Smart Clocks Set Timing Standards

Each of these "intelligent" rubidium clocks integrates a wide range of timing and synchronization functions within a single compact housing.

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Timing is everything in most telecommunications systems. Communications systems such as code-division-multiple-access (CDMA) cellular and synchronous-optical-network (SONET) systems rely on precise timing of transmitted data for proper operation. In a wireless environment, a lack of precise timing results in service-affecting dropped calls. In order to achieve that timing, these and other systems depend upon a precision atomic clock such as the iSync+™ Smart SRO-100 and SRO-75 rubidium (Rb) SynClock+™ standards from Temex Time. These smart synchronized-rubidium-oscillator (SROs) clocks can be seamlessly and auto-adaptively disciplined to a multi-vendor stratum 1 reference such as Global Positioning System (GPS), Cesium, LORAN-C, CDMA, and E1/T1 at industry's first 1-ns resolution thanks to its SmarTiming+™ technology, which controls parameters such as GPS's Time-RAIM and position hold and filters input noise such as jitter and wander dynamically up to 100,000 s for optimal output performance. The technology also provides a sync or track mode to phase or frequency align the output to the reference and to adjust the output offsets up to 1 s with a 1-s comparator. The SRO has also an integrated EEPROM to auto-calibrate the frequency in case of power failure or loss of reference and to measure time-interval-error (TIE) performance. In addition, it provides both sinewave and complementary-metal-oxide-semiconductor (CMOS)-level output signals with excellent short- and long-term stability, low current consumption, and fast warm-up times.

The SRO-100 is a self-contained Rb clock and synchronization system with standard 10-MHz and 1-PPS output signals.

The SRO-100 and SRO-75 are actually complete miniature synchronization systems, rather than simple Rb oscillators, generating CMOS, sinewave, and 1 pulse per second (PPS) signals as well as time-of-day information. In addition to the Rb electronics, they incorporate locking, disciplining and synchronization circuitries, bus control, EEPROM, and direct-digital-synthesizer (DDS) circuitry. The SRO-100 is available with sinewave and CMOS outputs in a housing with volume of 11 in.^{3} while the SRO-75 provides CMOS output signals in a volume of 5.5 in.^{3}

The clocks run in one of two modes: sync r or track. In sync mode, an SRO-100 or SRO-75 phase aligns the output to the reference. In case of loss of reference, the holdover feature for the SRO-100 is less than 2 µs over 48

hours, and less than 7 µs over 48 hours for the SRO-75. When locked to a stratum 1 reference, both clocks exceed the MTIE and TDEV masks defined by ITU-T G.811/823 and ANSI T1.101 standards. In track mode, an SRO-100 or SRO-75 frequency aligns the output to the reference. In either mode, an SRO-100 or SRO-75 can adjust the time or phase offset of the output to up to 1 s through a 1-ns resolution comparator, operating over a dynamic range of ±500 ns.

The SRO-100 **(see figure)** operates from a single voltage supply of +11 to +16 VDC or +18 to +32 VDC with standard sinewave output of 10 MHz (5 and 15 MHz are optional) and 60-MHz CMOS outputs. The frequency offset over temperature is $\pm 3 \times 10^{-11}$ at temperatures from –20 to +60°C. The clock requires less than 1.2 A current during warm-up. The long-term stability is better than 5×10^{-11}/month and typically better than 3×10^{-11}/month. The short-term stability is 3×10^{-11}/s, 1×10^{-11}/10 s and 3×10^{-12}/100 s. The phase noise is –75 dBc/Hz offset 1 Hz from a 10-MHz carrier, –95 dBc/Hz offset 10 Hz from the same carrier, –125 dBc/Hz offset 100 Hz from the same carrier, –145 dBc/Hz offset 1 kHz from the same carrier, and –145 dBc/Hz offset 10 kHz from the same carrier. Harmonics are less than –25 dBc while spurious content is less than –80 dBc.

The SRO-75 provides 60-MHz CMOS output signals. It operates from a single voltage supply of +11 to +16 VDC or +18 to +26 VDC, and requires less than 0.8 A warm-up current at +24 VDC. Both the SRO-100 and SRO-75 feature user-programmable DDS circuitry capable of generating signals from DC to 20 MHz with 32-b digital resolution, as well as RS-232C ports for computer control.

The clocks are ideal for telecom synchronization applications in CDMA, synchronous-digital-hierarchy (SDH), and SONET, as well as tracking and guidance control, analog- or digital-television synchronization, military systems, and navigation systems. They are designed for reliable operation (the Rb lamp life expectancy is 20 years) and are equipped with an analog frequency-adjustment range (by means of a DC voltage of 0 to 5 V) of 5×10^{-9} ±20 percent. Jumpstart SRO-100 and Jumpstart SRO-75 Designer Kits are also available (with documentation and software) to help familiarize engineers with the operation of these clocks, while testing performance and validating their system design concept. **Temex Time, Round Rock, TX; (512) 238-3127, FAX: (512) 238-3128, Internet: www.temextime.com.**