

# Small Instrumentation Modules

*SIM940 — 10 MHz rubidium frequency standard*

- Three 10 MHz outputs
- 1 pps input and output for GPS synchronization
- 20 year aging less than 0.005 ppm
- Ultra-low phase noise ( $< -130$  dBc/Hz at 10 Hz)
- 72 hour Stratum 1 level holdover

• SIM940 ... \$2250 (U.S. list)



## SIM940 10 MHz Rubidium Frequency Standard

The SIM940 integrates a rubidium oscillator (SRS model PRS10) into the SIM900 platform. It provides stable and reliable performance with an estimated 20 year aging of less than  $5 \times 10^{-9}$  and a demonstrated rubidium oscillator MTBF of over 200,000 hours. The SIM940 is an ideal instrument for calibration and R&D laboratories or any application requiring a precision frequency standard.

There are three 10 MHz outputs with exceptionally low phase-noise and Allan variance. The SIM940 can be phase-locked to an external 1 pps reference (like GPS), providing Stratum 1 performance. A 1 pps output is also provided that has less than 1 ns of jitter and may be set with 1 ns resolution.

All functions of the SIM940 can be controlled from a computer via the SIM900 Mainframe. Both RS-232 and GPIB interfaces are supported by the mainframe.

**Output**

Output frequency	10 MHz sine, 10 $\mu$ s wide 1 pps pulse
Amplitude ( $\pm 10\%$ )	0.5 Vrms (+7 dBm) into 50 $\Omega$
1 pps pulse amplitude	2.5 V into 50 $\Omega$ , 5 V into high impedance loads
Phase noise (SSB)	<-130 dBc/Hz (10 Hz) <-140 dBc/Hz (100 Hz) <-150 dBc/Hz (1 kHz) <-155 dBc/Hz (10 kHz)
Spurious	<-100 dBc (100 kHz BW)
Harmonics	<-60 dBc
Accuracy at shipment	$\pm 5 \times 10^{-11}$
Aging (after 30 days)	$< 5 \times 10^{-11}$ (monthly) $< 5 \times 10^{-10}$ (yearly) $5 \times 10^{-9}$ (20 years, typ.)
Short-term stability (Allan variance)	$< 2 \times 10^{-11}$ (1 s) $< 1 \times 10^{-11}$ (10 s) $< 2 \times 10^{-12}$ (100 s)
Holdover	72 hour Stratum 1 level ( $1 \times 10^{-11}$ )
Frequency retrace	$\pm 5 \times 10^{-11}$ (72 hrs. off, then 72 hrs. on)
Settability	$< 5 \times 10^{-12}$
Trim range	$\pm 2 \times 10^{-9}$ (0 to 5 VDC) $\pm 0.5$ ppm (remote interface)
Warm-up time	<6 minutes (time to lock) <7 minutes (time to $1 \times 10^{-9}$ )

**Front-Panel Indicators (LEDs)**

Locked	Indicates frequency is locked to rubidium
Unlocked	Indicates frequency is unlocked
1 pps input	Blinks with each 1 pps reference input applied to rear panel
1 pps sync	“On” when 1 pps output is synchronized within $\pm 1 \mu$ s of 1 pps input

**Rear-Panel Connections**

Frequency adjust	0 to 5 VDC adjusts frequency by $\pm 0.002$ ppm
1 pps input	100 k $\Omega$ input. Requires CMOS level pulses (0 to 5 VDC). If an external 1 pps input is applied, lock is maintained between the 1 pps input and 1 pps output with computer adjustable time constant from 8 minutes to 18 hours.
1 pps output	50 $\Omega$ pulse output
10 MHz outputs	Three 10 MHz sine outputs (50 $\Omega$ )
DB15/M	SIM interface (power & communication)

**Environmental**

Operating temperature	+10 $^{\circ}$ C to +40 $^{\circ}$ C
Temperature stability	$\Delta f/f < \pm 1 \times 10^{-10}$ (+10 $^{\circ}$ C to +40 $^{\circ}$ C)
Storage temperature	-55 $^{\circ}$ C to +85 $^{\circ}$ C
Magnetic field	$\Delta f/f < 2 \times 10^{-10}$ for 1 Gauss field reversal
Relative humidity	95% (non-condensing)

**General**

Interface	Serial via SIM interface, direct to PRS10
Power	Powered by SIM900 Mainframe, or by user-provided +24 VDC power supply (2.2 A at start-up, 0.6 A after warm-up period)
Dimensions	3.0" $\times$ 3.6" $\times$ 7.0" (WHL)
Weight	5 lbs.
Warranty	One year parts and labor on defects in materials and workmanship



SIM940 rear panel

**Ordering Information**

SIM940	10 MHz rubidium frequency std.	\$2250
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