

# 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)

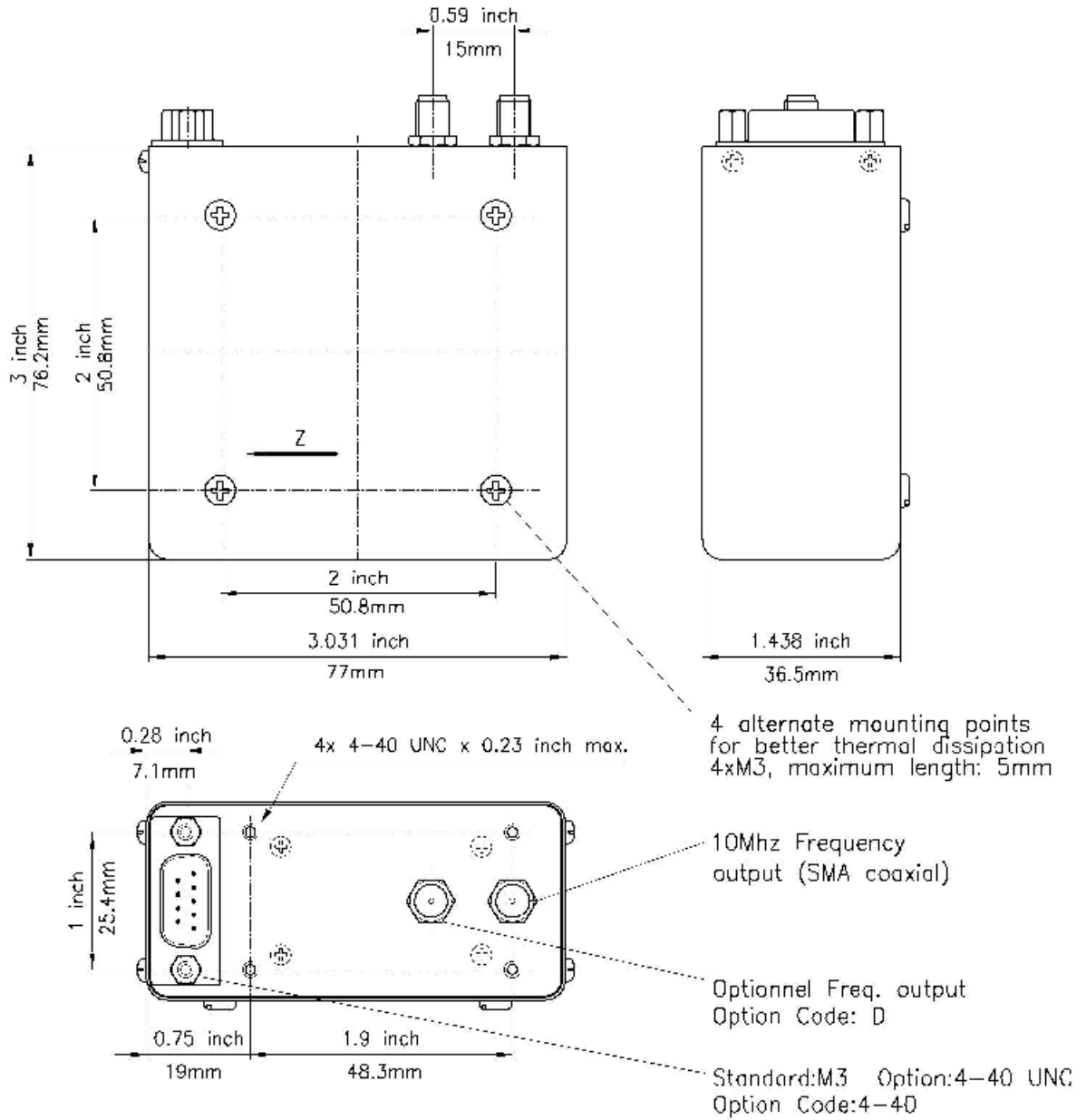
BB: Rb-cell heating current (500mA to 0mA)

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.

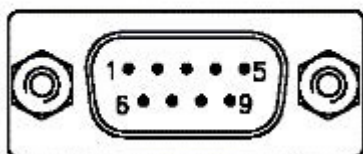
Fxx: output frequency correction through C- field, by steps of  $1 \times 10^{-11}$ , where xx is a signed 8 bits word.

**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)<br>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<br>(Thermal chamber with air flow)   | $\leq \pm 1 \times 10^{-10}$<br>over $-5^{\circ}\text{C}$ to $+55^{\circ}\text{C}$  | -30 to $70^{\circ}\text{C}$ (option code E70)<br>-30 to $60^{\circ}\text{C}$ (option code E)  |   |
| Frequency Accuracy @ Shipment  | $< 5\text{E}^{-11}$ ( $+25^{\circ}\text{C}$ ), typical  |   |   |
| Long term stability (Measured after 3 months of continuous operation)  | $< 5 \times 10^{-11}$ / month<br>(typical: $3 \times 10^{-11}$ / month)   | $< 3 \times 10^{-11}$ / month<br>$< 2 \times 10^{-10}$ /year (option code A)<br>(typical: $\pm 1 \times 10^{-11}$ / month)  |   |
| Short term stability   | $2 \times 10^{-11}$ / 1 s<br>$7 \times 10^{-12}$ / 10 s<br>$2 \times 10^{-12}$ / 100 s  | Improved short term stability<br>(option code S)<br>$1 \times 10^{-11}$ / 1 s<br>$3 \times 10^{-12}$ / 10 s<br>$1 \times 10^{-12}$ / 100 s                                      |   |
| Phase noise (10 MHz)   | -70 dBc/Hz at 1 Hz<br>-80 dBc/Hz at 10 Hz<br>-115 dBc/Hz at 100 Hz<br>-135 dBc/Hz at 1kHz<br>-140 dBc/Hz at 10 kHz  | @10 MHz<br>-80 dBc/Hz at 1 Hz<br>-100 dBc/Hz at 10Hz<br>-130 dBc/Hz at 100 Hz<br>-145 dBc/Hz at 1kHz<br>-153 dBc/Hz at 10 kHz<br>(option code Q3)                               | @10 MHz<br>-80 dBc/Hz at 1 Hz<br>-100 dBc/Hz at 10Hz<br>-130 dBc/Hz at 100 Hz<br>-145 dBc/Hz at 1kHz<br>-153 dBc/Hz at 10 kHz<br>-153 dBc/Hz at 100 kHz<br>(option code Q3/X) |
| Frequency retrace<br>(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<br>$5 \times 10^{-10}$ after 15' at $+25^{\circ}\text{C}$  | fast warm-up (option code F)<br>$5 \times 10^{-10}$ after 7' at $+25^{\circ}\text{C}$<br>fast warm-up (option code FE)<br>$5 \times 10^{-10}$ after 6' at $+25^{\circ}\text{C}$ |   |
| Analog frequency adjustment<br>For stable operation, an external voltage adjust. value shall be applied (DC voltage of 0 to 5V) to pin 8.<br>Typically: the cursor pin of a 10k $\Omega$ variable resistor connected between pins 4 and 5 can provide this adjustment voltage. | $2.5 \times 10^{-9} \pm 20\%$   | Large analog frequency tuning<br>(option code O)<br>$5 \times 10^{-9} \pm 20\%$<br>Precise analog frequency tuning<br>(option code G11)<br>$2.5$ to $3 \times 10^{-9}$          |   |
| Digital frequency adjustment through serial RS-232 port.   | $\pm 1.2 \times 10^{-7}$ (resolution: $1 \times 10^{-9}$ )<br>$2.5 \times 10^{-9}$ (resolution: $1 \times 10^{-11}$ ) $\pm 20\%$  |   |   |
| Output level   | Sine wave 0.5 Vrms $\pm 10\%$ , 50 $\Omega$   | 7-11dbm/50 $\Omega$ (option code 9DB)<br>12-15dbm/50 $\Omega$ (option code 13DB)  |   |
| >Number of output (s)  | Single output   | Dual output (option code D)   |   |
| Return loss  | -20 dB  |   |   |
| Harmonics  | $< -25\text{dBc}$   | $< -40$ dBc (option code X)   |   |
| Spurious $f_0 \pm 100\text{kHz}$   | $< -80\text{dBc}$   | $< -110$ dBc (option code X)  |   |
| Sub-harmonics  | $< -60\text{dBc}$   | $< -100$ 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<br>typical $< 25$ W at 28 V<br>$-5^{\circ}\text{C}$ : $< 13$ W<br>$+25^{\circ}\text{C}$ : $< 10$ W<br>$+50^{\circ}\text{C}$ : $< 7$ W | warm up: $< 32$ W<br>(with option code F or E)<br>warm up: $< 36$ W<br>(with option code FE)  |   |

| Type                          |  | LPFRS/AV1   |                  |                 |                     |
|-------------------------------|--|---|------------------|-----------------|---------------------|
|                               |  | Standard version  |                  | Options         |                     |
| Electrical Protection         | power +24V (12V)<br>RF output<br>TxD output<br>5V (Vref) output<br>RxD input<br>Frequency adjust input<br>Lock indicator | An internal diode protects against reverse polarity connection<br>ESD and short-cut protected<br>ESD and short-cut protected<br>ESD and short-cut protected<br>ESD protected<br>ESD protected<br>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            | locked   | Open Closed   | Closed Open      | < 0.4V 5V       | < 0.4V              |
| B = TTL                       | unlocked   |   |                  |                 |                     |

### ENVIRONMENTAL OPERATING

|                                  |   |  |
|----------------------------------|---|--|
| Magnetic field sensitivity       | < 2 x 10 <sup>-11</sup> / Gauss in X and Y axis<br>< 1 x 10 <sup>-10</sup> / Gauss in Z axis          |  |
| Low pressure (altitude)          | MIL-STD-810F method 500.4<br>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<br>(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<br>(Option code LM)<br>< 5 x 10 <sup>-11</sup> / g / all axis |

### ENVIRONMENTAL NON OPERATING

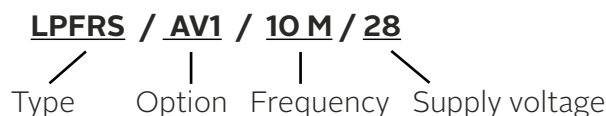
|                     |  |                               |
|---------------------|--|-------------------------------|
| Storage Temperature | Any temperature from -55°C to +85°C                    |                               |
| Shocks              | MIL STD 810 + 516.2 /160g, 4ms,<br>half sinus          | 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<br>Mate with ITT Cannon Series DB9 + SMA coaxial M3 mating<br>UNC mating<br><b>(Option code 4-40)</b> |
| Mounting Drill | Standard M3 mating  |

### Ordering Information:



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October 16, 2023

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