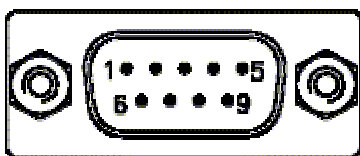
*Fxx*: output frequency correction through C-field, by steps of  $1 \times 10^{-11}$ , where *xx* is a signed 8 bits word.

**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	GND
6	TxD (RS232 transmit,TTL)
7	GND
8	Frequency adjust (0 to 5V)
9	RxD (RS232 receive,TTL)

**SPECIFICATIONS****ELECTRICAL:**

Type	LPFRS-01	
	Standard version	Options
Frequency	10 MHz	Optional 20 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( <b>option code E70</b> ) -30 to 60°C( <b>option code E</b> )
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 ( <b>option code A</b> ) (typical: $\pm 1 \times 10^{-11}$ / month)
Short term stability	$3 \times 10^{-11}$ / 1 s $1 \times 10^{-11}$ / 10 s $3 \times 10^{-12}$ / 100 s	Improved short term stability ( <b>option code S</b> ) $1 \times 10^{-11}$ / 1 s $3 \times 10^{-12}$ / 10 s $1 \times 10^{-12}$ / 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	-80 dBc/Hz at 1 Hz -100 dBc/Hz at 10Hz -130 dBc/Hz at 100 Hz -140 dBc/Hz at 1kHz -150 dBc/Hz at 10 kHz ( <b>option code Q3</b> )
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 ( <b>option code F</b> ) lock after 7' at +25°C
Analog frequency adjustment For stable operation, an external voltage adjust. value shall be applied (DC voltage of 0 to 5V) on pin 4. Typically: the cursor pin of a 10kΩ variable resistor connected between pins 2 and 3 (Vref & GND) can provide this adjustment voltage.(refer to op. manual).	$2.5 \times 10^{-9} \pm 20\%$	Large analog frequency tuning ( <b>option code O</b> ) $5 \times 10^{-9} \pm 20\%$ Precise analog frequency tuning ( <b>option code G11</b> ) $2.5$ to $3 \times 10^{-9}$
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: $1 \times 10^{-11}$ ) $\pm 20\%$	
Output level	sinewave 0.5 Vrms $\pm 10\%$ , 50 Ω	
>Number of output (s)	Single output	Dual output ( <b>option code D</b> )
Return loss	-20 dB	
Harmonics	$< -25$ dBc	$< -40$ dBc ( <b>option code X</b> )
Spurious $f_0 \pm 100$ kHz	$< -80$ dBc	$< -110$ dBc ( <b>option code X</b> )
Subharmonics	$< -60$ dBc	$< -100$ dBc ( <b>option code X</b> )
Supply voltage	<b>24V option</b> : 18 to 32 V	<b>12V option</b> : 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 24 V -5°C: $< 13$ W +25°C: $< 10$ W +50°C: $< 7$ W	warm up: $< 32$ W ( <b>with option code F or E</b> )

Type	LPFRS-01			
	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	<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**

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 magnetic sensitivity <b>(Option code LM)</b> < 2 x 10 <sup>-11</sup> / all axis
Storage Temperature	- 55°C to + 85°C	
Operating Temperature	-25°C to +55°C (55°C is the maximal temperature of the thermal chamber with air flow around the unit)	
Overall Environment Effects * (Altitude,Vibration,Shocks)	Meets or exceeds MIL-T-28800B for Type III, class 5 equipment + MIL Std 810 + 516.2 /160g, 4ms, half sinus	
Humidity	RTCA/DO-160C hot humidity, 35°C, 95% relative humidity	
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 <b>(Option code LM)</b> < 5 x 10 <sup>-11</sup> / g / all axis

**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
Mounting Drill	Standard M3 mating

**Ordering Information:**

