

# MRO-50

Miniature, Ultra-Portable High Precision  
& Performance Atomic Frequency Source



## NEW Low SWaP-C Miniaturized Rb Oscillator

The new Spectratime mRO-50 meets core telecom, military and critical infrastructure requirements to provide wider thermal range, quicker lock and higher stability.

The clock design is based on the proven rubidium clock heritage at Orolia and it has been adapted for low power (0.36W@3.3V) and size (51cc).

The mRO-50 essentially consists of a voltage-controlled crystal oscillator (VCXO) which is locked to a highly stable atomic transition in the ground state of the 85Rb isotope. The atomic clock provides a signal at the convenient frequency of 10MHz, meeting the performance of the atomic transition.

## Applications

Telecom, Navigation, Broadcast,  
Defense, Battery Powered Instruments

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## Main Features

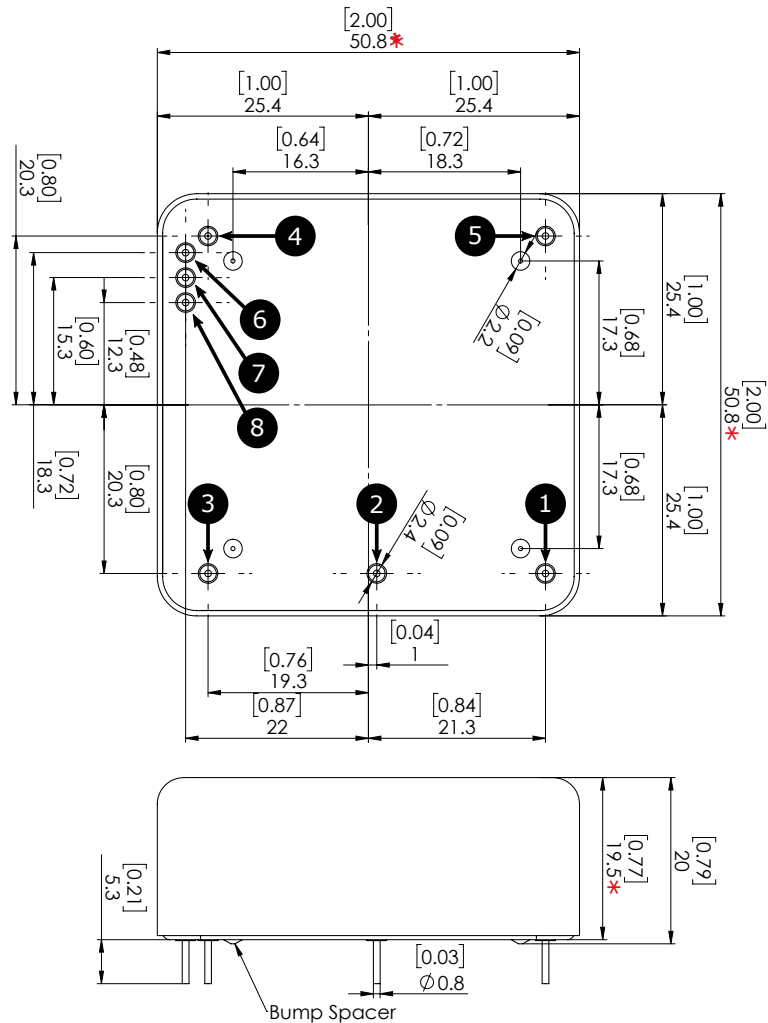
- High accuracy and stability atomic frequency clock
- Low SWaP-C (Size, Weight, Power and Cost) features
- Enhanced MAC (Miniature Atomic Clock) technology
- Small form factor & ultra-portable packaging
- Standard quartz oscillator pinouts
- MAC / SA.3x compatible pinouts
- RoHS compliant
- Operating temperature: -40°C to 80°C (option E80)

## Solution

- High stability frequency source
- Telecom & mobile network synchronization (TDM, PTP)
- Military airborne, ground, mobile & unmanned radio communications
- Oil & gas sensor-based exploration
- Instrumentation
- Portable & battery-sensitive applications
- GPS/GNSS-based applications

## Package:

all dimensions in mm [inch]



## Pin Layout

### PIN FUNCTION

- | PIN | FUNCTION                            |
|-----|-------------------------------------|
| 1   | Frequency Adjust (Analog 0-3V)      |
| 2   | GND                                 |
| 3   | 10MHz square output (0-3V)          |
| 4   | GND                                 |
| 5   | Power 5V or 3.3V depending on model |
| 6   | /LOCK (Bit)                         |
| 7   | TxD                                 |
| 8   | RxD                                 |

### Patent numbers:

China : ZL 2014 8 0075019.0 USA : 10,191,452 B2  
EU : 3102983  
Japan : JP 6416921

# Technical Specifications

## ELECTRICAL

Type		mRO-50	
		Standard version	Options
Frequency		10 MHz	
Frequency change within operating temperature range		$\leq 4 \times 10^{-10}$ over $-10^{\circ}\text{C}$ to $+60^{\circ}\text{C}$	(option code E) $\leq 4 \times 10^{-10}$ over $-10^{\circ}\text{C}$ to $+65^{\circ}\text{C}$ (option code E80) $< 6 \times 10^{-10}$ over $-40^{\circ}\text{C}$ to $+80^{\circ}\text{C}$
Linear drift measured over minimum 14 days After 3 months operations :		$< 1 \times 10^{-11}$ / day	(option code A) $< 5 \times 10^{-12}$ / day
Short term stability	1 sec 10 sec 100 sec	$\leq 1 \times 10^{-10}$ $\leq 3 \times 10^{-11}$ $\leq 1 \times 10^{-11}$	(option code S) $\leq 4 \times 10^{-11}$ $\leq 1.3 \times 10^{-11}$ $\leq 4 \times 10^{-12}$
Phase noise (10 MHz) in dBc/Hz	1 Hz 4 Hz 10 Hz 100 Hz 1000 Hz 10000 Hz	$\leq -60$ $\leq -70$ $\leq -85$ $\leq -110$ $\leq -135$ $\leq -140$	(option code S) $\leq -65$ $\leq -76$ $\leq -90$ $\leq -110$ $\leq -135$ $\leq -140$
Frequency retrace (in stable temperature, gravity, pressure and magnetic field conditions)		$< 1 \times 10^{-10}$ within 1 h after 24 h off	
Warm-up time		Lock $< 2$ minutes at over the full temperature range	
Analog frequency adjustment. For stable operation, an external voltage shall be applied (cf. the manual of the mRO-50 for electrical scheme)		$1 \times 10^{-8} \pm 20\%$ (3.3V) $1 \times 10^{-8} \pm 20\%$ (5V)	
Digital frequency adjustment range with serial RS-232 port.		Fine: $\pm 7 \times 10^{-9}$ (resolution: $3 \times 10^{-12}$ ) Coarse: $\pm 1 \times 10^{-7}$ (resolution: $1.6 \times 10^{-9}$ )	
Output level		Square wave 0-3V	
Spurious $f_0 \pm 100\text{kHz}$		$< -80\text{dBc}$	
Supply voltage Max Power Supply Ripple		5V $< 50$ mV peak to peak (from 1Hz to 1 MHz frequency band)	3.3V (option code 3.3 V) $< 5$ mV peak to peak (from 1Hz to 1 MHz frequency band)
Input power @ $25^{\circ}\text{C}$		0.45W steady state 1.5W start-up	0.36W steady state 1W start-up
Lock Indicator	Unlocked Locked	$> 3$ V $< 0.4$ V	

## ENVIRONMENTAL

Type	mRO-50
Magnetic field sensitivity	$< 1 \times 10^{-10}$ / Gauss
Storage Temperature	$-55^{\circ}\text{C}$ to $+85^{\circ}\text{C}$
Operating Temperature	$-10^{\circ}\text{C}$ to $+60^{\circ}\text{C}$ ( $+65^{\circ}\text{C}$ option E) (maximum temperature of the thermal chamber with air flow around the unit) $-40^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (option E80)
Overall Environment Effects Altitude Vibration, Shocks	Meets or exceeds: MIL-STD-810H, Method 500.6, 40,000ft MIL-STD-810H, Method 514.8 annex C general exposure 4 $G_{\text{rms}}$ MIL-STD-202, 30g, 11 ms, half sinus
Humidity	MIL-STD-810H, Method 507.6 $35^{\circ}\text{C}$ , 95% relative humidity
g-tip-over test	$2 \times 10^{-10}$ / g on worst sensitive axis

## PHYSICAL

Type	mRO-50
Size	50.8 x 50.8 x 19.5 mm (± 0.4 mm) 2" x 2" x 0.77"
Weight	75 g max. (70g typ.) 2.6 oz. max.
Volume	< 51 cc

## MTBF

Type	mRO-50
Cell lifetime / MTBF	10 years / 155860 hours at +25°C

## MORE ON APPLICATIONS

The Spectratime mRO-50 design has been improved to reduce power consumption and size to meet the latest requirements necessary to support various levels of military and commercial applications.



**AEROSPACE**

- GNSS operation through interference
- Low Earth Orbit satellite missions



**MILITARY**

- Military communication systems
- Key Infrastructure Emergency
- Vehicles Radars
- Aircraft and UAVs



**COMMERCIAL**

- Secured telecom
- Underwater geological applications
- Autonomous cars
- Aircrafts

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