EndRun TECHNOLOGIES
"Smarter Timing Solutions"

Meridian and Tycho *Options*

For Configuring Your GPS Time & Frequency Standard

The modular design of the Meridian Precision GPS TimeBase allows for the installation of up to five option modules in a single 1U chassis. A complete suite of time and frequency capabilities with an exceptionally high number and variety of outputs is available. To achieve this level of output density in a fanless, sealed chassis, EndRun has set a new standard in power efficiency and thermal packaging. The option modules can be installed at the factory and some can be easily installed by the customer as a plug-and-play field-upgrade.

The Tycho GPS Frequency Reference allows for the installation of up to two option modules. The modules are not available as field-upgrades in a Tycho. They must be installed at the factory.

Plug-and-Play Modules (Meridian Only)

Some of the option modules described in this datasheet are available as easy field-installable, plug-and-play options. The built-in option card recognition software lets you swap out modules at ease, without having to change your software. The Meridian software will automatically recognize the change and behave accordingly.

Other Options

There are other options available that are not listed in this datasheet. If you do not see what you are looking for then call us with your requirements.

Custom Solutions

The engineers at EndRun Technologies have decades of experience delivering precise time and frequency solutions. We will work with you to develop the specifications and design the products to fulfill your needs.

OPTIONS LIST

- Oscillator Upgrade Options
- Low-Phase-Noise Output Module
- Analog Timecode Buffer Module
- Programmable Digital Output Module
- Telecom Clock Output Module
- Sine Wave Output Module
- 10 MPPS Output
- Alarm Output
- Programmable Pulse Rate Output
- DC-Shift Time Code Output
- Direct Digital Synthesizer (DDS) Output
- Once-Per-Second Serial Output, Including Sysplex Timer
- DC Power Supply Options
- PTP/IEEE-1588
- Other Options Available: Contact Us
  1-877-749-3878
  sales@endruntechnologies.com

CE Compliance

The Meridian TimeBase, the Tycho Frequency Reference, and all options, are CE-Compliant.

A fully-optioned Meridian chassis with a High-Stability OCXO, two 10 MHz Low-Phase-Noise Output Modules (8 outputs), one Programmable Digital Output Module (4 outputs), and two Telecom Clock Output Modules (4 outputs).

Receiver/CPU Module Options

The Receiver/CPU Module is always present in the Meridian or Tycho. It provides several outputs as standard features. These are the AM Code (Time Code) Output, the 1PPS Output, the Serial Port and the Network Port. The Network Port includes all the standard network protocols. The Meridian also includes the Network Time Protocol (NTP). Specifications for the standard features are listed on the Meridian and Tycho datasheets.

In addition to the standard features, the Receiver/CPU Module can support several options via the two upper left BNC connectors. These include a Programmable Pulse Rate Output, a DC-Level-Shift Time Code Output, a DDS Output, and an Alarm Output. The network port supports a PTP/IEEE-1588 option (Meridian only). There is also a second RS-232 serial port available with a once-per-second, on-time, serial timestring. Specifications are below:

10 MPPS OUTPUT

- Quantity: One or two.
- Connector: Rear-panel BNC.
- Drive: TTL squarewave into 50Ω.
- Rate: 10 MPPS (other rates available).
- Accuracy: $< 10^{-13}$ to UTC for 24-hour averaging times when locked.
- Stability: See Stability Specifications for Programmable Pulse Rate Output below.

PROGRAMMABLE PULSE RATE OUTPUT

- Quantity: One or two.
- Connector: Rear-panel BNC.
- Drive: TTL squarewave into 50Ω.
- User-Selectable Rates: 1, 10, 100, 1K, 10K, 100K, 1M, 5M, 10M PPS or PP2S, PPM, DC Time Code.
- Accuracy: $< 10^{-13}$ to UTC for 24-hour averaging times when locked.
- Stability (Allan Deviation):

Tau in Secs	TCXO	MS-OCXO	HS/US-OCXO	Rb	HS-Rb
1	$1x10^{-9}$	$3x10^{-12}$	$1x10^{-12}$	$2x10^{-11}$	$2x10^{-11}$
10	$4x10^{-10}$	$4x10^{-12}$	$1.2x10^{-12}$	$6.7x10^{-12}$	$6.67x10^{-12}$
100	$5x10^{-11}$	$5.5x10^{-12}$	$1.8x10^{-12}$	$2.5x10^{-12}$	$2x10^{-12}$
1000	$7x10^{-12}$	$5x10^{-12}$	$2.2x10^{-12}$	$1.4x10^{-12}$	$9x10^{-13}$
10000	$1x10^{-12}$	$1x10^{-12}$	$1x10^{-12}$	$8x10^{-13}$	$5x10^{-13}$
100000	$1x10^{-13}$	$1x10^{-13}$	$1x10^{-13}$	$1x10^{-13}$	$1x10^{-13}$

DIRECT DIGITAL SYNTHESIZER (DDS) OUTPUT

The DDS Output is an add-on to the Programmable Pulse Rate Output listed above.

- Quantity: One or two.
- Connector: Rear-panel BNC.
- Signal: TTL squarewave into 50Ω.
- Drive: TTL squarewave into 50Ω.
- User-Selectable Synthesized Rates: 1 PPS to 10M PPS in 1 PPS steps, including 1.544M PPS and 2.048M PPS. These rates are phase locked to the system oscillator.

DC-SHIFT TIME CODE OUTPUT

The DC Time Code Output is included with the Programmable Pulse Rate Output. When you choose DC Time Code as your selection then it will be a TTL version of the same time code format that is being output on the AM Code BNC.

- Quantity: One or two.
- Connector: Rear-panel BNC.
- Signal: TTL squarewave into 50Ω.
- User-Selectable Formats: IRIG-B000 (IEEE-1344), IRIG-B002, IRIG-B003

ALARM OUTPUT

- Quantity: One.
- Connector: Rear-panel BNC or Barrier Strip (not shown - replaces 2 upper BNCs).
- Open Collector, 40V Max, 100 mA Max Saturation Current.
- High impedance after signal loss or at major hardware fault.

ONCE-PER-SECOND SERIAL OUTPUT

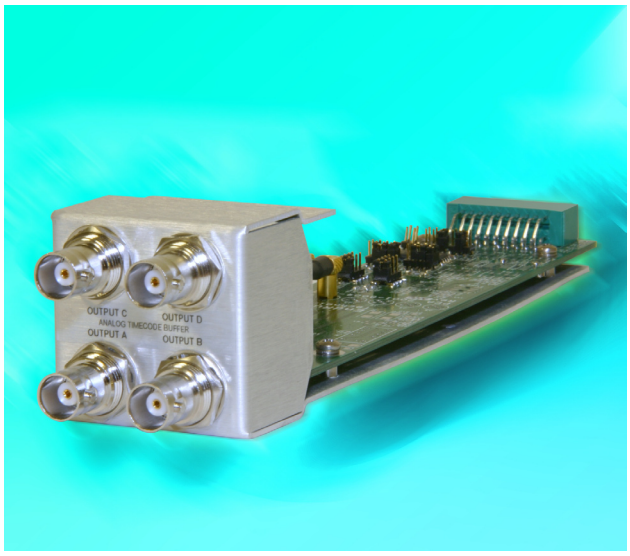
- Quantity: One.
- Connector: Rear-panel DB-9M Connector (not shown - replaces 2 upper BNCs).
- Serial I/O: Output only port at RS-232 levels.
- Baud rate: User-selectable to 4800, 9600, 19200, 57600.
- Parity: User-selectable to odd, even or none.
- ASCII Format: User-selectable to Sysplex, Truetime, EndRun, NENA or NMEA formats.
- On-Time Character: Each format has an "on-time" character which is transmitted during the first millisecond of each second for baud rates 9600, 19200, 57600. Specifically, the leading edge of the start bit of the "on-time" character is transmitted within 100 microseconds of the beginning of the second.

PTP/IEEE-1588 (Meridian only)

- Quantity: One.
- Connector: Rear-panel RJ-45 jack.
- PTP Grandmaster.
- IEEE-1588–2008 (V2) and IEEE-1588-2002 (V1).
- Version 2 Parameters: Default Profile. Multicast. Two-Step Clock. Delay Mechanism: E2E or P2P. Delay Interval: 2 seconds. Delay Request Interval: 1, 2, 4, 8 or 16 seconds. Sync Interval: 1 or 2 seconds. Transport: UDP/IPv4.
- PTP Timestamp Resolution: < 1 microsecond.
- PTP Slave Synchronization Accuracy: Network factors can often limit LAN synchronization accuracy to 10 microseconds, typical.

Other options and configurations are available - call us with your requirements.

Analog Timecode Buffer Module



The Analog Timecode Buffer Module adds four additional time code outputs to your Meridian or Tycho. These buffered outputs can provide synchronization of equipment such as synchronized generators, digital fault recorders, SCADA systems, and time displays, and are suitable for recording onto magnetic tape or for transmission over another medium such as coaxial cable. These time code outputs are duplicates of the standard AM Code Output on the Receiver/CPU Module. Available timecode formats are: IRIG-B, NASA36, or 2137. The format can be selected by using the front-panel keypad and display (Meridian only), the network port, or the RS-232 serial port.

The Analog Timecode Amplifier Module can be added to the Meridian Precision TimeBase as a "plug-and-play" option without hardware or software modification. In the Tycho this module must be installed at the factory.

SPECIFICATIONS

- Quantity: Four outputs
- Connector: Rear-panel BNCs.
- Drive: 1 Vrms into 50Ω.
- Frequency: 1 kHz.
- User-Selectable Code Format: IRIG-B120 (IEEE-1344 compatible), IRIGB122, IRIGB-123, NASA-36, 2137.

Programmable Digital Output Module

The Programmable Digital Output Module adds four independently programmable TTL outputs to your Meridian or Tycho. These buffered outputs provide on-time pulse rates from 1 PPS to 10 MPPS, or a DC time code output. These outputs are aligned to within 10 nanoseconds of the other TTL outputs in the Meridian (with the exception of the DDS outputs - see below). Each output can be individually selected by using the front-panel keypad and display (Meridian only), the standard network port, or the RS-232 serial port. If time code is selected it will be a DC version of the time code format being output on the standard AM Code BNC.

The Programmable Digital Output Module can be added to the Meridian Precision TimeBase as a "plug-and-play" option without hardware or software modification. In the Tycho this module must be installed at the factory.

An additional option provides access to the DDS (Direct Digital Synthesizer) that is resident in the Meridian and Tycho. Programmable synthesized pulse rates from 1 PPS to 10 MPPS in 1 PPS steps are available, including 1.544 MPPS or 2.048 MPPS. These pulse rates are phase locked to the system oscillator (not aligned to within 10 nanoseconds of the other TTL outputs in the Meridian).

SPECIFICATIONS

- Quantity: Four outputs
- Connector: Rear-panel BNCs.
- Drive: TTL (3V into 50Ω) or optional 5V into 100 kΩ (2 outputs only).
- Duty Cycle: 50% except 1PPS (mimics the standard 1PPS Output: 20 us or 1, 100, 500 ms).
- User-Selectable On-Time Pulse Rates: 1, 10, 100, 1K, 10K, 100K, 1M, 5M, 10M PPS and 1PP2S (pulse per even second), 1PPM (pulse per minute).
- Accuracy: $< 10^{-13}$ to UTC for 24-hour averaging times when locked.
- Stability (Allan Deviation):

Tau in Secs	TCXO	MS-OCXO	HS/US-OCXO	Rb	HS-Rb
1	$1x10^{-9}$	$3x10^{-12}$	$1x10^{-12}$	$2x10^{-11}$	$2x10^{-11}$
10	$4x10^{-10}$	$4x10^{-12}$	$1.2x10^{-12}$	$6.67x10^{-12}$	$6.67x10^{-12}$
100	$5x10^{-11}$	$5.5x10^{-12}$	$1.8x10^{-12}$	$2.5x10^{-12}$	$2x10^{-12}$
1000	$7x10^{-12}$	$5x10^{-12}$	$2.2x10^{-12}$	$1.4x10^{-12}$	$9x10^{-13}$
10000	$1x10^{-12}$	$1x10^{-12}$	$1x10^{-12}$	$8x10^{-13}$	$5x10^{-13}$
100000	$1x10^{-13}$	$1x10^{-13}$	$1x10^{-13}$	$1x10^{-13}$	$1x10^{-13}$

- User-Selectable Time Code Formats: IRIG-B000 (1344), IRIG-B002, IRIG-B003.
- User-Selectable DDS Rates: 1 PPS to 10 MPPS in 1 PPS steps.
- DDS rates are phase locked to the system oscillator.

Telecom Clock Output Module

This Telecom Clock Output Module adds two outputs to your Meridian or Tycho. The outputs can be any combination of T1, E1 and Composite Clock. Sync Status Messaging (SSM) is supported. An alarm relay output is also available as an option. When the Meridian/Tycho is configured with any of the available oscillator upgrades, it can operate as a Primary Reference Clock that will meet the requirements of ITU-T G.811/G.823/G.824 and ANSI T1.101. (Stated specifications assume an oscillator upgrade.) For detailed information on oscillator selection and holdover for telecom applications see the separate Telecom Clock Output Module datasheet.

User configuration is via the front-panel keypad/display (Meridian only), the network port, or the RS-232 serial port. Framing, Alarm, and Line Build-Out (T1) are all user configurable.

The Telecom Clock Output Module can be added to the Meridian Precision TimeBase as a "plug-and-play" option without hardware or software modification. In the Tycho this module must be installed at the factory.

COMPOSITE CLOCK OUTPUT

- Quantity*: Zero, one or two.
- Type: Transformer-coupled complementary-pair via 2xRJ48C. Single-ended via 2xBNC.
- Frequency: 64 kbps.
- Synchronization: Phase locked to the internal system 10 MHz.
- Data Format: All ones with user-selectable bipolar violation (BPV).
- Line Z: 110Ω nominal (complementary pair), or 75Ω nominal (single-ended).
- Pulse Shape: Conforms to ITU-T G.703.
- Pulse Amplitude: 3.4V pk into 133Ω, 3.0V pk into 110Ω, 2.4V pk into 75Ω.
- MTIE/Jitter/Wander: Conforms to ITU-T G.811/G.823 when locked.
- Line Code: Bipolar Return to Zero, Alternate Mark Inversion (AMI), 5/8 Duty Cycle. User-selectable for 64kcc AMI with no BPV, 64kcc AMI with 8 kHz BPV, or 64kcc with 8kHz BPV and missing BPV at 400 Hz.
- Alarm Code: User-selectable for BPV off (AIS) at Major (Blue) Alarm, or BPV always on. All zeros (LoS) at Critical (Red) Alarm.
- Connector*: RJ-45 style modular jack (RJ48C-compatible), 1 per output, or BNC (single-ended).

E1 CLOCK OUTPUTS

- Quantity*: Zero, one or two.
- Type: Transformer-coupled complementary-pair via 2xRJ48C. Single-ended via 2xBNC.
- Frequency: 2.048 Mbps.
- Synchronization: Phase locked to the internal system 10 MHz.
- Data Format: All ones. User-selectable for Unframed, Double-frame or CRC4 Multi-frame.
- Line Z: 120Ω nominal (complementary pair), or 75Ω nominal (single-ended).
- Pulse Shape: Conforms to ITU-T G.703.
- Pulse Amplitude: 3.0V pk into 120Ω, 2.2V pk into 75Ω.
- MTIE/Jitter/Wander: Conforms to ITU-T G.811/G.823 when locked.
- Line Code: Bipolar Return to Zero, Alternate Mark Inversion (AMI). (Identical to HDB3 for all ones data.)
- Alarm Code: User-selectable for Alarm Indication Signal (AIS), or Sync Status Messaging (SSM) on Sa4 through Sa8 or none at Major (Blue) Alarm. All zeros (LoS) at Critical (Red) Alarm.
- Connector*: RJ-45 style modular jacks (RJ48C-compatible), 1 per output, or BNC (single-ended).

T1 CLOCK OUTPUTS

- Quantity*: Zero, one or two.
- Type: Transformer-coupled complementary-pair.
- Frequency: 1.544 Mbps.
- Synchronization: Phase locked to the internal system 10 MHz.
- Data Format: All ones. User-selectable for Unframed, D4 SuperFrame (SF) or CRC6 Extended SuperFrame (ESF).
- Line Z: 100Ω nominal.
- Pulse Shape: Conforms to ITU-T G.703.
- Pulse Amplitude: 3.0V pk.
- MTIE/Jitter/Wander: Conforms to ANSI T1 101 and ITU-T G.811/G.824 when locked.
- Line Build-Out: User-selectable for short haul DSX-1 0-655 ft.
- Line Code: Bipolar Return to Zero, Alternating Mark Inversion (AMI). (Identical to B8ZS or PDE with all ones data.)
- Alarm Code: User-selectable for Alarm Indication Signal (AIS), or Sync Status Messaging (SSM), or none at Major (Blue) Alarm. All zeros (LoS) at Critical (Red) Alarm.
- Connector*: RJ-45 style modular jacks (RJ48C-compatible), 1 per output.

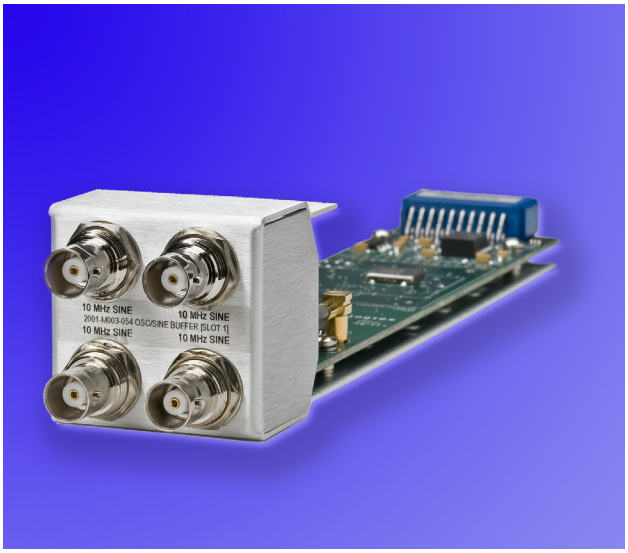
ALARM RELAY OUTPUTS

- Quantity*: Zero or three.
- Type: Form C.
- Rating: 750 mA @ 42VAC/60VDC.
- NC Contact: Closed for alarm-active condition.
- NO Contact: Closed for alarm-inactive condition.
- Minor Alarm: Active at minor clock faults.
- Major Alarm: Active at major clock fault (Blue Alarm).
- Critical Alarm: Active at clock operational fault (Red Alarm).
- Connector: DB9 Female.

* Specify outputs and connectors at time of order. Maximum quantity of E1, T1 and/or Composite Clock outputs is two and they must use the same connector type. For example: one E1 output and one T1 output both with RJ-45 style connectors. Alarm Relay is an additional option.

NOTE: This module is designed to provide highly-stable Building Integrated Timing Supply (BITS) reference clock signals directly to digital equipment.

Sine Wave Output Module



The Sine Wave Output Module adds four frequency outputs to your Meridian or Tycho. Frequency options are 1 MHz, 5 MHz and 10 MHz. This module is intended for those wanting sine wave outputs without the need for high-performance low-phase-noise. Four different versions of this module are available, depending on the combination of frequency outputs needed.

SPECIFICATIONS

- Quantity: 4 outputs (uses one out of five slots)
- Signal Type: Analog sine wave.
- Output Frequency: 1, 5, or 10 MHz depending on module type shown below.
- Output Level: +13 dBm, +/- 2 dBm into 50Ω.
- Module Type: Four 10-MHz outputs,
  or two 10-MHz outputs and two 5-MHz outputs,
  or two 10-MHz outputs and two 1-MHz outputs,
  or two 10-MHz outputs and one 5-MHz output and one 1-MHz output.
- Connector: BNC.

Meridian Power Supply Options

The Meridian can be configured with an assortment of DC power supply options. They can be used in place of the standard AC power supply, or in addition to it as a redundant power source. When used in place of the standard AC power supply, all five option slots remain available. However, the redundant power supply occupies two option slots, leaving three slots for other options. The power supplies are factory-installed and not field-swappable.

SPECIFICATIONS: Optional DC Power Supplies

- Isolation: Input is fully floating. Either input polarity can be connected to earth ground at the terminal block.
- Four voltage ranges:
  1. 10-20 VDC for nominal 12V input, 5A maximum.
  2. 19-36 VDC for nominal 24/28 VDC, 2.5A maximum.
  3. 37-76 VDC for nominal 48 VDC, 1.5A maximum.
  4. 70-160 VDC for nominal 125 VDC, 0.75A maximum.
- Connector: Three-position terminal block on rear panel.

SPECIFICATIONS: Standard Universal AC Power Supply

- AC Power Supply: 90-132 VAC/180-264 VAC, 47-63 Hz, 0.5A Max @ 120 VAC, 0.25A Max @ 240 VAC. Three-pin IEC 320 on rear panel.

DUAL-REDUNDANT POWER SUPPLIES

The dual-redundant power supply option may be any combination of AC-input or DC-input power options. The primary and secondary power supplies are connected in a dual-redundant configuration with hitless automatic primary-to-secondary and secondary-to-primary switchover. The Meridian is sourced from the primary power supply as long as it is operational and is supplied with external power.

A fault detector monitors the status of each redundant power supply. When a fault is detected it will trigger a system alarm and illuminate the front-panel Alarm LED.

Low-Phase-Noise Output Module

The Meridian and Tycho can be configured with several different, high-performance, dual-frequency 5/10-MHz oscillators. The Low Phase Noise Output Option works with these disciplined oscillators to provide up to 20 individually buffered, spectrally pure, sinewave outputs. The levels of the contributors to spectral impurity have been carefully controlled by the design of the oscillators that are offered, and by the design of the option module and its integration into the rackmount chassis. Very good channel-to-channel isolation has also been achieved in these modules.

Spectral Purity

Spectral purity refers to the power spectral density (PSD) of a waveform relative to that of an ideal, pure sinewave having frequency f_0. Such a perfect waveform would have a PSD consisting of two delta functions located at $+/- f_0$ on the Fourier frequency axis. Real world waveforms do not attain this level of purity and exhibit a power spectrum that contains additional periodic and random PSD components. Spectral purity is important in a frequency standard when it is used as the reference for synthesizing a carrier signal for the purpose of broadcasting or receiving information. Any impurities in the spectrum will to some degree mask the information that is intentionally modulated onto the carrier prior to broadcast.

Periodic Impurities

The periodic impurity components are further sub-classified as harmonic and non-harmonic. The harmonic components reside at Fourier frequencies that are integer multiples of f_0. Their levels are generally minimized by using passive bandpass filtering and ultra-linear output drivers.

Non-harmonic components are also commonly called spurious components, or "spurs". They can appear at any Fourier frequency and may arise from a variety of conditions. Usually they are generated externally to the oscillator, though not always, and are allowed to contaminate the output waveform due to inadequate shielding and power supply filtering or improper grounding techniques.

Random Impurities

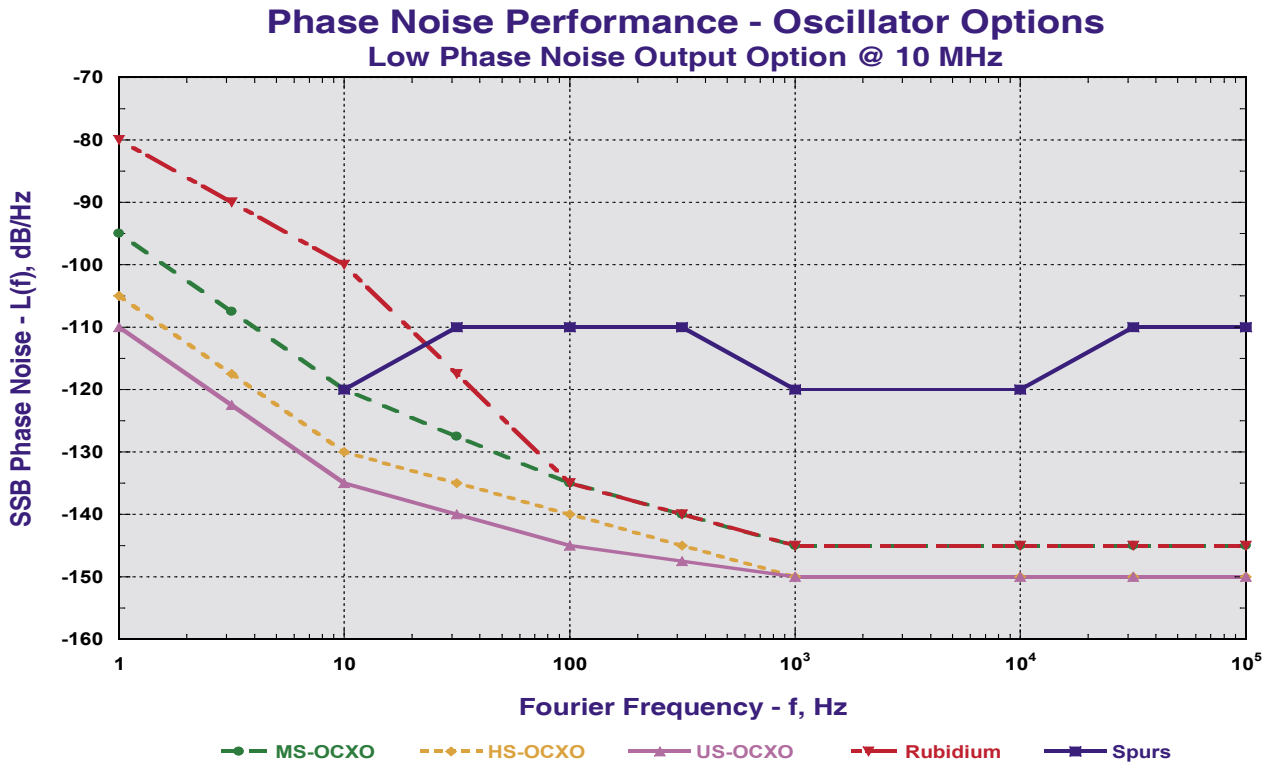
The random impurities are broadband in nature and make up the PSD "noise floor". Because of the ubiquitous nature of noise, the PSD of a real world waveform is at no point equal to zero. Precision frequency sources based on quartz crystal resonators exhibit extremely low levels of random noise, but it is still easily measurable. The PSD measured close to the source frequency f_0, is generally produced within the oscillator itself, and depending upon the point at which the noise has entered the oscillating circuitry, exhibits different PSD signatures. Selection of high-quality oscillators is the only way to control this aspect of spectral purity.

Phase Noise

Random noise sources within a precision crystal oscillator circuit effectively modulate the signal. The modulation due to random noise is divided between amplitude modulation (AM) and phase modulation (PM). In most applications, the PM component, or phase noise, is of greatest importance. This is due to the multiplicative effect on phase noise that occurs when we multiply the frequency of a precision source in order to synthesize a carrier wave. For example, one milliradian of phase noise at the $f_0 = 10$ MHz source is multiplied to one radian of phase noise at the 10 GHz carrier frequency.

The oscillators manufactured at EndRun Technologies exhibit extremely low close-in phase noise. This close-in phase noise is typically classified as flicker frequency modulation (FM). The flicker FM component of quartz oscillators is minimized by using the highest quality crystals and a healthy dose of black magic in the oscillator circuitry.

Low-Phase-Noise Output Module



QUANTITY:
- 4 outputs (uses one out of five slots)

OUTPUT FREQUENCY:
- 5 or 10 MHz
- Contact factory for other output frequencies.

OUTPUT LEVEL @ 50 OHMS:
- +13 dBm, +/- 2 dBm

HARMONICS @ 50 OHMS:
- < -45 dBc

CHANNEL-CHANNEL ISOLATION:
- > +75 dB

CONNECTOR:
- BNC

PHASE NOISE dBc/Hz @ 10 & 5 MHz

- With Medium-Stability OCXO:

1 Hz	-95	-100
10 Hz	-120	-130
100 Hz	-135	-140
1 KHz	-145	-150
10 KHz	-145	-150
100 KHz	-145	-150

- With High-Stability OCXO:

1 Hz	-105	-110
10 Hz	-130	-135
100 Hz	-140	-145
1 KHz	-150	-155
10 KHz	-150	-155
100 KHz	-150	-155

- With Ultra-Stable OCXO:

1 Hz	-110	-115
10 Hz	-135	-140
100 Hz	-145	-150
1 KHz	-150	-155
10 KHz	-150	-155
100 KHz	-150	-155

- With Rubidium (Meridian only):

1 Hz	-80	-80
10 Hz	-100	-100
100 Hz	-135	-135
1 KHz	-145	-145
10 KHz	-145	-145
100 KHz	-145	-145

Disciplined Oscillator Options

The Meridian and Tycho can be easily upgraded with various disciplined oscillators. An oscillator upgrade is indicated when your application requires either improved holdover accuracy while not locked to the GPS synchronization signal, or improved short-term stability and phasenoise whether locked to the GPS synchronization signal or not. Choices include three grades of oven-controlled quartz oscillators (OCXOs) and two grades of compact Rubidium vapor atomic frequency standards. The high-stabilty grades of both the OCXO and Rubidium options are individually characterized and hand-selected for state-of-the-art performance. We also guarantee that our OCXOs are free of sudden frequency steps, an industry exclusive. Our competitors' products cannot match the performance of our in-house manufactured OCXOs.

OCXO Options

The medium-stability OCXO (MS-OCXO), high-stability OCXO (HS-OCXO) and ultra-stable (US-OCXO) feature SC-cut crystals for fast warmup, low ageing and phase noise. By using premium, high-Q 5 MHz crystals and a frequency doubler, these units provide both 5 and 10 MHz outpus with exceptional close-in phase noise performance while delivering state-of-the-art long term ageing performance and freedom from sudden frequency steps.

The MS-OCXO provides very good temperature stability and it can support sinewave outputs with high spectral purity. The HS-OCXO improves temperature stability and close-in phase noise. Choose the US-OCXO for the ultimate, calibration laboratory grade OCXO performance. This unit halves the temperature coefficient relative to the HS-OCXO option and provides 1 second Allan Deviation at 6 parts in 10^{13}. With outstanding close-in phase noise performance, it can also support sinewave outputs with very high spectral purity.

Compact Rubidium Options (Meridian only)

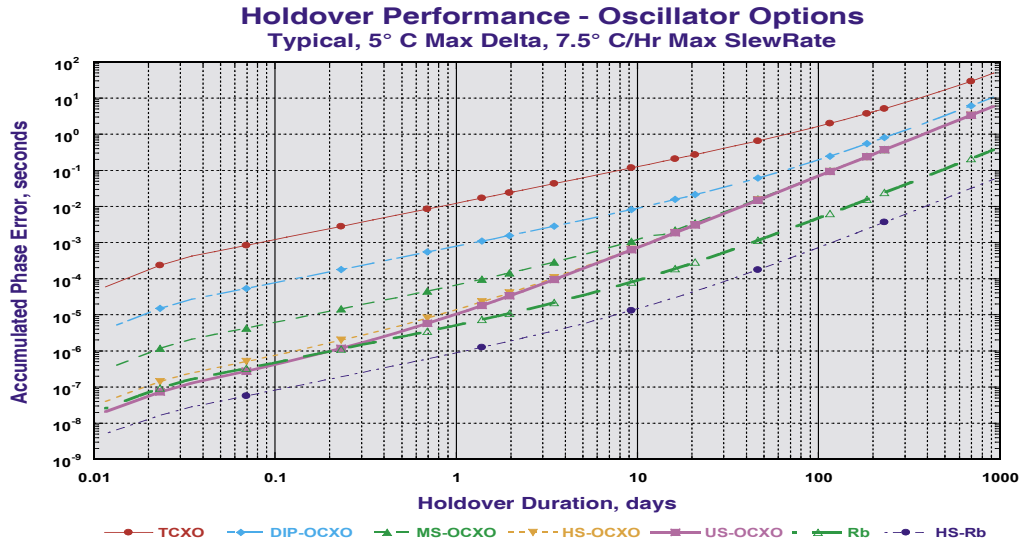
Phase noise and short-term stability of Rubidium vapor atomic frequency standards are inferior to that of quality OCXOs, so in many situations the HS-OCXO or US-OCXO is a better choice, offering comparable holdover performance for periods of several hours, superior short-term stability and much lower cost. But if you need the ultimate in long-term holdover performance and medium-term stability, a Rubidium option is the right choice.

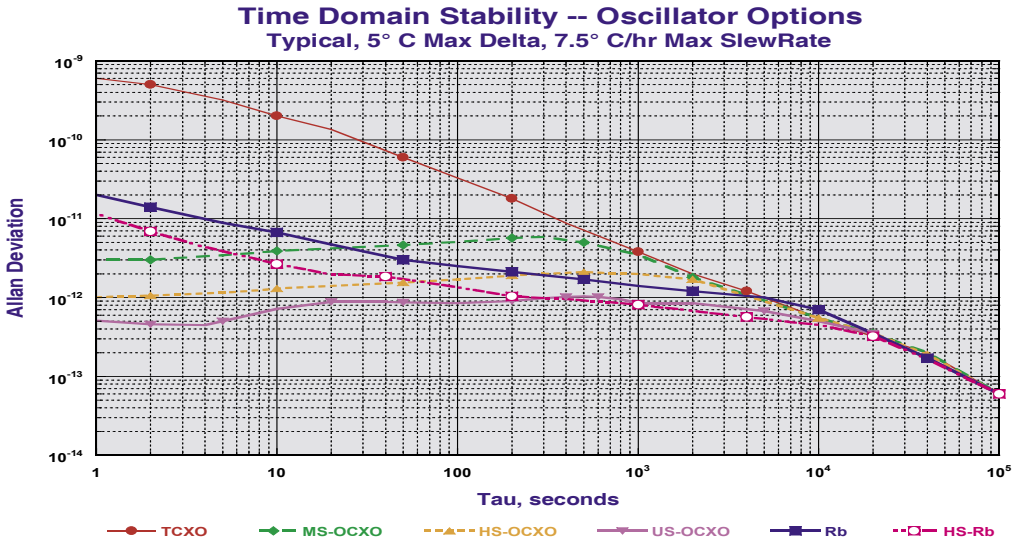
Relative to the HS-OCXO, the temperature stability of the standard Rubidium option is improved only slightly, but its long-term ageing is reduced by more than an order of magnitude. For the ultimate in temperature stability and long-term ageing performance we offer the high-stability HS-Rubidium option.

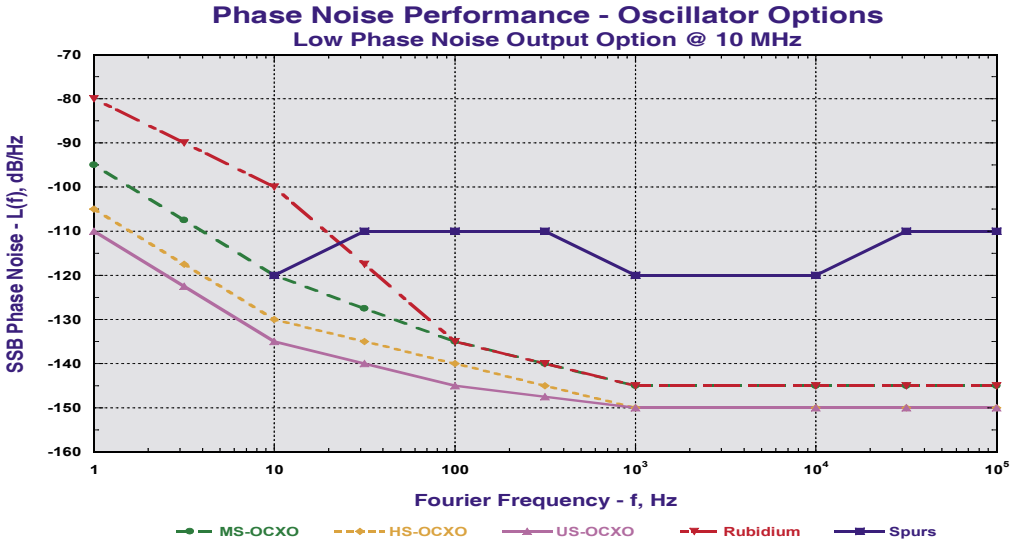
Oscillator Options
Summary Performance Data

	TCXO	MS-OCXO	HS-OCXO	US-OCXO	Rubidium	HS-Rubidium
Product Type	Meridian,Tycho	Meridian,Tycho	Meridian,Tycho	Meridian,Tycho	Meridian	Meridian
Temp Stability	2.5×10^{-6}	4×10^{-9}	1×10^{-9}	5×10^{-10}	1×10^{-9}	1×10^{-10}
Temp. Range °C	-20 to +70	0 to +70	0 to +70	0 to +70	-20 to +70	-20 to +70
Ageing Rate/Year	1×10^{-6}	3×10^{-8}	3×10^{-8}	3×10^{-8}	1×10^{-9}	5×10^{-10}
Allan Deviation @ 1 sec	1×10^{-9}	3×10^{-12}	1×10^{-12}	6×10^{-13}	2×10^{-11}	2×10^{-11}
Phase Noise dBc/Hz @ 10 MHz:						
1 Hz	-70	-95	-105	-110	-80	-80
10 Hz	-100	-120	-130	-135	-100	-100
100 Hz	-125	-135	-140	-145	-135	-135
1 KHz	-135	-145	-150	-150	-145	-145
10 KHz	-140	-145	-150	-150	-145	-145
100 KHz	-145	-145	-150	-150	-145	-145
Phase Noise dBc/Hz @ 5 MHz:						
1 Hz	-70	-100	-110	-115	-80	-80
10 Hz	-100	-130	-135	-140	-100	-100
100 Hz	-125	-140	-145	-150	-135	-135
1 KHz	-135	-150	-155	-155	-145	-145
10 KHz	-140	-150	-155	-155	-145	-145
100 KHz	-145	-150	-155	-155	-145	-145

Disciplined Oscillator Options







The rear of a Meridian chassis with (from left to right):
the standard Receiver/CPU Module which includes a GPS Antenna Input, Timecode and 1PPS Outputs, Network and Serial Ports.
Also two Sine Wave Output Modules (eight 10-MHz outputs), one Programmable Digital Output Module (four pulse rate outputs),
and two Analog Timecode Buffer Modules (eight additional Timecode Outputs).

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