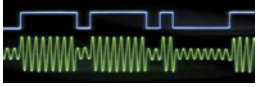
Symmetricom

Time & Frequency Synchronization Solutions

Product Catalog



Welcome to Symmetricom's Time and Frequency Synchronization Solutions Catalog

What does it mean to be the world leader in time and frequency synchronization solutions? It means that millions of people put their trust in our precision and reliability on a daily basis.

Around the globe people and organizations rely on the international timescale to set their time, and 87% of the total weighting of all cesium clocks that contribute to the international timescale are Symmetricom's. In this era of heightened security, we have developed crucial timing systems that help operate secure communication systems in a reliable manner.

Our network timing synchronization solutions support the integrity of IT systems of major, multinational companies on every continent. Our timing products are essential to the deployment of satellites, aircraft, power stations, missiles, and metrology. These are just a few of the responsibilities that we embrace.

At Symmetricom, our business is time—perfect time to be precise. Our time and frequency synchronization solutions have to provide perfect time so that we can help accelerate the deployment, enable the management and assure the performance of critical applications. Our domestic and international customers are demanding and diverse—governments, corporations and industries such as metrology, utility, space, industrial, defense and aerospace.

We understand all of our customers have unique needs, which is why we are organized to be their trusted advisor and help them every step of the way to make sure they achieve their goals. As the market leader, we provide the broadest range of off-the-shelf and customized time and frequency synchronization solutions. These are backed by customer support that is comprised of a group of seasoned professionals that are well versed in the products they service and the industries they support. We take our role as trusted advisor seriously because we understand that a product is only as effective as it is used, which is why we offer comprehensive installation, maintenance, operations and growth support, training, and consulting services.

This catalog represents our complete line of time and frequency synchronization solutions. We are confident that within these pages you will find products that will heighten your organization's efficiencies with a precision and reliability that is unmatched in the world.

Sincerely,
Bruce Bromage

EVP & GM
Timing Test Measurement Division
SYMMETRICOM

Your Network. Optimized.

For more than 30 years, Symmetricom has led the world in defining the world's standards for timing, frequency and synchronization solutions. And just as time does not stand still, nor do we, constantly finding ways to perfect the time that you need to meet your goals.

We offer the broadest range of time, frequency and synchronization products in the world, with customization capabilities that meet the ever changing needs of governments, corporations and industries such as metrology, utility, space, industrial, defense and aerospace. These solutions are backed up by comprehensive customer support, a strong R&D team and efficient manufacturing operations.

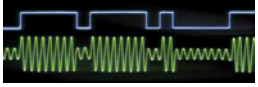
In order for you to find the solution that best meets your needs, we have divided our products into several sections. These are:

- **GPS & Time Code Instrumentation**
  No other company in the world can offer our product breadth, precision, innovation and expertise in GPS and time code instruments.
- **Broadcast Infrastructure**
  Our DVB/DAB GPS time source solutions ensure that the single frequency network achieves highly reliable and precise synchronization.
- **Time & Frequency Distribution**
  We offer the largest selection of quality time and frequency distribution receivers, amplifiers and modules in the marketplace.
- **Precision Frequency References**
  As the leading manufacturer of hydrogen, cesium and rubidium standards, and quartz oscillators, we set the standard for exceptional performance.
- **Advanced Timing Solutions**
  We offer a wide selection of modular products and services to support the most specialized time and frequency needs.
- **Bus Level Timing**
  Our time and frequency processor modules provide precise, versatile, and dependable timing for bus level integrated systems.
- **Network Timing**
  Our next generation GPS network time synchronization products provide secure, precise, automatic and reliable time for enterprise servers and desk tops.
- **Time Displays**
  Our time displays are designed to provide widely visible time to local or remote areas.
- **Space, Defense & Avionics**
  With over 30 years of space heritage and proven reliability, our time and frequency instrumentation solutions exceed the most stringent and extreme demands of this market.
- **Phase Noise & Allan Deviation Test Sets**
  Our state-of-the-art test sets enable accurate phase noise and Allan Deviation measurements to be made quicker and easier than ever before.
- **GPS Accessories**
  Our wide array of GPS accessories are designed to support unique requirements of each communication system.

After you have looked through this catalog, please feel free to contact us with the details of your company's application. We will work with you until you are completely satisfied.

Worldwide Telephone:
1-707-528-1230

Business Hours:
8:00 AM - 5:00 PM – PT



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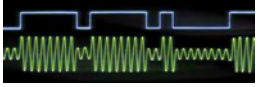

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GPS & Time Code Instrumentation

Your Network. Optimized.

Symmetricom's GPS & Time Code Instrumentation provide the precise time and frequency that is crucial to the operation of sophisticated communication systems.

Our product breadth, precision and expertise in GPS time and frequency generators, receivers, and other GPS related instrumentation, has been evident from the inception of GPS technology. Today, we continue to be in the forefront of new timing and synchronization solutions for communications and satellite and ground based instrumentation.

Whether it is the world's most powerful, accurate and versatile Selective Availability Anti-Spoofing Module (SAASM) based GPS time and frequency receiver or the world's first grandmaster clock for the IEEE 1588 Precise Time Protocol (PTP), we offer GPS and time code instrumentation solutions for multiple applications and a wide customer base.

XLi

Time and Frequency System

KEY FEATURES

- 12 Channel GPS Receiver with TRAIM
- Better Than 30 Nanoseconds RMS Accuracy to UTC
- Better Than $1x10^{-12}$ Frequency Accuracy
- Supports Primary and Secondary Reference Inputs (GPS, Time Code, IPPS)
- Configurable as Dual Redundant GPS Receiver in One Chassis
- Standard 10/100 Base-T Network Port
- Intuitive Web Based Management
- HTTP, Telnet, SNMP with MIB Standard
- Vacuum Fluorescent Display and Keypad
- Completely Modular with Plug-and Play Capability
- Numerous Field-Upgradeable, Plug-in Option Cards Available
- Time code reader/generator (IRIG A,B; IEEE 1344; NASA 36) AM and DC
- Auxiliary Reference Input Supports Lock to External Cesium to Enhance Holdover
- Standard Outputs: 1PPS, Selectable Pulse Rates and Alarm
- Flash Memory for Remote Software Upgrades

The modular ultra precision Model XLi Time and Frequency System is the most versatile and flexible solution for timing and synchronization requirements. The XLi is completely modular through a variety of option cards that are easily configured by the user. The wide range of option cards make it easy to tailor your system to support nearly every possible output/input needed for time and frequency applications, by combining up to ten option modules (2U chassis), oscillator upgrades, and two GPS receivers per unit.

Configuration recognition software automatically detects the unit's setup, without modifications to the operating system, providing "plug-and-play" configuration capability for current and future application needs. Modularity delivers the freedom to configure the XLi as a GPS timing receiver, or a time code unit (TCU). Deploy Symmetricom's GPS technology to generate ultra high precision time and frequency outputs for a wide range of synchronization requirements, or leverage Symmetricom's years of expertise in Time Code technology, which is built into the heart of the XLi system.

The XLi seemlessly integrates into a network centric environment. The 10/100 Base-T interface is standard. Remote management is facilitated with the intuitive HTML web based interface as well as SNMP with an enterprise MIB. Command line interface is also supported via Telnet or the RS-232/422 serial port. The XLi can function as a Stratum 1 NTP server with addition of the NTS option.

The standard XLi provides a wide range of time and frequency inputs and outputs such as: 1PPS output; time code input/output (IRIG A, B; IEEE 1344; NASA36) in both modulated (AM) and demodulated (DCLS) formats; programmable pulse rates; open collector alarm; front panel keypad and display; and more.

The modular XLi architecture allows easy extension of the software and hardware in the field. Software updates are remotely administered. Existing and future hardware option modules can be added as needed by the user. The GPS timing interface is also modular which facilitates future upgrade to alternate Global Navigation Satellite Systems (GNSS), such as Galileo, when available.

XLi Time and Frequency System

XLi SPECIFICATIONS

GPS RECEIVER (OPTIONAL)

- Receiver input: 1575.42 MHz L1 C/A code. Coarse acquisition. Position accuracy: typical 10 m RMS tracking 4 satellites.
- Tracking: 12 parallel channels. Multi satellite ensembling with TRAIM.
- Acquisition time: Cold start <20 min. (typical)
- 1PPS output accuracy: UTC(USNO): ±30 nS RMS 100 ns peak
- Frequency output accuracy: 1×10^{-12} @ 1 day
- Frequency/timing Allan Deviation stability (TCXO): 1×10^{-9} @ 1 sec; 3×10^{-10} @ 10 sec; 3×10^{-10} @ 100 sec; 2×10^{-10} @ 1000 sec; 1×10^{-12} @ 1 day
- Stability when not tracking satellites (TCXO): 5×10^{-7} (0°C to 50°C) typical

TIME CODE UNIT (TCU) SYNC GENERATOR

- Sync code: IRIG A,B; IEEE 1344; NASA 36
- Code out: IRIG A,B; IEEE 1344; NASA 36

OSCILLATOR

- Standard oscillator: VCTCXO
- Optional oscillators: OCXO, high stability OCXO, Rubidium, and high stability Rubidium.

STANDARD INPUT/OUTPUT SIGNALS

- Eight standard I/Os
  - Two for control and monitoring: Serial and Ethernet port.
  - Six for signals: 1PPS out, code in, code out, rate out, aux reference, and Open Collector Alarm output (all with BNC female connector). I/Os are configurable via the keypad/display, RS232/422, and the standard network port.
- RS-232/422: User selectable up to 19200 bps. Connector: Male 9-pin D subminiature
- Network interface: Standard 10/100 Base-T RJ-45. Protocols: HTTP, Telnet and SNMP for the user interface, FTP (for firmware upgrades), and optional NTP and SNTP.
- 1PPS: Pulse width: 20 µs (±1µs) on the rising edge on time, TTL levels into 50Ω, BNC female connector.
- Code input: AM or DC code (IRIG A,B; NASA 36). AM Code: 0.5 Vp-p to 10 Vp-p, 100 kΩ ground, ratio (AM): 3:1 ±10%. DC Code: Logic low <1.25 V and Min 300 mV, Logic Hi >1.25 V and Max 10 V. Impedance: 100 K or 50Ω. Polarity: positive or negative. Connector: BNC female
- Code out: Default is IRIG-B AM. Format: AM or DC code (IRIG A,B; NASA 36). AM Code: 3 Vp-p, into 50Ω ±10%, ratio (AM): 3:1. DC Code: TTL into 50Ω. Connector: BNC female
- Rate out: Default: 10 MPPS. Rate: 1PPS, 10 PPS, 100 PPS, 1 kPPS, 10 kPPS, 100 kPPS, 1 MPPS, 5 MPPS, and 10 MPPS. Duty cycle: 50% and 60/40%. Amplitude: TTL levels into 50Ω. Connector: BNC female
- Aux ref input: Input frequency: 1, 5, and 10 MHz sine-wave. Amplitude: 1 Vp-p to 10 Vp-p at 1 kΩ to ground. 1 Vp-p to 3 Vp-p at 50Ω to ground. Impedance: Configurable 1 kΩ or 50Ω to ground. Connector: BNC female
- Alarm: Open collector. Max 25V/50 mA. Connector: BNC female

MECHANICAL/ENVIRONMENTAL

- Time and frequency system
  - Power: Voltage: 90–260 Vac; Frequency: 47–440 Hz
  - Connector: IEC 320
  - Size: 1U: 1.75" x 17.1" x 15.35" (4.44 cm x 43.4 cm x 38.9 cm); 2U: 3.5" x 17.1"x 15.35" (8.89cm x 43.4cm x 38.9cm); Standard 19" (48.26 cm) EIA rack system, hardware included.
  - Operating temperature: 0°C to +50°C (+32°F to +122°F)
  - Storage temperature: –55°C to +85°C (–67°F to +185°F)
  - Humidity: 95%, non-condensing
  - Display: Graphics (160 X 16) vacuum fluorescent display. One line for time and day of year (TOD). Two-line alpha-numeric display for status messages and user input. Keypad: numeric 0–9, left, right, up, down, CLR, Enter, time key, status key and menu key.
- Antenna
  - Size: 3" Dia. x 3" H (7.62 cm x 7.62 cm)
  - Input: BNC female to GPS receiver. TNC on antenna
  - Power: +12 Vdc
  - Operating temperature: –55°C to +85°C (–67°F to +185°F)
  - Storage temperature: –55°C to +85°C (–67°F to +185°F)
  - Humidity: 95%, non-condensing
  - Certification: UL, FCC, CE, and C-UL

OPTIONS

See Options datasheet for details: XLi Options Datasheet

Software:

- Network time server on standard network port
- Frequency measurement
- Time interval/event timing
- Programmable pulse output
- Time Monitor Software for XLi

Hardware:

- GPS Timing engine
- Oscillator upgrades: OCXO, High Stability OCXO, Rubidium, High Stability Rubidium
- 1, 5, 10 MHz/MPPS frequency outputs
- Low phase noise frequency output (5MHz and 10MHz)
- Enhanced Low Phase Noise 10 MHz output
- N.1 Frequency Synthesizer, 1PPS to 50MPPS in 1PPS steps
- Have Quick/1PPS Time and Frequency Reference
- Have Quick output
- Multicode output for IRIG A, B, E, G, H; XR3/2137 and NASA 36
- DC power supplies (12 VDC, 24 VDC, and 48 VDC options)
- Telecommunications interface (E1 and T1 output options)
- Power Utility Frequency and Time Deviation Monitor
- Parallel BCD output
- PTTI BCD output with 10 volt 1PPS & 1PPM
- Expansion Module (4 user selected timing outputs)
- Extended cable length solutions: in-line amplifier (to 300'), down/up converter (to 1500'), fiber optic (to 2 km).

Rear View

XLi SAASM GB-GRAM

Time and Frequency Receiver

KEY FEATURES

- SAASM GB-GRAM PPS GPS Receiver with RAIM
- Military Signal P(Y) Code SAASM GPS Receiver and Civil Signal C/A-Code GPS Receiver
- Available with Dual Redundant SAASM GPS (P(Y)) Receiver in One Chassis
- Better than ±20 Nanoseconds RMS Accuracy to UTC
- Better than $1x10^{-12}$ Frequency Accuracy (1 day averaging)
- Standard 10/100 Base-T Ethernet
- Intuitive Web Based Management
- HTTP, Telnet, SNMP with MIB Standard
- Enterprise MIB, FTP (for Firmware Upgrades)
- Hot Start Ready via DAGR/PLGR
- Standard Vacuum Fluorescent Display and Keypad
- Completely Modular with Plug-and-Play Capability
- Numerous Field-Upgradeable, Plug-in Option Cards Available
- Flash Memory for Remote Software Upgrades
- IRIG Time Code Generator
- Standard 1PPS, Selectable Pulse Rate Outputs, Alarm, Auxiliary Reference, and Code In/Out for AM or DC IRIG A, B; IEEE 1344, or NASA 36

The XLi SAASM GB-GRAM Time and Frequency Receiver is an ultra accurate time and frequency instrument with a secure, Selective Availability Anti-Spoofing Module (SAASM) based GPS receiver. Developed for authorized military users, the XLi SAASM supports a wide range of applications including secure synchronization of military communication systems.

Powerful, accurate and versatile, this Precise Positioning Service (PPS) GPS instrument authenticates satellite signals (when keyed) with anti-spoofing (A-S) technology and corrects for Selective Availability (SA) if enabled. With the dual frequency XLi SAASM, the P(Y) code is received on both the L1 and L2 bands.

The XLi SAASM's GB-GRAM receiver is a lightweight, third-generation GPS PPS, 12-channel receiver supporting Direct Y and unclassifed (controlled) Black keys. The internal Ground-Based GPS Receiver Application Module (GB-GRAM) complies with the U.S. Government's GB-GRAM program that fulfills a GPS Wing initiative to migrate to a defined, open system architecture for ground-based embedded military applications. GB-GRAM incorporates the SAASM security device and is a low-power, secure, jam resistant standardized GPS solution used in communications and weapons platforms across the military.

Taking into account the Joint Chiefs of Staff mandate that all newly fielded DoD systems using GPS shall use SAASM PPS devices after 1 October 2006 (unless waivered), the XLi SAASM provides the highest immunity to jamming plus multiple options that enable military users to tailor their systems to support nearly every possible output/input needed for time and frequency applications. XLi SAASM also supports a hot start from a DAGR or PLGR to facilitate direct acquisition of the P(Y) code in a hostile environment where C/A code is denied or jammed.

The XLi SAASM configuration recognition software automatically detects the unit's setup at power-on providing "plug-and-play" configuration capability for current and future application needs. Many of the XLi SAASM's hardware and software options can be easily upgraded in the field.

Easily deployed to generate ultra high precision time and frequency outputs for mission critical applications, the XLi SAASM offers an intuitive HTML network centric interface along with telnet, and SNMP as standard features and optional NTP, in addition to 1PPS (Pulse Per Second); code In/Out for IRIG A, B; IEEE 1344, or NASA 36 (AM or DC); programmable rates; open collector alarm; a keypad; RS-232/422 port; time interval/ event timing (TI/ET); frequency measurement and more.

XLi SAASM GB-GRAM Time and Frequency Receivers (left: 1U model, right: 2U model)

XLi SAASM GB-GRAM SPECIFICATIONS

GPS SAASM GB-GRAM RECEIVER

- Receiver input: L1/L2, P(Y) code (PPS), SAASM GB-GRAM
- Tracking: 12 parallel, dual-frequency channels with RAIM (Receiver Autonomous Integrity Monitoring)
- Crypto Key input: DS-102. Compatible with AN/PYQ-10, AN/CYZ-10, KYK-13
  Black/red key support. Front panel connector.
- Security: SAASM GB-GRAM GPS PPS receiver
- Antenna/preamplifier: L1 1574.42 MHz and L2 1227.60 MHz, 40 dB gain
- Acquisition time: Cold start <20 min. (typical)
- 1PPS output accuracy: UTC(USNO) ±20nsec RMS, 100 nsec peak (99%)
- Frequency output accuracy: 1×10^{-12} @ 1 day
- Frequency/timing Allan Deviation stability (HS OCXO): 4×10^{-11} @ 1 sec
  4×10^{-11} @ 1000 sec
  1×10^{-12} @ 1 day
- Temperature Stability (unlocked): 1×10^{-9} (0°C to 50°C) typical

OSCILLATOR

- Standard oscillator: High Stability OCXO (HS OCXO)
- Optional oscillators: Rubidium, High Stability Rubidium

STANDARD INPUT/OUTPUT SIGNALS

- Eight standard I/Os
  - Two for control and monitoring: Serial and Ethernet port.
  - Six for signals: 1PPS out, code in, code out, rate out, aux reference, and Open Collector Alarm output (all with BNC female connector).
    I/Os are configurable via the keypad/display, RS232/422, and the standard network port.
- RS-232/422: User selectable up to 19200 bps
  Connector: Male 9-pin D subminiature
- Network interface: Standard 10/100 Base-T, RJ-45 8-pin connector.
  Protocols: HTTP, Telnet and SNMP; FTP (for firmware upgrades), and optional NTP and SNTP.
- 1PPS: Pulse width: 20 µs (±1µs) on the rising edge on time, TTL levels into 50Ω, BNC female connector.
- Code input: AM or DC code IRIG A, B, IEEE 1344, and NASA-36
  AM Code: 0.5 Vp-p to 10 Vp-p, 100 kΩ ground, ratio (AM): 3:1 ±10%
  DC Code: Logic low <1.25 V and Min 300 mV, Logic Hi >1.25 V and Max 10 V.
  Impedance: 100k or 50Ω
  Connector: BNC female
- Code out: Default is IRIG-B AM
  Format: AM or DC code IRIG A, B, IEEE 1344, and NASA-36.
  AM Code: 3 Vp-p, into 50Ω ±10%, ratio (AM): 3:1.
  DC Code: TTL into 50Ω
  Connector: BNC female
- Rate out: Default: 10 MPPS. Rate: 1/10/100PPS; 1/10/100kPPS; 1/5/10MPPS Duty cycle: 50% and 60/40%.
  Amplitude: TTL levels into 50Ω
  Connector: BNC female
- Aux ref input: Input frequency: 1, 5, and 10 MHz sine-wave.
  Amplitude: 1 Vp-p to 10 Vp-p at 1 kΩ to ground.
  1 Vp-p to 3 Vp-p at 50Ω to ground.
  Impedance: Configurable 1 kΩ or 50Ω to ground
  Connector: BNC female
- Alarm: Open collector. Max 25V/50 mA.BNC female

ADDITIONAL STANDARD FEATURES

- External frequency measure
  - Frequencies: 1, 5, 10 MHz
  - Resolution: 1×10^{-12} @ 100 seconds
  - Accuracy: 1×10^{-12} @ 1 day
- Time Interval/Event Timing
  - Resolution: 5 nsecs
  - Accuracy: ± 5 nsecs to XLi SAASM clock

MECHANICAL/ENVIRONMENTAL

- Time and frequency system
  - Power: Voltage: 90–260 Vac
    Frequency: 47–440 Hz
    Connector: IEC 320
  - Size: 1U: 1.75" x 17.1" x 15.35" (4.44 cm x 43.4 cm x 38.9 cm)
    2U: 3.5" x 17.1"x 15.35" (8.89cm x 43.4cm x 38.9cm)
    Standard 19" (48.26 cm) EIA rack system.
  - Operating temperature: 0°C to +50°C (+32°F to +122°F)
  - Storage temperature: –55°C to +85°C (–67°F to +185°F)
  - Humidity: 95%, non-condensing
  - Display: Graphics (160 X 16) vacuum fluorescent display. One line for time and day of year (TOD). Two-line alpha numeric display for status messages and user input. Keypad: numeric 0–9, left, right, up, down, CLR, Enter, time key, status key and menu key.
- Antenna
  - Size: 4" x 3.75" x 1.6" (10.16 cm x 9.53 cm x 4.07 cm)
  - Input: BNC female to GPS receiver. TNC on antenna
  - Power: +12 Vdc
  - Operating/storage temp: –55°C to +85°C (–67°F to +185°F)
  - Humidity: 95%, non-condensing
  - Certification: UL, FCC, CE, and C-UL

OPTIONS

See Options datasheet for details: XLi SAASM Options Datasheet

Software:

- Network time server on standard network port
- Programmable pulse output
- TimeMonitor Software for XLi

Hardware:

- Oscillator upgrades: Rubidium, High Stability Rubidium
- 1, 5, 10 MHz/MPPS frequency outputs
- Low phase noise frequency output (5MHz and 10MHz)
- Enhanced Low Phase Noise 10 MHz output
- N.8 frequency synthesizer, 8kPPS to 8.192MPPS in 8kPPS steps
- N.1 Frequency Synthesizer, 1PPS to 50MPPS in 1PPS steps
- Have Quick/1PPS Time and Frequency Reference
- Have Quick output
- Multicode output for IRIG A, B, E, G, H; XR3/2137 and NASA 36
- DC power supplies (12 VDC, 24 VDC, and 48 VDC options)
- Telecommunications interface (E1 and T1 output options)
- Parallel BCD output
- PTTI BCD output with 10 volt 1PPS & 1PPM
- Expansion Module (4 user selected timing outputs)
- Extended cable length solutions: in-line amplifier (to 300'), fiber optic (to 2 km)

Rear View (1U model with two option modules)

The XLi SAASM has been granted the Global Positioning Systems Wing Security Approval. United States government policy restricts the sale of Precise Positioning Service (PPS) GPS equipment such as the XLi SAASM to only users authorized by the U.S. Department of Defense. The views expressed in this brochure are those of Symmetricom and do not necessarily reflect the official policy or position of the Global Positioning Systems Wing, the Air Force, the DoD, or the U.S. Government.

XLi/XLi SAASM Options

For Customizing the:
XLi Time and Frequency System
XLi SAASM Time and Frequency Receiver

OPTIONS

Software:

- Network Time Server
- Frequency Measurement
- Time Interval/Event Timing
- Programmable Pulse Output

Hardware:

- Oscillator Upgrades
- 1, 5, 10 MHz/MPPS Frequency Outputs
- Low Phase Noise Frequency Outputs
- Enhanced Low Phase Noise Output
- N.1 Frequency Synthesizer
- N.8 Frequency Synthesizer
- Have Quick/1PPS Time and Frequency Reference
- Have Quick Output
- Multicode Output for IRIG A, B, E, G, H; XR3/2137 and NASA 36
- Parallel BCD Output
- PTTI BCD Output w/ 10V 1PPS/1PPM
- Expansion Module (4 outputs)
- DC Power Supplies
- Telecommunications Interface (T1/E1)
- Frequency and Time Deviation Monitor (FTM)

Symmetricom makes it easy to configure the XLi Time and Frequency System and XLi SAASM Time and Frequency Receiver (XLi SAASM) to meet your specific application needs with a variety of hardware and software options. Whether your application demands redundancy in power supplies, GPS, or any other function, all it takes is the proper configuration of cards.

Not sure how to achieve what you want? Simply call Symmetricom's time and frequency experts. You can also configure your own XLi and XLi SAASM system online at www.symmetricom.com.

Our wide range of option cards also makes it easy to adapt your XLi and XLi SAASM configuration if your application needs change. Plug-and-play cards and built-in option card recognition software lets you swap out modules without modifying your operation system. The XLi/XLi SAASM is available in a 1U and 2U chassis that supports up to 4 and 10 option modules respectively.

For more than 30 years Symmetricom has defined premium time and synchronization solutions. Put our expertise to work for you.

XLi Time and Frequency System

XLi SAASM Time and Frequency Receiver

Network Time Server on Standard Network Port

- Synchronize servers and workstations across the network
- High-bandwidth NTP capability
- High availability time referenced to XLi/XLi SAASM
- MD5 security protocol
- NTP broadcast mode
- SNMP Enterprise MIB
- Stratum 1 operation via GPS satellites

The high performance Symmetricom Network Time Server (NTS) represents a breakthrough in network synchronization technology. By combining a high-speed/high-capacity network interface and a wide range of network protocol support, XLi/XLi SAASM seamlessly integrates into existing networks.

The NTS distributes time to precisely synchronize client computer clocks over a network. Time is acquired from the host XLi/XLi SAASM and distributed over the network using the Network Time Protocol (NTP). Client computer clocks can be synchronized within milliseconds. Information on the health and status of the NTP server and the primary time synchronization source is available by using the SNMP protocol Enterprise MIB. Also, MD5 security protocol is included to authenticate NTP client-server communication. The standard network port, when factory enabled, serves as the NTP server via an RJ-45 Ethernet connector.

No additional hardware is needed for this option; it utilizes the XLi/XLi SAASM standard network port, leaving all option slots available.

SPECIFICATIONS: NETWORK TIME SERVER OPTION 87-8017

NETWORK PROTOCOLS

- Network time protocols
  - NTP v3/v4 (RFC 1305)
  - SNTP (RFC 1769)
  - TIME (RFC 868)
  - MD5 (RFC 1321)
- Other protocols
  - Telnet (RFC 854)
  - FTP (RFC 959)
  - MIB II (RFC 1213)
  - SNMP v2 Enterprise MIB II (RFC 1157)
- Network transport protocol: TCP/IP
- Simple Network Management Protocol (SNMP)
  - SNMP provides the network administrator with network status and statistics. This feature implements SNMP versions 1 & 2 and Management Information Base (MIB) I and II.
- Network interface: 10/100 Base-T Ethernet
- Network time accuracy: 1 to 10 mS typical
- Accuracy: Function of input synchronization source (IRIG or GPS)

CLIENT SOFTWARE

An NTP client/daemon is required for client-side synchronization with any network time server. Included with the NTP option is Symmetricom's SymmTime NTP client for Windows® 95/98/NT/2000/XP/Vista. Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network is also available.

Visit http://www.symmetricom.com for an extensive list of software time clients for various operating systems.

OPTIONS

- Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network.

Programmable Pulse Output

The Programmable Pulse Output option is a software option that provides a user configurable TTL level pulse output that can be used to supply a precisely synchronized "trigger" pulse at specific times or provide periodic pulse outputs. The rising edge of the trigger output may be programmed with microsecond resolution for fine control. The periodic pulse rates supports several popular frequencies such as 1 PPS, 1 PP 10 SEC, 1 PPM, 1 PP 10 MIN, 1 PPH, 1 PP 10 HR, 1 PPD, 1 PP 10 DAYS or 1 PP 100 DAYS are available. The pulse width is also programmable. The pulse is supplied via a rear panel BNC.

SPECIFICATIONS: PROGRAMMABLE PULSE OUTPUT (PPO) 87-8024

- Range: 500kHz to 1 PP Year (integer multiples of 1 uS)
- Pulse width: Programmable in 1µS steps up to 1 year
- On time edge: Rising
- Amplitude: TTL Levels into 50Ω
- Accuracy: 100nSec

Frequency Measurement
(Standard with XLi SAASM)

The Frequency Measurement is a software option that provides the ability to precisely measure the frequency of an externally applied 1, 5, or 10 MHz signal. Measurement resolution is better than 120 x 10^{-12} with only a 1-second averaging time. It supports a periodic, zero dead-time mode of operation as well as a single-shot, measurement-on-demand mode. The measurement interval can be specified in integer seconds over the range of 1 to 100,000 seconds. Frequency measurement results appear on the front panel display and are output via the communication port.

SPECIFICATIONS: FREQUENCY MEASUREMENT 87-8025

INPUT FREQUENCIES

- Keypad selectable frequencies of 1, 5, 10 MHz.
  - Input Level: 1.0 to 10 Vpp
  - Input Impedance: 1kΩ, jumper selectable to 50Ω
  - Measurement Range: ±1 x 10^{-5} maximum offset; compares the external frequency under test directly to the clock's disciplined oscillator
  - Input Frequency: 1 MHz, 5 MHz, 10 MHz
  - Resolution:
    - 120x10^{-12} @ 1 second
    - 12x10^{-12} @ 10 seconds
    - 1x10^{-12} @ 100 seconds
- Accuracy: These specifications are subject to change depending on the specific oscillator installed in the XLi.*
  - TCXO
    - 1x10^{-9} @ 1 second
    - 2x10^{-10} @ 100 seconds
    - 1x10^{-12} @ 1 day
  - Ovenized quartz
    - 1x10^{-10} @ 1 second
    - 1x10^{-10} @ 100 second
    - 1x10^{-12} @ 1 day
  - High-stability quartz
    - 4x10^{-11} @ 1 second
    - 4x10^{-11} @ 100 seconds
    - 1x10^{-12} @ 1 day
  - Rubidium
    - 4x10^{-11} @ 1 second
    - 6x10^{-12} @ 100 seconds
    - 1x10^{-12} @ 1 day
  - High-stability Rubidium
    - 4x10^{-11} @ 1 second
    - 6x10^{-12} @ 100 seconds
    - 1x10^{-12} @ 1 day

* For oscillator information, refer to Symmetricom's oscillator datasheet.

Time Interval/Event Timing
(Standard with XLi SAASM)

TIME INTERVAL

The Time Interval function is a software option that provides the user with the ability to precisely measure the interval between the time of occurrence of the clock-derived 1 Hz reference pulse and the rising edge of the user-supplied 1 Hz pulse.

EVENT TIMING

The Event Timing feature offers the capability of locating the time of occurrence of the rising edge of the applied pulse with respect to the time of year. A "burst" mode provides increased performance during short intervals. The collected data is available via the RS-232 or the Telnet port.

SPECIFICATIONS: TIME INTERVAL/EVENT TIMING (TI/ET) 87-8026

INPUT FREQUENCIES

- Rate: 1 PPS
- High level: Logic Hi >1.25V <10V
- Low level: Logic Low <1.25V >0V
- Active edge: Rising (Positive)
- Pulse width: 100 nS minimum
- Input impedance: >1k, jumper selectable to 50

TIME INTERVAL FEATURE

- Measurement
  - Rate: 1 per second
  - Resolution: 5 nS
  - Accuracy: ±5 nS (+ clock accuracy**)
  - Range: 0.0 to 1 year

* Display: Time into the second, updated once per second, is displayed to the nanosecond until another event occurs or until the "TIME", "STATUS", or "POSITION" push-button is pressed.

EVENT TIMING FEATURE

- Measurement
  - Rate: 10/second or 100/second burst
  - Resolution: 5 nS
  - Accuracy: ±5 nS (+ clock accuracy**)
  - Range: 0.0 to 1 year

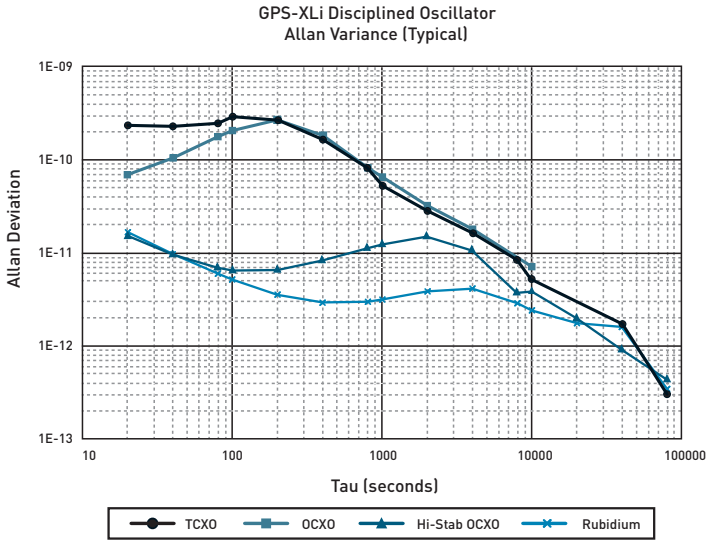
* Display: Event Time occurrence, hundreds of days through nanoseconds, is displayed until another event occurs or until the "TIME", "STATUS", or "POSITION" push-button is pressed.

** For clock accuracy see accuracy of host unit.

Oscillators

Symmetricom's GPS receiver takes full advantage of the excellent long-term stability of the GPS system to steer or "discipline" the receiver's local oscillator. This process dramatically enhances performance by removing the long-term aging and drift of the oscillator without operator intervention.

Symmetricom provides a full spectrum of ultra-precise frequency reference standards for every application. Upgrades to the XLi standard Temperature Compensated Voltage Controlled Crystal Oscillator (TCVCXO) are the Ovenized Crystal Oscillator (OCXO), High Stability Ovenized Crystal Oscillator (OCXO), Rubidium Oscillator, and the High Stability Rubidium Oscillator. The High Stability OCXO is standard in the XLi SAASM with upgrades to a Rubidium or High Stability Rubidium available.



OSCILLATORS SPECIFICATIONS (TYPICAL)

TCVCXO (Standard in XLi)

- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Frequency/timing Allan Deviation
- Stability
  - 1×10^{-9} @ 1 sec
  - 2×10^{-10} @ 1000 sec
  - 1×10^{-12} @ 24 hours
- Temperature: 5×10^{-7}, over 0°C to 50°C when not locked to a reference

Note: Not available in XLi SAASM

OCXO OSCILLATOR OPTION 87-399-18

- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Frequency/timing Allan Deviation
  - Stability:
    - 1×10^{-10} @ 1 sec
    - 1×10^{-10} @ 1000 sec
    - 1×10^{-12} @ 24 hours
- Temperature: 1×10^{-8}, over 0°C to 50°C when not locked to a reference
- Drift rate: 5×10^{-9} per 24 hours

HIGH STABILITY OCXO OSCILLATOR OPTION 87-399-19 (Standard in XLi SAASM)

- Accuracy: Function of input synchronization source
- Frequency/timing Allan Deviation
  - Stability:
    - 4×10^{-11} @ 1 sec
    - 4×10^{-11} @ 1000 sec
    - 1×10^{-12} @ 24 hours
- Temperature: 1×10^{-9}, over 0°C to 50°C when not locked to a reference
- Drift rate: 1×10^{-10} per 24 hours

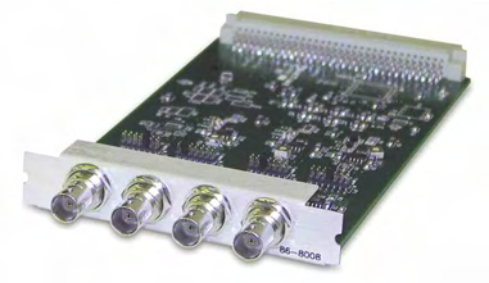
RUBIDIUM OSCILLATOR OPTION 87-399-RB1U, 87-399-RB2U

- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Frequency/timing Allan Deviation
  - Stability:
    - 4×10^{-11} @ 1 sec
    - 6×10^{-12} @ 1000 sec
    - 1×10^{-12} @ 24 hours
- Temperature: 3×10^{-10}, over 0°C to 50°C when not locked to a reference
- Drift rate: 5×10^{-11} per month (720 hours)

HIGH PERFORMANCE RUBIDIUM OSCILLATOR OPTION 87-399-RB2UA

- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Frequency/timing Allan Deviation
  - Stability:
    - 4×10^{-11} @ 1 sec
    - 6×10^{-12} @ 1000 sec
    - 1×10^{-12} @ 24 hours
- Temperature: 3×10^{-10}, over 0°C to 50°C when not locked to a reference
- Drift rate: 1×10^{-11} per month (720 hours)

1, 5, 10 MHz/MPPS



The 1, 5, 10 MHz/MPPS Output card provides four precise sine wave or square wave through four BNC outputs. These outputs are phased-locked to the host receiver's disciplined reference oscillator. They are automatically enabled upon power-up, and are independently selectable by the user with no configuration setup required.

Outputs are preconfigured at the factory. Please specify desired outputs on the sales order.

SPECIFICATIONS: 1, 5, 10 MHZ/MPPS OUTPUT 86-8008

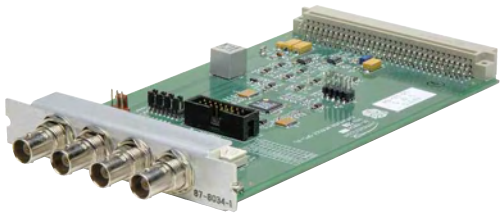
1, 5, or 10 MHz OUTPUT

- Amplitude: 1 Vrms into 50Ω
- Harmonic distortion: –30 dBc
- Synchronization: Phase locked to the clock 10 MHz
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Connector: Female, BNC

1, 5, or 10 MPPS OUTPUT

- Amplitude: TTL into 50Ω
- Duty cycle: 50%
- Synchronization: Phase locked to the clock 10 MHz
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)

Expansion Module



The Expansion Module is a versatile option that expands the number of standard time code and pulse rate outputs from the XLi. Four independent, user configurable outputs are provided. The output signals are selectable via an on-module rotary switch. Specify output signal configuration at time of order. A version of the module is also available supporting an alarm relay output.

The available output signal types are as follows:

- Time Code AM/DC: Format mirrors XLi standard code output (IRIG A,B; IEEE 1344 or NASA 36)
- Alarm
- Rates (1 PPS, 1 kPPS, 10 kPPS, 100 kPPS, 1 MPPS, 5 MPPS,10 MPPS)
- Programmable Pulse (Requires PPO option to be installed)
- Alarm Relay (87-8034-2)

SPECIFICATIONS:
- EXPANSION MODULE 87-8034-1
- EXPANSION MODULE W/ ALARM RELAY 87-8034-2

General

Connector: Female BNC
Quantity: 4
Options Slots:

- 1 slot (87-8034-1)
- 2 slots (87-8034-2)

Time Code

- Format: IRIG A, B; IEEE 1344 or NASA 36
- Amplitude (AM): 3.0 Vp-p +/-1V, into 50Ω
- Ratio (AM): 3:1 +/- 10%
- Amplitude (DC): TTL into 50Ω
- Phasing: In phase with carrier ± 10µS

Alarm

- Active High (Alarm state)
- Amplitude: TTL Levels into 50Ω

Rates

- Rate: 1 PPS, 1 kPPS, 10 kPPS, 100 kPPS, 1 MPPS, 5 MPPS, 10 MPPS
- Duty cycle: 60/40% +/- 10%
- Amplitude: TTL Levels into 50Ω

Programmable Pulse (Optional)

- On time edge: Rising
- Amplitude: TTL Levels into 50Ω

Alarm Relay 87-8034-2

- Connection: Terminal strip, COM, NO, NC
- Max Voltage: 48 VAC/VDC
- Max Current: 2A @ 24 VDC

Enhanced Low Phase Noise 10 MHz Output

This module provides the lowest phase noise frequency outputs from the XLi. Four isolated, 10 MHz frequency output signals with exceptional spectral purity. Isolation from the receiver's internal digital signal noise and power supply noise enables the high-performance phase noise and spurious noise characteristics that approches the performance of the on-module enhanced low noise oscillator. This option requires an oscillator upgrade to the XLi/XLi SAASM system, such as an OCXO, High Stability OCXO, Rubidium or High Stability Rubidium. The High Stability OCXO is standard in the XLi SAASM.

SPECIFICATIONS: ENHANCED LOW PHASE NOISE OUTPUT 87-8040

- Provides four 10 MHz frequency outputs
- Signal type: Analog sine wave
- Synchronization: Frequency locked to the clock 10 MHz
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Amplitude: +13dBm (±1.5 dBm)
- Output impedance: 50Ω
- Quantity: 4
- Connector: BNC female
- Option Slots: 2
- Harmonic distortion: -50 dBc (2nd harmonic)
- Spurious: -80dBc (10 Hz - 10 kHz SSB)
- Isolation: -60dBc
- Phase noise
  - -98 dBc/Hz @ 1 Hz offset
  - -127 dBc/Hz @ 10 Hz offset
  - -145 dBc/Hz @ 100 Hz offset
  - -150 dBc/Hz @ 1 kHz offset
  - -153 dBc/Hz @ 10 kHz offset

Low Phase Noise Output (5 MHz, 10 MHz)

This card provides four isolated, 50 ohm frequency output signals with exceptional spectral purity. Two version of this module are available to provide 10 MHz or 5 MHz outputs. Isolation from the receiver's internal digital signal noise and power supply noise enables high-performance phase noise and spurious noise characteristics as the on-module low noise oscillator source. The low phase noise option requires an oscillator upgrade to the XLi/XLi SAASM system, such as an OCXO, High Stability OCXO, Rubidium or High Stability Rubidium. The High Stability OCXO is standard in the XLi SAASM.

SPECIFICATIONS: LOW PHASE NOISE OUTPUT MODULE (5 MHZ AND 10 MHZ)

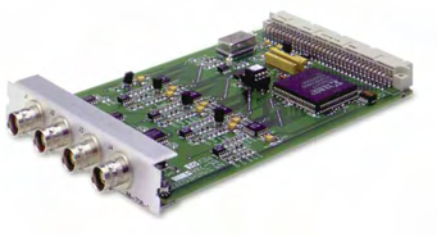
LOW PHASE NOISE 10 MHz OUTPUTS 87-8009-10

- Provides four 10 MHz frequency output signals
- Signal type: Analog sine wave
- Synchronization: Phase locked to the clock 10 MHz
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Amplitude: +13dBm (±1dBm)
- Output impedance: 50Ω
- Quantity: 4
- Connector: BNC female
- Option Slots: 1
- Harmonic distortion: –30dBc (2nd harmonic)
- Spurious: –90dBc (10 Hz - 10 kHz SSB)
- Isolation: –70dBc
- Phase noise
  - –85 dBc/Hz @ 1 Hz offset
  - –115 dBc/Hz @ 10 Hz offset
  - –140 dBc/Hz @ 100 Hz offset
  - –145 dBc/Hz @ 1 kHz offset
  - –150 dBc/Hz @ 10 kHz offset

LOW PHASE NOISE 5 MHz OUTPUTS 87-8009-5

- Provides four 5-MHz frequency output signals
- Signal type: Analog sine wave
- Synchronization: Phase locked to the clock 10 MHz
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Amplitude: +13dBm (±1dBm)
- Output impedance: 50Ω
- Quantity: 4
- Connector: BNC female
- Harmonic distortion: –30dBc
- Spurious: –90dBc
- Isolation: –70dBc
- Phase noise
  - –85 dBc/Hz @ 1 Hz offset
  - –115 dBc/Hz @ 10 Hz offset
  - –140 dBc/Hz @ 100 Hz offset
  - –145 dBc/Hz @ 1 kHz offset
  - –150 dBc/Hz @ 10 kHz offset

N.1 Frequency Synthesizer



The N.1 Frequency Synthesizer provides pulse rates from 1PPS through 50 MPPS in 1PPS steps, with the output locked to the system oscillator. This option card offers four independently programmable frequency synthesizers.

SPECIFICATIONS: N.1 FREQUENCY OUTPUTS 87-8022

- Channels: 4, independently programmable
- Input reference frequency: System 10 MPPS
- Output pulse rates: 1 PPS through 50 MPPS in 1 PPS steps
- Output drive: RS-422
- Wave form: Square wave
- Synchronization: Frequency locked to the clock 10 MHz
- Jitter cycle-to-cycle: <1nS
- Output connector: Triax female (Trompeter BJ-77)

N.8 Frequency Synthesizer

The N.8 Frequency Synthesizer provides pulse rates from 8 kPPS through 8192 kPPS in 8 KPPS steps, with the output frequency locked to the system oscillator. The output configuration is via the keypad/display, RS232/422, and the standard network port. This option card offers four independently programmable frequency synthesizers that provide pulse rates from 8 KPPS through 8192 kPPS in 8 kPPS steps.

SPECIFICATIONS: N.8 FREQUENCY OUTPUTS 86-708-1

- Channels: 4, independently programmable
- Output pulse rates: 8 kPPS through 8192 kPPS in 8 kPPS steps
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Output drive: RS-422 levels into 50Ω
- Wave form: Square wave
- Synchronization: Frequency locked to the clock 10 MHz
- Jitter cycle-to-cycle: <10 nS
- Connector: Triax female (Trompeter BJ-77)

Have Quick/1PPS Time and Frequency Reference Input

The Have Quick and / or 1PPS Time and Frequency reference is configurable to synchronize the XLi/XLi SAASM as a primary or secondary reference source. It can be configured to synchronize the major and minor time to the Have Quick incoming code, minor time to the 1PPS input, or major time to the Have Quick incoming code with minor time synchronized by the 1PPS.

SPECIFICATIONS: HAVE QUICK/1PPS REFERENCE 87-8016-3

1PPS Input

- Frequency: 1 Hz
- Accuracy: 1µSec
- Stability:
  - 1×10^{-9} @ 1 sec
  - 2×10^{-10} @ 1000 sec
  - 3×10^{-12} @ 1 day
- High Level: >1.25V <10V
- Low Level: <1.25V >0V
- Synchronization edge: Positive
- Impedance: 1K Ω to ground
- Connector: BNC female

Have Quick Input

- Format: Have Quick II (ICD-GPS-060)
- Bit period: 600µs ±10µs
- Bit rate: Approximately 1667 BPS
- Frame rate: 1 frame/second
- Accuracy: 1µSec
- Stability:
  - 1×10^{-9} @ 1 sec
  - 2×10^{-10} @ 1000 sec
  - 3×10^{-12} @ 1 day
- High Level: >4.5 and Max 5.5V
- Low Level: < +0.5V and Min 0V
- Impedance: 1k Ω to ground
- Connector: BNC female

Have Quick Output

The Have Quick Output option provides time of day, day of year and year in the Have Quick II format conforming to ICD-GPS-060. Have Quick II output is typically used to synchronize military radio systems. Transmission of the Time Figure of Merit (TFOM) in the Have Quick code is user selectable to insure compatibility with legacy equipment.

SPECIFICATIONS: HAVE QUICK OUTPUT 87-8016-6

- Format: Have Quick II (ICD-GPS-060)
- Bit period: 600µs ±10µs
- Bit rate: Approximately 1667 BPS
- Frame rate: 1 frame/second
- Frame length: 512 Bits or 504 bits with no TFOM
- Accuracy: 1 µs
- Connector: 4 Isolated female BNC
- High Level: >4.5 and Max 5.5V
- Low Level: <0.5V and Min 0V

Multicode Output

- Programmable formats
- Up to four code outputs
- Codes available: IRIG A, B, E, G, H; XR3/2137 and NASA 36

Select the various time code formats by using any of the three interfaces available: the front panel keypad and display, the RS-232/422 serial port, or the standard network port that is accessible from anywhere in the world. The available time code format menu contains IRIG A, B, E, G, H; XR3/2137, and NASA 36.

SPECIFICATIONS: MULTICODE OUTPUT 87-6002-XL1

- Amplitude modulated;
  - Amplitude into 50Ω: 0–3 Vpp, adjustable via internally accessible potentiometer
  - Amplitude into 600Ω: 0–10 Vpp, adjustable via internally accessible potentiometer
  - Modulation ratio: 2:1 to 5:1 adjustable via internally accessible potentiometer
- Connector: BNC
- Quantity: 4
- Output impedance: 25Ω
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Time codes

IRIG A 130	IRIG A 133	IRIG B 120	IRIG B 123
IRIG E 111	IRIG E 112	IRIG E 121	IRIG E 122
IRIG G 141	IRIG G 142	IRIG H 111	IRIG H 112
IRIG H 121	IRIG H 122	2137	XR-3

  NASA-36 (All codes in 24 hour format)
- Time references: Standard, UTC, GPS, or Local

DC Power Supplies

- Three voltage ranges: 12-18, 18-36, or 36-72 Vdc

The modular DC power supplies plug in the back of the XLi and can be used in place of the standard AC power supply, or in addition to it as a redundant power source. The DC power supplies will take two optional slots for the 1U chassis leaving only two for other options; however, in the 2U chassis, there is a dedicated bay only for the secondary power supply (DC included) leaving all 10 option slots available.

SPECIFICATIONS: DC POWER SUPPLIES

- Input connector: Three-position screw terminal block
- Isolation (ground): Input is fully floating. Either input polarity can be strapped to chassis ground at the input terminal block.
- Isolation input to output: 500 VAC, 710 VAC minimum
- Power supply status: The fault detector monitors all three output voltages and provides a visual (panel LED) and fault output if any output voltage decreases by 10%.
- Panel status LED: Green LED on with no fault and DC power applied. Green LED off with fault or no DC power applied.
- Output status line: Open collector. High impedance state with no fault. Low impedance state with power supply fault.
- Fan CFM: Exhaust 3-6 CFM

12 Vdc POWER INPUT 87-8012-12

- Input voltage range: 12-18 VDC for nominal 12 volt input
- Input current, maximum: 7.5 amps @ 12 volts input
- Output specifications:
  - +5 V ±2%, 20 watts, 4 amps
  - +12 V ±2%, 24 watts, 2 amps
  - -12 V ±2%, 24 watts, 2 amps

24 Vdc POWER INPUT 87-8012-24

- Input voltage range: 18-36 Vdc for nominal 24 volt input
- Input current, maximum: 6 amps @ 18 volts input
- Output specifications
  - +5 V ±2%, 25 watts, 5 amps
  - +12 V ±2%, 30 watts, 2.5 amps
  - -12 V ±2%, 24 watts, 2 amps

48 Vdc POWER INPUT 87-8012-48

- Input voltage range: 36-72 VDC for nominal 48 volt input
- Input current, maximum: 3 amps @ 36 volts input
- Output specifications:
  - +5 V ±2%, 25 watts, 5 amps
  - +12 V ±2%, 30 watts, 2.5 amps
  - -12 V ±2%, 24 watts, 2 amps

Telecommunications Interface

The T1 and E1 output modules provide telecommunications timing signals that meet the requirements of ITU-T G.703 and ITU-T G.704 for both the 12-frame multiframe (D4 or Super-Frame), 24-frame multiframe (ESF or Extended SuperFrame), and 16-frame multiframe (E1) formats. In addition, when the XLi or XLi SAASM is configured with an appropriate high stability oscillator option (OCXO, high stability OCXO, Rubidium and High Stability Rubidium) and locked to a GPS reference (or equivalent), the requirements of ANSI T1.101-1994 and ITU-T G.811 pertaining to primary reference source operation are met.

T1 Option: 87-6000T1-8

- Framed all 1s DS1/T1 1544 kb/s outputs (Two outputs: A and B)
  Formats: SuperFrame (D4)
  Line code: B8ZS/AMI (these are the same for all 1s)
  Interface: Balanced, Z0 =100Ω, on wire wrap pins
  Wave shaping: T1 short loop (DSX-1; 0 – 655')
- 64 kb/s composite clock output (Aux Out 1)
  Format: Per ITU-T G.703 standard
  Centralized Clock Interface, paragraph 1.2.2. AMI with 5/8 duty cycle. All 1s with bipolar violations at an 8 Kb/s rate.
  Interface: Balanced, 2 V peak into 135Ω, on wire wrap pins
- Outputs (Aux Out 2, 3, 4)
  Frequency: 1544 kb
  Interface: Balanced, RS-422 levels into 100Ω, on wire wrap pins

E1 Option: 87-6000E1-6

- Framed all 1s CEPT E1 2048 kb/s outputs (Two outputs: A and B)
  Format: 16 frame multiframe
  Line code: HDB3/AMI (these are the same for all 1s)
  Interface: Balanced, Z0=120Ω, on wire wrap pins
  Wave shaping: CEPT G.703 pulse template requirements
- Major and minor alarm relay closures
  Format: Form-C Normally Open and Normally Closed contacts
  Interface: Wire wrap pins
  Contacts: Rated to 115 VAC/150 VDC at 2 A
- 64 Kb/s composite clock output (Aux Out 1)
  Format: As per ITU-T G.703
  Centralized Clock Interface, paragraph 1.2.2. AMI with 5/8 duty cycle
  All 1s with bipolar violations at an 8 kb/s rate
  Interface: Balanced, 2 V peak into 135Ω, on wire wrap pins
- 2048 Kb/s sine outputs (Aux Out 2, 3, 4)
  Frequency: 2048 Kb/s
  Interface: Balanced RS-422 levels on wire wrap pins

General Specification (T1 and E1 Options)

- Synchronization
  Phase locked to the XLi 10 MHz reference clock
  Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Synchronization Status Messaging (SSM): not supported
- Major and minor alarm relay closures
  Format: Form-C normally open and normally closed contacts
  Interface: Wire wrap pins
  Contacts: Rated to 115 VAC/150 VDC at 2 A
- CE Compliant: No

Second Serial Talker or T1/E1 Output

The Second Serial Talker or T1/E1 module is multi-function, and user configurable to provide one of three signal types on the output ports:

- Serial Talker: re-broadcast or replication of the standard XLi serial port transmit data
- T1: 1544 kbps frequency
- E1: 2048 kbps frequency

The selection of the signal type is made with on-board jumpers. LEDs mounted to the rear panel identify the signal selected.

When configured for T1 or E1 outputs, and XLi or XLi SAASM is configured with an appropriate high stability oscillator option (OCXO, high stability OCXO, Rubidium and High Stability Rubidium) and locked to a GPS reference (or equivalent), the requirements of ANSI T1.101-1994 and ITU-T G.811 pertaining to primary reference source operation are met. This module is CE compliant.

SPECIFICATIONS: SECOND SERIAL TALKER OR T1/E1 OUTPUT 87-8047

Serial Talker

- Balanced RS-422 and RS-232
- Qty: Two RS-232 and four RS-422 outputs

T1

- Frequency: 1544 kbit/s
- Interface: Balanced, RS-422 levels into 120 Ω
- Synchronization: Phase locked to the clock 10MHz
- Qty: Four outputs
- Connector: Two Male 9-pin D
- Physical: Single high option bay.

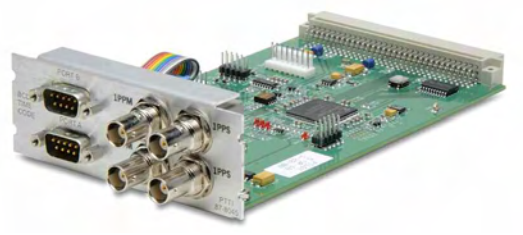
E1

- Frequency: 2048 kbit/s
- Interface: Balanced, RS-422 levels into 120 Ω
- Synchronization: Phase locked to the clock 10MHz
- Qty: Four outputs
- Connector: Two Male 9-pin D
- Physical: Single high option bay

General Specification (T1 and E1 Configurations)

- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Synchronization Status Messaging (SSM): not supported
- CE Compliant: Yes

PTTI BCD Output



SPECIFICATIONS: PTTI BCD OUTPUT 87-8045

BCD TIME CODE

- Data: 40-bit serial BCD output (time of day, day of year, TFOM)
  24-bit serial BCD output (time of day only)
- Output: ±6 V differential per ICD-GPS-060
- Connector: 9 Pin 'D', Male

1 PPS

- Output: 10 VDC, ±1 V into 50 ohms
- Pulse width: 20 microseconds, ±1 microsecond
- Rise time: <20 nanoseconds
- Fall time: <1 microsecond
- Phasing: In phase with the XLi 1PPS ± 100ns
- Connector: BNC

1 PPM

- Output: 10 VDC, ±1 V into 50 ohms
- Pulse width: 20 microseconds, ±1 microsecond
- Rise time: <20 nanoseconds
- Fall time: <1 microsecond
- Phasing: In phase with the XLi 1PPS ± 100ns
- Connector: BNC

MECHANICAL

- Option Slots: 2

Parallel BCD Output

The parallel BCD time output options provide an interface to synchronize external pieces of equipment. There are three versions of this option:

The first version provides 42 output lines with hundreds of days through units of milliseconds. In addition it provides four time quality lines and two data valid strobes.

The second version provides 54 output lines with hundreds of days through microseconds. Four time quality lines and three data valid strobes are also provided.

The third version provides hundreds of days through milliseconds, two strobes, and an unlock status line. No time quality data is provided.

SPECIFICATIONS: PARALLEL BCD OUTPUT

Parallel BCD mSec with Time Quality 87-8090

- Outputs:
  - Milliseconds through day-of-year, (4) time quality bits, (2) strobes (1PPS, 1kPPS)
- Output Drive (TTL): LVTTL levels, 4mA source or sink
- Logic Levels: Low <0.4V, High >2.4V
- Connector: 50 pin 'D' female
- Option Slots: 1
- Compatibility: Legacy XL-DC Parallel BCD Millisecond Module (86-390)

Parallel BCD uSec with Time Quality 87-8090-1

- Outputs:
  - Microseconds through day-of-year, (4) time quality bits, (3) strobes (1PPS, 1kPPS, 1MPPS)
- Output Drive (TTL): LVTTL levels, 4mA source or sink
- Logic Levels: Low <0.4V, High >2.4V
- Connectors: 50 pin 'D' female, 25 pin 'D' female
- Option Slots: 2
- Compatibility: Legacy XL-DC Parallel BCD Microsecond Module (86-390-1)

Parallel BCD mSec 87-8090-2

- Outputs: Milliseconds through day-of-year, (2) strobes (1PPS, 1kPPS), Unlock status
- Output Drive (TTL): LVTTL levels, 4mA source or sink
- Logic Levels: Low <0.4V, High >2.4V
- Connector: 50 pin 3M ribbon type connector male
- Option Slots: 1
- Compatibility: Legacy ExacTime 6000 GPS_Option_13A - Parallel BCD

Frequency and Time Deviation Monitor (FTM)

(Available for XLi Only)

This plug-in card meets the specific needs of the electrical power industry. It provides a digital display and computer-compatible outputs of the following parameters:

- Frequency Deviation – The instantaneous difference between the locally generated frequency (typically 50 or 60 Hz) and the precision frequency of the host Synchronized Clock.
- System Frequency – The user's locally generated frequency.
- Time Deviation – The accumulated difference in time between a clock locked to the locally generated frequency and the precise time of the Synchronized Clock.
- System Time – (Hours, minutes and seconds) as defined by a clock running off the user's locally generated frequency.
- Local Time – Local corrected UTC time seconds through days.

Both the display port and the communication port have user-selectable baud rates, parity and the number of data bits and stop bits.

The monitored frequency and time deviation values are available via the front panel display(s), the communication port, and the remote display driver RS-422 port.

Displays for XLi-FTM

MODEL	SIZE	DISPLAY DATA*
820-247	RD-2	Local Time HH:MM:SS
820-240	RD-4	System Frequency
820-258	RD-4	Delta Frequency
820-259	RD-4	Delta Time
820-260	RD-4	System Time
820-261	RD-4	Local Time
820-251	RD-1	Delta Time
820-251-1	RD-1	Delta Frequency
820-251-2	RD-1	System Frequency

SPECIFICATIONS: FREQUENCY AND TIME DEVIATION MONITOR 87-8023

GENERAL SPECIFICATIONS

- Measurement input: 95–260 VAC, 40–70 Hz; user-selectable 50 or 60 Hz operation.
- Signal conditioning: RFI input filter; multistage low-pass filter. Line fused; varistor protected 2500 VAC rms isolation. Transformer coupled.
- Remote display port: RS-422. Each output term has individual address codes.

FREQUENCY DEVIATION

- Current deviation of the measurement input frequency from the nominal frequency (50 or 60 Hz).Measurement Sample Rate: 1 sample per second

  Range: ±9.999 Hz
  Measurement resolution: 30 µHz
  Output data resolution: Resolution to 1 mHz

TIME DEVIATION

- Accumulated time drift due to user's local frequency difference as compared to the host clock. The user can enter an initial time offset.

  Measurement sample rate: 1 sample per second
  Range: ±99.999 seconds
  Measurement resolution: 500 nS
  Output data resolution: 1 mS
  Time offset input: ±99.999 seconds maximum. Entry via keypad or communication port.

SYSTEM FREQUENCY

- Current measurement of input reference frequency.

  Range: 40 - 70 Hz

  Measurement Resolution: 30 µHz
  Output Data Resolution: 1 mHz

SYSTEM TIME

- Arithmetic value calculated from local time, plus user-entered offset, plus time deviation.

* Input to displays are from FTM III serial display port. FTM displays are not driven from time codes such as IRIG B, etc.

XLi IEEE 1588 Grandmaster (PTP V2)

GPS Referenced Grandmaster Clock and IEEE 1588 Accuracy Measurement System Supporting Precise Time Protocol Version 2

KEY FEATURES

- Better Than 50 Nanosecond Time Stamp Accuracy to UTC
- Supports IEEE 1588-2008 (PTP v2)
  - Default PTP Profile
  - Two step clock operation
  - Multicast addressing
- Optional Master & Slave in Same Chassis for Network Measurements
- Time Interval Measurements of Slave Clock Accuracy
- Synchronized with a 12 Channel GPS Receiver
- Better Than $1x10^{-12}$ Frequency Accuracy
- Supports Primary and Secondary Reference Inputs
- Standard 10/100 Base-T Ethernet
- Telnet, SNMP & Enterprise MIB
- Standard Vacuum Fluorescent Display and Keypad
- Flash Memory for Remote Software Upgrades
- Time Code Input/Output (IRIG A,B; IEEE 1344; NASA 36)
- Standard 1PPS, Selectable Pulse Rate Outputs, Alarm, Auxiliary Reference, and Various Time Code In/Out

KEY BENEFITS

- Nanosecond Caliber Synchronization Accuracy Possible Between Clocks over Ethernet Network Infrastructure.
- Time Interval Measurements to Characterize Network Element Induced Time Transfer Rrrors.
- GPS for Precise UTC Time Accuracy.
- Operate as IEEE 1588 Protocol Grandmaster Clock for IEEE 1588 Slaves, Boundary Clocks, and Ordinary clocks.
- Plug and Play Compliant with IEEE 1588-2008.

IEEE 1588 Precise Time Protocol (PTP), with nanosecond caliber time transfer accuracy, provides a significant improvement in synchronization over Ethernet networks. This technology offers major cost savings in time distribution since it can be deployed using hardware clocks and Ethernet LAN hubs, switches and Cat 5 cables. The low overhead, multicast protocol can use the same LAN as normal network traffic.

The XLi IEEE-1588 Grandmaster contains a dedicated 1588 time stamp processor. Operating at 100 Base-T line speed with deep time stamp packet buffers, the XLi Grandmaster can support over fifty slave delay requests per second. This is made possible in part by sending periodic 1588 *Sync & Follow_Up* messages using multicast addressing, and in part by being able to quickly and accurately process 1588 slave initiated *Delay_Req* and *Delay_Resp* messages.

Ideal for measurement purposes, the XLi Grandmaster can also operate as a 1588 slave. Standard network elements impact 1588 time transfer accuracy. Switches in particular add nondeterministic latency and jitter to packet transit times that degrades 1588 slave synchronization accuracy. To achieve maximum accuracy, utilize IEEE 1588 enabled switches such as the Symmetricom SyncSwitch TC100.

The XLi Grandmaster operating as a slave is extremely useful for network time transfer accuracy measurements involving a 1588 slave separated from the XLi Grandmaster by network elements or topology. The remote slave 1PPS is compared to the remote GPS receiver 1PPS in the XLi Grandmaster using the standard Time Interval function. This enables accurate measurements of the network between the GPS referenced 1588 Grandmaster and the remote slave. Operating as a 1588 slave also means accurate time can be transferred over Ethernet from the XLi Grandmaster and, for example, output as IRIG B time code.

The XLi Grandmaster can also be configured with two 1588 ports. These ports can operate as two independently configured Grandmasters or as a Grandmaster and a slave. The master and slave configuration is an excellent 1588 network element or topology measurement solution. Synchronize the slave to the master then measure the slave one pulse-per-second (PPS) to the master using the standard Time Interval function in the Grandmaster. This is very useful in characterizing the time degradation effects of delay and jitter introduced by any network element or topology before deployment.

Optional Symmetricom TimeMonitor software collects and analyzes Time Interval data from the XLi Grandmaster. Statistics, histograms, mean time interval error charts, and much more are quickly and easily computed on small to extremely large datasets.

XLi IEEE 1588 Grandmaster

XLi IEEE 1588 GRANDMASTER (PTP V2) SPECIFICATIONS

IEEE 1588 SUBSYSTEM (per port)

- Compliance: IEEE 1588-2008
  - Default PTP Profile
  - Two step clock operation
  - Multicast addressing
- Number of IEEE 1588 ports: 1 Standard 10/100 Base-T
- Grandmaster operation
  - Time stamp accuracy: <50 nS to XLi clock with standard deviation <30 nS and RMS <80 nS
  - Sync Intervals: 0.5, 1 and 2 seconds
  - Packet throughput: >50 Delay_Req/second
  - Delay_Req buffer: 256 time stamps
- Slave operation
  - Sync interval: 2 seconds
  - Grandmaster accuracy: <18 nS to XLi master clock with standard deviation <150 nS via crossover cable
  - 1588 module 1PPS accuracy: < 50 nS to XLi master clock with standard deviation <135 nS via crossover cable

GPS RECEIVER

- Receiver input: 1575.42 MHz L1 C/A code
- Tracking: 12 parallel channels with TRAIM
- Acquisition time: Cold start <20 min. (typical)
- 1PPS output accuracy: UTC(USNO): ±30 nS RMS 100 ns peak 99%
- Frequency output accuracy: 1 x 10^{-12} @ 1 day
- Stability when not tracking satellites: 5 x 10^{-7} (0°C to 50°C) typical

STANDARD INPUT/OUTPUT SIGNALS

- Eight standard I/Os: Two control: Serial and Ethernet port. Six signals: 1PPS out, code in, code out, rate out, aux reference, and Open Collector Alarm output. Connector: All BNC female.
- RS-232/422: User selectable up to 19200 bps Connector: Male 9-pin D subminiature
- Network interface: Standard 10/100 base-T RJ-45 8-pin connector. Protocols: Telnet, HTTP, SNMP for the user interface, FTP (for firmware upgrades).
- 1PPS: Pulse width: 20 µs (±1µs) on the rising edge on time, TTL levels into 50Ω, BNC female connector.
- Code input: AM or DC code IRIG-A, B, IEEE 1344, NASA-36 AM Code: 0.5 Vp-p to 10 Vp-p, 100 kΩ ground, ratio (AM): 3:1 ±10% DC Code: Logic low <1.25 V and Min 300 mV, Logic Hi >1.25 V and Max 10 V. Impedance: 100k or 50Ω Polarity: positive or negative Connector: BNC female
- Code out: Format: AM or DC code IRIG-A, B, IEEE 1344, NASA-36. AM Code: 3 Vp-p, into 50Ω ±10%, ratio (AM): 3:1. DC Code: TTL into 50Ω Connector: BNC female
- Rate out: Default: 10 MPPS. Rate: 1PPS, 10 PPS, 100 PPS, 1 kPPS, 10 kPPS, 100 kPPS, 1 MPPS, 5 MPPS, and 10 MPPS. Duty cycle: 50% and 60/40%. Amplitude: TTL levels into 50Ω Connector: BNC female
- Aux ref input: Input frequency: 1, 5, and 10 MHz sine-wave. Amplitude: 1 Vp-p to 10 Vp-p at 1 kΩ to ground. 1 Vp-p to 3 Vp-p at 50Ω to ground. Impedance: Configurable 1 kΩ or 50Ω to ground Connector: BNC female
- Alarm: Open collector. Max 25V/50 mA. Connector: BNC female

OSCILLATOR

- Standard oscillator: VCTCXO
- Optional oscillators: OCXO, high stability OCXO, and Rubidium.

MECHANICAL/ENVIRONMENTAL

- Time and frequency system
  - Power: Voltage: 90–260 Vac. Frequency: 47–440 Hz
  - Connector: IEC 320
  - Size: 1U: 1.75" x 17.1" x 15.35" (4.44 cm x 43.4 cm x 38.9 cm) Standard 19" (48.26 cm) EIA rack system,
  - Operating temperature: 0°C to +50°C (+32°F to +122°F)
  - Storage temperature: –55°C to +85°C (–67°F to +185°F)
  - Humidity: 95%, non-condensing
  - Display: Graphics (160 X 16) vacuum fluorescent display. One line for time and day of year (TOD). Two-line alpha-numeric display for status messages and user input.
  - Keypad: Numeric 0–9, left, right, up, down, CLR, Enter, time key, status key and menu key.
- Antenna
  - Size: 3" Dia. x 3" H (7.62 cm x 7.62 cm)
  - Input: BNC female to GPS receiver. TNC on antenna
  - Power: +12 Vdc
  - Operating/storage temp: –55°C to +85°C (–67°F to +185°F)
  - Humidity: 95%, non-condensing
- Certification: UL, FCC, CE, and C-UL

TIME INTERVAL MEASUREMENT

- Measurement
  - Rate/Pulse Width:: 1 per second
  - Resolution: 5 nS
  - Accuracy: ±5 nS (+ clock accuracy)
- Input frequencies
  - Rate/Pulse Width: 1PPS, 100 nsec minimum pulse width
  - Level: Hi >1.25V <10V, Low <1.25V >0V
  - Active edge: Rising (Positive)
  - Input impedance: >1k, jumper selectable to 50

PRODUCT INCLUDES

XLi IEEE 1588 Clock, Cat 5 crossover cable and network cable, AC power cord, null modem cable, user guide on CD, rack mount brackets, L1 GPS antenna assembly with 50 ft. RG-59 cable, mounting hardware.

OPTIONS

See XLi Options datasheet for complete details on XLi GM specific options.

Software:

- Network time server on standard network port
- Frequency measurement
- Programmable pulse output
- Time Monitor Software for XLi

Hardware:

- Oscillator upgrades: OCXO, High Stability OCXO, Rubidium
- Multicode output for IRIG A, B, E, G, H; XR3/2137 and NASA 36
- Extended cable length solutions: in-line amplifier (to 300'), down/up converter (to 1500'), fiber optic (to 2 km).

Related products: SyncSwitch TC100 Transparent Clock

Rear view: Single 1588 port, Model 1510-712

Rear view: Dual 1588 port, Model 1510-713

SyncSwitch TC100

IEEE-1588 Transparent Clock/Managed Ethernet Switch

KEY FEATURES

- IEEE-1588 Transparent Clock
- PTP Enabled 10/100BASE-T/TX Switch
- PTP v1 and v2 Support
- End-to-End and Peer-to-Peer Transparency
- Plug-and-Play PTP ready
- Copper and Fiber Port Combinations
- Single Mode or Multimode Fiber Support
- Windows GUI Based Remote User Interface
- SNMP, IGMP, RSTP, Custom MIB
- VLAN Support
- Multicast Filtering
- Network Redundancy
- QoS Priority Optimization
- 1U Chassis, AC Powered
- CE(RoHS) Compliant

KEY BENEFITS

- Improve IEEE-1588 PTP master/slave synchronization accuracy
- Rack-and-stack chassis and AC power compatibility
- Managed switch optimized for IEEE-1588 performance
- Easy integration into existing network infrastructure
- Network redundancy for critical systems

The SyncSwitch TC100 Transparent Clock is a Precise Time Protocol (PTP) enabled Ethernet switch that mitigates time-transfer errors due to packet-queuing delays common in Ethernet switches. PTP packets traversing the network between a PTP Grandmaster and the PTP slaves often coexist on the same network as data traffic. Even minor traffic congestion in a switch randomly delays PTP packets and drastically degrades the time accuracy achievable by the PTP slave. The SyncSwitch is an Ethernet switch that solves this problem.

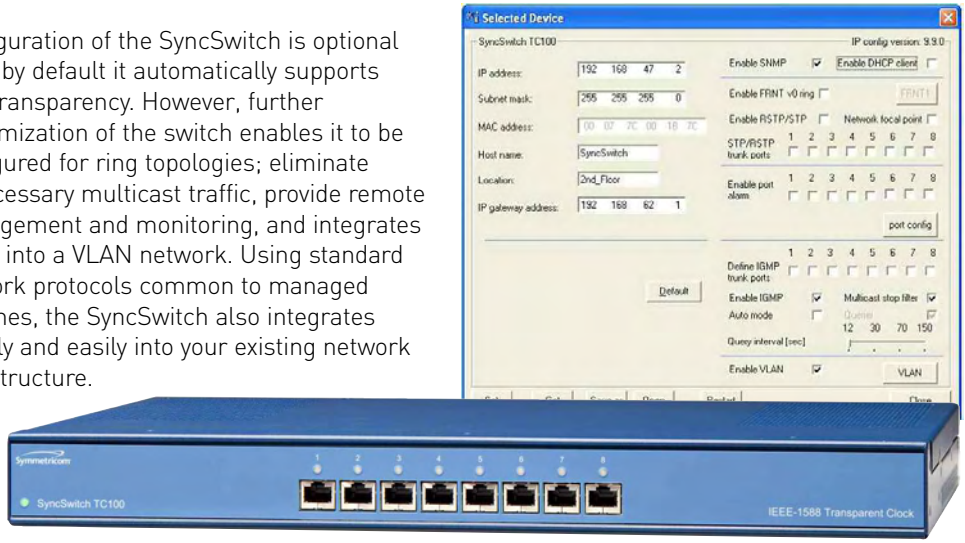
The SyncSwitch employs IEEE-1588 transparency technology for switches. This technology removes errors related to PTP packet delays inside the SyncSwitch and facilitates extremely accurate time synchronization between the PTP Grandmaster and the PTP slaves. These corrections are performed in real time while the TC100 switches all traffic at line speed. The TC100 automatically and simultaneously supports both End-to-End (E2E) and Peer-to-Peer (P2P) transparency as defined in the 2008 version of the IEEE-1588 standard. In other words, it supports IEEE-1588 v1 and v2 protocol for multicast PTP packets.

Configuration of the SyncSwitch is optional since by default it automatically supports PTP transparency. However, further customization of the switch enables it to be configured for ring topologies; eliminate unnecessary multicast traffic, provide remote management and monitoring, and integrates easily into a VLAN network. Using standard network protocols common to managed switches, the SyncSwitch also integrates quickly and easily into your existing network infrastructure.

Remote configuration changes to the SyncSwitch are easily accomplished via the intuitive Windows based GUI. All parameters are clearly presented and in most cases only need to be enabled or disabled via point and click operations. For more detailed configuration and monitoring, the SyncSwitch includes a custom SNMP MIB.

Physical port connections include copper and fiber combinations to accommodate various network topologies and distances. The 10/100BASE-T/TX ports can be enabled for auto-negotiation or individually configured for port speed, duplex, mirroring or sniffing. Ports 7 and 8 can optionally be 10/100BASE-T/TX copper or 100BASE-FX fiber with multimode or single mode fiber transceivers with LC connectors.

The SyncSwitch TC100 Transparent Clock is an essential network element in the deployment of IEEE-1588 enabled devices in real-world networks, particularly on LANs using multicast PTP traffic. The unique PTP transparency technology in the TC100 enables PTP slaves to accurately synchronize to PTP masters while minimizing any detrimental effects caused by traffic on the network.



SyncSwitch TC100 SPECIFICATIONS

TIMING FUNCTIONS

- IEEE Std 1588™-2008 — End-to-End (E2E) Transparent Clock; Peer-to-Peer (P2P) Transparent Clock; Multicast support only
- IEEE Std 1588™-2002 — End-to-End Transparency; Multicast support only
- Hybrid Operation — Simultaneous support of 1588-2008 E2E, 1588-2008 P2P and 1588-2002 multicast packet types

SWITCHING PERFORMANCE

- Switching Capacity — 1.6 Gbps when operating at full wire speed handling the maximum data rate in both directions on all eight ports.
- Forwarding Capacity — 800 Mbps wire-speed performance
- MAC Addresses — ≤ 8000
- VLANs — ≤ 11 with support for 802.1q trunking
- RSTP/STP — Rapid Spanning Tree Protocol
- FRNT Protocol — SyncSwitch-to-SyncSwitch Fast Re-configuration of Networks Topology
- Queuing — Head-of-line blocking prevention is set to ON for low priority packets to improve real-time performance.(Flow control is OFF by default).; Layer 3 DSCP (Differentiated Services Code Point) ToS values recognized and prioritized.

STANDARDS

- IEEE 1588 2008 (v2)
- IEEE 1588 2002 (v1)
- IEEE 802.1p CoS Classification
- IEEE 802.1q VLAN
- IEEE 802.1w Rapid Spanning Tree Protocol
- IEEE 802.1d Spanning Tree Protocol
- IEEE 802.3 10BASE-T
- IEEE 802.3u 100BASE-T/TX
- IEEE 802.3u 100BASE-FX
- IEEE 802.3x Flow Control
- IGMP v1, v2 Snooping
- DHCP (RFC 2131)
- SNMP v2c
- MIB-II (RFC 1213)
- BRIDGE-MIB (RFC 1493)
- IF-MIB (RFC 2863)
- Custom Symmetricom MIB

NETWORK CONNECTORS

- RJ-45 Ports — 10/100BASE-T/TX; Auto negotiation for: Speed, duplex, MDI/MDIX; Manual for: Speed, full and half duplex
- Fiber Ports — LC Multimode (see Options); LC Single Mode (see Options)

MECHANICAL/ENVIRONMENTAL

- Size — 1.75" x 17" x 11.25" (4.5 cm x 43.2 cm x 28.6 cm) 1U rack mount
- Power — 100-240 VAC, 50-60 Hz, 15 watts
- Operating Temperature — 0°C to +50°C (+32 to +122°F)
- Storage Temperature — -20°C to +85°C (-4 to +185°F)
- Humidity — To 95%, noncondensing
- Certifications — FCC, CE (RoHS), UL
- Server weight — 4.5 lbs (2 kgs), Shipping package: 9.5 lbs (4.3 kgs)

PRODUCT INCLUDES

SyncSwitch TC100, Windows GUI interface software on CD, rack-mount ears, manual and MIB on CD, power cord, QuickStart Guide, 1 Year Warranty.

OPTIONS

Three configurations:

Part Number	Description
1550R-100	8-Port 10/100BASET/TX
1550R-101	6-Port 10/100BASET/TX, 2-Port 100BASE-FX Multimode Fiber
1550R-102	6-Port 10/100BASET/TX, 2-Port 100BASE-FX Single Mode Fiber

XL-GPS

Time and Frequency Receiver

KEY FEATURES

- 12 Channel GPS Receiver with TRAIM
- Accurate to 30 Nanoseconds RMS to UTC (USNO)
- Frequency Accuracy to 1x10-12 (long term)
- Time code reader/generator (IRIG B; IEEE 1344); AM and DC
- 1PPS, Selectable Pulse Rates, and Alarm Outputs
- Ethernet Network Port (10/100 BaseT)
- SNMP with Enterprise MIB
- Telnet and Serial Port (RS-232/422) for Monitoring and Control
- Vacuum Fluorescent Display and Keypad
- Network Time Server Option Supports NTP
- Expansion Module Option with 4 Configurable Outputs
- Programmable Pulse Output Option
- Time Interval/Event Timing Option
- Frequency Measurement Option
- Remote Software Upgrades

The XL-GPS Time and Frequency Receiver is a high performance, cost effective instrument that generates precise time and frequency signals referenced to Coordinated Universal Time (UTC). This high value, networked managed device is an excellent solution for test and measurement, central timing systems, process automation, range timing systems and power industry applications.

At the core of the XL-GPS is Symmetricom's advanced XLi technology which assures ultra-accurate and reliable performance. The XL-GPS offers cost-effective functionality and ease-of-use where the XLi offers modularity and extensibility through multiple option slots and modules.

A robust 12 channel GPS satellite receiver provides a high accuracy UTC reference to 30 nanoseconds RMS UTC(USNO) with excellent long term frequency stability (less than 1x10-12). Time Receiver Autonomous Integrity Monitoring (TRAIM) protects against faulty satellite signals. An ovenized oscillator option improves short-term stability and holdover performance. A time code input is available as an alternative reference to GPS.

A variety of standard time and frequency outputs include a one pulse-per-second (1PPS), IRIG B/IEEE 1344 time code (AM & DC), programmable pulse rates up to 10 MPPS, and an alarm output. A Programmable Pulse Output (PPO) option generates a synchronized "trigger pulse" at a specific time of day. An optional Expansion Module provides four, user configurable outputs to fan out signals.

The front panel display provides operators with "at-a-glance" system status. Monitoring and control is via serial port (RS-232/422) and network (telnet, SNMP) with password protection. Telnet and SNMP interfaces can be selectively disabled.

The versatile XL-GPS supports analysis of 1, 5, 10 MHz frequencies via the Frequency Measurement (FM) option. Precise event time tagging and time interval measurements to 5 nanosecond resolution are supported via the Time Interval/Event Timing (TI/ET) option. The Network Time Server (NTS) option enables the unit as a Stratum 1 Network Time Protocol (NTP) server to synchronize networked computers and devices.

The XL-GPS modular architecture is easily maintained and extended in the field. Software updates are remotely administered. The plug-and-play option bay allows extension of the XL-GPS hardware functionality with the optional Expansion Module and future option modules in the field.

XL-GPS Time and Frequency Receiver

XL-GPS SPECIFICATIONS

GPS RECEIVER

- Receiver input: 1575.42 MHz L1 C/A code. Coarse acquisition. Position accuracy: typical 10 m RMS tracking 4 satellites.
- Tracking: 12 parallel channels. Multi satellite ensembling with TRAIM.
- Acquisition time: Cold start <20 min. (typical)
- 1 PPS output accuracy: UTC(USNO): ±30 nS RMS 100 ns peak
- Frequency output accuracy: 1 x 10^{-12} @ 1 day
- Frequency/timing Allan Deviation stability:

	TCXO (std)	OCXO (optional)
	1 x 10^{-9} @ 1 sec	1 x 10^{-10} @ 1 sec
	2 x 10^{-10} @ 1000 sec	1 x 10^{-10} @ 1000 sec
	1 x 10^{-12} @ 1 day	1 x 10^{-12} @ 1 day

- Stability when not tracking satellites: TCXO: 5 x 10^{-7} (0°C to 50°C) typical
  OCXO: 1 x 10^{-8} (0°C to 50°C) typical

TIME CODE READER/GENERATOR

- Codes: IRIG B, IEEE 1344

OSCILLATOR

- Standard oscillator: VCTCXO
- Optional oscillator: OCXO

STANDARD INPUT/OUTPUT SIGNALS

- Eight standard I/Os
  - Two for control and monitoring: Serial and Ethernet port.
  - Six for signals: 1 PPS out, time code in/out, rate out, open collector alarm out, optional Time Interval/Event Timing input, optional Frequency Measure input (all with BNC female connector). I/Os are configurable via the keypad/display, RS232/422, and the standard network port.
- RS-232/422: User selectable up to 19200 bps
  Connector: Male 9-pin D subminiature
- Network interface: Standard 10/100 base-T RJ-45 8-pin connector. Protocols: Telnet and SNMP for the user interface, FTP (for firmware upgrades), and optional NTP and SNTP server
- 1 PPS: Pulse width: 20 µs (±1µs) on the rising edge on time, TTL levels into 50 Ω, BNC female connector.
- Code out: Format: AM or DC code (IRIG-B120/B000; IEEE 1344).
  AM Code: 3 Vp-p, into 50 Ω ±10%, ratio (AM): 3:1.
  DC Code: TTL into 50 Ω
  Connector: BNC female
- Code input: AM or DC code (IRIG-B120/B000; IEEE 1344)
  AM Code: 0.5 Vp-p to 10 Vp-p, 100 kΩ ground, ratio (AM): 3:1 ±10%
  DC Code: Logic low <1.25 V and Min 300 mV, Logic Hi >1.25 V and Max 10 V.
  Impedance: 100k or 50 Ω
  Polarity: positive or negative
  Connector: BNC female
- Rate out: Default: 10 MPPS. Rate: 1 PPS, 10 PPS, 100 PPS, 1kPPS, 10kPPS, 100kPPS, 1 MPPS, 5 MPPS, and 10 MPPS. Duty cycle: 50% and 60/40%.
  Amplitude: TTL levels into 50 Ω
  Connector: BNC female
- Alarm: Open collector. Max 25V/50 mA.
  Connector: BNC female

MECHANICAL/ENVIRONMENTAL

- Time and frequency system
  - Power: Voltage: 90–260 Vac, 110-300 VDC
    Frequency: 47–63 Hz
  - Connector: IEC 320
  - Size: 1U: 1.75" x 17.1" x 15.35"
    (4.44 cm x 43.4 cm x 38.9 cm)
    Standard 19" (48.26 cm) EIA rack system, hardware included.
  - Operating temperature: 0°C to +50°C (+32°F to +122°F)
  - Storage temperature: –55°C to +85°C (–67°F to +185°F)
  - Humidity: 95%, non-condensing
  - Display: Graphics (120 X 16) vacuum fluorescent display. One line for time and day of year (TOD). Two-line alpha-numeric display for status messages and user input.
    Keypad: Includes: numeric 0–9, left, right, up, down, CLR, Enter, time key, status key and menu key.
- Antenna
  - Size: 3" Dia. x 3" H (7.62 cm x 7.62 cm)
  - Input: BNC female to GPS receiver. TNC on antenna
  - Power: +12 Vdc
  - Operating temperature: –55°C to +85°C (–67°F to +185°F)
  - Storage temperature: –55°C to +85°C (–67°F to +185°F)
  - Humidity: 95%, non-condensing
  - Certification: UL, FCC, CE, and C-UL

OPTIONS

- Network Time Server (on standard network port)
- Expansion Module
- Alarm Relay (requires Expansion Module)
- Oscillator Upgrade: OCXO
- Frequency Measurement (FM)
- Time Interval/Event Timing (TI/ET)
- Programmable Pulse Output (PPO)
- Extended cable lengths (75'-1500')
- GPS In-line amplifier for extended cable runs up to 300' (91 m)
- GPS Antenna down/up converter for long cable runs up to 1500' (457 m)
- Antenna splitter kit
- Lightning arrestor

See XLi Options datasheet for complete details on XL-GPS specific options.

XL-GPS Rear View (with Expansion Module)

Broadcast Infrastructure

Your Network. Optimized.

In the world of single frequency networks that offer Digital Video Broadcast, having multiple transmitters send exactly the same digital information on exactly the same frequency and at exactly the same instant is critical.

Symmetricom's GPS instruments are designed to ensure that all stations in a network achieve highly reliable and precise synchronization. Our robust synchronization products provide single frequency networks with highly accurate timekeeping (maintaining sub-millisecond levels), low phase noise for clearer reception, multiple 10 MHz and 1PPS outputs, redundant time sources to back up GPS such as T1 and E1 networks, and SNMP for configuration and monitoring.

4370A

DVB Sync Source

STANDARD FEATURES

- 12-Channel GPS Receiver
- < 50ns Accuracy to UTC
- Flash Memory for Remote Upgrades
- Modular/Hot Swap Design
- Primary and Secondary Reference Inputs
- Multiple 10MHz Outputs
- Multiple 1PPS Outputs
- Dual Hot Swap Power Supplies
- Low Phase Noise
- SNMP for Configuration and Monitoring
- RoHS Compliant
- Output Squelching
- Alarm Relay Contacts
- NTP

OPTIONAL FEATURES

- 2 MHz and 2 Mbit/sec Outputs
- 2 MHz and 2 Mbit/sec Input
- Redundant Chassis Configuration

The 4370A DVB Sync Source is a flexible timing system designed for Single Frequency Network (SFN) synchronization for DVB/DAB applications. These applications require a precision time and frequency reference to synchronize transmitters across multiple locations. Without synchronization, networks are not able to reliably deliver video and audio content to the end user.

The 4370A enables Terrestrial and Mobile networks to be deployed across varied landscapes by providing access to low cost, reliable precision time and frequency reference signals, in multiple formats ensuring a robust and reliable network.

REDUNDANCY AND RELIABILITY

The 4370A receives reference-timing signals from GPS, fiber optic and E1 inputs and translates them to generate the output signals. In case of a loss of GPS, the 4370A automatically switches to and locks to the auxiliary fiber optic or 2 MHz, 2Mbit/sec input to continually provide outputs that are traceable to a primary reference clock. The 4370As can be linked together via the optional fiber optic transceiver on the input, to provide a double redundant system with no single point of failure allowing for the utmost in system reliability. In this configuration, one 4370A is designated primary and one secondary. The primary 4370A synchronizes to the primary synch source—GPS. The secondary 4370A synchronizes to the primary through the fiber. All RF and pulse outputs from the two units are therefore coherently maintained at the same frequency and phase.

The input synchronization sources are assigned a priority order of use. For example, GPS could be given the highest priority. If the GPS receiver in the primary 4370A unit fails, the secondary 4370A unit assumes the primary role, meaning that it starts to track its GPS receiver, which is still functioning properly. The 4370A with the failed GPS then tracks the new primary 4370A. Since each 4370A contains a flywheel oscillator, the necessary switching occurs without any discontinuity in the phase or frequency of the outputs. Should both GPS receivers fail; either 4370A can begin to track one of the secondary inputs while the other 4370A continues to track the primary. In this manner, all outputs of two interconnected 4370A can be derived coherently from any one of the references connected to either unit.

All of the 4370A outputs are provided on hot swappable modules so each one can be removed if needed or additional outputs can be added without the need for powering down your network.

4370A DVB Sync Source

DVB Digital Video Broadcasting

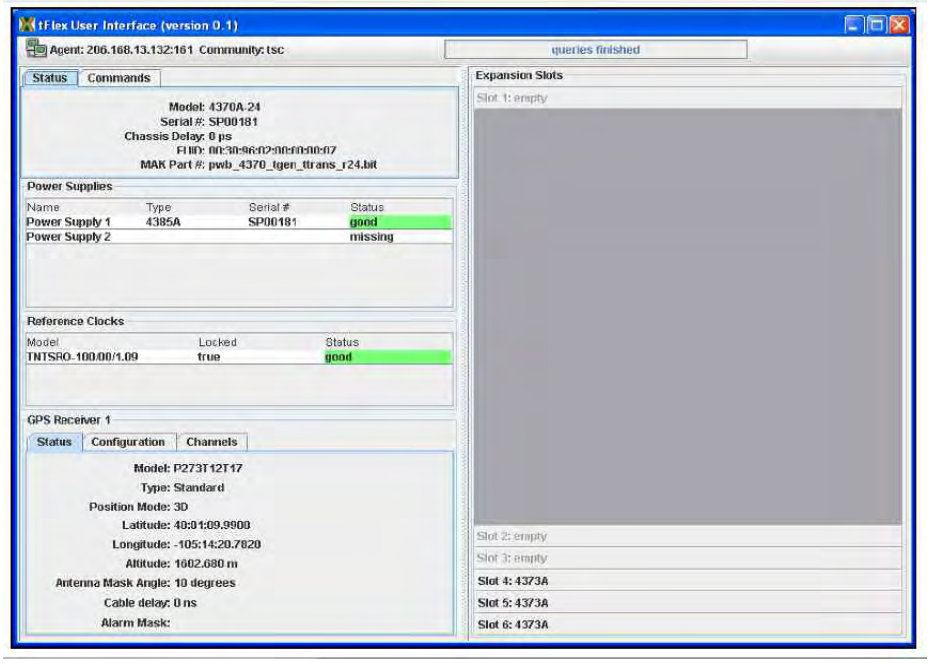
STANDARD CONFIGURATION

The standard 4370A can be configured with AC/DC hot swap power supplies, 10MHz hot swap output modules and 1PPS hot swap output modules. The 4370A 1U chassis can support up to six hot swap output modules which will provide 24 total outputs in a single 1U chassis. When fully configured, the 4370A still provides dual power supplies and multiple input sources. The front panel includes a time display, status and alarm indicators, and access to redundant power supply modules. It also includes push buttons to display the IP address and manually set the selected input and switching mode. The rear panel provides access to all input and output modules, power supply connections, alarm connections, and Ethernet port.

DVB SYNC SOURCE GRAPHICAL USER INTERFACE

The 4370A can be remotely configured and monitored using SNMP. MIB definitions can be obtained from the DVB Sync Source web server. Once you download the MIB definition bundle, you can extract it for import into MIB browser applications or SNMP management software. The bundle contains MIB definitions for the chassis, plug-in module types, trap recipient registration, and a MIB module that holds only textual conventions used throughout the other MIB modules.

The pre installed GUI facilitates access to status of the power supply, reference clock, GPS receiver, and plug-in modules. The status information automatically updates about every 45 seconds. Third party SNMP management tools can alternatively be used to provide the same monitor and configuration capability.



A ROBUST DVB SYNC SOURCE

Robust DVB synchronization (high reliability + high precision) calls for key attributes in the SFN's timing reference. The DVB sync source addresses each of these key attributes within the core architecture and option modules.

HIGHLY ACCURATE TIMEKEEPING

Direct GPS input should provide < 50 nS accuracy to UTC (coordinated universal time — the international standard). This will maintain to the sub-millisecond level the spacing between bits traveling through the air — so bit echoes do not interfere with each other.

LOW PHASE NOISE

The timing source utilized to generate a signal on a channel can contribute to noise on that channel — which can interfere with clear reception of information. Low phase noise in the timing source reduces the likelihood of that occurring.

REDUNDANT TIME SOURCES THAT ARE ALSO HIGHLY ACCURATE

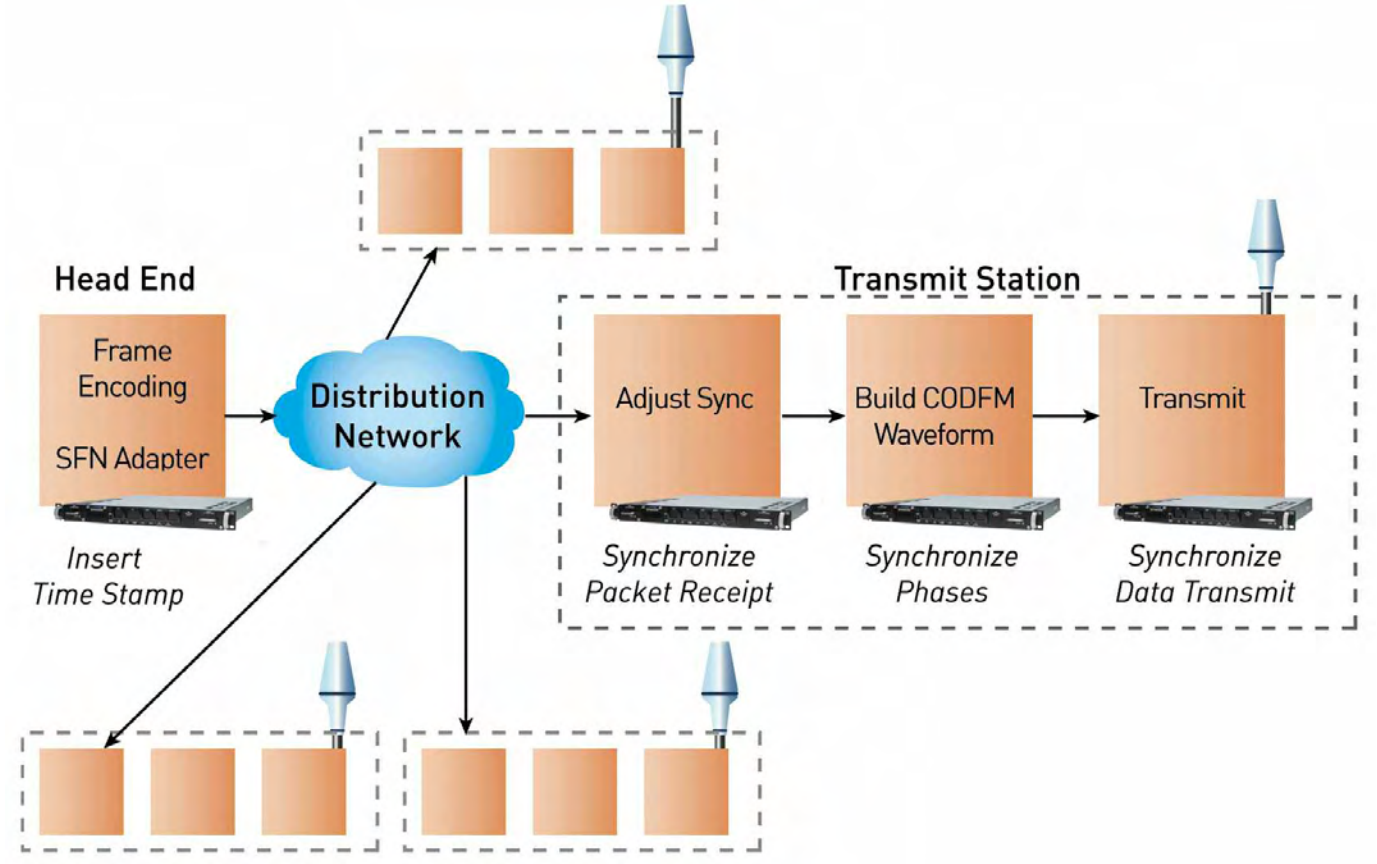
Planners should take into account what happens if GPS reception is lost. That requires a holdover clock that tracks GPS and maintains accuracy if GPS is lost — at least for a day, or longer should operators decide to protect against outages of greater duration. Alternatively, the sync source may also take advantage of other available timing sources, such as E1 networks.

REDUNDANT HOT SWAPPABLE DESIGN

Planners may also want the option to configure two sync sources — one as primary and one as backup — for automatic switchover if the primary fails. Designation of "primary" should depend on which has GPS reception. Even if the primary source goes down, the secondary should still track the primary's GPS receiver if that receiver still functions properly. Redundant GPS receivers are also an option SFN planners may wish to consider. Making devices hot swappable means that technicians can replace modules in a chassis without powering down the system or disrupting the network. For example, network operators can specify dual hot swappable power supplies to further enhance reliability.

SNMP FOR CONFIGURATION AND MONITORING

Technicians in the network operations center will want network-wide visibility to anywhere an out-of-spec condition may occur so they can take immediate action. The ability to monitor alarms and be able to diagnose errors at a glance ensures robust network operation.



4370A DVB SYNC SOURCE MODULES

Symmetricom makes it easy to configure the 4370A DVB Sync Source to meet varying time and frequency requirements. Below is a description of available modules.

10MHz Output Module

The 10MHz output card provides four low phase noise sine wave outputs through four BNC connectors. These outputs are phase locked to the host receiver's disciplined reference oscillator. They are automatically enabled upon initialization and are independently selectable by the user with no configuration setup required.

This option is a hot swap module that can be added or removed from the 4370A without hardware or software modification and without disturbance to the main system.

Outputs are preconfigured at the factory but can be configured by the user via the network SNMP interface.

10MHz OUTPUT SPECIFICATIONS

- Amplitude: 1Vrms into 50 ohms
- Harmonic distortion: <-40dBc
- Accuracy: Function of input synchronization source
- Squelch: When signal accuracy out of specification
- Connector: BNC

1PPS Output Module

The 1PPS output card provides pulse outputs through four BNC connectors. These outputs are phase locked to the host receiver's disciplined reference oscillator. They are automatically enabled upon initialization and are independently selectable by the user with no configuration setup required.

This option is a hot swap module that can be added or removed from the 4370A without hardware or software modification and without disturbance to the main system.

Outputs are preconfigured at the factory but can be configured by the user via the network SNMP interface.

1PPS OUTPUT SPECIFICATIONS

- Level: >2.4V High
<0.8V Low
- Pulse width: <100uS ±10µS
- Rise time: <15nS
- Jitter: <200pS
- Squelch When signal accuracy out of specification
- Connector: BNC

Telecommunications Output Module

The E1 Output provides 2 MHz and 2 Mbit/sec outputs meeting the requirements of ITU-TG.703.10 and ITU-T G.703.6

Oscillator Specifications
The below tables describe the Allan deviation and phase noise performance of the internal OCXO.

OSCILLATOR SPECIFICATIONS

- Allan Deviation ($\sigma(\tau)$)

	OCXO
1s	2E-11
10s	2E-11
100s	2E-11
Holdover	1E-10/day

- Phase Noise (dBc/Hz)

	OCXO
1Hz	-95
10Hz	-125
100Hz	-125
1kHz	-130
10kHz	-140

Power Supply Module

The 4370A can be configured with dual redundant AC or DC hot swap power supply modules. Each module is inserted in the front of the 4370A for easy access.

POWER SUPPLY MODULE SPECIFICATIONS

- AC Power supply module
  - 100 - 240VAC, 45-65Hz
  - Hot swap module
  - Status LED
- DC Power supply module
  - 40.5 - 70VDC
  - Hot swap module
  - Status LED

4370A SPECIFICATIONS

GPS RECEIVER

- TNC Connector Receiver input: 1575.42MHz L1 C/A code
- Tracking: 12 parallel channels
- Acquisition time: Cold start <20 min
- 1PPS output accuracy: UTC(USNO) ±50ns RMS 100ns peak when in fixed position mode, <500ns, 2sigma in 3D mode
- Frequency output accuracy: 1E-11 @ 1 day
- Allan deviation (Locked to GPS)
  - Averaging time
    - 100s: <1E-11
- Holdover
  - OCXO: 1E-10/day

STANDARD INPUT/OUTPUT SIGNALS

- Network Interface: Standard 10/100Base-T RJ-45, 8 pin connector
- Protocols: TCP/IP and SNMP
- 1PPS
  - Level: >2.4V High
<0.8V Low
  - Pulse width: <100uS ±10µS
  - Rise time: <15nS
  - Jitter: <200pS
  - Connector: BNC
  - Squelch: When signal accuracy out of specification
- 10MHz
  - Level: 13dBm ±2dBm
  - Format: Sine wave
  - Harmonic: <-40dBc
  - Impedance: 50Ω
  - Connector: BNC
  - Squelch: When signal accuracy out of specification
- Phase noise (dBc/Hz)

Offset (Hz)	OCXO
1	-95
10	-125
100	-125
1kHz	-130
10kHz	-140

- E1
  - Format: 2MHz per ITU-T Rec. G.703 §10
2Mb/s per ITU-T Rec. G.703 §6
  - Connector: BNC
  - Impedance: 75Ω
  - Squelch: When signal accuracy out of specification

MECHANICAL/ENVIRONMENTAL

- Power
  - Dual redundant supplies
    - 100 - 240VAC, 50-60Hz
    - 40.5 - 70VDC
    - 40W (full loaded chassis)
- Size
  - Height: 1.75"
  - Width: 17.00"
  - Depth: 19.00"
- Weight: Approximately 8.4 kg (18.5 pounds) with two power supplies and six plug-in modules
- Operating temperature: 0°C - 50°C
- Humidity: 0 - 90% non-condensing
- Display: Year, Day, Hour, Minute, Second
Loss of input signal
Unlock
- Optional antenna
  - Size: 3" dia x 3" H
  - Input: N Female to GPS receiver
  - Power: 5VDC
  - Operating temperature: -55°C to +85°C
  - Storage temperature: -55°C to +85°C
  - Humidity: 95% non-condensing
  - Certification: CE

OPTIONS

- Telecommunications interface (2MHz & 2Mb/s outputs)
- Fiber optic interface

Rear View Fully Loaded Chassis

Time & Frequency Distribution

Your Network. Optimized.

When delivering a centralized reference signal to a number of different equipment stations without degrading the signal is critical, Symmetricom offers the largest selection of quality time and frequency distribution receivers, amplifiers and modules in the world.

These products provide accurate centralized reference signals with the best quality, lowest noise and the most uptime to an assortment of communication infrastructures, thereby assuring the highest level of precision and reliability throughout the system.

When used with Symmetricom's GPS receivers, frequency standards and oscillators, our time and frequency modules effectively distribute signals and generate all rates needed for today's complex communication systems, satellite earth stations, test facilities and engineering laboratories.

6502B

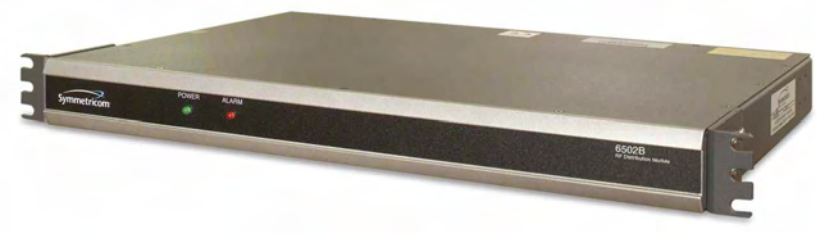
RF Distribution Module

KEY FEATURES

- Low Phase Noise
- High Channel Isolation
- Ten Channel Output Distribution
- Daisy Chain For More Than 100 Outputs
- CE Compliant

The Symmetricom 6502B Distribution Module is a ten channel, RF distribution amplifier packaged in a 1U rack mount chassis. It is comprised of ten, low phase noise RF amplifiers that maintain high channel isolation (>100dB). Up to ten units can be daisy chained together to give up to 100 outputs or each output of one unit can be used as a source for other 6502B units to give almost infinite expansion capability with virtually no signal degradation.

The 6502B standard configuration accepts input frequencies from 0.1MHz to 10MHZ at 1Vrms amplitude and provides ten buffered outputs of the same frequency. Each output and input has an alarm indicator that warns of either a loss of signal or a signal of insufficient amplitude.



6502B RF Distribution Module

6502B SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- RF output (ten)

Frequency:	0.1 to 10 MHz
Level:	1 V rms (nominal)
Gain:	1 (nominal)
Harmonic distortion:	<-40dB
Non-harmonic signals:	<-80dB
Load impedance:	50Ω
Isolation:	>100dB*
Connectors:	BNC

*Isolation between channels one to ten >130dB

- Additive SSB phase noise

(1 Hz Bandwidth)	Offset from carrier
1 Hz	-120dB
10 Hz	-135dB
100 Hz	-145dB
1,000 Hz	-155dB
10,000 Hz	-160dB

- RF input

Frequency:	0.1 to 10 MHz
Level:	1 V rms (nominal)

- Alarm output

Summary alarm indicates failure of any output signal.

Each output & main:	Red LED
Non-alarm condition:	Relay energized (fail safe) C Form contacts
Alarm output disable:	Panel switch
Connector:	9 pin D-male

- Controls & indicators

Power:	Green LED, power is connected
Alarm:	Red LED, signal output failure

Please note: If input level is less than 10dBm specify low alarm threshold version (-509).

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature (operating): 0°C to 55°C
- Relative humidity: 0 to 95%, non-condensing
- Power requirements
  - AC input (±10%): 100 - 120 VAC, <10W
180 - 240 VAC, <10W
  - DC input (optional): 22V to 56 VDC, <10W
- Dimensions
  - Height: 1U (~1.75 inches) (4.44 cm)
  - Width: 19" (48.26 cm)
  - Depth: 12" (30.48 cm)
- Weight: <5 lbs. (2.25 Kg)
- MTBF: >500,000 hrs

ORDERING INFORMATION	Part No.
• 6502B Standard Configuration	14364-101
• 6502B with DC input	14364-102
• 6502B with option 509	14364-104
• 6502B with option 509 and DC input	14364-105
• 6502B without alarm override switch	14364-106

Rear View

4036B

1x15 RF Distribution Amplifier

KEY FEATURES

- Low Phase Noise
- High Channel Isolation
- 15 Outputs
- Yields 225 Outputs at 2nd Level
- LED Status Indicators for All Inputs and Outputs
- Status Information via Ethernet
- Settable Gain
- CE Compliant

Symmetricom's 4036B is a 1-input, 15-output RF distribution amplifier in a 1U chassis. It provides fifteen isolated copies of a single input. The unit operates over a frequency range of 1MHz to 20 MHz. Fault sensing of signal level is provided on the input and every output. Faults are indicated on front panel LEDs as well as via an Ethernet interface.

4036B 1x15 RF Distribution Amplifier

4036B SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- RF Output (15)

Frequency:	1 MHz – 20 MHz
Input level:	0 to 1 V rms (13 dBm)
Gain:	0dB, jumper selectable -1dB, 1dB or 2dB
Input/output impedance:	50Ω
Isolation:	>100 dB
Spurious distortion:	<-80 dBc
Harmonic distortion:	<-40 dBc
Connectors:	BNC female

- Additive SSB Phase noise

1Hz	-135 dBc
10Hz	-145 dBc
100Hz	-155 dBc
1kHz	-163 dBc
10kHz+	-163 dBc

- Status
  - Senses signal presence on all inputs and outputs
  - Green/Red LEDs on Front Panel
  - LED Indicators for 5 MHz, 10 MHz, and Other
  - Network interface
    - Ethernet 10/100 Base T
    - RJ 45 Connector
    - Protocols: TCP/IP, UDP/IP, ARP, Telnet, DHCP, BOOTP, HTTP and AutoIP

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature: 0°C to 50°C
- Humidity: 0 to 95% non-condensing
- Power requirements (AC Input): 90 – 264 V AC, 10W, 47 – 63 Hz
- Dimensions: 1U (~1.75" / 4.44cm) x 19" (48.26cm) x 12" (30.48cm)
- Weight: 9 lbs (4.10 Kg)

ORDERING INFORMATION	Part No.
• 4036B Standard Configuration	TSC 4036B

Rear View

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5087B

Wideband Distribution Amplifier

KEY FEATURES

- 12 Channel Wideband Sine Wave Distribution
- +13 dBm to +22.5 dBm Adjustable Output Power
- Accepts +3 to +22.5 dBm Inputs
- Input AGC Maintains Output Level with Varying Input Level
- High Isolation/Low Cross-talk Between Outputs
- Low Additive Phase Noise
- Front Panel Status Indicators for Health Monitoring at a Glance
- Ethernet Port for Remote Control and Monitoring
- Fault Alarm Output

The 5087B Wideband Distribution amplifier is an economical solution for distributing signals from various frequency standards such as Cesium, Rubidium, Quartz or GPS receivers.

APPLICATIONS

Frequency standards typically have few outputs, each of which drives one load over short distances. When you have many devices requiring frequency reference inputs, or you need to deliver the frequency standard output from one building to another, the 5087B is the right choice.

- **Standards lab** – simultaneous calibration of multiple test equipment.
- **Manufacturing and R&D** – connecting all test equipment in a rack to the same frequency source.
- **Intra-building distribution** – distributing frequency standards from the cal lab to manufacturing and R&D.

High output-to-output isolation and output-to-input isolation keeps the effects of "accidents" from propagating to other channels or upstream to the frequency standard. For example, if an output is accidentally shorted or someone connects an active signal to the output of the distribution amplifier, the effect is minimized on any other output.

FAULT MONITORING

Front panel lights allow you to check status of the amplifier at a glance. Indicators are provided for power, alarm, input, and all 12 outputs.

An alarm occurs whenever there is loss of input signal, or loss of any of the 12 outputs. The alarm signal can be connected to audible or visible alarms, or logically "Ored" to other alarms.

Full remote control and monitoring of the amplifier can be done through the Ethernet port, including checking status and alarm conditions.

5087B Wideband Distribution Amplifier

5087B SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Inputs

Number of inputs:	1
Frequency range:	1 to 10 MHz
Signal type:	Sine wave
Connector:	Rear panel BNC (female) Shield is chassis (earth) ground
Amplitude:	0.3 Vrms to 3 Vrms Automatic Level Control
Impedance:	50Ω nominal
Input status[1]:	Front panel indicator
Damage level:	+24 dBm
VSWR:	<1.5:1

- Frequency outputs[2] (into 50Ω)

Number of outputs:	12
Frequency range:	1 to 10 MHz
Signal type:	Sine wave
Connector type:	Rear panel BNC (female) Shield is chassis (earth) ground
Amplitude[3]:	1 Vrms to 3 Vrms adjustable
Impedance:	50Ω nominal
Harmonics[4]:	<-40 dBc
Spurious 10 Hz - 50 kHz:	<-80 dBc
Channel status[5]:	Front panel indicator

Single sideband additive phase noise (1 Hz bandwidth) 10MHz carrier

Offset frequency	Phase Noise (dBc/Hz)
1 Hz	-110
10 Hz	-123
100 Hz	-128
1 kHz	-144
10 kHz	-150

Isolation[6]

Output to output:	<-104 dBc (typical)
Output to input:	<-100 dBc
VSWR:	< 1.5:1

- Alarm port

Connector type:	BNC
Normal state:	TTL high
Alarm state:	TTL low
Output configuration:	Open-collector, 10k Ohm pull-up to 5 Vdc
Alarm conditions:	Loss of input signal, activation of input alarm, loss of any of 12 frequency outputs.
Status:	Front panel LED

- Remote interface

Data communications:	Ethernet (10 Base T)
Connector type:	RJ-45

ENVIRONMENTAL SPECIFICATIONS

- Temperature

Operating:	0°C to +50°C
Non-operating:	-62°C to + 75°C

- Humidity

Operating:	95% non-condensing, 40°C

- Altitude

Operating:	15,000 ft

- Shock: Meets IEC 60068-2-27 requirements
- Vibration: Meets IEC 60068-2-6 for sinusoidal vibration and IEC 60068-2-64 for random vibration requirements.
- EMC: Meets EN61326-1:2001 Electrical Requirements for Electrical Equipment for Measurement, Control and Laboratory use- Part 1: General Requirements EN 55011 Class A, Radiated Emissions.
- Safety: Meets EN61010-1:2001 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory use- Part 1: General Requirements. UL/CSA Certified product

SUPPLEMENTAL CHARACTERISTICS

- Mechanical characteristics

Net weight:	6.2 kg
Shipping weight:	10 kg
Dimensions	
Height:	90 mm (2U rack)
Width:	450 mm (standard 19-inch rack)
Depth:	364 mm (excluding connectors)

- Power requirements

AC input[7]:	100-240 VAC; 50 to 60 Hz

- Warranty: 1 year, return to Symmetricom

NOTES

1. Input status indicates if input amplitude drops below 0.3 Vrms. It does not indicate signal quality (frequency accuracy or stability) nor wave shape.
2. All outputs are always active. To reduce noise, connect a 50Ω terminator (not supplied with unit) on unused outputs.
3. An ALC circuit on the input amplifier assures output amplitude consistent with desired setting in the range 1 to 3 Vrms, into 50Ω.
4. Assumes harmonic distortion of <-50dBc of input signal.
5. Output channel status indicates if output drops below 0.3 Vrms (+2.6 dBm) at the output BNC connector, not at the end of the attached cable.
6. Output isolation is measured by injecting 900 Hz signal (0.5Vpp about 20us wide) into an output port and measuring the associated phase noise spur at 900 Hz offset on adjacent output ports and input port.
7. Auto sensing AC mains supply. A "power on" LED is located on the front panel.

Rear view

4059B

1x15 Low Frequency Distribution Amplifier (IRIG A/B or G)

KEY FEATURES

- Exceptional IRIG A/B or G Distribution
- High Channel Isolation
- 15 Outputs
- Yields 225 Outputs at 2nd Level
- LED Status Indicators for All Inputs and Outputs
- Status Information via Ethernet
- CE Compliant

Symmetricom's 4059B is a one-input, fifteen-output IRIG Distribution Amplifier in a 1U, 19 inch rack mount chassis. It provides fifteen isolated (>70 dB) outputs from a single input. This unit is ideal for distributing IRIG A/B or G. An Ethernet port on the rear panel provides the capability to remotely monitor the status of the input and all output signals. Any failure in the unit will immediately provide an alarm to this port. The front panel provides green LED status for the input and green/red for all output signals, as well as indicating an input of 1 kHz, 10 kHz, or other. A green LED on the front panel also provides power status.

4059B 1x15 Low Frequency Distribution Amplifier (IRIG A/B or G)

4059B SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Time code input and outputs (15)

Code format:	Any
Modulation frequency:	1 – 100 kHz
Modulation ratio:	Any
Amplitude:	<6 V P-P
Output isolation:	>70 dB
Gain:	0 dB
Input impedance:	Jumper Selectable 50 ± 5Ω or 10k ± 100Ω
Output impedance:	50 ± 5Ω

- Status

  Senses signal presence on all inputs and outputs
  Green/Red LEDs on Front Panel
  LED Indicators for carrier frequency – 1 kHz, 10 kHz, and Other
  Network (RJ-45 connector)

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature: 0°C to 50°C
- Humidity: 0 to 95% non-condensing
- Power requirements (AC Input): 90 – 264 V AC, 10W, 47 – 63 Hz
- Dimensions: 1U (~1.75" / 4.44cm) x 19" (48.26cm) x 12" (30.48cm)
- Weight: 9 lbs (4.10 Kg)

ORDERING INFORMATION	Part No.
• 4059B Standard Configuration	TSC 4059B

Rear View

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4033A

1x15 Pulse Distribution Amplifier 5V Output

KEY FEATURES

- Detects 1PPS, IRIG-B, or Other
- Compact Rack Mount 1U-High Package
- ±500ps Differential Delay Between Outputs
- LED Status Indicators for All Inputs and Outputs
- Status Information via Ethernet
- CE Compliant

Symmetricom's 4033A is a one-input, fifteen-output pulse distribution amplifier in a 1U, 19-inch rack mount chassis. It provides fifteen isolated outputs from a single input. An Ethernet port on the rear panel provides the capability to remotely monitor the status of the input and all output signals. Any failure in the unit will immediately provide an alarm to the Ethernet port. The front panel provides green LED status for the input and green/red for all output signals, as well as indicating an input of 1PPS, DC IRIG, or Other.

4033A 1x15 Pulse Distribution Amplifier 5V Output

4033A SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- 1PPS Output (15)

Output impedance:	50 ±5Ω
Load impedance:	50Ω
Logic one:	4.5 V minimum
Logic zero:	+0.8 V maximum
Rise time:	<2.0 ns
Fall time:	<2.0 ns
Jitter:	<50 ps rms
Skew between outputs:	<±2 ns
Connectors:	BNC female

- 1PPS Input

Repetition rate:	1PPS – 1MPPS
Duty cycle:	0 – 50%
Input impedance:	50Ω
Logic one:	>2.4 V
Logic zero:	+0.8 V maximum
Connector:	BNC female

- Status

  Senses signal presence on all inputs and outputs
  Green/Red LEDs on Front Panel
  LED Indicators for 1PPS, DC IRIG, and Other
  Network (RJ-45 connector)

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature: 0°C to 50°C
- Humidity: 0 to 95% non-condensing
- AC Input: 90 – 264 V AC, 10 W, 47 – 63 Hz
- Dimensions: 1.75" (4.44 cm) H x 19" (48.26 cm) W x 12" (30.48 cm) D
- Weight: 9 lb (4 kg)

ORDERING INFORMATION	Part No.
• 4033A Standard Configuration	TSC 4033A

Rear View

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9611

Switch & Distribution Unit

KEY FEATURES

- Automatic Selection of Redundant Signal Inputs
- Twelve Signal Outputs
- Flexible Signal Configuration
- RS-232/422 Control Port
- Up To 32 Units on One Common Control Port
- CE Compliant

Symmetricom's 9611 Switch & Distribution Unit is an intelligent switching, monitoring and distribution system, packaged in a 1U rack mount chasis. It includes a dual input A-B switch that provides a powerful redundant capability.

The internal microprocessor can be set up to switch on a number of critera (i.e., voltage level and period detection). Internally, the unit can be configured to direct selected signals to up to twelve independently buffered outputs. Each output can be set for internal monitoring of the output signals. In addition, each output system can be set up as a signal monitor. Any single-ended type signal can be connected to any output line and that line can be configured to simply monitor the signal. The input signal can be connected to any output buffer for additional distribution of the input signal.

The internal microprocessor is controlled, configured and monitored by means of an RS-232 input/output port. Switch status as well as output status is reported on the front panel for immediate feedback of information to the operator as well as via the RS-232 port. A second connector on the rear panel allows up to thirty-two units to be daisy-chained and controlled via a single serial port on the computer.

This universal and highly versatile instrument is unequalled in the industry. No other low cost system offers these capabilities in a single product.

9611 Switch & Distribution Unit

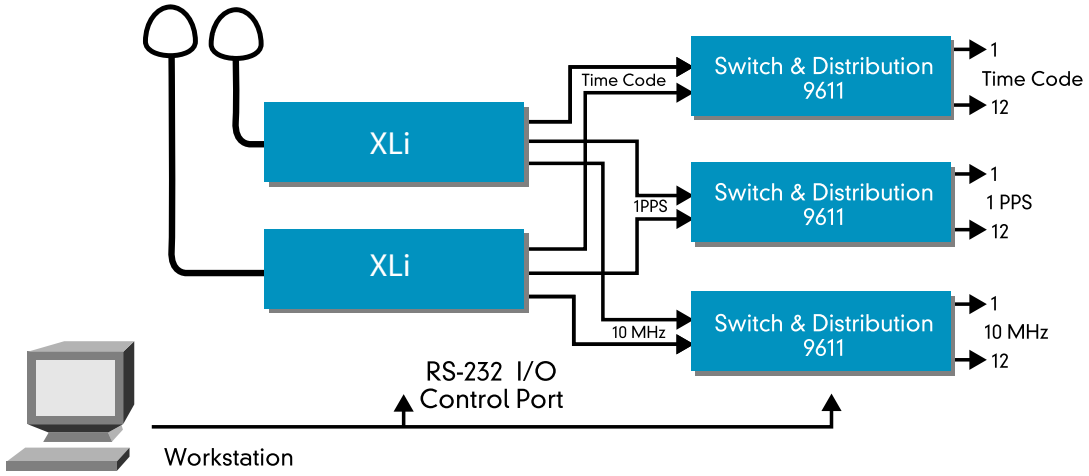
9611 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Output levels: 0-6 volts p-p, DC-10 MHz (3 volts p-p above 5 MHz)
- Output impedance: (selectable) 10Ω, 50Ω or 600Ω
- Input levels: 0-6 volts p-p, DC-10 MHz
- Input impedance: 50Ω or 1K, selectable
- Time period selection
  - Range: 300 ns to 100 seconds in decade steps
- Distortion: Total harmonic at 10MHz, 3 V P-P into 50Ω
  Less than 0.5% (-40 dB)
  Spurs less than 60 dBc above 1KHz
- Phase noise (-dBVrms/÷Hz): At 10MHz, 3 V P-P into 50Ω when using channel A or B as input
  Less than 102 @ 1Hz
  Less than 125 @ 10Hz
  Less than 140 @ 100Hz
  Less than 145 @ 1KHz
  Less than 150 @ 10KHz
  Less than 160 @ 100KHz
  Spurs less than -120 dB @ 1KHz
- Crosstalk: Channel B into Channel A, less than 40dB at 10MHz.
- Reverse isolation: Channel 1 through 12 to any other channels 1 through 12, less than 60dB at 10MHz.
- Hum noise levels: Less than -70dB

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature
  - Operating: 0ºC to 50ºC
  - Non-operating: -40ºC to +70ºC
- Humidity (non-condensing)
  - Operating: 10% to 90%
  - Non-operating: 5% to 95%
- Altitude
  - Operating: 0 to 25,000'
  - Non-operating: 0 to 40,000'
- Power requirements
  - AC input: 120 or 230 V AC, <10W
- Dimensions
  - Height: 1U (~1.73") (4.39 cm)
  - Width: 19" (48.26 cm)
  - Depth: 13" (32.02 cm)
- Weight: ~7.5 lbs. (3.37 Kg)



Working Diagram

Rear View

4091A

1U RF Autosense Fault Switch and Distribution Amplifier

KEY FEATURES

- HOT SWAP Power Supply
- 1-20 MHz Operation
- Eight Signal Outputs
- Manual Override
- Remote Control via Ethernet
- CE Compliant

OPTIONAL FEATURES

- Redundant AC Power

The 4091A is a 1U rackmount fault sense switch that accepts two RF inputs and produces eight outputs (chosen from the two inputs). The unit comes standard with a single HOT SWAP AC power supply and can be configured with redundant HOT SWAP AC power supplies. It has LED indicators that display the selected input as well as a control switch that is used to manually operate the switch or place the switch in "auto" mode. When in "auto" mode, the unit automatically switches upon failure of the selected input. In addition to front panel control, the unit can be controlled remotely via the Ethernet port on the rear of the unit.

4091A 1U RF Autosense Fault Switch and Distribution Amplifier

4091A SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- RF Input (2)

Frequency:	1 - 20 MHz
Level:	1 V RMS nominal into 50Ω
Connectors:	BNC female
Control:	Locking Toggle

- RF Output (8)

Connectors:	BNC female
Gain:	1.0 +/- 10%
Harmonics:	<-40 dBc
Spurious:	<-80 dBc

- SSB Phase noise

1 Hz	-135 dBc
10 Hz	-145 dBc
100 Hz	-155 dBc
1 kHz	-163 dBc
10 kHz +	-163 dBc

- Control & status

  Switch between inputs
  Set to autoswitch on input failure
  Signal presence on all inputs and outputs
  Green/Red LEDs on Front Panel
  Network (RJ-45 connector)

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature: 0°C to 40°C
- Humidity: 0 to 95% non-condensing
- Power requirements (AC Input): 90 – 264 V AC, 10W, 47 – 63 Hz
- Dimensions: 1U (~1.75" (4.44cm) x 19" (48.26cm) x 12" (30.48cm)
- Weight: 12 lbs (5.40 Kg)

ORDERING INFORMATION	Part No.
• 4091A with Single AC Power	TSC 4091A
• 4091A with Redundant AC Power	TSC 4091A-01

Rear View

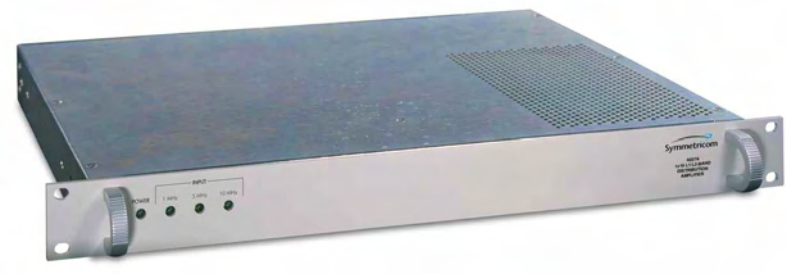
4037A

1x16 L1/L2-Band Distribution Amplifier

KEY FEATURES

- Exceptional L1/L2-Band Distribution
- 16 Outputs
- LED Status Indicators for Power
- CE Compliant

Symmetricom's 4037A is a one-input, sixteen-output L1/L2-Band amplifier in a 1U, 19 inch rack mount chassis. It provides sixteen isolated (>15 dB) outputs from a single input. This unit is ideal for distributing GPS antenna signals. The front panel provides green LED status for the power and antenna bias voltage setting.



4037A 1x16 L1/L2-Band Distribution Amplifier

4037A SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Input and outputs (16)

  TNC Connectors

Frequency:	L1/L2-Band
Output isolation:	>15 dB
Gain:	0 dB
Impedance:	50 ± 5Ω

- Status

  Green LEDs on Front Panel
  LED Indicators for Power, Antenna Power (5 V,12 V or None)

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature: 0ºC to 50ºC
- Humidity: 0 to 95% non-condensing
- Power requirements (AC Input): 90 – 264 V AC, 10 W, 47 – 63 Hz
- Dimensions: 1U (~1.75" / 4.44cm) x 19" (48.26cm) x 12" (30.48cm)
- Weight: 9 lbs (4.10 Kg)

ORDERING INFORMATION	Part No.
• 4037A Standard Configuration	TSC 4037A

Rear View

56000

Modular Time & Frequency Distribution System

KEY FEATURES

- Frequency Generator and Distribution
- Time Codes Generator and Distribution
- Up to 3 External Redundant References
- All Modules are Hot Swappable with Easy Plug & Play Operation
- Completely Redundant System
- Monitoring Capability of All Inputs and Outputs
- Network-Based Management
- Powerful SNMP Interface
- User-Friendly HTML Interface
- 16 Module Slots with Up to 6 Independently Programmable Outputs Per Module
- Copper and Optical Fiber Optics for Inputs / Outputs
- Front LEDs Status Indicators on All Modules
- External T1 Reference Input

MAJOR APPLICATIONS

- Communication Systems
- Encryption & Decryption
- Station Clock CDS10 & CDS20 Replacements
- Earth Station and Mobile Station SATCOM
- Distribution of Specialized Signals
- Secure Frequency Agile
- Any Applications Requiring Precise E1/T1 Frequencies

Symmetricom's 56000 is a versatile Data Rate Clock (DRC) and Distribution System supporting an extensive variety of input references, oscillators, output frequencies, input/output interface styles, powerful network based management tools, and complete power supply plans. The modular architecture supports various clock rates and frequencies required in today's sophisticated communications applications.

The 56000 backplane can accept 1, or 10 MHz; IRIG B time code; and any TTL signal from DC to 10Mbps. Multiple redundant external frequency references can be applied to a hitless switch (passive combiner) located on each frequency synthesizer circuit card. The hitless switch provides a glitch-free transition from one input source to another, ensuring reliable and disturbance-free outputs, even in the event of failure of one of the input sources. The frequency reference inputs can be replaced or enhanced by an on-board oscillator circuit card or an on-board GPS timing receiver. The oscillators are disciplined to either the input frequency or GPS. Using the oscillators in combination with external reference inputs provides various levels of redundancy. The oscillators also add holdover capability so that uninterrupted operation is maintained in the event of total failure of the reference input(s).

Model 56000 outputs can include distributed or generated clock signals, frequencies, Network Time Protocol, and IRIG B time code. N.1 clock rate generation from 1Hz to 25MPPS in 1PPS steps is available in addition to N.8 clock rate generation from 8 KPPS to 8.192 MPPS in 8KPPS steps. Also available is a Telecommunications Interface that provides a variety of outputs and alarms common in today's telecommunications applications. The chassis is configured with front and rear plug-in cards. The front panel plug-in circuit cards perform the modular rate generation and distribution functions and are hot swappable. The rear panel interfaces are also implemented using plug-in cards with a wide variety of connector types and styles. Of the 21 card slots available, four are reserved for the power supply(s), and the balance can hold almost any combination of available circuit cards. The basic chassis includes power supply, power input module, fault monitoring CPU and a CPU interface module. There are 16 available card slots for the various synthesizer/ distributor cards. Additional 56000 systems can be daisychained using an optional on-board fiber optics transmitter and receiver pair. Large networks of time-frequency distribution can be constructed using the fiber optics link.

56000 Modular Time & Frequency Distribution System

56000 PRODUCT LIST

FREQUENCY SYNTHESIZERS

- N.1PPS to 25MPPS in 1Hz steps, 6 independently programmable outputs
- N.8 8 kPPS to 8192 kPPS in 8 kPPS steps, 6 independently programmable outputs
- 1-5-10 MHz, 6 sine wave outputs
- 1-5-10 MHz, 6 RS-422 or TTL outputs

TELECOMMUNICATIONS INTERFACE

There are six modules per individual Telecommunications Interface board. To use the Telecommunications Interface, select any combination of up to six submodules listed below.

- Alarm relay: User-selectable major and minor alarms
- Composite clock
- Sine wave output: User-programmable frequencies: 1.544 MHz, 2.048 MHz
- Single-ended square wave output: User-programmable frequencies: 8 kPPS, 64 kPPS, 1.544 MPPS, 2.048 MPPS
- AMI output: User-programmable frequencies: 1.544 MHz,2.048 MHz
- RS-422 Square wave output: User-programmable frequencies: 8 kPPS,64 kPPS,1.544 MPPS,2.048 MPPS

DISCIPLINED OSCILLATORS

TCXO, Quartz, High-Stability Quartz, Rubidium

NETWORK TIME SERVER

Supports the network time protocol for the time synchronization of clients over the Ethernet.

TIME CODE GENERATOR

- IRIG B generator
- Synchronized generator
- 6 outputs

GPS REFERENCE MODULE

Provides 40 ns rms (100 ns peak)timing accuracy to UTC.

TELECOMMUNICATIONS REFERENCE MODULE

Synchronizes frequency to a reference T1 or E1 input signal.

NETWORK INTERFACE CARD

10/100 base T Ethernet card Provides network based access to CPU with Telnet, powerful SNMP interface, FTP (for firmware upgrade), DHCP and browser based HTML interface.

DISTRIBUTION

- Six channel analog amplifier
- Six channel digital amplifier

INPUT/OUTPUT BOARDS

- Six channel output cards
  - BNC connectors
  - Wirewrap connectors
  - Twinax connectors
  - DB-25 connector
  - RJ-11 connectors
- Passive Bus Input Interface: BNC connectors
- Network Time Server Interface (AUI Connector)
- CPU I/O Interface
  - 2 reference inputs,2 status inputs
  - 3 status inputs
  - 2 timing inputs,2 status inputs
  - 2 alarm outputs,status input
  - All CPU I/O modules come with RS-232/422 interface for external access to CPU

FIBER OPTICS (ST CONNECTORS)

- Input/output
- AC outputs
- DC outputs
- IRIG B TX/RX

CHASSIS CONFIGURATIONS

- Single 90 –264 Vac power supply
- Dual 90 –264 Vac power supplies
- Single -48 Vdc ±20%power supply
- Dual 90 –264 Vac/-48 Vdc
  - ±20% power supplies

56000 SPECIFICATIONS

MECHANICAL/ENVIRONMENTAL

- Dimensions: 19" W x 5.22" H x 14" D (48 cm x 13 cm x 36 cm)
- Weight: Approximately 13 lbs. (6 kg)
- Operating temperature: 0°C to +50°C
- Storage temperature: -40°C to +85°C
- Humidity: To 95% relative, noncondensing
- Cooling mode: Convection
- Certifications:* UR, FCC, CE, C-UR

* Contact Symmetricom for specific module certifications.

Rear View

Precision Frequency References

Your Network. Optimized.

Symmetricom's hydrogen, cesium and rubidium standards, and quartz oscillators have supported more military communications, satellite ground stations, and test & measurement applications than any other precision frequency references in the world. Approximately 90% of the total weighting of all cesium clocks that contribute to the international timescale are ours, giving substance to our claim that the world runs on Symmetricom time.

Our precision frequency references are the result of many years of research and development performed in the areas of atomic physics, electronics engineering and software design. This has resulted in precision frequency standards that deliver exceptional performance and unsurpassed accuracy, stability and reliability in the most challenging of environments.

We design and manufacture our own physics packages, in which a resonance in the hydrogen, cesium or rubidium atom is used as the basis for the stability and accuracy of an output reference signal. We also design and manufacture the supporting electronics, software and packaging for our products.

Your Network. Optimized.

Cesium Product Matrix

CsIII

Cs-4000

5071A

	CsIII	Cs4000	5071A
Accuracy (standard perf./high perf.)	<1E-12 / N/A	<1E-12 / N/A	<1E-12 / <5.0E-13
Stability (10S)(standard perf./high perf.)	<8.5E-12 / N/A	<8.5E-12 / N/A	<8.5E-12 / <3.5E-12
Stability (flicker floor) (standard perf./high perf.)	<5E-14 / N/A	<5E-14 / N/A	<5E-14 / <1E-14
Phase noise 1 Hz offset	-95 dBc (5 MHz)	-95 dBc (5 MHz)	-106 dBc (5 MHz)
RF outputs (sine)	2 total	6 total	4 total
1 MHz	0	1	1
5 MHz	1	2	1
10 MHz	1	2	1
100 kHz	0	1	1
TTL output (10 MHz)	1	optional	N/A
1PPS output	1	3	3
Custom outputs	N/A	optional	N/A
1PPS sync input	1	2	2
Operating voltage	AC/DC	AC/DC	AC/DC
Battery backup	N/A	optional	standard
Time of day	N/A	optional	standard
Warranty electronics/tube	2 yr./12 yr.	2 yr./12 yr.	2 yr./12 yr.
Warranty electronics/high perf. tube	N/A	N/A	2 yr./5 yr.
Ethernet interface	N/A	standard	N/A
RS-232 control and monitoring	standard	standard	standard
Monitor 3 software	standard	standard	N/A
Telecom synthesizer T1/E1	optional	optional	N/A
Front panel interface	N/A	optional	standard
Portability kit	optional	N/A	N/A
Dimensions	19" x 15" x 3.5"	19" x 21" x 5.2"	19" x 21" x 5.2"
Weight	<30 lbs.	<50 lbs.	<70 lbs.
MTBF	>130,000 hours	>145,000 hours	>160,000 hours

5071A

Primary Frequency Standard

KEY FEATURES

- Menu-driven Operation
- Easy-to-read Clock and Message Displays
- Complete Status Information
- Automatic Logging of Major Internal Events
- Full Clock and Frequency Control
- Automatic Synchronization of 1PPS Signal
- CE Compliant

KEY SPECIFICATIONS

- Standard Long-Life Cesium Beam Tube
  - Accuracy: $\pm 1 \times 10^{-12}$
  - Environmental Stability: $\leq 1 \times 10^{-13}$ Frequency Change for Any Combination of Environmental Conditions
  - Long-Term Stability: $\leq 5 \times 10^{-14}$ for 5-Day Averaging Time
- Optional High-performance Tube
  - Accuracy: $\pm 5.0E^{-13}$
  - Environmental Stability: $\leq 8 \times 10^{-14}$ Frequency Change for Any Combination of Environmental Conditions
  - Long-Term Stability: $\leq 1.0 \times 10^{-14}$ for 5-Day Averaging Time

The 5071A primary frequency standard has the accuracy and stability you need for both laboratory and field applications. A stability specification for 30-day averaging time means the 5071A will keep extremely predictable time and phase for long periods. Further, the 5071A can be used for long-term averaging of noisy signals such as GPS.

The 5071A is easy to use. No more manual start-up steps or complicated adjustments—everything is automatic. A logical menu structure simplifies front panel operations, selections, and status reporting. Remote control features tailor the 5071A for complete operation and manageability in virtually any location.

The 5071A is a direct descendant of and replacement for the veteran 5060A, 5061A and 5061B cesium standards. This innovative product is the result of more than 35 years of experience in the precision frequency standard business.

5071A—MEETING THE NEEDS OF LEADING-EDGE METROLOGY AND CALIBRATION LABS

Timekeeping and National Standards Laboratories verify the stability and accuracy of their in-house cesium standards to Coordinated Universal Time (UTC), provided by the Bureau International des Poids et Mesures (BIPM) in Paris. A standard's accuracy and reliability determine the quality of service these timekeeping labs provide. Of even greater concern is the stability of a standard. Stability directly affects a laboratory's ability to deliver timekeeping and calibration services to its clients.

The 5071A offers exceptional stability and is the first cesium standard to specify its stability for averaging times longer than one day. The instrument takes into account environmental conditions that can heavily influence a cesium standard's long-term stability. Digital electronics continuously monitor and optimize the instrument's operating parameters.

5071A Primary Frequency Standard

Thus, the 5071A's response to environmental conditions such as temperature and humidity are virtually eliminated. The 5071A primary frequency standard maintains its accuracy and stability, even in unstable environments.

SATELLITE COMMUNICATIONS

Stable frequency generation is required to transmit and receive signals properly between ground terminals and communication satellites. Frequency flexibility is also needed to adjust for satellite-to-satellite carrier-frequency differences. The 5071A's state-of-the-art technology produces offset and primary frequencies with the same guaranteed stability.

For secure communications, precise timing synchronization ensures that encrypted data can be recovered quickly. Frequency-agile signals also require exact synchronization between transmitter and receiver during channel hops.

The 5071A automates the synchronization to any external 1PPS signal, greatly simplifying this aspect of satellite communications.

THE 5071A AND GPS

The 5071A primary frequency standard can work very well with a GPS timing receiver to produce and maintain highly accurate time and frequency.

The GPS system provides accurate time, frequency, and location information worldwide by means of microwave radio broadcasts from a system of satellites. Timing accuracy for the GPS system is based, in large part, on the accuracy and stability of a number of 5071A primary frequency standards. These standards are maintained by the GPS system, the US Naval Observatory, and various timing laboratories around the world which contribute to UTC, the world time scale.

Because of their accurate time reference, GPS signals processed by a good GPS timing receiver, can provide highly accurate time and frequency outputs. However, since GPS receivers rely on very low level microwave signals from the satellites, they sometimes lose accuracy because of interfering signals, local antenna problems, or bad satellite data.

In spite of these problems, a GPS timing receiver can be an excellent backup and reference to a local 5071A primary frequency standard. The GPS receiver provides an independent reference that can be used to verify the accuracy of a caesium standard, or it can be used as a temporary backup should the caesium standard need repair. The local 5071A standard has better short-term stability, better output signal quality, and is not perturbed by interfering signals, intermittent signal loss, or bad satellite data.

With these characteristics, the synergy created by combining a good quality GPS timing receiver and a 5071A primary frequency standard can produce a highly robust, inexpensive, and redundant frequency and time system.

EXCEPTIONAL ACCURACY

The intrinsic accuracy of the improved cesium beam tube assures that any high-performance 5071A will power up to within ±5.0E-13 of the accepted standard for frequency. This is achieved under full environmental conditions in 30 minutes or less—and without the need for any adjustments or alignments.

UNSURPASSED STABILITY

The 5071A high-performance cesium beam tube guarantees stability to be better than 1 part in 10^{14} for averaging times of five days or greater. The 5071A is the first cesium standard to specify stability for averaging times longer than $1x10^{5}$ seconds (approximately one day).

The 5071A is also the first cesium standard to specify and guarantee a flicker floor. Flicker floor is the point at which the standard's stability (σ_y (2, τ)) does not change with longer averaging. The high-performance 5071A Flicker floor is guaranteed to be 1 part in 10^{14} or better. Long-term measurements at the National Institute of Standards and Technology (NIST) show that the flicker floor is typically better than $5x10^{-15}$.

Unstable environments are normal for many cesium standard applications. The 5071A features a number of microprocessor-controlled servo loops which allow it to virtually ignore changes in temperature, humidity, and magnetic fields.

The 5071A delivers exceptional performance over very long periods of time, greatly increasing the availability of critical time and frequency services. Actual measurements made at NIST have demonstrated that a 5071A with the High- Performance CBT will drift no more than $5x10^{-14}$ over the entire life of the CBT.

TRADITIONAL RELIABILITY

The 5071A has demonstrated an average mean time between failures (MTBF) of greater than 160,000 hours since its introduction in 1992. This data is based on actual field repair data. Backing up this reliability is a 12-year warranty on the Standard Long-Life Cesium Beam Tube and a five-year warranty for the highperformance tube.

Complete repair and maintenance services are available at four strategically located service centers worldwide.

FULL TRACEABILITY TO NIST

Symmetricom provides NIST traceability to the accuracy measurements made on every 5071A. Traceability to NIST is maintained through the NIST-supplied Time measurement and analysis system (TMAS). This service exceeds the requirements of MIL-STD-45662A and can be a valuable tool in demonstrating traceability to your customers.

STRAIGHTFORWARD OPERATION

Internal microprocessor control makes start-up and operation of the 5071A extremely simple. Once connected to an ac or dc power source, the 5071A automatically powers up to its full accuracy specifications. No adjustments or alignments are necessary during power-up or operation for the life of the cesium tube.

An intuitive menu structure is accessible via the front panel LCD display and keypad. These menus—Instrument State, Clock Control, Instrument Configuration, Event Log, Frequency Offset and Utilities—logically report status and facilitate control of the instrument. These functions are described below.

Instrument State
Overall status is displayed, including any warnings in effect. Key instrument parameters such as C-field current, electron multiplier voltage, ion pump current, and cesium beam tube oven voltage are available. You can initiate a hard copy report of this data on your printer with the push of a button.

Clock Control
Set the time and date, schedule leapseconds, adjust the epoch time (in 50-ns steps), and automatically synchronize the 1PPS signal to within 50 ns of an external pulse using this menu.

Instrument Configuration
Set the instrument mode (normal or standby) and assign frequencies (5 or 10 MHz) to the two independently programmable output ports; configure the RS-232C data port.

Event Log
Significant internal events (power source changes, hardware failures, warning conditions) are automatically recorded with the time and date of their occurrence. A single keystroke produces a hard copy on your printer for your records.

Frequency Offset (Settability)
Output frequencies may be offset by as much as 1 part in 10^9 in steps of approximately 6.3 parts in 10^{15}. All product stability and output specifications apply to the offset frequency.

Utilities
The firmware revision level and cesium beam tube identification information can be displayed.

HIGH-PERFORMANCE CESIUM BEAM TUBE

The 5071A high-performance cesium beam tube is optimal for the most demanding operations. The high performance tube offers a full-environment accuracy specification of ±5.0E-13—two times
better than the specification for the standard tube. Stability is also significantly improved. The high-performance tube reaches a Flicker floor of $1x10^{-14}$ or better, and long-term measurements at NIST show that the flicker floor is typically better than $5x10^{-15}$.

INTEGRATED SYSTEMS AND REMOTE OPERATION

Today, cesium standards are often integrated into telecommunication, satellite communication, or navigation systems as master clocks. To accommodate these environments, the 5071A provides complete remote control and monitoring capabilities. Instrument functions and parameters can be interrogated programmatically.

Communication is accomplished via the standard commands for programmable instruments (SCPI) language and a dedicated RS-232C port. Also, a rear panel logic output can be programmed to signal when user-defined "abnormal" conditions exist.

For uninterruptible system service, an internal battery provides 45 minutes of backup in case of ac power failure. Thus, the 5071A can be managed easily even in the most remote locations.

Rear View

5071A SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Frequency outputs

Frequency	5MHz & 10MHz[1]
Format	Sine
Amplitude	≥1Vrms
Harmonic	≤-40dBc
Non harmonic	≤-80dBc
Connector	N
Load impedance	50Ω
Location	rear panel
Isolation between ports	≥110dB (typical)
Frequency	100kHz & 1MHz
Format	Sine
Amplitude	≥1Vrms
Harmonic	≤-40dBc
Load impedance	50Ω
Location	rear panel
Connector	BNC

- Timing outputs

Format	1PPS
Amplitude	≥2.4V into 50Ω (TTL Compatible)
Pulse width	20us
Rise time	≤5ns
(slew rate >10^{9} volts/second at 1.5V)	
Jitter	≤1ns rms
Connector	BNC
Load impedance	50Ω
Location	One front panel Two rear panel Timing Inputs
Automatic synchronization to within 50ns of reference pulse	
Sync input	(2) 1PPS
(each may be independently armed)	
Amplitude	+2 to +10V Max
Pulse width	100nS min to 100us max
Rise time	≤50ns
Jitter	≤1ns rms
Connector	BNC
Load impedance	50Ω
Location	One front panel One rear panel
Manual sync	
Range	-0.5 to +0.5s
Resolution	50ns

Remote System Interface and Control

RS-232-C (DTE Configuration)
Complete remote control and interrogation of all instrument functions and parameters

Software command set:	Standard Commands for Programmable Instruments (SCPI), version 1990.0 adapted for RS-232C
Connector	9-pin male rectangular D subminiature type
Location	rear panel
Alarm (TTL)	BNC
Output	TTL High, normal TTL low, fault

Circuit is TTL open collector with internal pull-up resistor. Circuit can sink up to 10mA

Location	rear panel

- Accuracy and long term stability

Conditions - and any combination of

Temperature	0°C to 50°C
Humidity	0 to 85% (40°C max)
Magnetic field	dc, 55, 60Hz, 2G peak any orientation
Shock and vibration	100-mm drop

	Standard Performance	High Performance
Accuracy	±1.0E-12	±5.0E-13
Frequency change vs environment	±1.0E-13	±8.0E-14
Warm-up time (typical)	30 Min	30 Min
Reproducibility	±1.0E-13	±1.0E-13
Settability		
Range	±1.0E-9	±1.0E-9
Resolution	6.3E-15	6.3E-15
Control:	Via RS-232 port	

- Stability

Avg. Time (s)	Standard Performance Allan Deviation	High Performance Allan Deviation
0.01	≤7.5E-11	≤7.5E-11
0.1	≤1.2E-11	≤1.2E-11
1	≤1.2E-11	≤5.0E-12
10	≤8.5E-12	≤3.5E-12
100	≤2.7E-12	≤8.5E-13
1,000	≤8.5E-13	≤2.7E-13
10,000	≤2.7E-13	≤8.5E-14
100,000	≤8.5E-14	≤2.7E-14
5 days	≤5.0E-14	≤1.0E-14
30 days	≤5.0E-14	≤1.0E-14
Flicker floor		
Guaranteed	≤5.0E-14	≤1.0E-14
Typical	≤1.5E-14	≤5.0E-15

SSB Phase noise

Offset (Hz)	10MHz Output	5MHz Output
1	≤-100dBc	≤-106dBc
10	≤-130dBc	≤-136dBc
100	≤-145dBc	≤-145dBc
1,000	≤-150dBc	≤-150dBc
10,000	≤-154dBc	≤-154dBc
100,000	≤-154dBc	≤-154dBc

ENVIRONMENTAL AND PHYSICAL SPECIFICATIONS

- General environment

Temperature	
Operating	0°C to 55°C
Non-operating	-40°C to 70°C
Humidity	0 to 95%RH (45C max)
Magnetic field	dc, 55, 60Hz 0 to 2 gauss peak - any orientation
Atmospheric pressure	≤1E-13 change in frequency for pressure down to 19kPa (equivalent to an altitude of 12.2km)
Shock and vibration	
Mil-T-28800D, Type III, class 5	
Hammer Blow Shock Test, Mil-S-901C, Grade A, Class 1, Type A	
Mile-STD, 167-1 (phase noise)	
EMI:	Conducted and radiated emissions per CISPR 11/EN 55011, Group 1, Class A
EMC:	per MIL-STD-461C, Part 7, Class B dc magnetic field up to 7.8 Gauss

AC Power requirements

Operating voltage	100, 120 Vac ±10%, 45 to 440 Hz 220, 240 Vac ±10%, 45 to 66 Hz
Frequency	45 to 440Hz 45 to 66Hz
Power	
Operating	50W (Standard Performance) 58W (High Performance)
Warm-up	100W

DC Power requirements

22 to 42 VDC

Operating	45W (Standard Performance) 50W (High Performance)
Warm-up	85W
Internal Standby battery	
Capacity	45 minutes from full charge
Charge time	16 hours max from fully discharged state
Charge source	ac input power supply

Dimensions/weight

Height	133.4 mm
Width	425.5 mm
Depth	523.9 mm
Weight	30 kg
MTBF	>160,000 hrs.

[1] Each output can be set to either 5 or 10MHz from the front panel or by remote control.

[2] Lifetime accuracy (high-performance CBT only) after a minimum two-month warm-up. Change no more than 5.0E-14 for the life of the CBT.

ORDERING INFORMATION	Part No
High Performance Tube	5071A-C001
Standard Performance Tube	5071A-C002
High Performance Tube with 48 VDC Option	5071A-C007
Standard Performance Tube with 48 VDC Option	5071A-C008

Cs4000

Cesium Frequency Standard

STANDARD FEATURES

- Multiple RF Outputs
- CsIII Technology
- AC & DC Inputs
- Internal Battery Back-up
- Color Touch Panel User Interface
- Ethernet Interface
- CE Compliant

OPTIONAL FEATURES

- T1/E1 Outputs
- No Touch Panel User Interface
- 24VDC Input
- Custom Outputs Available

The Symmetricom Cs4000 is a new cesium frequency standard platform that provides exceptional performance in a configurable 3U rack mount chassis. The Cs4000 is designed for high precision timing and frequency applications requiring high stability, low noise RF and 1PPS reference signals. Symmetricom's advanced Cesium III digital technology is the engine that drives this exceptional performance.

The Cs4000 includes a new color front panel Graphical User Interface (GUI) that provides easy to use monitoring and control of the instrument. All functional control of the cesium and optional output cards are managed via the front panel GUI. The GUI is a touch panel LCD screen that provides easy at a glance access to cesium health, control and configuration data. Remotely, you now have two methods of interfacing with the Cs4000. A new Ethernet interface provides monitoring capability via an embedded web page server. Both static IP and DHCP are supported. The Cs4000 also provides an RS-232 port that allows the user comprehensive monitor and control access via ASCII commands or via Symmetricom's Monitor 3 windows based utility program.

The Cs4000 is designed to provide standard and custom output signal formats. The standard outputs include, 100kHz, 1, 5, 10MHz and 1PPS. Optional outputs include T1 and E1 both of which support multiple signaling and alarming formats. Realizing that custom signaling is part of many system designs, the Cs4000 has a custom output area that can support most signaling requirement. Because of this, the standard output signals are not affected and can be utilized along with whatever custom format is required.

The Cs4000 meets the challenges of laboratory standards, satcom terminals, mobile communications systems and a wide variety of test and measurement applications.

Cs4000 Cesium Frequency Standard

Cs4000 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Frequency outputs
  - Frequency: 1 ea 100kHz & 1MHz Sine
    - Amplitude: 1Vrms
    - Harmonic: <–40dBc
    - Non harmonic: <–80dBc
    - Connector: BNC
    - Load impedance: 50Ω
    - Location: rear panel
  - Frequency: 2 ea 5 &10 MHz Sine
    - Amplitude: 1Vrms
    - Harmonic: <–40dBc
    - Non harmonic <–80dBc
    - Connector: Type N
    - Load impedance: 50Ω
    - Location: rear panel
- Timing outputs
  - Format: Three 1PPS
  - Amplitude: >3.0V into 50Ω
  - Pulse width: 20µs positive pulse
  - Rise time: <5ns
  - Jitter: <1ns rms
  - Connector: BNC
  - Load impedance: 50Ω
  - Location: rear panel (2)
    front panel (1)
- Timing inputs
  - Sync input: Two 1PPS
  - Connector: BNC
  - Load impedance: 50Ω
  - Location: rear panel (1)
    front panel (1)
- Remote system interface and control
  - RS-232-C (DTE Configuration)
  - Complete remote control and interrogation of all instrument functions and parameters
  - Connector
    - RS-232-C: 9-pin male rectangular D subminiature type
    - Location: rear panel (1)
  - **Network interface**
    - Physical Layer: 10 base 100 TX (IEEE 802.3)
    - Connector: RJ45
    - Location: rear panel (1)
    - Transport: TCP/IP
    - Protocol: HTTP
  - Alarm (TTL): BNC
    - Location: rear panel
  - Output TTL: high, normal
    - TTL low, fault
    - Circuit is TTL open collector with internal pullup resistor
    - Circuit can sync up to 10mA

PERFORMANCE SPECIFICATIONS

- Performance
  - Accuracy: ±1.0E-12
  - Warm-up time: (typical) 30 Min
  - Reproducibility: ±2.0E-13
  - Settability
    - Range: ±1.0E-9
    - Resolution: 1.0E-15
- Stability

AvgTime (s)	Allan Deviation
1	≤1.2E-11
10	≤8.5E-12
100	≤2.7E-12
1,000	≤8.5E-13
10,000	≤2.7E-13
100,000	≤8.5E-14
Floor	≤5.0E-14

- SSB Phase noise

Offset (Hz)	5MHz Output
1	≤-95dBc
10	≤-130dBc
100	≤-145dBc
1,000	≤-155dBc
10,000	≤-155dBc
100,000	≤-160dBc

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- General environment
  - Operating
    - Temperature: 0°C to 50°C
    - Humidity: 95% up to 50°C (non-condensing)
  - Non-operating (transport)
    - Temperature (storage): -30°C to 70°C
    - Temperature (short term): -40°C to 75°C
  - Magnetic field: 0 to 2 gauss
  - Shock: 30g/11ms, 3 axis
  - Vibration: MIL-T-28800E, Type III, Class 5
  - Altitude (operating): 0 to 50,000'
- AC Power requirements
  - Operating voltage (±10%): 100 to 240 VAC
  - Frequency: 47 to 63 Hz
  - Power
    - Operating: <65W
    - Warm-up: <80W
- DC Power requirements
  - 36 - 75VDC*
  - 60W (Operating)
  - 70W (Warm Up)

* 24VDC (22 - 36VDC) Power supply option available

- Dimensions: 17.22" W x 5.22" H x 20.63" D (43.73 cm x 13.25 cm x 52.40 cm)
- Internal standby battery
  - Capacity: 45 minutes @ 25°C from full charge (without front panel display)
    20 minutes @ 25°C from full charge (with front panel display)
  - Charge time: 16 hours maximum from fully discharged state
  - Charge source: AC or DC
- Weight: 45 lbs. (20.4 Kg)
- MTBF: >145,000 hrs.

ORDERING INFORMATION	Part No.
• 48VDC, Display, Battery, Ethernet	14645-111
• 24VDC, Display, Battery, Ethernet	14645-112
• 48VDC, Display, Battery, T1, Ethernet	14645-123
• 48VDC, Display, Battery, E1, Ethernet	14645-115
• 48VDC, No Display	14645-105
• 24VDC, No Display	14645-106

Rear view of Cs4000

CsIII

Cesium Frequency Standard
Model 4310B

KEY FEATURES

- Third Generation Cesium Technology
- 2U Compact Rack Mount
- AC & DC inputs
- Remote Monitoring & Control
- 5 & 10MHz Outputs
- 1PPS Sync input
- 1PPS Output
- <30 lbs
- CE Compliant

OPTIONAL FEATURES

- T1/E1 Outputs
- Portability Kit

Symmetricom's CsIII is a lightweight, compact, economical cesium frequency standard. The technology developed for the CsIII is an evolutionary step forward in the quest for higher stability, lower phase noise and longer life. An ever-increasing base of demanding users in communications, timing, synchronization and other applications take advantage of this performance.

The CsIII is configured with 5 and 10MHZ sinewave outputs, a 10MHz TTL output a 1PPS sync input and a 1PPS timing output. All monitoring and control of the unit is done via the serial interface and Symmetricom's proprietary Monitor3 software.

Packaged in a 2U, 19-inch rack mounted chassis, the CsIII weighs less than 30 lbs. An optional portability kit and T1/E1 synthesizer are available for added functionality and versatility.

The CsIII comes standard with a 2-year electronics warranty and 12-year tube warranty.

The CsIII is ideal for SATCOM, Calibration, Metrology and many other Test & Measurement applications that required cesium stability and accuracy.

CsIII Cesium Frequency Standard

CsIII SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Frequency outputs

Frequency:	1 each 5 MHz and 10 MHz
Format:	Sine
Amplitude:	1 Vrms
Harmonic:	<-40dBc
Non harmonic:	<-80dBc
Connector:	BNC
Load impedance:	50Ω
Location:	rear panel
Frequency:	10 MHz
Format:	TTL
Amplitude:	>2.2V
Load impedance:	50Ω
Location:	rear panel
Connector:	BNC

- Timing outputs

Format:	1PPS
Amplitude:	>3.0V into 50Ω (TTL compatible)
Pulse width:	20µs positive pulse
Rise time:	<5ns
Jitter:	<1ns rms
Connector:	BNC
Load impedance:	50Ω
Location:	rear panel

- Timing inputs

Sync input:	1PPS
Amplitude:	>3.0V into 50Ω (TTL compatible)
Pulse width:	20µs positive pulse
Rise time:	<5ns
Jitter:	<1ns rms
Connector:	BNC
Load impedance:	50Ω
Location:	rear panel

REMOTE SYSTEM INTERFACE AND CONTROL

RS-232-C (DTE Configuration)
Complete remote control and interrogation of all instrument functions and parameters

Connector	
RS-232-C:	9-pin male rectangular D subminiature type
Location:	rear panel
Alarm (Relay):	9-pin female rectangular D subminiature type
Location:	rear panel

- Performance parameters

Accuracy:	±1.0E-12
Warm-up time (typical):	30 minutes
Reproducibility:	±2.0E-13
Settability	
Range:	±1.0E-9
Resolution:	1.0E-15
Control:	Via RS-232 port

- Stability

Averaging Time(s)	Allan Deviation
1	<1.2E-11
10	<8.5E-12
100	<2.7E-12
1,000	<8.5E-13
10,000	<2.7E-13
100,000	<8.5E-14
floor	<5.0E-14

- SSB Phase noise

Offset (Hz)	5MHz output
1	<-95dBc
10	<-130dBc
100	<-145dBc
1,000	<-155dBc
10,000	<-155dBc
100,000	<-160dBc

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- General Environment

Temperature	
Operating:	0°C to 50°C
Non-operating:	-40°C to 70°C
Humidity:	95% up to 50°C
Magnetic field:	0 to 2 gauss
Altitude (operating):	0 to 50,000 feet

- AC Power requirements

Operating voltage (±10%):	100 to 240 VAC
Frequency:	47 to 63 Hz
Power	
Operating:	65W
Warm-up:	90W

- DC Power requirements

22 to 36 VDC
36 to 75 VDC
30W 1.3A @ 24V (Operating)
65W 2.7A @ 24V (Warm Up)

- Dimensions/Weight

Height:	3.50" (89.9mm)
Width	
Front panel:	19.00" (483mm)
Instrument	17.31" (440mm)
Depth:	15.0" (381mm)
Weight:	<30lbs (13.5kg)
MTBF:	>130,000 hrs.

ORDERING INFORMATION	Part No.
• 24VDC	14534-110
• 48VDC	14534-109

CsIII connections

8040C

Rubidium Frequency Standard

STANDARD FEATURES

- Six Configurable Outputs
- RF & Pulse Outputs
- AC Input
- Remote Monitoring & Control
- GPS Disciplining
- CE Compliant

OPTIONAL FEATURES

- Twelve Configurable Outputs
- Low Phase Noise

Today's precision test equipment requires a stable reference to make accurate frequency measurements. The equipment used varies depending on stability, accuracy and output signal format. All of these parameters can lead to a multitude of configurations, platforms and products that can be expensive to implement and maintain.

The Symmetricom 8040C solves this problem by providing a stable and accurate frequency reference with multiple output signal formats in an easy to install 1U rack mountable chassis.

Unlike other units, the 8040C offers configurable RF outputs, GPS disciplining and a RS-232 interface for command and control.

The 8040C has six outputs, each of which can be user configured to provide a 1, 5 or 10MHz sine or square wave or 1PPS output. The standard configuration for the 8040C has three 10MHz, one 5MHz, one 1MHz and one 1PPS output.

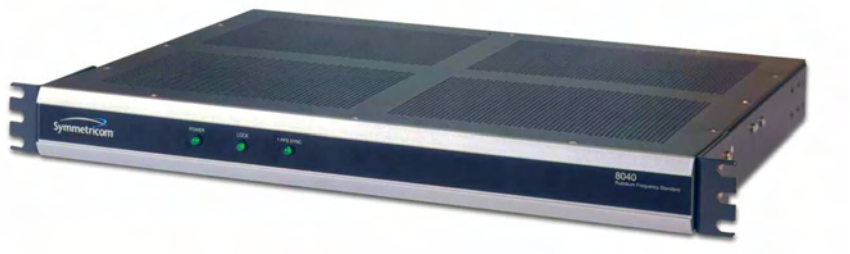
A 1PPS input allows the 8040C to be disciplined by a GPS receiver for improved frequency accuracy and long-term stability. The 8040C auto adaptive algorithm allows plug and play connectivity for easy GPS disciplining.

The 8040C is field configurable, allowing the instrument to support changing functionality in evolving systems.

If more outputs are required, the 8040C can be purchased with an option card that adds six additional outputs bringing the total output configuration to twelve. The option card, like the standard unit, can be configured for any combination of available frequency or format.

Also available is a low phase noise version that provides a greater than 30 dB improvement in close in phase noise.

The 8040C is designed around Symmetricom's award winning SA.22C rubidium oscillator, which is deployed worldwide as the reference oscillator in wireless base stations.



8040C Rubidium Standard

8040C SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

	Standard	Low Noise
• Frequency outputs		
Frequency:	1, 5 & 10MHz	1, 5 & 10MHz
Format:	Sinewave	Sinewave
Amplitude:	1Vrms	1Vrms
Harmonic:	<-40dBc	<-40dBc
Non-harmonic:	<-60dBc	<-80dBc
Connector:	BNC	BNC
Load impedance:	50Ω	50Ω
Location:	rear panel	rear panel
Frequency:	1,5 & 10MHz	1,5 & 10MHz
Format:	TTL	TTL
Amplitude:	>3V Peak	>3V Peak
Pulse width:	50% duty cycle	50% duty cycle
Connector:	BNC	BNC
Load impedance:	50Ω	50Ω
Location:	rear panel	rear panel
• Timing outputs		
Format:	1PPS	1PPS
Amplitude:	>3V	>3V
Pulse width:	400ns	400ns
Rise time:	<20nS	<20nS
Jitter:	<10pS RMS	<10pS RMS
Connector:	BNC	BNC
Load impedence:	50Ω	50Ω
Location:	rear panel	rear panel
• Timing inputs		
Sync input:	1PPS	1PPS
Amplitude:	TTL compatible	TTL compatible
Connector:	BNC	BNC
Load impedence:	50Ω	50Ω
Location:	rear panel	rear panel

PERFORMANCE PARAMETERS

• Accuracy at shipment:	<±5E-11	<±5E-11
• Retrace:	<±5E-11	<±5E-11
On-off-on:	24h, 24h, 24h @ 25°C	
• Control range:	±1E-6 with 1E-12 resolution	±1E-6 with 1E-12 resolution
• Warm-up time		
Time to lock:	<5 minutes	<5 minutes
Time to <1E-9:	<8 minutes	<8 minutes
• GPS Disciplining		
Time for valid output:	<20 minutes	<20 minutes
Frequency accuracy:	<1E-12	<1E-12
• Stability		
Avg. Time (s)	**Allan Deviation**	**Allan Deviation**
1	<3.0E-11	<1.5E-11
10	<1.0E-11	<8E-12
100	<3.0E-12	<2.5E-12
• Aging		
Monthly:	<5E-11	<5E-11
Yearly:	<5E-10	<5E-10

	Standard	Low Noise
• SSB phase noise		
Offset (Hz)	10MHz	10MHz
1	-72dBc	-100dBc
10	-95dBc	-130dBc
100	-130dBc	-144dBc
1,000	-140dBc	-150dBc
10,000	-148dBc	-150dBc
• Remote system interface & control RS-232-C (DTE configuration)		
Connector RS-232:	9-pin male rectangular D	9-pin male rectangular D
Location:	rear panel	rear panel
Protocol:	8 data bits 1 stop bit	8 data bits 1 stop bit
Baud rate:	57600	57600

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

• General environment (operating)	
Temperature:	0°C to 50°C
Temperature coefficient:	<3E-10
Storage temperature:	-40°C to 70°C
Humidity:	95% up to 50°C
Magnetic field:	DC (±2 Gauss)
Magnetic sensitivity:	<4E-11/Gauss
Altitude (operating):	0 to 50,000 feet

- AC power requirements
  - 90 to 240 VAC
  - 47 to 63 Hz
  - 25W (operating)
  - 45W (warm-up)
- Dimensions/Weight
  - 19"W x 1.75"H x 12"D
  - <6 lbs.
- MTBF = 232,500 hours IAW Telcordia (Bellcore) SR332, Issue 1

ORDERING INFORMATION	Part No.
• 6 output standard performance	15230-101
• 12 output standard performance	15230-102
• 6 output low phase noise	15230-104
• 12 output low phase noise	15230-105

8040C connections (shown with 12 output option)

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XPRO

High-Performance Rubidium Oscillator

STANDARD FEATURES

- 10MHz Output
- 1PPS Output
- <5E-11 per month aging
- Digital monitor & control
- RoHs 5/6 compliant

OPTIONAL FEATURES

- <1E-11 per month aging

The Symmetricom XPRO is a high performance rubidium oscillator designed for a wide range of telecommunications and test and measurement applications. The XPRO is a drop in replacement for our venerable LPRO, which has been widely installed in wireless base station applications, RF test equipment and other applications where an embedded high performance oscillator is required.

The XPRO leverages over 35 years of proven rubidium atomic physics with advanced digital electronics architecture to provide an exceptionally stable oscillator that meets the most demanding performance requirements.

The XPRO with its low profile and standard connector interface is designed for ease of integration into time and frequency systems. Great care has been taken in the design to minimize EMI emissions and susceptibility, including the use of a filtered 9 pin D-connector, SMA for the RF output and a shielded outer cover.

The XPRO is designed for long operating periods without maintenance (long life Rb lamp, extended crystal control range). The XPRO, with a 5E-11 per month aging, will maintain 1E-9 frequency accuracy for 10 years or longer without recalibration. A low aging rate option is available for XPRO that will provide 1E-11 per month aging providing an even more robust reference source.

Standard outputs are 10MHz, 1PPS and a rubidium lock status bit. All monitoring and control is done via the RS-232 interface allowing the user access to comprehensive status and control parameters.

XPRO High-Performance Rubidium Oscillator

XPRO SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

RF Output

- Frequency: 10MHz
- Format: Sinewave
- Amplitude: +7.8 ± 0.8dBm
- Load impedance: 50Ω @ 10MHz
- Connector: SMA
- Qty: 1

1PPS Output

- Rise time: <5nS
- Pulse width: <20µS
- Level: >4.5V (15pF Load)
- Jitter: <1ns RMS
- Connector: DB-9
- Qty: 1

PERFORMANCE PARAMETERS

- Phase noise (SSB), £(f), dBc/Hz
- SB Freq

1 Hz	<-80
10 Hz	<-90
100 Hz	<-128
1 kHz	<-145
10 kHz	<-155

- Spectral purity

Harmonics:	<-60dBc
Non-harmonics:	<-80dBc

- Aging

Monthly (after 1 month):	<±5.0E-11/Month <1.0E-11/Month (option)
10 years:	<±1.0E-9

- Frequency accuracy at shipment: <±5.0E-11 (@ +25ºC)
- Frequency retrace <±2.5E-11 (on-off-on: 24h, 48H, 24H at 25ºC)
- Short term stability σ_y (τ) (Allan deviation)

τ (sec)	
1	<1.0E-11
10	<3.2E-12
100	<1.0E-12

- Frequency control

Analog freq. adj. range:	±1.5E-9 (0 - 5V) Digital freq. adj. res: ±1.0E-6 with 2.0E-12 resolution

- Warm-up

	-20ºC	+25ºC
Time to lock:	<8.7 min	<6 min
Time to <1E-9:	<10.2 min	<8 min
Time to <4E-10	<12.7 min	<10.6 min

- Max input (Amps) @24V: <1.45A <1.43A
- Input voltage range: +19 to 32 Vdc
- Voltage sensitivity: 0.72E-11/V (over input voltage range)
- Input power, quiescent

+24 Vdc @ -25°C:	<13W
+19 Vdc @ +65°C:	<8.5W

- Lock status (BITE) 5VCMOS

  low = Lock
  high = Unlock

- RS-232 control/monitor interface
  Provides ID, status/monitor information, and frequency/operating parameter adjustments. Protocol: 57,600, 8, 1, None, No flow control.

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature

Operating:	-25ºC to +70ºC baseplate
Storage:	-55ºC to +85ºC

- Sensitivity: <6.0E-10 over op. temp. range
  <3E-10 (0ºC to 50ºC)
- Altitude

Operating:	-200 to 40,000'
Non-operating:	-200 to 70,000'

- Magnetic sensitivity: dc(≤2Gauss)
  ≤ ±1.0E-11/Gauss
- RH (operating): ≤85% non-condensing
  Meet or exceed Telcordia GR-63-CORE Issue .2, April 2002, section 4.1.2
- Vibration:

Operating:	Meets or exceeds Telcordia GR-63-CORE Issue .2, April 2002 section 4.4.3 and 5.4.2 (no unlock, 1.0g peak sine @ 5 - 100Hz)
Non-operating:	Telcordia GR-63-CORE, Issue .2, April 2002, section 4.4.4 and 5.4.3, curve 1 or Figure 4-3 (1.5g peak max sine @ 5-500Hz)

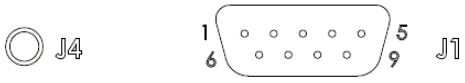
- EMI: Compliant to FCC Part 15 Class B (conducted and radiated emissions) and complies with EN55022B emissions (radiated and conducted) and EN50082-1 (immunity).
- MTBF:

Ground Benign	Temperature	MTBF
	20°C	1,175,359 hrs
	40°C	591,317 hrs
	60°C	243,402 hrs

- Input connector: (1) DB-9 (All input power, monitoring, 1PPS)
- RF Connector: (1) SMA
- Dimensions

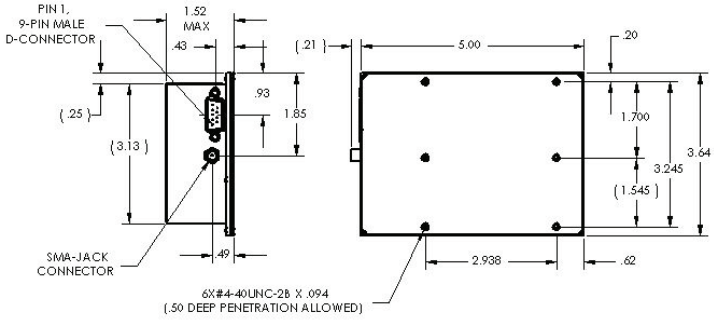
Height:	1.5" (3.81cm)
Width:	3.7" (12.7cm)
Depth:	5.0" (9.4cm)
Weight:	<1.1lbs (<500g)

XPRO CONNECTION DIAGRAM



RF Out 10MHz Sine	1	+24V RTN	6	+24V
	2	1PPS SYNC	7	1PPS OUT
	3	D OUT	8	SERVICE
	4	D IN	9	FREQ CTL
	5	LOCKBITE		

XPRO OUTLINE DRAWING



8200

Ruggedized Rubidium Oscillator

STANDARD FEATURES

- 10MHz Output
- Hermetically Sealed
- Shock/Vibration Hardened
- Digital Monitor & Control
- <1.0 Inches High

OPTIONAL FEATURES

- 5MHz Output

The Symmetricom 8200 is a ruggedized rubidium oscillator designed for ground tactical, shipboard and airborne applications where superior frequency stability under diverse environmental conditions is required. Advanced communications, navigation and targeting systems require precision oscillators that can withstand a wide range of operating environments with minimal degradation in frequency accuracy and stability. The 8200 support these applications with superior phase noise and excellent short and long term frequency stability.

The 8200 is unique in that it combines excellent short and long term frequency stability in a small, low profile package measuring less than 1.0 inches high.

The long life rubidium lamp and extended crystal control range of the 8200 helps extend operating periods and minimize maintenance intervals. An alarm signal derived from the basic physics operation indicates when output frequency is outside roughly +5E-8 of absolute frequency offset. The low temperature coefficient and excellent frequency stability extend holdover performance.

The height and footprint easily meet the requirements for 1U VME applications. Use of a filtered D-Connector for I/O signals minimizes EMI emissions and susceptibility. For ease of integration, the Symmetricom 8200 only needs one input supply voltage and will allow direct plug-in into another circuit board.

The 8200 is designed around proven rubidium technology that has been deployed in numerous airborne, shipboard and ground tactical platforms for over thirty years.

8200 Rubidium Oscillator

8200 SPECIFICATIONS

(All specifications at 25°C unless otherwise noted)

ELECTRICAL SPECIFICATIONS

- **RF Output** **8200**
  - Frequency: 5 or 10MHz
  - Format: Sinewave
  - Amplitude: 0.7V rms nominal
  - Load impedance: 50 ohms @ 5 or 10MHz
  - Connector: SMA
  - Qty: 1

PERFORMANCE PARAMETERS

- Phase noise (SSB), £(f), dBc/Hz (Static)

SB Freq	10 MHz
1 Hz	**<**-72
10 Hz	**<**-90
100 Hz	**<**-128
1 kHz	**<**-140
10 kHz	**<**-148

- Spectral purity
  - Harmonics: **<**-30dBc
  - Non-harmonics: **<**-75dBc (**<**150MHz)*
    <-80dBc (>150MHz)
    *<-70dBc at 147.5MHz ±300kHz
- Aging
  - Monthly (after 1 month): <±5.0E-11/month
  - 10 years: <±1.0E-9
- Frequency accuracy at shipment: <±5.0E-11 (@ +25° C)
- Frequency retrace <±5.0E-11 (on-off-on: 24h, 24H, 24H @ 25°C)
- Short term stability σ_y (τ) (Allan deviation)

τ (sec)	
1	<3.0E-11
10	<1.0E-11
100	<3.0E-12

- Frequency control
  - Analog freq. adj. range: ±1.5E-9, 0 - 5V into 5kΩ
  - Digital freq. adj. res: ±1.0E-6 with 1.0E-12 resolution
- Warm-up -40°C
- Time to lock: <8 min
- Time to **<**1E-9: <10 min
- Max. @ 28V: <20W
- Input voltage range: +15 to 32 Vdc
  (Protected against reverse polarity & transients)
- Voltage sensitivity: <5.0E-12
  (10% voltage change from nom. 28 Vdc)
- Input power, quiescent:

+28 Vdc @ -40°C baseplate	**<**16W
+28 Vdc @ +25°C baseplate	**<**12W
+28 Vdc @ +80°C baseplate	**<**8 W

- Lock Status (BITE)
  TTL low = Lock
  TTL high = Unlock
- RS-232 control/monitor interface
  Provides ID, status/monitor information, and frequency/operating parameter adjustments. Protocol: 9600, 8, 1, None, No flow control.

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature
  - Operating: -40° C to +80° C baseplate
  - Storage: -55° C to +95° C
  - Sensitivity: **<**3.0E-10 over op. temp. range
- Thermal shock (non-operating):
  MIL-STD-202, Method 107, Test Condition A, 10 cycles -55° C to 85° C
- Orientation sensitivity: **<**5.0E-11 for any orientation
- Pressure sensitivity: **<**1.0E-13/mbar
- Altitude
  - Operating: Sea level to 40,000' (12,192 m)
  - Non-operating: Sea level to 80,000' (24,384 m)
- Magnetic field sensitivity: dc(**≤**2Gauss)
  ≤ ±4.0E-11/Gauss
- Relative humidity (operating):
  0 to 95% RH per MIL-STD-810, Method 507.4
- Salt fog: MIL-STD-810, Method 509.4
- Vibration: MIL-STD-810, Method 514.5, Procedure I
  - Operating: Category 24, Minimum Integrity, 7.7 grms @ 0.04 g^2/Hz 20 Hz -1kHz, 15 min/axis (maintain lock)
  - Non-operating: Category 24, Minimum Integrity, 15.4 grms @ 0.16 g^2/Hz 20 Hz -1kHz, 30 min/axis
- Shock: MIL-STD-202, Method 213
  - Operating: 30g, 11msec, half-sine (maintain lock)
  - Non-operating: 50g, 11msec, half-sine
- EMI
  MIL-STD-461
  - Emissions: CE102, RE102
  - Susceptibility: CS101, CS114, RS103
- MTBF: MIL-HDBK-217F, 90,000 hours. Ground fixed @ +40°C baseplate
- On-Off cycling endurance: 5000 cycles at 10°C baseplate
- Input connector: (1) DB-15 (All input power, monitoring, I/O)
- Dimensions
  - Height: 0.95"
  - Width: 4.00"
  - Depth: 4.63"
  - Volume: 17.6 in^3
  - Weight: **<**1.5 lbs

1050A

Quartz Frequency Standard

KEY FEATURES

- Low Aging, to <5.0E-11 Per Day
- 1 MHz, 5 MHz and 10 MHz Outputs;
- Front Panel Monitors and Function Meter
- Precise Frequency Tuning Via Front Panel Control
- Low Phase Noise, -160dBc @ 10 kHz
- Internal Battery and Automatic Charger

OPTIONAL FEATURES

- External Disciplining
- 1PPS Output

Symmetricom's 1050A Quartz Frequency Standard is a multiple output instrument suitable for 19" rack mounting. The instrument features a selected third overtone SC-cut precision quartz crystal with drive levels optimized for very low aging, excellent short and long term frequency stability, and retrace characteristics.

The quartz crystal oscillator exhibits unusually high spectral purity at frequencies close to the carrier frequency permitting multiplication to millimeter-wave frequencies with excellent signal-to-noise ratio. A single stage solid-state oven, advanced design and careful component selection techniques ensures the instrument's highly stable operation and ruggedness. Normally operated from a 115 or 230 VAC, 47 to 400 Hz power source, the instrument also offers a built-in standby battery and internal battery charger. Switch over to this internal battery is automatic in the event of external power failure.

Operating controls and monitors are conveniently located on the front panel. LED status monitors indicate Power On, Power Alarm, Oven Ready (oscillator at operating temperature) Battery On and Battery Charge. A built-in meter and thumb wheel switch permit monitoring of supply voltage, control voltage, oscillator oven and battery voltage and battery charging current. Five digital thumb wheel switches permit offset of the frequency over a range of 4E-7. Rear panel connections include fused power input connections and 1 MHz, 5 MHz and 10 MHz output BNC connectors. 1 PPS outputs are also available. A frequency-control voltage can be applied through a BNC connector for external tuning of the crystal oscillator.

The 1050A satisfies a wide variety of applications with stringent requirements for precision time and frequency in radar systems, missile range timing systems, deep space communications, satellite command terminals, GPS monitoring stations, calibration labs and test equipment.

1050A Quartz Frequency Standard

1050A SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Outputs
  - Frequency: 1 MHz, 5 MHz, and 10 MHz
  - Output amplitude: 0.9 Vrms to 1.5 Vrms into 50Ω
  - Harmonic distortion: -40 dB
  - Spurious signals
    - 5 MHz: -80dB
    - 1 MHz, 10 MHz: -70db
- Aging per day:* 1.0E-10
- Short term stability:

Averaging Time	Allan Deviation
1 s	1.0E-12
10 s	1.0E-12
100 s	1.0E-12

- SSB phase noise (bandwidth = 1 Hz)

Offset from signal	5 MHz
1 Hz	-116dBc
10 Hz	-140dBc
100 Hz	-150dBc
1000 Hz	-157dBc
10000 Hz	-160dBc

- Frequency adjustment range
  - Front panel 5 digit: 4.0E-7
- Maximum frequency change
  - Overoperating temperature: 1.0E-9
  - Due to load change (50Ω ± 10%): 5.0E-11

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature ranges
  - Operating: 0°C to 50°C
  - Storage: -60°C to 80°C
  - Storage with battery: -40°C to 60°C
- Power requirements

	Standard	Disciplined
DC input:	26 to 30V, 8W @ 25°C	26 to 30V, 13W @ 25°C
AC input:	115 or 230V±10%, 47 to 400Hz, 20W @ 25°C	115 or 230V±10%, 47 to 400Hz, 30W @ 25°C

	Standard	Disciplined
Charge capacity @ 25°C:	~10 hours	~6 hours

- Dimensions
  - Height: 3.5" (89 mm)
  - Width: 19" (483 mm)
  - Depth: 18" (457 mm)
- Weight: 33 lbs. (15 kg)

OPTIONS

- 015 External Disciplining Option
  - Warm-up time to lock: 30 minutes
  - External phase lock
    - External oscillator frequency: 5 MHz
    - External oscillator level: 1 V rms
  - Resolution: ±2.5E-12
  - Loop time constant (switch selectable): 1 s or 100 s
  - Digital tuning range: 2.0E-8
  - Automatic acquisition: 2.0E-8

ORDERING INFORMATION	Part No.
• 1050A Standard Configuration	02507-103
• 1050A Standard Configuration with 1PPS Option	02507-107
• 1050A with 015 Disciplining Option	02492-103
• 1050A with 015 Disciplining Option & 1PPS Option	02492-107

1050A connections

* Aging typically improves to a level of parts in E-11 per day.
Observed aging rates as low as 1.0E-12 reported after years of unperturbed operation.

- Internal battery and automatic charger

4145B

Ultra-Clean Phase-Locked Oscillator

KEY FEATURES

- High Performance: Cleans up the Signal From a Cs Frequency Standard
- Utilizes the Best Quartz Technology: BVA and SC
- Selectable Time Constants: 10, 50, 200 or 400 Seconds to Optimize Performance
- Exceptional Short and Medium-Term Stability (typical):
  - L (1 Hz) = -125 dBc/Hz at 5 MHz
  - L (10 kHz) = -165 dBc/Hz at 10 MHz
  - $\sigma_y = 1.5x10^{-13}$ from 1 to 1000 seconds
- Standard 19" Chassis: Mounts in Standard Hardware Rack

The 4145B Ultra-clean phase-locked oscillator filters the output from a high-performance Cs frequency standard and improves both the phase noise and Allan deviation. The 4145B is the best choice when you need improved short and medium-term performance than a Cs provides.

Please contact Symmetricom with any specific requirements.

4145B Ultra-Clean Phase-Locked Oscillator

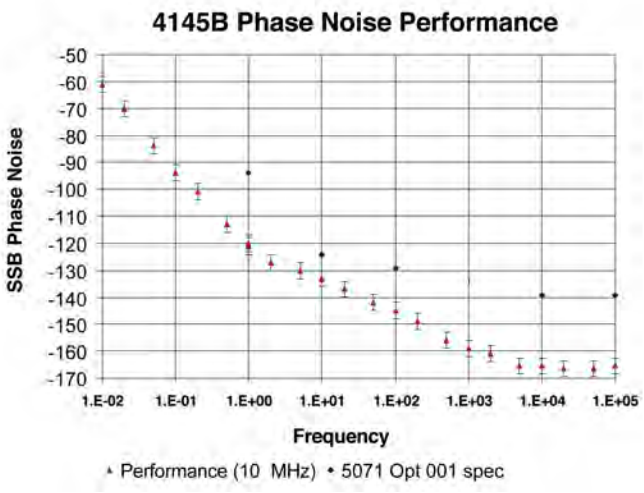
4145B SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

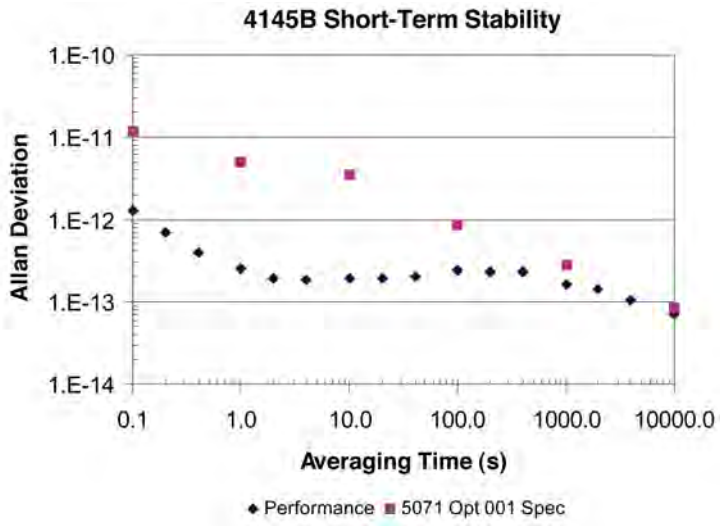
- Input voltage: 85 - 264 V AC
- Input frequency: 47-63 Hz
- Input DC voltage: 24 Vdc + 10%
- Power consumption: 50Ω (max)
- Connector: IEC plug
- Stability (Allan Deviation)
  - 1s $3x10^{-13}$
  - 100s $3x10^{-13}$
- Phase noise **L(f) at 10MHz**
  - 1 Hz -120 dBc/Hz
  - 10 Hz -130 dBc/Hz
  - 100 Hz -140 dBc/Hz
  - 1 kHz -155 dBc/Hz
  - 10 kHz -160 dBc/Hz
  - 100 kHz -160 dBc/Hz

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Weight: 9 Kg (20 lbs)
- Dimensions: 43.2cm x 13.3cm x 55.9 cm (17" x 5.25" x 22")



4145B Phase Noise Performance



4145B Short-Term Stability

1000B

Ultra-Stable Crystal Oscillator

KEY FEATURES

- Low Aging, 5.0E-11 Per Day
- Low Phase Noise, -160dBc at 10 kHz
- Independently Buffered Outputs
- Linearized Electronic Frequency Control
- Fast Warm-Up, 15 Minutes to 2.0E-8
- 0°C to 55°C Operating Temperature Range

Symmetricom's 1000B achieves low aging rates by utilizing high-performance SC-cut quartz crystal resonators. The specified aging is reached within 30 days of continuous operation, and typically continues to improve. Several users report observed aging rates as low as 1E-12 per day after years of continuous operation.

A dewar-insulated oven provides superior temperature stability over the full temperature range. The maximum frequency change over the operating temperature range is <5E-9. An oven temperature indicator (10mV per degree K) is provided at the power connector.

The oscillator circuit produces phase noise of -116 dBc at 1 Hz and -160 dBc at 10 kHz. Low noise, high isolation buffer amplifiers provide four independent outputs. The buffer amplifiers isolate outputs from load variations. An internal voltage regulator minimizes fluctuations due to power supply ripple.

Linearized electronic frequency control allows the use of servo loop techniques for fine frequency tuning. Linearity is better than 5% over the specified tuning range. The 1000B crystal oscillator meets the demands of a wide range of applications for military and industrial environments. The oscillator is found in precision frequency counters and synthesizers, GPS receivers, microwave multiplier chains, phase noise calibration test equipment, Stratum II telecommunications applications, radar and tactical communications systems, secure communications systems, satellite ground terminals and space flight systems.

1000B Ultra-Stable Crystal Oscillator

1000B SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

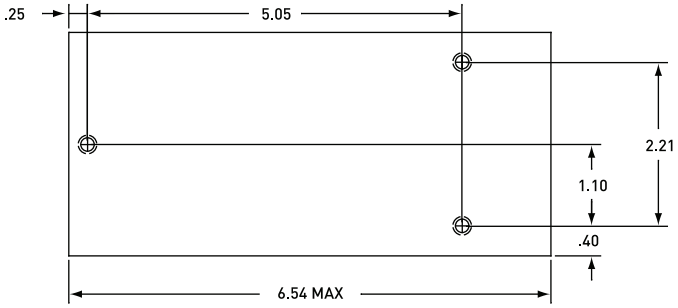
- Frequency: (4) 5MHz
- Amplitude: (2) 1Vrms, (2) 0.5 Vrms
- Harmonic distortion: <-40dBc
- Spurious signals: <-80dBc
- Short term stability:
  - 1s: <1.0E-12
  - 10s: <1.0E-12
- Aging per day (see note 1) (after 30 days of operation): <1.0E-10
- Phase noise (-dBc/Hz):
  - 1: <-116dBc
  - 10: <-140dBc
  - 100: <-150dBc
  - 1000: <-157dBc
  - 10kHz: <-160dBc
  - 100kHz: <-160dBc
- Temperature coefficient: <1.0E-9
- Frequency adjustment range
  - Tuning slope: Positive
  - Control range: 0 to 10V
- Load change (50Ω +/-10%) <5.0E-11
- Input voltage
  - Oven supply: 18 to 30VDC
  - Electronics supply: 18 to 30VDC

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

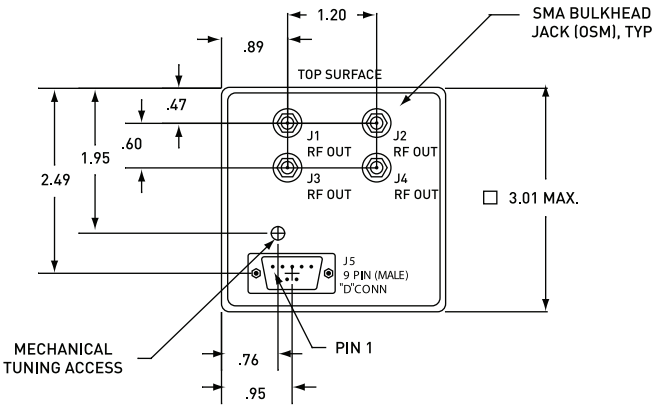
- Supply sensitivity
  - 1% change in input: <1.0E-11
- EMI susceptibility (side bands)
  - 0.1Vrms on power supply inputs
  - 10 Hz to 104 Hz: <-100dBc
- Temperature
  - Operating: 0°C to 55°C
  - Non-operating: -40°C to 85°C
- Power requirements
  - Warm-up: <13W
  - Operating at 25°C: <3.5W
- Warm-up to 2.0E-8 of final frequency: <15 minutes
- Oven monitors temperature: 10mv/C
- Dimensions: 3.0"W x 6.54"D x 3.0"H
- Weight: <1.5lbs (0.67kg)
- Connectors
  - RF (J1 - J4): SMA
  - Power (J5): 9 pin D-subminiature

ORDERING INFORMATION	Part No.
• 1000B with (4) 5MHz outputs	05818-103

Note 1: Aging typically improves to a level of parts in 1E-11 per day (1E-8/year). After years of unperturbed operation, some users have observed aging rates as low as 1E-12.



Bottom View



Front View

MHM 2010

Active Hydrogen Maser

KEY FEATURES

- Patented Magnetic Quadrapole for Superior Atomic Beam Focusing
- Very Low Hydrogen Usage (< 0.01 Mole Per Year) for Extended Maintenance-Free Operation
- Unique, Stand-Alone, Cavity Auto Tuning Feature
- Proprietary Teflon Coating Technique, Eliminating Any Re-Coating Requirement and Extending Maintenance Free Life
- CE Compliant

Symmetricom's MHM 2010™ is the only commercially available active hydrogen maser with stand-alone cavity switching auto tuning manufactured in the USA. This technique enables the MHM 2010 to deliver long-term stability normally only attributed to the most stable of cesium atomic standards.

Each MHM 2010 is manufactured to exacting quality standards and carefully checked at each stage to insure a top quality product. Once built, the units are subjected to extensive performance testing, verifying all aspects of operation.

Before shipment, each unit goes through rigorous testing and performance monitoring to insure that the unit meets or exceeds all specifications.

MHM 2010 Active Hydrogen Maser

MHM 2010 SPECIFICATIONS

STABILITY

- Allan deviation (measured in 1Hz bandwidth):

1s	2.0E-13
10s	3.0E-14
100s	7.0E-15
1000s	3.2E-15
Floor*	3.0E-15

- Long term: <2.0E-16 per day*
- Auto tuning: no external reference required

* Achieved after extended period of unperturbed, continuous operation.

ENVIRONMENTAL

- Temperature sensitivity: <1.0E-14/°C
- Magnetic sensitivity: <3.0E-14/Gauss
- Power source sensitivity: <1.0E-14

CONTROL

- Synthesized frequency resolution: 7.0E-17
- Frequency control range: 7.0E-10

Note : The synthesizer maintains continuous phase throughout frequency change.

AVAILABLE OUTPUTS

Frequency	Amplitude
5 MHz	13dBm (3 each)
10 MHz	13dBm
100 MHz	13dBm

- Load impedance: 50Ω

TIMING OUTPUT

- Format: 1PPS (positive going pulse)
- Amplitude: >3 V into 50Ω (TTL compatible)
- Pulsewidth: 20 µs
- Rise time: <3 ns
- Jitter: <10 ps RMS

TIMING INPUT

- Auto-sync input: 1PPS
- Amplitude: >3 V into 50Ω (TTL compatible)
- Pulsewidth: ≥20 µs
- Rise time: <5 ns
- Jitter: <1 ns RMS
- Synchronization input to output: <15 ns

PHASE NOISE ℒ(f)

Outputs	5 MHz	10 MHz
1 Hz	≤-112dBc	≤-106dBc
10 Hz	≤-130dBc	≤-124dBc
100 Hz	≤-148dBc	≤-142dBc
1 KHz	≤-155dBc	≤-149dBc
10 KHz	≤-155dBc	≤-149dBc
100 KHz	≤-155dBc	≤-149dBc

POWER

- Operating voltage: 85 to 264 VAC
- Frequency range: 47 to 63 Hz
- Peak power: 150W
- Operating power: 75W
- External DC input: 22 to 28 VDC 3.1A (typical)
- Standby battery: 8 hours operation

PHYSICAL SPECIFICATIONS

- Height: 42.0" (106.68 cm)
- Width: 18.0" (45.72 cm)
- Depth: 30.0" (76.0 cm)
- Weight: 475 lbs. (without batteries*)

* Add 66 lbs. for batteries

ORDERING INFORMATION

	Part No.
• (3) 5 MHz, (1) 10 MHz, (1) 100 MHz	75001-101
• (3) 5 MHz, (1) 10 MHz, (2) 100 MHz	75001-102
• (3) 5 MHz, (1) 10 MHz, 1 PPS Sync. 1PPS output	75001-103
• (3) 10 MHz, 1 PPS Sync. (2) 1PPS output	75001-104
• (2) 5 MHz, (1) 100 MHz, 1 PPS Sync. 1PPS output	75001-105
• (2) 5 MHz, (2) 10 MHz, 1 PPS Sync. (2) 1PPS output	75001-106
• (2) 5 MHz, (2) 10 MHz, (1) 100MHz	75001-107
• (2) 5 MHz, (1) 10 MHz, (1) 100MHz ,1 PPS Sync, 1PPS output	75001-108
• (3) 5 MHz, (2) 10 MHz, (2) 100MHz	75001-109
• (3) 5 MHz, (3) 10 MHz	75001-110
• (4) 5 MHz, (2) 10 MHz	75001-111
• (3) 10 MHz, (2) 100MHz,1 PPS Sync, (2) 1PPS output	75001-112
• (3) 5 MHz, (1) 10 MHz, (2) 100MHz, 1 PPS Sync. 1PPS output	75001-113
• (3) 5 MHz, (1) 10 MHz, (1) 100MHz, 1 PPS Sync, (2) 1PPS output	75001-114

MHM 2010 Back Panel Configuration

AOG-110

Auxiliary Output Generator

KEY FEATURES

- 5 MHz Low Phase Noise Outputs
- Output Phase Offset Programmable to 1 Picosecond
- Output Frequency Programmable to 1.0E-19 Fractionally Over 5.0E-8 Range
- Temperature Control Insures Thermal Stability
- RF Subsystem Developed from Hydrogen Maser Technology
- Second Generation Microprocessor Control
- Digital Phase and Frequency Control Menu Driven Interface with Keypad Access
- LCD Display Provides Easy Access to Configuration and Performance Information
- Full System Control via RS-232 Compatible Interface
- Password Protected Remote Operation Provides Security
- Absolute and Relative Frequency Control
- Dual-Mode, Timed Frequency Control Allows Interval Frequency and Final Frequency Settings
- Output Relative Phase Control Over User Defined Intervals
- Suspend And Resume Available on Programmed Intervals
- Real-Time Clock Set and Adjust

Symmetricom's Auxiliary Output Generator™, designated the AOG-110, solves performance and capability issues associated with the use of high stability frequency standards. Until now, intermediate offset generators that extended a standard's frequency range without a performance sacrifice were difficult or impractical to obtain. Now, the AOG-110 is available with a 5 MHz output, programmable over a broad frequency range with extremely high resolution and precise phase control at an economical price.

The 5 MHz output, available on three buffer-isolated output ports, features a high performance crystal oscillator phase-locked to the external standard's output reference and employs heterodyne techniques developed for Symmetricom's Atomic Hydrogen Maser. Internally, the 5 MHz is used to develop one pulse per second (1PPS) which is available as an output. The 1PPS output can be synchronized to an external 1PPS reference by the AOG's operator controls.

The output frequency is controlled by directly offsetting a phase accumulator (synthesizer) in the PLL chain. The maximum synthesized fractional frequency range is ±1E-7, with a fractional resolution of 1E-19. By altering the frequency output over a precise time interval, output phase control is achieved. Typically, the user defines the desired phase offset and time interval within which the offset is made. Once set, the AOG-110 automatically implements the appropriate frequency offset and precise time interval. Direct control over both frequency and time interval is available.

The frequency, phase and 1PPS synchronization of the AOG are independently controlled through a menu-driven interface on the front panel. The interface also provides operational status information. The local interface consists of an LCD display, a real-time clock display, and a 16-key keypad coupled to a microprocessor. An RS-232 serial port is available for remote operation. Generally the operator uses either exclusive local control or exclusive remote control. Shared control between local and remote interface is available. Remote control supports password protection that requires entry of a code before the use of local controls is possible. Numerous other options include: baud rate, parity and data format; unit identification number; settable VCO phase-locked loop (PLL) bandwidth and real time clock format. Storage of these options in a nonvolatile memory prevents loss due to power failure or removal.

The AOG-110 remote command set includes 11 commands for frequency, phase control, security control, status, on-line help and 1PPS synchronization control. All commands are parsed for correct syntax and operational range prior to execution. Commands that contain errors are rejected and reported to the remote console without affecting the 5 MHz output.

AOG-110 Auxiliary Output Generator

AOG-110 SPECIFICATIONS

PERFORMANCE

- One second stability better than 3.0E-13
- Approximate 1/t stability from one second
- Phase noise: <3dB over Maser
- Three 5 MHz outputs: +13dBm into 50Ω
- VCXO range: >1.0E-6
- Output isolation: >80dB
- 5 MHz input range: +6dBm to +15dBm
- Temperature sensitivity: <10 picosecond per degree C

TIMING OUTPUT

- Format: 1PPS (positive going pulse)
- Amplitude: >3 V into 50Ω (TTL compatible)
- Pulse width: 20 µs
- Rise time: <5 ns
- Jitter: <1 ns RMS

TIMING INPUT

- Sync input: 1PPS
- Amplitude: >3 V into 50Ω (TTL compatible)
- Pulse width: ≥20 µs
- Rise time: <5 ns
- Jitter: <1 ns RMS
- Synchronization input to output: <15 ns

POWER REQUIREMENTS

- Universal supply: 85-265 VAC, 47-440 Hz
- Secondary DC input: 18-30 Vdc
- 20 Watt operational power, 40 Watt start-up

DIMENSIONS

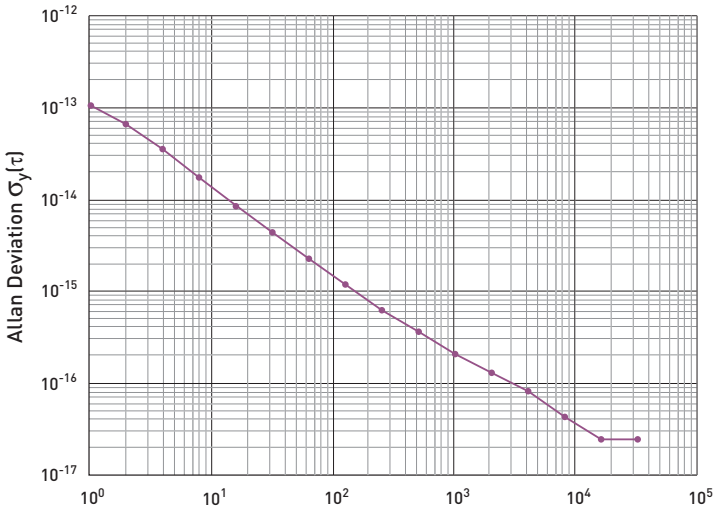
- 7.0" x 16.75" x 21.0" rack-mount chassis (17.78 cm x 42.54 cm x 53.34 cm)
- Weight: approximately 40 lbs.

COMPUTER INTERFACE

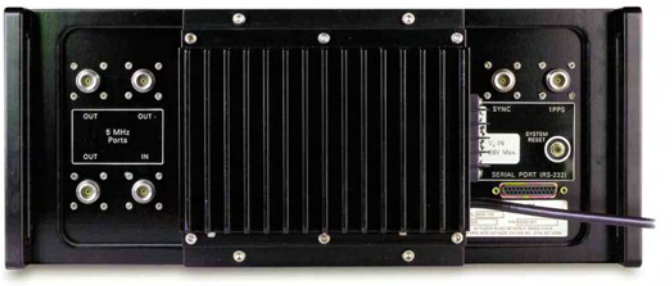
- RS-232 compatible control port
- Supports 1200, 2400, 4800, 9600 and 19200 baud rates
- Remote lockout mode requires password for keypad control
- All frequency, phase and clock controls available remotely
- Operational data and identification available remotely

Frequency Stability

AOG Noise Floor



Typical AOG performance when input is from MHM 2010



The AOG-110 is used by calibration laboratories, engineering facilities and metrology laboratories with high stability frequency standards such as Masers to generate high quality RF sine wave signal offsets without sacrificing performance.

Advanced Timing Solutions

Your Network. Optimized.

Symmetricom offers Advanced Timing Solutions to those customers whose time and frequency needs are so specialized that they warrant products that exactly match their specifications.

From one of a kind timing systems, such as the one we developed for US LORAN-C transmitter stations, to products that offer picosecond measurement, Advanced Timing Solutions products address the highest precision and most complex timing and frequency requirements.

We offer a wide selection of modular products and services, which makes it possible to integrate semi-custom timing systems from standard products and modules. We routinely work with customers to provide customized timing systems for a wide range of applications. Most Advanced Timing Solutions products have hot swap power supplies, hitless switching and many other features, which make these products suitable for high reliability applications.

TSC UTC

UTC Recovery System

KEY BENEFITS

- <15ns Synchronization to UTC (USNO), Assuming Proper Calibration
- Graphical User Interface (GUI)
- Compatible with all Symmetricom Modules to Generate Output Signals
- 5 MHz, 1PPS and IRIG-B (123 & 000) Outputs for Local Use or Distribution
- No Hard Drive: Utilization of Flash Memory Increases Reliability While Simplifying Code Updates
- Dual Fans, Visual and Network Status Indications, and Dual Power Supplies for Maximum Reliability
- GPS Processing Using Symmetricom's KAS-2© Timescale Software
- Operates with Any 5 MHz Clock Source (Any Cesium or Rubidium)

Symmetricom's UTC recovery system is a GPS disciplined cesium standard. It is integrated from a GPS Rx, 100ps 2-Channel Timer, RF Distribution Amplifier, Synthesizer, Sychronizable Divider, and Time Code Generator. The UTC recovery system generates frequency, 1PPS, and time codes that are all synchronized to UTC. The Kalman filter based software controls the divider and synthesizer without disturbing the cesium standard. A Graphical User Interface allows the user to control the system and monitor its performance.

The UTC Recovery System can be configured to custom requirements.

Please contact Symmetricom with any specific requirements.

UTC Recovery System

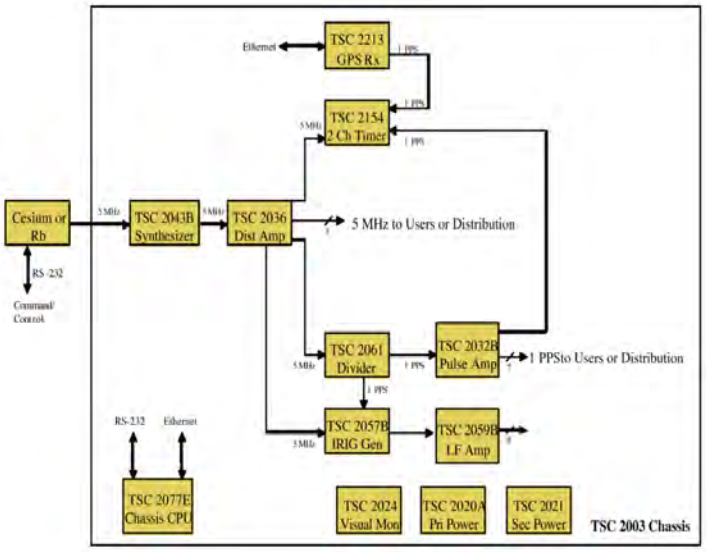
OPERATION

Custom software provides a transportable X-based GUI interface for command and control of the system operation and for display of system performance. The GUI is divided into sections based on function. The GPS panel provides a polar plot of tracked satellites as well as a table of the tracking information for each satellite (including the reported offset to UTC). The system also includes a plot that shows raw GPS data and the filtered data used to steer the DDS. The GUI also contains Time code and alarm information.

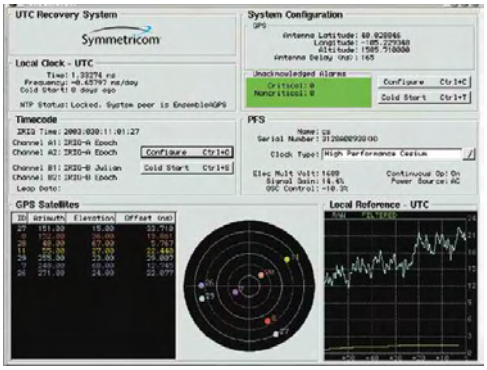
UTC RECOVERY SYSTEM SPECIFICATIONS

PERFORMANCE SPECIFICATIONS

- Offset to UTC(USNO): <15 ns (when properly calibrated)
- 1PPS
  - Rise time: <1ns
  - Jitter: <100ps
- 5 MHz (assuming cesium standard)
  - Harmonics: <40dBc
  - Spurious: <80dBc
  - Phase noise: Same specification as cesium (not degraded)
- IRIG-B (123)
  - Output level: <6 V P-P into 50Ω
  - 3:1 modulation ratio
- IRIG-B (000)
  - Output level: TTL into 50Ω
  - Resolution: 10 ms



UTC Block Diagram



UTC GUI

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Multi-Channel Measurement System (MMS)

Flexibility, Reliability and Precision

KEY BENEFITS

- Flexibility: Can Measure Up to 28 RF Signal Inputs in a Single Chassis
- Multiple Frequency Inputs: Handles Up to Three Different Frequencies, with Eight Inputs Each
- High Resolution: Less than 100 Femtoseconds
- Low Noise Performance: Less than 5.0 x 10-13 Allan Deviation at 5 MHz (1 Second)
- Standard 19-inch Rack Mount Chassis
- Easily Expandable by Incorporating More Modules
- Reliable: Network-based Fault Reporting and Dual Cooling Fans
- Graphical Interface Available via Ethernet Connection to PC
- Network Based Phase Data Output
- Optional SQL Database Integrated with Stable 32

Symmetricom's Multi-Channel Measurement System (MMS) is a flexible, multi-channel system that is ideal for a full production environment. This advanced instrument offers customers a cost effective way to measure the phase difference between multiple continuous wave RF signals, enabling expansion from a base configuration of four signal inputs to a full 28 in a single chassis. Chassis can be added to increase signal measurement capacity. The MMS samples all inputs once every second and computes the phase difference relative to the 32 MHz internal oscillator. The system can also be configured to measure as many as three different frequencies simultaneously, with a frequency range of one to 20 MHz.

Expansion is made easy by the fact that the base system is designed for mounting in a 19-inch rack. Customers can increase the number of additional inputs simply by adding more standard modules, with four inputs available per module. The modular nature of the Multi-Channel Measurement System makes the product ideal for a range of customer needs, and the ability to add modules as production demands increase streamlines the resulting ramp-up.

DATABASE MANAGEMENT SYSTEM

The powerful relational database management system from Symmetricom augments the Multi-Channel Measurement System's capabilities by enabling storage of as many as three years of one-second data and—through an ODBC/SQL interface—helps retrieve data rapidly.

MMS 4-Channel Configuration

MMS 28-Channel Configuration

OPERATION

The MMS is a multiple mixer measurement system. The instrument measures the phase difference between an RF signal from the clock under test and a reference RF signal that is common to all measurement channels on a four-channel measurement module. An internal numerical oscillator provides the reference RF signal. Phase differences are measured directly rather than by using time differences, because phase measurements do not require knowledge of absolute frequency. The measured phase differences are then converted to nominal time differences, dividing the phase difference by a user-supplied scale factor.

MMS SPECIFICATIONS

PERFORMANCE SPECIFICATIONS

- Allan deviation (1 s) <5.0 x 10-13 at 5 MHz
  <2.5 x 10-13 at 10 MHz

ELECTRICAL SPECIFICATIONS

- Frequency range: 1 – 20 MHz
- Input signal level: 3 dBm – 17 dBm
- Input impedance: 50Ω
- Input connectors: SMA
- Pentium 233 computer card
  - 64 MB flash
  - 4 MB RAM
  - SVGA adapter
  - PS/2 mouse port
  - PS/2 keyboard connector
  - 2 serial ports (RS-232)
  - 1 Ethernet port
- Power requirements
  - Input voltage: 100 to 240 VAC ±10%
  - Input frequency: 50/60 Hz
- Power consumption: 160 W maximum
- Connector type: IEC plug

PHYSICAL SPECIFICATIONS

- Weight: 40 kg (88 lbs.)
- Dimensions: 43.2 cm x 17.8 cm x 60.9 cm
  (17 inches x 7 inches x 24 inches)

ORDERING INFORMATION (single frequency)	**Part No.**
4 Channel Measurement System	TSC 12030-110
8 Channel Measurement System	TSC 12030-120
12 Channel Measurement System	TSC 12030-130
16 Channel Measurement System	TSC 12030-140
20 Channel Measurement System	TSC 12030-151
24 Channel Measurement System	TSC 12030-161
Measurement Database	TSC 4077-01

Contact factory for dual frequency configurations.

Commercial Time-Scale System

Fully Integrated, World-Class Turn-Key Timing System

STANDARD FEATURES

- Include Up To 7 High Performance Cs Clocks
- GPS Common View Time Comparison
- BIPM Reporting
- Frequency Accuracy +/- 1E-14 (Long Term)
- Time Accuracy to 5ns RMS to UTC (USNO)
- NTP
- Battery Back-Up
- Local GUI

OPTIONAL FEATURES

- Active H-Maser
- Multi-Channel Measurement System
- Hot Swap Distribution Chassis
- Multiple Outputs
- TWTT
- Data Storage

As the international standard time scale, Universal Coordinated Time (UTC) is the composite of clocks throughout the world. The time of each clock is reported to the International Bureau of Weights and Measures (BIPM) using either GPS common view (CV) or Two-Way Satellite Time and Frequency Transfer. National laboratories also compute a local time scale steered to agree with UTC designated as UTC(local). Local UTC time-scale systems have state-of-the-art frequency stability, phase noise performance, and system availability. To be incorporated in UTC, their internal clocks cannot themselves be steered by UTC and the CV data must be calculated and reported to the BIPM in accordance with its published method and format.

The Symmetricom Time-Scale System meets these requirements using Symmetricom manufactured commercial timing products. Compared to other solutions, Symmetricom offers faster deployment, lower ownership costs, higher product quality, spare parts that are easier and less expensive to get, and a single point of responsibility for all system support.

The Symmetricom solution unites these advantages with the world's most widely adopted frequency standards for UTC generation. (The Symmetricom 5071A, alone accounts for 76% of all UTC clocks and contributes 87% of UTC time.) The Symmetricom –Time-Scale System can combine up to seven high-performance frequency standards in a time scale that drives the local real-time clock (RTC) signal. A timing quality GPS receiver provides the information used to steer the system output to UTC and generates GPS common-view data. This allows the frequency standards to be reported to the BIPM for inclusion in the international time scale. As a fully integrated solution, the system provides industry-leading frequency stability, phase-noise performance, and time-scale availability in a unit as small as one instrument rack.
In short, it's now possible to purchase a fully integrated, world-class timing solution comparable to the best national laboratories with commercial hardware and software support included. A unique set of design features enables the state-of-the-art functionality, performance, and reliability needed to establish a national timing reference or a global or regional navigation satellite system.

FIG 1 Turn Key Timing System

CONFIGURATION OPTIONS

One advantage of a modular solution is the ability to cost-effectively plug and play components to tailor the solution to a specific need. Symmetricom offers a variety of frequency standards and other configuration options. A minimum system consists of:

- Equipment rack
- 5071A cesium standard
- Monitor
- Keyboard
- Battery backup unit (BBU)
- Modular chassis with controller, synthesizer, RF distribution amplifier, and GPS receiver,

This minimum system provides a time scale steered to UTC, real time frequency and time references, NTP, and GPS common view data that may be used to contribute clock data to the BIPM for the UTC calculation. Additional clocks, the clock measurement system, supplemental power backup, the database, additional signal generation, and additional signal distribution may be added later. Table 1 shows the equipment provided in the standard configuration and available equipment upgrades.

Some of the options available within the framework of the standard Timescale System are:

- Adding a two-way time transfer modem
- Adding or deleting output signal types and distribution
- Adding or deleting cesium standards
- Adding one or more active hydrogen masers

The choice of frequency standards depends on the applications for the system's frequency and time outputs. All Symmetricom atomic clocks interface to the Timescale System and provide status and fault monitoring information.

Standard Configuration (Single Cesium Clock Steered to UTC) **Produces a real time clock steered to UTC via GPS. The RTC has 5 outputs at 5 MHz and a single 1 PPS output.**
5071A High Performance Cesium Standard
Real Time Clock Subsystem
Switch & Distribution Subsystem
Battery Backup Subsystem
UTC Recovery, Clock Steering and Common View Monitor & Control Software
Rack, monitor, keyboard and cables
Upgrade to include 8-Clock Measurement System:
8 Channel Multi Clock Measurement System
Database
Multiple Clock Upgrade
5071A High Performance Cesium Standard (S)
MHM2010 Active Hydrogen Maser (S)
1MHz, 10 MHz, and IRIG-B Upgrade
Additional RF and timecode outputs

Table 1 Symmetricom Timescale System Configurations

SYSTEM SPECIFICATIONS FOR STANDARD SYMMETRICOM TIME-SCALE SYSTEM

NUMBER OF CLOCKS: 3 or more high-performance 5071A cesium clocks

SYSTEM TIME AND FREQUENCY:
Time scale computed as the average of the clocks

Switching: automatic switching between clocks with no time or frequency discontinuities and long-term time or frequency errors

OUTPUTS

5 MHz (Steered system output)
Level: 13 ± 1 dBm, 50 W
Spurious: < -80 dBc
Harmonics: < -40 dBc
Phase noise:

Offset frequency (Hz)	dBc/Hz
1	-106
10	-136
100	-151
1 k	-156
10 k	-160
100 k	-160

SHORT-TERM STABILITY:

τ (s)	σy(t)
1	$5x10^{-12}$
10	$3.5x10^{-12}$
100	$8.5x10^{-13}$
1 k	$2.7x10^{-13}$
10 k	$8.5x10^{-14}$
100 k	$2.7x10^{-14}$
500 k	$1x10^{-14}$

FREQUENCY ACCURACY: ±$1x10^{-14}$ for 10 day averages after 10 days of continuous operation

FREQUENCY HOLDOVER: ±1x10-13 for 30 days over the full temperature range

1 PPS
Time accuracy: 5 ns RMS relative to UTC(USNO) at time of shipment
Time stability (wander): 3 ns RMS relative to UTC(USNO) via passive GPS
Time holdover: ± 300 ns relative to UTC over the full temperature range after 10 days of operation
Time transfer accuracy: 2 ns RMS relative to UTC via GNSS common view
Jitter: < 100 ps
Level: Logic 0 < 0.8 V, Logic 1 > 4.5 V into a 50 W load

NTP Transactions: > 200/s (without S250i)

DATA STORAGE: Sufficient to store all clock comparison measurements for 10 years

BATTERY BACKUP: 24 VDC Nominal
> 2 hrs

USER INTERFACE: All control through a local GUI using keyboard, mouse, and LCD display

STATUS MONITORING:
Outputs
System specifications
Clock parameters
Power supply voltages
Backup battery status
Faults stored in a database for analysis

TIME COMPARISON:
Passive GPS comparison with UTC via GPS (< 1 ns resolution)
-L2 codeless reception, GLONASS, and GALILEO upgrade optional

Two-way GPS comparison with UTC via BIPM Common-View and Clock Reports (< 2 ns RMS)

Time comparisons of 3 clocks and real-time steered clock < 1 ps

TIME SCALE
No discontinuity in time scale on clock additions or deletions

Clock models
- Cs clocks have white fm and random walk fm
- H masers have white pm, white fm, random walk fm, random walk frequency aging

Clock weighting to optimize short and long-term stability
- 3 weights per clock

Kalman filter time and frequency estimation
-Minimum squared error estimates
- Optimum transient response

Filter remains optimum even when measurement data are missing
- Bad data filtering
- Fast rejection based on matched filter response to known outlier types such as phase steps
- Robust outlier detection based on inconsistencies with the physical model

ENVIRONMENTAL

Power: 100, 120, 220, or 240 VAC nominal, 47-63 Hz, 1 kW maximum
24 VDC nominal

Ambient Temperature: 0 – 50 ºC

GNSS Antenna Location: Roof Mounted with clear view of sky above 10 degrees
Surveyed antenna position with accuracy < 0.5 m required (survey service optional)

SYSTEM SPECIFICATIONS FOR STANDARD TIME-SCALE SYSTEM WITH AT LEAST 1 ACTIVE HYDROGEN MASER

Adding active hydrogen masers to the Turn-key Timing System provides additional output signals with the best frequency stability commercially available. As with the 5071A units, the masers can be reported to the BIPM for inclusion in the international time scale

NUMBER OF CLOCKS:

2 or more high-performance 5071A cesium clocks

1 or more MHM-2010 active hydrogen masers

SYSTEM TIME AND FREQUENCY:

Time scale computed as the weighted average of the clocks

Switching: automatic switching between clocks with no time or frequency discontinuities and long-term time or frequency errors

OUTPUTS

5 MHz (Steered system output)

Level:	13 ± 1 dBm, 50 W
Spurious:	< -80 dBc
Harmonics:	< -40 dBc

Phase noise:

Offset frequency (Hz)	dBc/Hz
1	-106
10	-136
100	-151
1 k	-156
10 k	-160
100 k	-160

SHORT-TERM STABILITY (1 HZ MEASUREMENT BANDWIDTH):

τ (s)	σy(t)
1	2.5×10^{-13}
10	5×10^{-14}
100	1.3×10^{-14}
1 k	3.2×10^{-15}
10 k	3×10^{-15}
100 k	3×10^{-15}
500 k	4×10^{-15}

FREQUENCY ACCURACY:

±5x10-15 for 10 days after 10 days of continuous operation

FREQUENCY HOLDOVER:

±1x10-13 for 30 days over the full temperature range

1 PPS

Time accuracy:	5 ns RMS relative to UTC(USNO) at time of shipment
Time stability (wander):	3 ns RMS relative to UTC via passive GPS
Time holdover:	± 300 ns relative to UTC over the full temperature range after 10 days of operation
Time transfer accuracy:	2 ns RMS relative to UTC via GNSS common view
Jitter:	< 100 ps
Level:	Logic 0 < 0.8 V, Logic 1 > 4.5 V into a 50 W load

NTP

Transactions: > 200/s (without S250i Enterprise Time Servers)

DATA STORAGE: sufficient to store all clock comparison measurement for 10 years

BATTERY BACKUP: 24 VDC Nominal

> 1 hrs

Hotpack environmental chambers require facility backup power (e.g. generator)

USER INTERFACE: All control through a local GUI using keyboard, mouse, and LCD display

STATUS MONITORING:

Outputs
System specifications
Clock parameters
Power supply voltages
Backup battery status
Faults stored in a database for analysis

TIME COMPARISON:

Passive GPS comparison with UTC via GPS (< 1 ns resolution)
- L2 codeless reception, GLONASS, and GALILEO upgrade optional

Two-way GPS comparison with UTC via BIPM Common-View and Clock Reports (< 2 ns RMS)

Time comparisons of 3 clocks and real-time steered clock < 1 ps

TIME SCALE

No discontinuity in time scale on clock additions or deletions

Clock models
- Cs clocks have white fm and random walk fm
- H masers have white pm, white fm, random walk fm, random walk frequency aging
- Clock weighting to optimize short and long-term stability
- 3 weights per clock

Kalman filter time and frequency estimation
- Minimum squared error estimates
- Optimum transient response
- Filter remains optimum even when measurement data are missing

Bad data filtering
- Fast rejection based on matched filter response to known outlier types such as phase steps
- Robust outlier detection based on inconsistencies with the physical model

ENVIRONMENTAL

Power: 100, 120, 220, or 240 VAC nominal, 47-63 Hz, 1 kW maximum
24 VDC nominal
Hotpack Environmental Chambers require 208/230 V, 3 kW each

Ambient Temperature: 0 – 50 °C
Hotpack 0 - 30 °C
Without Hotpack, masers located in a room with 23 ± 0.15 °C temperature control
GNSS Antenna Location: Roof mounted with clear view of sky above 10 degrees
Surveyed antenna position with accuracy < 0.5 m required (survey service optional)

TSC 4400

GPS Disciplined Rb Oscillator

KEY FEATURES

- Provides a Coherent Timing Signal Set
  - 1PPS: 4 Outputs
  - 10 MHz: 4 Outputs
  - IRIG-B: 4 Outputs
- Network Time Protocol (NTP) Server
- Capable of Steering an External Frequency Reference
- Front Panel LEDs Indicate System Status
- Status Information via Ethernet
- Operates with L1/L2 GPS Frequencies
- Includes GPS Antenna

The TSC 4400 is a time recovery system capable of generating precise timing signals traceable to UTC(USNO). It utilizes a GPS disciplined rubidium frequency reference to provide timing outputs characterized by the short-term stability of the atomic reference and the long-term stability of GPS.

The versatility of the TSC 4400 makes it suitable for a variety of applications. It is capable of steering external frequency references (e.g.: cesium) via RS232 to further improve timing performance. Its size allows for two units to be mounted side by side in a standard 19" rack providing full redundancy for those applications requiring uninterrupted timing signals.

The Ethernet connection also simplifies integration with complex systems by allowing health and status information to be monitored remotely.

The TSC 4400 can be configured to custom requirements.

Please contact Symmetricom with any specific requirements.

TSC 4400 GPS Disciplined Rb Oscillator

TSC 4400 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- 10 MHz Output
  - Connector: SMA female
  - Level: 1 ± 0.1 V RMS
  - Impedance: 50 ± 5Ω
  - SSB Phase noise (Rb)
    - 1 Hz -95 dBc/Hz
    - 10 Hz -130 dBc/Hz
    - 100 Hz -140 dBc/Hz
    - 1 kHz -150 dBc/Hz
    - 10 kHz -155 dBc/Hz
    - 100 kHz -155 dBc/Hz
- 1PPS Output
  - Connector: SMA female
  - Level: 3.0 V
  - Impedance: 50 ± 5Ω
  - UTC offset accuracy: 15 ns RMS
  - Holdover accuracy: 50 ns @ 6 hours
    100 ns @ 12 hours
    300 ns @ 24 hours
- IRIG-B Output
  - Connector: SMA female
  - Time code: IRIG-B 123
  - Impedance: 50 ± 5Ω
  - Accuracy: <5 µs

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

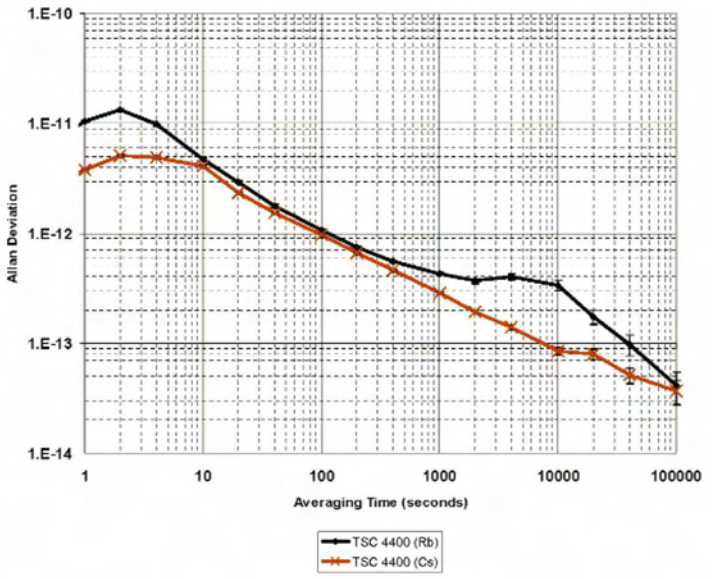
- Temperature: 0°C to 50°C
- Humidity: 0 to 95% non-condensing
- AC Input: 90 – 264 V AC, 85 W, 47 – 63 Hz
- Dimensions: 3.5" (8.89 cm) H x 9.5" (24.13 cm)W x 22" (55.88 cm) D
- Weight: 12 lb (5.5 kg)
- Color: Parchment White

CONFIGURATION OPTIONS

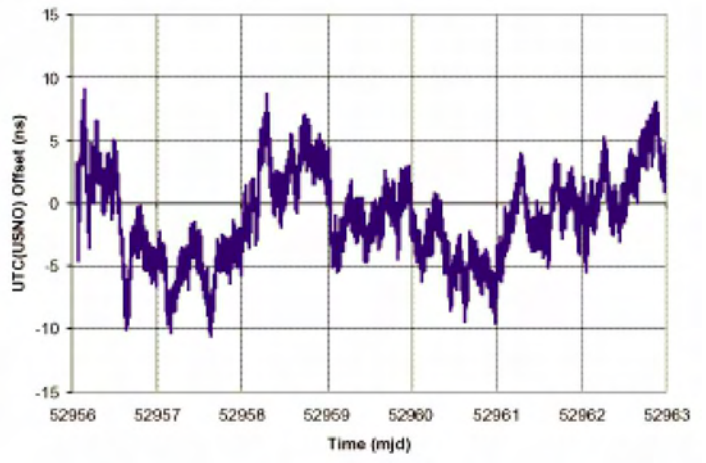
- Dual frequency receiver
  - 4400 Standard product
  - 4400-01 With rack Mount chassis
  - 4400-02 Fully redundant, includes rack mount
- Single frequency receiver
  - 4400-03 Single frequency L1 receiver
  - 4400-04 With rack mount chassis
  - 4400-05 Fully redundant, includes rack mount

ACCESSORIES

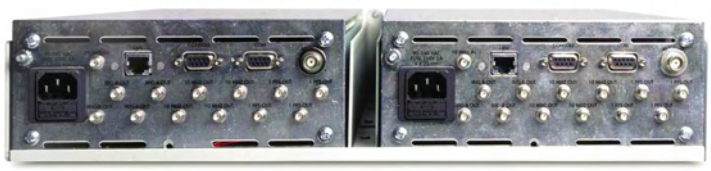
- OP001 30 m GPS antenna cable
- OP002 60 m GPS antenna cable
- OP003 Lightning arrestor



Typical Performance (10 MHz)



Typical Performance (1PPS)



Rear View

TSC UTCG

Multiplexes Frequencies, Time Codes, and Pulses on One Optical Fiber

KEY BENEFITS

- Transmits a Digital Signal Containing Both Time and Frequency Information
- Auto-detects the 5-,10-, or 100-MHz Input Reference
- Simple User Interface Enables Easy Configuration and Monitoring
- Redundant Power Supplies Can Be Hotswapped to Maintain Continuous Operation
- Holdover Capability in Case of Loss of Input Reference
- A Single UTCG Supports at Least 400 Remote Users

The Universal Time & Frequency System (UTFS) from Symmetricom is designed to achieve precise time and frequency signal distribution and synchronization via optical fiber to local areas as well as to widely dispersed locations. At the front end of the UTFS is the Universal Time Code Generator (UTCG), a state-of-the-art multiplexer that receives multiple inputs, including a frequency reference (required), 1PPS Sync signal (optional), and IRIG-B time code (optional). In turn, the UTCG simultaneously outputs all timing, RF, and time code on a single fiber to one or more Time Code Translators (TCTs) at remote locations.

HIGH-QUALITY SIGNALS

Because fiberoptic cable carries the time code to the TCT, the signal is of extremely high quality. There are no ground loops, crosstalk, or attenuation. No matter how many or what type of timing signals are needed at a remote location, only a single fiber pair is ever required. One fiber carries all timing signals to the TCT and the other optional fiber returns status information to the UTCG.

An optional Ethernet connection enables remote monitoring of system status and configuration. Electrical and visual alarm outputs are also available to allow continuous status monitoring.

In addition, the UTCG has the ability to compare its internal time to an external 1PPS signal. When this feature is enabled and the two signals are offset by more than 20 ns, the system automatically triggers an alarm. The UTCG is housed in a 4U 19-inch rack-mount modular chassis. The system includes dual redundant power supplies that can be hot-swapped to keep the system running if one fails.

TSC UTCG Universal Time Code Generator

OPERATION

The UTCG synchronizes its internal time to an external reference. The internal 100-MHz time base phase locks to a 5-, 10-, or 100-MHz reference input connected to the unit. If a 1PPS is also connected, it is used to define the start of second. IRIG-B time code can be utilized to set the internal epoch. Alternatively, the user can set the time from the front-panel interface.

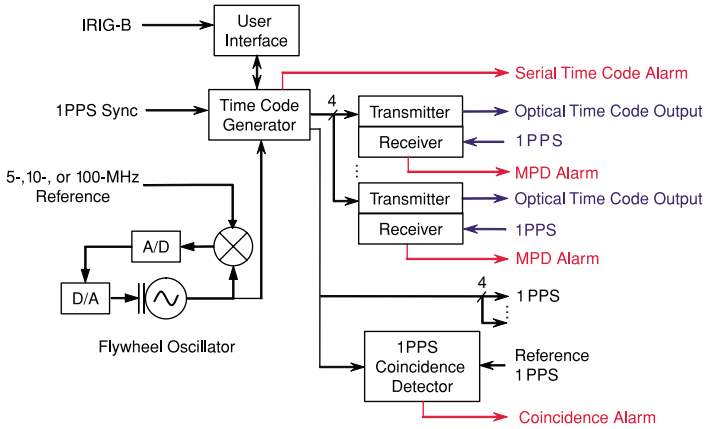
After initialization, the UTCG starts to produce a100-Mb/s serial time code. The unique feature of the UTCG is that the serial time code carries the start of second, the identification of the second, and the reference frequency, all in a single signal. This information is decoded at the receiver and used to produce the output signals. Once the fiberoptic output is enabled, the serial time code is modulated onto either a single-mode laser or a light emitting diode and transmitted via the appropriate optical fiber to the receiver.

The UTCG front panel allows the user to monitor and control operation of the unit. The time can be slewed relative to the initial time in increments of 10 ns. In addition, leap seconds can be programmed to occur according to their schedule. Front panel LEDs and optically isolated contact closures annunciate alarms for failure of a downstream device, loss of phase lock, clock slip relative to an external 1PPS, approaching the end of the VCXO control range, and power supply failure. An Ethernet port for control and monitoring is an optional feature. All modules, including the redundant power supplies, are hot-swappable.

TSC UTCG SPECIFICATIONS

GENERAL SPECIFICATIONS

- Frequency Reference Input (required)
  - Frequency: 5, 10, or 100 MHz
  - Holdover: Maximum shift 3.5 x 10-9 on loss of input signal
  - Long term drift: ±3.7 x 10-7 over 24 hours
  - Impedance: 50 ±5W
- Time code input: IRIG-B 123
- Synchronization input: 1PPS TTL
- Fiberoptic output (to TCT Module)
  - Quantity: Four
  - Output connector: LC
  - Optical fiber
    - Multi-mode: up to 2km
    - Single-mode: up to 30km
- Temperature range: 0-50 C (operating)
- Humidity: 0-90% non-condensing (operating)
- Settability: 5ns
- Input power (Redundant power supply standard)
  - Voltage range: 90-240 V~
  - Frequency: 45-65 Hz
  - Current (max): 0.20 A (90 V)
- Alarm output
  - Quantity: Two
  - Connector: SMA female
  - Type: Opto-isolated switch
- Physical
  - Size: 19-inch EIA rack-mount chassis, 4U high x 9" (22.9 cm) deep
  - Weight: <30 lb
- Control and status port (optional)
  - Physical layer: 10/100 Ethernet
  - Protocol: TCP/IP
  - Connector: RJ-45



TSC UTCG Block Diagram

TSC FEC

Expansion for Fiberoptic Time and Frequency Signals

KEY BENEFITS

- Cost-effective Upgrade Path
- Ability to Expand System Outputs as Needed (Add Outputs One At a Time)
- Capacity At the High End is Extensive
- Dual Redundant Power Supplies Can Be Hot-swapped to Maintain Continuous Operation

The Universal Time & Frequency System (UTFS) distributes precise time and frequency signals via optical fiber to local and remote locations. At the front end of the UTFS is the Universal Time Code Generator (UTCG), a state-of-the-art multiplexer that links to frequency, 1PPS and IRIG-B references. In turn, the UTCG simultaneously outputs all timing signals—RF signals, serial time codes and pulsed outputs—on a single fiber to as many as four Time Code Translators (TCTs) at remote locations.

The Fiberoptic Expansion Chassis (FEC) provides a means to expand beyond the four fiberoptic outputs from the UTCG. Customers starting out with a minimal configuration system can readily add functionality—in the form of additional Time Code Translators with accompanying output modules—as organizational needs and budgets increase.

EXPANSIVE CAPABILITY

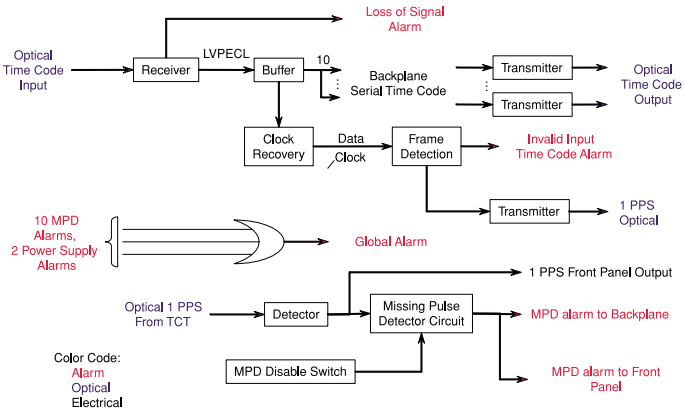
For example, a Fiberoptic Expansion Chassis with one input module and 10 output modules can multiply one UTCG output to 10. In this scenario, the customer can add 40 fiberoptic outputs to the system by adding four expansion chassis. By adding one more expansion chassis level, the number of fiberoptic outputs and potential TCTs in the system can increase to at least 400. And upgrading is as easy as adding hardware. No configuration is necessary. The Fiberoptic Expansion Chassis and power supplies are identical to the UTCG, greatly simplifying logistics.

TSC FEC Fiberoptic Expansion Chassis

OPERATION

The Fiberoptic Expansion Chassis receives a single optical input and transmits from 2 to 10 identical optical outputs. The input module performs an optical-to-electrical conversion and puts the electrical serial time code on the chassis backplane. Each output module performs an electrical-to-optical conversion and forwards the time code without modification. All modules, including the redundant power supplies, are hot swappable.

The input module also decodes the input signal and validates the serial time code. The output module receives the optical 1PPS, which is optionally returned from each TCT, and produces an alarm when the 1PPS is missing. Missing 1PPS alarms are provided with enable/disable switches. These alarms, along with power supply alarms, are aggregated with the CRC and loss-of-signal alarms by the input module, and then transmitted via suppressed optical 1PPS to the upstream device, such as the UTCG.



FEC Block Diagram

TSC FEC SPECIFICATIONS

GENERAL SPECIFICATIONS

- Input module
  - Fiberoptic input and output
    - Connectors: LC
  - Optical fiber
    - Multi-mode: up to 2 km
    - Single-mode: up to 30 km
  - Alarm output on SMA connector for monitoring chassis alarm
  - LEDs
    - Loss of signal
    - CRC
    - Chassis
- Output module
  - Quantity: 2-10 per chassis
  - Connectors
    - Fiberoptic: LC
    - 1PPS monitor: SMA
  - Optical fiber
    - Multi-mode: up to 2 km
    - Single-mode: up to 30 km

PHYSICAL & ENVIRONMENTAL SPECIFICATIONS

- Temperature range: 0°C – 50°C (operating)
- Humidity: 0 – 90% Non-condensing (operating)
- Input power
  - Voltage range: 90-240 V~
  - Frequency: 45-65 Hz
  - Current (max): 0.20 A (90 V)
- Size: 19-inch EIA rack-mount chassis, 4U high x 9" (22.9 cm) deep
- Weight: 31.5 lbs with all modules installed

TSC TCT

Configurable Time and Frequency Outputs

KEY BENEFITS

- Fully Automatic Operation
- Advances the Time to Remove Synchronization Delay
- Can Produce Any Output Signal Needed:
  - Dual RS-232 Time Code
  - PB-1 Time Code
  - Parallel BCD Time Code
  - 5- or 10-MHz Signal
  - IRIG-B and NASA 36-bit Serial Time Code
  - Configurable Pulse Rate (1PPS -1MPPS)
- Additional Output Types Available on Request

The Time Code Translator (TCT), housed in a 1U 19-inch rack-mount chassis, receives all of the timing signals from the UTCG via fiberoptic cable and constructs and synchronizes the resulting output signals. The customer can configure every TCT with up to four different time and frequency outputs by selecting plugin modules.

Additional TCTs can be added to the system to expand signals as well as to provide redundancy. Another important TCT feature is the incorporation of "advance" capability, which compensates for fiberoptic path delays from the UTCG. The TCT includes a front-panel time display and panel alarm indicator for ease of monitoring.

If a fault interrupts the timing signal from the UTCG, then an internal holdover oscillator continues to maintain all output signals. When the signal returns, the TCT automatically resynchronizes itself to match the timing signal from the UTCG.

OPERATION

The TCT phase locks to the optical signal from the UTCG, reads the serial time code, and generates all of the electrical output signals. The frequency of the input reference is recovered by phase locking a VCXO to the received signal. The recovered clock is then used to determine the start of frame, which is the position of the 1PPS, and to decode the data, which contains the epoch of each second. If the input signal is lost, the TCT will go into flywheel mode, continuing to provide signals at the output module. An advance can be set so that the TCT removes the delay introduced by the optical fiber.

The recovered 100 MHz,1PPS, and time code are transmitted to each of the four output module slots. Each plug-in module synthesizes an output signal. Pulse rates are created by dividing and synchronizing with the 1PPS, frequencies are created by direct digital synthesis, and time codes are calculated from the internal time base. The modular architecture makes it easy for Symmetricom to add new signal types as users request them.

The TCT displays the time and its internal status on the front panel. The status includes loss of signal, time-code CRC error, internal error, resynchronization of the internal time base, PLL out of lock, VCXO control voltage near end of range, leap year, and leap second occurring today. In addition, the TCT produces an optical 1PPS, which may optionally be monitored by the upstream equipment. This 1 PPS is suppressed when there is a TCT failure, and transmits the failure event to the upstream equipment. The returned 1PPS may also be used to monitor the performance of the TCT. Transmission of detailed status information, in addition to the return PPS, is an optional feature.

TSC TCT Time Code Translator

TSC TCT SPECIFICATIONS

GENERAL SPECIFICATIONS

- Fiberoptic Input (from UTG or FEC)
  - Input connector: LC
  - Optical fiber: Multi-mode up to 2 km; Single-mode up to 30 km
- Display:
  - Year (two-digit), day, hour, minute, second
  - Leap second +
  - Leap second –
  - Leap year
  - Internal fault
  - Loss of input signal
  - VCXO unlock
  - Rate re-sync
  - Serial time code CRC error
  - Electronic frequency control out of range
- Holdover
  - Maximum shift: 3.5 x 10-9 on loss of input signal
  - Long term drift: ±3.7 x 10-7 over 24 hours
  - Thermal stability: ±10 ppm/C

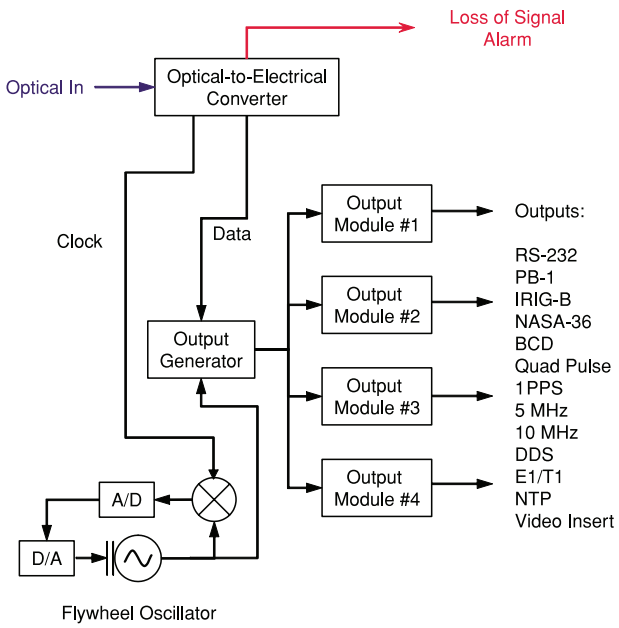
PHYSICAL & ENVIRONMENTAL SPECIFICATIONS

- Size: 19-inch EIA rack chassis, 1U high x 16.75" (42.5 cm) deep
- Weight: 12 lb (5.5 kg)
- Temperature range: 0°C – 50°C (operating)
- Humidity: 0 – 90% non-condensing (operating)
- Altitude: 3,048 m maximum (10,000 feet)
- Input power
  - Voltage range: 90 – 240 V~
  - Frequency: 45 – 65 Hz
  - Current (max): 0.20 A (90 V~)

OUTPUT MODULES

- Configurable pulse rate (1,10,100 and 1 kPPS, or quad 1PPS – 1M PPS)
  - Height: 1TCT module slot; Four outputs per module
  - Connector: 50Ω TNC female
  - Skew: <±2 ns
  - Jitter: <200 ps
- RF (1, 5, or 10 MHz)
  - Height: 1TCT module slot; Four outputs per module
  - Impedance: 50Ω
  - Connector: TNC female
  - Output level: 1 V RMS (13 ±1dBm)
  - Output Isolation: >100 dB
  - Harmonic distortion: <-40 dBc
  - Phase noise:
    - 1Hz: -115 dBc
    - 10 Hz: -125 dBc
    - 100 Hz: -125 dBc
    - 1kHz: -135 dBc
    - 10 kHz: -140 dBc
    - 100 kHz: -150 dBc
- Parallel BCD time code
  - Height: 1 TCT module slot
  - Connector: DB-62 female
  - Output format: Parallel BCD ms load
  - TTL Compatible
  - Leap second: subtract or add
  - Transition times: All bits settle within 100 ns
- Dual time code (IRIG-B and NASA 36)
  - Height: 1TCT module slot
  - Connectors: 4 TNC female, 2 each code type
  - Modulated code outputs
    - Frequency: 1 kHz
    - Level: Fixed, 5 ±0.5 Vpp into 50Ω
    - Modulation ratio: Fixed 3.3:1
    - Impedance: 50Ω
    - TTL Compatible
- Parallel PB-1 code
  - Height: 1TCT module slot
  - Connector: DB-62 female
  - Format: Parallel Binary PB-1 (IRIG STD 205-87) 27-bit binary ms of the day; 9-bit binary day; parity bits P1 and P2; and read enable pulse
  - TTL Compatible
  - Transition times: All bits settle within 100 ns (one hundred nanoseconds)
- Dual RS-232 time code
  - Height: 1TCT module slot
  - Connectors: Two DB-9 female
  - Time output: Once per second
  - Time encoded: Binary-coded decimal
  - Character format: Start bit, 7 data bits, odd parity bit, Stop bit
  - Baud rates: 9,600 and 19,200 baud (selectable)
  - Four-digit year: Jumper-configurable option

Rear View



TSC TCT Block Diagram

4340A

Fiberoptic Distribution Amplifier

KEY FEATURES

- Cost-Effective Upgrade Path
- Ability to Expand System Outputs as Needed (Add Outputs One at a Time)
- Capacity at the High End is Extensive
- Dual Redundant Power Supplies Can Be Hot-Swapped to Maintain Continuous Operation
- 1U Rack Mount Chassis
- SFP Transceiver Sockets Enable Easy Reconfiguration

The Universal Time & Frequency System (UTFS) distributes precise time and frequency signals via optical fiber to local and remote locations. At the front end of the UTFS is the Universal Time Code Generator (UTCG), a state-of-the-art multiplexer that links to
frequency, 1PPS and IRIG-B references. In turn, the UTCG simultaneously outputs all timing signals—RF signals, serial time codes and pulsed outputs—on a single fiber to as many as four Time Code Translators (TCTs) at remote locations.

The Fiberoptic Distribution Amplifier provides a means to expand beyond the four fiberoptic outputs from the UTCG. Customers starting out with a minimal configuration system
can readily add functionality—in the form of additional Time Code Translators with accompanying output modules—as organizational needs and budgets increase.

EXPANSIVE CAPABILITY

For example, a Fiberoptic Distribution Amplifier with one input transceiver and 8 output transceivers can multiply one UTCG output to 8. In this scenario, the customer can add 32 fiberoptic outputs to the system by adding four expansion chassis. By adding one more distribution level, the number of fiberoptic outputs and potential TCTs in the system can increase to at least 256. And upgrading is as easy as adding hardware. No configuration is necessary. Hot swap SFP sockets for fiber optic transceivers provides easy expansion or transceiver replacement for different networks. An AC or DC hot swap redundant supply can be ordered with the unit.

TSC 4340A Fiberoptic Distribution Amplifier

OPERATION

The Fiberoptic Distribution Amplifier receives a single optical input and transmits from 2 to 8 identical optical outputs. The input transceiver performs an optical-to-electrical conversion and puts the electrical serial time code on the chassis mother-board. Each output transceiver performs an electrical-to-optical conversion and forwards the time code without modification. All modules, including the redundant power supplies, are hot swappable.

The unit also decodes the input signal and validates the serial time code. Each output transceiver receives the optical 1PPS, which is optionally returned from each TCT, and produces an alarm when the 1PPS is missing. These alarms, along with power supply alarms, are aggregated with the CRC and loss-of signal alarms and then transmitted to the upstream device, such as the UTCG.

TSC 4340A SPECIFICATIONS

GENERAL SPECIFICATIONS

- Input module
  - Fiberoptic input and output: 8
  - Connectors: LC SFP Socket
  - Optical fiber transceivers: Multi-mode up to 2 km; Single-mode up to 30 km
  - Chassis alarm
  - LEDs: Power, Input, Outputs (8)
- Output module
  - Quantity: 2-8 per chassis
  - Connectors: Fiberoptic: LC SFP Socket
  - Optical fiber transceivers: Multi-mode up to 2 km; Single-mode up to 30 km

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature range: 0°C-50°C (operating)
- Humidity: 0-90% Non-condensing (operating)
- Input power
  - Voltage range: AC: 90-240 V~; DC: 18-32 V
  - Frequency: 45-65 Hz
  - Power (max): 18 W
- Size: 19-inch EIA rack-mount chassis, 1U high x 9" (22.9 cm) deep
- Weight: 10.5 lbs (4.8 kg)

Rear View

Bus Level Timing

Your Network. Optimized.

Symmetricom's time and frequency processor modules provide precise, versatile, and dependable timing for bus level integrated systems.

We work hard at building modules that fit into most computer bus architectures. In fact, we offer three different bus level product categories: PCI, VME, and PC.

Our time and frequency processor modules can be configured within a wide variety of computing environments (including Windows, Solaris, Linux, Unix, VxWorks, and more) and meet most interface requirements.

These modules allow the capability to customize your systems with interrupt driven algorithms, satisfying most timing requirements. In addition, these cards are configurable to provide precise time to a single computer, synchronize multiple interconnected computers, or act as a source for timing outputs. They can synchronize a computer clock to an input reference as well as act as a synchronized time generator for other connected boards or devices.

PCI and VME Software Availability

Symmetricom does not charge for software drivers

PCI Family Drivers	
Operating System	**Form**
Dec UNIX	Source Code
IRIX	Source Code
LabVIEW	Source Code
LINUX	Symmetricom
LynxOS	Source Code
Open VMS	Source Code
PowerMAC	Source Code
pSOS	Source Code
QNX	Source Code
QRTP	Source Code
Solaris 2.5.1 (2.6)	Source Code
Solaris 2.7 (Solaris 7)	Source Code
Solaris 2.8 (Solaris 8, 9, 10)	Symmetricom
VISA	Source Code
VxWorks	Source Code
2000/XP/VISTA/7	Symmetricom
Server 2003/2008	Symmetricom

bc635/637VME & TTM635/637VME Drivers	
Operating System	**Form**
HP UX 9.x	Source Code
HP UX 10.x	Source Code
HP RT 1.x	Source Code
HP RT 2.x	Source Code
LabVIEW	Source Code
Solaris 2.5.1 (2.6)	Source Code
Solaris 2.7 (Solaris 7)	Source Code
System V UX	Source Code
VxWorks	Source Code

Source Code is software that has been maintained by users of these bus cards for that particular operating system. Symmetricom provides this software at no charge as a convenience for customers. Symmetricom is not responsible for the usability of the source code to the customer application and does not provide any technical assistance/support of the source code. From time to time customers will enhance the software for current operating systems and return a copy of the updated software to Symmetricom. Symmetricom in turn makes the software available to other users at no charge.

Symmetricom software is compiled software for the specific bus card and target operating system that is actively maintained by Symmetricom. There is **no** charge for this software.

PCI Bus Card Feature Matrix

	bc635PCIe	bc635PCI-V2	bc635PCI-U	PCI-SG 2U
Product Life Cyle Status	New	New	Lagacy	Legacy
Sync Inputs				
GPS	optional (bc637PCIe) 170 nanosecond accuracy	optional (bc637PCI-V2) (1) 170 nanosecond accuracy		optional (GPS-PCI 2U) 1 microsecond accuracy
1PPS	■	■	■	■
AM and DCLS time code inputs	■	■	■	■
IRIG A, B, IEEE 1344	■	■	■	■ (2)
IRIG E, G, NASA 36, XR3, 2137	■	■		
Sync Outputs				
1PPS	■	■	■	■
IRIG B, IEEE 1344	■	■	■	■ (2)
IRIG A, E, G, NASA 36, XR3, 2137	■	■		
Simultaneous AM and DCLS time code outputs	■	■		
Timing Functions				
Accuracy (3)	1 microsecond	1 microsecond	1 microsecond	1 microsecond
100ns Resolution	■	■	■	■
BCD Time	■	■	■	■
Unix/Binary Time	■	■	■	
1, 5, 10 MPPS output	■	■	■	■
Programmable Rate Generation Outputs/Interrupts	0.0000001 PPS to 10 MPPS	0.0000001 PPS to 10 MPPS	<1 PPS to 250 KPPS	1 PPS to 1 MPPS
Event Time Capture/Interrupts	3x Event Captures	1x Event Captures	1x Event Captures	1x Event Captures
Time Compare (Alarm) Output/Interrupts	■	■	■	■
Real Time Clock (In the event of a power failure.)	Battery backed	Battery backed	Battery backed	3 day limit
Flywheeling/Holdover	■	■	■	■
OCXO for Extended Flywheel Accuracy; 10 MHz sine out	optional	optional	optional	
External Freq. Input – Disciplining Local Oscillator	1 PPS, 10 MHz	1 PPS, 10 MHz	1 PPS, 10 MHz	1 PPS
External Freq. Input – Cesium/Rubidium Direct	10 MHz	10 MHz	10 MHz	
PCI Express, low profile card size, standard and low profile cover plates	■			
Standard half size card (4.2" x 6.875")		■	■	■
3.3V and 5.0V Universal Signaling on PCI Local Bus; PCI-X Compatible		■	■	■
Software and Drivers (included at no extra charge)				
Windows	■	■	■	■
Solaris	■	■	■	
Linux	■	■	■	

(1) The bc637PCI-V2 is the replacement for the discontinued bc637PCI-U.

(2) No IEEE 1344 support.

(3) Accuracy is a function of the input reference. Time codes are generally 1-5 microseconds, GPS is 170 nanoseconds to 1 microsecond depending on model. See datasheets for full details.

bc635PCIe

PCI Express Time & Frequency Processor

KEY FEATURES

- IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 & 2137 Time Code Inputs and Outputs
- Simultaneous AM and DCLS Time Code Inputs and Outputs
- 100-Nanosecond Clock Resolution for Time Requests
- Programmable <<1 PPS to 100 MPPS DDS Rate Synthesizer Output/Interrupt
- 1, 5, or 10 MHz Rate Generator Output
- 1 PPS and 10 MHz Inputs
- Three (3) External Event Time Capture/Interrupts
- Programmable Time Compare Output/Interrupt
- Zero Latency Time Reads
- Battery Backed Real Time Clock (RTC)
- Low Profile PCI Express Form Factor
- Linux, Solaris & Windows Software Drivers/SDKs Included
- Superior User Interface & Documentation
- Optional OCXO Upgrade

KEY BENEFITS

- Precise Sub-Microsecond Time Available to Host Computer Applications
- Easy Integration Facilitated with included Windows, Linux & Solaris SDKs & Drivers
- Extremely Fast Time Reads
- Programmable Time & Frequency Functions to Quickly Customize for Specific Applications
- Wide Variety of Time Codes Facilitate Easy Integration with Existing Systems
- Dedicated and Responsive Technical Support to Assist in PCIe Card Integration
- Very Well Documented for Easy & Fast System Integration

EASY System Integration

Symmetricom's bc635PCIe timing module provides unparalleled precise time and frequency functions to the host computer and peripheral data acquisition systems. Integration into a custom application is easy and very efficient through the use of the full-featured Windows, Linux and Solaris SDKs/drivers included standard with the module.

Time is typically acquired from time code signals such as IRIG B. Extensive time code generation and translation are both supported. The translator reads and disciplines the internal oscillator to either the amplitude modulated (AM) and DC level shift (DCLS) formats of IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 or 2137 time codes. The generator outputs either IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 or 2137 in both AM and/or DCLS formats.

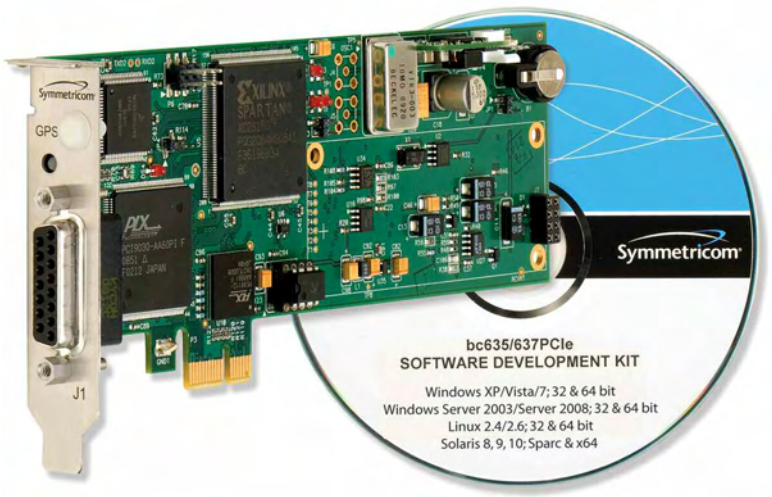
Central to the operation of the module is a disciplined 10 MHz oscillator that is either a TCXO or optional OCXO that provides the timing module's 100-nanosecond clock. Current time (days to 100 nanoseconds) can be accessed across the PCIe bus with no PCIe bus wait states, which allows for very high speed, low latency time requests. The 10 MHz oscillator drives the module's frequency and time code generator circuitry. If the input reference is lost, the module will continue to maintain time (flywheel) based on the 10 MHz oscillator's drift rate. The optional OCXO oscillator improves flywheel drift performance over the standard TCXO. If power is lost, a battery backed real time clock (RTC) maintains the time.

The module has a state-of-the-art DDS rate synthesizer with a range from 0.0000001 PPS to 100 MPPS. The module may also be programmed to generate an interrupt at a precise predetermined time based on a time compare (Strobe). Three Event Time Capture inputs provide a means of latching time of different external events.

A key feature of the bc635PCIe is the ability to generate interrupts on the PCIe bus at programmable rates. These interrupts are useful to synchronize applications on the host computer as well as signal specific timing events over the bus.

The external frequency input is a unique feature allowing the time and frequency of the bc635PCIe to be derived from an external oscillator that may also be disciplined (DAC voltage controlled) based on the selected input reference. The module may be operated in generator (undisciplined) mode where an external 10 MHz from a Cesium or Rubidium standard is used as the frequency reference. This creates an extremely stable PCIe based clock for all bc635PCIe timing functions.

Integration of the module is easily facilitated with the included SDKs/drivers for 32/64 bit Windows and Linux, and 64 bit Solaris.



bc635PCIe Time & Frequency Processor & Included SDKs/Drivers

bc635PCIe SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Real Time Clock

Bus request resolution:	100 nanoseconds
Latency:	Zero
Major time format:	Binary or BCD
Minor time format:	Binary

- Synchronization sources: Time code, 1 PPS

- Time code translator (inputs)

Time code formats:	IRIG A, B, G, E, IEEE 1344, NASA 36, XR3, 2137
Time accuracy:	<5 µS (AM carrier frequencies 1 kHz or greater) <1 µS (DCLS)
AM ratio range:	2:1 to 4:1
AM Input amplitude:	1 to 8V p-p
AM Input impedance:	>5kΩ
DCLS Input, Event2:	5V HCMOS >2V high, <0.8V low

- Time code generator (outputs)

Time code format:	IRIG A, B, G, E, IEEE 1344, NASA 36, XR3, 2137
AM ratio:	3:1 +/- 10%
AM amplitude:	3.5 +/- 0.5Vpp into 50Ω
DCLS amplitude:	5V HCMOS, >2V high, < 0.8V low into 50Ω

- Timing functions (outputs are rising edge on time)

DDS rate synthesizer	
Frequency range:	0.0000001 PPS to 100 MPPS
Output amplitude:	5V HCMOS, >2V high, < 0.8V low into 50Ω, square wave
Jitter:	<2 nS p-p
Legacy pulse rate synthesizer	(Heartbeat, aka Periodic)
Frequency range:	<1 Hz to 250 kHz
Output amplitude:	5V HCMOS, >2V high, < 0.8V low into 50Ω, square wave
Time compare (Strobe)	
Compare range:	1 µS through days
Output amplitude:	5V HCMOS, >2V high, < 0.8V low into 50Ω, 1 µS pulse
1 PPS Output:	5V HCMOS, >2V high, < 0.8V low into 50Ω, 60 µS pulse
1 PPS Input, Event3:	5V HCMOS, >2V high, < 0.8V low
External Event Input:	5V HCMOS, >2V high, < 0.8V low, zero latency
External 10 MHz oscillator:	Digital 40% to 60% or sine wave, 0.5 to 8Vp-p, >10kΩ
Oscillator Control Voltage:	Jumper selectable 0-5VDC or 0-10VDC

- On-board disciplined oscillator

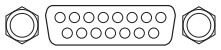
Frequency:	10 MHz
1, 5, or 10 MHz output:	5V HCMOS, >2V high, < 0.8V low into 50Ω
Stability:	
Standard TCXO:	5.0E-8 short term 'tracking' 5.0E-7/day long term 'flywheeling'
Optional OCXO:	2.0E-9 short term 'tracking' 5.0E-8 /day long term 'flywheeling'

- Real-time clock (RTC) Battery backed time and year information
- PCIe Specification: Single lane PCI Express (PCIe) Interface, r1.0a compatible

Size:	Standard height Low Profile PCIe
Power:	+3.3V @ 400 mA +12V @ 250 mA (TCXO), 350 mA (OCXO)

- Connector

Timing I/O: 15-pin 'DS'



Pin	Direction	Signal
1	input	External 10 MHz
2		Ground
3	output	Strobe
4	output	1 PPS
5	output	Time Code (AM)
6	input	External Event1
7	input	Time Code (AM)
8		Ground
9	output	Oscillator Control Voltage
10	input	Time Code (DCLS); Event2
11	output	Time Code (DCLS)
12		Ground
13	output	1, 5, 10 MHz
14	input	External 1 PPS; Event3
15	output	Heartbeat/DDS

bc635PCIe Low profile and standard cover panels

- Complete specifications can be found in the manual located at http://www.symmetricom.com

ENVIRONMENTAL SPECIFICATIONS

- Environment

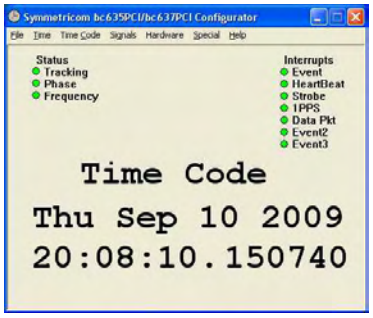
Temperature:	
Operating:	0°C to 70°
Storage:	-30°C to 85°C
Humidity	
Operating:	5% to 95% non-condensing
Operating altitude:	Up to 18,000 meters MSL

- Certifications: FCC, CE(RoHS)

SOFTWARE

- The bc635PCIe includes on CD the SDKs and drivers for the 32/64 bit versions of Windows and Linux, and 64 bit Solaris. Included are test application programs with source code so that you can review the bc635PCIe card status and adjust board configuration and output parameters. Each SDK includes an extensive list of function calls to quickly and easily speed integration of the bc635PCIe card into your target environment. For Windows, an additional clock utility program, TrayTime, is provided that can be used to automatically update the host computer's clock.

- The bc635PCIe firmware is easily field-upgradeable over the PCIe bus.



PRODUCT INCLUDES

- bc635PCIe Time & Frequency Processor board; Standard height and low-profile cover plates; one year warranty; PCIe User's Guide CD; Windows, Linux and Solaris SDK/Driver software CD.

OPTIONS

- GPS synchronization, see bc637PCIe product
- OXCO (oven controlled crystal oscillator) for extended holdover
- 15-Pin 'D' connector (J1) to BNC adapter cables

bc637PCIe

GPS Synchronized, PCI Express Time & Frequency Processor

KEY FEATURES

- GPS Synchronized with 170 Nano Second RMS Accuracy to UTC
- IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 & 2137 Time Code Inputs and Outputs
- Simultaneous AM and DCLS Time Code Inputs and Outputs
- 100-Nanosecond Clock Resolution for Time Requests
- Programmable <<1 PPS to 100 MPPS DDS Rate Synthesizer Output/Interrupt
- 1, 5, or 10 MHz Rate Generator Output
- 1 PPS and 10 MHz Inputs
- Three (3) External Event Time Capture/Interrupts
- Programmable Time Compare Output/Interrupt
- Zero Latency Time Reads
- Battery Backed Real Time Clock (RTC)
- Low Profile PCI Express Form Factor
- Linux, Solaris & Windows Software Drivers/SDKs Included
- Superior User Interface & Documentation
- Optional OCXO Upgrade

KEY BENEFITS

- Precise Sub-Microsecond Time Available to Host Computer Applications
- Easy Integration Facilitated with included Windows, Linux & Solaris SDKs & Drivers
- Extremely Fast Time Reads
- Programmable Time & Frequency Functions to Quickly Customize for Specific Applications
- Wide Variety of Time Codes Facilitate Easy Integration with Existing Systems
- Dedicated and Responsive Technical Support to Assist in PCIe Card Integration
- Very Well Documented for Easy & Fast System Integration

EASY System Integration

Symmetricom's GPS referenced bc637PCIe timing module provides unparalleled precise time and frequency functions to the host computer and peripheral systems. Precise time is acquired from the GPS satellite system or from time code signals. GPS synchronization provides 170 nanosecond RMS accurate time to UTC (USNO) enabling the bc637PCIe to precisely synchronize multiple computers to UTC. Integration into a custom application is easy and very efficient through the use of the full-featured Windows, Linux and Solaris SDKs/drivers included standard with the module.

Extensive time code generation and translation are both supported. The translator reads and disciplines the internal oscillator to either the amplitude modulated (AM) and DC level shift (DCLS) formats of IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 or 2137 time codes. The generator outputs either IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 or 2137 in both AM and/or DCLS formats.

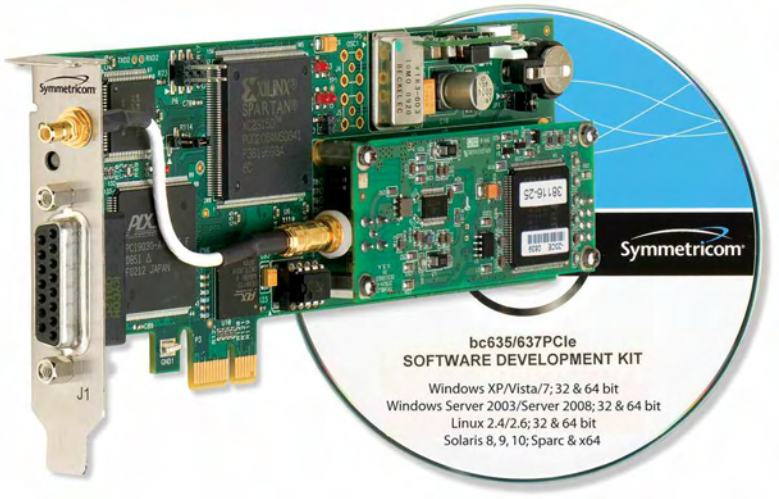
Central to the operation of the module is a disciplined 10 MHz oscillator that is either a TCXO or optional OCXO that provides the timing module's 100-nanosecond clock. Current time (days to 100 nanoseconds) can be accessed across the PCIe bus with no PCIe bus wait states, which allows for very high speed, low latency time requests. The 10 MHz oscillator drives the module's frequency and time code generator circuitry. If the input reference is lost, the module will maintain time (flywheel) based on the 10 MHz oscillator's drift rate. The optional OCXO oscillator improves flywheel drift performance over the standard TCXO. If power is lost, a battery backed real time clock (RTC) maintains the time.

The module has a state-of-the-art DDS rate synthesizer with a range from 0.0000001 PPS to 100 MPPS. The module may also be programmed to generate an interrupt at a precise predetermined time based on a time compare (Strobe). Three Event Time Capture inputs provide a means of latching time of different external events.

A key feature of the bc637PCIe is the ability to generate interrupts on the PCIe bus at programmable rates. These interrupts are useful to synchronize applications on the host computer as well as signal specific timing events over the bus.

The unique external frequency input allows the time and frequency of the bc637PCIe to be derived from an external oscillator that may also be disciplined (DAC voltage controlled) based on the selected input reference. The module may be operated in generator (undisciplined) mode where an external 10 MHz from a Cesium or Rubidium standard is used as the frequency reference. This creates an extremely stable PCIe based clock for all bc637PCIe timing functions.

Integration of the module is easily facilitated with the included SDKs/drivers for 32/64 bit Windows and Linux, and 64 bit Solaris.

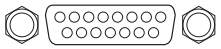


bc637PCIe GPS Synchronized Time & Frequency Processor & Included SDKs/Drivers

bc637PCIe SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- GPS Receiver/Antenna
  - 12 channel parallel receiver
  - GPS time traceable to UTC(USNO)
  - Accuracy: 170 ns RMS, 1 µSec peak to peak to UTC(USNO), at stable temperature and ≥4 satellites tracked.
  - Maximum Belden 9104 cable length: 150' (45 m). For longer cable runs see Options.
- Real Time Clock
  - Bus request resolution: 100 nanoseconds
  - Latency: Zero
  - Major time format: Binary or BCD
  - Minor time format: Binary
- Synchronization sources: GPS, Time code, 1 PPS
- Time code translator (inputs)
  - Time code formats: IRIG A, B, G, E, IEEE 1344, NASA 36, XR3, 2137
  - Time accuracy: <5 µS (AM carrier frequencies 1 kHz or greater) <1 µS (DCLS)
  - AM ratio range: 2:1 to 4:1
  - AM Input amplitude: 1 to 8V p-p
  - AM Input impedance: >5kΩ
  - DCLS Input, Event2: 5V HCMOS >2V high, <0.8V low
- Time code generator (outputs)
  - Time code format: IRIG A, B, G, E, IEEE 1344, NASA 36, XR3, 2137
  - AM ratio: 3:1 +/- 10%
  - AM amplitude: 3.5 +/- 0.5Vpp into 50Ω
  - DCLS amplitude: 5V HCMOS, >2V high, < 0.8V low into 50Ω
- Timing functions (outputs are rising edge on time)
  - DDS rate synthesizer
  - Frequency range: 0.0000001 PPS to 100 MPPS
  - Output amplitude: 5V HCMOS, >2V high, < 0.8V low into 50Ω, square wave
  - Jitter: <2 nS p-p
  - Legacy pulse rate synthesizer (Heartbeat, aka Periodic)
  - Frequency range: <1 Hz to 250 kHz
  - Output amplitude: 5V HCMOS, >2V high, < 0.8V low into 50Ω, square wave
  - Time compare (Strobe)
  - Compare range: 1 µS through days
  - Output amplitude: 5V HCMOS, >2V high, < 0.8V low into 50Ω, 1 µS pulse
  - 1 PPS Output: 5V HCMOS, >2V high, < 0.8V low into 50Ω, 60 µS pulse
  - 1 PPS Input, Event3: 5V HCMOS, >2V high, < 0.8V low
  - External Event Input: 5V HCMOS, >2V high, < 0.8V low, zero latency
  - External 10 MHz oscillator: Digital 40% to 60% or sine wave, 0.5 to 8Vp-p, >10kΩ
  - Oscillator Control Voltage: Jumper selectable 0-5VDC or 0-10VDC
- On-board disciplined oscillator
  - Frequency: 10 MHz
  - 1, 5, or 10 MHz output: 5V HCMOS, >2V high, < 0.8V low into 50Ω
  - Stability:
  - Standard TCXO: 5.0E-8 short term 'tracking' 5.0E-7/day long term 'flywheeling'
  - Optional OCXO: 2.0E-9 short term 'tracking' 5.0E-8 /day long term 'flywheeling'
- Real-time clock (RTC) Battery backed time and year information
- PCIe Specification: Single lane PCI Express (PCIe) Interface, r1.0a compatible
  - Size: Standard height Low Profile PCIe
  - Power: +3.3V @ 400 mA +12V @ 300 mA (TCXO), 400 mA (OCXO)
- Connector
  - GPS Antenna: SMB socket
  - Timing I/O: 15-pin 'DS'



Pin	Direction	Signal
1	input	External 10 MHz
2		Ground
3	output	Strobe
4	output	1 PPS
5	output	Time Code (AM)
6	input	External Event1
7	input	Time Code (AM)
8		Ground
9	output	Oscillator Control Voltage
10	input	Time Code (DCLS); Event2
11	output	Time Code (DCLS)
12		Ground
13	output	1, 5, 10 MHz
14	input	External 1 PPS; Event3
15	output	Heartbeat/DDS

bc637PCIe Low profile and standard cover panels

- Complete specifications can be found in the manual located at http://www.symmetricom.com

ENVIRONMENTAL SPECIFICATIONS

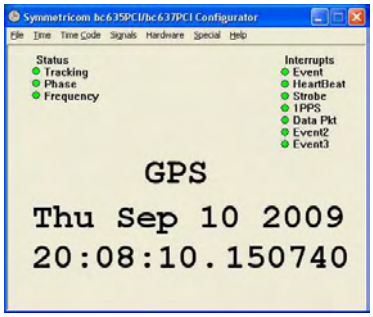
- Environment

	Module	GPS Antenna
Temperature:		
Operating:	0ºC to 70ºC	-40ºC to 70ºC
Storage:	-30ºC to 85ºC	-55ºC to 85ºC
Humidity:		
Operating:	5% to 95% non-condensing	100% condensing
Operating altitude:	Up to 18,000 meters MSL	

- Certifications: FCC, CE(RoHS)

SOFTWARE

- The bc637PCIe includes on CD the SDKs and drivers for the 32/64 bit versions of Windows and Linux, and 64 bit Solaris. Included are test application programs with source code so that you can review the bc637PCIe card status and adjust board configuration and output parameters. Each SDK includes an extensive list of function calls to quickly and easily speed integration of the bc637PCIe card into your target environment. For Windows, an additional clock utility program, TrayTime, is provided that can be used to automatically update the host computer's clock.
- The bc637PCIe firmware is easily field-upgradeable over the PCIe bus.



PRODUCT INCLUDES

- bc637PCIe GPS synchronized Time & Frequency Processor board; L1 GPS antenna; 50' (15 m) Belden 9104 coaxial cable; 1 ft. antenna mounting mast (30 cm) with two Clamps; standard height and low-profile cover plates; one year warranty; PCIe User's Guide CD; Windows, Linux and Solaris SDK/Driver software CD.

OPTIONS

- OXCO (oven controlled crystal oscillator) for extended holdover
- 15-Pin 'D' connector (J1) to BNC adapter cables
- GPS antenna in-line amplifier for cable runs to 300' (90 m)
- GPS antenna down/up converter for cable runs to 1500' (457 m)
- Lightning arrestor

bc635PCI-V2

PCI Time & Frequency Processor

KEY FEATURES

- IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 & 2137 Time Code Inputs and Outputs
- Simultaneous AM or DCLS Time Code Inputs
- Simultaneous AM and DCLS Time Code Outputs
- 100-nanosecond clock resolution for time requests
- Programmable <<1 PPS to 100 MPPS DDS Rate Synthesizer Output/Interrupt
- 1, 5, or 10 MHz Rate Generator Output
- 1 PPS or 10 MHz Inputs
- External Event Time Capture/Interrupt
- Programmable Time Compare Output/Interrupt
- Zero Latency Time Reads
- Battery Backed Real Time Clock (RTC)
- PCI Local Bus Operation
- Universal Signaling (3.3V or 5.0V Bus)
- CE(RoHS) Compliant
- Linux, Solaris & Windows Software Drivers/SDKs available
- Optional OCXO Upgrade

Symmetricom's bc635PCI-V2 timing module provides unparalleled precise time and frequency to the host computer and peripheral data acquisition systems. Time is typically acquired from time code signals such as IRIG B.

Central to the operation of the module is a disciplined 10 MHz oscillator that is either an on-board TCXO (or optional OCXO) or an off-board External oscillator that can provide the timing module's 100-nanosecond clock. Current time (days to 100 nanoseconds) can be accessed across the PCI bus with no PCI bus wait states, which allows for very high-speed time requests. The selected on-board or off-board 10 MHz oscillator drives the module's frequency and time code generator circuitry. If the input reference is lost, the module will continue to maintain time (flywheel) based on the selected 10 MHz oscillator's drift rate. The optional OCXO oscillator improves flywheel drift performance over the standard TCXO. If power is lost, a battery-backed real time clock (RTC) is available to maintain time.

Extensive time code generation and translation are supported. The generator outputs either IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 or 2137 in both amplitude modulated (AM) and DC level shift (DCLS) formats. The translator reads and may be used to discipline the 10 MHz oscillator to either the AM or DCLS format of IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 or 2137 time codes.

The module also has a state-of-the-art DDS rate synthesizer capable of 0.0000001 PPS to 100 MPPS. The module may also be programmed to generate a single interrupt at a predetermined time based on a time compare (Strobe). An Event Time Capture feature provides a means of latching time of an external event.

A key feature of the bc635PCI-V2 is the ability to generate interrupts on the PCI bus at programmable rates. These interrupts can be used to synchronize applications on the host computer as well as signal specific events.

The external frequency input is a unique feature allowing the time and frequency of the bc635PCI-V2 to be derived from an external oscillator that may also be disciplined (DAC voltage controlled) based on the selected input reference. The module may be operated in generator (undisciplined) mode where an external 10 MHz from a Cesium or Rubidium standard is used as the frequency reference. This creates an extremely stable PCI based clock for all bc635PCI-V2 timing functions.

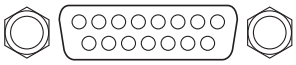
The bc635PCI-V2 automatically supports both 3.3V and 5.0V signaling of the PCI bus. Integration of the module is easily facilitated with optional drivers for Windows 2000/XP, Linux, or Solaris.

bc635PCI-V2 Time & Frequency Processor.

bc635PCI-V2 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Real Time Clock
  - Bus request resolution: 100 nanoseconds BCD
  - Latency: Zero
  - Major time format: Binary or BCD
  - Minor time format: Binary 1 µS to 999.999 mS
- Synchronization sources: Time code, 1 PPS
- Time code translator (inputs)
  - Time code formats: IRIG A, B, G, E, IEEE 1344, NASA 36, XR3, 2137
  - Time accuracy: <5 µS (AM carrier frequencies 1 kHz or greater)
<1 µS (DCLS)
  - AM ratio range: 2:1 to 4:1
  - AM Input amplitude: 1 to 8V p-p
  - AM Input impedance: >5kΩ
  - DCLS Input: 5V HCMOS >2V high, <0.8V low, 270Ω
- Time code generator (outputs)
  - Time code format: IRIG A, B, G, E, IEEE 1344, NASA 36, XR3, 2137
  - AM ratio: 3:1 +/- 10%
  - AM amplitude: 3.5V p-p +/- 0.5V into 50Ω
  - DCLS amplitude: 5V HCMOS, >2V high, <0.8V low into 50Ω
- Timing functions (outputs are rising edge on time)
  - DDS rate synthesizer
    - Frequency range: 0.0000001 PPS to 100 MPPS
    - Output amplitude: 5V HCMOS, >2V high, < 0.8V low into 50Ω, square wave
    - Jitter: <2 nS p-p
  - Legacy pulse rate synthesizer: (Heartbeat, aka Periodic)
    - Frequency range: <1 Hz to 250 kHz
    - Output amplitude: 5V HCMOS, >2V high, < 0.8V low into 50Ω, square wave
  - Time compare (Strobe)
    - Compare range: 1 µS through days
    - Output amplitude: 5V HCMOS, >2V high, < 0.8V low into 50Ω, 1 µS pulse
  - 1 PPS Output: 5V HCMOS, >2V high, < 0.8V low into 50Ω, 60 µS pulse
  - 1 PPS Input: 5V HCMOS, >2V high, < 0.8V low, 270Ω
  - External Event Input: 5V HCMOS, >2V high, < 0.8V low, 270Ω, zero latency
  - External 10 MHz oscillator: Digital 40% to 60% or sine wave, 0.5 to 8Vp-p, >10kΩ
  - Oscillator Control Voltage: Jumper selectable 0-5VDC or 0-10VDC into 1kΩ
- On-board disciplined oscillator
  - Frequency: 10 MHz
  - 1, 5, or 10 MHz output: 5V HCMOS, >2V high, < 0.8V low into 50Ω
  - Stability:
  - Standard TCXO: 5.0E-8 short term 'tracking'
5.0E-7/day long term 'flywheeling'
  - Optional OCXO: 2.0E-9 short term 'tracking'
5.0E-8 /day long term 'flywheeling'
- Real-time clock (RTC) Battery backed time and year information
- PCI local bus™
  - Specification: 2.2 compliant
2.3 compatible
PCI-X compatible
  - Size: Single-width (4.2" x 6.875")
  - Device type: PCI Target, 32 bit, universal signaling
  - Data transfer: 8-bit, 32-bit
  - Interrupt levels: Automatically Assigned (PnP)
  - Power: TCXO: +5V @ 700 mA
OCXO: +5V @ 800 mA, 1.1 A at start-up
+12V @ 50 mA
- Connectors
  - Firmware update port: 6 pin, PS2 mini-DIN J2
  - Timing I/O: 15-pin 'DS' J1



Pin	Direction	Signal
1	input	External 10 MHz
2		Ground
3	output	Strobe
4	output	1 PPS
5	output	Time Code (AM)
6	input	External Event
7	input	Time Code (AM)
8		Ground
9	output	Oscillator Control Voltage
10	input	Time Code (DCLS)
11	output	Time Code (DCLS)
12		Ground
13	output	1, 5, 10 MHz
14	input	External 1 PPS
15	output	Heartbeat/DDS

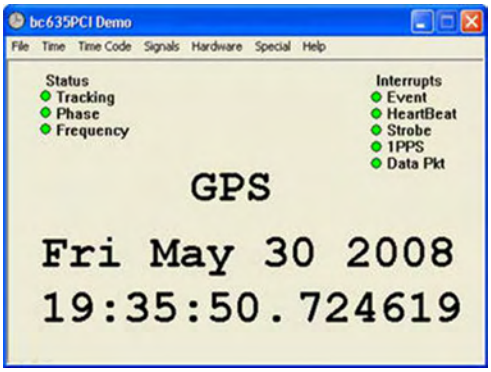
- Complete specifications can be found in the manual located at http://www.symmetricom.com

ENVIRONMENTAL SPECIFICATIONS

- Environment
  - Temperature:
    - Operating: 0ºC to 70ºC
    - Storage: -30ºC to 85ºC
  - Humidity
    - Operating: 5% to 95% non-condensing
    - Operating altitude: Up to 18,000 meters MSL
- Certifications: FCC, CE(RoHS)

SOFTWARE

- The bc635PCI-V2 includes the Symmetricom bc635pcidemo.exe application program for Windows 2000/XP. Using this program you can review the bc635PCI-V2 card status and adjust board configuration and output parameters. An additional clock utility program, TrayTime, is provided that can be used to update the Host computer's clock.



PRODUCT INCLUDES

- bc635PCI-V2 Time & Frequency Processor board, one year warranty, PCI User's Guide CD, Windows software CD.

OPTIONS

- GPS synchronization, see bc637PCI-V2
- OCXO (oven controlled crystal oscillator) for extended holdover
- 'D' connector (J1) to BNC adapter
- SDK (Software Development Kit) for: Windows 2000/XP, Linux, Solaris (Contact factory for additional drivers)

bc637PCI-V2

GPS Synchronized, PCI Time & Frequency Processor

KEY FEATURES

- GPS synchronized with 170 nanosecond RMS accuracy to UTC
- IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 & 2137 Time Code Inputs and Outputs
- Simultaneous AM or DCLS Time Code Inputs
- Simultaneous AM and DCLS Time Code Outputs
- 100-nanosecond clock resolution for time of day requests
- Programmable <<1 PPS to 100 MPPS DDS Rate Synthesizer Output/Interrupt
- 1, 5, or 10 MHz Rate Generator Output
- 1 PPS or 10 MHz Inputs
- External Event Time Capture/Interrupt
- Programmable Time Compare Output/Interrupt
- Zero Latency Time Reads
- Battery Backed Real Time Clock (RTC)
- PCI Local Bus Operation
- Universal Signaling (3.3V or 5.0V Bus)
- CE(RoHS) Compliant
- Linux, Solaris & Windows Software Drivers/SDKs available
- Optional OCXO Upgrade

Symmetricom's GPS referenced bc637PCI-V2 timing module provides precise time and frequency to the host computer and peripheral data acquisition systems. Precise time is acquired from the GPS satellite system or from time code signals. GPS synchronization provides 170 nanosecond RMS accurate time to UTC (USNO) and enables the bc637PCI-V2 to be an ideal master clock for precisely synchronizing multiple computers to UTC.

Central to the operation of the module is a disciplined 10 MHz oscillator that is either an on-board TCXO (or optional OCXO) or an off-board External oscillator that can provide the timing module's 100-nanosecond clock. Current time (days to 100 nanoseconds) can be accessed across the PCI bus with no PCI bus wait states, which allows for very high-speed time requests. The selected on-board or off-board 10 MHz oscillator drives the module's frequency and time code generator circuitry. If the input reference is lost, the module will continue to maintain time (flywheel) based on the selected 10 MHz oscillator's drift rate. The optional OCXO oscillator improves flywheel drift performance over the standard TCXO. If power is lost, a battery-backed real time clock (RTC) is available to maintain time.

Extensive time code generation and translation are supported. The generator outputs either IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 or 2137 in both amplitude modulated (AM) and DC level shift (DCLS) formats. The translator reads and may be used to discipline the 10 MHz oscillator to either the AM or DCLS format of IRIG A, B, G, E, IEEE 1344, NASA 36, XR3 or 2137 time codes.

The module also has a state-of-the-art DDS rate synthesizer capable of 0.0000001 PPS to 100 MPPS. The module may also be programmed to generate a single interrupt at a predetermined time based on a time compare (Strobe). An Event Time Capture feature provides a means of latching time of an external event.

A key feature of the bc637PCI-V2 is the ability to generate interrupts on the PCI bus at programmable rates. These interrupts can be used to synchronize applications on the host computer as well as signal specific events.

The external frequency input is a unique feature allowing the time and frequency of the bc637PCI-V2 to be derived from an external oscillator that may also be disciplined (DAC voltage controlled) based on the selected input reference. The module may be operated in generator (undisciplined) mode where an external 10 MHz from a Cesium or Rubidium standard is used as the frequency reference. This creates an extremely stable PCI based clock for all bc637PCI-V2 timing functions.

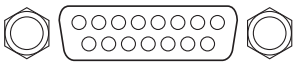
The bc637PCI-V2 automatically supports both 3.3V and 5.0V signaling of the PCI bus. Integration of the module is easily facilitated with optional drivers for Windows 2000/XP, Linux, or Solaris.

bc637PCI-V2 GPS Synchronized, Time & Frequency Processor.

bc637PCI-V2 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- GPS Receiver/Antenna
  - 12 channel parallel receiver
  - GPS time traceable to UTC(USNO)
  - Accuracy: 170 ns RMS, 1 µsec peak to peak to UTC(USNO), at stable temperature and ≥4 satellites tracked.
  - Maximum Belden 9104 cable length: 150' (45 m). For longer cable runs see Options.
- Real Time Clock
  - Bus request resolution: 100 nanoseconds BCD
  - Latency: Zero
  - Major time format: Binary or BCD
  - Minor time format: Binary 1 µS to 999.999 mS
- Synchronization sources: GPS, Time code, 1 PPS
- Time code translator (inputs)
  - Time code formats: IRIG A, B, E, G, IEEE 1344, NASA 36, XR3, 2137
  - Time accuracy: <5 µS (AM carrier frequencies 1 kHz or greater) <1 µS (DCLS)
  - AM ratio range: 2:1 to 4:1
  - AM Input amplitude: 1 to 8V p-p
  - AM Input impedance: >5kΩ
  - DCLS Input: 5V HCMOS >2V high, <0.8V low, 270Ω
- Time code generator (outputs)
  - Time code format: IRIG A, B, E, G, IEEE 1344, NASA 36, XR3, 2137
  - AM ratio: 3:1 +/- 10%
  - AM amplitude: 3.5V p-p +/- 0.5V into 50Ω
  - DCLS amplitude: 5V HCMOS, >2V high, <0.8V low into 50Ω
- Timing functions (outputs are rising edge on time)
  - DDS rate synthesizer
    - Frequency range: 0.0000001 PPS to 100 MPPS
    - Output amplitude: 5V HCMOS, >2V high, <0.8V low into 50Ω, square wave
    - Jitter: <2 nS p-p
  - Legacy pulse rate synthesizer: (Heartbeat, aka Periodic)
    - Frequency range: <1 Hz to 250 kHz
    - Output amplitude: 5V HCMOS, >2V high, <0.8V low into 50Ω, square wave
  - Time compare (Strobe)
    - Compare range: 1 µS through days
    - Output amplitude: 5V HCMOS, >2V high, <0.8V low into 50Ω, 1 µS pulse
  - 1 PPS Output: 5V HCMOS, >2V high, <0.8V low into 50Ω, 60 µS pulse Accuracy the same as GPS Receiver specification above, or relative to the input time code.
  - 1 PPS Input: 5V HCMOS, >2V high, <0.8V low, 270Ω
  - External Event Input: 5V HCMOS, >2V high, <0.8V low, 270Ω, zero latency
  - External 10 MHz oscillator: Digital 40% to 60% or sine wave, 0.5 to 8Vp-p, >10kΩ
  - Oscillator Control Voltage: Jumper selectable 0-5VDC or 0-10VDC into 1kΩ
- On-board disciplined oscillator
  - Frequency: 10 MHz
  - 1, 5, or 10 MHz output: 5V HCMOS, >2V high, <0.8V low into 50Ω
  - Stability:
  - Standard TCXO: 5.0E-8 short term 'tracking' 5.0E-7/day long term 'flywheeling'
  - Optional OCXO: 2.0E-9 short term 'tracking' 5.0E-8 /day long term 'flywheeling'
- Real-time clock (RTC) Battery backed time and year information
- PCI local bus™
  - Specification: 2.2 compliant 2.3 compatible PCI-X compatible
  - Size: Single-width (4.2" x 6.875")
  - Device type: PCI Target, 32 bit, universal signaling
  - Data transfer: 8-bit, 32-bit
  - Interrupt levels: Automatically Assigned (PnP)
  - Power: TCXO: +5V @ 700 mA OCXO: +5V @ 800 mA, 1.1 A at start-up +12V @ 50 mA
- Connectors
  - GPS Antenna: SMB socket
  - Firmware update port: 6 pin, PS2 mini-DIN J2
  - Timing I/O: 15-pin 'DS' J1



Pin	Direction	Signal
1	input	External 10 MHz
2		Ground
3	output	Strobe
4	output	1 PPS
5	output	Time Code (AM)
6	input	External Event
7	input	Time Code (AM)
8		Ground
9	output	Oscillator Control Voltage
10	input	Time Code (DCLS)
11	output	Time Code (DCLS)
12		Ground
13	output	1, 5, 10 MHz
14	input	External 1 PPS
15	output	Heartbeat/DDS

- Complete specifications can be found in the manual located at http://www.symmetricom.com

ENVIRONMENTAL SPECIFICATIONS

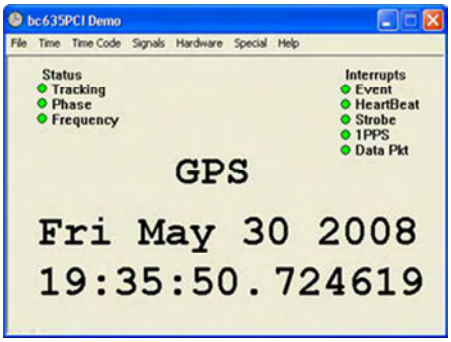
- Environment

	Module	GPS Antenna
Temperature:		
Operating:	0ºC to 70ºC	-40ºC to 70ºC
Storage:	-30ºC to 85ºC	-55ºC to 85ºC
Humidity:		
Operating:	5% to 95% non-condensing	100% condensing
Operating altitude:	Up to 18,000 meters MSL	

- Certifications: FCC, CE(RoHS)

SOFTWARE

- The bc637PCI-V2 includes the Symmetricom bc635pci demo and bc637PCI GPS Demo application programs for Windows 2000/XP. Using this program you can review the bc637PCI-V2 card status and adjust board configuration and output parameters. Bc637pcidemo provides direct access to the GPS receiver used on the bc637PCI-V2 board. An additional clock utility program, TrayTime, is provided that can be used to update the Host computer's clock.



PRODUCT INCLUDES

- bc637PCI-V2 GPS synchronized Time & Frequency Processor board, L1 GPS antenna, 50' (15 m) Belden 9104 coaxial cable, 1 ft. antenna mounting mast (30 cm) with two clamps, one year warranty, PCI User's Guide CD, Windows software CD.

OPTIONS

- OCXO (oven controlled crystal oscillator) for extended holdover
- D' connector (J1) to BNC adapter
- SDK (Software Development Kit) for: Windows 2000/XP, Linux, Solaris (Contact factory for additional drivers)
- GPS antenna in-line amplifier for cable runs to 300' (90 m)
- GPS antenna down/up converter for cable runs to 1500' (457 m)
- Lightning arrestor

bc635PCI-U

PCI Time & Frequency Processor

KEY FEATURES

- PCI Local Bus Operation
- 3.3V and 5.0V Universal Signaling
- IRIG A, B and IEEE 1344 Time Code Inputs
- 1 PPS or 10 MHz Inputs
- IRIG B Time Code Output
- 1, 5, or 10 MHz Rate Generator Output
- Programmable <1 Hz to 250kHz Rate Synthesizer Output/Interrupt
- External Event Time Capture/Interrupt
- Programmable Time Compare Output/Interrupt
- Zero Latency Time Reads
- Battery Backed Clock
- Extensive Software Drivers/SDKs Available
- Optional OCXO Upgrade

Symmetricom's bc635PCI-U timing module provides precision time and frequency reference to the host computer and peripheral data acquisition systems. Time is typically acquired from time code signals such as IRIG B. The bc635PCI-U automatically supports both the 3.3V and 5.0V signaling of the PCI bus. Integration of the module is easily facilitated with optional drivers for Windows 2000/XP, Linux or Solaris.

Central to the operation of the module is a disciplined 10 MHz oscillator and 100 nanosecond clock. Current time (days to 100 nanoseconds) can be accessed across the PCI bus with zero latency, which allows for very high speed time requests. The on-board oscillator is rate-matched (disciplined) to the input time source and drives the precision 10 MHz frequency output and time code generator circuitry. If the time input is lost, the module will continue to maintain time (flywheel). An optional OCXO oscillator substantially improves flywheel drift performance. If power is lost, a battery-backed clock is available to maintain time.

Both time code generation and translation are supported. The generator supplies IRIG B time code output that is synchronized to the input time source. The translator reads IRIG A, IRIG B and IEEE-1344 time codes.

An Event Time Capture feature provides a means of latching time for an external event input. The module can also be programmed to generate a periodic pulse rate as well as generate a single interrupt at a predetermined time (Time Compare).

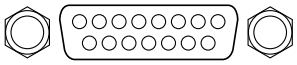
A key feature of the bc635PCI-U is the ability to generate interrupts on the PCI bus at programmable rates. These interrupts can be used to synchronize applications on the host computer as well as signal specific events. The external frequency input is a unique feature allowing the internal timing of the bc635PCI-U to slave to the 10 MHz output from a Cesium or Rubidium standard. This creates an extremely stable PCI based clock for all bc635PCI-U timing functions and is superior to any disciplining technique.

bc635PCI-U Time & Frequency Processor

bc635PCI-U SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Real time clock
  - Bus request resolution: 100 nanoseconds
  - Latency: Zero
  - Major time format: Binary or BCD
  - Minor time format: Binary
- Time code translator
  - Time code formats: IRIG A, IRIG B, IEEE 1344 (Modulated or DCLS)
  - Time accuracy: <5 µS (modulated) <1 µS (DCLS)
  - Modulation ratio: 3:1 to 6:1
  - Input amplitude: 500 mV to 5V P-P
  - Input impedance: >10KΩ, AC coupled
- Time code generator
  - Time code format: IRIG B
  - Modulation ratio: 3:1
  - Output amplitude: 4 V P-P (fixed) into 50Ω
  - DC level shift: TTL/CMOS, 50Ω
- Timing functions
  - Pulse rate synthesizer (TTL, 50Ω): <1 Hz to 250 kHz
  - Time compare (TTL, 50Ω): Programmable 1 µSec through hours
  - Event capture (TTL, 50Ω): 100 nSec resolution, zero latency
  - 1 PPS pulse rate (TTL, 50Ω): Positive edge on-time
- Disciplined oscillator
  - Frequency: 10 MHz
  - Outputs (TTL): 1, 5, or 10 MHz (selectable)
  - Rate stability
    - Standard VCXO: 5.0E-8 short term 'tracking' 5.0E-7/day long term 'flywheeling'
    - Optional oven osc: 2.0E-9 short term 'tracking' 5.0E-8 /day long term 'flywheeling'
  - Sync sources: GPS, Time Code, 1 PPS, 10 MHz
- PCI local bus™
  - Specification: PCI Local Bus™:
    - 2.2 compliant
    - 2.3 compatible: does not provide interrupts at system start-up and therefore does not support the PCI Local Bus Specification Revision 2.3 feature of software disable of interrupts at start-up
    - PCI-X compatible
    - Not compatible with dual core processors
  - Size: Single-width (4.2" x 6.875")
  - Device type: PCI Target, 32 bit, 5V signalling
  - Data transfer: Byte, Half Word, Word
  - Interrupt levels: Automatically Assigned (PnP), not supported in Windows 98
  - Power: +5V @ 350 mA, +12V @ 400 mA, -12V @ 70 mA
- Connector
  - J1 - Module I/O: 15-pin 'DS'



Pin	Direction	Signal
1	input	External 10 MHz input
2	n/a	Ground
3	output	Strobe output
4	output	I PPS output
5	output	Time Code output (AM)
6	input	External Event input
7	input	Time Code input (AM)
8	n/a	Ground (Recommended Time Code return)
9	output	Oscillator Control Voltage output
10	input	Time Code input (DCLS)
11	output	Time Code output (DCLS)
12	n/a	Ground
13	output	1, 5, 10 MHz output
14	input	External 1 PPS input
15	output	Periodic Pulse output

- Complete specifications can be found in the manual located at: www.symmetricom.com/media/files/downloads/product-manuals/bc635%2D637PCI%2DU.pdf

ENVIRONMENTAL SPECIFICATIONS

- Environment

Temperature	Module	Ant/Rcvr
Operating:	0ºC to 70ºC	-40ºC to 70ºC
Storage:	-30ºC to 85ºC	-55ºC to 85ºC
Humidity		
Operating:	5% to 95%* *non-condensing	95%
Operating altitude:	Up to 18,000 meters MSL	

SOFTWARE

- The bc635PCI-V2 includes the Symmetricom Demonstration driver, bc635cpp, an application program for Windows 2000/XP. Using this program you can review the bc635PCI-U card status and adjust board configuration and output parameters. An additional clock utility program, TrayTime, is provided to update the PC clock. This software operates as a background task keeping the host computer clock synchronized to the bc635PCI-U card.

The bc635cpp.exe utility can be used to query current settings, modify settings and retrieve or monitor data generated by the card.

PRODUCT INCLUDES

- bc635PCI-U Time & Frequency Processor board, one year warranty, PCI User's Guide, Windows Demonstration software CD.

OPTIONS

- For GPS synchronization, see bc637PCI-V2 datasheet at www.symmetricom.com/products/gps%2Dsolutions/bus%2Dlevel%2Dtiming/bc637PCI%2DV2/
- Ovenized crystal oscillator for extended holdover
- 'D' connector (J1) to BNC adapter
- Drivers: Windows 2000/XP, Linux or Solaris
  Contact factory for additional driver support

bc635/637PMC

PCI Mezzanine Time & Frequency Processor

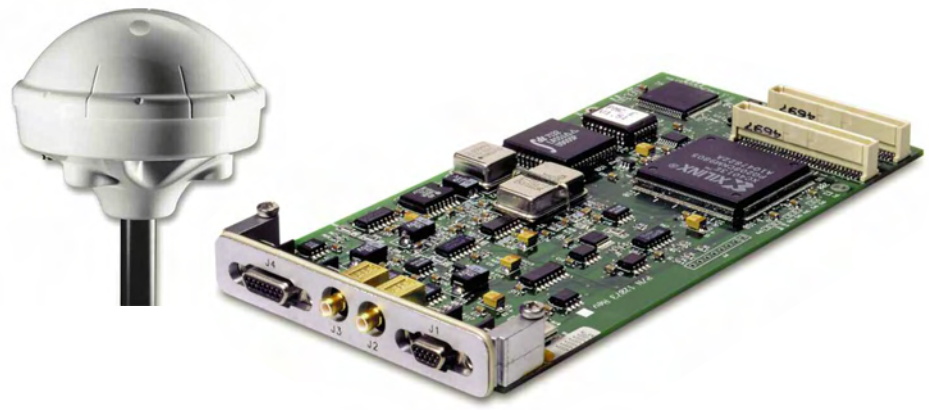
KEY FEATURES

- PCI Local Bus Operation
- GPS or Time Code Inputs
- Time Code Outputs
- Pulse Rate Outputs
- Frequency Outputs (1, 5, or 10 MHz)
- External Event Capture Register/Interrupt
- Programmable Periodic Output/Interrupt
- Programmable Time Strobe Output/Interrupt
- 10 mm Stacking Height
- Micro-Miniature or SMB Output Connectors
- Fully Supports "BUSMODE" Enabling
- IEEE 1344 Compliant IRIG B Time Code

Symmetricom's bc635/637PMC receiver module provides precision time and frequency reference to the host computer system and peripheral data acquisition systems. Time is acquired from either the GPS satellites using a supplied antenna/receiver (bc637PMC only) or from time code signals, typically IRIG B. Integration of the module is facilitated with optional drivers for Windows NT/2000/XP, Linux, Solaris, or VxWorks. Central to the operation of the module is a disciplined 10 MHz oscillator and 100 nanosecond clock. Current time (days to 100 nanoseconds) can be accessed across the PCI bus with zero latency, which allows for very high speed time requests. The oscillator is rate-matched (disciplined) to the input time source and drives the precision 10 MHz frequency output and time code generator circuitry. If time is lost, the module will continue to maintain time (flywheel).

Both time code generation and translation are supported. The generator supplies IRIG B time code output that is synchronized to the input time source. The translator decodes IRIG A, IRIG B or NASA 36.

An Event Time Capture feature provides a means of latching time for an event input. The module can also be programmed to generate a periodic pulse rate as well as to generate a single time strobe at a pre-determined time.



PMC Time & Frequency Processor (shown with optional antenna/receiver, bc637PMC)

bc635/637PMC SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Real time clock

Bus request resolution:	100 nanoseconds
Latency:	Zero
Major time format:	Binary or BCD
Minor time format:	Binary

- Time code translator

Time code formats:	IRIG A, IRIG B*, NASA 36 (Modulated or DCLS)
Time accuracy:	<5 µS (modulated) <1 µS (DCLS)
Modulation ratio:	3:1 to 6:1
Input amplitude:	500 mV to 5V P-P
Input impedance:	>10KΩ

* See IEEE 1344 compliance below

- Time code generator

Time code format:	IRIG B*
Modulation ratio:	3:1
Output amplitude:	4 V P-P (fixed) into 50Ω
DC level shift:	TTL/CMOS

* See IEEE 1344 compliance below

- IEEE 1344 compliance

The translator processes the 27 control function bits of IRIG B time code as set forth in IEEE 1344 (see page 52 of this catalog). The 27 control function bits provided by the input IRIG B time code are output in the generated IRIG B time code one time frame after received. If the input IEEE 1344 bits are not present in the input IRIG B time code, the last two digits of year are placed in bits 1-9 of the control function field of the generated IRIG B time code.

- Timing functions

Heartbeat clock (TTL, 50Ω):	Programmable Periodic, <1 Hz to 250 kHz
Time strobe (TTL, 50Ω):	Programmable 1 µSec through hours
Event capture (TTL, 50Ω):	100 nSec resolution, zero latency
1 PPS pulse rate (TTL, 50Ω):	Positive edge on-time

- Disciplined oscillator

Frequency:	10 MHz
Outputs:	1, 5, or 10 MHz (selectable)
Rate stability:	5.0E-8 short term 'tracking' 5.0E-7 /day long term 'flywheeling'
Sync sources:	GPS, Time Code, 1 PPS, 10 MHz

- PCI local bus™

Specification:	Fully compliant with IEEE P1386/Draft 2.0 and IEEE P1386.1/Draft 2.0*
Size:	Standard (2.913" x 5.866")
Stacking height:	10 mm
Device type:	PCI Target, 32 bit, 5V signalling
Data transfer:	Byte, Half Word, Word
Interrupt levels:	Automatically Assigned (PnP)
Power:	+5 VDC @ 350 mA

*Does not fit in MVME5500 PMC2 slot
For detailed information,click here to access the Field Service Bulletin

- GPS Subsystem (bc637PMC only)

Time accuracy:	<1 µSecond
Position accuracy:	10 to 20 meters SEP (SA off)
Maximum velocity:	300 meters/sec (1,080 KPH)
Number of channels:	8
Receiver frequency:	1.575 GHz (L1, C/A code)
Time to first fix:	Brief power off: 1.5 minutes (1, 3, and 4 satellites) Worst case: 5 to 15 minutes
Solution modes:	1, 3, and 4 satellites

- Connector types

J1 - GPS Interface 9-pin micro 'DP'
J2 - Time Code In SMB socket
J3 - Time Code Out SMB socket
J4 - Module I/O 15-pin micro 'DP'

ENVIRONMENTAL SPECIFICATIONS

	Module	Ant/Rcvr
• Temperature		
Operating:	0°C to 70°C	-40°C to 70°C
Storage:	-30°C to 85°C	-55°C to 85°C
• Humidity		
Operating:	5% to 95%* *non-condensing	95%

OPTIONS

- Extended length GPS antenna cable
- Isolation transformer time code input
- 'D' connector (J1) to BNC adapter
- 15 pin high-density 'DP' to 15 pin 'DP' adapter cable
- Drivers: Windows NT/2000/XP, and Linux, Solaris, VxWorks
  Contact factory for additional driver support

ORDERING INFORMATION

• BC12073-1001	bc635PMC Time & Frequency Processor w/SMB-to-BNC I/O cables
• BC12073-2000	bc637PMC GPS Time & Frequency Processor (includes GPS antenna/receiver & 50' (15 m) cable)
• PCI-WINSDK	PCI Windows software developer's kit
• PCI-LXDRV	PCI Linux Driver
• PCI-VXDRV	PCI VxWorks Driver (PPC target)
• PCI-SDRV32	PCI 32-bit Solaris Driver
• PCI-SDRV64	PCI 64-bit Solaris Driver
• BC11576-1000	'D' to BNC adapter (provides IRIG in, IRIG out, 1 pps out, event in, periodic out)
• BC11576-9860115	'D' to BNC adapter (provides IRIG in, IRIG out, 1 pps out, 1 pps in, event in)
• PCI-BNC-CCS	'D' to BNC adapter (provides IRIG in, IRIG out, 1 pps out, 1 pps in, event in, DCLS out)
• PMC-GPS	PMC 9-pin micro-D to 15-pin HD Adapter
• PMC-I/O	PMC I/O cable (15-pin micro-D to 15-pin DS)
• 812597-050	Spare RS422 50' (15 m) antenna cable*
• 812597-100	Spare RS422 100' (30 m) antenna cable*
• 812597-200	Spare RS422 200' (60 m) antenna cable*

* Contact factory regarding longer cabling requirements.

bc635/637CPCI

Compact PCI Time & Frequency Processor

KEY FEATURES

- CompactPCI™ Bus Operation
- GPS or Time Code Inputs
- Time Code Outputs
- Pulse Rate Outputs
- Frequency Outputs (1, 5, or 10 MHz)
- External Event Capture Register/Interrupt
- Programmable Periodic Output/Interrupt
- Programmable Time Strobe Output/Interrupt
- IEEE 1344 Compliant IRIG B Time Code
- Windows NT/2000/XP Support

Symmetricom's bc635/637 CompactPCI receiver module provides precision time and frequency reference to the host computer system and peripheral data acquisition systems. Time is acquired from either the GPS satellites using a supplied antenna/receiver (bc637CPCI only) or from time code signals, typically IRIG B. Integration of the module is facilitated with optional drivers for Windows NT/2000/XP, Linux, Solaris and VxWorks. CompactPCI uses industry standard mechanical components and high-performance connector technologies to provide a system that is optimized for rugged applications.

Central to the operation of the module is a disciplined 10 MHz oscillator and 100 nanosecond clock. Current time (days to 100 nanoseconds) can be accessed across the CPCI bus with zero latency, which allows for very high speed time requests. The oscillator is rate-matched (disciplined) to the input time source and drives the precision 10 MHz frequency output and time code generator circuitry. If time is lost, the module will continue to maintain time (flywheel). Both time code generation and translation are supported. The generator supplies IRIG B time code output that is synchronized to the input time source. The translator decodes IRIG A, IRIG B and NASA 36.

An Event Time Capture feature provides a means of latching time for an event input. The module can also be programmed to generate a periodic pulse rate as well as to generate a single time strobe at a pre-determined time.

CPCI Time & Frequency Processor (shown with optional antenna/receiver, bc637CPCI)

bc635/637CPCI SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Real time clock
  - Bus request resolution: 100 nanoseconds
  - Latency: Zero
  - Major time format: Binary or BCD
  - Minor time format: Binary
- Time code translator
  - Time code formats: IRIG A, IRIG B*, NASA 36 (Modulated or DCLS)
  - Time accuracy: <5 µS (modulated) <1 µS (DCLS)
  - Modulation ratio: 3:1 to 6:1
  - Input amplitude: 500 mV to 5V P-P
  - Input impedance: >10KΩ
  - * See IEEE 1344 Compliance below
- Time code generator
  - Time code format: IRIG B*
  - Modulation ratio: 3:1
  - Output amplitude: 4 V P-P (fixed) into 50Ω
  - DC level shift: TTL/CMOS
  - * See IEEE 1344 Compliance below
- IEEE 1344 compliance

  The translator processes the 27 control function bits of IRIG B time code as set forth in IEEE 1344 (see page 52 of this catalog). The 27 control function bits provided by the input IRIG B time code are output in the generated IRIG B time code one time frame after received. If the input IEEE 1344 bits are not present in the input IRIG B time code, the last two digits of year are placed in bits 1-9 of the control function field of the generated IRIG B time code.
- Timing functions
  - Heartbeat clock (TTL, 50Ω): Programmable Periodic, <1 Hz to 250 kHz
  - Time strobe (TTL, 50Ω): Programmable 1 µSec through hours
  - Event capture (TTL, 50Ω): 100 nSec resolution, zero latency
  - 1 PPS pulse rate (TTL, 50Ω): Positive edge on-time
- Disciplined oscillator
  - Frequency: 10 MHz
  - Outputs: 1, 5, or 10 MHz (selectable)
  - Rate stability
    - Standard VCXO: 5.0E-8 short term 'tracking' 5.0E-7/day long term 'flywheeling'
    - Optional oven osc: 2.0E-9 short term 'tracking' 5.0E-8/day long term 'flywheeling'
  - Sync sources: GPS, Time Code, 1 PPS, 10 MHz
- PCI local bus™
  - Specification: CompactPCI Specification PICMG 2.0 R2.1 Specification 2.2
  - Size: Single-width 3U (3.94" x 6.3")
  - Device type: PCI Target, 32 bit, 5V signalling
  - Data transfer: Byte, Half Word, Word
  - Interrupt levels: Automatically Assigned (PnP)
  - Power: +5 VDC @350 mA +12 VDC @10 mA (bc635PCI) +12 VDC @ 100 mA (bc637PCI) -12 VDC @10 mA
- GPS subsystem (bc637PCI only)
  - Time accuracy: <1 µSecond
  - Position accuracy: 10 to 20 meters SEP (SA off)
  - Maximum velocity: 300 meters/sec (1,080 KPH)
  - Number of channels: 8
  - Receiver frequency: 1.575 GHz (L1, C/A code)
  - Time to first fix: Worst case: 5 to 15 minutes
  - Solution modes: 1, 3, and 4 satellites
- Connector types
  - J1 - Module I/O: 15-pin 'DS'
  - J2 - GPS interface: 15-pin high-density 'DP'

ENVIRONMENTAL SPECIFICATIONS

• Temperature	Module	Ant/Rcvr
Operating:	0ºC to 70ºC	-40ºC to 70ºC
Storage:	-30ºC to 85ºC	-55ºC to 85ºC
Humidity		
Operating:	5% to 95%* *non-condensing	95%
Operating altitude:	Up to 18,000 meters MSL	

OPTIONS

- Extended length GPS antenna cable
- Isolation transformer time code input
- Ovenized crystal oscillator
- 'D' connector (J1) to BNC adapter
- Drivers: Windows NT/2000/XP, Linux, Solaris, VxWorks Contact factory for additional driver support

ORDERING INFORMATION

• BC12063-1000	bc635CPCI Time & Frequency Processor
• BC12063-2000	bc637CPCI GPS Time & Frequency Processor (includes GPS antenna/receiver & 50' (15 m) cable)
• BC11736-2000	Ovenized oscillator option (factory installed)
• PCI-WINSDK	PCI Windows software developer's kit
• PCI-LXDRV	PCI Linux Driver
• PCI-VXDRV	PCI VxWorks Driver (PPC target)
• PCI-SDRV32	PCI 32-bit Solaris Driver (Solaris 5 & Solaris 6)
• PCI-SDRV64	PCI 64-bit Solaris Driver (Solaris 7 & Solaris 8)
• BC11576-1000	'D' to BNC adapter (provides IRIG in, IRIG out, 1 pps out, event in, periodic out)
• BC11576-9860115	'D' to BNC adapter (provides IRIG in, IRIG out, 1 pps out, 1 pps in, event in)
• PCI-BNC-CCS	'D' to BNC adapter (provides IRIG in, IRIG out, 1 pps out, 1 pps in, event in, DCLS out)
• 812591-050-xxx	Spare RS422 50' (15 m) antenna cable*
• 812591-100-xxx	Spare RS422 100' (30 m) antenna cable*
• 812591-200-xxx	Spare RS422 200' (60 m) antenna cable*

* Contact factory regarding longer cabling requirements.

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TTM635VME

VME Time & Frequency Processors

KEY FEATURES

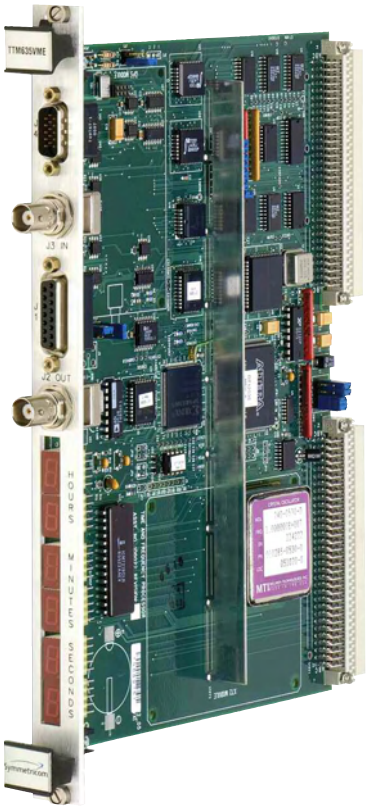
- 6U, Single Width VME
- Time Code Inputs
- Time Code Output
- 1PPS Pulse Rate Output/Interrupt
- Frequency Outputs (1, 5, 10 MHz)
- External Event Capture/Interrupt
- Programmable Periodic Output/Interrupt
- Programmable Time Strobe Output/Interrupt
- Battery Backed Clock
- Extensive Driver Support

Symmetricom's TTM635VME time and frequency processor module provide precision time and frequency reference to the host computer and peripheral data acquisition systems. Time is acquired from time code signals, typically IRIG B. Integration of the module is facilitated with drivers for several operating systems (see Software). Time is displayed on the front panel (hours, minutes, seconds) via LED digits.

Central to the operation of the module is a disciplined 10 MHz oscillator and 100 nanosecond clock. Current time (days to 100 nanoseconds) can be accessed across the bus with zero latency, which allows for very high speed time requests. The oscillator is rate matched (disciplined) to the input time source and drives the precision 10 MHz frequency output and time code generator circuitry. If the time source is lost, the module will continue to maintain time (flywheel). If power is lost, a +/-10 PPM battery backed clock is available to maintain time.

Both time code generation and translation are supported. The generator supplies IRIG B or IRIG H time code output that is synchronized to the input time source. The translator decodes IRIG B, 2137 or XR3 time code inputs.

An event time capture feature provides a means of latching the time of an event input and/or generating a bus interrupt that is coincident with an external TTL pulse. The module can also be programmed to generate a periodic pulse rate/interrupt as well as to generate a strobe/interrupt at a single predetermined time.



VME Time & Frequency Processor

TTM635VME SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Real time clock
  - Bus request resolution: 100 nanoseconds
  - Bus request latency: Zero
  - Major time format: Binary or BCD
  - Minor time format: Binary
- Time code translator
  - Time code formats: IRIG A, IRIG B (modulated or DCLS)
    XR3, 2137 (modulated only)
  - Modulation ratio: 3:1 to 6:1
  - Input amplitude: 500 mV to 5 V P-P
  - Input impedance: >10KΩ (AC coupled)
- Time code generator
  - Time code format: IRIG B (modulated or DCLS)
    IRIG H (DCLS only)
  - Output amplitude: 0 V to 10 V P-P (adjustable)
  - DC level shift: TTL/CMOS
- Timing functions
  - Heartbeat (TTL, 50Ω): Programmable periodic
    2.3 mHz to 2.5 MHz
  - Time strobe (TTL, 50Ω): Programmable, 1mS through hrs
  - Event capture (TTL, 50Ω): 100 nS resolution, zero latency
  - 1PPS pulse rate (TTL, 50Ω): Positive edge on-time
- Disciplined oscillator
  - Frequency: 10 MHz
  - Outputs (50): 1, 5, or 10 MHz (selectable)
  - Rate accuracy
    - Standard VCXO: 5.0E-8 short term (tracking)
      5.0E-7/day long term (flywheeling)
    - Optional oven oscillator: 2.0E-9 short term (tracking)
      5.0E-8/day long term (flywheeling)
  - Sync sources: GPS, time code, 1PPS, 10 MHz
- VME Bus
  - Size: 6Ux160 mm; B size, single
  - Address space: A16, AM codes $29 and $2D,
    64 bytes
  - Data transfer: D16
  - Interrupter: D08(O), I(1-7), ROAK
  - Power: +5 VDC @ 1.5 A
    +12 VDC @ 50 mA
    +12 VDC @ 250 mA (GPS)
    -12 VDC @ 30 mA
- Environment

	Module	Ant/Rec
Temperature		
Operating:	0°C to 70°C	-30°C to + 70°C
Storage:	-50°C to 125°C	-55°C to +100°C
Humidity		
Operating:	5% to 95%*	95%
	*non-condensing	

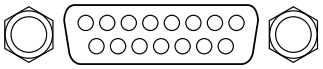
SOFTWARE

Customer source software drivers available for download at www.symmetricom.com. Various operating systems available.

OPTIONS

- 'D' Connector (J1) to BNC Adapter
- Ovenized Crystal Oscillator
- Isolation Transformer Time Code Input
- Connectors

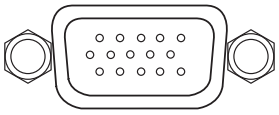
J1 Timing I/O: 15-pin 'DS'



Pin	Direction	Signal
1	Input/Output	External 10MHz Input or Ovenized Oscillator Output*
2		Ground
3	Output	Strobe
4	Output	1 PPS
5	Output	Time Code (AM)
6	Input	External Event
7	Input	Time Code
8		Time Code Return/Ground
9	Output	Oscillator Control Output
10		Not Used
11	Output	Time Code (DCLS)
12		Ground
13	Output	1,5,10 MHz
14	Input	External 1 PPS
15	Output	Periodics

* Pin 1 is an output when the optional ovenized oscillator is installed.

J2 Out Time Code: BNC
J3 In Time Code: BNC
J4 Timing I/O: 15-pin 'DP'



Pin	Direction	Signal
1	Input	RS-422 Rx(+)
2	Input	RS-422 Rx(-)
3	Output	DCLS Out(+)**
4	Output	DCLS Out(-)**
5		Ground
6		Not Used
7	Output	**
8	Input	DCLS In (+)**
9	Input	DCLS In (-)**
10		Ground
11	Output	**
12	Output	**
13		Not Used
14		Ground
15	Output	**

** May also support some legacy timing functions found in the TTM637VME model. See manual for full details.

TTM635VME
Time & Frequency
Processor

Complete specifications can be found in the manual located at http://www.symmetricom.com

bc635VME & bc637VME

VME Time & Frequency Processors

KEY FEATURES

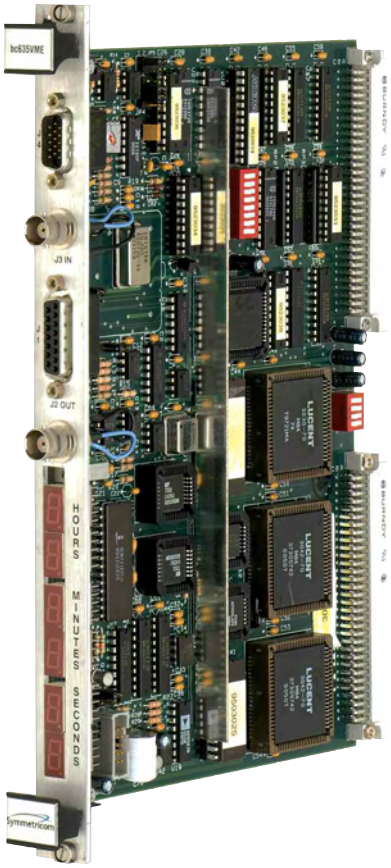
- 6U, Single Width VME
- GPS or Time Code Inputs
- Time Code Output
- 1 PPS Pulse Rate Output/Interrupt
- Frequency Outputs (1, 5, 10 MHz)
- External Event Capture/Interrupt
- Programmable Periodic Output/Interrupt
- Programmable Time Strobe Output/Interrupt
- Battery Backed Clock
- Extensive Driver Support

Symmetricom's bc635/637VME time and frequency processor modules provide precision time and frequency reference to the host computer and peripheral data acquisition systems. Time is acquired from either the GPS satellites using a supplied antenna/receiver (bc637VME only) or from time code signals, typically IRIG B. Integration of the module is facilitated with drivers for several operating systems (see software). Time is displayed on the front panel (hours, minutes, seconds) via LED digits.

Central to the operation of the module is a disciplined 10 MHz oscillator and 100 nanosecond clock. Current time (days to 100 nanoseconds) can be accessed across the bus with zero latency, which allows for very high speed time requests. The oscillator is rate matched (disciplined) to the input time source and drives the precision 10 MHz frequency output and time code generator circuitry. If the time source is lost, the module will continue to maintain time (flywheel). If power is lost, a +/-10 PPM battery backed clock is available to maintain time.

Both time code generation and translation are supported. The generator supplies IRIG B or IRIG H time code output that is synchronized to the input time source. The translator decodes IRIG B, 2137 or XR3 time code inputs.

An event time capture feature provides a means of latching the time of an event input and/or generating a bus interrupt that is coincident with an external TTL pulse. The module can also be programmed to generate a periodic pulse rate/interrupt as well as to generate a strobe/interrupt at a single predetermined time.



bc635VME Time & Frequency Processor

bc635/637VME SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Real time clock

Bus request resolution:	100 nanoseconds
Bus request latency:	Zero
Major time format:	Binary or BCD
Minor time format:	Binary

- Time code translator

Time code formats:	IRIG B (modulated or DCLS) IRIG A (DCLS only) XR3, 2137 (modulated only)
Modulation ratio:	3:1 to 6:1
Input amplitude:	500 mV to 5 V P-P
Input impedance:	>10KΩ (AC coupled)

- Time code generator

Time code format:	IRIG B (modulated or DCLS) IRIG H (DCLS only)
Modulation ratio:	3:1
Output amplitude:	0 V to 10 V P-P (adjustable)
DC level shift:	TTL/CMOS

- Timing functions

Heartbeat (TTL, 50Ω):	Programmable periodic 2.3 mHz to 2.5 MHz
Time strobe (TTL, 50Ω):	Programmable, 1mS through hrs
Event capture (TTL, 50Ω):	100 nS resolution, zero latency
1PPS pulse rate (TTL, 50Ω):	Positive edge on-time

- Disciplined oscillator

Frequency:	10 MHz
Outputs (50):	1, 5, or 10 MHz (selectable)
Rate accuracy	
Standard VCXO:	5.0E-8 short term (tracking) 5.0E-7/day long term (flywheeling)
Optional oven oscillator:	2.0E-9 short term (tracking) 5.0E-8/day long term (flywheeling)
Sync sources:	GPS, time code, 1 PPS, 10 MHz

- VME Bus

Size:	6Ux160 mm; B size, single width
Address space:	A16, AM codes $29 and $2D, 64 bytes
Data transfer:	D16
Interrupter:	D08(O), I(1-7), ROAK
Power:	+5 VDC @ 1.5 A +12 VDC @ 50 mA +12 VDC @ 250 mA (GPS) -12 VDC @ 30 mA

- GPS Subsystem (bc637VME only)

Time accuracy:	<±1 microsecond
Position accuracy:	10 to 20 meters SEP
Maximum velocity:	300 meters/second (1,080 KPH)
Number of channels:	8
Receiver frequency:	1.757 GHz (L1, C/A code)
Time to first fix:	Brief power off: 1.5 min. (1, 3 and 4 satellites)
Solution modes:	1, 3 and 4 satellites

- Environment

	Module	Ant/Rec
Temperature		
Operating:	0°C to 70°C	-30°C to +70°C
Storage:	-50°C to 125°C	-55°C to +100°C
Humidity		
Operating:	5% to 95%* *non-condensing	95%

SOFTWARE

Customer Source Software drivers available for download at www.symmetricom.com, various operating systems available.

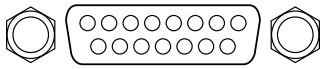
OPTIONS

- Antenna cables, bc637 only[1]
- Isolation transformer time code input
- Ovenized crystal oscillator
- 'D' connector (J1) to BNC adapter

[1] includes GPS antenna/receiver and 50' (15 m) cable; contact factory regarding longer cabling requirements

- Connectors

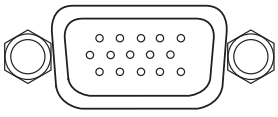
J1 Timing I/O: 15-pin 'DS'



Pin	Direction	Signal
1	Input/Output	External 10MHz Input or Ovenized Oscillator Output*
2		Ground
3	Output	Strobe
4	Output	1 PPS
5	Output	Time Code (AM)
6	Input	External Event
7	Input	Time Code
8		Time Code Return/Ground
9	Output	Oscillator Control Output
10		Not Used
11	Output	Time Code (DCLS)
12		Ground
13	Output	1,5,10 MHz
14	Input	External 1 PPS
15	Output	Periodics

* Pin 1 is an output when the optional ovenized oscillator is installed.

J2 Out Time Code: BNC
J3 In Time Code: BNC
J4 Timing I/O: 15-pin 'DP'



Pin	Direction	Signal
1	Input	RS-422 Rx(+)
2	Input	RS-422 Rx(-)
3	Output	RS-422 Tx(+)
4	Output	RS-422 Tx(-)
5		Ground
6		Not Used
7	Output	GPS 1PPS**
8	Input	GPS RS-422 1PPS+**
9	Input	GPS RS-422 1PPS-**
10		Ground
11	Output	GPS RS-422 Tx(-)**
12	Output	GPS RS-422 Tx(+)**
13		Not Used
14		Ground
15	Output	1GPS +12 VDC**

** GPS timing functions found in the bc637VME model. See manual for full details.

Complete specifications can be found in the manual located at http://www.symmetricom.com

bc635VME Time & Frequency Processor

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SYMMETRICOM GLOBAL SERVICES • Toll free in the USA: 1-888-367-7966 • Worldwide: +1.408.428.7907 • Global e-mail: support@symmetricom.com

PC03V

VMEbus Time Code Reader

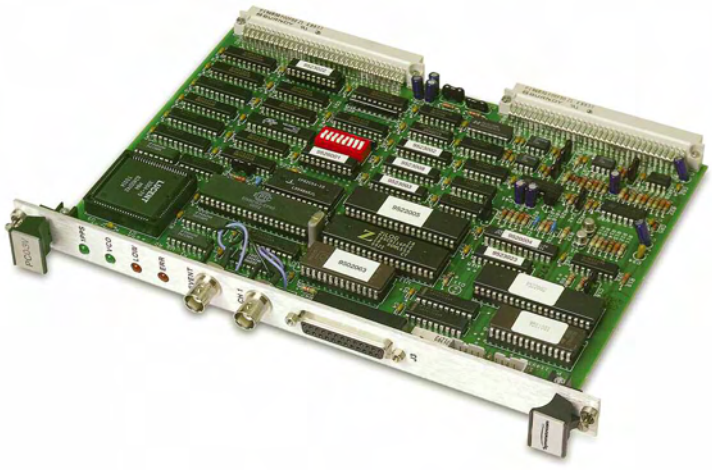
KEY FEATURES

- Translates IRIG A, IRIG B, IRIG G, 2137, XR3, NASA 36
- Translates Codes Forward, Reverse, High Speeds, Low Speeds
- Accepts Carrier Frequencies from 125 Hz to 500 kHz
- Zero Latency Access to Decoded Time
- Two Programmable Time Coincident Strobes/Interrupts
- Programmable Heartbeat Pulse/Interrupt
- External Event Time Capture/Interrupt

Symmetricom's PC03V is a double height VMEbus module designed to translate serial time code signals and to provide additional capabilities not normally found in a single board time code reader. Any of the six most commonly used time codes are translated in either the forward or reverse direction and at tape speeds that are slower or faster than real time. This makes the PC03V an ideal unit for use in tape search applications.

Time output resolution depends on the code type and whether the time code is coming in at the real time rate (i.e., from a satellite receiver or a central timing facility) or at a non-real time rate (i.e., from a magnetic tape recorder). When processing a time code at the real time rate, a synchronized 1 MHz time base reference maintains time of day (TOD) down to a resolution of 1 microsecond. In the case of a non-real time rate, the PC03V maintains TOD to carrier cycle resolution (e.g., 1 mS for IRIG B with a 1 kHz carrier).

High speed time tagging applications require minimal access time (the time from the data request until the requester receives the data — termed latency). To minimize this latency, the PC03V continually maintains current time from microseconds to days. In response to either a VMEbus READ at the PC03V Base Address Location (CAPTR, time capture register) or an external time capture strobe, the current time is transferred to, and held in, four 16 bit output registers for subsequent access across the bus. Internal handshake protocol logic ensures that the transfer does not take place during state changes.



VMEbus Time Code Reader

PC03V SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Time code input

Code formats:	IRIG A, B, G; XR3, 2137, NASA 36
Carrier range:	125 Hz to 500 kHz
Code direction:	Forward and reverse
Modulation ratio:	3:1 to 6:1
Input amplitude:	500 mV to 10 V P-P
Input impedance:	>10KΩ

- Time data

Bus request resolution:	4 ms - XR3 1 ms - IRIG B, 2137 & NASA 36 100 µs - IRIG A 10 µs - for IRIG G
Bus request latency:	Zero
Time format:	Binary coded decimal (BCD)

- Timing functions

Heartbeat:	TTL, active low, programmable periodic
Strobes 1 & 2:	TTL, active high or low, 1 µS to Hours
Event capture:	TTL, positive or negative edge triggered, 50 nS minimum width

- VMEbus interface

Specification:	Meets VMEbus Spec, Revision C.1
Size:	6Ux4HP (160 mm); B-size, single width
Address space:	A16, AM codes $29 and $2D, 256 bytes
Data transfer:	D16
Interrupter:	D08(O), I(1-7), ROAK
Power:	+5 VDC @ 1.7A +12 VDC @ 100 mA -12 VDC @ 100 mA

ENVIRONMENTAL SPECIFICATIONS

- Temperature: 0°C to 50°C
- Humidity: 10% to 80%, non-condensing
- Connector types

Time code inputs:	BNC
Event input:	BNC
Signal I/O:	25 pin 'D' socket; P2, rows A & C
PDC output:	20 pin header

bc824VXI

Rubidium Frequency Standard

KEY FEATURES

- Four Oscillator Modes
  - Free running
  - 10 MHz Synchronization
  - 1PPS Synchronization
  - IRIG B Synchronization
- Low Phase Noise Outputs
- 50 Nanosecond Clock Resolution
- Register/Message Based Device
- External Event Time Capture
- Programmable Periodics & Alarm
- IRIG B Output

The bc824VXI Rubidium Frequency Standard plug-in card is an ultra stable atomic oscillator supported by a C-size mainframe and resource manager configured in accordance with the VXIbus specification. The timing card will provide an ultra stable 10 MHz sine wave or TTL outputs with minimal noise. The bc824VXI employs both a rubidium oscillator and a low phase noise ovenized crystal oscillator (OCXO). The rubidium oscillator provides exceptional long term stability if the synchronizing input is lost. The OCXO phase locks to the rubidium oscillator, removing rubidium frequency spurs and providing an excellent noise floor.

The VXIbus Rubidium Frequency Standard Plug-in card is a register based device as well as a message based device. The message based interface capability will provide minimal access latency to the card via the system bus. The capability of the interrupt generation will allow interrupt driven algorithms to interface to the card. The bc824VXI will synchronize to an external 1PPS, 10 MHz reference or IRIG B time code. If the input source is lost, then time will be maintained in a flywheel state based on the on-board rubidium standard.

bc824VXI Rubidium Frequency Standard

bc824VXI SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Phase noise: <-75 dBc/Hz @ 1 Hz
  <-110 dBc/Hz @ 10 Hz
  <-140 dBc/Hz @ 100 Hz
  <-150 dBc/Hz @ 1 kHz
  <-150 dBc/Hz @ 10 kHz
  <-70 dBc Overall
- Spurious: <-70 dBc Overall
- Harmonics: <-50 dBc

DISCIPLINED OSCILLATOR

- Frequency: 10 MHz
- Outputs: 10 MHz
- Rate accuracy

Stability	Allen Variance
1 sec	1E-10
10 sec	3E-11
100 sec	1E-11
Aging	
Monthly:	<5E-11
Yearly:	<5E-10
Temperature coefficient	
0°C to 50°C	3E-10
-25°C to 70°C	6E-10

(includes aging, frequency offset over temperature range, setting accuracy and 10% input voltage change)

- Accuracy at shipment: 5E-11 @ 25°C
- Frequency retrace: 5E-11 (after 1 hour power on, less than 25 hours power off)

SYNC SOURCES

- bc824VXI: Time Code, 1PPS, 10 MHz

REAL TIME CLOCK

- Bus request resolution: 100 nanoseconds
- Bus request latency: Zero
- Major time format: Binary or BCD
- Minor time format: Binary

TIME CODE TRANSLATOR

- Time code formats: IRIG B (modulated or DCLS)
- Modulation ratio: 3:1 to 6:1
- Input amplitude: 500 mV to 5 V P-P
- Input impedance: >10KΩ (AC coupled)
- Signal to noise ratio: 20 dB (minimum)

TIME CODE GENERATOR

- Time code format: IRIG B
- Modulation ratio: 3:1
- Output amplitude: 4 V P-P (fixed)
- DC level shift: TTL/CMOS

TIMING FUNCTIONS

- Heartbeat (TTL, 50Ω): Programmable periodic
  10 MHz to 3 Hz
- Event capture (TTL, 50Ω): 100 ns resolution, zero latency
- Enhanced event (TTL, 50Ω): 10 ns resolution, 50µs latency
- Event compare (TTL): Programmable, 1ms - hours
- 1PPS pulse rate (TTL, 50Ω): Positive edge on-time

ENVIRONMENTAL SPECIFICATIONS

- Temperature — **Module**
  - Operating: 0°C to 70°C
  - Storage: -40°C to 75°C
- Humidity
  - Operating: 10% to 80%*
  - Storage: 5% to 95%
  *non-condensing

VXI BUS

- Address space: A16 only
- Data transfer: Byte, Half-Word, Word
- Power:

V	Warmup	Operating
+5 VDC	2A	1A
+12	2A	0.5A
-12	0.5A	0.5A
+24	3A @ 0C	1A
-24	0.4A	0.4A

- Input voltage sensitivity: <5E-11 (D = ±10% VDC)
- Warm-up time: Time to lock <4 min (25C)
  6 minutes//1E-9

PHYSICAL SPECIFICATIONS

- Size: Double wide C-size
  (9.2 in x 13.5 in)
- Weight: 4.25 lbs
- Connector types: 8 front panel BNC outputs
  1 front panel BNC (10 MHz cal input)
  15-pin 'D' connector
  P1 & P2 per VXIbus specification
- LEDs: Power, Locked, Fault, Tracking

bc620AT

PC Time & Frequency Processor

KEY FEATURES

- PC, XT or AT Bus Operation (ISA/EISA Compatible)
- Time Code Inputs
- Time Code Output
- Pulse Rate Outputs
- Frequency Outputs (1, 5, or 10 MHz)
- External Event Capture/Interrupt
- Programmable Periodic Output/Interrupt
- Programmable Time Strobe Output/Interrupt
- Battery Backed Clock

Symmetricom's bc620AT time and frequency processor modules provide precision time and frequency reference to the host computer and peripheral data acquisition systems. Time is acquired from time code signals, typically IRIG B.

Central to the operation of the module is a disciplined 10 MHz oscillator and 100 nanosecond clock. Current time (days to 100 nanoseconds) can be accessed across the bus with zero latency, which allows for very high speed time requests. The oscillator is rate-matched (disciplined) to the input time source and drives the precision 10 MHz frequency output and time code generator circuitry. If the time source is lost, the module will continue to maintain time (flywheel). If power is lost, a 10 PPM battery backed clock is available to maintain time.

Both time code generation and translation are supported. The generator supplies IRIG B time code output synchronized to the input time source. The translator decodes either IRIG B, 2137, XR3 or NASA 36 time code inputs.

An event time capture feature provides a means of latching time for an event input. The module can also be programmed to generate a periodic pulse rate interrupt as well as to generate a single time strobe at a predetermined time.

PC Time & Frequency Processor

bc620AT SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Real time clock
  - Bus request resolution: 100 nanoseconds
  - Latency: Zero
  - Major time format: Binary or BCD
  - Minor time format: Binary
- Time code translator
  - Time code formats: IRIG B, NASA 36 (modulated or DCLS)
    XR3, 2137 (modulated only)
  - Modulation ratio: 3:1 to 6:1
  - Input amplitude: 500 mV to 5 V P-P
  - Input impedance: >10KΩ (AC coupled)
  - Carrier frequency: ±50 PPM (max)
- Time code generator
  - Time code format: IRIG B
  - Modulation ratio: 3:1
  - Output amplitude: 1 V to 10 V P-P (adjustable) into 50Ω
  - DC level shift: TTL/CMOS
- Timing functions
  - Heartbeat (TTL, 50Ω): Programmable periodic
    2.3 mHz to 2.5 MHz
    (adjustable pulse width)
  - Time strobe (TTL, 50Ω): Programmable, 1 mS through
    hours (1 mS pulse width)
  - 1 PPS output (TTL, 50Ω): 200 mS pulse width
  - Event capture input: 100 nS resolution, zero latency
    (20 nS min pulse width; 250 nS min period)
- Disciplined oscillator
  - Frequency: 10 MHz
  - Outputs: 1, 5, or 10 MHz (selectable)
  - Rate accuracy:
    - Standard VCXO: 5.0E-8 short term (tracking)
      5.0E-7/day long term (flywheeling)
    - Optional oven oscillator: 2.0E-9 short term (tracking)
      5.0E-8/day long term (flywheeling)
  - Sync sources: GPS, Time Code, 1 PPS
- External time base frequency input
  - 10 MHz square wave: TTL (45-55% duty cycle)
  - 10 MHz sine wave: 0.5 to 4.0 V P-P
- AT bus
  - Address space: 1 Block of 16 Bytes in the PC I/O Map Range
    100H-3FFH
  - Data transfer: 8-bit
  - Interrupt levels: IRQ 3-7, 9-12, 14-15
    (jumper selected)
  - Power: +5 VDC @ 450 mA
    +12 VDC @ 55 mA (bc620AT)
    +12 VDC @ 250 mA (bc627AT)
    -12 VDC @ 20 mA
- Environment

	Module	**Antenna/Receiver**
Operating temperature:	0°C to 70°C	-30°C to + 70°C
Storage temperature:	-50°C to 100°C	-55°C to +100°C
Humidity		
Operating:	5% to 95%*	95%
	*non-condensing	

- Connector types
  - J1 - module I/O signals: 15-pin 'DS'

OPTIONS

- Isolation transformer time code input
- Ovenized crystal oscillator
- 'D' connector (J1) to BNC adapter
- WINSDK for Windows 95/98/NT/2000

Network Timing

Your Network. Optimized.

All IT networks are dynamic in their pursuit of higher performance and increased security. Only with time that is accurate, secure, reliable and synchronized can an IT enterprise hope to achieve its present and future goals.

Symmetricom's next generation of GPS network time synchronization products provide high-performance, flexible and automated time distribution solutions to precisely, securely and consistently manage time on enterprise servers and desktops—critical for network security, server log file accuracy, billing systems, electronic transactions, database integrity, software development, VoIP and many more essential applications.

Our network time synchronization products include dedicated GPS network time servers and easy to manage synchronization, management and monitoring software that synchronizes the time on IT devices such as workstations, servers and routers—all designed to improve and secure your IT system's performance and lower your risk of IT system failures.

Your Network. Optimized.

Time Server Product Matrix

Time Server Product Comparison



		ENTERPRISE CLASS			ADVANCED TIMING		MILITARY	
	Feature	**NTS-150**	**S200**	**S300**	**S250**	**S350**	**S300 SAASM**	**S350 SAASM**
Time Protocols	NTP Server (v2, v3, v4)	■	■	■	■	■	■	■
	SNTP, Time, Daytime	■	■	■	■	■	■	■
	NTP Peering/Client		■	■	■	■	■	■
	NTP Multicast Server/Client		■	■	■	■	■	■
	NTP Broadcast Server/Client		■	■	■	■	■	■
	NTP performance, requests/second	**200**	**3200**	**7000**	**3200**	**7000**	**7000**	**7000**
Time References (inputs)	GPS (12 channel)	■	■	■	■ **(1)**	■	**L1/L2**	**L1/L2**
	NTP Peering		■	■	■	■	■	■
	Dial-up internal modem (ACTS, JJY, ITU-R TF583.4)			■		■		
	Low Frequency Radio (WWVB, JJY, DCF77) (optional)			■		■		
	10MHz input				■	■		■
	1PPS input				■	■		■
	IRIG B AM Input				■	■		■
	IRIG A/B/E/G/NASA36/XR3/2137 inputs (AM & DCLS)					■		■
	T1/E1 input (optional)					■		
	Reference priority, user configurable					■		■
Network Security Protocols	HTTP/HTTPS/SSL		■	■	■	■	■	■
	Telnet (w/disable fcn.)	■	■	■	■	■	■	■
	SNMP V1, V2c, V3 with Custom MIB II	**v1**	■	■	■	■	■	■
	DHCP (w/disable fcn.)	■	■	■	■	■	■	■
	SSH/SCP (w/disable fcn.)		■	■	■	■	■	■
	IPv6 and IPv4/IPv6		■	■	■	■	■	■
	MD5 for NTP	■	■	■	■	■	■	■
	NTP v4 Autokey (Server and Client)			■		■	■	■
	RADIUS Authenticated login			■		■	■	■
	1000Base-T equipped port (Gigabit)			■		■	■	■
	Total number of Ethernet ports	**1**	**3**	**4**	**3**	**4**	**4**	**4**
User Interface	Web Interface		■	■	■	■	■	■
	Vacuum florescent display/multi-line	**Opt. LED**	■	■	■	■	■	■
	Numeric keypad		■	■	■	■	■	■
	LED's: Sync, Network, Alarm, NTP	**(4)**	■	■	■	■	■	■
	USB		■	■	■	■	■	■
	RS-232	■	■	■	■	■	■	■
	Alarm relays			■		■	■	■
	Keypad lockout			■		■	■	■
Osc.	OCXO upgrade		■	■	■	■	■	■
	Rubidium upgrade		■	■	■	■	■	■
Timing Outputs	Timing accuracy	**3**	**2**	**2**	**2**	**2**	**2**	**2**
	Sysplex output (dedicated port)		■	■	■	■	■	■
	1PPS output				■	■		■
	10MHz output				■	■		■
	IRIG B AM output				■	■		■
	IRIG A/B/E/G/NASA36/XR3/2137 outputs (AM & DCLS)					■		■
	T1/E1 output (optional)					■		
Misc.	General server status logs (Syslog, 1-8 Servers)		■	■	■	■	■	■
	Autocheck for firmware upgrades		■	■	■	■	■	■
	Email alerts		■	■	■	■	■	■
	Serve NTP in UTC or GPS Timescale		■	■	■	■	■	■

(1) Also available without GPS (2) ± 50 Nanoseconds (3) ± 1 Microseconds (4) Sync and Network LEDS only

TSMatrixSAASM/PDF/0809

SyncServer® S200

Enterprise Class GPS Network Time Server

KEY FEATURES

- High-Bandwidth NTP Time Server
- Stratum 1 Operation Via GPS Satellites
- 3 Independent 10/100Base-T Ports
- High-Resolution Vacuum Fluorescent Display
- Full Numeric Keypad
- IPv6 and IPv4 Compliant
- Secure Web-Based Management
- SSH, SSL, SCP, SNMP v3, Custom MIB, HTTPS, Telnet, and More
- Stratum 2 Operation via NTP Servers
- Nanosecond Time Accuracy to UTC
- Dedicated Sysplex Timer Output
- Email Alerts for Alarms or Errors
- Single Satellite Timing
- Dual USB Ports
- Two-Year Warranty
- Rubidium & OCXO Oscillator Upgrades

KEY BENEFITS

- Synchronize Thousands of Client, Server & Workstation Clocks
- Very Reliable and Secure Source of Time for Your Network
- Extremely Accurate Time Source for Network Synchronization
- Improve Network Log File Accuracy to Speed Network Fault Diagnosis and Forensics
- Very Easy to Install and Maintain
- Multiple NTP Ports for Easy Network Configuration and Adaptation
- Intuitive Web Interface for Easy Control & Maintenance
- IPv6 Compliance Futureproofs Your Network

The SyncServer® S200 GPS Network Time Server synchronizes clocks on servers for large or expanding IT enterprises and for the ever-demanding high-bandwidth Next Generation Network. Accurately synchronized clocks are critical for network log file accuracy, security, billing systems, electronic transactions, database integrity, VoIP, and many other essential applications.

The S200 is the easiest to set up and maintain network time server in the world. The front panel is designed to quickly bring the time server online with a few front panel keystrokes or DHCP. To fully configure the unit, use the very intuitive web interface. The S200 is also the first network time server to offer step-by-step wizards for the most common operations. The state-of-the-art user interface offers the network administrator ease-of-use and remote access, with intuitive web pages and full control of the server via a standard browser interface.

Once online, the S200 provides reliable and secure network synchronization technology by combining multi-port, high-speed/ high-capacity network interfaces and versatile GPS timing receiver technology. It supports a wide range of network protocols including IPv4 and IPv6, for easy management and seamless integration into your existing and future network.

The high availability and throughput of the three 10/100Base-T ports translates into the support of hundreds of thousands of network clients while maintaining microsecond caliber NTP timestamp accuracy. They also provide the flexibility needed to easily adapt to different and changing network topologies and security requirements.

The Stratum 1 level S200 derives its time directly from the atomic clocks aboard the GPS satellite system. By using the integrated, 12-channel GPS receiver, every visible satellite can be tracked and used to maintain extremely accurate and reliable time.

If the GPS reference signal is ever lost, the S200 can automatically revert to a Stratum 2 mode and retrieve time from other user-designated time servers. Another option is that the S200 can be upgraded to an internal Rubidium atomic oscillator that keeps the S200 accurate to 25 microseconds per day.

The SyncServer S200 is your answer to bringing perfect timing to your network.

SyncServer S200 SPECIFICATIONS

NETWORK PROTOCOLS

NTP (v2 - RFC1119, v3 - RFC1305, v4 - No RFC)
NTP Unicast, Multicast, Broadcast
SNTP Simple Network Time Protocol (RFC4330)
TIME (RFC868)
DAYTIME (RFC867)
HTTP/SSL/HTTPS (RFC2616)
SSH/SCP (Internet Draft)
SNMPv3 (RFC3584)
Custom MIB
DHCP (RFC2131)
Telnet (RFC854)
MD5 Authentication (RFC1321)
SMTP Forwarding
Syslog 1 to 8 servers
IPv4
IPv6 and IPv4/IPv6 Hybrid

Key management protocols can be individually disabled.
LAN 1: Management & Time protocols: LAN 2 & LAN 3: Time protocols only.

SERVER PERFORMANCE

- Stratum 1: 3200 NTP requests per second while maintaining an overall time stamp accuracy of 14 microseconds to UTC with a variation of less than 33 microseconds typical. This accuracy is inclusive of all NTP packet delays in and out of the SyncServer as measured at the network interface. Client synchronization accuracy to server on a LAN is 0.5 - 2 milliseconds (typical). The SyncServer easily supports many hundreds of thousands of NTP clients.
- Stratum 2: Peering can be used as the primary mode of operation or as a back up mode in case the GPS reference signal is lost. Time stamp accuracy depends on NTP peer server(s). NTP request handling capacity remains the same regardless of stratum level.
- Holdover Accuracy

TCXO (standard):	21 milliseconds/day
OCXO (optional):	1 milliseconds/day
Rubidium (optional):	25 microseconds/day

GPS RECEIVER/ANTENNA

- 12 channel parallel receiver
- Minimum number of satellites for time: 1 intermittently
- GPS time traceable to UTC (USNO)
- Accuracy: <50 ns RMS, 150 ns peak to peak to UTC, ≥4 satellites tracked. Network factors can reduce client synchronization accuracy to 0.5-2 ms (typical).
- Maximum Belden 9104 cable length: 150' (45 m). For longer cable runs see Options.

MECHANICAL/ENVIRONMENTAL

- Size: 1.75" x 17" x 11.25" (4.5 cm x 43.2 cm x 28.6 cm) 1U rack mount
- Power: 100-240 VAC, 50-60 Hz, 25 watts (45 watts with Rb osc.), IEC 60320 C14 connector, power switch.
- Operating temperature: 0°C to +50°C; 0°C to +45°C with Rubidium option
- Storage temperature: -10°C to +70°C
- Humidity: To 95%, noncondensing
- Certifications: FCC, CE (RoHS), UL, PSE, China RoHS
- Server weight alone: 8 lbs (3.6 kgs)
- Shipping package weight: 15 lbs (6.8 kgs)

Front Panel

Display:	Sharp, high-resolution 32x256 dot-matrix vacuum-fluorescent. 1, 2 or 4 line.	
Keypad:	0-9 numeric, up, down, left, right, ENTER, CLR, TIME, STATUS, MENU.	
LEDs (tri-color green/red/orange)		
Sync:	Time reference status	
Network:	Network connection status	
NTP:	NTP activity	
Alarm:	Fault condition	
Serial:	DB9-F	9600, N, 8, 1
USB:	(2x) ports for back up, restore, and upgrade operations via the front panel.	

Rear Panel

Network (3x):	RJ-45	10Base-T/100Base-TX Ethernet
Sysplex:	DB9-M	RS-232
GPS:	BNC	L1, 1575 MHz

CLIENT SOFTWARE

An NTP client is required for client-side synchronization with any network time server, including the S200. Included with the S200 is Symmetricom's SymmTime NTP client for Windows. Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network is also available.

PRODUCT INCLUDES

S200 Network Time Server, L1 GPS antenna, 50' (15 m) Belden 9104 coaxial cable, 1 ft. antenna mounting mast (30 cm) with two clamps, category 5 patch cable, DB9-M to DB9-F RS-232 extension cable, manual, SymmTime NTP client for Windows, Enterprise MIB software, power cord, and rack mount ear kit. Two-year warranty.

OPTIONS

[To see Options datasheet please click here]

- Rubidium or OCXO oscillator upgrade for extended holdover
- ±40-60 Vdc power supply
- Window mounted antenna
- GPS antenna in-line amplifier for cable runs to 300' (90 m)
- GPS antenna down/up converter for cable runs to 1500' (457 m)
- Lightning arrestor
- Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network is also available.
- NTP Network Time Displays, 2" or 4" (5 cm or 10 cm), 6 digit, red LEDs

Rear View

Front View

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SyncServer® S250

GPS Network Time Server with Timing Enhancements

KEY FEATURES

- High-Bandwidth NTP Time Server
- Stratum 1 Operation Via GPS Satellites
- 50 Nanosecond Time Accuracy to UTC
- 3 Independent 10/100Base-T Ports
- High-Resolution Vacuum Fluorescent Display
- Full Numeric Keypad
- IPv6 and IPv4 Compliant
- Secure Web-Based Management
- SSH, SSL, SCP, SNMP v3, Custom MIB, HTTPS, Telnet, and More
- Dual USB Ports
- Independent Time References: GPS, IRIG B, 1PPS, 10 MHz
- Versatile Timing Outputs: IRIG B, 1PPS, 10 MHz, Sysplex
- Two-Year Warranty
- Rubidium & OCXO Oscillator Upgrades
- S250i Model With No GPS

KEY BENEFITS

- Synchronize Thousands of Client Clocks
- Extremely Accurate Reference for Network Time Synchronization and Time & Frequency Applications
- Automatic, Prioritized Reference Selection Between GPS, IRIG B, 1PPS & 10 MHZ
- Very Easy to Configure a Cesium Standard as Backup for GPS
- Multiple NTP Ports for Easy Network Configuration and Adaptation
- Intuitive Web Interface for Easy Control & Maintenance
- IPv6 Compliance Futureproofs Your Network

The SyncServer® S250 Precision GPS Network Time Server synchronizes clocks on servers for large or expanding networks and for the ever-demanding high-bandwidth Next Generation Network. Accurately synchronized clocks are critical for network log file accuracy, security, billing systems, electronic transactions, database integrity, VoIP, and many other essential applications.

The S250 is the easiest to set up and maintain network time server in the world. The front panel is designed to quickly bring the time server online with a few front panel keystrokes or DHCP. To fully configure the unit, use the very intuitive web interface. The S250 is also the first network time server to offer step-by-step wizards for the most common operations. The state-of-the-art user interface offers the network administrator ease-of-use and remote access, with intuitive web pages and full control of the server via a standard browser interface.

Once online, the S250 provides reliable and secure network synchronization technology by combining multi-port, high-speed/ high capacity network interfaces and versatile GPS timing receiver technology. It supports a wide range of network protocols including IPv4 and IPv6, for easy management and seamless integration into your existing and future network.

The high availability and throughput of the three 10/100Base-T ports translates into the support of hundreds of thousands of network clients while maintaining microsecond caliber NTP timestamp accuracy. They also provide the flexibility needed to easily adapt to different and changing network topologies and security requirements.

The Stratum 1 S250 will automatically synchronize to GPS, IRIG B AM, 1PPS, and 10 MHz in that priority. It smoothly transitions from one reference to the next available if the higher priority signal is lost or regained. This is perfect for operating with different backup time or frequency sources. The S250 can also revert to a Stratum 2 mode and retrieve time from other user-designated time servers. Similarly the S250 generates IRIG B, 1PPS and 10 MHz outputs and can be upgraded to an internal Rubidium atomic oscillator. While tracking GPS the S250 is accurate to 50 nanoseconds to UTC.

The SyncServer S250 is your answer to bringing perfect timing to your network.

SyncServer S250 SPECIFICATIONS

NETWORK PROTOCOLS

NTP (v2 - RFC1119, v3 - RFC1305, v4 - No RFC)
NTP Unicast, Multicast, Broadcast
SNTP Simple Network Time Protocol (RFC4330)
TIME (RFC868)
DAYTIME (RFC867)
HTTP/SSL/HTTPS (RFC2616)
SSH/SCP (Internet Draft)
SNMPv3 (RFC3584)
Custom MIB
DHCP (RFC2131)
Telnet (RFC854)
MD5 Authentication (RFC1321)
SMTP Forwarding
Syslog 1 to 8 servers
IPv4
IPv6 and IPv4/IPv6 Hybrid

Key management protocols can be individually disabled.
LAN 1: Management & Time protocols: LAN 2 & LAN 3: Time protocols only.

SERVER PERFORMANCE

- Stratum 1: 3200 NTP requests per second while maintaining an overall time stamp accuracy of 14 microseconds to UTC with a variation of less than 33 microseconds typical. This accuracy is inclusive of all NTP packet delays in and out of the SyncServer as measured at the network interface. Client synchronization accuracy to server on a LAN is 0.5 - 2 milliseconds (typical). The SyncServer easily supports many hundreds of thousands of NTP clients.
- Stratum 2: Peering can be used as the primary mode of operation or as a back up mode in case the GPS reference signal is lost. Time stamp accuracy depends on NTP peer server(s). NTP request handling capacity remains the same regardless of stratum level.
- Holdover Accuracy/Oscillator Aging

TCXO (standard):	21 milliseconds/day	<1E-06/month
OCXO (optional):	1 milliseconds/day	<1E-07/month
Rubidium (optional):	6 microseconds/day	<5E-11/month

GPS RECEIVER/ANTENNA

- 12 channel parallel receiver
- Minimum number of satellites for time: 1 intermittently
- GPS time traceable to UTC (USNO)
- Accuracy: <50 ns RMS, 150 ns peak to peak to UTC, ≥4 satellites tracked. Network factors can reduce client synchronization accuracy to 0.5-2 ms (typical).
- Maximum Belden 9104 cable length: 150' (45 m). For longer cable runs see Options.

MECHANICAL/ENVIRONMENTAL

- Size: 1.75" x 17" x 11.25" (4.5 cm x 43.2 cm x 28.6 cm) 1U rack mount
- Power: 100-240 VAC, 50-60 Hz, 25 watts (45 watts with Rb osc.), IEC 60320 C14 connector, power switch.
- Operating temperature: 0°C to +50°C; 0°C to +45°C with Rubidium option
- Storage temperature: -10°C to +70°C
- Humidity: To 95%, noncondensing
- Certifications: FCC, CE (RoHS), UL, PSE, China RoHS
- Server weight alone: 8 lbs (3.6 kgs)
- Shipping package weight: 15 lbs (6.8 kgs)

CLIENT SOFTWARE

An NTP client is required for client-side synchronization with any network time server, including the S250. Included with the S250 is Symmetricom's SymmTime NTP client for Windows. Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network is also available.

Front Panel

Display:		Sharp, high-resolution 32x256 dot-matrix vacuum-fluorescent. 1, 2 or 4 line.
Keypad:		0-9 numeric, up, down, left, right, ENTER, CLR, TIME, STATUS, MENU.
LEDs (tri-color green/red/orange)		
Sync:		Time reference status
Network:		Network connection status
NTP:		NTP activity
Alarm:		Fault condition
Serial:	DB9-F	9600, N, 8, 1
USB:		(2x) ports for back up, restore, and upgrade operations via the front panel.

Rear Panel

Network (3x):	RJ-45	10Base-T/100Base-TX Ethernet
Sysplex:	DB9-M	RS-232
GPS:	BNC	L1, 1575 MHz
IRIG B AM in:	BNC	IRIG B 120/121/122/123, IEEE-1344, 1V to 8V p-p, >5KΩ
IRIG B AM out:	BNC	IRIG B 123, IEEE-1344 Modulated 3:1, 3.5Vpp, 50Ω Accurate to 10 µS to input
1PPS-in:	BNC	TTL, Active rising edge 270Ω
1PPS-out:	BNC	TTL, Rising edge on-time, 50Ω
10 MHz-in:	BNC	Sine wave or square wave, 1Vpp to 5Vpp, >50KΩ
10 MHz-out:	BNC	Sine wave >3Vpp & <7Vpp into 50Ω

S250 PRODUCT INCLUDES

S250 Network Time Server, L1 GPS antenna, 50' (15 m) Belden 9104 coaxial cable, 1 ft. antenna mounting mast (30 cm) with two clamps, category 5 patch cable, DB9-M to DB9-F RS-232 extension cable, manual, SymmTime NTP client for Windows, Enterprise MIB software, power cord, and rack mount ear kit. Two-year warranty.

S250i PRODUCT INCLUDES (no GPS version)

S250i Network Time Server, category 5 patch cable, DB9-M to DB9-F RS-232 extension cable, manual, SymmTime NTP client for Windows, Enterprise MIB software, power cord, and rack mount ear kit. Two-year warranty.

OPTIONS

[To see Options datasheet please click here]

- Rubidium or OCXO oscillator upgrade for extended holdover
- ±40-60 Vdc power supply
- Window mounted antenna
- GPS antenna in-line amplifier for cable runs to 300' (90 m)
- GPS antenna down/up converter for cable runs to 1500' (457 m)
- Lightning arrestor
- Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network is also available.
- NTP Network Time Displays, 2" or 4" (5 cm or 10 cm), 6 digit, red LEDs

Rear View

Front View

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SyncServer® S300

High Performance, Enhanced Security GPS Network Time Server

KEY FEATURES

- Ultra High-Bandwidth NTP Time Server
- Stratum 1 Operation via GPS Satellites
- Gigabit Ethernet Port plus 3 Additional Independent 10/100Base-T Ports
- Internal Dial-up Modem for Time Reference Redundancy
- Stratum 2 Operation via NTP Servers
- RADIUS, NTPv4 Autokey, MD5 Authentication
- Secure Web-Based Management
- SSH, SSL, SCP, SNMP, Custom MIB, HTTPS, Telnet, and More
- High-Resolution Vacuum Fluorescent Display
- Full Numeric Keypad
- IPv6 and IPv4 Compatible
- Nanosecond Time Accuracy to UTC
- Dedicated Sysplex Timer Output
- Alarm Relays
- Single Satellite Timing
- Rubidium & OCXO Oscillator Upgrades
- Upgrade to Radio Broadcast Time Sync

KEY BENEFITS

- Synchronize Thousands of Client, Server & Workstation Clocks
- Very Reliable and Secure Source of Time for Your Network
- Multiple NTP Ports for Easy Network Configuration and Adaptation
- Extremely Accurate Time Source for Network Synchronization
- Enhanced Network & Security Features
- Improve Network Log File Accuracy to Speed Network Fault Diagnosis and Forensics
- Access Multiple Time Sources for Reliable and Secure Time
- Very Easy to Install and Maintain
- Intuitive Web Interface for Easy Control & Maintenance

Setting new standards for security, reliability, redundancy and versatility in network time servers, the SyncServer® S300 GPS Network Time Server is the solution for synchronizing the time on servers and workstations for large or expanding IT enterprises. Accurately synchronized clocks are critical for network log file accuracy, security, billing systems, electronic transactions, database integrity, VoIP, and many other essential applications.

The high performance S300 continues the SyncServer legacy of being the easiest to set up and maintain network time servers in the world. The front panel is designed to quickly bring the server online with a few front panel keystrokes or DHCP. To fully configure the unit, use the very intuitive web interface or the step-by-step web based wizards for the most common operations.

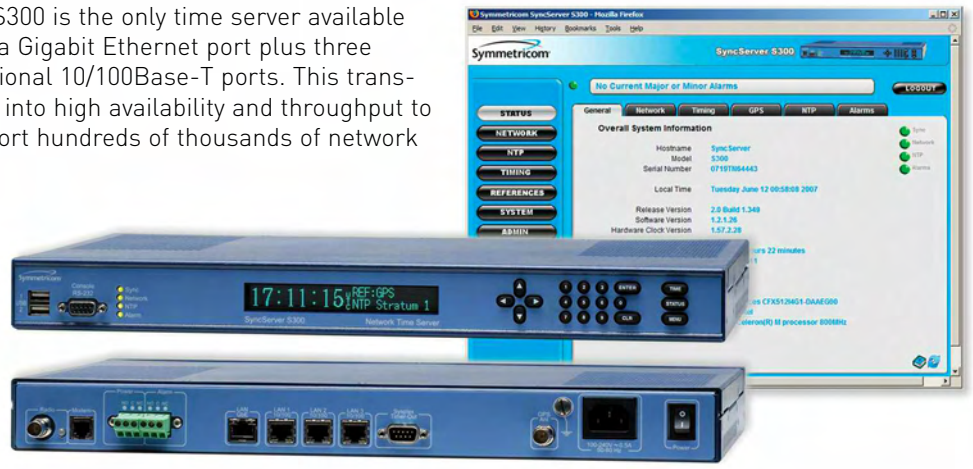
Once online, the S300 provides very reliable and secure network synchronization technology by combining multi-port network interfaces with multiple time reference technology and enhanced security protocols. Support of the essential security and network protocols provide for easy management and seamless integration into your existing and future network.

The S300 is the only time server available with a Gigabit Ethernet port plus three additional 10/100Base-T ports. This translates into high availability and throughput to support hundreds of thousands of network clients while maintaining microsecond caliber NTP timestamp accuracy. These four completely independent ports provide the flexibility needed to easily adapt to different and changing network topologies and security requirements.

The Stratum 1 level S300 derives its extremely accurate time directly from the atomic clocks aboard the GPS satellite system. For redundancy and time assurance, the S300 also includes an internal modem to connect directly to legal time provided by national time authorities. Reliability is further enhanced via Stratum 2 operation by retrieving time from other user-designated time servers. An optional AM radio will synchronize to national time broadcasts, which can be an alternative to GPS when GPS is not viable option.

To further protect against the loss of accurate time, the S300 can be upgraded to an internal Rubidium atomic oscillator that keeps the S300 accurate to microseconds per day.

The SyncServer S300 is your answer to bringing perfect timing to your network — securely, reliably and easily — and for many years to come.



SyncServer S300 SPECIFICATIONS

NETWORK PROTOCOLS

NTP (v2 - RFC1119, v3 - RFC1305, v4 - No RFC)
NTP Unicast, Broadcast, Multicast, Autokey
SNTP Simple Network Time Protocol (RFC4330)
TIME (RFC868)
DAYTIME (RFC867)
HTTP/SSL/HTTPS (RFC2616)
SSH/SCP (Internet Draft)
Syslog 1 to 8 servers

SNMP v1, v2c, v3 (RFC3584)
Custom MIB
DHCP (RFC2131)
Telnet (RFC854)
MD5 Authentication (RFC1321)
RADIUS (RFC2865)
SMTP Forwarding
IPv4, IPv6 and IPv4/IPv6 Hybrid

Key management protocols can be individually disabled.

LAN 1: Management & Time protocols; LAN 2, 3 & GbE: Time protocols only.

SERVER PERFORMANCE

- 7000 NTP requests per second while maintaining accuracy associated with reference time source. The accuracy is inclusive of all NTP packet delays in and out of the SyncServer as measured at the network interface. Client synchronization accuracy to server on a LAN is 0.5 - 2 milliseconds (typical). The SyncServer easily supports many hundreds of thousands of NTP clients. NTP request handling capacity remains the same regardless of Stratum level.
- Stratum 1 via GPS: Overall time stamp accuracy of 7 microseconds to UTC with a variation of less than 42 microseconds typical
- Stratum 1 via Dial-up modem: <50 milliseconds to UTC (<20 ms typical).
- Stratum 2: Peering can be used as the primary mode of operation or as a back up mode in case the primary reference signals are lost. Time stamp accuracy depends on NTP peer server(s).
- Holdover Accuracy

TCXO (standard):	18 milliseconds/day
OCXO (optional):	1 milliseconds/day
Rubidium (optional):	6 microseconds/day

GPS RECEIVER/ANTENNA

- 12 channel parallel receiver
- Minimum number of satellites for time: 1 intermittently
- GPS time traceable to UTC (USNO)
- Accuracy: <50 ns RMS, 150 ns peak to peak to UTC, ≥4 satellites tracked.
- Maximum Belden 9104 cable length: 150' (45 m). For longer cable runs see Options.

INTERNAL ANALOG MODEM

- Telecom approved in more than 50 countries
- Time Encoding: ACTS, JJY, and ITU-R TF583.4

MECHANICAL/ENVIRONMENTAL

- Size: 1.75" x 17" x 11.25" (4.5 cm x 43.2 cm x 28.6 cm) 1U rack mount
- Power: 100-240 VAC, 50-60 Hz, 25 watts (45 watts with Rb osc.),
- Operating temperature: 0°C to +50°C
- Storage temperature: -10°C to +70°C
- Humidity: To 95%, noncondensing
- Certifications: FCC, CE (RoHS), UL, PSE, China RoHS
- Server weight: 9 lbs (4.1 kgs), Shipping package: 16 lbs (7.3 kgs)

Front Panel

Display:	Sharp, high-resolution 32x256 dot-matrix vacuum-fluorescent. 1, 2 or 4 line.
Keypad:	0-9 numeric, up, down, left, right, ENTER, CLR, TIME, STATUS, MENU. Keypad lockout.
LEDs (tri-color green/red/orange)	
Sync:	Time reference status
Network:	Network connection status
NTP:	NTP activity
Alarm:	Fault condition
Serial:	DB9-F 9600, N, 8, 1
USB:	(2x) ports for back up, restore, and upgrade operations via the front panel.

Rear Panel

Network (4x):	1x RJ-45 10Base-T/100Base-TX/1000Base-T Gigabit Ethernet 3x RJ-45 10Base-T/100Base-TX Ethernet Speed/Duplex: Auto, 10/full/half, 100/full/half
Sysplex:	DB9-M RS-232
GPS:	BNC L1, 1575 MHz
Modem:	RJ-11 analog phone jack
Radio:	BNC, Optional antenna required for operation.
Power:	IEC 60320 C14 connector & power switch.
Relays:	2x, SPDT (Form C).

CLIENT SOFTWARE

Included with the S300 is Symmetricom's SymmTime NTP client for Windows. See Options for comprehensive software solutions.

PRODUCT INCLUDES

S300 Network Time Server, L1 GPS antenna, 50' (15 m) Belden 9104 coaxial cable, 1 ft. antenna mounting mast (30 cm) with two clamps, category 5 patch cable, DB9-M to DB9-F RS-232 extension cable, manual, SymmTime NTP client for Windows, Enterprise MIB software, power cord, and rack mount ear kit. Two-year warranty.

OPTIONS

[To see Options datasheet please click here]

- Rubidium or OCXO oscillator upgrade for extended holdover
- AM Radio/Antenna (40, 60 or 77.5 kHz) for WWVB (USA), JJY (Japan) or DCF77 (Europe)
- ±40-60 Vdc power supply
- Window mounted GPS antenna
- GPS antenna in-line amplifier for cable runs to 300' (90 m)
- GPS antenna down/up converter for cable runs to 1500' (457 m)
- Lightning arrestor
- Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network.
- NTP Network Time Displays, 2" or 4" (5 cm or 10 cm), 6 digit, red LEDs

Front View

Rear View

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SyncServer® S350

Ultra Precise & Versatile GPS Network Time Server

KEY FEATURES

- Ultra High-Bandwidth NTP Time Server
- Stratum 1 Operation via GPS Satellites
- Gigabit Ethernet port plus 3 additional Independent 10/100Base-T Ports
- Internal Dial-up Modem for Time Reference Redundancy
- Independent Time References: GPS, Timecodes, 1PPS, 10 MHz
- Versatile Timing Outputs: IRIG A/B/E/G/NASA36/XR3/2137 AM or DCLS, 1PPS, 10 MHz, Sysplex
- Stratum 2 Operation via NTP Servers
- RADIUS, NTPv4 Autokey, MD5 Authentication
- Secure Web-Based Management
- SSH, SSL, SCP, SNMP, Custom MIB, HTTPS, Telnet, and More
- IPv6 and IPv4 Compatible
- Nanosecond Time Accuracy to UTC
- Alarm Relays
- Rubidium & OCXO Oscillator Upgrades
- Upgrade to Radio Broadcast Time Sync
- Optional T1/E1 Input/Output

KEY BENEFITS

- Synchronize Thousands of Client, Server & Workstation Clocks
- Very Reliable and Secure Source of Time for Your Network
- Multiple NTP Ports for Easy Network Configuration and Adaptation
- Extremely Accurate Time Source for Network Synchronization
- Enhanced Network & Security Features
- User Prioritized Reference Selection between, GPS, Timecode, 1PPS and 10 MHz
- Access Multiple Time Sources for Reliable and Secure Time
- Intuitive Web Interface for Easy Control & Maintenance

Setting new standards for security, reliability, redundancy and versatility in network time servers, the SyncServer® S350 GPS Network Time Server is the solution for synchronizing the time on servers and workstations for large or expanding IT enterprises. Accurately synchronized clocks are critical for network log file accuracy, security, billing systems, electronic transactions, database integrity, VoIP, and many other essential applications.

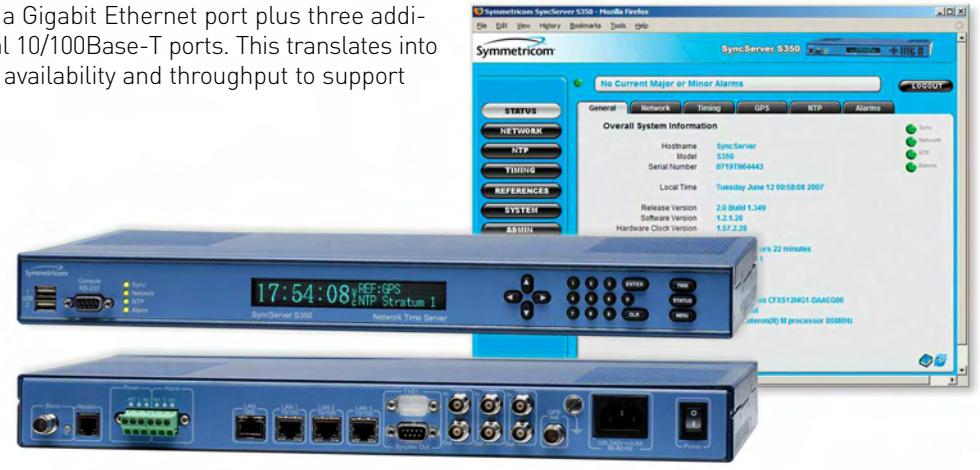
The S350 continues the SyncServer legacy of being the easiest to set up and maintain network time servers in the world. The front panel is designed to quickly bring the server online with a few front panel keystrokes or DHCP. To fully configure the unit, use the very intuitive web interface or the step-by-step web-based wizards for the most common operations.

Once online, the S350 provides very reliable and secure network synchronization technology by combining multi-port network interfaces with multiple time reference technology and enhanced security protocols. Support of essential security and network protocols provide for easy management and seamless integration into your existing and future network.

The S350 is the only time server available with a Gigabit Ethernet port plus three additional 10/100Base-T ports. This translates into high availability and throughput to support hundreds of thousands of network clients while maintaining microsecond caliber NTP timestamp accuracy. These four completely independent ports provide the flexibility needed to easily adapt to different and changing network topologies and security requirements.

The Stratum 1 S350 will automatically synchronize to GPS, IRIG, 1PPS, and 10 MHz sources. Users can set the priority and the S350 will smoothly transition from one reference to the next if the higher priority signal is lost or regained. An internal modem will synchronize to dial-up time sources if local references are not available.The S350 can also revert to a Stratum 2 mode and retrieve time from other user-designated time servers. Similarly the S350 generates many timecodes, 1PPS and 10 MHz outputs and can be upgraded to an internal Rubidium atomic oscillator that keeps the S350 accurate to microseconds per day. Optionally, T1/E1 inputs/outputs are available as is an AM radio to synchronize to national time broadcasts.

The SyncServer S350 is your answer to bringing perfect timing to your network – securely, reliably and easily – and for many years to come.



SyncServer S350 SPECIFICATIONS

NETWORK PROTOCOLS

NTP (v2 - RFC1119, v3 - RFC1305, v4 - No RFC)
NTP Unicast, Broadcast, Multicast, Autokey
SNTP Simple Network Time Protocol (RFC4330)
TIME (RFC868)
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HTTP/SSL/HTTPS (RFC2616)
SSH/SCP (Internet Draft)
Syslog 1 to 8 servers

SNMP v1, v2c, v3 (RFC3584)
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MD5 Authentication (RFC1321)
RADIUS (RFC2865)
SMTP Forwarding
IPv4, IPv6 and IPv4/IPv6 Hybrid

Key management protocols can be individually disabled.

LAN 1: Management & Time protocols; LAN 2, 3 & GbE: Time protocols only.

SERVER PERFORMANCE

- 7000 NTP requests per second while maintaining accuracy associated with reference time source. The accuracy is inclusive of all NTP packet delays in and out of the SyncServer as measured at the network interface. Client synchronization accuracy to server on a LAN is 0.5 - 2 milliseconds (typical). The SyncServer easily supports many hundreds of thousands of NTP clients. NTP request handling capacity remains the same regardless of Stratum level.
- Stratum 1 via GPS: Overall time stamp accuracy of 7 microseconds to UTC with a variation of less than 42 microseconds typical
- Stratum 1 via Dial-up modem: <50 milliseconds to UTC (<20 ms typical).
- Stratum 2: Peering can be used as the primary mode of operation or as a back up mode in case the primary reference signals are lost. Time stamp accuracy depends on NTP peer server(s).
- Holdover Accuracy/Oscillator Aging

TCXO (standard):	18 milliseconds/day	<1E-06/month
OCXO (optional):	1 milliseconds/day	<1E-07/month
Rubidium (optional):	3 microseconds/day	<5E-11/month

GPS RECEIVER/ANTENNA

- 12 channel parallel receiver
- Minimum number of satellites for time: 1 intermittently
- GPS time traceable to UTC (USNO)
- Accuracy: <50 ns RMS, 150 ns peak to peak to UTC, ≥4 satellites tracked.
- Maximum Belden 9104 cable length: 150' (45 m). For longer cable runs see Options.

INTERNAL ANALOG MODEM

- Telecom approved in more than 50 countries
- Time Encoding: ACTS, JJY, and ITU-R TF583.4

MECHANICAL/ENVIRONMENTAL

- Size: 1.75" x 17" x 11.25" (4.5 cm x 43.2 cm x 28.6 cm) 1U rack mount
- Power: 100-240 VAC, 50-60 Hz, 25 watts (45 watts with Rb osc.),
- Operating temperature: 0°C to +50°C
- Storage temperature: -10°C to +70°C
- Humidity: To 95%, noncondensing
- Certifications: FCC, CE (RoHS), UL, PSE, China RoHS
- Server weight: 9 lbs (4.1 kgs), Shipping package: 16 lbs (7.3 kgs)

Front Panel

Display:	Sharp, high-resolution 32x256 dot-matrix vacuum-fluorescent. 1, 2 or 4 line.
Keypad:	0-9 numeric, up, down, left, right, ENTER, CLR, TIME, STATUS, MENU. Keypad lockout.
LEDs (tri-color green/red/orange)	
Sync:	Time reference status
Network:	Network connection status
NTP:	NTP activity
Alarm:	Fault condition
Serial:	DB9-F 9600, N, 8, 1
USB:	For back up, restore, and upgrade operations.

Rear Panel

Network (4x):		1x RJ-45 10Base-T/100Base-TX/1000Base-T Gigabit Ethernet 3x RJ-45 10Base-T/100Base-TX Ethernet Speed/Duplex: Auto, 10/full/half, 100/full/half
Sysplex:		DB9-M RS-232
GPS:		BNC L1, 1575 MHz
IRIG in:	BNC	IRIG A/B/E/G/NASA36/XR3/2137/IEEE-1344 AM: Ratio 2:1 to 3.5:1, Amp: 1V to 8V p-p, Zin >5KΩ DCLS: <1.5 V for logic 0, >2.0 V for logic 1
IRIG out:	BNC	IRIG A/B/E/G/NASA36/XR3/2137/IEEE-1344 AM: Ratio 10:3, Amp: 3.5 ± 0.5 Vpp, Zout 50Ω DCLS: <0.8 V for logic 0, >2.4 V for logic 1, Zout 50Ω IRIG G AM: Ratio 10:3, Amp: 3.0±0.5 Vpp, Zout 50Ω DCLS: <0.8 V for logic 0, >2.4 V for logic 1, Zout 50Ω
1PPS-in:	BNC	Rising edge active, TTL into 270Ω
1PPS-out:	BNC	Rising edge on-time, TTL into 50Ω
10 MHz-in:	BNC	Sine wave or square wave, 1Vpp to 8Vpp, Zin >50KΩ
10 MHz-out:	BNC	Sine wave >2Vpp & <6Vpp into 50Ω Sine wave >4Vpp & <12Vpp no load
Modem:		RJ-11 analog phone jack
Radio:		BNC, Optional antenna required for operation.
Power:		IEC 60320 C14 connector & power switch.
Relays:		2x, SPDT (Form C).

CLIENT SOFTWARE

Included with the S350 is Symmetricom's SymmTime NTP client for Windows. See Options for comprehensive software solution.

PRODUCT INCLUDES

S350 Network Time Server, L1 GPS antenna, 50' (15 m) Belden 9104 coaxial cable, 1 ft. antenna mounting mast (30 cm) with two clamps, category 5 patch cable, DB9-M to DB9-F RS-232 extension cable, manual, SymmTime NTP client for Windows, Enterprise MIB software, power cord, and rack mount ear kit. Two-year warranty.

OPTIONS

[To see Options datasheet at please click here]

- Rubidium or OCXO oscillator upgrade for extended holdover
- AM Radio/Antenna (40, 60 or 77.5 kHz) for WWVB (USA), JJY (Japan) or DCF77 (Europe)
- T1/E1 Input/Output (OCXO or Rubidium oscillator required to meet G.811 specification)
- ±40-60 Vdc power supply
- Window mounted GPS antenna
- GPS antenna in-line amplifier for cable runs to 300' (90 m)
- GPS antenna down/up converter for cable runs to 1500' (457 m)
- Lightning arrestor
- Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network.
- NTP Network Time Displays, 2" or 4" (5 cm or 10 cm), 6 digit, red LEDs

Rear View

Front View

SyncServer® S300 SAASM

High Performance, Enhanced Security GB-GRAM SAASM Network Time Server

KEY FEATURES

- SAASM GB-GRAM PPS Receiver with RAIM
- Military Signal P(Y) Code SAASM GPS Receiver and Civil Signal C/A-Code GPS Receiver
- Ultra High-Bandwidth NTP Time Server
- Stratum 1 Operation via GPS Satellites
- Gigabit Ethernet port plus 3 additional Independent 10/100Base-T Ports
- Stratum 2 Operation via NTP Servers
- RADIUS, NTPv4 Autokey, MD5 Authentication
- Secure Web-Based Management
- SSH, SSL, SCP, SNMP, Custom MIB, HTTPS, Telnet, and More
- IPv6 and IPv4 Compatible
- Nanosecond Time Accuracy to UTC
- Hot Start Ready via DAGR/PLGR
- Alarm Relays
- Single Satellite Timing
- High-Resolution Vacuum Fluorescent Display
- Full Numeric Keypad
- Rubidium & OCXO Oscillator Upgrades

KEY BENEFITS

- Synchronize Thousands of Client, Server & Workstation Clocks
- Very Reliable and Secure Source of Time for Your Network
- Multiple NTP Ports for Easy Network Configuration and Adaptation
- Extremely Accurate Time Source for Network Synchronization
- Enhanced Network & Security Features
- Improve Network Log File Accuracy to Speed Network Fault Diagnosis and Forensics
- Intuitive Web Interface for Easy Control & Maintenance
- Compliant with DoD mandate to use GPS SAASM PPS receivers

Setting new standards for security, reliability, redundancy and versatility in network time servers, the SyncServer® S300 SAASM Network Time Server is the solution for synchronizing the time on servers, workstations and network elements for DoD networks. Accurately synchronized clocks are critical for network log file accuracy, security, electronic transactions, database integrity, communications, and many other essential DoD applications.

The S300 continues the SyncServer legacy of being the easiest to set up and maintain network time servers in the world. The front panel is designed to quickly bring the server online with a few front panel keystrokes or DHCP. To fully configure the unit, use the very intuitive web interface or the step-by-step web-based wizards for the most common operations.

Once online, the S300 provides very reliable and secure network synchronization technology by combining multi-port network interfaces with multiple time reference technology and enhanced security protocols. Support of essential security and network protocols provide for easy management and seamless integration into existing and future networks. The S300 is the only time server available with a Gigabit Ethernet port plus three additional 10/100Base-T ports.

This translates into high availability and throughput to support hundreds of thousands of network clients while maintaining microsecond caliber NTP timestamp accuracy. These four completely independent ports provide the flexibility needed to easily adapt to different and changing network topologies and security requirements.

The Stratum 1 S300 SAASM with a secure, Selective Availability Anti-Spoofing Module (SAASM) based GB-GRAM compliant GPS receiver, derives its time directly from the atomic clocks aboard the GPS satellite system. By using the integrated, 12-channel GPS receiver, every visible satellite can be tracked and used to maintain extremely accurate and reliable time. If the GPS signal is ever lost, the S300 can automatically revert to a Stratum 2 mode and retrieve time from other user designated time servers. Another option is that the S300 can be upgraded to an internal Rubidium atomic oscillator that keeps the S300 accurate to 6 microseconds per day.

The SyncServer S300 SAASM is the answer to bringing the ultimate in NTP timing to your network – securely, reliably and easily – and for many years to come.

SyncServer S300 SAASM SPECIFICATIONS

NETWORK PROTOCOLS

NTP (v2 - RFC1119, v3 - RFC1305, v4 - No RFC)
NTP Unicast, Broadcast, Multicast, Autokey
SNTP Simple Network Time Protocol (RFC4330)
TIME (RFC868)
DAYTIME (RFC867)
HTTP/SSL/HTTPS (RFC2616)
SSH/SCP (Internet Draft)
Syslog 1 to 8 servers

SNMP v1, v2c, v3 (RFC3584)
Custom MIB
DHCP (RFC2131)
Telnet (RFC854)
MD5 Authentication (RFC1321)
RADIUS (RFC2865)
SMTP Forwarding
IPv4, IPv6 and IPv4/IPv6 Hybrid

Key management protocols can be individually disabled.

LAN 1: Management & Time protocols; LAN 2, 3 & GbE: Time protocols only.

SERVER PERFORMANCE

- 7000 NTP requests per second while maintaining accuracy associated with reference time source. The accuracy is inclusive of all NTP packet delays in and out of the SyncServer as measured at the network interface. Client synchronization accuracy to server on a LAN is 0.5 - 2 milliseconds (typical). The SyncServer easily supports many hundreds of thousands of NTP clients. NTP request handling capacity remains the same regardless of Stratum level.
- Stratum 1 via GPS: Overall time stamp accuracy of 7 microseconds to UTC with a variation of less than 42 microseconds typical
- Stratum 2: Peering can be used as the primary mode of operation or as a back up mode in case the primary reference signals are lost. Time stamp accuracy depends on NTP peer server(s).
- Holdover Accuracy/Oscillator Aging

TCXO (standard):	18 milliseconds/day	<1E-06/month
OCXO (optional):	1 milliseconds/day	<1E-07/month
Rubidium (optional):	6 microseconds/day	<5E-11/month

GPS SAASM GB-GRAM RECEIVER

- Receiver input: L1/L2, P(Y) code (PPS), SAASM GB-GRAM
- Tracking: 12 parallel, dual-frequency channels with RAIM (Receiver Autonomous Integrity Monitoring)
- Crypto Key input: DS-102. Compatible with AN/PYQ-10, AN/CYZ-10, KYK-13
- Security: SAASM GB-GRAM GPS PPS receiver
- Antenna/preamplifier: L1 1574.42 MHz and L2 1227.60 MHz, 40 dB gain
- GPS time traceable to UTC (USNO)
- Accuracy: <50 ns RMS, 150 ns peak to peak to UTC, ≥4 satellites tracked.
- Maximum Belden 9104 cable length: 150' (45 m). For longer cable runs see Options.

MECHANICAL/ENVIRONMENTAL

- Size: 1.75" x 17" x 11.25" (4.5 cm x 43.2 cm x 28.6 cm) 1U rack mount
- Power: 100-240 VAC, 50-60 Hz, 25 watts (45 watts with Rb osc.),
- Operating temperature: 0°C to +50°C
- Storage temperature: -10°C to +70°C
- Humidity: To 95%, noncondensing
- Certifications: FCC, UL
- Server weight: 9 lbs (4.1 kgs), Shipping package: 16 lbs (7.3 kgs)

Front Panel

Display:	Sharp, high-resolution 32x256 dot-matrix vacuum-fluorescent. 1, 2 or 4 line.
Keypad:	0-9 numeric, up, down, left, right, ENTER, CLR, TIME, STATUS, MENU. Keypad lockout.
LEDs (tri-color green/red/orange)	
Sync:	Time reference status
Network:	Network connection status
NTP:	NTP activity
Alarm:	Fault condition
CV:	Crypto Variable Status
Serial:	DB9-F 9600, N, 8, 1
USB:	For back up, restore, and upgrade operations.
PLGR/DAGR:	DB15-M, Hot Start Port
Key Fill:	Crypto Key input. DS-102. Compatible with AN/PYQ-10, AN/CYZ-10, KYK-13. Black/red key support.
Button:	Zeroize crypto keys

Rear Panel

Network (4x):	1x RJ-45 10Base-T/100Base-TX/1000Base-T Gigabit Ethernet 3x RJ-45 10Base-T/100Base-TX Ethernet Speed/Duplex: Auto, 10/full/half, 100/full/half
Sysplex:	DB9-M RS-232
GPS:	BNC
Power:	IEC 60320 C14 connector & power switch.
Relays:	2x, SPDT (Form C).

CLIENT SOFTWARE

Included with the S300 SAASM is Symmetricom's SymmTime NTP client for Windows. See Options for comprehensive software solution.

PRODUCT INCLUDES

S300 SAASM Network Time Server, L1/L2 GPS antenna (ordered separately at no extra charge), 50' (15 m) Belden 9104 coaxial cable, 1 ft. antenna mounting mast (30 cm) with two clamps, category 5 patch cable, DB9-M to DB9-F RS-232 extension cable, manual, SymmTime NTP client for Windows, Enterprise MIB software, power cord, and rack mount ear kit. Two-year warranty.

OPTIONS

- Rubidium or OCXO oscillator upgrade for extended holdover
- ±40-60 Vdc power supply
- GPS antenna in-line amplifier for cable runs to 300' (90 m)
- Lightning arrestor
- Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network.
- NTP Network Time Displays, 2" or 4" (5 cm or 10 cm), 6 digit, red LEDs

Rear View

Front View

SyncServer® S350 SAASM

Ultra Precise & Versatile GB-GRAM SAASM Network Time Server

KEY FEATURES

- SAASM GB-GRAM PPS Receiver with RAIM
- Military Signal P(Y) Code SAASM GPS Receiver and Civil Signal C/A-Code GPS Receiver
- Ultra High-Bandwidth NTP Time Server
- Stratum 1 Operation via GPS Satellites
- Gigabit Ethernet port plus 3 additional Independent 10/100Base-T Ports
- Independent Time References: GPS, Timecodes, 1PPS, 10 MHz
- Versatile Timing Outputs: IRIG A/B/E/G/NASA36/XR3/2137 AM or DCLS, 1PPS, 10 MHz, Sysplex
- Stratum 2 Operation via NTP Servers
- RADIUS, NTPv4 Autokey, MD5 Authentication
- Secure Web-Based Management
- SSH, SSL, SCP, SNMP, Custom MIB, HTTPS, Telnet, and More
- IPv6 and IPv4 Compatible
- Nanosecond Time Accuracy to UTC
- Hot Start Ready via DAGR/PLGR
- Alarm Relays
- Rubidium & OCXO Oscillator Upgrades

KEY BENEFITS

- Synchronize Thousands of Client, Server & Workstation Clocks
- Very Reliable and Secure Source of Time for Your Network
- Multiple NTP Ports for Easy Network Configuration and Adaptation
- Extremely Accurate Time Source for Network Synchronization
- Enhanced Network & Security Features
- User Prioritized Reference Selection between, GPS, Timecode, 1PPS and 10 MHz
- Intuitive Web Interface for Easy Control & Maintenance
- Compliant with DoD mandate to use GPS SAASM PPS receivers

Setting new standards for security, reliability, redundancy and versatility in network time servers, the SyncServer® S350 SAASM Network Time Server is the solution for synchronizing the time on servers, workstations and network elements for DoD networks. Accurately synchronized clocks are critical for network log file accuracy, security, electronic transactions, database integrity, communications, and many other essential DoD applications.

The S350 continues the SyncServer legacy of being the easiest to set up and maintain network time servers in the world. The front panel is designed to quickly bring the server online with a few front panel keystrokes or DHCP. To fully configure the unit, use the very intuitive web interface or the step-by-step web-based wizards for the most common operations.

Once online, the S350 provides very reliable and secure network synchronization technology by combining multi-port network interfaces with multiple time reference technology and enhanced security protocols. Support of essential security and network protocols provide for easy management and seamless integration into existing and future networks. The S350 is the only time server available with a Gigabit Ethernet port plus three additional 10/100Base-T ports. This translates into high availability and throughput to support hundreds of thousands of network clients while maintaining microsecond caliber NTP timestamp accuracy. These four completely independent ports provide the flexibility needed to easily adapt to different and changing network topologies and security requirements.

The Stratum 1 S350 SAASM with a secure, Selective Availability Anti-Spoofing Module (SAASM) based GB-GRAM compliant GPS receiver will automatically synchronize to GPS, IRIG, 1PPS, and 10 MHz sources. Users can set the priority and the S350 will smoothly transition from one reference to the next if the higher priority signal is lost or regained. The S350 can also revert to a Stratum 2 mode and retrieve time from other user-designated time servers. Similarly the S350 generates many timecodes, 1PPS and 10 MHz outputs and can be upgraded to an internal Rubidium atomic oscillator that keeps the S350 accurate to microseconds per day in holdover.

The SyncServer S350 SAASM is the answer to bringing the ultimate in NTP timing to your network – securely, reliably and easily – and for many years to come.

SyncServer S350 SAASM SPECIFICATIONS

NETWORK PROTOCOLS

NTP (v2 - RFC1119, v3 - RFC1305, v4 - No RFC)
NTP Unicast, Broadcast, Multicast, Autokey
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TCXO (standard):	18 milliseconds/day	<1E-06/month
OCXO (optional):	1 milliseconds/day	<1E-07/month
Rubidium (optional):	3 microseconds/day	<5E-11/month

GPS SAASM GB-GRAM RECEIVER

- Receiver input: L1/L2, P(Y) code (PPS), SAASM GB-GRAM
- Tracking: 12 parallel, dual-frequency channels with RAIM (Receiver Autonomous Integrity Monitoring)
- Crypto Key input: DS-102. Compatible with AN/PYQ-10, AN/CYZ-10, KYK-13
- Security: SAASM GB-GRAM GPS PPS receiver
- Antenna/preamplifier: L1 1574.42 MHz and L2 1227.60 MHz, 40 dB gain
- GPS time traceable to UTC (USNO)
- Accuracy: <50 ns RMS, 150 ns peak to peak to UTC, ≥4 satellites tracked.
- Maximum Belden 9104 cable length: 150' (45 m). For longer cable runs see Options.

MECHANICAL/ENVIRONMENTAL

- Size: 1.75" x 17" x 11.25" (4.5 cm x 43.2 cm x 28.6 cm) 1U rack mount
- Power: 100-240 VAC, 50-60 Hz, 25 watts (45 watts with Rb osc.),
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- Humidity: To 95%, noncondensing
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Network:	Network connection status
NTP:	NTP activity
Alarm:	Fault condition
CV:	Crypto Variable Status
Serial:	DB9-F 9600, N, 8, 1
USB:	For back up, restore, and upgrade operations.
PLGR/DAGR:	DB15-M, Hot Start Port
Key Fill:	Crypto Key input. DS-102. Compatible with AN/PYQ-10, AN/CYZ-10, KYK-13. Black/red key support.
Button:	Zeroize crypto keys

Rear Panel

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Sysplex:		DB9-M RS-232
GPS:		BNC
IRIG in:	BNC	IRIG A/B/E/G/NASA36/XR3/2137/IEEE-1344 AM: Ratio 2:1 to 3.5:1, Amp: 1V to 8V p-p, Zin >5KΩ DCLS: <1.5 V for logic 0, >2.0 V for logic 1
IRIG out:	BNC	IRIG A/B/E/G/NASA36/XR3/2137/IEEE-1344 AM: Ratio 10:3, Amp: 3.5 ± 0.5 Vpp, Zout 50Ω DCLS: <0.8 V for logic 0, >2.4 V for logic 1, Zout 50Ω IRIG G AM: Ratio 10:3, Amp: 3.0±0.5 Vpp, Zout 50Ω DCLS: <0.8 V for logic 0, >2.4 V for logic 1, Zout 50Ω
1PPS-in:	BNC	Rising edge active, TTL into 270Ω
1PPS-out:	BNC	Rising edge on-time, TTL into 50Ω
10 MHz-in:	BNC	Sine wave or square wave, 1Vpp to 8Vpp, Zin >50KΩ
10 MHz-out:	BNC	Sine wave >2Vpp & <6Vpp into 50Ω Sine wave >4Vpp & <12Vpp no load
Power:		IEC 60320 C14 connector & power switch.
Relays:		2x, SPDT (Form C).

CLIENT SOFTWARE

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PRODUCT INCLUDES

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OPTIONS

- Rubidium or OCXO oscillator upgrade for extended holdover
- ±40-60 Vdc power supply
- GPS antenna in-line amplifier for cable runs to 300' (90 m)
- Lightning arrestor
- Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network.
- NTP Network Time Displays, 2" or 4" (5 cm or 10 cm), 6 digit, red LEDs

Rear View

Front View

SYMMETRICOM, INC., TTM DIVISION • 3750 Westwind Boulevard • Santa Rosa, California 95403 • tel: +1.707.528.1230 • fax: +1.707.527.6640
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SYMMETRICOM GLOBAL SERVICES • Toll free in the USA: 1-888-367-7966 • Worldwide: +1.408.428.7907 • Global e-mail: support@symmetricom.com

SyncServer Options

For customizing the:
SyncServer S200
SyncServer S250
SyncServer S250i
SyncServer S300
SyncServer S350
SyncServer S300 SAASM
SyncServer S350 SAASM

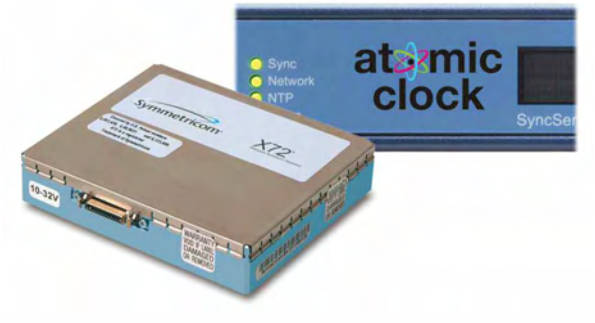
OPTIONS

- Rubidium Atomic Oscillator
- Oven Controlled Crystal Oscillator (OCXO)
- Low Frequency Radio
- Window Mounted GPS Antenna
- 48 Vdc Power Supply
- Network Time Displays
- Synchronization Software
- Inline GPS Signal Amplifier
- Lightning Arrestor
- GPS Antenna Cable Splitter
- GPS Down/Up Converter for Long Cable Runs
- T1/E1 Input/Output

Symmetricom makes it easy to configure the SyncServer S200/S250/S300/S350 to meet your specific application needs with a variety of hardware and software options. Whether your application requires specific NTP stratum behaviors controllable using oscillator upgrades, different GPS antenna solutions, or a variety of other useful options, we have a good solution for you.

Not sure how to achieve what you want? Simply call Symmetricom's network timing experts. For more than 30 years Symmetricom has defined premium time and synchronization solutions. Put our expertise to work for you.

Rubidium Atomic Oscillator



Rubidium atomic clock oscillator upgrades improve holdover accuracy and saves you valuable time. The standard SyncServer is equipped with a temperature compensated crystal oscillator (TCXO) that keeps the server accurate to nanoseconds when tracking GPS. However, if the GPS signal is lost, thereby placing the server in holdover, the TCXO will soon drift away from perfect. Upgrading the oscillator improves the holdover accuracy significantly.

Rubidium holdover accuracy is 3 to 25 microseconds per day. The value of the upgraded oscillator is that if the GPS signal is lost the SyncServer can continue to serve very accurate NTP time. This provides IT staff plenty of time to correct the problem with no degradation or disruption in network time synchronization accuracy.

Oven Controlled Crystal Oscillator (OCXO)

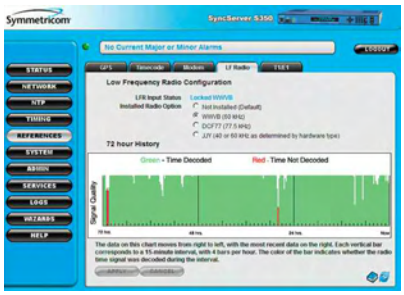
The Ovenized Crystal Oscillator (OCXO) upgrade improves holdover accuracy. By keeping the crystal oscillator at a fixed temperature, if the GPS signal is lost, thereby placing the server in holdover, the OCXO reduces clock the drift.

OCXO holdover accuracy is about 1 millisecond per day. The value of the upgraded oscillator is that if the GPS signal is lost the SyncServer can continue to serve accurate NTP time for several days. This provides some time to correct the problem with minimal degradation or disruption in network time synchronization accuracy.

National Low Frequency Radio Time Broadcast Receiver

National time authorities in the United States, Japan and Europe broadcast accurate time via AM radio signals that are traceable to the national time standard. All SyncServer S300/S350 time servers are equipped to synchronize to these broadcasts via optional radio antennas.

The Symmetricom Low Frequency Radio Option (LFR) is a useful back-up time reference to GPS and also provides a legally traceable path to a national time standard. The LFR can also be used as an alternative to GPS if GPS is not a viable option.



The LF Radio web page in the S300/S350 provides AM signal availability and decoding information for a rolling 72 hour period.

The AM signals travel via ground waves and sky waves and signal strength varies with distance from the transmitter and time of day. Generally the signals are available 24 hours a day. However, inside some structures and great distances from the transmitter the signal may be available only at night or not at all.

Accuracy: <50 milliseconds to UTC (<20 ms typical).

Option includes antenna, 50' (15 m) cable & mount. Maximum cable length is 500' (150 m).

Click links for approximate signal strength for your location:
US: WWVB Europe: DCF77 Japan: JJY

48 Vdc Power Supply

The 48 Vdc equipped SyncServers are supplied with primary and secondary 48 Vdc inputs to accommodate inputs from alternate DC power sources. Using diode switching, the polarity of the inputs can be different such as plus-plus, plus-minus, minus-plus, or minus-minus. Specifications are 40-60 Vdc, 50 watts maximum, 1.5 amps. Isolation: Ground input is fully floating. Either input polarity may be strapped to Chassis ground at the input terminal block.

SyncServers are sold as AC or DC models. Specify at the time of order the power supply configuration of choice. All SyncServer options are compatible with either AC or DC models.

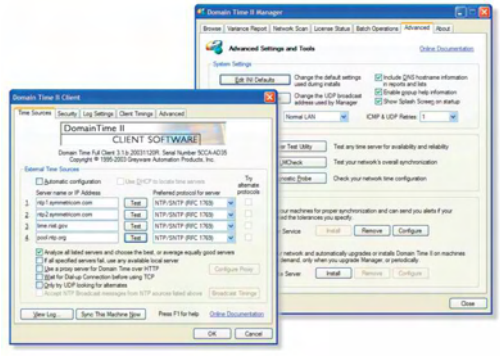
T1/E1 Input/Output

A T1/E1 frequency reference can be a useful, seamless back-up if GPS or other reference is lost. The S350 automatically detects and tracks an attached T1 or E1 signal (MHz or Mbps) and is ready to smoothly synchronize to it if a higher priority signal is lost.

The T1 output (1.544 Mbps) has ESF framing and B8ZS line coding enabled at 100 ohms. The E1 output (2.048 Mbps) has FAS framing and CRC-4 multiframe with HDB3 line coding enabled. AIS may be manually selected for either output. Signals cannot be mixed, T1 in and E1 out for example. T1/E1 output is provided only while tracking GPS.

Signal input/output is via the D9 connector with wire wrap or BNC adapters optionally available. The SyncServer S350 T1/E1 option requires the OCXO or Rubidium oscillator to meet the G.811 MTIE specification.

Synchronization Software



Network time synchronization software is an essential part of distributing time to synchronize the network. Symmetricom's Domain Time II is a comprehensive software solution that simplifies network time synchronization. Versatile time clients and software servers keep the network hierarchy synchronized to a master clock such as the SyncServers. Easy to use management tools simplify and automate many tasks related to keeping these clients up-to-date. Monitoring functions track the synchronization across the network and notify you of any problems. The result is a reliable time synchronization system that requires little management overhead and offers tremendous value to the integrity of network operations and applications.

Please click here for full details and the datasheet sheet.

Network Time Displays

Symmetricom's Network Time Displays are maintenance free clocks that keep accurate time by synchronizing their time—over the network—to a network time server. These clocks use existing Ethernet network infrastructure and the standard network time protocol (NTP) to keep the time correct. Display formats include 12 or 24 hour format as well as daylight savings time transitions so that the display should never need the time adjusted. All displays are available with either Standard AC power and Ethernet connections or a combined Power-over-Ethernet connection (PoE).

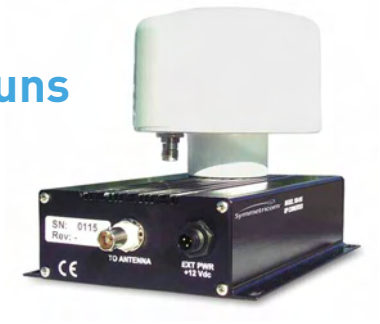
Automatic network address configuration via DHCP coupled with display discovery and remote management software makes for easy and complete configuration and control of the displays over the network from a single PC.

Please click here for full details and the datasheet sheet.

GPS Antenna Cable Accessories

Antenna cable accessories enable versatile solutions that are simple to achieve. Inline GPS amplifiers are an easy way to extend cable runs from 150 feet (45 meters) to 300 feet (90 meters). Lightning arrestors provide valuable electrical shock protection to the SyncServer. Antenna cable splitters leverage a single antenna and cable between two GPS equipped time servers.

GPS Down/Up Converter for Long Cable Runs



GPS signal down/up conversion is required when signal losses in the antenna cable limit the distance between the receiver and the antenna assembly. Signal strengths and noise immunity as well as the cost benefits over the use of low loss cable and amplifiers are the main advantages of using the Antenna Down/Up Converter assembly.

The down converter antenna and up converter unit replace the standard L1 GPS antenna. The signal output from the converter is L1 C/A code that can be decoded by any L1 GPS receiver. Cable lengths of up to 1500 feet (457 meters) are supported.

Please click here for full details.

Window Antenna Option

SyncServers can track GPS satellites through a window and still maintain accurate time. Depending on user entered position accuracy; time accurate to 5 microseconds to UTC is possible from tracking a single intermittent GPS satellite. A position accurate to 1 km provides accuracy to 100 microseconds.

This option includes a Window Antenna with suction cup, a 6 foot (2 meter) cable, and a BNC-to-TNC adapter to connect to the standard antenna/cable that ships with SyncServers.

No special GPS receiver software upgrade is required. Compatible with all SyncServer standard antenna accessories. Use in place of standard GPS roof antenna that ships with all GPS equipped models.

Note: some window glazing blocks the GPS signals preventing the SyncServer from tracking GPS.

Option Availability Matrix

	S200	S250i	S250	S300	S350
Rubidium Upgrade	•	•	•	•	•
OCXO Upgrade	•	•	•	•	•
40-60 Vdc Power Supply	•	•	•	•	•
Time Displays	•	•	•	•	•
Synchronization Software	•	•	•	•	•
Window Antenna*	•		•	•	•
GPS Down Up Converter*	•		•	•	•
GPS Antenna Cable Accessories	•		•	•	•
Low Frequency Radio*				•	•
T1/E1 Input/Output*					•

*Not available on SAASM models

NTS-150

GPS Network Time Server

KEY FEATURES

- Stratum 1 Network Time Server
- 10/100Base-T Autosensing Ethernet Interface
- Synchronize Thousands of Clients
- 12 Channel GPS Receiver
- Single Satellite Timing Mode
- NTP Broadcast Mode
- SymmTime NTP Client Software
- SNMP Enterprise MIB
- MD5 Security Protocol
- Upgradable Flash Memory
- Robust Chassis Design
- Telnet Remote Control
- Optional Time Display
- Two-Year Warranty

KEY BENEFITS

- Improve Network Log File Accuracy to Speed Network Fault Diagnosis and Forensics
- Accurately Synchronize Mission Critical Network Operations and Applications
- Cost-Effective Solution to Synchronize The Workstations, Servers, Routers, etc. on a Network
- Reliable and Secure Time is Acquired From Atomic Clocks Aboard the Global Positioning System (GPS) Satellites
- Window or Roof Mounted GPS Antenna Choices for Easy Installation
- Thousands of Client Computer Clocks Can Be Synchronized Typically to Within 1 to 2 Milliseconds (typical)
- Easy to Install Server Appliance

Symmetricom's Stratum 1 level NTS-150™ derives accurate time directly from the atomic clocks aboard the GPS satellite system. By using an integrated, 12-channel GPS receiver, every visible satellite can be tracked and used to maintain accurate and reliable time. Even in urban canyon environments where satellite visibility can be limited, the automatic, single satellite tracking mode provides accurate time from as few as one intermittent satellite and can also track satellites using a window mounted antenna. A GPS antenna and cable is included.

The near plug-and-play operation of the quality rack mount unit with an autosensing, high bandwidth 10/100Base-T interface makes installation quick and ongoing maintenance and support costs virtually nonexistent. The high reliability of the NTS-150 is backed by Symmetricom's long-standing experience building dedicated network time servers.

The NTS-150 Network Time Server supports a wide variety of time and network protocols to seamlessly integrate into your network. SNMP with MIB II support offers a standard interface for network management systems. MD5 security protocol is included to authenticate NTP client-server communication. FTP is supported for easy firmware upgrades.

A comprehensive RS-232/telnet command set provides versatile control of the NTS-150. An intuitive, Windows®-based start-up program is provided to quickly configure the NTS-150 for immediate use on your network. Telnet is supported for remote status and control over the network. The optional UTC time display shows full date information to the second for visual reference.

Symmetricom also offers the full featured SyncServer® S200 and S300 network time servers. These industry leading time servers include multiple NTP ports, an easy to use web interface, front panel keypad, high resolution front panel displays, and many more features. Upgrades to OCXO or Rubidium oscillators for extended holdover are also available. If advanced timing functions are required, the SyncServer S250 and S350 provide multiple input and output timing signals.

NTS-150 GPS Network Time Server with and without time display

NTS-150 SPECIFICATIONS

NETWORK PROTOCOLS

NTP v2, v3 & v4
NTP broadcast mode
SNTP Simple Network Time Protocol
TIME (RFC 868)
DAYTIME (RFC 867)
MD5 Authentication (RFC 1321)
Telnet (RFC 859)
FTP (RFC 959)
SNMP (RFC 1157)
MIB II (RFC 1213)
DHCP (RFC 2132)

INPUT/OUTPUT CONNECTIONS

- Network: 10/100Base-T Ethernet autosensing; RJ-45
- Serial: Bi-directional RS-232, 9600, N, 8, 1; 9-pin D

SERVER PERFORMANCE

- 40 NTP requests per second while maintaining accuracy associated with the GPS reference time source. The accuracy is inclusive of all NTP packet delays in and out of the time server as measured at the network interface. Client synchronization accuracy to server on a LAN is 1 - 2 milliseconds (typical). The NTS-150 can support an estimated 16,000 NTP clients. Stratum 1 via GPS: Overall time stamp accuracy of 72 microseconds to UTC with a variation of less than 600 microseconds typical.

MANAGEMENT/USER INTERFACE

- RS-232: Local terminal access for status and control
- Telnet: Full status and control, password protected
- Simple Network Management Protocol (SNMP): Provides the network administrator with the NTP time server protocol status; network status, statistics and Management Information Base (MIB) II.
- FTP: System software upgrades are possible via FTP to flash memory
- Status LED: Tri-color LED indicates normal operation and major and minor alarms
- Activity LED: Bi-color LED indicates 100Base-T, 10Base-T, or no connection
- Optional UTC time display: 2 line, 32 character backlit LCD

GPS RECEIVER/ANTENNA

- 12 channel parallel receiver
- Minimum satellites for time: 1 intermittently
- GPS time traceable to UTC (USNO)
- Accuracy <1 microsecond to UTC. Network factors can reduce client synchronization accuracy 1-2 ms (typical).
- Includes 12 V L1 GPS antenna (window or roof mount) with 50' (15 m) of Belden 9104 coaxial cable
- Maximum Belden 9104 cable length: 150' (45 m). For longer cable runs see Options.

MECHANICAL/ENVIRONMENTAL

- Size: 1.73" x 17" x 10.63" (4.4 cm x 43.2 cm x 27 cm) 1U rack mount
- Power: 100-240 Vac, 47 to 440 Hz, <20 watts
- Operating temperature: 0°C to +50°C
- Storage temperature: -50°C to +85°C
- Humidity: to 95%, noncondensing
- Certifications: FCC, CE, UL, PSE

CLIENT SOFTWARE

- An NTP client/daemon is required for client-side synchronization with any network time server, including the NTS-150. Included with the NTS-150 is Symmetricom's SymmTime™ NTP client for Windows® 95/98/NT/2000/XP. Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network is also available.

PRODUCT INCLUDES

- NTS-150 Network Time Server, two-year warranty, L1 GPS antenna (window or roof mount – specify at time of order), 50' (15 m) Belden 9104 coaxial cable, category 5 patch cable, manual, SymmTime NTP client for Windows 95/98/NT/2000/XP, Enterprise MIB software, Windows-based start-up program, power cord, and rack mount ear kit. (Roof mount antenna includes a 1' (30 cm) mounting mast and two clamps.)

OPTIONS

- Optional UTC time display
- -48Vdc Power supply
- Extended cable lengths
- GPS antenna in-line amplifier for cable runs to 300' (90 m)
- GPS antenna down/up converter for cable runs to 1500' (457 m)
- Lightning arrestor
- GPS Antenna splitter kit
- Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network is also available.
- NTP Network Time Displays, 2" or 4" (5 cm or 10 cm), 6 digit, red LEDs

Domain Time II

Time Synchronization Software Suite

Precise Time Synchronization for the Entire Enterprise

KEY FEATURES

- Comprehensive Time Client, Server & Management Software for Precise Time Synchronization Across the Network
- Install, Update, Configure, Monitor, and Troubleshoot All Time Clients From a Single Workstation.
- Adaptable Time Hierarchy Automatically Adjusts to Changes in the Network Assuring Clients Access to the Correct Time
- Detailed Event Logging for Time Auditing Purposes
- 64-bit and VISTA Support

KEY BENEFITS

- Precisely Time Synchronize Mission Critical Network Operations and Applications
- Monitor Network Synchronization and Be Alerted When Synchronization is Outside Your Specifications
- Hold Network Time Accuracy Within Specified Limits
- Ensure Accurate Time on All Network Clients
- Reduce or Eliminate Costs Involved in Installing and Managing Time Synchronization Across a Network
- Manage Time Synchronization on Both Large and Small Networks Just as Easily
- Improve Network Log File Accuracy to Speed Network Diagnosis and Forensics

Accurate network time synchronization is critical for network log file accuracy, billing systems, electronic transactions, database integrity, software development, and many more essential applications in today's corporate enterprise. Symmetricom's Domain Time™ II software in combination with a GPS referenced network time server delivers the only comprehensive network time synchronization solution available today.

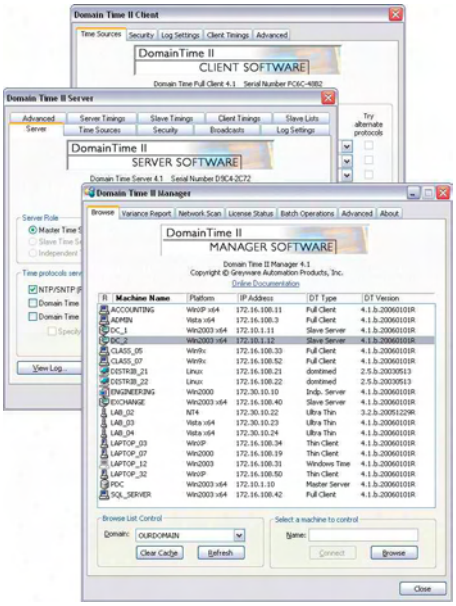
Domain Time II is a comprehensive software solution that simplifies time synchronization across the network. Versatile time clients and software servers keep the network hierarchy synchronized to a GPS referenced network time server. Easy to use management tools simplify and automate many tasks related to keeping these clients up-to-date. Monitoring functions track the synchronization across the network and notify you of any problems. The result is a reliable time synchronization system that requires little management overhead and offers tremendous value to the integrity of network operations and applications.

Domain Time II's management tools enable complete control of your entire network time hierarchy from a single workstation. You can install, update, configure, monitor time synchronization and troubleshoot, and track Domain Time II components enterprise-wide. This eliminates the costs involved in manually installing and maintaining time software on large numbers of machines distributed across the network.

Precise delivery of time is made possible through high-precision time protocols, time-source averaging, clock training, slewing, target seeking, and an efficient time cascade update hierarchy. On large networks the software servers automatically take over for each other when one becomes unavailable, and clients automatically find alternate servers if there's a failure. Time components can also be set manually for multiple levels of fallback time sources.

Domain Time II tracks multiple types of data that verify exactly who synchronized from whom, when, and what the actual adjustments were.

There is also built-in protection against malicious or inadvertent tampering with the time on your network – with a combination of active and passive defenses.



Domain Time II Software Suite for Network Timing

DOMAIN TIME II SPECIFICATIONS

DOMAIN TIME II CLIENTS

- Full Client: The Full Client lets you specify time sources, proxies, protocols, and clock accuracy settings. It runs as a background service which eliminates the need to set the time using a batch command or requiring the logged-in user to have time change rights on NT/2000 machines. Any desired custom parameter can be set manually using its Control Panel applet, or the client can be set for fully automatic operation.
- Thin Client: The Thin Client is a completely automatic time client. It is approximately half the size of the Full Client and has no configuration options. It is optimized for a small footprint and extremely low system overhead.
- Ultra Thin Client: The Ultra Thin Client is a broadcast-listener time client. It runs as a background service and has no configuration options. It is designed to be an extremely low overhead, high-accuracy service that synchronizes directly with any NTP broadcast server.
- DTSET command-line client: DTSET is a multi-protocol time client that can be run manually, from an icon, or in a batch file. Choose this client when you only want to synchronize time manually or in scripts.

DOMAIN TIME II SERVER

- The Domain Time II Server is a background service that obtains the correct time from a trusted time source, such as a GPS referenced network time server, and then immediately maintains the correct time on all machines on the network. Domain Time II Server supports multiple time protocols for the highest compatibility with all time sources and clients.

DOMAIN TIME II MANAGEMENT TOOLS

- Domain Time II Manager remotely installs or updates Domain Time components from a central workstation. It also provides software license information, time variance reports, and remote configuration of Domain Time II components. The monitor function tracks the status of your clocks system-wide and sends alerts if any monitored system is out of sync. The many automated/background features save a great deal of time in managing the installation and monitoring of the time clients.

DOCUMENTATION

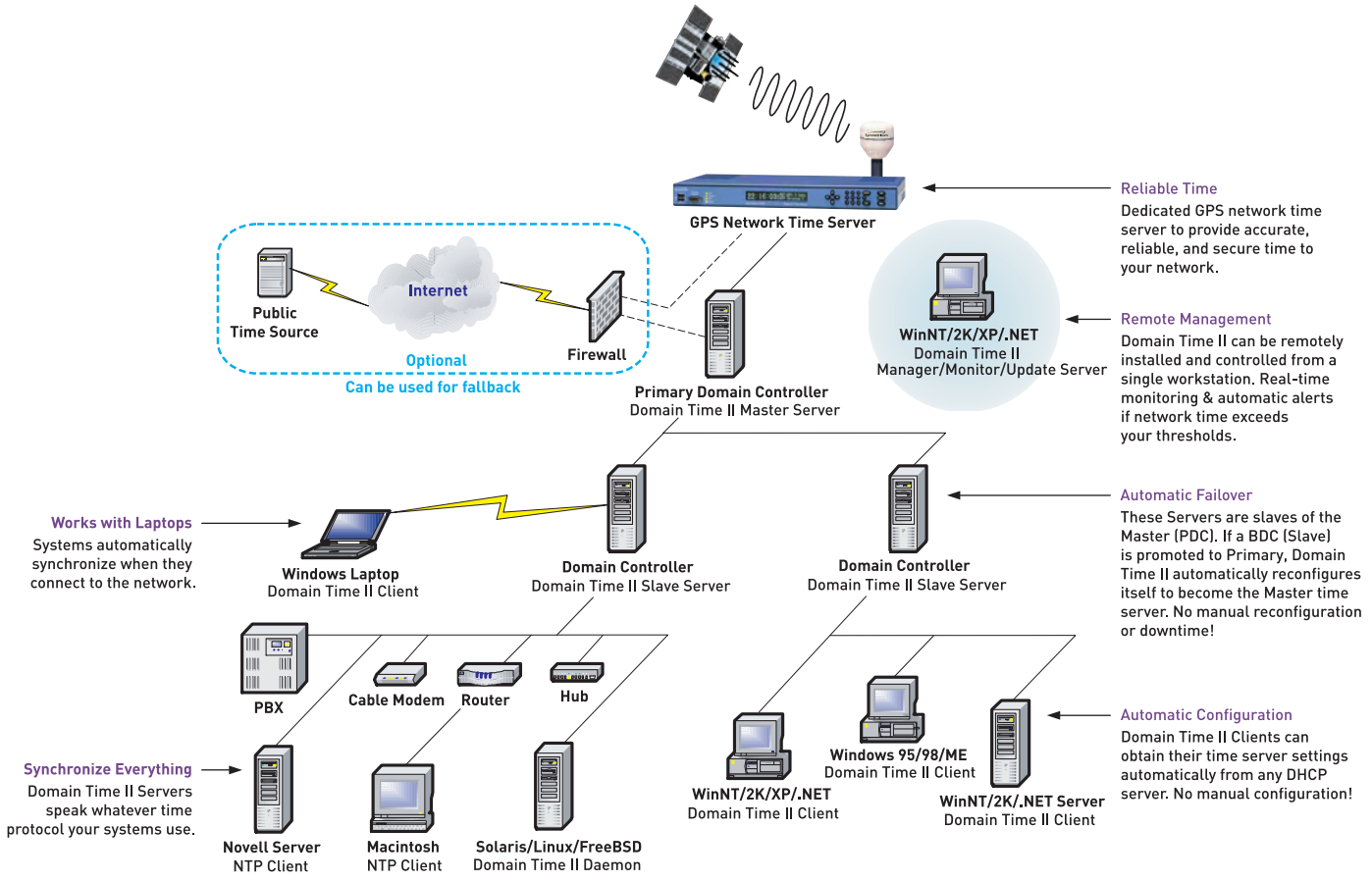
- All documentation is online at http://dtdocs.ntp-systems.com

SYSTEM REQUIREMENTS

• Clients:	(Full, Thin, and DTSET Command-line) 32-bit Windows 95/98/ME/NT[1]/2K/XP/2K3/Vista
	64-bit Windows XP/2K3/Vista[2]
	v.2.5 Clients also available for Solaris 7/8 (Sparc or x86, 32-bit), Linux RedHat, Mandrake, SuSE, TurboLinux, Debian/Stormix (x86, 32-bit), FreeBSD (x86, 32-bit)
• Server:	32-bit Windows NT[1]/2K/XP/2K3/Vista
	64-bit Windows XP/2K3/Vista[2]
• Management tools:	32-bit Windows NT[1]/2K/XP/2K3/Vista
	64-bit Windows XP/2K3/Vista[2]

[1] Current version supported for NT on Intel only. v.3.2 available for NT on Alpha.

[2] Native 64-bit support for x64 (AMD64 or Intel EM64T processors)



Audit Server for Domain Time II

Verifiable Audit Trail of the Time Synchronization of Your Network

KEY FEATURES

- Automatically Audit the Time on Your Network
- Clear, Indisputable Records
- Generate Alerts if Time or Audit Period Exceeds Specified Tolerances
- Integrates Perfectly with DomainTime II Time Synchronization Software Suite
- Integrates with Existing Network Management Programs
- 64-bit and VISTA Support

KEY BENEFITS

- Complete Records of Time Synchronization Accuracy of the Computers on Your Network
- Know When a Machine was Last Synchronized, with What Time Source, as Well as its Variance from the Reference Time Source
- Peace of Mind From an Automatic Software System Routinely Auditing Time on Your Network
- Know That You Will be Notified if Time or Audit Period is Out of Tolerance
- Cross Check Network Time with Independent Time Sources for Historical Validation

Audit Server is a software system designed to work in conjunction with Domain Time II time synchronization software components to provide a secure, verifiable audit trail of the time synchronization of your network. It automatically provides the clear, indisputable records you need to easily resolve any contested timestamp issue that may arise.

Federal regulatory agencies as well as major securities organizations like NASDAQ with their OATS (Order Audit Trail System) already require this type of audit collection to prevent fraud and to establish the validity of transactions. Audit Server meets or exceeds such requirements and makes it painless to comply with the regulations.

The records collected by Audit Server include complete information to allow auditors to determine precisely when a machine was last synchronized, with what time source, as well as its variance from the reference time source.

Audited Time is being able to prove conclusively (on demand) whether the time on any monitored system was correctly synchronized at a particular time and date with a specified time source.

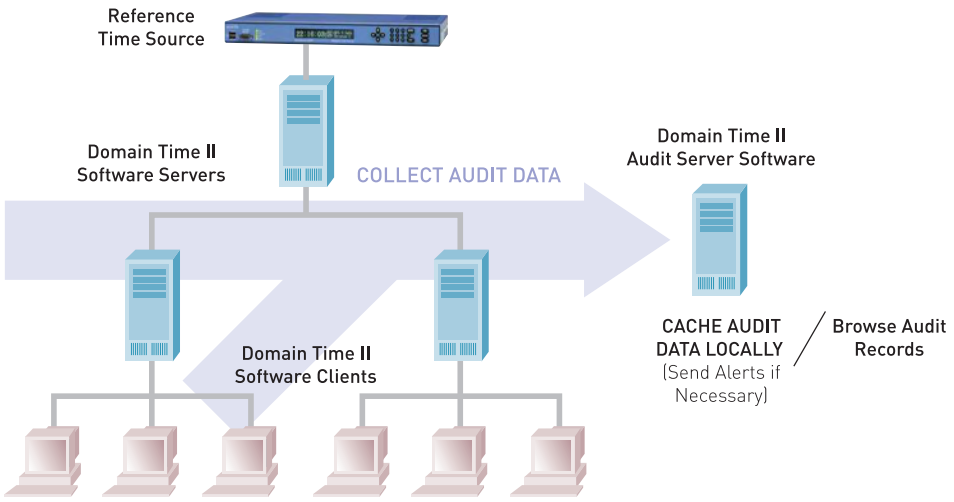


FIG. 1 Audit Server gathers data from Domain Time II clients and servers, generates alerts if necessary, and makes audit records available for browsing and archiving.

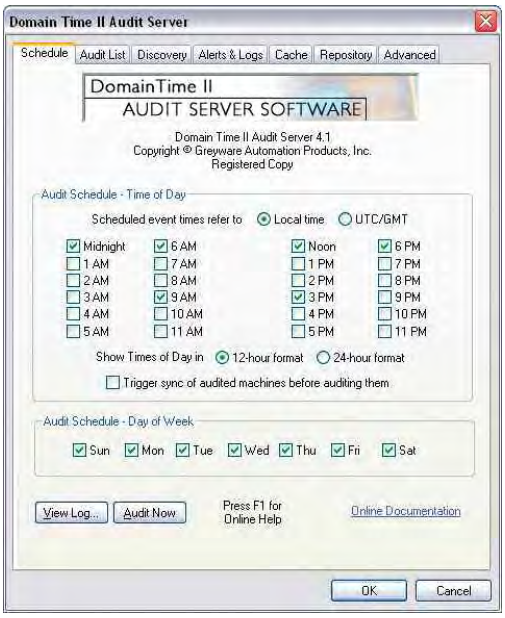


FIG. 2 Specify the schedule when you want Audit Server to audit your network time synchronization.

Audit Server uses the built-in time synchronization and data collection capabilities of the Domain Time II time synchronization products (Domain Time II Server and Clients) to construct and maintain a verifiable and secure audit trail indicating when the clock on a machine was last synchronized. Domain Time II components all work together to easily and automatically provide Audited Time on your network with minimal intervention on your part.

TO SUCCESSFULLY PROVIDE AUDITED TIME...

- *Monitored machines must be able to be reliably and individually identified*
- *Time on individual machines must be synchronized regularly and accurately with a known time source*
- *Vital information such as when the local clock was last adjusted and with what time source must be easily retrievable*
- *Sync information must be collected regularly and compiled into concise and complete audit records*

IDENTIFYING MONITORED MACHINES

All Domain Time II Server and Client services are individually identified using a unique serial number that is assigned when the Domain Time software is installed. Even if the IP address or name of the machine changes, the audit records will clearly identify the machine running that particular instance of Domain Time II.

ACCURATE AND RELIABLE NETWORK SYNCHRONIZATION

A Domain Time II Server connects securely to a trusted network time source such as a Symmetricom dedicated GPS referenced network time server, and then distributes that time accurately and verifiably to every time-aware machine on the network using the Domain Time II time distribution system.

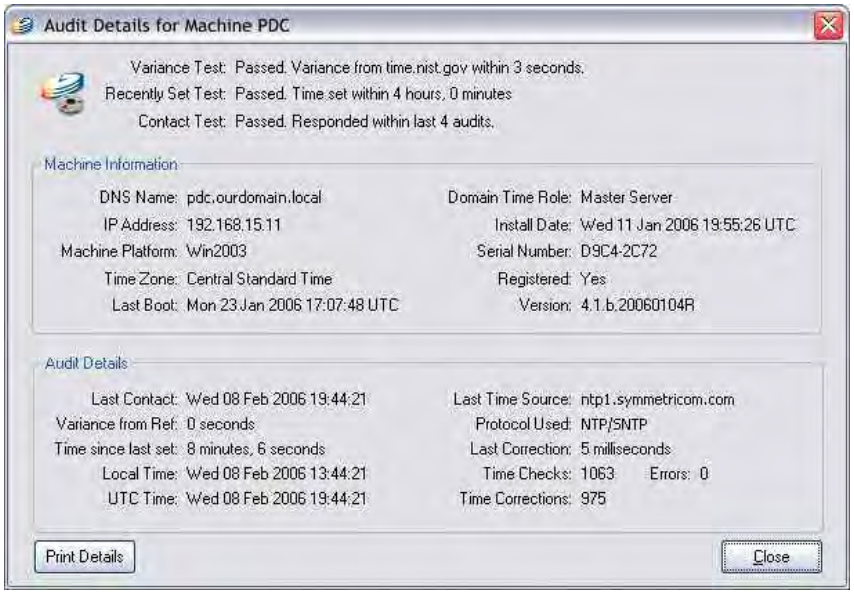


FIG. 3 Sample of the information contained in an individual audit record.

In addition, Domain Time II components have a function called Clock Change Monitor that prevents users from manually changing the time on machines to falsify records. Domain Time II also has sophisticated security features to ensure that the entire system time is correct, including protection from rogue time servers, Denial-of-Service attacks, and more.

RETRIEVAL OF VITAL TIME SYNC INFORMATION

Domain Time Servers and Client services keep detailed internal statistics on their operation which is regularly queried by Audit Server. The statistics include such information as the name/IP address and time of the last time source used for synchronization, the amount of correction to the local clock that was made, the protocol used to set the time, etc. Statistics are regularly retrieved from clients and servers using the Domain Time II protocol, which allows for efficient transfer of the information to the Audit Server, with a very small amount of traffic. This means that the audit process is very low-overhead and has minimal impact on the network.

Audit Server can also obtain the current time from an NTP time source at the time an audit occurs. This allows the audit record to include at least basic information from any NTP machines (such as a GPS based network time server or router) that may also be involved in providing time to the network. This also can serve as a time cross check and historical validation if you also monitor an official public time source.

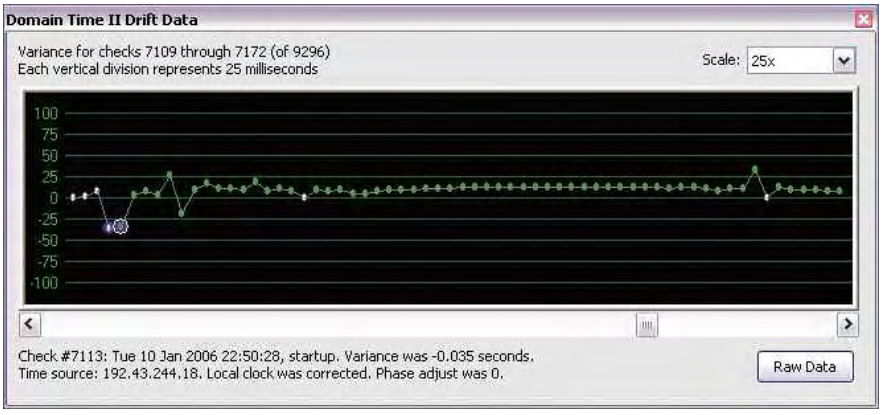


FIG. 4 Numeric log data can also be viewed graphically as well as in text form to analyze time drift data.

REGULAR COLLECTION OF AUDIT RECORDS

The Audit Server automatically contacts Domain Time II Servers and Clients (and any specified NTP servers) to collect their audit data on a schedule you specify. This information is compiled into compact record files that include all relevant information about each monitored system. Each record is optimized to minimize the amount of disk space used to retain the records. The Audit Record Viewer allows you to view the data in an easy-to-read format, and to extract the data to text files in a summary or full-detail form.

AUTOMATIC ERROR NOTIFICATION

Audit Server verifies that machines you have selected to be audited are actually having their time set and that they are responding to the audits. If any machine fails to be synchronized within your desired tolerance, or if a machine misses more audits than your specified maximum error limit, an email alert is automatically generated so that the problem can be addressed immediately.

INTEGRATION WITH EXISTING NETWORK MANAGEMENT SYSTEMS

Audit Server can create a special summary log of audit records each day if you are using your own log file collection and analysis program and need the audit record information to appear in a particular format to be imported correctly. This allows Audit Server to do its work yet you can continue to use your preferred network management system to monitor the network.

DOCUMENTATION

- All documentation is online at http://dtdocs.ntp-systems.com

SYSTEM REQUIREMENTS

- Requires Domain Time II Server and Clients (version 4.1 or later) to be installed.
- Windows NT/2K/XP/2003Vista*

* Native 64-bit support for XP/2003/Vista on AMD64 or Intel EM64T (x64) processors. (no Intel Itanium support)

Time Server Express Loaner Service

Minimize Time Synchronization Interruptions to Your IT Enterprise in the Event of Failure

KEY FEATURES

- Network Time Server Sent Overnight as Loaner for a Failed Unit
- Free Shipping for all Repair Related Shipments
- A Single Phone Call Initiates the Express Loaner Service
- Symmetricom-supplied Packaging and Preprinted Shipping Labels and Paperwork Save Time in Returning Units
- One Year Free Extended Warranty Coverage if a 3-year Express Loaner Service Contract is Purchased With the New Server (a Great Complement to the 2-year Standard Warranty)

KEY BENEFITS

- Minimize Time Synchronization Interruptions on Your Network
- Assure Maximum IT Enterprise Network Uptime in the Event of Network Time Server Failure
- Peace of Mind That a Single Phone Call Initiates the Express Loaner Service
- Easy Shipping of Servers That Saves Both Time and Money
- Hassle-free Time Server Management

Symmetricom's network time servers are the most reliable in the world. However, electronic components have been known to fail — and when this occurs with a network time server, the time synchronization continuity of an IT network enterprise is at risk.

Symmetricom's Express Loaner Service is our answer to supporting maximum uptime for your enterprise. Simply put, the Express Loaner Service will ship a loaner network time server overnight to your location in the event your time server fails.

HOW IT WORKS

Here is how simple it is to get back on synchronized time once you sign up with a 1 to 3 year Express Loaner contract.

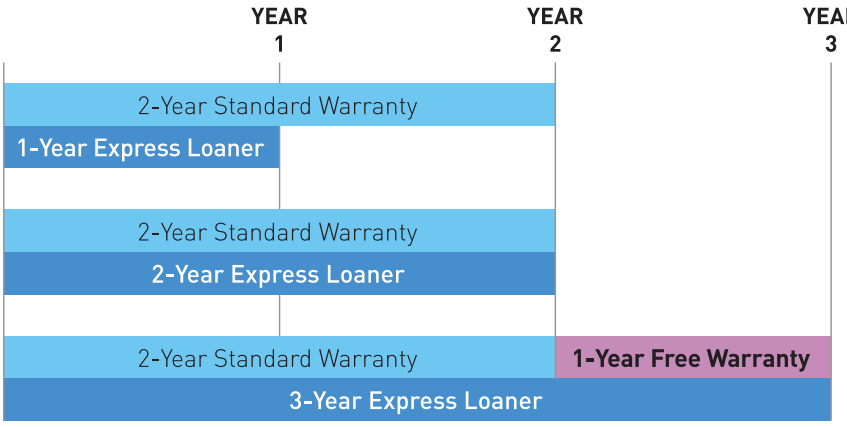
Place a call to Symmetricom Global Services. Tell them the model of your Symmetricom time server. Symmetricom Global Services will ship that model overnight to your specified location. Once delivered, you install it. We'll will be on hand by phone if you need help with the installation.

Included with the Express Loaner are completed shipping documents that will let you ship back the failed unit to Symmetricom's repair facility. Just place your failed unit in the shipping box, attach the label, and send it off. We pay all the freight charges.

Once your unit is repaired (usually in less than 30 days) we will ship it back to you. Included with this shipment is a return shipping label to make it easy for you to return the Express Loaner. Just place the Express Loaner in the shipping box, attach the label and send it off. Naturally, we pay the freight charge. It couldn't be easier.

DELIVERY TIME

Our goal is to have your loaner arrive within 24 hours of your request. However, in order to meet this goal, requests for the Express Loaners must be received by noon Pacific Time on a business day. RMAs issued by noon for Express Loaners will receive our best effort to be shipped to arrive the next business day at your location.



The Express Loaner Service is an excellent complement to the 2-year Standard Warranty. The 3-year Express Loaner contract includes one year of Extended Warranty coverage at no extra charge when purchased with a new time server.

EXPRESS LOANER CONTRACTS

The Express Loaner Service is an excellent complement to Symmetricom's 2-year Standard Warranty, which includes all repairs.

The Express Loaner Service is offered in 1-year, 2-year and 3-year contract lengths. The 3-year contract length offers a superb value if purchased with the network time server since it adds an additional year of Extended Warranty coverage to the 2-year Standard Warranty at no extra charge.

AVAILABILITY

The Express Loaner Service is currently available in the continental United States. Canada can be accommodated. However, due to potential customs delays, we cannot assure a next business day delivery to Canada.

QUALITY GUARANTEED

Our Quality system is certified to Telcordia GR-2981-CORE, ISO-9001/2000 and TL 9000. We maintain an ASQC/Malcolm Baldrige Quality Auditor and ISO Auditors on staff. We also regularly solicit your comments regarding our support services to continually improve your experience. Your satisfaction is our goal.

SYMMETRICOM GLOBAL SERVICES

Symmetricom Global Services is the dedicated services division of Symmetricom, Inc. We offer services designed to help you lower costs, streamline processes, ensure quality and save time. We are 100% focused on service, delivering the support you need to increase customer satisfaction and grow your business.

CONTACT US

Please visit us online at http://www.symmetricom.com. Your Symmetricom sales representative has more information on all our products and services. You can also contact any of our regional offices.

USA
Phone: 1-888-367-7966 (1-888-FOR-SYMM) or 1-408-428-7907
Fax: 1-408-428-7998
Email: support@symmetricom.com

Time Displays

Your Network. Optimized.

Symmetricom time displays are designed to provide widely visible time to local or remote areas. Ranging in character size from 0.5 inches to 4 inches high, these displays can be mounted in instrumentation racks, consoles, on ceilings/walls or desktop areas. Our Airborne Time Display is a small and rugged airborne display that can be mounted in a standard aircraft instrument panel.

All of Symmetricom's time code products are available with several optional configurations, and several are capable of displaying countdown time.

Network Time Displays

NTP Referenced Clocks

KEY FEATURES

- Digital and Analog Clocks Automatically Synchronize with NTP Network Time Servers Over an Ethernet Network
- AC or Power-over-Ethernet configurations
- Remote Network Configuration Management
- All International Time Zones
- Daylight Savings Support
- High Quality, Professional Appearance
- 2 or 4 Inch Digit Sizes
- 12 Inch analog faces with 12 or 24 hour formats
- High Visibility with Adjustable Brightness
- Multiple Time and Date Formats

KEY BENEFITS

- Correct Time is maintained via Automatic Synchronization to NTP Servers Over the Network
- Easy, Cost Saving Installation Using Existing Ethernet Network and Cabling to Connect to Time Servers Instead of Dedicated Cabling to Transfer Time Signals
- Can Use Wireless Ethernet Connections to Eliminate Difficult Cable Connections
- DHCP for Automatic Network Configuration Saves Time
- Automatic Network Discovery and Remote Management via the Network for Easy and Complete Configuration and Control
- Time Zone and Daylight Savings Support Eliminate Manual Time Adjustments
- Bright Digits Can Be Seen Near or Far Depending on Brightness Level

Symmetricom's Network Time Displays are maintenance free clocks that keep accurate time by synchronizing their time – over the network – to a network time server. These clocks use existing Ethernet network infrastructure and the standard network time protocol (NTP) to keep the time correct. Select between analog or digital displays including 12 or 24 hour formats. All international time zones are supported as well as daylight savings time transitions so the clock should never need manual adjustment.

Display installation and configuration is an easy, cost effective task made even easier by using existing network wiring instead of requiring dedicated cabling to distribute time signals. All displays are available with either standard AC power and Ethernet connections or a combined Power-over-Ethernet connection (PoE). Time over the network saves both time and money since it is not necessary to pull dedicated cabling (such as coaxial or RS-485) throughout a facility to transfer the time to the displays.

Once connected to the network, automatic network address configuration via DHCP coupled with our display discovery and remote management software makes for easy and complete configuration and control of the displays over the network from a single PC. You do not even need to physically see the display to change the settings and verify the correct time and time formats.

Display configuration is saved to non-volatile memory to survive any power fail situation.

Each display is configurable to synchronize with a network time server and will accommodate a second time server as an alternate. These time servers need only be accessible over the LAN/WAN and support NTP.

The digital displays lend themselves well to network equipment racks, control rooms, manufacturing facilities and large open spaces where the precise and accurate digital time needs to be very visible. The classic analog displays are well suited for formal or smaller spaces such as class rooms and meeting rooms. Multiple displays also work well as time zone clocks in control rooms.

Network Time Displays

NETWORK TIME DISPLAY SPECIFICATIONS

Model	ND-2	ND-4	ND-CLK
Display	Six 2.3" (5.8 cm) red LED digits hh:mm:ss	Six 4.0" (10.1 cm) red LED digits hh:mm:ss	12 Hr: black text 24 Hr: 1-12 black/13-00 red
Unlock Indicator	■	■	■
12/24 Hour Mode	■	■	Choose clock face type
Daylight Savings	■	■	■
International Time Zones	■	■	■
AM/PM Indicator	■	■	
US Date (mm/dd/yy)	■	■	
European Date (dd/mm/yy)	■	■	
Adjustable Brightness	■	■	
User Interface/Remote Access			
MS Windows GUI	■	■	■
Telnet CLI	■	■	■
Password Protected	■	■	■
Protocols			
NTP Client	■	■	■
SNTP Client	■	■	■
Telnet	■	■	■
DHCP	■	■	■
UDP	■	■	■
Connectors			
Ethernet, 10BaseT, RJ-45	■	■	■
RS-232 DB9	■	■	■
Power: AC Model	IEC 320	IEC 320	IEC 320
Power: POE Model	Via the Ethernet RJ-45	Via the Ethernet RJ-45	Via the Ethernet RJ-45
Mechanical			
Size Inches cm	Width x Height x Depth (1) 19" x 3.5" x 6.5" 48.3 x 8.9 x 16.5	Width x Height x Depth 25.5" x 7.63" x 4.25" 64.1 x 19.4 x 10.8	Diameter x Depth 12.5" x 4.25" 31.8 x 10.8 face
Weight	8.2 Lbs. (3.7 Kg)	9.2 Lbs. (4.0 Kg)	7.6 Lbs. (3.45 Kg)
Material	Welded steel with black powder coat paint inside & out	Welded steel with black powder coat paint inside & out	Round black metal case with polycarbonate lens
Mounting	Rack mount	Wall via keyholes 16" (40.6 cm) apart	Wall via keyhole
Electrical			
Power: AC Models	90 - 264 VAC, 47-63 Hz, <15 W	90 - 264 VAC, 47-63 Hz, <15 W	90 - 265 VAC, 47-63 Hz, < 10 W
Power: POE Models	+48 Vdc, <12.95 W Class 0 per IEEE802.3af	+48 Vdc, <12.95 W Class 0 per IEEE802.3af	+48 Vdc, <12.95 W Class 0 per IEEE802.3af
Certification	CE, FCC	CE, FCC	CE, FCC
Product Includes			
AC powered models	Display, power cord, manual and MS Windows based configuration software on CD. Rack mount removable brackets.	Display, power cord, manual and MS Windows based configuration software on CD.	Display, power cord, manual and MS Windows based configuration software on CD.
POE powered models	Display, manual and MS Windows based configuration software on CD. Rack mount removable brackets.	Display, manual and MS Windows based configuration software on CD.	Clock, manual and MS Windows based configuration software on CD.

1. Size includes rack mount ears. Size without the rack mount ears: 17" W x 3.5" H x 6.2" D (43.2 x 8.9 x 15.7 cm)

Time Code Displays

TCD-2, TCD-4 DISPLAYS

KEY FEATURES

- Displays for Time of Day (TOD) or Date
- 2 and 4 inch models available
- Synchronizes to IRIG B, IEEE 1344, SMPTE time codes
- Automatic time code detection and synchronization
- High visibility and brightness control
- 12 and 24 hour HH:MM:SS formats
- Multiple Time and Date formats
- Supports all time zones
- AC and/or DC power inputs

Symmetricom's series of time code displays is designed to synchronize to time code signals and display the time or date. The displays are available with two or four inch LEDs which provide great visibility from long distances.

The time code displays are easily configured and automatically detect the time code signal type. Time codes supported are IRIG B, IEEE 1344 and SMPTE.

The displays are designed for international use and are configurable for any time zone. Automatic daylight saving time adjustments are supported in the U.S, Canada and European Union.

TCD-2 Rack or shelf mount time code display. 6 digit numeric display with two inch high LED numbers. Adjustable intensity allows for easy visibility at distances to 85 feet.

TCD-4 Wall or shelf mount time code display. 6 digit numeric display with four inch high LED numbers. Adjustable intensity allows for easy visibility at distances to 125 feet.

Time Code Displays

Model	TCD-2	TCD-4
Display	Six 2.3" (5.8 cm) red LED digits hh:mm:ss, mm:dd:yy, dd:mm:yy	Six 4.0" (10.1 cm) red LED digits hh:mm:ss, mm:dd:yy, dd:mm:yy
Unlock Indicator	■	■
12/24 Hour Mode	■	■
Daylight Saving	■	■
US Date (mm/dd/yy)	■	■
European Date (dd/mm/yy)	■	■
Adjustable Brightness	■	■
Time Code Inputs		
IRIG B	■	■
IEEE 1344	■	■
SMPTE	■	■
Connectors		
Time Code Input	BNC Female	BNC Female
Power		
AC	IEC 320	IEC 320
DC	2.1 mm male panel mt jack, center pin + (positive)	2.1 mm male panel mt jack, center pin + (positive)
Control Interface		
RS-232	DB-9 Connector	DB-9 Connector
Configuration Switches	Dip switch - Rear panel	Dip switch - Rear panel
Mechanical		
Size Inches cm	Width x Height x Depth (1) 19" x 3.5" x 6.5" 48.3 x 8.9 x 16.5	Width x Height x Depth 25.5" x 7.63" x 4.25" 64.1 x 19.4 x 10.8
Weight	5 Lbs.	8 Lbs.
Material	Welded steel with black powder coat paint inside & out	Welded steel with black powder coat paint inside & out
Mounting	Rack mount	Wall via keyholes 16" (40.6 cm) apart
Electrical		
Power		
AC	90 - 264 VAC, 47-63 Hz, <10 W	90 - 264 VAC, 47-63 Hz, <10 W
DC	15 – 28 VDC <10 W Primary or backup supply	15 – 28 VDC <10 W Primary or backup supply
Battery	Rechargeable Manganese Lithium Coin Cell, 3V, 17mAh Panasonic ML1220	Rechargeable Manganese Lithium Coin Cell, 3V, 17mAh Panasonic ML1220
Certification	CE,FCC, RoHS (Category 9 exempt)	CE,FCC, RoHS (Category 9 exempt)
Product Includes		
	Display, power cord, manual, rack mount removable brackets, CD manual	Display, power cord, manual, CD manual

Remote Time Displays

RD-1, RD-2, RD-4, RD-5 Remote Displays

KEY FEATURES

- Displays for Time of Day (TOD) or Time of Year (TOY)
- Wide Selections of Heights – From 1/2 Inch to 4 Inch
- Accepts Wide Variety of Time Codes
- Perfect for Count Down or Control Room Applications

Symmetricom's series of remote time displays is designed to provide widely visible time to local or remote areas. Ranging in character size from 0.5 inches to 4 inches high, these displays can be mounted in instrumentation racks, consoles, on ceilings/walls, or desktop areas. Standard time code input on most displays is IRIG B. Several of these displays are capable of displaying countdown time.

RD-05 Compact desktop/ceiling-mount time code display. Twelve adjustable-intensity, 0.5-inch LEDs display day of year through seconds.

RD-1 Remote 19-inch rack-mount time code display. One-inch-high LED digits are easily visible up to 40 feet. Adjustable intensity.

RD-2 Remote rack-, wall- or ceiling-mount time code display. Two-inch-high LED digits are visible from up to 85 feet. Alphanumeric display optionally available.

RD-4 Remote wall- or ceiling-mount time code display. Six-digit numeric display with four-inch high LED characters. Adjustable intensity allows for easy visibility at distances of 125 feet.

9520-647 is a small and rugged airborne display that can be mounted in a standard aircraft instrument panel. This unit decodes IRIG B serial time code and displays hours, minutes and seconds via red, yellow or green LED digits. Conventional aircraft DC power is used.

Remote Time Displays

REMOTE TIME DISPLAYS SPECIFICATIONS

RD-05 0.5" REMOTE DISPLAY

- Display digits
  - Height: 0.56" (1.4 cm)
  - Type: Numeric LED
  - Quantity: 12 (DDD:HH:MM:SS)
  - Color: Red, adjustable intensity
- Input code (autodetect): IRIG B 123 (AM or DC)
- Manual controls: Intensity, local offset (±HH:MM), days display on/off, year leap second, daylight savings, 12/24 hour mode, switch lockout, firmware version
- Viewing distance: 25' (7.52 m)
- Size
  - Chassis: 7.5" W x 1.64" H x 3.6" D (19 cm x 4.2 cm x 9.1 cm)
  - Chassis with desk/ wall mount: 9" W x 2.7" H x 5.25" D (22.9 cm x 6.1 cm x 13.3 cm); (10.8 cm) deep with connectors
- Power: 115 Vac (230 Vac available)
- Operating temperature: 0°C - 50°C

RD-11" REMOTE DISPLAY

- Display digits
  - Height: 1" (2.54 cm)
  - Type: Numeric LED
  - Quantity: 12 digits (DDD:HH:MM:SS) (optional 14 digits)
  - Color: Red, adjustable intensity
- Input code: IRIG B, MILA, BUDX amplitude modulated
- Manual code: Intensity, local offset (±HH:MM), days display on/off, year leap second, daylight savings, 12/24 hour mode, switch lockout, firmware version
- Viewing distance: 40' (12.2 m)
- Size
  - Panel height: 3.47" (8.81 cm)
  - Panel width: 17" (43.18 cm)
  - Rack mount: 19" (48.26 cm)
  - Wall mount: 17" (43.18 cm)
  - Depth: 4" (10.16 cm)
- Power: 95 - 260 Vac, 47 - 440 Hz, <10 watts
- Operating temperature: 0°C to +50°C

RD-2 2" REMOTE DISPLAY

- Display digits
  - Height: 2" (5.08 cm)
  - Type: Numeric LED (optional alphanumeric)
  - Quantity: 9 (DDD:HH:MM:SS)
  - Color: Red
- Input code (autodetect): IRIG B, NASA 36, MILA amplitude modulated
- Viewing distance: 85' (25.9 m)
- Size: 3.5" H x 17.75" W x 4" D behind panel (8.9 cm x 45.1 cm x 10.1 cm) Mounts in standard 19" EIA rack systems, or with optional wall/ceiling adapter.
- Power: 95 - 260 Vac, 47 - 440 Hz, <25 watts

RD-4 4" REMOTE DISPLAY

- Display digits
  - Height: 4" (10.16 cm)
  - Type: Numeric LED
  - Quantity: 6 digits (optional 9 with DOY)
  - Color: Red, adjustable intensity
- Input code (autodetect): IRIG B amplitude modulated
- Viewing distance: 125' (38.1 m)
- Size: 7" H x 33" W x 3.5" D (17.8 cm x 83.8 cm x 8.9 cm) For wall or ceiling mount, hardware included
- Power: 95 - 260 Vac, 47 - 440 Hz, <25 watts
- Operating temperature: 0°C to +50°C

9520-647 AIRBORNE DISPLAY

- Code input: IRIG B, modulated
- Input level: 0.5 V to 5.0 V P-P
- Controls: Front panel LED intensity control
- Display: Hours - seconds via 0.4" LED's, red, yellow or green
- Dimensions: 1.5" H x 5.0" W x 5.37" D (5.74" W with mounting flanges)
- Power input: 28 VDC ±4 VDC, 4 watts
- Environment: 0°C to 60°C 0 to 95% relative humidity (non-condensing) 50,000' altitude

9520-647 Airborne Display

OPTIONS

Not available in all units. Please contact Symmetricom with configurations of required displays.

- RS-232
- RS-422
- 9600 Baud input (for Model RD-2 and RD-4)
- Other input codes, including MILA and BUDX
- Transformer input coupling
- Frequency and time displays (data derived from Symmetricom Model FTM III)

Space, Defense & Avionics

Your Network. Optimized.

Symmetricom makes rubidium and quartz oscillators that meet or exceed the complex, high reliability requirements for frequency references in the Space, Defense, and Avionics markets. Their small size, low power consumption, fast warm-up capability, superior stability and spectral purity make these devices ideal for critical applications in harsh environments whether airborne, maritime, ground-based, or space.

9400

Ovenized Master Oscillator

KEY FEATURES

- Output Frequency: 5 MHz - 25 MHz
- Space-Qualified and Radiation Rated to >100 krad (Si)
- Power Consumption: <3.6W @ 25ºC
- Frequency Aging @ 5MHz: <5.0E-11/Day, <1.5E-8/Year
- Temperature Range: -25ºC to +65ºC

OPTIONAL FEATURES

Available options for this product include:

- Improved phase noise (-122 dBc at 1 Hz offset vs. standard -116 dBc)
- DC/DC converter for input power conditioning
- Customized mechanical isolation systems for vibration & pyrotechnic shock
- Multiple RF output ports
- Crystal radiation preconditioning
- TTL or LVDS output
- Improved acceleration sensitivity

Contact Symmetricom to configure a 9400-series oscillator that will meet your specific needs.

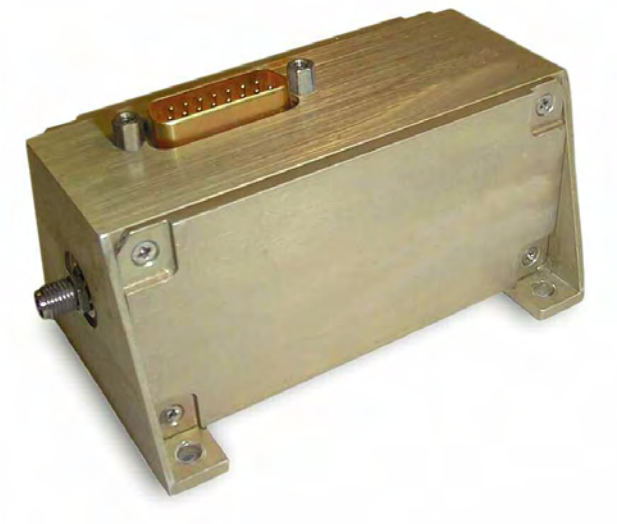
Symmetricom's 9400 Series is a master oscillator that produces a highly stable, low noise, reference frequency output.

The use of surface mount technology allows for the greatest possible reduction in size without compromises in performance or reliability. All discrete components manufactured to military standards are purchased from military certified and qualified vendors. The environmentally rugged 9400 features an ovenized SC-cut quartz resonator and sustaining electronics to achieve temperature insensitive performance. The 9400 master oscillator also exhibits excellent short-term stability, phase noise and aging characteristics.

Backed by an extensive oscillator legacy, the 9400 oscillator series meets the challenge of stringent specifications for frequency control, even under the most adverse environmental conditions.

These oscillators are suitable for direct installation as a component in equipment and systems as well as for use as a master frequency standard, local oscillator, or time base, satisfying a range of applications such as:

- Shipboard timing references
- Satellite on-board timing and frequency standard
- Land-mobile system frequency reference
- Receivers/transmitters/LO



9400 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Standard Output Frequency: 5 MHz
- Initial Accuracy: ±2.0E-8
- Format: Sine wave (TTL or LVDS optional)
- Amplitude: 7.0 dBm ±1 dB
- Harmonic distortion: <-40 dBc
- Non-harmonic distortion: <-90 dBc
- Load impedance: 50 Ω
- VSWR: 1.5:1

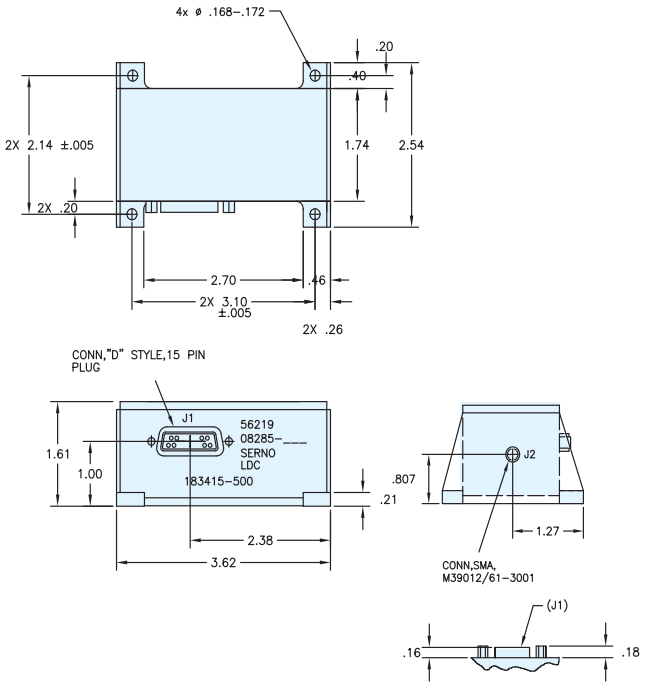
PERFORMANCE PARAMETERS

- Short-term stability
  - 1 second (Allan deviation): <3.0E-12
  - 10 second (Allan deviation): <1.0E-12
- SSB phase noise (static)
  - 1 Hz: -116 dBc
  - 10 Hz: -140 dBc
  - 100 Hz: -150 dBc
  - 1 kHz: -157 dBc
  - 10 kHz: -160 dBc
  - 100 kHz: -160 dBc
- Aging
  - Per day: <5.0E-11
  - Per year: <1.5E-8
- Frequency Retrace (after up to 24 hrs. off and 1 hour on at 25° C): ±1.0E-8
- Acceleration sensitivity
  - Per g, total gamma: 4.0E-9
  - Low g option, total gamma: 7.0E-10
- Frequency change vs. Temperature
  - -25° C to +65° C: ±4.0E-9
  - Warm-up time from +25° C: 15 minutes to within 2.0E-8 of final frequency
- Input Voltage
  - Range: 15 to 18 Vdc
  - Sensitivity: <2.0E-10 for ±5% voltage change
- Steady-state power consumption: <3.6 W at 25°C; <2.4 W at 25°C in vacuum
- Warm-up power consumption: <6 W
- Electronic Frequency Control (EFC) Range: ±4.0E-7 typical

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Operating Temperature: -25° C to +65° C
- Storage temperature: -40° C to +100° C
- Random vibration
  - Operating (endurance): 20 g rms
- Radiation Performance:
  - Total Dose: 100 krad (Si)
  - SEU: Compliant
  - Neutron Fluence: Compliant
  - Prompt Dose Rate: Compliant
- EMI/EMC Performance: Contact Factory
- MTBF: > 10 million hours
- Reliability specification: MIL-HDBK-217F
- Weight: 0.23 kg

9400 OUTLINE DRAWING



9400 CONNECTION DESCRIPTIONS

Pin No. J1	Function
1	No Connection
2	No Connection
3	No Connection
4	+ Elec Pwr Input
5	No Connection
6	No Connection
7	No Connection
8	No Connection
9	Oven Temp Monitor
10	Oven Temp Monitor
11	No Connection
12	+ Elec Pwr Input
13	Pwr Gnd
14	Pwr Gnd
15	Pwr Gnd
SMA J2	RF Output

9500

Ovenized Master Oscillator

KEY FEATURES

- Output Frequency: 4 MHz - 25 MHz
- Space-Qualified and Radiation Rated to >100 K Rad (Si)
- Power Consumption: <3.6W @ 25°C
- Size: 4.25" x 6.0" x 8.62"
- Frequency Aging @ 5MHz: <5.0E-11/Day, <1.5E-8/Year
- Temperature Range: -25°C to +60°C

OPTIONAL FEATURES

Available options for this product include:

- Serial DAC tuning – allows digital tuning over EFC range
- Discrete telemetry & control circuitry – enables analog readouts of output power, baseplate temperature, other functions
- Customized mechanical isolation systems
- Crystal radiation preconditioning
- Multiple RF output ports
- TTL or LVDS output
- Improved acceleration sensitivity
- Improved frequency change vs. temperature of ≤3.0E-12/°C

Contact Symmetricom to configure a 9500-series oscillator that will meet your specific needs.

Symmetricom's 9500 Series is a master oscillator that produces a highly stable, low noise reference frequency output. Particularly suited to space applications, it delivers the best stability performance available in a commercial product.

A mixture of through-hole and surface mount technology, along with the SC-cut quartz resonator, is completely enclosed in an insulating dewar and then kept at a precisely controlled temperature. The result is temperature-insensitive performance and excellent short-term stability, phase noise, and aging characteristics.

All EEE parts on the 9500 are selected in accordance with MIL-STD-975/PPL-21 for Grade 1 or Grade 2 applications, and are procured from approved QML/QPL sources of supply.

The environmentally rugged 9500 Series is suitable for direct installation as a component in equipment and systems as well as for use as a master frequency standard, local oscillator, or time base.

The 9500 series satisfies a range of applications that include:

- Navigation payload frequency reference
- GPS space borne frequency reference
- Land-mobile system frequency reference
- Satellite on-board frequency standard
- Remote station primary frequency standard

9500 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Standard Output Frequency 5 MHz
- Initial Accuracy ±2.0E-8
- Format Sine wave (TTL or LVDS optional)
- Amplitude 7.0 dBm ±1 dB
- Harmonic distortion <-50 dBc
- Non-harmonic distortion <-90 dBc
- Load impedance 50 Ω
- VSWR 1.5:1

PERFORMANCE PARAMETERS

- Short-term stability
  - 1 second (Allan deviation): <1.0E-12
  - 10 second (Allan deviation): <5.0E-13
  - 100 second (Allan deviation): <5.0E-13
  - 1000 second (Allan deviation): <1.0E-12
- SSB phase noise (static)
  - 1 Hz -116 dBc
  - 10 Hz -140 dBc
  - 100 Hz -150 dBc
  - 1 kHz -157 dBc
  - 10 kHz -165 dBc
  - 100 kHz -165 dBc
- Aging
  - Per day: <5.0E-11
  - Per year: <1.5E-8
- Frequency Retrace (after up to 24 hrs. off and 1 hour on at 25° C): ±1.0E-8
- Acceleration sensitivity
  - Per g, total gamma: 4.0E-9
  - Low g option, total gamma 2.0E-9
- Frequency change vs. Temperature
  - -25° C to +60° C: ±3.0E-10
  - Warm-up time from +25° C: 60 minutes to within 2.0E-8 of final frequency
- Input Voltage
  - Range: 22 to 38 Vdc
  - Sensitivity: <2.0E-9 for ±5% voltage change
- Steady-state power consumption: <3.6 W at 25°C; <2.9 W at 25°C in vacuum
- Warm-up power consumption: <8 W
- Electronic Frequency Control (EFC) Range ±2.0E-7 typical

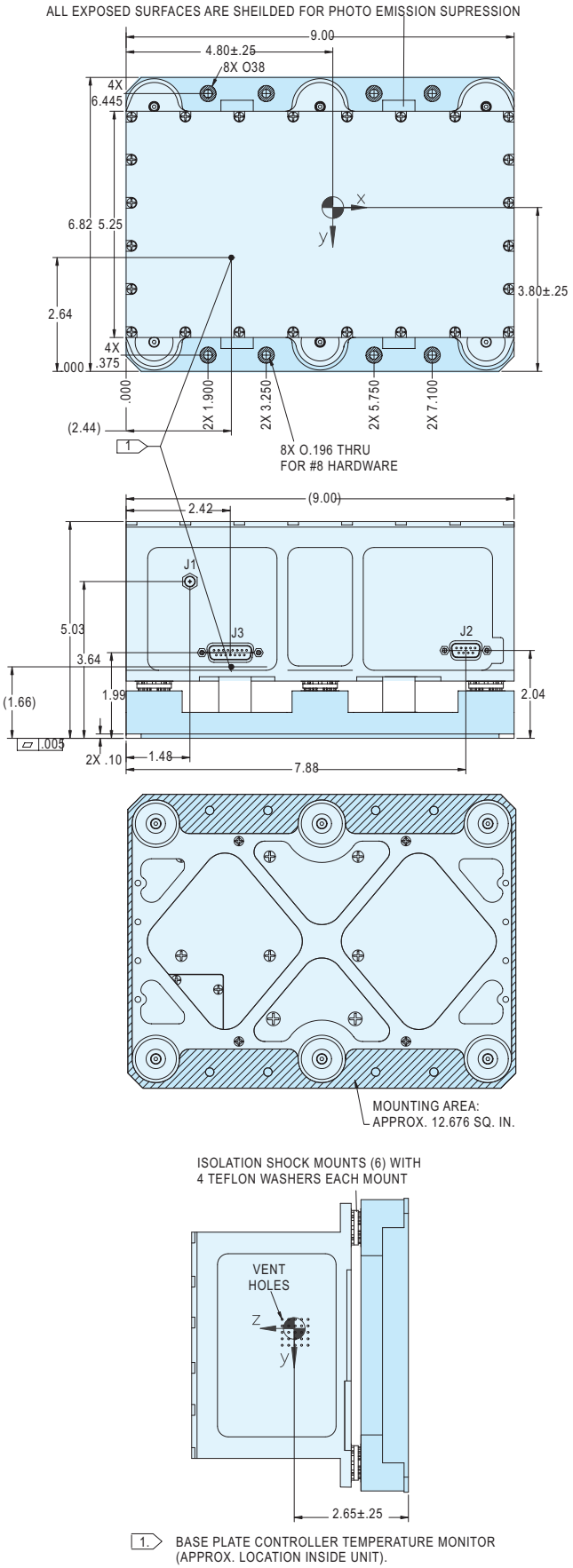
ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Operating Temperature: -25° C to +60° C
- Storage temperature: -40° C to +100° C
- Random vibration
  - Operating (endurance): 20 g rms
- Pyrotechnic shock: 3000 g
- Radiation Performance:
  - Total Dose: 100 krad (Si)
  - SEU: Compliant
  - Neutron Fluence: Compliant
  - Prompt Dose Rate: Compliant
- EMI/EMC Performance: Contact Factory
- MTBF > 10 million hours
- Reliability specification: MIL-HDBK-217F
- Weight: 2.73 kg

9500 CONNECTION DESCRIPTIONS

PIN NO.	FUNCTION
J1-SMA	RF OUT
J2	D CONN 9 PINS
J3	D CONN 15 SOCKETS

9500 OUTLINE DRAWING



9600

Ultra-miniature Space and Military OCXO Series

KEY FEATURES

- Output Frequency: 4 MHz - 60 MHz
- Warm-Up Time: ≤5 Minutes From 25°C
- Fast Warm-Up Option Available
- Low Power Consumption: <1.3W @ 25°C (In Vacuum)
- Compact Sizes -Typical: 1.33" x 1.33" x 1.33"
- Frequency Aging:
  5 MHz: <5.0E-11/day
  10 MHz: <3.0E-10/day
- Frequency Change vs. Temperature: ±4.0E-9 (-40°C to +65°C)
- Low g-sensitivity Option Available

OPTIONAL FEATURES

Available options for this product include:

- Output frequency (4 MHz to 60 MHz available)
- Output format (Sine wave, TTL, or LVDS)
- Panel-mount or PCB-mount package style
- Component screening to space (grade 1) requirements
- Fast warm-up time: ≤5 minutes to within 2.0E-8 of final frequency from -40°C (+25°C is standard). Warm-up power increases to approx. 14 W.
- Low acceleration sensitivity of ≤2.0E-10 at 10 MHz
- Crystal radiation preconditioning

Contact Symmetricom to configure a 9600-series oscillator that will meet your specific needs.

Symmetricom's 9600 is an ultra-miniature ovenized crystal oscillator designed to provide a high stability output for a wide variety of military and space applications.

The use of hybrid circuity allows for the greatest possible reduction in size without compromises in performance or reliability.

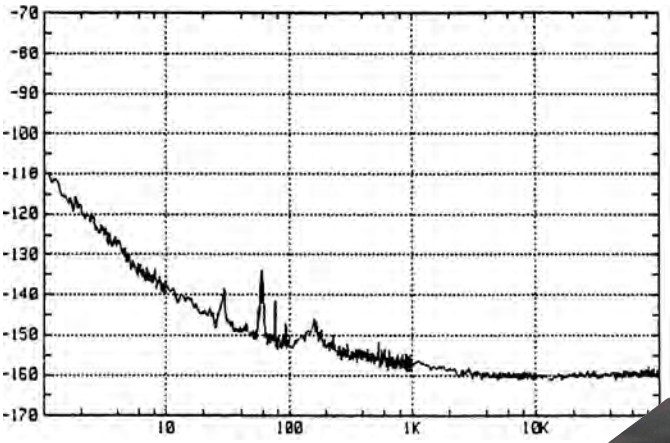
Assembly is performed by skilled operators certified to NASA approved workmanship standards. Hybrid circuits are produced at facilities qualified to MIL-PRF-38534C. All discrete components are manufactured and tested standard to grade 2 or optionally to grade 1 requirements per MIL-STD-975.

The rugged 9600 features a SC-cut quartz resonator and sustaining electronics that are controlled at a precise temperature to achieve temperature-insensitive performance, and excellent short term stability, phase noise, and aging characteristics. This allows it to meet the challenges of many military and space specifications for time and frequency, even under the most adverse environmental conditions.

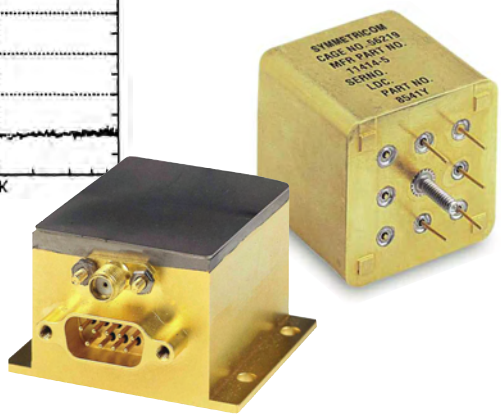
Backed by an extensive oscillator legacy, the 9600 series can be customized in output frequency, warm-up time, g-sensitivity, and other characteristics, making it useful for applications such as:

- Radio navigation
- Radar warning receivers
- Satellite transmission
- Satellite tracking and guidance

This rugged, compact crystal oscillator is especially advantageous when utilized in mobile transportable and portable applications where fast warm-up, low power consumption and small size are required.



Typical phase noise test results for the 10MHz oscillator



9600 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

	5 MHz	10 MHz
• Standard Output Frequency		
• Initial Accuracy	±5.0E-8	±5.0E-8
• Format	Sine wave (TTL or LVDS optional)	Sine wave (TTL or LVDS optional)
• Amplitude	7.0 dBm ±1 dB	7.0 dBm ±1 dB
• Harmonic distortion	<-30 dBc	<-30 dBc
• Non-harmonic distortion	<-90 dBc	<-90 dBc
• Load impedance	50 Ω	50 Ω
• VSWR	1.5:1	1.5:1

PERFORMANCE PARAMETERS

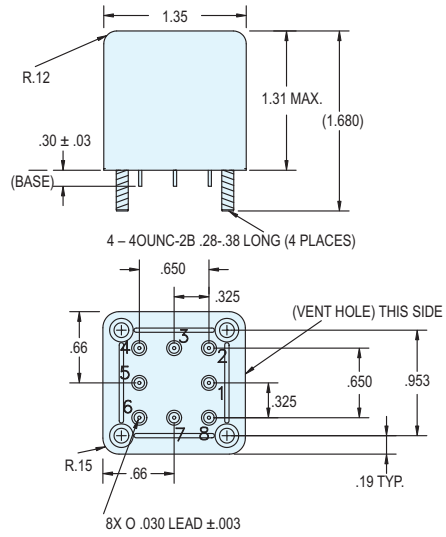
• Short-term stability		
1 second (Allan deviation):	<2.0E-12	<5.0E-12
10 second (Allan deviation):	<2.0E-12	<5.0E-12
100 second (Allan deviation):	<5.0E-12	<1.0E-11
• SSB phase noise (static)		
1 Hz	-112 dBc	-100 dBc
10 Hz	-140 dBc	-125 dBc
100 Hz	-150 dBc	-145 dBc
1 kHz	-157 dBc	-150 dBc
10 kHz	-160 dBc	-155 dBc
100 kHz	-160 dBc	-155 dBc
Aging		
Per day:	<5.0E-11	<3.0E-10
Per year:	<1.5E-8	<4.0E-8
10 years:	<2.0E-7	<1.0E-6
• Frequency Retrace (after up to 24 hrs.off and 1 hour on at 25° C):	±1.0E-8	±1.0E-8
• Acceleration sensitivity		
Per g, total gamma:	3.0E-9	≤1.5E-9
Low g option, total gamma	N/A	≤2.0E-10
• Frequency change vs. Temperature		
-40° C to +65° C:	±4.0E-9	
• Warm-up time from +25° C:	≤5 minutes to within 2.0E-8 of final frequency	
• Input Voltage		
Range:	12 to 15 Vdc	
Sensitivity:	<5.0E-10 for ±5% voltage change	
• Steady-state power consumption at 25° C:	<1.3 W in vacuum	
• Warm-up power consumption:	4 to 8 W	
• Electronic Frequency Control (EFC) Range	±4.0E-7 minimum	
EFC Input	0 to 5 Vdc, (+) sensing	
EFC Linearity	10% typical	
• Load change sensitivity:	±1.0E-9 for ±5% load change	

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

• Operating Temperature:	-40° C to +65° C
• Storage temperature:	-55° C to +100° C
• Random vibration	
Operating (endurance):	35 g rms
• Pyrotechnic shock:	3000 g
• Radiation Performance:	
Total Dose:	100 kRad (Si)
ELDRS:	Compliant
SEL:	Compliant
Neutron Fluence:	Contact Factory
Prompt Dose Rate:	Contact Factory
• EMI/EMC Performance:	Contact Factory
• EEE Parts Screening Level	NASA Grade 2 equivalent
• MTBF	>6,000,000 hours
• Reliability specification:	MIL-HDBK-217F
• Weight:	0.10 kg

9600 OUTLINE DRAWING

PCB-MOUNT PACKAGE STYLE



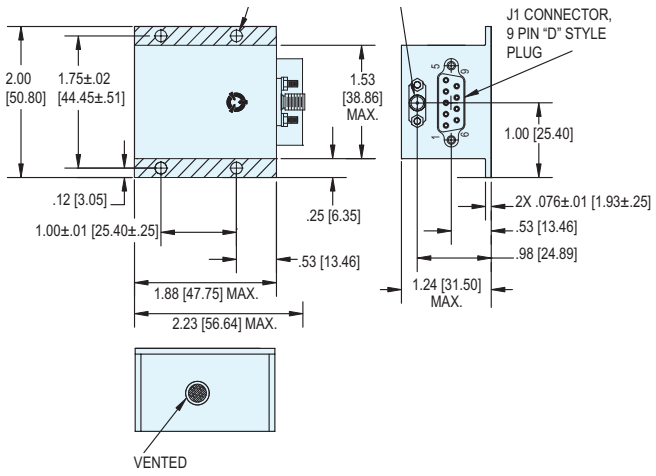
CONNECTION DESCRIPTIONS

PCB-MOUNT PACKAGE STYLE

PIN NO.	FUNCTION
1	RF OUTPUT
2	N/C
3	N/C
4	GROUND/CHASSIS GROUND
5	+12 VDC TO +15VDC
6	EFC TUNING VOLTAGE INPUT
7	N/C
8	+12 VDC TO +15VDC

9600 OUTLINE DRAWING

PANEL-MOUNT PACKAGE STYLE



CONNECTION DESCRIPTIONS

PANEL-MOUNT PACKAGE STYLE

PIN NO.	FUNCTION
J1-1	POWER +12VDC TO +15VDC
J1-2	N/C
J1-3	N/C
J1-4	GROUND/CHASSIS GROUND
J1-5	EFC TUNING VOLTAGE INPUT
J1-6	GROUND/CHASSIS GROUND
J1-7	POWER +12VDC TO +15VDC
J1-8	N/C
J1-9	N/C
J2-1	RF OUTPUT

9700

Ultra-miniature Space-Qualified OCXO Series

KEY FEATURES

- Output Frequency: 4 MHz - 60 MHz
- Warm-up Time: ≤5 minutes from 25°C
- Fast Warm-up Option Available
- Low Power Consumption: <1.3W @ 25°C (In Vacuum)
- Compact Sizes-Typical: 1.33" x 1.33" x 1.33"
- Frequency Aging:
  5 MHz: <5.0E-11/day
  10 MHz: <3.0E-10/day
- Frequency Change vs. Temperature: ±4.0E-9 (-40°C to +65°C)
- Radiation Rated: 100 krad (Si)

OPTIONAL FEATURES

Available options for this product include:

- Output frequency (4 MHz to 60 MHz available)
- Output format (Sine wave, TTL, or LVDS)
- Panel-mount or PCB-mount package style
- Fast warm-up time: ≤5 minutes to within 2.0E-8 of final frequency from -40°C (+25°C is standard). Warm-up power increases to approx. 14 W.
- Crystal radiation preconditioning

Contact Symmetricom to configure a 9700-series oscillator that will meet your specific needs.

Symmetricom's 9700 is an ultra-miniature ovenized crystal oscillator designed to provide a high stability output for a wide variety of space-qualified applications.

The use of hybrid circuity allows for the greatest possible reduction in size without compromises in performance or reliability.

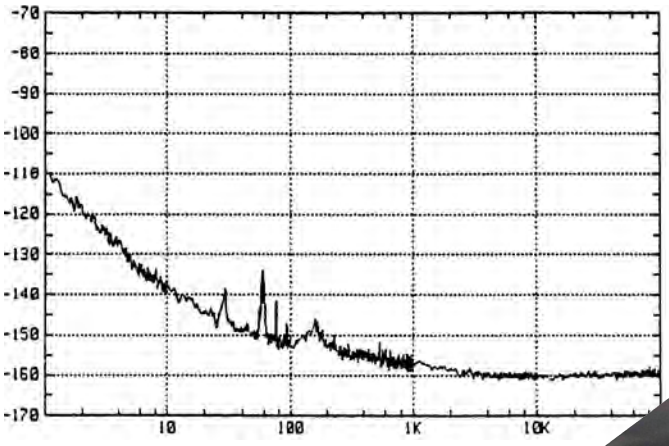
Assembly is performed by skilled operators certified to NASA approved workmanship standards. Hybrid circuits are produced at facilities qualified to MIL-PRF-38534C. All discrete components are manufactured and tested to Grade 1 requirements per MIL-STD-975.

The rugged 9700 features an SC-cut quartz resonator and sustaining electronics that are controlled at a precise temperature to achieve temperature insensitive performance, and excellent short term stability, phase noise, and aging characteristics. This allows it to meet the challenges of space specifications for time and frequency standards, even under the most adverse environmental conditions.

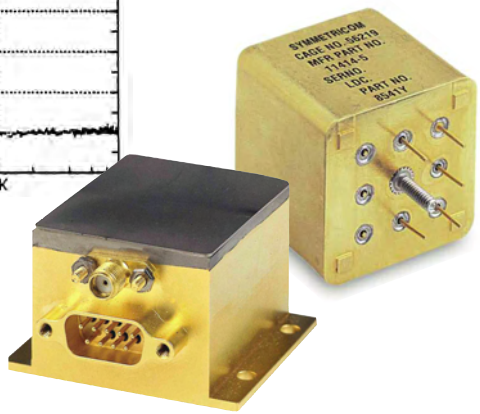
Backed by an extensive oscillator legacy the 9700 series can be customized in output frequency, warm-up time, g-sensitivity, and other characteristics, making it useful for applications such as:

- Radio navigation
- Satellite transmission
- Satellite tracking and guidance

This rugged, compact crystal oscillator is especially advantageous when utilied in applications where fast warm-up, low power consumption, and small size are required.



Typical phase noise test results for the 10MHz oscillator



9700 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

	5 MHz	10 MHz
• Standard Output Frequency		
• Initial Accuracy	±5.0E-8	±5.0E-8
• Format	Sine wave (TTL or LVDS optional)	Sine wave (TTL or LVDS optional)
• Amplitude	7.0 dBm ±1 dB	7.0 dBm ±1 dB
• Harmonic distortion	<-30 dBc	<-30 dBc
• Non-harmonic distortion	<-90 dBc	<-90 dBc
• Load impedance	50 Ω	50 Ω
• VSWR	1.5:1	1.5:1

PERFORMANCE PARAMETERS

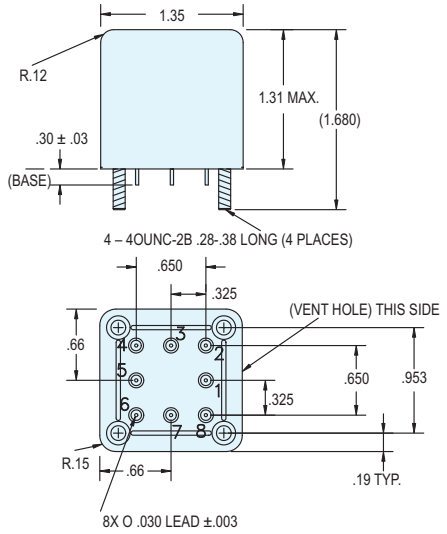
• Short-term stability		
1 second (Allan deviation):	<2.0E-12	<5.0E-12
10 second (Allan deviation):	<2.0E-12	<5.0E-12
100 second (Allan deviation):	<5.0E-12	<1.0E-11
• SSB phase noise (static)		
1 Hz	-112 dBc	-100 dBc
10 Hz	-140 dBc	-125 dBc
100 Hz	-150 dBc	-145 dBc
1 kHz	-157 dBc	-150 dBc
10 kHz	-160 dBc	-155 dBc
100 kHz	-160 dBc	-155 dBc
• Aging		
Per day:	<5.0E-11	<3.0E-10
Per year:	<1.5E-8	<4.0E-8
10 years:	<2.0E-7	<1.0E-6
• Frequency Retrace (after up to 24 hrs. off and 1 hour on at 25° C):	±1.0E-8	
• Acceleration sensitivity		
Per g, total gamma:	≤3.0E-9	≤1.5E-9
• Frequency change vs. Temperature		
-40° C to +65° C:	±4.0E-9	
• Warm-up time from +25° C:	≤5 minutes to within 2.0E-8 of final frequency	
• Input Voltage		
Range:	12 to 15 Vdc	
Sensitivity:	<5.0E-10 for ±5% voltage change	
• Steady-state power consumption at 25° C:	<1.3 W in vacuum	
• Warm-up power consumption:	4 to 8 W	
• Electronic Frequency Control (EFC) Range	±4.0E-7 minimum	
EFC Input	0 to 5 Vdc, (+) sensing	
EFC Linearity	10% typical	
• Load change sensitivity:	±1.0E-9 for ±5% load change	

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

• Operating Temperature:	-40° C to +65° C
• Storage temperature:	-55° C to +100° C
• Random vibration	
Operating (endurance):	35 g rms
• Pyrotechnic shock:	3000 g
• Radiation Performance:	
Total Dose:	100 kRad (Si)
ELDRS:	Compliant
SEL:	Compliant
Neutron Fluence:	Contact Factory
Prompt Dose Rate:	Contact Factory
• EMI/EMC Performance:	Contact Factory
• EEE Parts Screening Level	NASA Grade 1 equivalent
• MTBF	>6,000,000 hours
• Reliability specification:	MIL-HDBK-217F
• Weight:	0.10 kg

9700 OUTLINE DRAWING

PCB-MOUNT PACKAGE STYLE



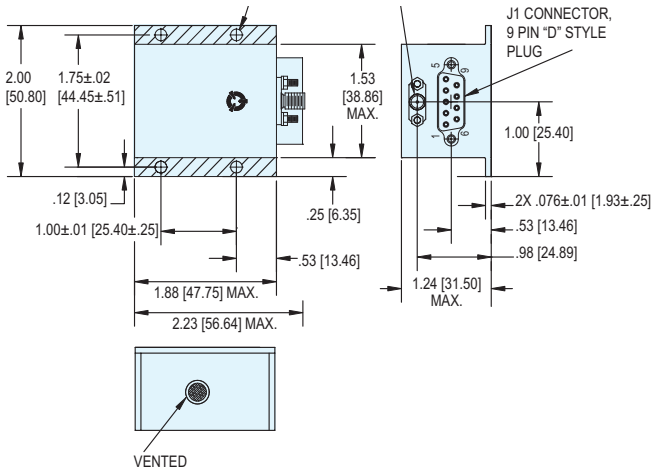
CONNECTION DESCRIPTIONS

PCB-MOUNT PACKAGE STYLE

PIN NO.	FUNCTION
1	RF OUTPUT
2	N/C
3	N/C
4	GROUND/CHASSIS GROUND
5	+12 VDC TO +15VDC
6	EFC TUNING VOLTAGE INPUT
7	N/C
8	+12 VDC TO +15VDC

9700 OUTLINE DRAWING

PANEL-MOUNT PACKAGE STYLE



CONNECTION DESCRIPTIONS

PANEL-MOUNT PACKAGE STYLE

PIN NO.	FUNCTION
J1-1	POWER +12VDC TO +15VDC
J1-2	N/C
J1-3	N/C
J1-4	GROUND/CHASSIS GROUND
J1-5	EFC TUNING VOLTAGE INPUT
J1-6	GROUND/CHASSIS GROUND
J1-7	POWER +12VDC TO +15VDC
J1-8	N/C
J1-9	N/C
J2-1	RF OUTPUT

9800

Ultra-miniature Space and Military VHF OCXO Series

KEY FEATURES

- Output Frequency: 50MHz - 200MHz
- Component Quality:
  B-Level (Military) Standard
  S-Level (Space) Optionally Available
- Warm-Up Time: <10 Minutes From 25ºC
- Fast Warm-up Option Available
- Low Power Consumption: <1.3W @ 25ºC (Vacuum)
- Compact Sizes
  Typical: 1.33" x 1.33" x 1.33"
- Frequency Aging @ 100 MHz:
  <-1.0E-6 in the first year
- Frequency Change vs. Temperature:
  ±5.0E-7 (-40°C to +65°C)
- Low Acceleration Sensitivity:
  ≤8.0E-10 per g

OPTIONAL FEATURES

Available options for this product include:

- Output frequency (50 MHz to 200 MHz available)
- Panel-mount or PCB-mount package style
- Component screening to B-level (military) or S-level (space) requirements
- Fast warm-up time: ≤10 minutes to within 2.0E-8 of final frequency from -40°C (+25°C is standard). Warm-up power increases to approx. 14 W.
- Crystal radiation preconditioning

Contact Symmetricom to configure a 9800-series oscillator that will meet your specific needs.

Symmetricom's 9800 is an ultra-miniature ovenized crystal oscillator that provides a high stability VHF sinewave output. The use of hybrid circuitry allows for the greatest possible reduction in size without compromises in performance or reliability.

Assembly is performed by skilled operators certified to NASA approved workmanship standards. Hybrid circuits are produced at facilities qualified to MIL-PRF-38534C. All discrete components are manufactured and tested to B-level standards, and S-level (space-qualified) is optionally available.

The rugged 9800 features an SC-cut quartz resonator and sustaining electronics that are controlled at a precise temperature to achieve temperature-insensitive performance, and excellent phase noise and aging characteristics. This allows it to meet the challenges of military or space specifications for time and frequency standards, even under the most adverse environmental conditions.

The 9800 is the obvious choice where a combination of excellent spectral purity and long term stability is essential. It contributes to simplification of system design because its low frequency aging extends the period of time needed between synchronization.

In addition to a choice between B-level or S-level component quality, the 9800 series can be customized in output frequency, warm-up time, and other characteristics, making it useful for applications such as:

- Radio navigation
- Radar warning receivers
- Satellite transmission
- Satellite tracking and guidance

This rugged, compact crystal oscillator is especially advantageous when utilized in mobile transportable and portable applications where fast warm-up, low power consumption and small size are required.

9800 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Standard Output Frequency: 100 MHz
- Initial Accuracy: ±2.0E-7
- Format: Sine wave
- Amplitude: 7.0 dBm ±1 dB
- Harmonic distortion: <-30 dBc
- Non-harmonic distortion: <-90 dBc
- Load impedance: 50 Ω
- VSWR: 1.5:1

PERFORMANCE PARAMETERS

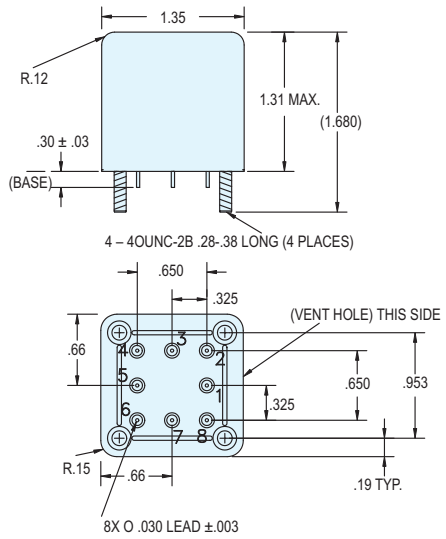
- SSB phase noise (static)
  - 1 Hz: -60 dBc
  - 10 Hz: -90 dBc
  - 100 Hz: -120 dBc
  - 1 kHz: -150 dBc
  - 10 kHz: -160 dBc
  - 100 kHz: -160 dBc
- Aging
  - Per day: <1.0E-9
  - Per year: <1.0E-6, first year, after 30 days operation
  - 10 years: <3.0E-6
- Frequency Retrace (after up to 24 hrs. off and 1 hour on at 25° C): ±1.0E-8
- Acceleration sensitivity
  - Per g, total gamma: 8.0E-10
- Frequency change vs. Temperature
  - -40° C to +65° C: ±5.0E-7
- Warm-up time from +25° C: 10 minutes to within 2.0E-8 of final frequency
- Input Voltage
  - Range: 12 to 15 Vdc
  - Sensitivity: <1.0E-7 for ±5% voltage change
- Steady-state power consumption at 25° C: <1.3 W in vacuum
- Warm-up power consumption: 4 to 8 W
- Electronic Frequency Control (EFC) Range: ± 6 ppm minimum
  - EFC Input: -10 to +10 Vdc, (-) sensing
  - EFC Linearity: 10% typical
- Load change sensitivity: ±5.0E-8 for ±5% load change

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Operating Temperature: -40° C to +65° C
- Storage temperature: -55° C to +100° C
- Random vibration
  - Operating (endurance): 35 g rms
- Pyrotechnic shock: 3000 g
- Radiation Performance:
  - Total Dose: 100 kRad (Si)
  - ELDRS: Compliant
  - SEL: Compliant
  - Neutron Fluence: Contact Factory
  - Prompt Dose Rate: Contact Factory
- EMI/EMC Performance: Contact Factory
- EEE Parts Screening Level: B-Level or S-Level, depending on application
- MTBF: >6,000,000 hours
- Reliability specification: MIL-HDBK-217F
- Weight: 0.10 kg

9800 OUTLINE DRAWING

PCB-MOUNT PACKAGE STYLE



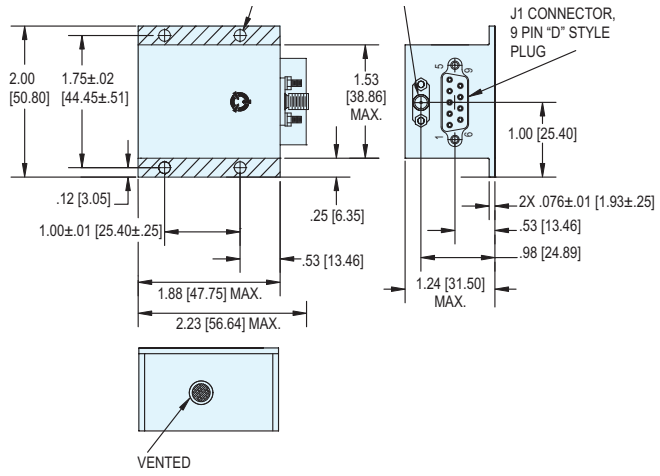
CONNECTION DESCRIPTIONS

PCB-MOUNT PACKAGE STYLE

PIN NO.	FUNCTION
1	RF OUTPUT
2	N/C
3	N/C
4	GROUND/CHASSIS GROUND
5	+12 VDC TO +15VDC
6	EFC TUNING VOLTAGE INPUT
7	N/C
8	+12 VDC TO +15VDC

9800 OUTLINE DRAWING

PANEL-MOUNT PACKAGE STYLE



CONNECTION DESCRIPTIONS

PANEL-MOUNT PACKAGE STYLE

PIN NO.	FUNCTION
J1-1	POWER +12VDC TO +15VDC
J1-2	N/C
J1-3	N/C
J1-4	GROUND/CHASSIS GROUND
J1-5	EFC TUNING VOLTAGE INPUT
J1-6	GROUND/CHASSIS GROUND
J1-7	POWER +12VDC TO +15VDC
J1-8	N/C
J1-9	N/C
J2-1	RF OUTPUT

9210B

Military OCXO

KEY FEATURES

- 5 or 10 MHz Output
- <1.0E-10 Per Day Aging (5 MHz)
- <4.0E-9 Per g Acceleration Sensitivity
- Random Vibration endurance of up to 30 g rms

OPTIONAL FEATURES

Available options for this product include:

- Output frequency: 5 MHz or 10 MHz
- Low acceleration sensitivity of ≤2.0E-10 per g (10 MHz model only)

Contact Symmetricom to configure a 9210B oscillator that will meet your specific needs.

As the military moves toward implementing more advanced communications, navigation and targeting systems, precision oscillators that can withstand a wide range of operating environments are becoming more critical.

The Symmetricom 9210B is a COTS military oven-compensated crystal oscillator (OCXO) designed for ground tactical and airborne applications where superior phase noise and frequency stability are required. Phase noise performance is critical in many radar applications, and precise frequency accuracy and stability are critical for secure communication and navigation applications.

The 9210B is based around a double oven SC-cut crystal resonator enclosed in an industry standard 2.0" x 2.0" x 1.25" package.

The standard oscillator is available in either 5 or 10 MHz output configurations, both of which provide excellent frequency stability and phase noise performance in static or dynamic environments.

For more challenging dynamic applications at 10 MHz where phase noise under vibration is a key specification, a low g sensitivity option is available that improves acceleration sensitivity to < 2.0E-10 per g.

9210B SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

	5 MHz	10 MHz
• Standard Output Frequency		
• Initial Accuracy	'±5.0E-8	'±5.0E-8
• Format	Sine wave	Sine wave
• Amplitude	7.0 dBm ±1 dB	7.0 dBm ±1 dB
• Harmonic distortion	<-30 dBc	<-30 dBc
• Non-harmonic distortion	<-80 dBc	<-80 dBc
• Load impedance	50 Ω	50 Ω
• VSWR	1.5:1	1.5:1

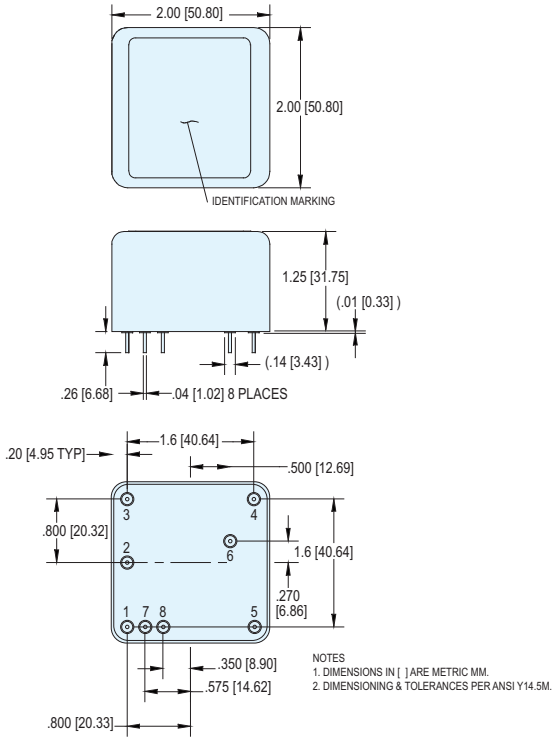
PERFORMANCE PARAMETERS

	5 MHz	10 MHz
• Short-term stability		
1 second (Allan deviation):	<2.0E-12	<5.0E-12
10 second (Allan deviation):	<2.0E-12	<5.0E-12
100 second (Allan deviation):	<5.0E-12	<1.0E-11
• SSB phase noise (static)		
1 Hz	-110 dBc	-100 dBc
10 Hz	-140 dBc	-130 dBc
100 Hz	-150 dBc	-145 dBc
1 kHz	-157 dBc	-155 dBc
10 kHz	-160 dBc	-157 dBc
100 kHz	-160 dBc	-157 dBc
• Aging		
Per day:	<1.0E-10	<3.0E-10
Per year:	<1.5E-8	<4.0E-8
10 years:	<2.0E-7	<1.0E-6
• Frequency Retrace (after up to 24 hrs. off and 1 hour on at 25° C):	±1.0E-8	±1.0E-8
• Acceleration sensitivity		
Per g, total gamma	≤4.0E-9	≤2.0E-9
Low g option, total gamma	N/A	≤2.0E-10
• Frequency change vs. Temperature		
-30° C to +70° C:	±1.0E-8	±1.0E-8
• Warm-up time from +25° C:	≤5 minutes to within 2.0E-8 of final frequency	
• Input Voltage		
Range	12 to 15 Vdc	
Sensitivity	<1.0E-9 for ±5% voltage change	
• Steady-state power consumption:	<3 W	
• Warm-up power consumption:	4 to 12 W	
• Electronic Frequency Control (EFC) Range	±5.0E-7 minimum	
EFC Input	Analog (0 to 5 Vdc)	
EFC Linearity	5% typical	
• Load change sensitivity:	±1.0E-9 for ±5% load change	

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

• Operating Temperature:	-40° C to +70° C
• Storage temperature:	-55° C to +100° C
• Operating Humidity:	95% RH up to 65° C
• Operating Altitude:	0 to 65,000 feet
• Random vibration Operating (endurance):	35 G RMS
• Shock:	20 g for 11 ms half-sine impulse
• EMI/EMC Performance:	Contact Factory
• MTBF	100,000 hours (ground fixed); 45,000 hours (ground mobile)
• Reliability specification:	MIL-HDBK-217F
• Weight:	0.12 kg

9210B OUTLINE DRAWING



9210B CONNECTION DESCRIPTIONS

PIN NO.	FUNCTION
1	EFC TUNING INPUT (0 TO +5 VDC)
2	REFERENCE VOLTAGE OUT (+8.5 TO +9 VDC)
3	RF OUTPUT
4	GND
5	SUPPLY (+12 TO +15 VDC)
6	GND
7	NC
8	NC

9250

Low-Profile Military OCXO

KEY FEATURES

- 10 MHz Output
- <3.0E-10 Per Day Aging
- ≤2.0E-9 per g Acceleration Sensitivity
- Low Phase Noise
- <0.9 Inches High

OPTIONAL FEATURES

Available options for this product include:

- Analog or IC EFC input
- Low acceleration sensitivity of 3.0E-10 per g

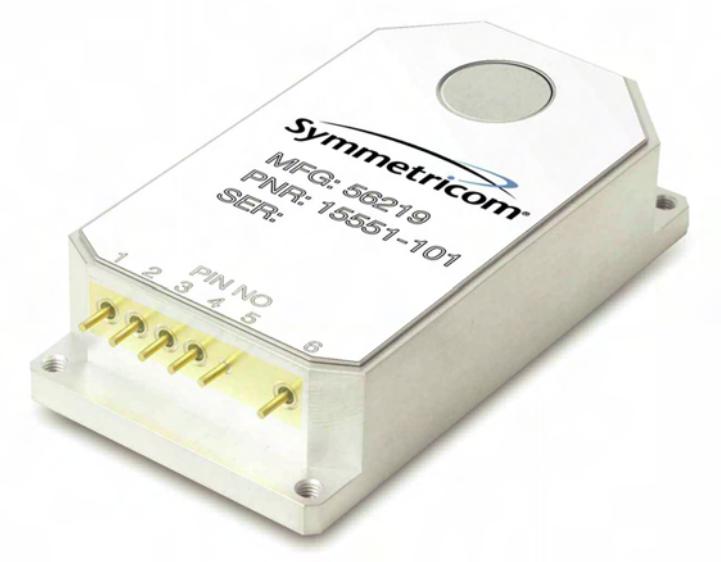
Contact Symmetricom to configure a 9250 oscillator that will meet your specific needs.

As the military moves toward implementing more advanced communications, navigation, and targeting systems, precision oscillators that can withstand a wide range of operating environments are becoming more critical.

The Symmetricom 9250 is a military OCXO designed for ground tactical and airborne applications where superior phase noise and frequency stability are required. Phase noise performance is critical in many radar applications, and precise frequency accuracy and stability are critical for secure communication and navigation applications.

The 9250 is based around an ovenized 10 MHz, 3rd-overtone SC-cut crystal resonator enclosed in a hermetically sealed 1.50" x 2.76" x 0.9" package. All inputs and outputs are accessible via feed-through pins on the side of the chassis. The small, low profile package allows for easy integration into complex subsystems where space is at a premium.

Symmetricom has achieved this low-profile package without sacrificing performance. The 9250 achieves -100 dBc phase noise at 1 Hz offset from the 10 MHz carrier. Its low-g acceleration sensitivity also means it will maintain low phase noise under challenging dynamic applications.



9250 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

• Standard Output Frequency	10 MHz
• Initial Accuracy	'±5.0E-8
• Format	Sine wave
• Amplitude	7.0 dBm ±1 dB
• Harmonic distortion	<-30 dBc
• Non-harmonic distortion	<-80 dBc
• Load impedance	50 Ω
• VSWR	1.5:1

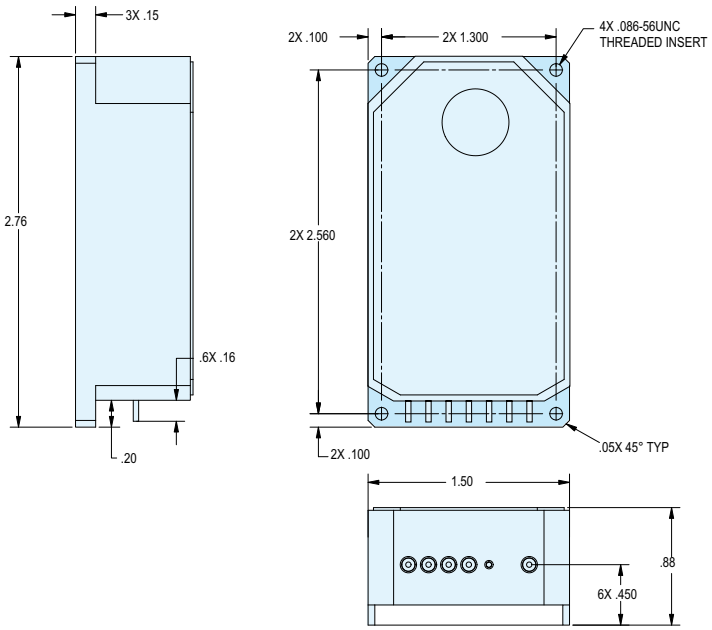
PERFORMANCE PARAMETERS

• Short-term stability	
1 second (Allan deviation):	<1.0E-11
10 second (Allan deviation):	<1.0E-11
• SSB phase noise (static)	
1 Hz	-100 dBc
10 Hz	-125 dBc
100 Hz	-140 dBc
1 kHz	-150 dBc
10 kHz	-155 dBc
100 kHz	-155 dBc
• Aging	
Per day:	<3.0E-10
Per year:	<4.0E-8
10 years:	<1.0E-6
• Frequency Retrace (after up to 24 hrs. off and 1 hour on at 25° C):	±1.0E-8
• Acceleration sensitivity	
Per g, total gamma:	2.0E-9
Low g option, total gamma	3.0E-10
• Frequency change vs. Temperature	
• -30° C to +70° C:	±4.0E-8
• Warm-up time from +25° C:	5 minutes to within 2.0E-8 of final frequency
• Input Voltage	
Range	12 to 15 Vdc
Sensitivity	<1.0E-9 for ±5% voltage change
• Steady-state power consumption:	<3 W
• Warm-up power consumption:	4 to 12 W
• Electronic Frequency Control (EFC) Range	±5.0E-7
EFC Input	Analog (0 to 5 Vdc) or IC
EFC Linearity	10% typical
• Load change sensitivity:	±1.0E-9 for ±5% load change

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

• Operating Temperature:	-40° C to +70° C
• Storage Temperature:	-55° C to +100° C
• Operating Humidity:	95% RH up to 50° C
• Operating Altitude:	0 to 65,000 feet
• Random vibration	
Operating (endurance):	35 g rms
• Shock:	20 g for 11 ms half-sine impulse
• EMI/EMC Performance:	Contact Factory
• MTBF	100,000 hours (ground fixed) 45,000 hours (ground mobile)
• Reliability specification:	MIL-HDBK-217F
• Weight:	0.09 kg

9250 OUTLINE DRAWING



9250 CONNECTION DESCRIPTIONS

PIN NO.	FUNCTION
1	EFC TUNING VOLTAGE INPUT
2	+ 12VDC to +15VDC
3	SCL
4	SDA
5	CHASSIS GND
6	10 MHZ SINE RF OUTPUT

9633

Ultra-miniature Military OCXO with Vibration Compensation

KEY FEATURES

- 10 MHz Output
- Electronic and Mechanical Vibration Compensation
- < 3.0E-10 Per Day Aging
- < 2.0E-11 Per g Acceleration Sensitivity
- Low Phase Noise
- Temperature Range: -40°C to +70°C

OPTIONAL FEATURES

Available options for this product include:

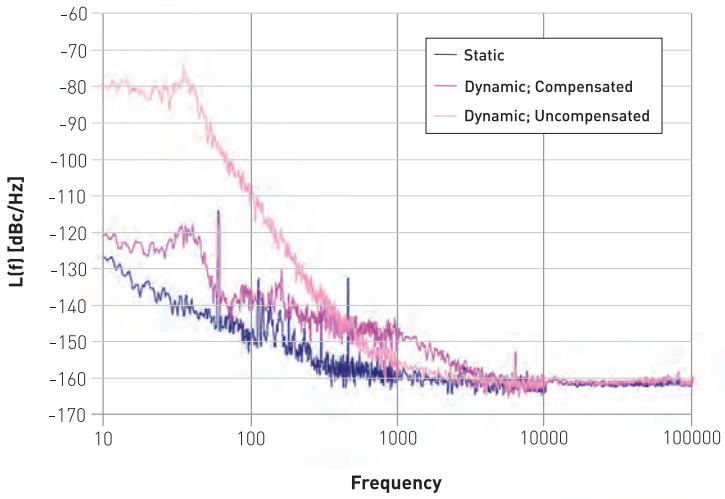
- Analog or IC EFC input

Contact Symmetricom to configure a 9633 oscillator that will meet your specific needs.

As the military moves toward implementing more advanced communications, navigation and targeting systems, precision oscillators that can withstand a wide range of operating environments are becoming more critical.

The Symmetricom 9633 is a military OCXO designed for ground tactical and airborne applications where superior frequency stability and phase noise in high-vibration environments are required. Both electronic and mechanical compensation techniques are utilized to provide up to 40dB of compensation when operating under vibration. Total gamma acceleration sensitivity of < 2.0E-11 per g can be achieved. The 9633 thus provides not only superior dynamic phase noise, but also frequency accuracy, and stability needed for today's radar, secure communications, and navigation applications.

The 9633 is based on an ovenized 10 MHz 3rd overtone SC-cut crystal resonator, enclosed in a hermetically sealed 1.60" x 3.00" x 1.58" H package.



Dynamic Phase Noise (typical performance)

9633 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

• Standard Output Frequency	10 MHz
• Initial Accuracy	±5.0E-8
• Format	Sine wave
• Amplitude	7.0 dBm ±1 dB
• Harmonic distortion	<-35 dBc
• Non-harmonic distortion	<-80 dBc
• Load impedance	50 Ω
• VSWR	1.5:1

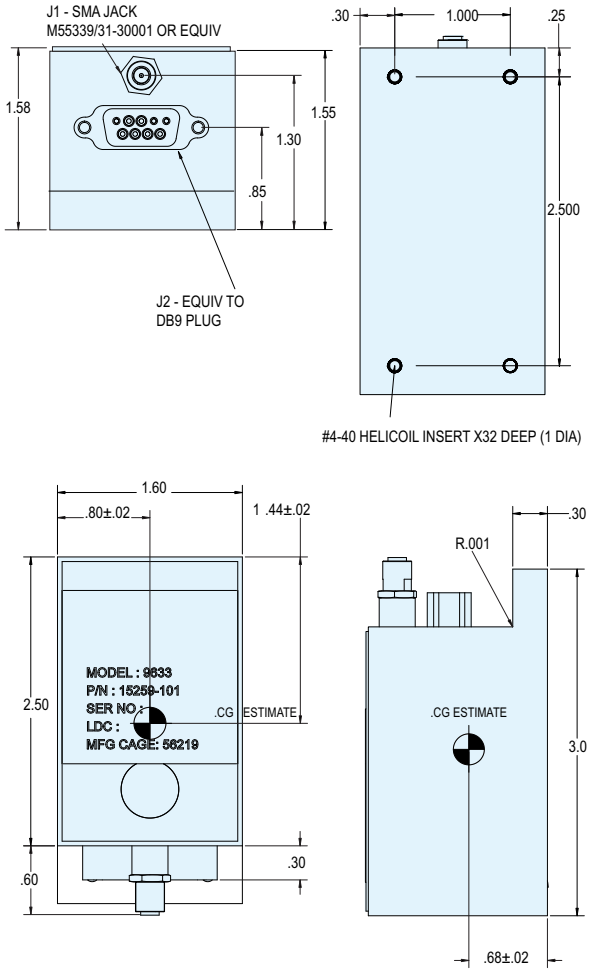
PERFORMANCE PARAMETERS

• Short-term stability	
1 second (Allan deviation):	<5.0E-12
10 second (Allan deviation):	<5.0E-12
100 second (Allan deviation):	<1.0E-11
• SSB phase noise (static)	
1 Hz	N/A
10 Hz	-120 dBc
100 Hz	-140 dBc
1 kHz	-150 dBc
10 kHz	-155 dBc
100 kHz	-155 dBc
• Aging	
Per day:	<3.0E-10
Per year:	<4.0E-8
10 years:	<1.0E-6
• Frequency Retrace (after up to 24 hrs. off and 1 hour on at 25° C):	±1.0E-8
• Acceleration sensitivity	
Per g, total gamma:	≤2.0E-11
• Frequency change vs. Temperature	
-30° C to +70° C:	±1.0E-8
Warm-up time from +25° C:	≤5 minutes to within 2.0E-8 of final frequency
• Input Voltage	
Range:	12 to 15 Vdc
Sensitivity:	<5.0E-10 for ±5% voltage change
• Steady-state power consumption:	<3 W
• Warm-up power consumption:	4 to 12 W
• Electronic Frequency Control (EFC)	
Range	±5.0E-7 minimum
EFC Input	Analog or I²C
EFC Linearity	10% typical
• Load change sensitivity:	±1.0E-9 for ±5% load change

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

• Operating Temperature:	-40° C to +70° C
• Storage temperature:	-55° C to +100° C
• Operating Humidity:	95% RH up to 65° C
• Operating Altitude:	0 to 65,000 feet
• Random vibration	
Operating (endurance):	35 g rms
• Shock:	20 g for 11 ms half-sine impulse
• EMI/EMC Performance:	Contact Factory
• MTBF	100,000 hours (ground fixed) 45,000 hours (ground mobile)
• Reliability specification:	MIL-HDBK-217F
• Weight:	0.16 kg

9633 OUTLINE DRAWING



CONNECTION DESCRIPTIONS

PIN NO.	FUNCTION
J1-1	RF OUT
J2-1	CHASSIS GROUND
J2-2	SCL I^2C - CLOCK
J2-3	SDA I ^2C - DATA
J2-4	CHASSIS GROUND
J2-5	CHASSIS GROUND
J2-6	DO NOT CONNECT
J2-7	DO NOT CONNECT
J2-8	PWR
J2-9	PWR

9638B

Low-Profile Ultra-miniature Military OCXO with Vibration Compensation

KEY FEATURES

- 10 MHz Output
- Electronic Vibration Compensation
- < 3.0E-10 Per Day Aging
- < 2.0E-11 Per g Acceleration Sensitivity
- Low Phase Noise
- Temperature Range: -40°C to +70°C

OPTIONAL FEATURES

Available options for this product include:

- Analog or IC EFC input

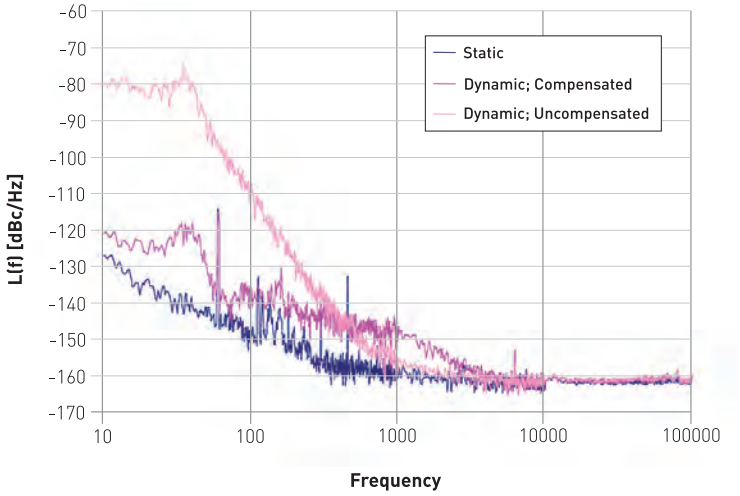
Contact Symmetricom to configure a 9638B oscillator that will meet your specific needs.

As the military moves toward implementing more advanced communications, navigation and targeting systems, precision oscillators that can withstand a wide range of operating environments are becoming more critical.

Like Symmetricom's 9633, the 9638B is a military OCXO designed for ground tactical and airborne applications where superior frequency stability and phase noise in high-vibration environments are required. But while the 9633 utilizes both electronic and mechanical compensation techniques to counter the effects of vibration, the 9638B uses only electronic compensation. The benefit is reduced package height — 1.01" for the 9638B vs. 1.58" for the 9633.

The 9638B thus provides a very small package that delivers superior dynamic phase noise, frequency accuracy, and stability for today's radar, secure communications, and navigation applications.

The 9638B is based on an ovenized 10 MHz 3rd overtone SC-cut crystal resonator, enclosed in a hermetically sealed package.



Dynamic Phase Noise (typical performance)

9638B SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

- Standard Output Frequency: 10 MHz
- Initial Accuracy: ±5.0E-8
- Format: Sine wave
- Amplitude: 7.0 dBm ±1 dB
- Harmonic distortion: <-35 dBc
- Non-harmonic distortion: <-80 dBc
- Load impedance: 50 Ω
- VSWR: 1.5:1

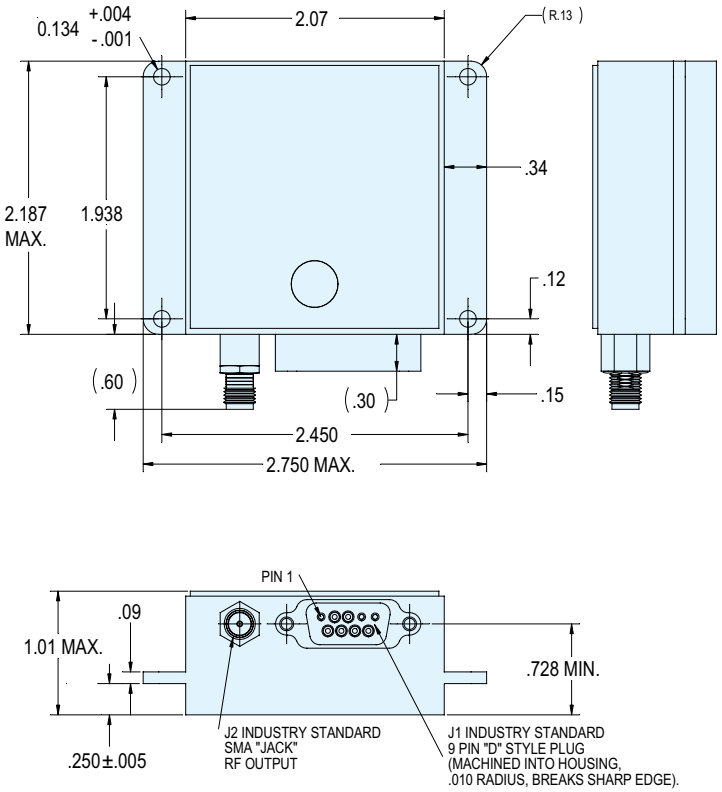
PERFORMANCE PARAMETERS

- Short-term stability
  - 1 second (Allan deviation): <5.0E-12
  - 10 second (Allan deviation): <5.0E-12
  - 100 second (Allan deviation): <1.0E-11
- SSB phase noise (static)
  - 1 Hz: N/A
  - 10 Hz: -120 dBc
  - 100 Hz: -140 dBc
  - 1 kHz: -150 dBc
  - 10 kHz: -155 dBc
  - 100 kHz: -155 dBc
- Aging
  - Per day: <3.0E-10
  - Per year: <4.0E-8
  - 10 years: <1.0E-6
- Frequency Retrace (after up to 24 hrs. off and 1 hour on at 25° C): ±1.0E-8
- Acceleration sensitivity
  - Per g, total gamma: 2.0E-11
- Frequency change vs. Temperature
  - -30° C to +70° C: ±1.0E-8
  - Warm-up time from +25° C: 5 minutes to within 2.0E-8 of final frequency
- Input Voltage
  - Range: 12 to 15 Vdc
  - Sensitivity: <5.0E-10 for ±5% voltage change
- Steady-state power consumption: <3 W
- Warm-up power consumption: 4 to 12 W
- Electronic Frequency Control (EFC)
  - Range: ±5.0E-7 minimum
  - EFC Input: Analog or I²C
  - EFC Linearity: 10% typical
- Load change sensitivity: ±1.0E-9 for ±5% load change

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Operating Temperature: -40° C to +70° C
- Storage temperature: -55° C to +100° C
- Operating Humidity: 95% RH up to 65° C
- Operating Altitude: 0 to 65,000 feet
- Random vibration
  - Operating (endurance): 35 g rms
- Shock: 20 g for 11 ms half-sine impulse
- EMI/EMC Performance: Contact Factory
- MTBF: 100,000 hours (ground fixed)
45,000 hours (ground mobile)
- Reliability specification: MIL-HDBK-217F
- Weight: 0.16 kg

9638B OUTLINE DRAWING



9638B CONNECTION DESCRIPTIONS

PIN NO.	FUNCTION
J2-1	10 MHz RF OUTPUT
J1-1	CHASSIS GND
J1-2	SCL I²C - CLOCK
J1-3	SDA I²C - DATA
J1-4	CHASSIS GND
J1-5	CHASSIS GND
J1-6	DO NOT CONNECT
J1-7	DO NOT CONNECT
J1-8	PWR
J1-9	PWR

9920 & 9940

Hybrid Space-Qualified XO and VCXO

KEY FEATURES

- Choose between 9920 series XO or 9940 series VCXO.
- 10 MHz to 1.2 GHz Output Frequency
- MIL-PRF-38534C Class H or K Certified
- Sine Wave or PECL Outputs
- Low Aging and Phase Noise
- Radiation Hardened
- Environmentally Robust

OPTIONAL FEATURES

Available options for these products include:

- Output frequency
- Output format (Sine wave or PECL) and corresponding package style
- Supply Voltage (PECL output units)
- Mil-PRF-38534C Class H or K certification

Contact Symmetricom to configure a 9920- or 9940-series oscillator that will meet your specific needs.

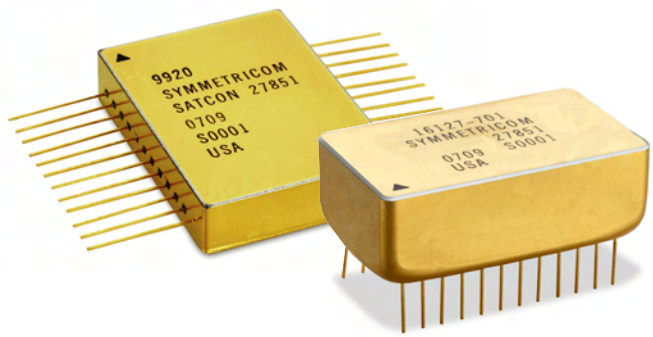
Symmetricom has a 35-year legacy of high-reliability and high-performance quartz oscillators, and these oscillators are now available in hybrid construction for applications that require minimal size, weight and power. Choose between the model 9920 Series crystal oscillator (XO) or 9940 Series voltage-controlled crystal oscillator (VCXO).

Both the 9920 and 9940 series utilize 3rd or 5th overtone AT-cut crystals in a Colpitts configuration with optional multiplication circuitry and output amplifier or driver stages. The precision crystals are contained within hermetic or vacuum sealed packages housed within the hybrid circuit package, resulting in the lowest end-of-life frequency drift possible.

These hybrid oscillators are based on heritage designs and manufacturing techniques proven for reliability in numerous space applications. The hybrids are manufactured in a MIL-PRF-38534C class K facility, in a class 100,000 clean room that provides for maximum reliability.

Output frequency, output waveform, and package style can be chosen to meet a wide variety of standard and custom applications.

The 9920 and 9940 series have demonstrated excellent performance after exposure to high levels of shock, vibration, and radiation, consistent with the rigorous requirements of space applications.



9920 & 9940 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

	9920	9940	9922	9942
• Standard Output Frequency	50 MHz	150 MHz	600 MHz	400 MHz
• Available Output Frequency	10 MHz to 500 MHz	10 MHz to 250 MHz	10 MHz to 1.2 GHz	10 MHz to 600 MHz
• Initial Accuracy	±10 ppm	Settable to ±1 ppm	±10 ppm	Settable to ±1 ppm
• Format	Sine wave	Sine wave	PECL	PECL
• Amplitude	7.0 dBm	7.0 dBm	N/A	N/A
• Harmonic distortion	<-20 dBc	<-20 dBc	N/A	N/A
• Subharmonic distortion	<-20 dBc	<-20 dBc	N/A	N/A
• Non-harmonic distortion	<-65 dBc	<-65 dBc	<-65 dBc	<-65 dBc
• Load impedance	50 Ω	50 Ω	50 Ω	50 Ω
• VSWR	2.0:1	2.0:1	2.0:1	2.0:1

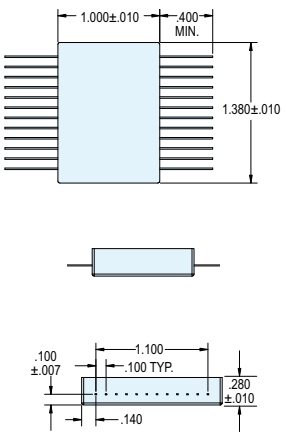
PERFORMANCE PARAMETERS

• SSB phase noise (static)				
10 Hz	-80 dBc	-56 dBc	-68 dBc	-50 dBc
100 Hz	-110 dBc	-90 dBc	-100 dBc	-80 dBc
1 kHz	-140 dBc	-128 dBc	-118 dBc	-110 dBc
10 kHz	-155 dBc	-138 dBc	-128 dBc	-130 dBc
100 kHz	-155 dBc	-142 dBc	-132 dBc	-138 dBc
• Aging				
Per year:	1 ppm	2 ppm	1 ppm	2 ppm
10 years:	5 ppm	15 ppm	8 ppm	15 ppm
• Acceleration sensitivityPer g, total gamma:	3.0E-9	3.0E-9	v3.0E-9	3.0E-9
• Frequency change vs. Temperature				
-40° C to +85° C:	±30 ppm	±40 ppm	±30 ppm	±30 ppm
-20° C to +70° C:	±20 ppm	±30 ppm	±20 ppm	±20 ppm
0° C to +50° C:	±5 ppm	±15 ppm	±10 ppm	±10 ppm
• Input Voltage				
Range:	8 - 15 Vdc	8 - 15 Vdc	+5 Vdc or +3.3 Vdc	+5 Vdc or +3.3 Vdc
Sensitivity:	<1 ppm for ±5% voltage change	<2.5 ppm for ±5% voltage change	<1 ppm for ±5% voltage change	<1 ppm for ±5% voltage change
• Steady-state power consumption:	220 mW	220 mW	375 mW	375 mW
• Electronic Frequency Control (EFC) Range	N/A	±50 ppm	N/A	±50 ppm
EFC Input	N/A	0.5 to 4.5 Vdc	N/A	0.5 to 4.5 Vdc (5V PECL); 0.3 to 3.3 Vdc (3.3V PECL)
EFC Linearity	±20%	±20%	±20%	±20%
• Load change sensitivity:	<0.1 ppm for ±5% load change	<0.1 ppm for ±5% load change	<0.1 ppm for ±5% load change	<0.1 ppm for ±5% load change

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

• Operating Temperature:	-55° C to +125° C	-55° C to +125° C	-55° C to +125° C	-55° C to +125° C
• Storage temperature:	-65° C to +125° C	-65° C to +125° C	-65° C to +125° C	-65° C to +125° C
• Random vibration operating (endurance):	20 g rms	20 g rms	20 g rms	20 g rms
• Pyrotechnic shock:	500 g for 6 ms half-sine impulse	500 g for 6 ms half-sine impulse	500 g for 6 ms half-sine impulse	500 g for 6 ms half-sine impulse
• Radiation Performance:				
Total Dose:	100 kRad (Si)	100 kRad (Si)	100 kRad (Si)	100 kRad (Si)
ELDRS:	Compliant	Compliant	Compliant	Compliant
SEL:	Compliant	Compliant	Contact Factory	Contact Factory
Neutron Fluence:	Contact Factory	Contact Factory	Contact Factory	Contact Factory
Prompt Dose Rate:	Contact Factory	Contact Factory	Contact Factory	Contact Factory
• EMI/EMC Performance:	Contact Factory	Contact Factory	Contact Factory	Contact Factory
• MTBF	>20,000,000 hours	>20,000,000 hours	>20,000,000 hours	>20,000,000 hours
• Reliability specification:	MIL-HDBK-217F	MIL-HDBK-217F	MIL-HDBK-217F	MIL-HDBK-217F
• Crystal:	T05	Surface mount	Surface mount	Surface mount
• Package Style:	24-pin ddip, 0.5" profile	24-pin ddip, 0.5" profile	24-pin flatpak, 0.3" profile	24-pin flatpak, 0.3" profile
• Weight:	<30 grams	<30 grams	<30 grams	<30 grams

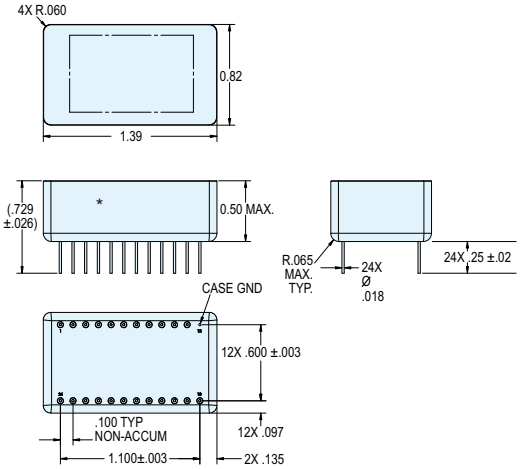
24-PIN FLATPAK OUTLINE DRAWING



24-PIN FLATPAK CONNECTION DESCRIPTIONS

PIN NO.	FUNCTION
1	VCXO OUTPUT
2	N/C
3	N/C
4	N/C
5	N/C
6	N/C
7	N/C
8	N/C
9	N/C
10	N/C
11	N/C
12	GROUND
13	Q
14	Q
15	GROUND
16	N/C
17	N/C
18	N/C
19	N/C
20	N/C
21	N/C
22	N/C
23	N/C
24	+5VDC(OR3.3VDC)

24-PIN DDIP OUTLINE DRAWING



24-PIN DDIP CONNECTION DESCRIPTIONS

PIN NO.	FUNCTION
1	EXTERNAL RESISTOR OR V TUNE
2	N/C
3	N/C
4	N/C
5	N/C
6	N/C
7	N/C
8	N/C
9	N/C
10	N/C
11	N/C
12	CASE GND
13	RF OUT
14	N/C
15	N/C
16	N/C
17	N/C
18	N/C
19	N/C
20	N/C
21	N/C
22	N/C
23	N/C
24	8-15 VDC INPUT

9960

Hybrid Space-Qualified TCXO

KEY FEATURES

- Choose between fixed-frequency or voltage-controlled TCXO's.
- 10 MHz to 225 MHz Output Frequency
- MIL-PRF-38534 class K Certified
- Exceptional Long Term Frequency Accuracy
- Temperature Stability better than ±1ppm
- Low Aging and Phase Noise
- Radiation Hardened
- Environmentally Robust

OPTIONS

Available options for this product include:

- Output frequency
- Ddip package height (9961 vs. 9962)

Contact Symmetricom to configure a 9960-series oscillator that will meet your specific needs.

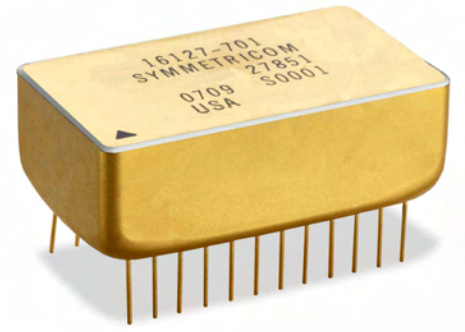
Symmetricom has a 35-year legacy of high-reliability and high-performance quartz oscillators, and these oscillators are now available in hybrid construction for applications that require minimal size, weight and power. The model 9960 is a temperature compensated crystal oscillator (TCXO) capable of fixed frequency or voltage controlled operation.

The 9960 series utilizes 3rd or 5th overtone AT-cut crystals in a Colpitts configuration with optional multiplication circuitry and output amplifier or driver stages. The precision crystals are contained within hermetic or vacuum sealed packages housed within the hybrid circuit package, resulting in the lowest end-of-life frequency drift possible. Compensation is achieved by characterization of the individual crystals over temperature, and the incorporation of specific components to offset the effect of changes in the temperature.

These hybrid oscillators are based on heritage designs and manufacturing techniques proven for reliability in numerous space applications. The hybrids are manufactured in a mil-prf-38534 class K facility, in a class 100,000 clean room that provides for maximum reliability.

Output frequency and package style can be chosen to meet a wide variety of standard and custom applications.

The 9960 series has demonstrated excellent performance after exposure to high levels of shock, vibration, and radiation, consistent with the rigorous requirements of space applications.



9960 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

	9960	9961	9962
• Standard Output Frequency	10 MHz	100 MHz	100 MHz
• Available Output Frequency	8 MHz to 20 MHz	10 MHz to 225 MHz	10 MHz to 225 MHz
• Initial Accuracy	Settable to ±0.1 ppm via external voltage or resistor	Settable to ±0.1 ppm via external voltage or resistor	Settable to ±0.1 ppm via external voltage or resistor
• Format	Sine wave	Sine wave	Sine wave
• Amplitude	≥7.0 dBm	≥7.0 dBm	≥7.0 dBm
• Harmonic distortion	<-20 dBc	<-20 dBc	<-20 dBc
• Subharmonic distortion	<-20 dBc	<-20 dBc	<-20 dBc
• Non-harmonic distortion	<-65 dBc	<-65 dBc	<-65 dBc
• Load impedance	50 Ω	50 Ω	50 Ω
• Load VSWR	2.0:1	2.0:1	2.0:1

PERFORMANCE PARAMETERS

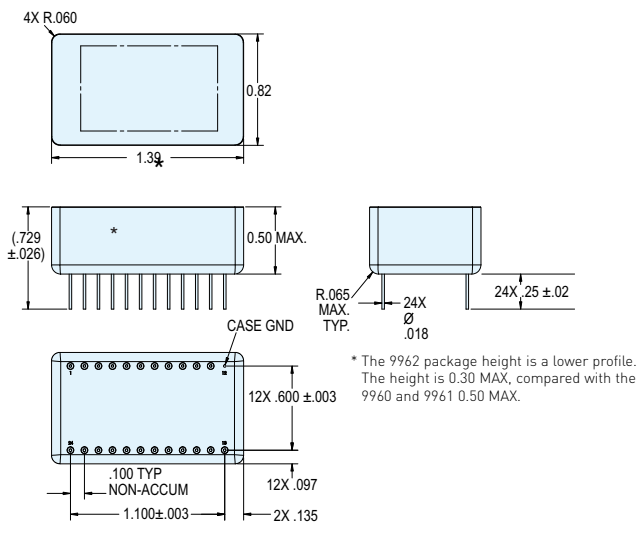
• SSB phase noise (static)			
1 Hz	-78 dBc	-45 dBc	-42 dBc
10 Hz	-108 dBc	-75 dBc	-74 dBc
100 Hz	-125 dBc	-105 dBc	-105 dBc
1 kHz	-142 dBc	-135 dBc	-135 dBc
10 kHz	-150 dBc	-150 dBc	-150 dBc
100 kHz	-150 dBc	-150 dBc	-150 dBc
• Aging			
Per year:	≤0.5 ppm	≤1 ppm	≤1 ppm
10 years:	≤3 ppm	≤5 ppm	≤8 ppm
• Acceleration sensitivity			
Per g, total gamma:	≤2.0E-9	≤2.0E-9	≤3.0E-9
• Frequency change vs. Temperature			
-40° C to +85° C:	N/A	±2 ppm	±2 ppm
-20° C to +70° C:	N/A	±1 ppm	±1 ppm
0° C to +50° C:	±0.5 ppm	±0.5 ppm	±0.5 ppm
• Input Voltage			
Selectable range*:	8 - 15 Vdc	8 - 15 Vdc	8 - 15 Vdc
Sensitivity:	<0.1 ppm for ±5% voltage change	<0.1 ppm for ±5% voltage change	<0.1 ppm for ±5% voltage change
• Steady-state power consumption:	220 mW	220 mW	220 mW
• Electronic Frequency Control (EFC) Range	±3 ppm	±10 ppm	±10 ppm
EFC Input	0 to 6 Vdc	0 to 6 Vdc	0 to 6 Vdc
EFC Linearity	±10%	±10%	±10%
• Load change sensitivity:	<0.1 ppm for ±5% load change	<0.1 ppm for ±5% load change	<0.1 ppm for ±5% load change

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

• Operating Temperature:	-55° C to +125° C	-55° C to +125° C	-55° C to +125° C
• Storage temperature:	-65° C to +125° C	-65° C to +125° C	-65° C to +125° C
• Random vibration			
Operating (endurance):	20 g rms	20 g rms	20 g rms
• Pyrotechnic shock:	500g for 1ms half-sine impulse	500g for 1ms half-sine impulse	500g for 1ms half-sine impulse
• Radiation Performance:			
Total Dose:	100 kRad (Si)	100 kRad (Si)	100 kRad (Si)
ELDRS:	Compliant	Compliant	Compliant
SEL:	Compliant	Compliant	Compliant
Neutron Fluence:	Contact Factory	Contact Factory	Contact Factory
Prompt Dose Rate:	Contact Factory	Contact Factory	Contact Factory
• EMI/EMC Performance:	Contact Factory	Contact Factory	Contact Factory
• MTBF	>20,000,000 hours	>20,000,000 hours	>20,000,000 hours
• Reliability specification:	MIL-HDBK-217F	MIL-HDBK-217F	MIL-HDBK-217F
• Crystal:	T08	T05	Surface mount
• Package Style:	24-pin ddip, 0.5" profile	24-pin ddip, 0.5" profile	24-pin ddip, 0.3" profile
• Weight:	<30 grams	<30 grams	<30 grams

Note: *above specifications assume operation at +/- 5% from selected voltage

9960 / 9961 / 9962 OUTLINE DRAWING



* The 9962 package height is a lower profile. The height is 0.30 MAX, compared with the 9960 and 9961 0.50 MAX.

9960 CONNECTION DESCRIPTIONS

PIN NO.	FUNCTION
1	EXTERNAL RESISTOR OR V TUNE
2	N/C
3	N/C
4	N/C
5	N/C
6	N/C
7	N/C
8	N/C
9	N/C
10	N/C
11	N/C
12	CASE GND

PIN NO.	FUNCTION
13	RF OUT
14	N/C
15	N/C
16	N/C
17	N/C
18	N/C
19	N/C
20	N/C
21	N/C
22	N/C
23	N/C
24	SUPPLY VOLTAGE

Phase Noise & Allan Deviation Test Sets

Your Network. Optimized.

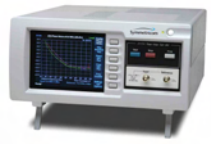
Over 20 years of research both at the National Institute of Standards and Technology (NIST) and in private industry have been dedicated to the research and development of Symmetricom's phase noise and Allan deviation (ADEV) test sets.

Our digital, state-of-the-art test sets bring a paradigm shift to the way that phase noise and ADEV measurements are made. What was once a complicated and costly procedure has now been made easier, more accurate, and more cost effective.

Typically used to characterize high precision oscillators and atomic clocks, Symmetricom's test sets are simple one-box solutions that characterize even the lowest noise references more accurately than ever before.

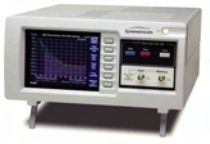
Your Network. Optimized.

Test Set Product Matrix



5115A

5120A



5125A

	5115A	5120A	5125A
Input frequency range	1-30 MHz	1-30 MHz	1-400 MHz
Simultaneous real-time phase noise and Allan deviation measurements	●	●	●
Frequency counter	●	●	●
Allan Deviation noise floor (at 1 sec)	1E-14	3E-15	3E-15
Cross correlation		●	●
Phase noise floor 10 MHz input, 1 Hz offset	-133 dBc/Hz	-145 dBc/Hz	-145 dBc/Hz
Phase noise floor 10 MHz input, 10 kHz offset	-147 dBc/Hz	-175 dBc/Hz	-170 dBc/Hz
Phase noise floor 100 MHz input, 1 Hz offset	–	–	-130 dBc/Hz
Phase noise floor 100 MHz input, 10 kHz offset	–	–	-170 dBc/Hz
Factory upgrade options	to 5120A	internal reference osc.	–

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5115A

High-Performance Phase Noise and Allan Deviation Test Set

KEY FEATURES/BENEFITS

- Simultaneous Phase Noise and Allan Deviation Measurements
- 1 - 30 MHz Frequency Range
- Measurement Results Displayed within Seconds: No External Data Processing Required
- Industry Leading Accuracy (±1.0 dB)
- Supports Measurements with Input and Reference at Different Frequencies
- Cost Effective Solution
- Allan Deviation Measurements (to over 300 Days)
- Phase Noise Measurements as Close as 0.1 mHz from the Carrier
- No Measurement Calibration Required: Saves Time
- Real-time Noise Floor Displayed
- Intuitive Remote Network Management and Data Acquisition
- Easy to Use Graphical User Interface
- Phase Noise Measurements Down to -147 dBc/Hz

ACCURATE, COST EFFECTIVE MEASUREMENTS IN SECONDS

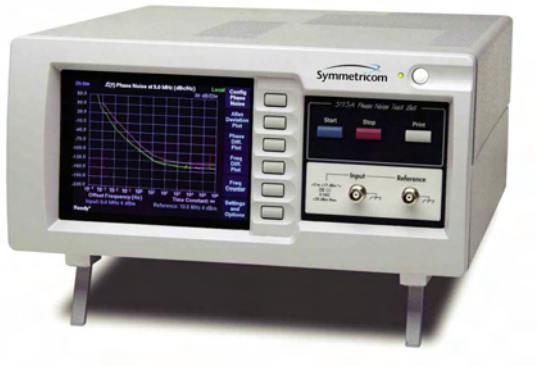
Making accurate phase noise and Allan deviation measurements has never been easier or more cost effective. The all-digital 5115A High-Performance Phase Noise and Allan Deviation (ADEV) Test Set transforms the way these measurements are made. Traditional analog measurement instruments require an external phase-lock loop, turning these types of measurements into a complicated and costly endeavor. Compare this to the innovative 5115A, which makes fast yet accurate single sideband (SSB) phase noise and ADEV measurements at the click of a button, all at a fraction of the cost of alternative solutions.

Symmetricom's 5115A is the easiest to use phase noise and ADEV test set in the world: simply connect the device under test (DUT) and a reference signal (which can be at a different frequency than the DUT) and press the 5115A's green **Start** button. Seconds later valid measurement data appears on the unit's high resolution display. With the all-digital 5115A, tedious multi-step configuration and calibration routines are no longer required.

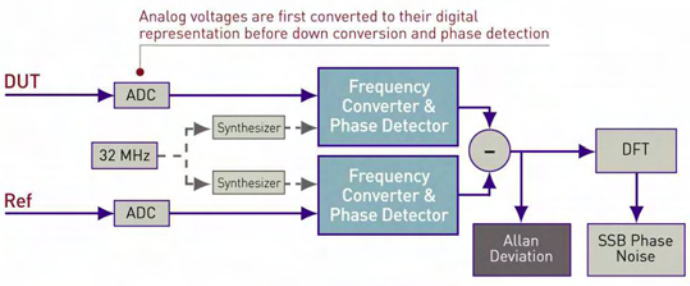
The 5115A leverages the extensive knowledge and experience obtained by Symmetricom during the development of the industry standard for ADEV measurements, the 5110A. In addition to ADEV measurement capability, the next generation 5115A provides phase noise measurement accuracy to previously impossible levels of ±1.0 dB. This combined with the superb phase noise and ADEV measurement floor means that with the 5115A you can characterize references more accurately than ever before.

Symmetricom's mastery of phase noise and ADEV measurement techniques as well as recent advances in high speed, low noise analog to digital converters, has allowed the combination of multiple measurement tools to be integrated into a single, one box solution. This enables the 5115A to make more accurate measurements while remaining cost effective.

The 5115A brings a paradigm shift to the way that phase noise and ADEV measurements are made. With the 5115A, measurements that used to be complicated and costly are now faster, easier, more accurate and more cost effective in both R&D and production environments.



5115A High-Performance Phase Noise and Allan Deviation Test Set



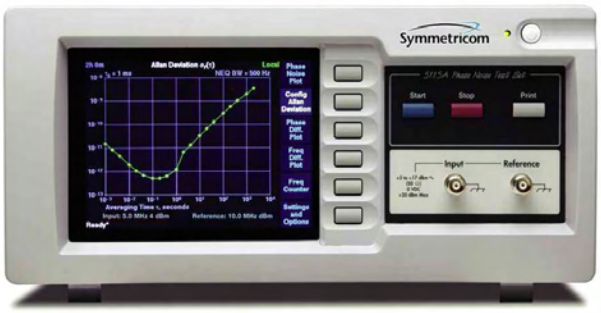
5115A Block Diagram

BENEFITS OF AN ALL-DIGITAL TEST SET

The 5115A combines sophisticated timing technologies into a single, advanced measurement instrument containing Symmetricom's patented phase measurement algorithm. As is shown in the *5115A Block Diagram* above, upon entry to the 5115A the DUT and reference signals are immediately converted to their digital representations. This allows the 5115A to make accurate measurements without the need for an external phase-lock loop, enabling calibration-free measurements. Additionally, the all-digital 5115A does not require that the frequency of the reference be the same as the DUT.

FUTUREPROOFED TEST SET

If future measurement requirements change such that the 5115A's phase noise and ADEV floor no longer meet your needs, the 5115A can be upgraded for even better performance. A quick factory upgrade converts the 5115A into a 5120A, improving the phase noise floor by up to 28 dB. For further information on the 5120A's specifications please see this unit's datasheet.



5115A SPECIFICATIONS

PERFORMANCE

- Input frequency range: 1-30 MHz (sinewave)
- Allan deviation: <1E-14 at 1 sec (0.5 Hz bandwidth)

Phase Noise Specifications

- Measurement accuracy: ±1.0 dB
- Offset frequency range: 0.1 mHz to 1 MHz
- System noise floor (for 10 MHz input):

Offset	ℒ(f) Phase Noise
1 Hz	-133 dBc/Hz
10 Hz	-143 dBc/Hz
≥100 Hz	-147 dBc/Hz

ELECTRICAL SPECIFICATIONS

- Input signal level: 3-17 dBm
- Input impedance: 50Ω
- Input connectors: TNC (supplied with two BNC adapters)

MECHANICAL & ENVIRONMENTAL SPECIFICATIONS

- Size: 34 cm x 17 cm x 44 cm (13" x 7" x17")
- Power: 100-240 VAC, 50-60 Hz, 40W (max), IEC 320 connector, power switch.
- Operating temperature: 15°C to 40°C
- Storage temperature: -25°C to 55°C
- Unit weight alone: 9 kg (19 lbs)
- Shipping package weight: 12 kg (25 lbs)

OPTIONS

- Rack Mount Tray Kit (Option 001)

UPGRADES

- Factory Upgradeable to 5120A - For Improved Noise Floor

PRODUCT INCLUDES

5115A Test Set, 2 TNC-BNC adapters, manual (on CD) and power cord. One-year warranty.

FRONT PANEL

- Display: Sharp, high-resolution 640x480 RGB LCD
- Buttons: 6 SoftKeys, Start, Stop, Print, Power
- TNC (2x): Input, Reference (3 - 17 dBm)
- LED: Power

REAR PANEL

- USB (2x): Supports mouse, keyboard and select PostScript-compatible printer connections
- Network: RJ-45 10/100BaseT Ethernet

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5120A

High-Performance Phase Noise and Allan Deviation Test Set with Ultra Low Noise Floor

KEY FEATURES/BENEFITS

- Simultaneous Phase Noise and Allan Deviation Measurements
- 1 - 30 MHz Frequency Range
- Measurement Results Displayed within Seconds: No External Data Processing Required
- Industry Leading Accuracy (±1.0 dB)
- Supports Measurements with Input and Reference at Different Frequencies
- Allan Deviation Measurements (to over 300 Days)
- Phase Noise Measurements as Close as 0.1 mHz from the Carrier
- No Measurement Calibration Required: Saves Time
- Real-time Noise Floor Displayed
- Optional Internal Reference Oscillator
- Best Price-Performance Solution
- Intuitive Remote Network Management and Data Acquisition
- Easy to Use Graphical User Interface
- Phase Noise Measurements Down to -175 dBc/Hz

ACCURATE, COST EFFECTIVE MEASUREMENTS IN SECONDS

Making accurate phase noise and Allan deviation measurements has never been easier or more cost effective. The all-digital 5120A High-Performance Phase Noise and Allan Deviation (ADEV) Test Set with Ultra Low Noise Floor transforms the way these measurements are made. Traditional measurement instruments require an external phase-lock loop, turning these types of measurements into a complicated and costly endeavor. Compare this with the 5120A, which makes fast yet accurate single sideband (SSB) phase noise and ADEV measurements at the click of a button, all at a fraction of the cost of alternative solutions.

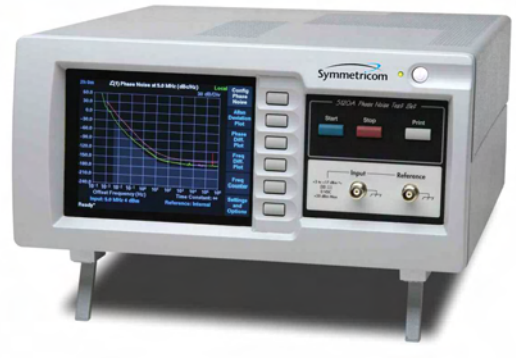
Symmetricom's 5120A is the easiest to use phase noise and ADEV test set in the world: simply connect the device under test (DUT) and reference signal (which can be at a different frequency than the DUT) and press the 5120A's green **Start** button. Seconds later valid measurement data appears on the unit's high resolution display. With the all-digital 5120A, tedious multi-step configuration and calibration routines are no longer required.

The 5120A leverages the extensive knowledge and experience obtained by Symmetricom during the development of the industry standard for ADEV measurements, the 5110A. In addition to top of the line ADEV measurement capability, the next generation 5120A provides phase noise measurement accuracy to previously impossible levels of ±1.0 dB. This combined with the best-in-industry phase noise and ADEV measurement floor means that with the 5120A you can characterize even your lowest noise references more accurately than ever before.

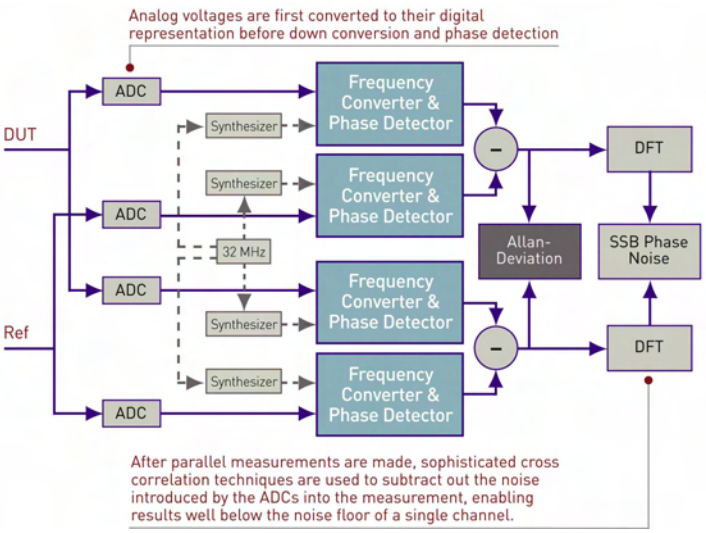
Symmetricom's mastery of phase noise and ADEV measurement techniques as well as recent advances in high speed, low noise analog to digital converters, has allowed the combination of multiple measurement tools to be integrated into a single, one box solution. This enables the 5120A to make more accurate measurements while remaining cost effective.

For further convenience, Symmetricom has added an internal reference oscillator option for the 5120A. This one box solution, known as the 5120A-01, saves you the time of procuring and calibrating an external reference. After making just one connection from the DUT to the 5120A-01, you can begin making accurate measurements.

The 5120A brings a paradigm shift to the way that phase noise and ADEV measurements are made. With the 5120A, measurements that used to be complicated and costly are now faster, easier, more accurate and more cost effective in both R&D and production environments.



5120A High-Performance Phase Noise and Allan Deviation Test Set with Ultra Low Noise Floor



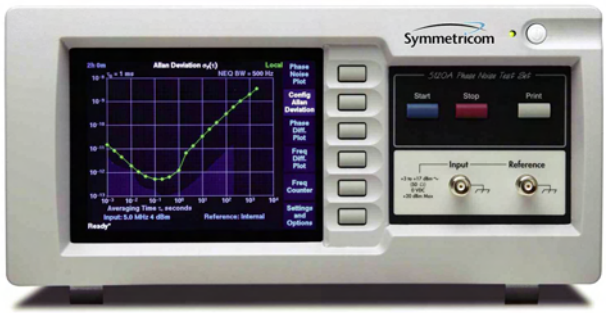
5120A Block Diagram

BENEFITS OF AN ALL-DIGITAL TEST SET

The 5120A combines sophisticated timing technologies into a single, advanced measurement instrument containing Symmetricom's patented phase measurement algorithm. As is shown in the *5120A Block Diagram* above, upon entry to the 5120A the DUT and reference signals are immediately converted to their digital representations. This allows the 5120A to make accurate measurements without the need for an external phase-lock loop, enabling calibration-free measurements. Additionally, the all-digital 5120A does not require that the frequency of the reference be the same as the DUT.

BENEFITS OF CROSS-CORRELATION

The parallel upper and lower channels in the *5120A Block Diagram*, illustrate the unit's innovative cross correlation technique. After making simultaneous measurements in parallel, the 5120A cross correlates the discrete Fourier transform from the two channels to estimate the noise of the input devices while rejecting the independent noises of the two measurement subsystems. This enables the end result to be well below the noise floor of a single channel instrument.



5120A SPECIFICATIONS

PERFORMANCE

- Frequency range: 1-30 MHz (sinewave)
- Allan deviation: <3E-15 at 1 sec (0.5 Hz bandwidth)

Phase Noise Specifications

- Measurement accuracy: ±1.0 dB
- Offset frequency range: 0.1 mHz to 1 MHz
- System noise floor (for 10 MHz input):

Offset	ℒ(f) Phase Noise
1 Hz	-145 dBc/Hz
10 Hz	-155 dBc/Hz
100 Hz	-165 dBc/Hz
≥10 kHz	-175 dBc/Hz

- System noise floor (for 10 MHz input) when using 5120A-01's internal reference:

Offset	ℒ(f) Phase Noise
1 Hz	-120 dBc/Hz
≥10 kHz	-168 dBc/Hz

ELECTRICAL SPECIFICATIONS

- Input signal level: 3-17 dBm
- Input impedance: 50Ω
- Input connectors: TNC (supplied with two BNC adapters)

MECHANICAL & ENVIRONMENTAL SPECIFICATIONS

- Size: 34 cm x 17 cm x 44 cm (13" x 7" x17")
- Power: 100-240 VAC, 47-63 Hz, 60W (max), IEC 320 connector, power switch.
- Operating temperature: 15°C to 40°C
- Storage temperature: -25°C to 55°C
- Unit weight alone: 9 kg (20 lbs)
- Shipping package weight: 12 kg (26 lbs)

OPTIONS

- Internal Reference Oscillator Option (5120A-01) – Factory Upgrade
- Rack Mount Tray Kit (Option 001)

PRODUCT INCLUDES

5120A Test Set, 2 TNC-BNC adapters, manual (on CD) and power cord. One-year warranty.

FRONT PANEL

- Display: Sharp, high-resolution 640x480 RGB LCD
- Buttons: 6 SoftKeys, Start, Stop, Print, Power
- TNC (2x): Input, Reference (3-17 dBm)
- LED: Power

REAR PANEL

- USB (2x): Supports mouse, keyboard and select PostScript-compatible printer connections
- Network: RJ-45 10/100BaseT Ethernet

5125A

High-Performance, Extended-Range Phase Noise and Allan Deviation Test Set

KEY FEATURES/BENEFITS

- Simultaneous Phase-Noise and Allan-Deviation Measurements
- 1 - 400 MHz Input Frequency Range
- Measurement Results Displayed within Seconds
- No External Data Processing Required
- Industry Leading Accuracy
- Makes Measurements with Input and Reference at Different Frequencies
- Allan-Deviation Measurements to over 300 Days
- Phase-Noise Measurements as Close as 0.1 mHz from the Carrier
- No Measurement Calibration Required: saves time
- Displays Internal Noise Estimate
- Easy to Use Graphical User Interface
- Excellent Phase-Noise Measurements Down to -170 dBc/Hz (typical) 10 kHz from the carrier (10 MHz input)

QUICK, ACCURATE, COST EFFECTIVE MEASUREMENTS NOW POSSIBLE OVER 400 MHz INPUT FREQUENCY RANGE

Symmetricom's new 5125A makes accurate phase-noise measurements on signals from 1 MHz to 400 MHz, covering the full range of the most commonly used frequency references. The 5125A, which requires absolutely no configuration, displays measurement results seconds after the **Start** button is pressed.

Symmetricom, the world's leading provider of high performance frequency standards, has designed the third generation, all-digital 5125A to meet the most demanding requirements. The 5125A's industry-leading close-in phase-noise performance, -140 dBc/Hz at a 1 Hz offset (10 MHz fundamental), makes it the perfect solution to characterize the lowest noise frequency references available, such as those used in RADAR and satellite communications.

The all-digital architecture employed in the 5125A uses advanced, high-speed, low-noise analog-to-digital converters in a patented architecture that does not require a phase-lock loop to make measurements. This provides multiple benefits for 5125A users. First, the input carrier signals can be characterized much more accurately than before, to within 0.1 mHz of the carrier. Second, the measurements can be used to simultaneously evaluate the short-term stability. Last but not least, the user does not need to calibrate each individual measurement setup.

In addition to phase-noise measurements, the 5125A simultaneously performs a variety of other measurements, which enables users to more fully characterize their Devices Under Test (DUT).

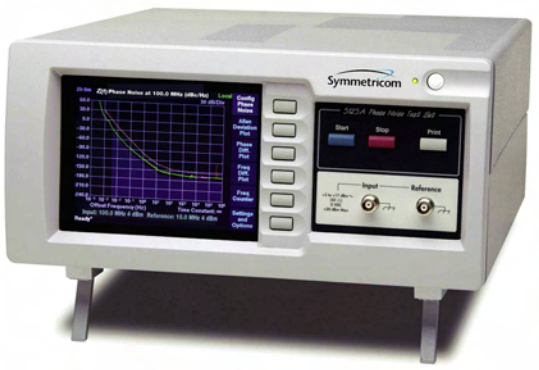
The industry-standard stability metric for short-term stability, the Allan deviation (ADEV), can be measured out to more than 300 days; the frequency and phase vs. time are plotted in real time; and the frequency counter displays 13 digits of precision in 1 second.

ESTABLISHED HERITAGE IN TIME AND FREQUENCY MEASUREMENTS

Over 25 years of research at the National Institute of Standards and Technology (NIST) and in private industry have come to fruition in Symmetricom's phase noise test sets, which employ both direct sampling of the RF waveforms as well as cross correlation, making it possible to easily characterize the highest performance time and frequency references. The 5125A builds on the experience gained with the Symmetricom's ground breaking 5120A by extending the direct sampling approach throughout the frequency range up to 400 MHz.

QUICKEST START-TO-FINISH MEASUREMENTS

Thanks to the 5125A's innovative internal architecture, it requires no user configuration or calibration and thus makes phase-noise measurements in a matter of seconds.



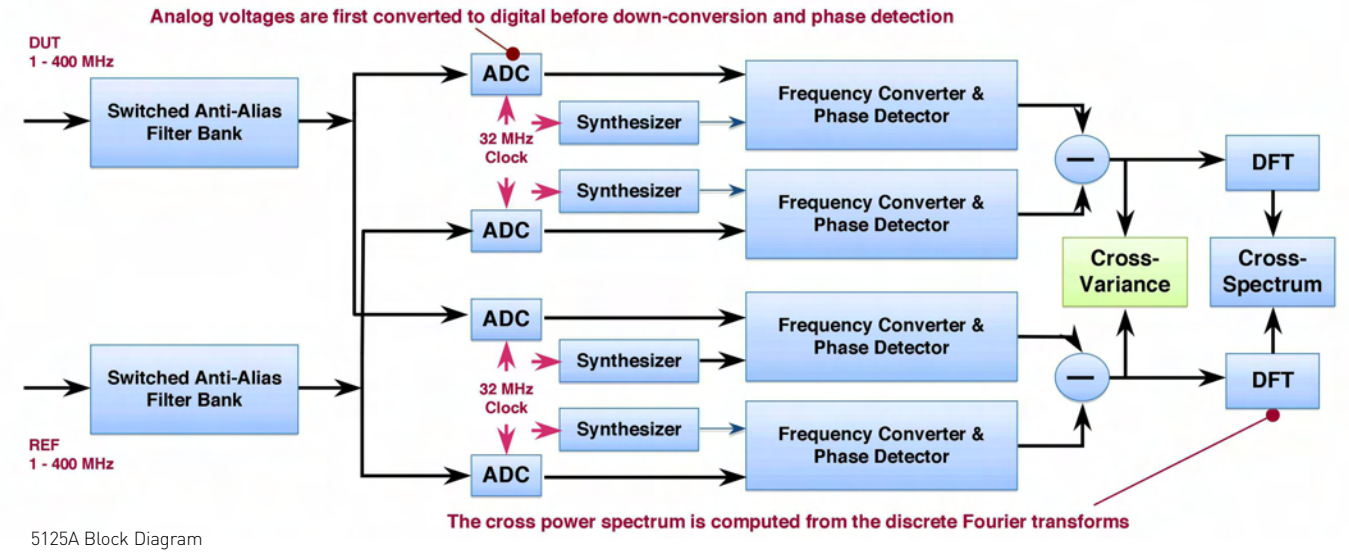
5125A High-Performance Extended-Range Phase Noise and Allan Deviation Test Set

BENEFITS OF AN ALL-DIGITAL TEST SET

The 5125A combines sophisticated timing technologies into a single, advanced measurement instrument. As is shown in the *5125A Block Diagram* below, after bandpass filtering to prevent undesired aliasing, the DUT and reference signals are converted to digital. This allows the 5125A to make accurate measurements without the need for an external phase-lock loop and to measure both phase noise and Allan Deviation simultaneously. The use of a ratiometric phase measurement that depends on a trigonometric phase detector eliminates the need for user calibration.

BENEFITS OF CROSS-CORRELATION

The parallel measurement channels in the 5125A Block Diagram, illustrate the unit's use of cross correlation. After making independent phase-difference measurements, the 5125A computes the cross spectrum using the discrete Fourier transforms from the two channels to estimate the noise of the input devices while rejecting the noises of the measurement sub-systems. This enables the instrument noise to be well below the noise floor of a single channel.



5125A Block Diagram

5125A SPECIFICATIONS

PERFORMANCE

- Frequency range: 1-400 MHz (sinewave)
- Allan deviation: <3E-15 at 1 sec (10-400 MHz, 0.5 Hz BW)

Phase Noise Specifications

- Measurement accuracy: ±1.0 dB
- Offset frequency range: 0.1 mHz to 1 MHz
- System noise floor (specifications): $\mathcal{L}$(f) dBc/Hz

Offset Frequency	Input Frequency 10 MHz	100 MHz	400 MHz
1 Hz	-140	-120	-110
10 Hz	-150	-130	-120
100 Hz	-157	-140	-130
1 kHz	-162	-150	-140
10 kHz	-165	-160	-150
>100 kHz	-165	-165	-155

- System noise floor (typical): $\mathcal{L}$(f) dBc/Hz

Offset Frequency	Input Frequency 10 MHz	100 MHz	400 MHz
1 Hz	-145	-130	-116
10 Hz	-155	-140	-126
100 Hz	-160	-150	-136
1 kHz	-165	-160	-146
10 kHz	-170	-170	-156
>100 kHz	-170	-170	-162

ELECTRICAL SPECIFICATIONS

- Input signal level: 3-17 dBm
- Input impedance: 50Ω
- Input connectors: TNC (supplied with two BNC adapters)

MECHANICAL & ENVIRONMENTAL SPECIFICATIONS

- Size: 34 cm x 17 cm x 44 cm (13" x 7" x17")
- Power: 100-240 VAC, 47-63 Hz
  IEC 320 connector, power switch.
- Operating temperature: 15°C to 45°C
- Storage temperature: -25°C to 55°C

OPTIONS

- Rack Mount Tray Kit (Option 001)
- Unlike the 5120A there is no internal reference option

PRODUCT INCLUDES

5125A Test Set, 2 TNC-BNC adapters, manual (on CD) and power cord. One-year warranty.

FRONT PANEL

- Display: High-resolution 640x480 RGB LCD
- Buttons: 6 SoftKeys, Start, Stop, Print, Power
- TNC (2x): Input, Reference (3-17 dBm)
- LED: Power

REAR PANEL

- USB: 2 each
- Network: RJ-45 10/100BaseT Ethernet
- Printers: Printers with internal PostScript interpreters only.

GPS Accessories

Your Network. Optimized.

The requirements, environment, goals and equipment of communication systems define the time and frequency solutions that are integrated into these systems.

Because no two communication systems are exactly alike, consideration that goes into choosing the core product, such as a GPS time and frequency receiver, must also go into the selection of those accessories that will guarantee the efficacy, protection and integrity of the entire system.

Symmetricom provides a broad array of GPS accessories, from lightning arrestors to in-line amplifiers to antennas, that are designed to support the unique requirements of each communication system.

Our experts can advise you on what accessories will best serve your needs, because when it comes to your success, we believe that no part is too small.

GPS Antenna Accessories

Lightning Arrestor

Lightning may damage GPS system components and receiving equipment, even without a direct hit, resulting in costly repairs and critical interruption of service. The lightning arrestor is designed to work in conjunction with a low-resistance, low-inductance ground to protect your GPS receiver and elements of the antenna system from lightning discharges and field-induced electrical surges. In-line lightning arrestors are mounted between the antenna and the point where the cable enters the building and require no additional power or wiring except the ground lead.

In-Line Antenna Amplifier

In-line amplifiers overcome signal attenuation in by amplifying the GPS signal. Mounting the amplifier inside the mounting mast helps protect it from moisture and exposure to the elements. Use the in-line amplifier for cable runs of 150 to 300 feet (45 m to 90 m).

L1 Antenna GPS Up/Down Converter

Use the GPS Down/Up converter for cable runs of 250 to 1500 feet (75 m to 457 m). GPS signal down/up conversion is required when signal losses in the antenna cable limit the distance between the receiver and the antenna assembly. The Down/Up Converter may also work with non-Symmetricom L1 GPS receivers. The signal output from the converter is L1 C/A code that can be decoded by any L1 GPS receiver.

Antenna Splitter

An antenna splitter may be used to drive multiple GPS receivers using a single antenna. With built-in amplification to overcome splitter losses, the Active Splitters may be conveniently cascaded without adding separate amplifiers and bias-tees between splitters. Power is conveniently obtained from the GPS receiver(s) connected to the amplifier, eliminating the need for a separate dc power supply and wiring.

GPS ANTENNA SYSTEM RULES

Rule 1. Antenna placement.

A. View of the sky

Select an area where the GPS antenna will have an unobstructed view of the sky. An ideal position has no obstructions above 10 degrees above the horizon. The total blockage of the sky (due to buildings, mountains, etc.) should be less than 50%. If less than 50% of the sky is visible to the antenna, contact Symmetricom for further assistance.

B. Lightning considerations

Locate the antenna at least 15 meters away from lightning rods, towers, or structures that attract lightning. GPS antenna damage is usually not the result of a direct lightning strike, but the effects of a lightning strike on a nearby structure. Locate the GPS antenna lower than any structures that may attract a strike.

C. Maintenance considerations

If the GPS antenna fails or must be checked, having the antenna positioned in an accessible location will facilitate maintenance. Avoid installing the antenna on a tower, which requires a specialist to maintain.

D. Interference consideration

Avoid the direct radiation from transmitting antennas (such as TV or Cellular).

Rule 2. Is a GPS line amplifier needed?

A. Cable length

Add up the total length of all the cables for the installation. If the total cable length is 150 feet or less, no amplifier is needed. If the total length is between 150 feet and 300 feet, a line amplifier is required. For lengths greater than 300 feet, contact Symmetricom for further assistance.

B. Placement

Mount line amplifiers as close to the antenna as possible. Connect the amplifier directly to the antenna. The line amplifiers fit nicely inside the antenna mast where they are protected from the weather.

Rule 3. Lightning arrestors.

A. Is a lightning arrestor needed?

Very probably, yes. Lightning does not have to strike the antenna to significantly damage the antenna and GPS receiver. Lightning strikes induce damaging voltages in the antenna system when striking nearby objects.

B. What do I need?

A commonly used configuration is to place a lightning arrestor where the antenna cable enters the building (either inside or outside), because there is often a good earth ground nearby to connect to. If the cable between this lightning arrestor and
the GPS receiver is longer than four meters, it is good practice to place a second lightning arrestor within four meters of the GPS receiver. The second arrestor reduces any lightning-induced voltages in the cable to the receiver.

C. Grounding

The lightning arrestor does not need a grounding strap if it is directly bolted to a grounding plate. A grounding strap should be used if you cannot connect directly to a grounding plate.
If you are not comfortable designing your own lightning protection system, seek professional assistance. This is only a guide.

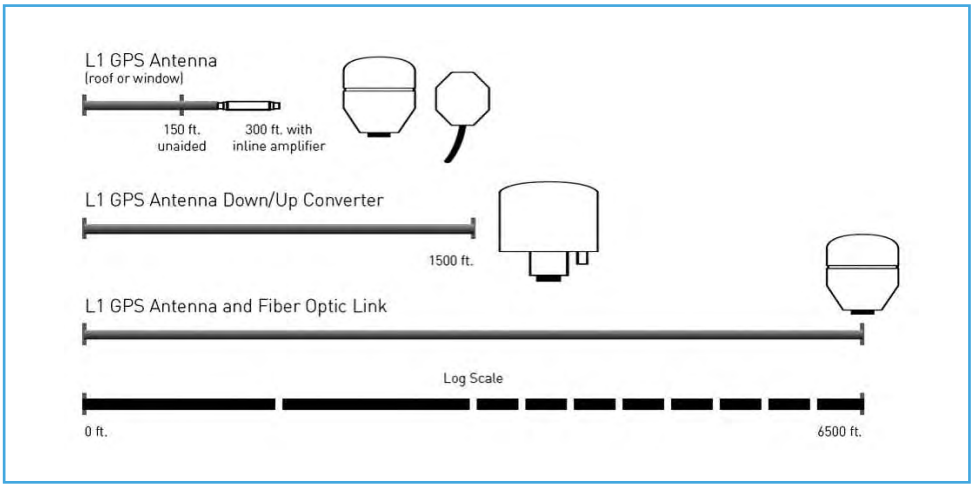
Rule 4. Interconnect cables.

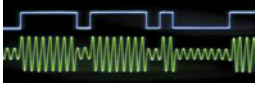
A. Cable options

Symmetricomís interconnect cables are available in various lengths. For ease of pulling antenna system cable through a conduit, or if you wish to cut the cable to an exact length, you may choose to have a connector on only one end.

B. Multiple antenna site installations

Multiple site installations may be done more efficiently using bulk cable and a connector installation tool kit. For more information about multiple antenna site installations or general questions about GPS antenna system installation, please contact Symmetricomís Customer Technical Assistance Center.





Symmetricom Global Services

Your Expert Service and Support Partner

Symmetricom Global Services (SGS) is the dedicated services division of Symmetricom, Inc. We are 100% focused on service and can provide the assistance you need at anytime, anywhere.

Symmetricom serves a wide variety of domestic and international markets, each one with their unique issues. Our team of professional specialists can provide daily service and support solutions for:

- Time and frequency solutions for Aerospace and Defense applications
- Synchronization for Global Telecommunications Networks
- High precision frequency standards, including Cesium atomic clocks, Hydrogen Masers, Rubidium and Quartz
- Time and frequency generators for public utilities and energy management
- Network time servers and othersynchronization and timing solutions for enterprise networks

Because we understand that each business within these markets has unique needs, we have established processes, people and systems that are organized to address their specific requirements.

Your feedback is also very important to us. We take your satisfaction seriously. Through annual surveys and satisfaction questionnaires, we actively encourage your comments. We are always striving to exceed your expectations. If you have any comments, you can always email them to us at: **customer_relations@symmetricom.com.** We look forward to hearing from you.

Our service products are organized into three main categories:

- Maintenance
- Training
- Installation

MAINTENANCE

Our maintenance programs make things easier and less expensive for you. Whether you are involved in secure communication, test and measurement, metrology, range instrumentation, IT networks, or avionics, we will work with you to not only solve issues but also to find more cost effective alternatives to current processes.

Basically, our goal is to add value to your operations. Our maintenance offerings include Technical Support, On-Site Maintenance, Extended Warranty, Express Loaner Service, Direct Cesium Tube Replacement, Calibration service and Repair services.

Technical Support

Technical Support is available globally 24 hours a day, 7 days a week, 365 days a year. Coverage is available for all Symmetricom hardware and software. From answering equipment questions to troubleshooting problems, we have the expertise to quickly and efficiently assist you.

On-Site Maintenance

On-Site Maintenance is an on-site service to resolve issues with Symmetricom equipment. Our technical expert will travel to your location and troubleshoot the equipment, making repairs if necessary (spare parts are supplied by the customer or Symmetricom's Express Loaner Service). On-Site Maintenance services are available on an annual contract basis with guaranteed response times or on a case-by-case basis as you need the support and staff can be scheduled to visit your site.

Extended Warranty

Extended Warranty contracts are available for Symmetricom hardware products. They extend your initial return-to-factory repair warranty services and help you avoid the time and expense necessary in requesting, purchasing and processing payments for individual repairs by providing you with a contract return authorization number. An Extended Warranty contract is the most effective method for you to obtain repair services for your Symmetricom products and includes guaranteed repair turnaround time. As an alternative, customers may request and purchase repairs on a case-by-case basis.

All together, our maintenance programs are designed to offer you helpful support, costs savings and peace of mind.

SPECIAL TIMING, TESTING AND MEASUREMENT MAINTENANCE PROGRAMS

Time Server Express Loaner Service

Our Time Server Express Loaner Service, available in the United States and Canada, ships a loaner network time server overnight to your location in the event your time server fails. With your Express Loaner contract, you simply place a call to Symmetricom Global Services (SGS) and tell us the model of your Symmetricom time server. We then ship that model overnight to your specified location. Once delivered, you install it and SGS will be available by telephone if you need help with the installation.

Included with the Express Loaner are completed shipping documents that will let you ship back the failed unit to Symmetricom's repair facility. Just place your failed unit in the shipping box, attach the label and send it. We pay all the freight charges.

Once your unit is repaired (usually in less than 30 days) we ship it back to you. We include a return shipping label to make it easy for you to return the Express Loaner. Just place the Express Loaner in the shipping box, attach the label and send it. Again, we pay all the freight charges.

Symmetricom's Express Loaner Service is our answer to supporting maximum uptime for your enterprise.

Symmetricom Global Services

Direct Cesium Tube Replacement

Direct Cesium Tube Replacements are available for many models of cesium instruments manufactured by Symmetricom, Agilent® and FEI®. If you want to renew your cesium tube life span and restore performance at less than the cost of purchasing a new unit, this service is for you. Quality installation at our factory is guaranteed and both standard performance and high performance cesium tubes are available. More information is available online by clicking here.

Calibration Service

Calibration service is available for selected cesium, rubidium and quartz instruments as well as for our Phase Noise and Allan Deviation Test Sets. Since these products are normally deployed in or test critical, high reliability timing applications, our calibration service helps ensure your unit's performance is meeting expectations. Cesium units undergo a Frequency Accuracy Stability measurement in our factory, and are calibrated to published specifications from the United States Naval Observatory (USNO). Rubidium and quartz units are calibrated to our factory standard specifications. We also conduct a physical evaluation of each product, so if your unit needs any repairs, we'll let you know.

TRAINING

Most of our customers operate highly sophisticated equipment. Many work in the most hostile and demanding environments. We pride ourselves on offering these customers solutions that are designed for relative ease of use and absolute success. We also make it easy for them to receive all the necessary training so they can succeed in their critical applications. SGS training courses focus on the application, operation and maintenance of Symmetricom products. Taught by expert instructors, students receive training in functionality, troubleshooting, installation and maintenance. Students graduating our training courses will thoroughly understand the product. A trained staff helps you avoid problems from the start, since they will know the proper methods of installation and maintenance. If a problem does arise that can't familiar enough with the product to work through troubleshooting and correction procedures with our telephone Technical Support staff. SGS training courses help protect your equipment investment and ensure the proper operation of your system or network.

Training courses are available for all Symmetricom products. Courses at our training centers include hands-on work with Symmetricom equipment, and can be scheduled at our facilities in San Jose (California, USA), Santa Rosa (California, USA) or at customer-designated locations.

If you have a unique training requirement, we can work with you to develop a customized class or seminar. The length and scope of instruction can be tailored to fit your specific needs.

TRAIN-THE-TRAINER

For customers with their own training staff, we offer Training License programs. You receive Train-the-Trainer instruction from our experts, along with the rights to reproduce and modify our training materials for your use. A Training License also includes any course updates we make, for as long as we offer the course. If you have a large number of employees you want trained, this may be the most cost-effective solution for you.

In all our training offerings, we look forward to helping you provide essential skills for your staff.

INSTALLATION

Symmetricom products are designed to operate in a customer's unique and sophisticated environment. Installed properly, Symmetricom products will exceed your expectations. We offer installation services on all Symmetricom products to ensure a proper and successful installation. We adhere to strict quality controls and always use our certified installation personnel.

Ordering our installation service means the job will be done correctly and on-time. We can do the work during or after normal business hours. We can also schedule a rush installation if you need it right away. Our trained staff will make sure your Symmetricom equipment is in place and working properly before we leave.

To ensure the installation goes smoothly, we offer our Site Survey service. This includes a pre-installation checklist so we can identify any issues before work begins. It will pinpoint any obstacles so we can plan around them. Basically, a Site Survey tells us exactly what you need for a successful installation, covering all the details like cable length, type of conduit and optimum GPS antenna location (if applicable).

We also provide you with our all-inclusive statement of work before any work begins. This covers all installation responsibilities and ensures there will be no hidden costs.

QUALITY GUARANTEED

Our Quality system is certified to ISO 9001/2000. We regularly solicit your comments regarding our support services to continually improve your experience. Your satisfaction is our goal.

CONTACT US

Please visit us online at
www.Symmetricom.com

Your Symmetricom sales representative has more information on all our products and services. You can also contact any of our regional offices.

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Terms & Conditions

This document set forth the terms and conditions of sale and/or acknowledgment ("Terms" or "Acknowledgment") of original purchaser's ("Buyer") purchase order for Symmetricom, Inc. ("Symmetricom") products ("Goods") These Terms may only be waived or modified in a written agreement signed by any authorized representative of Symmetricom. ANY ADDITIONAL OR DIFFERENT TERMS IN BUYER'S PURCHASE ORDER ARE HEREBY DEEMED TO BE MATERIAL ALTERATIONS, AND NOTICE OF OBJECTION TO THEM AND REJECTION OF THEM ARE HEREBY GIVEN. NEITHER SYMMETRICOM'S ACKNOWLEDGMENT OF THE PURCHASE ORDER, NOR SYMMETRICOM'S FAILURE TO OBJECT TO CONFLICTING, CONTRARY OR ADDITIONAL TERMS AND CONDITIONS IN THE PURCHASE ORDER SHALL BE DEEMED AN ACCEPTANCE OF SUCH TERMS AND CONDITIONS, OR A WAIVER OF THE PROVISIONS HEREOF. UNLESS OTHERWISE STATED IN A PREVIOUSLY EXECUTED WRITTEN PURCHASE AGREEMENT BETWEEN SYMMETRICOM AND BUYER COVERING THE SPECIFIC GOODS THAT ARE THE SUBJECT OF BUYER'S PURCHASE ORDER, SYMMETRICOM'S ACCEPTANCE OF BUYER'S PURCHASE ORDER IS SPECIFICALLY CONDITIONED UPON BUYER'S ACCEPTANCE OF THESE TERMS. These Terms establish the rights, obligations and remedies of Symmetricom and Buyer which apply to Buyer's order accepted by Symmetricom herein ("Agreement") for the purchase of Goods. Buyer's acceptance to these Terms shall be conclusively presumed from a) Buyer's receipt of this Acknowledgment without written objection within three (3) business days of receipt of this Acknowledgment, b) Buyer's instructing Symmetricom to begin work or to ship any Goods after receipt of this Acknowledgment, or c) acceptance by Buyer of all or any part of the Goods ordered.

1. INSPECTION; ACCEPTANCE – Inspection and acceptance of the Goods shall be the Buyer's responsibility. Buyer shall promptly inspect and accept any Goods after receipt of such Goods. In the event the Goods do not conform to the applicable Goods specifications or purchase order, such as obvious defects, Buyer shall promptly notify Symmetricom of such nonconformance in writing and Symmetricom shall have a reasonable opportunity to repair or replace the nonconforming Goods at its option. Buyer is deemed to have accepted the Goods and to have waived any such nonconformance in the event such written notification is not received by Symmetricom within ten (10) days after delivery of the Goods. To the extents any defects and damages are not discoverable during the above acceptance and inspection period, Buyer's sole remedy for such discovered defects shall be set forth in Section "Limited Warranty" below.

2. DELIVERY – Buyer acknowledges that delivery dates provided by Symmetricom are estimates only, and that Symmetricom is not liable for failure to delivery on such dates. Symmetricom shall make reasonable efforts to meet Buyer's delivery requirements. In the event Symmetricom is more than 30 days late against Symmetricom's acknowledged ship date, Buyer's sole remedy is to cancel the applicable purchase order.

3. EXPORT CONTROL – Buyer is hereby informed that the Goods and related technical data and information (collectively "Symmetricom Technology") provided by Symmetricom hereunder are subject to United Sates ("U.S.") export control laws, orders and regulations, including without limitation those enforced by the Office of Foreign Asset Control of the U.S. Department of Treasury, the Bureau of Industry Security of the U.S. Department of Commerce and the International Traffic in Arms Regulations enforced by the U.S. State Department (collectively "Regulations"), and may be subject to export or import regulations in other countries. These Regulations are available to Buyer and the public on these U.S. agencies websites and are subject to change from time to time by these same agencies. Buyer agrees to comply strictly with all such Regulations when re-exporting or otherwise shipping, transferring or transmitting Symmetricom Technology, and will not engage in any transactions in connection with Symmetricom Technology that would be prohibited by these Regulations. Without limiting the foregoing, Buyer shall not sell, transfer or otherwise make available any Symmetricom Technology to a) any person or company who is a legal resident or is controlled by a legal resident identified on the U.S. Department of Commerce's Denied Person or Entity List, the U.S. Department of Treasury's Specially Designated Nationals or Blocked Person Lists, or the Department of State's Debarred Parties List, as published and revised from time to time on these agencies websites; b) to any U.S. sanctioned or embargoed country; or c) any party if its knows or suspect that Symmetricom Technology will be used in the design, development, production or use of nuclear weapons, ballistic missiles chemical/biological weapons or proliferation or are destined for a facility engaged in such activities. Buyer acknowledges its responsibility to obtain a license to export, re-export or import as may be required. Symmetricom may suspend performance if Buyer is in violation of applicable regulations.

4. FORCE MAJEURE - Neither party shall be liable to the other for any delay or failure to perform its obligations hereunder (except the payment of sums due) to the extent caused by an event beyond such party's reasonable control, including but not limited to strikes, stoppage of work, delays by suppliers or subcontractors, embargoes, government regulations, delays or refusals to grant an export or import license or the suspension or revocation thereof or any acts of any government, fire, floods, severe weather conditions or any other acts of God; quarantine, public enemies, war, acts of terrorism or acts of civil or military authority ("Force Majeure event"). If such an event occurs, the affected party shall give immediate written notice to the other party. In the event Symmetricom is the affected party, Symmetricom's time of performance of any such obligations shall be extended for the time period of such delay or Symmetricom may elect to suspend performance hereunder for the duration of the Force Majeure event or terminate the affected purchase order or agreement without penalty and without being deemed in default or in breach thereof.

5. HAZARDOUS/TOXIC SUBSTANCES - Symmetricom shall provide Buyer with any Material Safety Data Sheets (MSDS) applicable to the Goods offered hereunder upon Buyer's request.

6. INFRINGEMENT INDEMNITY

6.1. Symmetricom agrees to defend Buyer, from and against any third party's suits, claims, actions or proceedings alleging that the Buyer's use of the Goods infringes or misappropriates such third party's United States patent, copyright, or other proprietary rights, and Symmetricom agrees to reimburse Buyer for any damages finally awarded against Buyer by a court of competent jurisdiction that may result from any such third party claim; provided, (a) Buyer notifies Symmetricom promptly in writing of the claim; (b) Symmetricom has the sole control of the defense and all related settlement negotiations; and (c) Buyer provides Symmetricom (at Symmetricom's request and reasonable expense) with all necessary assistance, information and authority to perform these duties. This entire Section "INFRINGEMENT INDEMNITY" states the sole obligation and exclusive liability of Symmetricom and Buyer's sole and exclusive remedy for any infringement
claims and actions.

6.2. This indemnity does not extend to any claim of infringement based on or arising from (i) Symmetricom's compliance with Buyer's designs, specifications or instructions; (ii) modification, alteration or enhancement of the Goods by Buyer or any other third party; (iii) the combination or use of the Goods furnished hereunder with materials or components not provided or specifically specified by Symmetricom; or (iv) the use of any version of software other than the latest commercially available version of the software made available to Buyer to the extent the infringement would have been avoided by use of such version. At any time after such a claim has been made or Symmetri-com believes is likely to be made, or such Good is finally found to be an infringement and Buyer is enjoined from its use, Symmetricom shall, at its option and using commercially reasonable efforts, either:

(a) Obtain for Buyer the right to continue using such Goods with no additional cost to Buyer; or
(b) Replace or modify such Goods, while retaining comparable functionality; or
(c) Accept the return of the Goods and refund the purchase price less a pro-rated portion for use of the Goods.

7. PRICES AND PAYMENTS - Unless otherwise agreed to by Symmetricom in writing, all prices are in U.S. Dollars and are based on delivery EX-Works Factory (EXW Factory). Price is exclusive of all applicable Taxes (as defined in Section "TAXES" below), freight charges, insurance and brokerage fees. Symmetricom shall send an invoice for each shipment of Goods to Buyer at the address specified by in Buyer's purchase order. Payment shall be made in U.S. Dollars. Payment term is subject to Symmetricom's credit

approval. Where approved, Buyer shall pay for the Goods in full thirty (30) days from date of invoice, without regard to delays for inspection or transportation and notwithstanding any order for services to be performed. For locations outside of U.S. or Canada, Buyer may prepay, or if the Order is over $10,000 USD, pay by means of an irrevocable letter of credit, drawn or confirmed by a U.S. bank in favor of Symmetricom, with drafts payable at sight, unless otherwise agreed in advance by Symmetricom. All bank charges incurred by the opening bank and charges to effect payment to Symmetricom in U.S. Dollars shall be Buyer's responsibility. Overdue payments shall bear interest of one and one-half percent (1.5%) per month or the maximum rate allowable by law.

8. **QUALITY -** Symmetricom utilizes quality assurance procedures consistent with ISO 9001/2000, and shall provide evidence of such compliance upon Buyer's request.

9. **LICENSE; INTELLECTUAL PROPERTY OWNERSHIP -** As between Symmetricom and Buyer, Buyer acknowledges and agrees that Symmetricom owns all right, title and interest to all Intellectual Property Rights (hereinafter defined) to the software, technology, designs, engineering details, schematics and similar data relating to or incorporated in the Goods and any accompanying documentation or information derived from the foregoing. Buyer acknowledges and agrees its use of the copyright and other Intellectual Property Rights in and/or derived from the Goods, pursuant to these Terms shall not give the Buyer any right, title or interest in or to the Intellectual Property Rights in the Goods. No title to or ownership of any Intellectual Property Rights to the software, designs and technology incorporated or embodied in the Goods, including any engineering details, schematics data, accompanying documentation or information derived from the foregoing is transferred to Buyer, Buyer shall take reasonable precautions to prevent unauthorized access and use of the software and documentation by third parties. To the extent permitted by relevant law, Buyer shall not, nor allow any third party to copy, decompile, disassemble or otherwise reverse engineer the Goods, or attempt to do so. Buyer is prohibited from, and shall prevent any third party from, removing, covering or altering any of Symmetricom's patents, copyright, trademarks notices placed upon, embedded in or displayed by the Goods or their packaging and related materials. Symmetricom reserves all rights not specifically granted to Buyer hereunder. If a purchase order includes software or any product which may contain or consist of software or other intellectual property, such software or other intellectual property is licensed and not sold to Buyer, subject to Buyer's acceptance of all the terms and conditions contained in the software user license agreement, the terms and conditions of which are set forth in the license agreement accompanying such software or other intellectual property. "Intellectual Property Rights" means any patent, copyright, trade name, trademark, service mark, mask works, trade secret, know-how, or any other intellectual property right or proprietary right, whether registered or unregistered and whether now known or hereafter recognized in any jurisdiction.

10. **LIMITATION OF LIABILITY –** THE REMEDIES PROVIDED HEREIN ARE THE BUYER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL SYMMETRICOM BE LIABLE TO BUYER FOR ANY INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR PROFITS, LOST BUSINESS OPPORTUNITY, LOST DATA, EQUIPMENT DOWNTIME, OR DAMAGES RELATING TO BUYER'S PROCUREMENT OF SUBSTITUTE PRODUCTS OR SERVICES, WHETHER IN AN ACTION IN CONTRACT, TORT (INCLUDING STRICT LIABILITY), BREACH OF WARRANTY, OR OTHERWISE, ARISING OUT OF OR IN CONNECTION WITH THE GOODS OR THE PROVISION OF SERVICES HEREUNDER, EVEN IF EACH PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCEPT FOR LIABILITY FOR PERSONAL INJURY OR PROPERTY DAMAGE ARISING FROM SYMMETRICOM'S GROSS NEGLIGENCE OR WILLFUL MISCONDUCT, IN NO EVENT WILL SYMMETRICOM'S TOTAL CUMULATIVE LIABILITY IN CONNECTION WITH ANY ORDER HEREUNDER OR SYMMETRICOM'S PRODUCTS, FROM ALL CAUSES OF ACTION OF ANY KIND, INCLUDING TORT, CONTRACT, NEGLIGENCE, STRICT LIABILITY AND BREACH OF WARRANTY, EXCEED THE TOTAL AMOUNT PAID BY BUYER HEREUNDER. SOME JURISDICTIONS DO NOT ALLOW CERTAIN LIMITATIONS OR EXCLUSIONS OF LIABILITY, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY.

11. **PURCHASE ORDERS -** All purchase orders are subject to acceptance by Symmetricom. Except as stated in "DELIVERY", purchase orders accepted by Symmetricom may not be canceled except with Symmetricom's prior written consent, which consent maybe given by Symmetricom in its sole discretion. Buyers may contact Symmetricom Customer Assistance Center at (408) 428-7907, or toll-free in the USA at (888) 367 – 7966 for any questions concerning their orders.

12. **RESALE NOT INTENDED –** The Goods sold or licensed to Buyer by Symmetricom hereunder are not for resale by Buyer, unless Symmetricom agreed in advance in writing. Symmetricom has separate terms and conditions governing purchases for resale.

13. **RETURN OF GOODS -** Any return of Goods will be subject to Symmetricom's prior written consent and must be made pursuant to Symmetricom's return procedures then in effect. Any Goods accepted by Symmetricom for return must be returned, transport prepaid, to Symmetricom's facility in original boxes and packing material, unless otherwise agreed by Symmetricom. The Goods shall be returned to Symmetricom at the risk and responsibility of Buyer.

14. **SHIPPING; FREIGHT COSTS –** Symmetricom may ship the Goods from any of its factory location or its suppliers' factory location. Goods will be shipped "best way", unless specified otherwise in Buyer's purchase order. Unless agreed in advance by Symmetricom, shipment terms are EX-Works Factory (EXW Factory). All freight and transportation charges shall be the responsibility of the Buyer. In the event Symmetricom prepays transportation charges, Buyer shall be obligated to reimburse Symmetricom upon receipt of an invoice for such charges. Goods are packed and marked by Symmetricom in containers suitable for prevention of damage under normal commercial air or ground transportation and in accordance with the requirements of the carrier.

15. **SUPPORT -** Technical telephone support and on-site support are not included with purchases of Goods hereunder. Such support services are available for purchase by contacting Symmetricom at (408) 428-7907, or toll-free in the USA at (888) 367 – 7966.

16. **TAXES -** Price of Goods is exclusive of all applicable sales, use, excise, value added, and similar taxes, customs fees, duties, surcharges and other charges levied by any governmental authority (collectively "Taxes"), Buyer is responsible for the payment of all such Taxes, except for taxes based solely upon the income of Symmetricom. Buyer shall pay all costs, including collection costs, penalties, and interest, associated with its non-payment of such Taxes. If Buyer claims an exemption from any or all of the Taxes, it shall first provide Symmetricom with a validly issued exemption or resale certificate acceptable to the appropriate taxing authority.

17. **TERMINATION -** Symmetricom reserves the right, by written notice of default, to cancel or indefinitely suspend an accepted purchase order if: (i) Buyer defaults in the performance of its obligations hereunder, or otherwise breaches the contract, (ii) Buyer ceases business operations or enters into any bankruptcy, insolvency, receivership or like proceeding not dismissed within thirty (30) days, or assigns its assets for the benefit of creditors, or (iii) when obtaining third-party financing in connection with Buyer's Product purchase(s) fails to do so in a timely manner on terms satisfactory to Symmetricom.

18. **TITLE AND RISK OF LOSS –** Title (except for Software) and risk of loss of the Goods shall pass to Buyer upon delivery EX-Works Factory (EXW Factory).

19. **LIMITED WARRANTY.**

19.1 Hardware (including firmware) – Symmetricom warrants, for a period of twelve (12) months from Symmetricom's date of shipment, the Goods shall be free from defects in design, material, and workmanship under normal use and service, and shall conform to and perform substantially in accordance with Symmetricom's published specifications in

Terms & Conditions

effect at the time of shipment. Symmetricom further warrants that the Goods shall be free and clear of all liens and encumbrances and shall have good and valid title at the time of transfer by Symmetricom. This warranty shall survive inspection, acceptance, and payment by Buyer. Symmetricom does not warrant that the operation of the Goods shall be uninterrupted or error free or meet Buyer's intended use or purpose. Symmetricom's warranty does not cover failures caused by acts of God, including electrical or environmental conditions; abuse, negligence, accident, damage in transit; or improper site preparation.

19.1.1. This warranty shall be null and void in the event (i) Buyer or any third party repair or attempts repair of the Goods without Symmetricom's advance written authorization; or (ii) defects are the result of repairs, modifications, alterations, improper or inadequate maintenance by Buyer or third party; or (iii) of damage to said Goods are caused by Buyer or third party-supplied software, interfacing or supplies; or (iv) of improper use (including termination of non-certified third party equipment on Symmetricom's proprietary interfaces and operation outside of the product's specifications) by Buyer or third party; or (v) the Goods are shipped to any country other than that originally specified in the Buyer's purchase order.

19.1.2. Buyer's sole remedy for a breach of the foregoing Goods warranty, whether express or implied, howsoever arising, shall be as set forth in this Section. Goods not meeting the foregoing warranty during the warranty period shall be repaired or replaced, at Symmetricom's option, upon return of such Goods to Symmetricom's factory,; provided, however that Buyer has first obtained a return materials authorization ("RMA") number from Symmetricom authorizing such return. Buyer may obtain an RMA number by logging onto Symmetricom's website www.symmetricom.com. Buyer shall place the RMA number on the exterior packaging of all returns. Buyer shall be responsible for the shipping costs to ship the Good to Symmetricom and Symmetricom shall pay for shipping costs to return the repaired or replacement Good to Buyer. Repaired or replaced portion of the Good shall be warranted for the remainder of the unused warranty term or for ninety (90) days from shipment, whichever is longer.

19.2. Software - Symmetricom warrants that the accompanying media shall be free from defects in materials and workmanship under normal use for a period of ninety (90) days from date of shipment. The physical media warranty does not apply to defects arising from misuse, theft, vandalism, fire, water, acts of God or other similar perils. Symmetricom shall not be liable for any damages caused by the Buyer's failure to fulfill its responsibilities as stated above. Buyer's sole and exclusive remedy and Symmetricom's entire liability for a breach of the foregoing warranty shall be for Symmetricom, at its option to replace the Software media, or if unable to replace the Software media, then to refund the license fee paid for the Software.

19.3. THE FOREGOING WARRANTY SHALL BE THE ONLY WARRANTY WITH RESPECT TO THE SUBJECT MATTER HEREOF AND SHALL BE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF TITLE, MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON INFRINGEMENT HOWSOEVER ARISING. WHERE LEGISLATION IMPLIES IN THIS AGREEMENT ANY CONDITION OR WARRANTY AND THAT LEGISLATION VOIDS OR PROHIBITS PROVISIONS IN A CONTRACT WHICH EXCLUDE OR MODIFY THE OPERATION OF THAT CONDITION OR WARRANTY, THE CONDITION OR WARRANTY IS DEEMED TO BE INCLUDED IN THIS AGREEMENT. HOWEVER, SYMMETRICOM'S LIABILITY FOR BREACH OF THE CONDITION OR WARRNTY WILL BE LIMITED AT SYMMETRICOM'S OPTION TO REPLACE OR REPAIR THE GOODS. TO THE EXTENT ANY OF THE FOREGOING LIMITED REMEDY FINALLY FAILS ITS ESSENTIAL PURPOSE, SYMMETRICOM'S TOTAL LIABILITY TO BUYER FOR SUCH BREACH SHALL BE LIMITED TO THE ACTUAL PRICE PAID BY BUYER FOR THE DEFECTIVE GOODS AND SUBJECT TO THE "LIMITATION OF LIABILITY" SECTION.

NOTE: Symmetricom's GPS positioning products for navigation are an AID TO NAVIGATION only and MUST be used in conjunction with normal navigation practices.

20. GENERAL

20.1. **Arbitration -** Disputes hereunder shall be settled by binding arbitration under the rules and auspices of the American Arbitration Association then in effect. Such arbitration shall occur in the State of California. Judgment upon award(s) rendered by the arbitrator may be entered in any court having jurisdiction.

20.2. **Assignment -** purchase orders, payments, warranties and other rights or obligations hereunder may not be assigned or delegated by the Buyer without prior written consent of Symmetricom. Without limiting the generality of the foregoing, these Terms shall be binding upon and shall inure to the benefit of the parties' respective successors and assigns.

20.3. **Attorneys' Fees And Costs -** In the event of litigation arising out of any order hereunder, the prevailing party shall be entitled to reimbursement of reasonable attorneys' fees and costs in addition to any other relief awarded.

20.4. **Choice Of Law –** Orders hereunder shall be governed by and construed under the laws of the State of California, without regard to its conflicts of law provisions. The United Nations Conventions on Contracts for the International Sale of Goods are expressly excluded when interpreting orders hereunder.

20.5. **Delays -** In the event either party has knowledge of an event or circumstance that will prevent or threatens to prevent its timely performance hereunder, it shall immediately notify the other party in writing.

20.6. **Entire Agreement -** These Terms constitute the entire agreement between the parties relating to the subject matter hereof, and supersede all prior oral or written proposals, understandings, representations, warranties, covenants, and communications between the parties, and may not be explained or governed by any prior course of dealings between Symmetricom and Buyer or by trade custom or usage.

20.7. **Language -** The language of these terms and all notices, communications and proceedings regarding these Terms shall be in English.

20.8. **Notices -** Notice to any party required or permitted hereunder will be deemed to have been duly given on the day of service if served personally, on the day following the day on which notice is deposited with an overnight courier service having package tracking capability, or on the fifth (5th) day after mailing prepaid certified mail. Buyer's notice address shall be its address appearing on the accepted purchase order. Symmetricom's notice address shall be: Symmetricom, Inc., 2300 Orchard Parkway, San Jose, CA 95131, USA.

20.9. **Severability -** Any provision or portion hereof deemed to be invalid, illegal or unenforceable by a court of competent jurisdiction, shall not affect any other provision and the remainder of these Terms shall continue in full force and effect.

20.10. **Survival Of Obligations -** Such Terms that are intended by their meaning to survive termination hereof will survive such termination.

20.11. **Waiver -** The waiver by either party of a breach of any provision hereunder shall not operate or be construed as a waiver of any subsequent breach of that or any other provision.

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Your Network. Optimized.

Symmetricom

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