



# LPRO

## Low Profile Rubidium Oscillator

### KEY FEATURES

- 10 MHz Sine Wave
- 1.5 Inch Total Height
- <math>5E-11</math>/Month Aging
- Single 24 Vdc Supply; Wide Operating Supply Range (19 to 32V)
- Alarm Signal for Rb Unlock
- Meets TDMA and GSM Frequency Requirements Without an External Reference or Routine Calibration
- CE Compliant

### INTRODUCTION

Symmetricom's LPRO is a field proven rubidium time and frequency reference. It offers the high reliability of a design that has been refined over many years from the experience gained in fielding tens of thousands of rubidium oscillators. With its one-board package incorporating surface mount technology, the LPRO is the first rubidium designed for high volume production. As a result LPRO is the most widely produced rubidium oscillator in history.

The LPRO is designed for ease of integration into time and frequency systems because of its low profile and single circuit board design. The height and footprint are designed to accommodate a 1U high application. Great care has been taken in the design to minimize EMI emissions and susceptibility, including the use of both a filter plate connector for I/O signals and an outer mu-metal cover. It is easy to integrate into a system, requiring only one input supply voltage and allowing direct plug-in into another circuit board. Suitable applications include: telecom networks such as digital cellular/PCS base stations, SONET/SDH digital network timing, as well as test and measurement applications that require the long term stability available only from an atomic standard. When linked with a GPS receiver, the LPRO provides the necessary timing requirements for CDMA cel-

lular and PCS systems. The low temperature coefficient and excellent frequency stability extend holdover performance when the GPS signals are not available.

The LPRO is designed for long operating periods without maintenance (long life Rb lamp, extended crystal control range). This allows engineers to design in the LPRO as a lifetime reference for RF transmission applications. The LPRO will maintain  $1E-9$  frequency accuracy for 10 years or longer without recalibration. The design provides a stable frequency with a good short and long term stability, and excellent spur performance. The LPRO provides a 5V CMOS-compatible alarm signal derived from the basis physics operation which indicates when output frequency is outside roughly  $\pm 5E-8$  of absolute frequency offset.



FIG.1 LPRO

## LPRO Specifications

### ELECTRICAL SPECIFICATIONS

Unless otherwise indicated, 24 Vdc input @25°C

- Output/Frequency/Waveform: 10 MHz sine wave
- Output Level: 0.55 VRMS  $\pm$  0.05VRMS into 50  $\Omega$  [+7.8  $\pm$  0.8 dBm]
- Output Impedance: 50 ohm @10 MHz
- Phase Noise (SSB):

1 Hz	<-75 dBc/Hz
10 Hz	<-89 dBc/Hz
100 Hz	<-128 dBc/Hz
1000 Hz	<-140 dBc/Hz
10 kHz	<-147 dBc/Hz
- Spurs:

Harmonic:	2nd	<-60 dBc
	Other:	<-65 dBc
Non-Harmonic:	1 Hz to 1 kHz	<-89 dBc
	1 kHz to 10 kHz	<-97 dBc
	10 kHz to 100 kHz	<-100 dBc
	>100 kHz to 1 GHz	<-68 dBc
- Aging: Monthly (after 1 month): <5E-11/month  
10 years <1E-9
- Frequency Accuracy At Shipment:  $\pm$  5E-11 (25°C)
- Frequency Retrace: < $\pm$ 2.5E-11; [after 24 hrs power on @ 25°C & up to 48 hrs power off]
- Short Term Stability: t=1 sec <2.5E-11  
t=10 sec <0.8E-11  
t=100 sec <0.25E-11
- Frequency Control:  
Internal trim range (trim pot):  $\geq$   $\pm$ 1.5E-9  
External trim range (electronic):  $\geq$   $\pm$ 1.5E-9 (0V to +5V)
- Setting Resolution, Trim Pot: 1E-11
- Warm-Up:

	(at -20°C)	(at 25°C)
Time to Lock:	<8.7 min	<5.4 min
Time to <1E-9:	<10.2 min	<7.3 min
Time to <4E-10:	<12.7 min	<10.6 min
Max Input (Amps) @24V:	<1.45 amps	<1.43 amps
- Input Voltage Range: +19 to 32.0 Vdc
- Voltage Sensitivity: .72E - 11/V (over input voltage range)
- Input Power, Quiescent: +24Vdc <13W @ 25°C; +19Vdc <7W @ 65°C
- Status Monitor:  
Analog: VCXO volts, lamp volts; [20 kOhm impedance, filtered]  
Digital: LOCK monitor: 5V CMOS load  
Lock: 0V to 50 mV [within  $\sim$  $\pm$ 5E - 8]  
Unlock: 4.2 to 4.7V

### ENVIRONMENTAL SPECIFICATIONS

- Operating Temperature: -25°C baseplate to +70°C BP  
[-20°C baseplate to +70°C BP including warm-up]
- Temperature Coefficient: [-25°C to 70°C] <6E-10; [0°C to 50°C] <3E-10
- Storage Temperature: -55°C to +85°C
- Altitude:  
Operating: -200 ft to 40,000 ft.  
Non-operating: -200 ft to 70,000 ft.
- Magnetic Field Sensitivity, dc ( $\pm$ 2 GAUSS): < $\pm$ 4E - 11/GAUSS
- Relative Humidity:  $\leq$ 85% non-condensing; meet or exceed Telcordia. GR-63-CORE Issue 1, October 1995, section 4.1.2.
- Vibration:  
Operating: Meets or exceeds Telcordia GR-63-CORE, Issue 1, October 1995, section 4.4.3 and section 5.4.2 (no unlock. 1.0 g peak sine @ 5-100Hz).  
Non-operating (transportation): Telcordia GR-63-CORE, Issue 1, October 1995, section 4.4.4 and section 5.4.3, curve 1 of Figure 4-3. (1.5 g peak max sine @ 5-500Hz).
- EMI: Compliant to FCC Part 15 Class B (conducted and radiated emissions) and complies with EN55022B emissions (radiated and conducted) and EN50082-1 (immunity).
- MTBF: Per Telcordia GR-63-CORE Issue 1, (Ground Fixed, Controlled)  
Amb. Temp: 20°C 25°C 30°C 40°C 50°C 60°C  
MTBF (hrs) 381k 351k 320k 253k 189k 134k  
(RELEX version 7.2 Bellcore method 1 case 3 40°C 50% stress)

### PHYSICAL SPECIFICATIONS

- Weight: 1.10 lbs. max.
- Size: 3.7" X 5.0" X 1.5" H
- Warranty: 2 years
- Extended Warranty: Consult factory

*Note: Consult factory for application support, test reports or special requirements.*



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