Master Reference Oscillator – NewSpace Compact

The NewSpace Master Reference Oscillator (MRO) is a Space Subsystem which generates and distributes highly stable and reliable frequency signals. It is suitable for LEO (Low Earth Orbit) and MEO (Medium Earth Orbit) constellations as well as small GEO (Geosynchronous Equatorial Orbit) satellites with a lifetime up to 12 years. The MRO is specifically designed for telecommunications, navigation and earth observation applications where frequency stability, ultra-low phase noise and low power consumption are crucial.

It provides up to 4 outputs with highly stable frequencies at 100 and 200 MHz. These signals are generated from an ultra-stable oscillator, allowing the MRO to achieve a long-term stability of ±200 ppb over a 12-year lifetime. The short-term stability is ensured by the intrinsic OCXO performance and long-term stability is guaranteed by the microcontroller, which disciplines the oscillator on a GNSS PPS signal. Advanced algorithms ensure smooth synchronisation while avoiding any glitches or jumps in the frequency.

The subsystem is Single Point Failure (SPF) free, with nominal and redundant functions fully isolated from each other. It can be used in cold and hot redundancy. The MRO includes a DC/DC converter, On/Off telecommands, PPS input/outputs via RS422, a CAN communication bus and all telemetry necessary for reliable monitoring and operation. The MRO is based on a modular architecture to ease assembly and integration. It also allows easy customisation to answer specific needs.

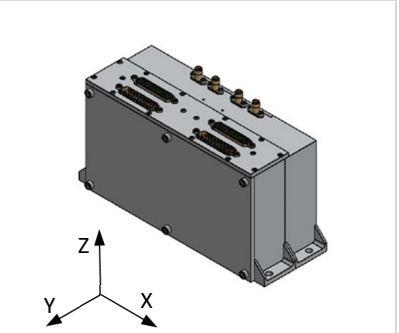
Our product quality adheres to the highest industry standards. Each component is chosen according to AECQ-100/200 criteria. Active components undergo radiation testing for every lot.

This compact NewSpace MRO is an ideal solution for scenarios requiring a lightweight device with small footprint. It is part of Rakon's NewSpace Equipment portfolio which includes GNSS receivers and Software Defined Radio (SDR) devices for NewSpace constellations.

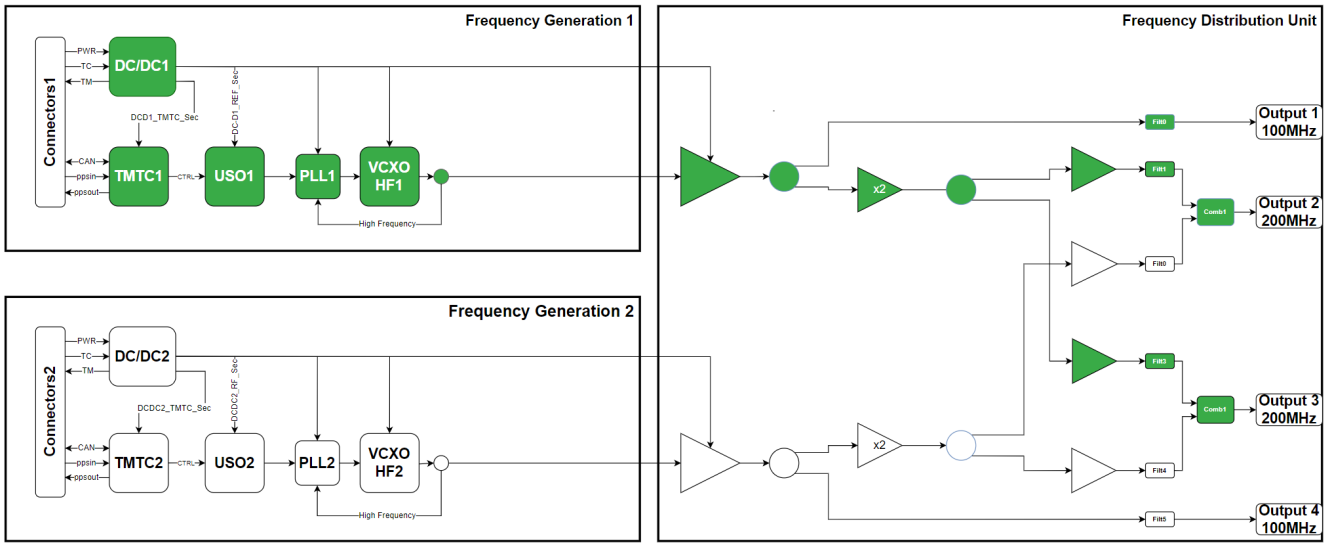
Key Features

- Output frequency: 100MHz/200 MHz
- Overall frequency stability:
  ±50 ppb for 2 years
  ±200 ppb for 12 years
- Output power: 9 dBm
- Typical phase noise @100 MHz
  -100 dBc/Hz (@10 Hz)
  -125 dBc/Hz (@100 Hz)
  -150 dBc/Hz (@1 kHz)
  -165 dBc/Hz (@floor)
- Outputs: 2x 200 MHz + 2x 100 MHz
- Power bus: 28 V
- Communication interface: CAN
- PPS: 2x inputs + 2x outputs (RS422)
- Mass: 2.3 kg
- Power consumption: 9 – 11 W
- Frequency connectors: SMA
- Power & TM/TC connectors: SubD

216 x 108 x 118 mm



Modules and Block Diagram



MRO Block Diagram

Typical Performance Characteristics

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Nominal frequency			100		MHz
Supply voltage		24		34	V
Frequency stability over temperature				±1.5	ppb
Overall frequency drift	After 2 years After 12 years			±50 ±200	ppb ppb
Holdover (48 hours)				±2	ppb
Short-term stability	ADEV @1s		1E-12		
	ADEV @10s		1E-12		
	ADEV @100s		1E-12		
	ADEV @1000s		5E-12		
Output waveform (100 MHz)	Sine				
Output power level (100 MHz)	EOL / adjusted by port		+9		dBm
Harmonics level (100 MHz)				-30	dBc
Spurious level (100 MHz)				-100	dBc
Phase noise @ 100 MHz output	10 Hz offset 100 Hz offset 1 kHz offset 10 kHz offset		-100 -125 -150 -165		dBc/Hz
Output waveform	Sine				
Output power level (200 MHz)	EOL / adjusted by port		+12		dBm
Harmonics level (200 MHz)				-30	dBc
Spurious level (200 MHz)				-100	dBc
Phase noise @ 200 MHz output	10 Hz offset 100 Hz offset 1 kHz offset 10 kHz offset		-95 -120 -145 -160		dBc/Hz

Environment Conditions

Parameter	Condition / Remarks	Min.	Typ.	Max.	Unit
Operating Acceptance temperature	TO_P	-15	25	60	°C
Non-operating temperature	Qualification	-35		85	°C
Random vibration	Out of plane		In Plane		
	20 Hz – 100 Hz: +9dB/Octave 100 Hz – 500 Hz: 0.5 g^2/Hz 500 Hz – 700 Hz: -3dB/Octave 700 Hz – 2000 Hz: -9 dB/Octave Overall level = 20.16 gRMS		20 Hz – 100 Hz: +9 dB/Octave 100 Hz – 500 Hz: 0.5 g^2/Hz 500 Hz – 700 Hz: -3 dB/Octave Overall level = 12.2 gRMS		
Sine vibration	X, Y and Z axes 5 – 21 Hz: ±6.8 mm 21 – 100 Hz: ±20 g				
Mechanical shock (SRC – Q = 10)	X, Y and Z axes 100 Hz: 30 g 1000 Hz: 1100 g 10000 Hz: 1100 g				
Radiation	Up to 50 krads				
Lifetime	Up to 12 years				

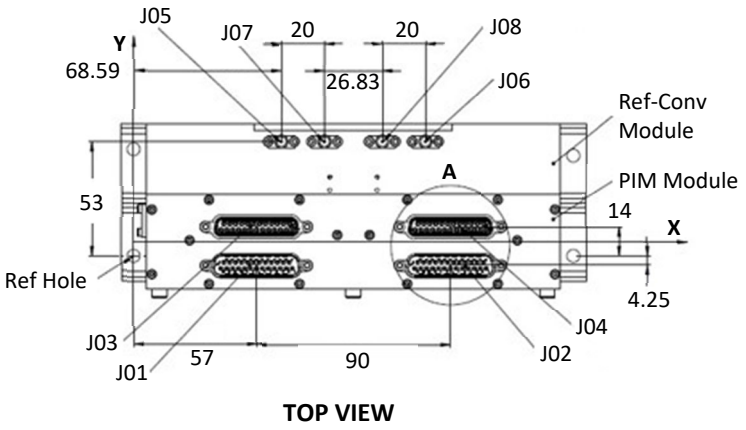
Testing

Test	Condition / Remarks	Qualification testing	Acceptance testing
Functional		✓	✓
Vibration		✓	✓
Mechanical shocks		✓	–
Thermal cycling		✓	✓
Thermal vacuum		✓	–

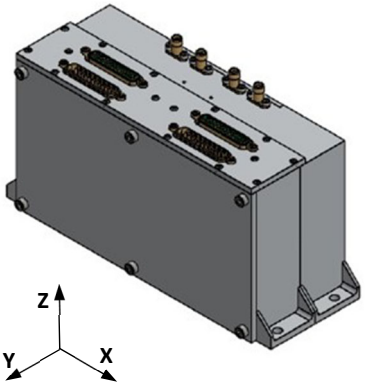
Physical Parameters (2 outputs @ 100MHz and 2 outputs @ 200MHz)

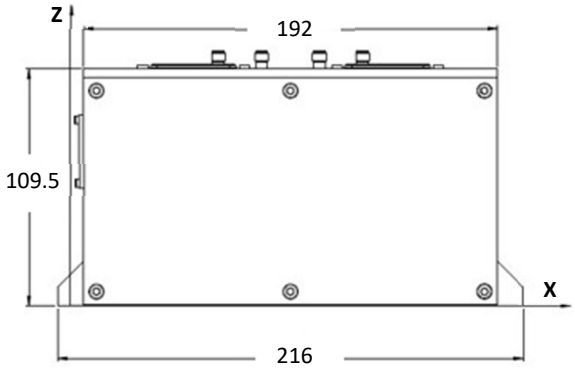
Parameter	Condition / Remarks
Mass	2.3 kg
Package	X x Y x Z: 216 x 108 x 118 mm
Power consumption (Cold redundancy)	Typical: 9.2 W Max: 10.2 W Warm-up: 20.7 W

Product Outline

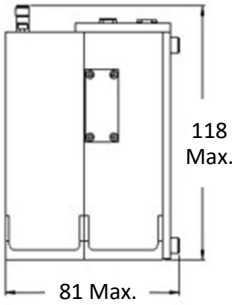


TOP VIEW



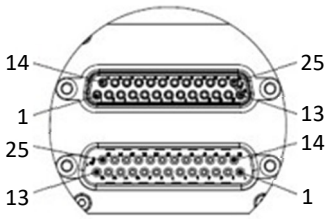


FRONT VIEW



SIDE VIEW

DETAIL A



NOTE:
- Unit: mm
- General tolerance: ±0.2 mm