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# 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**



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## **SIM940 10 MHz Rubidium Frequency Standard**

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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 (-130 dBc/Hz at 10 Hz offset) and one second Allan variance ( $< 2 \times 10^{-11}$ ). 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)<br>< -140 dBc/Hz (100 Hz)<br>< -150 dBc/Hz (1 kHz)<br>< -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)<br>< $5 \times 10^{-10}$ (yearly)<br>$5 \times 10^{-9}$ (20 years, typ.) |
| Short-term stability (Allan variance) | < $2 \times 10^{-11}$ (1 s)<br>< $1 \times 10^{-11}$ (10 s)<br>< $2 \times 10^{-12}$ (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)<br>$\pm 0.5$ ppm (remote interface)                                  |
| Warm-up time                          | < 6 minutes (time to lock)<br>< 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   |

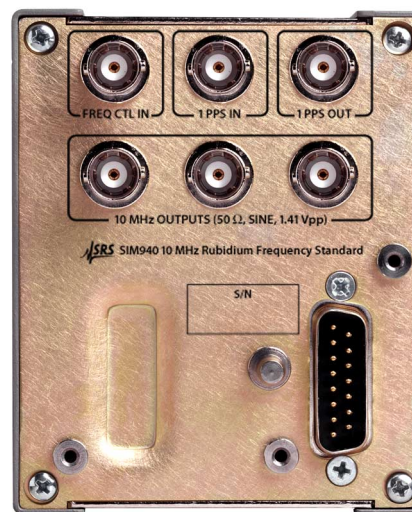
|                |  |
|----------------|--|
| 10 MHz outputs | Three 10 MHz sine outputs (50 $\Omega$ ) |
| DB15/M         | SIM interface (power & communication)    |

## 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      | +24 V (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.