

● **TIMING, TEST & MEASUREMENT
PRODUCT CATALOG**



Welcome to Symmetricom's Timing, Test and Measurement Products Catalog



Since the beginning of time, the universe has had to deal with the laws of time. Every star, planet, system, and living organism has to have a relationship with time. Time plays an essential role in survival and death, in order and chaos.

At Symmetricom, our business is time—perfect time to be precise. For more than 30 years we have been defining the standards for timing, frequency and synchronization solutions. While our clients are not the planets or stars, we supply innovative applications and professional services for those industries that observe them. For those organizations that rely on order for their survival, our time and frequency devices heighten their efficiencies with a precision and reliability that is unmatched in the world.

Symmetricom serves a wide variety of domestic and international markets including industrial, metrology, telecommunications, utility, space, defense and avionics. Understanding that each business within these markets has unique needs, our processes, people and systems are organized to address a multitude of specific requirements. As the market leader, we provide the broadest range of off-the-shelf and customized time, frequency and synchronization solutions. They all share one thing in common—the pursuit of perfection.

This catalog represents our complete line of timing, test and measurement solutions. Every product in this catalog is backed by a knowledgeable Customer Service department, made up of a group of seasoned individuals that are well versed in the products they service and the industries they support. And because we understand that a product is only as effective as it is used, we offer comprehensive installation, maintenance, operations and growth support, training, and consulting services.

We believe our strength comes from our focused expertise. We make no claims of inventing time. We just work to perfect it. This way we can concentrate our efforts on supporting our customer's success.

Sincerely,

Bruce Bromage
EVP & GM, Timing Test and
Measurement Division

Perfect Timing. It's Our Business.

Symmetricom is the market leader in time, frequency and synchronization solutions. With over 30 years of experience, we offer solutions so precise they help define the world's standards. While we can't lay claim to inventing time, we can confidently state that we perfect it.

We offer a broad range of time and frequency products 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 and expertise in GPS and time code instruments.
- **Time & Frequency Distribution**
We offer the largest selection of time and frequency distribution receivers and modules in the marketplace.

- **Precision Frequency References**

We are the leading manufacturer of hydrogen, cesium and rubidium standards, and quartz oscillators.

- **Bus Level Timing**

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

- **Network Timing**

We make secure, precise, automatic and reliable time for Next Generation Network synchronization.

- **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 address the high reliability and rugged demands of this market.

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:

11:00 AM - 8:00 PM - EST





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“Precise time and frequency synchronization is critical to the operation and maintenance of electric power systems including generation, transmission and distribution. It is essential to service restoration as well as system analysis following any significant system disturbance including the blackouts of August 1996 and August 2003. Bonneville Power has used equipment from several different Symmetricom product lines for a number of years and has been very satisfied with their performance.”

Ken Martin

Principal Engineer

Bonneville Power Administration

GPS & Time Code Instrumentation

No other company in the world can offer our product breadth, precision and expertise in GPS and time code instruments.

Symmetricom has been providing Timing and Synchronization solutions for communications and satellite and ground based instrumentation from the beginning of the GPS program. Our time and frequency generators, receivers, and other GPS related instrumentation, were the early adopters of the GPS technology at its inception, and furthered its reliance on the GPS program as it grew to full operation with satellites hovering 20,000 plus kilometers over the earth.

From minimal infrastructure investment to missile launches, 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 1×10^{-12} Frequency Accuracy
- Supports Primary and Secondary Reference Inputs
- Configurable as Dual Redundant GPS Receiver in One Chassis
- Standard 10/100 base-T Ethernet Network Port with Telnet, SNMP
- Enterprise MIB, FTP (for Firmware Upgrades)
- 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
- Generator or Synchronized Generator
- Standard 1PPS, Selectable Pulse Rate Outputs, Alarm, Auxiliary Reference, and Code In/Out for AM or DC IRIG A, B or NASA 36

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, just by combining up to ten options, 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 Model 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.

Model XLi offers the industry's first network centric interface with Telnet, and SNMP as a standard feature and optional NTP, in addition to 1PPS; code In/Out for AM or DC IRIG A, B or NASA 36; programmable rates; alarm open collector; a 16-key keypad; RS-232/422 port; 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 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 (without S/A 99%).
- 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} @ 1Ksec
 - 1×10^{-12} @ 1 day
- Stability when not tracking satellites: 5×10^{-7} [0°C to 50°C] typical

TIME CODE UNIT (TCU) SYNC GENERATOR

- Sync code: IRIG A, B, NASA 36
- Code out: IRIG A, B, 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:
 - Six for signals:
- Serial and Ethernet port. 1PPS out, code in, code out, rate out, aux reference and Open Collector Alarm output (all with BNC female connector). All 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.
- 1PPS: Pulse width: 20 μ s ($\pm 1\mu$ s) on the rising edge on time, TTL levels into 50 Ω , BNC female connector.
- Code input: AM or DC code IRIG A, B, and NASA-36
AM Code: 0.5 Vp-p to 10 Vp-p, 100 k Ω ground, ratio (AM): 3:1 $\pm 10\%$
DC Code: Logic low <1.25 V and Min 300 mV, Logic Hi >1.25 V and Max 10 V.
Impedance: 100 K or 50 Ω
Polarity: positive or negative
Connector: BNC female
- Code out: Default is IRIG B AM
Format: AM or DC code IRIG A, B, and NASA-36.
AM Code: 3 Vp-p, into 50 Ω $\pm 10\%$, ratio (AM): 3:1.
DC Code: TTL into 50 Ω
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 50 Ω
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 kW to ground. 1 Vp-p to 3 Vp-p at 50 Ω to ground. Impedance: Configurable 1 k Ω or 50 Ω 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 43.3 cm x 38.9 cm)
Standard 19" [48.26 cm] EIA rack system, hardware included.
2U: 3.5" x 17.1" x 15.35"
(8.89 cm x 43.3 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 (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: 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 +12 Vdc
 - 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 pages for complete details.)

- Network time server on standard network port
- Telecommunications interface (E1 and T1 output options)
- 1, 5, 10 MHz/MPPS frequency outputs
- Low phase noise frequency output
- Multicode output for IRIG A, B, E, G, H, XR3/2137 and NASA 36
- N.8 frequency synthesizer, 8KPPS to 8.192MPPS in 8KPPS steps
- DC power supplies (12 Vdc, 24 Vdc, and 48 Vdc options)
- Oscillator upgrades: OCXO, High Stability, OCXO, Rubidium, High Stability Rubidium
- Frequency measurement
- Time interval/event timing
- Programmable pulse output
- Power Utility Frequency and Time Deviation Monitor
- Have Quick/1PPS Time and Frequency Reference
- N.1 Frequency Synthesizer, 1PPS to 50MPPS in 1PPS steps
- Extended cable lengths
- 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



Rear View



XLi SAASM

Time and Frequency Receiver

KEY FEATURES

- SAASM PPS GPS Receiver with RAIM
- Configurable as Dual Redundant SAASM GPS P(Y) Receiver in One Chassis
- Military Signal P(Y) Code SAASM GPS Receiver and Civil Signal C/A-Code GPS Receiver
- Better than ± 20 Nanoseconds RMS Accuracy to UTC
- Better than 1×10^{-12} Frequency Accuracy (1 day averaging)
- Standard 10/100 base-T Ethernet Network Port with Telnet, SNMP
- 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 or NASA 36

The XLi SAASM Time and Frequency Receiver is an ultra precision 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 is designed to prevent hostile imitation (spoofing) of GPS signals by decrypting the P(Y) code in addition to the removal of SA (Selective Availability) when enabled. With the dual frequency XLi SAASM, the P(Y) code is received on both the L1 and L2 bands.

The XLi SAASM supports encrypted and unclassified (controlled) black key which can be distributed and loaded electronically. Decryption of the black key takes place within the SAASM module.

Taking into account the Joint Chiefs of Staff mandate that all newly fielded DoD systems using GPS shall use SAASM PPS devices no later than 1 October 2006 (unless waived), 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 a network centric interface with telnet, and SNMP as a standard feature and optional NTP, in addition to 1PPS (Pulse Per Second); code In/Out for AM or DC IRIG A, B or NASA 36; programmable rates; open collector alarm; a keypad; RS-232/422 port; time interval/ event timing (TI/ET); frequency measurement and more.



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

XLi SAASM Specifications

GPS SAASM RECEIVER

- Receiver input: L1/L2, P(Y) code (PPS), SAASM
- Tracking: 12 parallel, dual-frequency channels with RAIM (Receiver Autonomous Integrity Monitoring)
- Crypto Key input: DS-102. Compatible with KYK-13, KOL-18, AN/CYZ-10. Black/red key support. Front panel connector.
- Security: SAASM GPS receiver
- Antenna/preamplifier: L1 1574 MHz and L2 1227 MHz, 40 dB gain, all weather, outdoor mounting
- Acquisition time: Cold start <20 min. (typical)
- 1PPS output accuracy: UTC(USNO) ± 20 nsec RMS, 100 nsec peak
- Frequency output accuracy: 1×10^{-12} @ 1 day
- Frequency/timing Allan Deviation stability (HS OCXO): 3×10^{-11} @ 1 sec
 3×10^{-11} @ 1000 sec
 1×10^{-12} @ 1 day
- Stability when not tracking satellites: 1×10^{-8} (0°C to 50°C) typical

TIME CODE UNIT (TCU) SYNC GENERATOR

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

OSCILLATOR

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

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

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: Telnet and SNMP for the user interface, FTP (for firmware upgrades), and optional NTP and SNTP.
- 1PPS: Pulse width: 20 μ s (± 1 μ s) on the rising edge on time, TTL levels into 50 Ω , BNC female connector.
- Code input: AM or DC code IRIG A, B, and NASA-36
AM Code: 0.5 Vp-p to 10 Vp-p, 100 k Ω 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 50 Ω
Polarity: positive or negative
Connector: BNC female
- Code out: Default is IRIG-B AM
Format: AM or DC code IRIG A, B, and NASA-36.
AM Code: 3 Vp-p, into 50 Ω ± 10 %, ratio [AM]: 3:1.
DC Code: TTL into 50 Ω
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 50 Ω
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 k Ω to ground. 1 Vp-p to 3 Vp-p at 50 Ω to ground. Impedance: Configurable 1 k Ω or 50 Ω 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)
Standard 19" (48.26 cm) EIA rack system, hardware included.
2U: 3.5" x 17.1" x 15.35" (8.89cm x 43.4cm x 38.9cm)
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 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 complete details.)

- Network time server on standard network port
- Telecommunications interface (E1 and T1 output options)
- 1, 5, 10 MHz/MPPS frequency outputs
- Low phase noise frequency output
- Multicode output for IRIG A, B, E, G, H, XR3/2137 and NASA 36
- N.8 frequency synthesizer, 8KPPS to 8.192MPPS in 8KPPS steps
- Oscillator upgrades: High Stability OCXO, Rubidium, High Stability Rubidium
- Programmable pulse output
- Have Quick/1PPS Time and Frequency Reference
- N.1 Frequency Synthesizer, 1PPS to 50MPPS in 1PPS steps
- Extended cable lengths (150'-300')
- GPS In-line amplifier for extended cable runs up to 300' (91 m)
- Lightning arrester



Rear View of XLi SAASM (1U model)



XLi/XLi SAASM Options

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

OPTIONS

- Network Time Server on Standard Network Port
- Telecommunications Interface (T1/E1)
- Frequency Measurement
- Time Interval/Event Timing
- Programmable Pulse Output
- 1, 5, 10 MHz/MPPS Frequency Outputs
- Low Phase Noise Frequency Outputs
- Multicode Output for IRIG A, B, E, G, H, XR3/2137 and NASA 36
- N8 Frequency Synthesizer
- DC Power Supplies
- Oscillator Upgrades
- Frequency and Time Deviation Monitor (FTM)
- N.1 Frequency Synthesizer
- Have Quick/1PPS Time and Frequency Reference

Symmetricon makes it easy to configure the XLi Time and Frequency Systems 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 Symmetricon's time and frequency experts. You can also configure your own XLi and XLi SAASM system

online at www.symmetricon.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.

For more than 30 years Symmetricon 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 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: TCP/IP Ethernet or IEEE 802.3
- Network time accuracy: 1 to 10 milliseconds typical
- Accuracy: Function of input synchronization source (IRIG or GPS)

CLIENT SOFTWARE

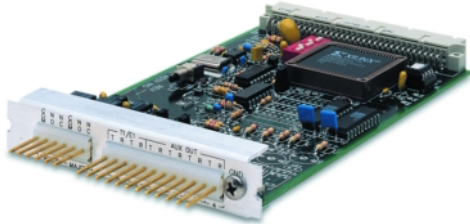
An NTP client/daemon is required for client-side synchronization with any network time server. Included with the NTP option is Symmetricom's WinSync NTP client for Windows® 95/98/NT/2000. Comprehensive time client, server & management software for easy distribution, management and monitoring of time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

Telecommunications Interface



- Provides T1, E1, and status alarm outputs for network synchronization
- Composite clock, logic level, RS-422, and sine wave

T1 OUTPUT

The T1 output provides telecommunications timing signals meeting the requirements of ITU-T G.703 and ITU-T G.704 for both the 12-frame multiframe (D4 or SuperFrame) and 24-frame multiframe (ESF or Extended SuperFrame) formats. In addition, when the clock is configured with an appropriate high stability oscillator option, the requirements of ANSI T1.101-1994 and ITU-T G.811 pertaining to primary reference source operation are met.

This option can be added to the XLi/XLi SAASM in a “Plug-and-Play” manner without hardware or software modification.

E1 OUTPUT

The E1 option card provides the user with telecommunications timing signals meeting the requirements of ITU-T G.703 and ITU-T G.704 for the 16-frame multi-frame. In addition, requirements of ANSI T1.101-1994 and ITU-T G.811 pertaining to primary reference source operation are met.

T1 Option Specifications

- 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, $Z_0=100\Omega$, on wire wrap pins
 - Wave shaping: T1 short loop (DSX-1; 0 – 655')
- 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
- Outputs (Aux Out 2, 3, 4)
 - Frequency: 1544 Kb/s
 - Interface: Balanced, RS-422 levels into 100Ω , on wire wrap pins
- Synchronization
 - Phase locked to the clock 10 MHz
 - Accuracy: Function of input synchronization source (IRIG or GPS)

E1 Option Specifications

- 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, $Z_0=120\Omega$, 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
- Synchronization
 - Phase locked to the clock 10 MHz
 - Accuracy: Function of input synchronization source (IRIG or GPS)

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 120×10^{-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.

Frequency Measurement Specifications

INPUT FREQUENCIES

- Keypad selectable frequencies of 1,5,10 MHz.
 - Input Level: 1.0 to 10 Vpp
 - Input Impedance: $1k\Omega$, jumper selectable to 50Ω
 - Measurement Range: $\pm 1 \times 10^{-9}$ maximum offset; compares the external frequency under test directly to the clock's disciplined oscillator
 - Input Frequency: 1 MHz, 5 MHz, 10 MHz
 - Resolution:
 - 120×10^{-12} @ 1 second
 - 12×10^{-12} @ 10 seconds
 - 1×10^{-12} @ 100 seconds
- Accuracy: These specifications are subject to change depending on the specific oscillator installed in the XLi.*

TCXO

- 1×10^{-9} @ 1 second
- 2×10^{-10} @ 100 seconds
- 1×10^{-12} @ 1 day

Ovenized quartz

- 1×10^{-10} @ 1 second
- 1×10^{-10} @ 100 seconds
- 1×10^{-12} @ 1 day

High-stability quartz

- 3×10^{-11} @ 1 second
- 3×10^{-11} @ 100 seconds
- 1×10^{-12} @ 1 day

Rubidium

- 3×10^{-11} @ 1 second
- 4×10^{-12} @ 100 seconds
- 1×10^{-12} @ 1 day

High-stability Rubidium

- 3×10^{-11} @ 1 second
- 4×10^{-12} @ 100 seconds
- 1×10^{-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

INPUT FREQUENCIES

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

TIME INTERVAL FEATURE

- Measurement
 - Rate: 1 per second
 - Resolution: 5 nanoseconds
 - Accuracy: ± 5 nanoseconds (+ 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 nanoseconds
 - Accuracy: ± 5 nanoseconds (+ 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.



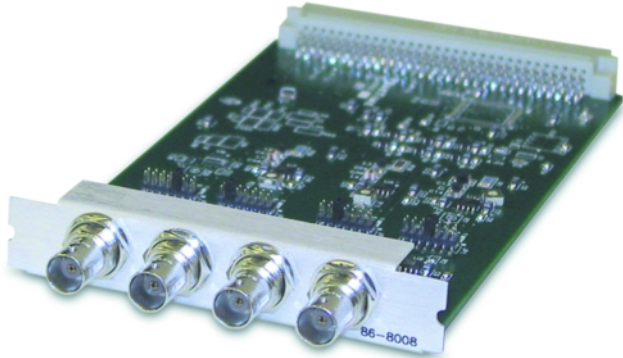
Programmable Pulse Output

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 1PPS, 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

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

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.

This option can be added to the XLi/XLi SAASM in a "Plug-and-Play" manner without hardware or software modification.

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

1, 5, 10 MHz/MPPS Output Card Specifications

1 MHZ OUTPUT

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

5 MHZ OUTPUT

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

10 MHZ OUTPUT

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

1 MPPS OUTPUT

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

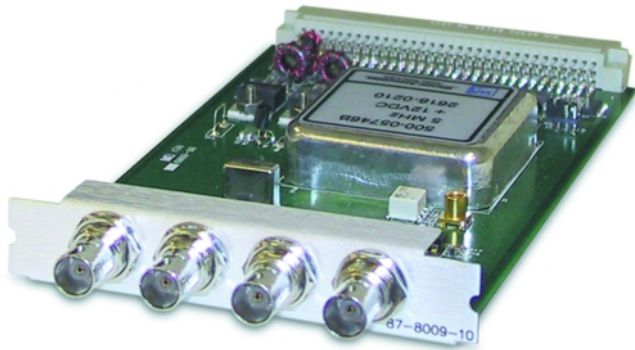
5 MPPS OUTPUT

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

10 MPPS OUTPUT

- Amplitude: TTL into 50Ω
- Duty cycle: 60/40%
- Synchronization: Phase locked to the clock 10 MHz
- Accuracy: Function of input synchronization source (IRIG or GPS)

Low Phase Noise Output



This card provides four isolated, 50 ohm frequency output signals with exceptional spectral purity. Isolation from the receiver's internal digital signal noise and power supply noise enables the same high-performance phase noise and spurious noise characteristics as the low noise oscillator source. The low phase noise option requires an oscillator upgrade to the XLi system, such as OCXO, High stability OCXO, Rubidium, or High Stability Rubidium. The OCXO is standard in the XLi SAASM.

This option can be added to the XLi in a "Plug-and-Play" manner without hardware or software modification.

Low Phase Noise Output Card Specifications

LOW PHASE NOISE 10 MHZ OUTPUTS

- 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 (IRIG or GPS)
- Amplitude: +13dBm (± 1 dBm)
- Output impedance: 50 Ω
- Quantity: 4
- Connector: BNC female
- Harmonic distortion: -30dBc
- Spurious: -90dBc
- Isolation: -70dBc
- Phase noise
 - 85dBc/Hz @ 1 Hz offset
 - 115dBc/Hz @ 10 Hz offset
 - 140dBc/Hz @ 100 Hz offset
 - 145dBc/Hz @ 1 kHz offset
 - 150dBc/Hz @ 10 kHz offset

LOW PHASE NOISE 5 MHZ OUTPUTS

- 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 (IRIG or GPS)
- Amplitude: +13dBm (± 1 dBm)
- Output impedance: 50 Ω
- Quantity: 4
- Connector: BNC female
- Harmonic distortion: -30dBc
- Spurious: -90dBc
- Isolation: -70dBc
- Phase noise
 - 85dBc/Hz @ 1 Hz offset
 - 115dBc/Hz @ 10 Hz offset
 - 140dBc/Hz @ 100 Hz offset
 - 145dBc/Hz @ 1 kHz offset
 - 150dBc/Hz @ 10 kHz offset

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.

This option can be added to the XLi/XLi SAASM in a “Plug-and-Play” manner without hardware or software modification.

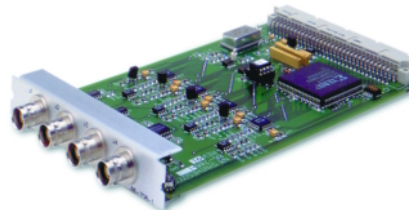
Multicode Output Specifications

- Amplitude modulated carrier and DC shift outputs are paired
 - 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 (IRIG or GPS)
- 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

N8 Frequency Synthesizer



The N8 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.

This option can be added to the XLi/XLi SAASM in a “Plug-and-Play” manner without hardware or software modification.

N8 Frequency Outputs Specifications

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

DC Power Supplies



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.

This option can be added to the XLi/XLi SAASM in a “Plug-and-Play” manner without hardware or software modification.

DC Power Supplies Specifications

12 VDC POWER INPUT

- Input connector: Three-position screw terminal block
- Input voltage range: 9–18 Vdc for nominal 12 volt input
- Input current, maximum: 12 amps @ 9 volts input
- 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
- Output specifications:
 - +5 V $\pm 2\%$, 20 watts, 4 amps
 - +12 V $\pm 2\%$, 24 watts, 2 amps
 - 12 V $\pm 2\%$, 24 watts, 2 amps
- 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

24 VDC POWER INPUT

- Input connector: Three position screw terminal block
- Input voltage range: 18–36 Vdc for nominal 24 volt input
- Input current, maximum: 6 amps @ 18 volts input
- Isolation (ground): Input is fully floating. Either input polarity may be strapped to chassis ground at the input terminal block.
- Isolation input to output: 500 Vac, 710 Vac minimum
- Output specifications
 - +5 V $\pm 2\%$, 25 watts, 5 amps
 - +12 V $\pm 2\%$, 30 watts, 2.5 amps
 - 12 V $\pm 2\%$, 30 watts, 2.5 amps
- 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

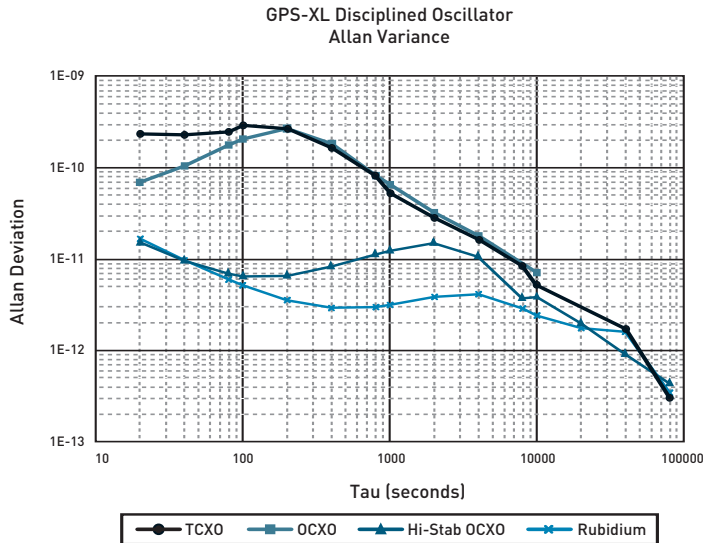
48 VDC POWER INPUT

- Input connector: Three position screw terminal block
- Input voltage range: 36–72 Vdc for nominal 48 volt input
- Input current, maximum: 3 amps @ 36 volts input
- Isolation (ground): Input is fully floating. Either input polarity may be strapped to chassis ground at the input terminal block.
- Isolation input to output: 500 Vac, 710 Vac minimum
- Output specifications:
 - +5 V $\pm 2\%$, 25 watts, 5 amps
 - +12 V $\pm 2\%$, 30 watts, 2.5 amps
 - 12 V $\pm 2\%$, 30 watts, 2.5 amps
- 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

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), the 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

TCVCXO (Standard in XLI)

- Accuracy: Function of input synchronization source (IRIG or GPS)
 - Frequency/timing Allan Deviation
 - Stability
 - 1 x 10⁻⁹ @ 1 sec
 - 2 x 10⁻¹⁰ @ 1 K sec
 - 3 x 10⁻¹² @ 24 hours
 - Temperature: 5 x 10⁻⁷, over 0°C to 50°C when not locked to a reference
- Note: Not available in XLI SAASM

OCXO OSCILLATOR OPTION

- Accuracy: Function of input synchronization source (IRIG or GPS)
- Frequency/timing Allan Deviation
 - Stability:
 - 1 x 10⁻¹⁰ @ 1 sec
 - 1 x 10⁻¹⁰ @ 1 K sec
 - 1 x 10⁻¹² @ 24 hours
- Temperature: 1 x 10⁻⁸, over 0°C to 50°C when not locked to a reference
- Drift rate: 5 x 10⁻⁹ per 24 hours

HIGH STABILITY OCXO OSCILLATOR OPTION (Standard in XLI SAASM)

- Accuracy: Function of input synchronization source
- Frequency/timing Allan Deviation
 - Stability:
 - 3 x 10⁻¹¹ @ 1 sec
 - 3 x 10⁻¹¹ @ 1 K sec
 - 1 x 10⁻¹² @ 24 hours
- Temperature: 1 x 10⁻⁹, over 0°C to 50°C when not locked to a reference
- Drift rate: 1 x 10⁻¹⁰ per 24 hours

RUBIDIUM OSCILLATOR OPTION

- Accuracy: Function of input synchronization source (IRIG or GPS)
- Frequency/timing Allan Deviation
 - Stability:
 - 3 x 10⁻¹¹ @ 1 sec
 - 4 x 10⁻¹² @ 1 K sec
 - 1 x 10⁻¹² @ 24 hours
- Temperature: 3 x 10⁻¹⁰, over 0°C to 50°C when not locked to a reference
- Drift rate: 5 x 10⁻¹¹ per month (720 hours)

HIGH PERFORMANCE RUBIDIUM OSCILLATOR OPTION

- Accuracy: Function of input synchronization source (IRIG or GPS)
- Frequency/timing Allan Deviation
 - Stability:
 - 3 x 10⁻¹¹ @ 1 sec
 - 4 x 10⁻¹² @ 1 K sec
 - 1 x 10⁻¹² @ 24 hours
- Temperature: 3 x 10⁻¹⁰, over 0°C to 50°C when not locked to a reference
- Drift rate: 1 x 10⁻¹¹ per month (720 hours)



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

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 μ Hz
 - 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

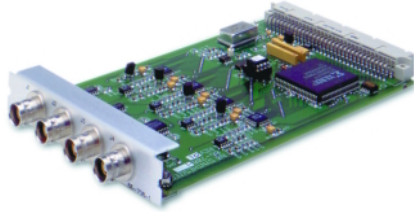
- Current measurement of input reference frequency.
 - Range: 40 - 70 Hz
 - Measurement Resolution: 30 μ Hz
 - Output Data Resolution: 1 mHz

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.

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

- Channels: 4, independently programmable
- Input reference frequency: System 10 MPPS
- Output pulse rates: 1PPS through 50 MPPS in 1PPS steps
- Output drive: RS-422
- Wave form: Square wave
- Jitter cycle-to-cycle: <1nS
- Output connector: Triax

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.

1PPS Input Specifications

- Frequency: 1 Hz
- Accuracy: 1 μ Sec
- Stability:
 - 1 x 10⁻⁹ @ 1 sec
 - 2 x 10⁻¹⁰ @ 1000 sec
 - 3 x 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 Specifications

- Format: Have Quick II (ICD-GPS-060)
- Bit period: 600 μ s \pm 10 μ s
- Bit rate: Approximately 1667 BPS
- Frame rate: 1 frame/second
- Accuracy: 1 μ Sec
- Stability:
 - 1 x 10⁻⁹ @ 1 sec
 - 2 x 10⁻¹⁰ @ 1000 sec
 - 3 x 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



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 1×10^{-12} (long term)
- IRIG B Time Code Output
- 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 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 1×10^{-12}). Time Receiver Autonomous Integrity Monitoring (TRAIM) protects against faulty satellite signals. An ovenized oscillator option improves short-term stability and holdover performance.

A variety of standard time and frequency outputs include a one pulse-per-second (1PPS), IRIG B 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. The GPS timing interface is also modular which facilitates future upgrade to alternate Global Navigation Satellite Systems (GNSS), such as Galileo, when available.



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]
- 1PPS output accuracy: UTC(USNO): ±30 nS RMS 100 ns peak (without S/A 99%).
- 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 GENERATOR

- Code out: IRIG B

OSCILLATOR

- Standard oscillator: VCTCXO
- Optional oscillator: OCXO

STANDARD INPUT/OUTPUT SIGNALS

- Eight standard I/Os
 - Two for control and monitoring:
 - Six for signals:
 - Serial and Ethernet port.
 - 1PPS out, time code 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
- 1PPS: Pulse width: 20 µs (±1µs) on the rising edge on time, TTL levels into 50Ω, BNC female connector.
- Code out: Default is IRIG B AM
Format: AM or DC code IRIG B.
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, 1kPPS, 10kPPS, 100kPPS, 1 MPPS, 5 MPPS, and 10 MPPS. Duty cycle: 50% and 60/40%.
Amplitude: TTL levels into 50Ω
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: 47–63 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 +12 Vdc
 - 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 complete details.)

- 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)



Rear View (with Expansion Module)



XL-750

GPS Time Source

KEY FEATURES

- 12 Channel GPS Receiver Provides a Continuous UTC Time Reference
- Extremely Accurate Output Pulses
- IRIG Time Code Output
- Electrically Isolated Outputs and Inputs
- Synchronization of SCADA System Equipment, Remote Terminal Units (RTU), Protection Relays and Power/Tariff Meters
- Multiple Format RS232 Serial Time Broadcast
- Event Time Tagging (option)
- Network Time Server (option)

Symmetricom's XL-750 GPS Time Source has been developed to address key power industry timing requirements. Whether it's the monitor, control or analysis of the power system, the XL-750 is the cost-effective GPS time synchronization solution.

To begin with, the XL-750 offers superb timing accuracy (100ns to UTC). Using GPS satellites, it generates extremely accurate output pulses and time codes in multiple formats.

The XL-750 synchronizes a wide variety of microprocessor-based power system equipment including: SCADA systems, remote terminal units (RTUs), protection relays, sequence of event recorders, digital fault recorders, tariff meters and others. Field programmable using a Windows-based configuration program, the XL-750 allows the user to define output pulses or choose from pre-programmed pulses and time codes. Each output can feed directly to different areas through electrically isolated outputs which insures

reliable operation in a harsh substation environment.

The XL-750 generates a wide range of timing signals via four output ports. A fixed output provides an IRIG B amplitude modulated (AM) time code signal. Three independently configurable digital ports can provide pulses or unmodulated time code. The XL-750 pulse output is easily configured to provide common power industry pulse rates including a 1 pulse-per-second (PPS), 1 pulse-per-minute (PPM), and 1 pulse-per-hour (PPH). Supported signal levels are TTL (standard) and optionally RS422, fiber optic or high voltage MOSFET outputs.

A serial port (RS232) is provided for configuration and synchronous time string broadcasts. A dual channel, event time tagging option provides 100 nanosecond time stamping of external event pulses. A Network Time Server (NTS) option is available which allows the XL-750 to synchronize computer clocks and other network devices via the Network Time Protocol (NTP).



XL-750 GPS Time Source

XL-750 Specifications

RECEIVER/GENERAL SPECIFICATIONS

- GPS receiver
 - Input: 1575.42 MHz L1 CA code
 - Position accuracy: 10m RMS (typical) tracking 4 satellites
 - Tracking: 12 parallel channels with multi-satellite ensembling with TRAIM
 - Acquisition time: <30 minutes typical
- Accuracy
 - 1PPS output: $\pm 100\text{nS}$ RMS UTC(USNO), Positive edge on-time
 - P2 & P3: $\pm 100\text{nS}$ RMS UTC(USNO), Positive edge on-time
 - P4 RS232 pulse/code output: $\pm 1.5\mu\text{S}$ UTC (USNO)
 - Pulse durations: Programmable from 10mS to 24 hours
 - Pulse duration accuracy: To $\pm 300\text{nS}$ to positive edge
- Oscillator: TCXO

INPUT/OUTPUT SIGNALS

- User configurable outputs (3)
 - IRIG B time code (B00x)
 - IRIG B modified Manchester encoding (B22x)
 - Selectable extensions (IEEE 1344, AFNOR)
 - DCF77 pulse simulation
 - Configurable pulses per second/minute/hour/day
 - Pulse rate duration (10ms-24 hours)
 - Connector and signal type: BNC female (P2, P3)
 - TTL: 0-5V, 150mA (standard)
 - RS422: $\pm 6\text{V}$, 50 Ω (optional)
 - HV switch, MOSFET 300V, 1A (optional)
 - Fiber Optic: 62.5/125um ST (optional)
 - 9-pin D male subminiature (P4-pin1)
 - RS232 levels: $\pm 10\text{V}$, 15mA
- Time code modulated output:
 - IRIG B time code (B12x)
 - Selectable extensions (IEEE 1344, AFNOR)
 - Connector: BNC female (P5)
 - 6Vpp into 50 Ω
- Serial port I/O
 - XL-750 Configuration port
 - Time string broadcast
 - Connector: 9-pin D male subminiature (P4)
 - RS232 levels: $\pm 10\text{V}$, 15mA
- Alarm relay output:
 - Synchronization status: (NO/NC)
 - Connector: 3 pin (P7)
- Event time tagging (option):
 - Dual channel, 100 nsec resolution
 - TTL 0-5 V
 - Connector: 2 pin (P6)
 - Minimum pulse duration: 1 μsec
 - Maximum events per second: 100
- Network time server (option):
 - NTP Version 2, 3, 4, Stratum 1 server
 - Network interface: 10baseT
 - Connector: RJ-45, 8-pin (P8)

MECHANICAL/ENVIRONMENTAL SPECIFICATIONS

- Time system
 - Power
 - Voltage ranges: L = 12-36 VDC
M = 20-60 VDC
H = 90-350 VDC
 - Power drain: 6W max (load dependent)
 - Fuse: 500mA
 - Connector: 2 pin plug with mating connector
 - Size: 1.58" x 6.3" x 6.3" (4cm x 16cm x 16cm)
 - Operating temperature: 0°C to +50°C (32°F to +122°F)
 - Humidity: 95% non-condensing
 - Display: LCD 2 line x 16 characters
 - Rackmount: Kit included
 - Isolation: 2.5kV between all outputs
2.5kV all outputs to base
1kV power supply to base unit
- Antenna
 - Size: 3" Dia x 3" H (7.62 cm x 7.62)
 - Input: SMA female to GPS receiver. TNC on antenna.
 - Power: +5 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

OPTIONS

- Power supply ranges (12-36, 20-72, 90-250Vdc)
- Network time server (NTS)
- Event time tagging (2 channel)
- High voltage switching (P2 and/or P3)
- Fiber option output (P2 and/or P3)
- RS422 output (P2 and/or P3)
- Lightning arrester
- Antenna cable length options (150, 300, >300')
- 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

RELATED PRODUCTS

- High Isolation Repeater (HIR)



Rear View



XL-DC

GPS Time and Frequency Receiver

KEY FEATURES

- Less Than 40 Nanoseconds rms Accuracy to UTC During Selective Availability
- Better Than 1×10^{-12} Frequency Accuracy
- Versatile and Modular Architecture
- Supports Many Different Output Options
- 1PPS Output
- IRIG B Time Code Output
- Internet/Local Network Remote Control Option

Symmetricom's XL-DC provides the highest degree of time and frequency accuracy available in a GPS timing receiver. Standard outputs include a 1PPS, analog IRIG B time code and serial I/O time strings. A major advantage of the XL-DC is its versatile and modular architecture. A wide range of time and frequency plug-in options allow the XL-DC to be customized for specific applications and easily upgraded at a later time.

Symmetricom's proprietary multi-satellite ensembling techniques provide very stable and precise timing outputs. Timing accuracy is less than 40 nanoseconds rms to UTC even during Selective Availability (SA). This superior oscillator disciplining to GPS enables internal oscillator accuracy to better than 1×10^{-12} . For applications requiring increased oscillator stability during GPS outages, the XL-DC can be upgraded to include ovenized quartz or rubidium oscillators.

The very modular backplane architecture supports multiple time and frequency output options to address specific needs. The standard model supports up to four

single-height plug-in modules. Using the optional 3.5" high chassis, the XL-DC can accommodate up to ten single-height modules. These modules can be incorporated at any time and significantly increase the adaptability of the XL-DC to changing requirements.

The option modules are a cost-effective way to create a very versatile clock to support different applications beyond those supported by the standard outputs. For example, adding the Network Time Server and Telecommunications modules allow the XL-DC to synchronize computer clocks across an Ethernet network as well as routers, multiplexers, switches and other telecommunications equipment that use T1 signals. Option modules can also increase signal distribution. Additional sinewave or time code modules can eliminate the need for other signal distribution chassis. The wide range of options lends itself well to configuring the XL-DC as the central time and frequency source for many applications commonly found in the laboratory, range, and enterprise environments. See the Options section for a complete list of options.



XL-DC Time & Frequency Receiver

XL-DC Specifications

RECEIVER/GENERAL

- XL-timing accuracy UTC/USNO: <40 ns rms (150 ns peak) tracking 8 satellites.
- Receiver input: 1575 MHz L1 C/A code
- Tracking: Eight parallel channels. Multi-satellite ensembling.
- Position accuracy: Latitude, longitude, and altitude within 10 meters, referenced to WGS84, after completing of 24-hour initialization position averaging.
- Acquisition time: Warm start (has ephemeris data and position) typically <2 minutes. Cold start typically less than 20 minutes.
- Internal oscillator
 - Accuracy: 1×10^{-12} when tracking satellites
 - Stability: 1×10^{-9} at 1 second
 - 3×10^{-10} at 100 seconds
 - 1×10^{-12} at one day
 - Stability when not tracking satellites: 2×10^{-4} over 0°C to +50°C
- Antenna: L1, GPS, 40dB, RG-59/U cable, 50' (15 m) supplied; maximum cable length 150' (46 m). For longer cable runs, see Options.

TIMING OUTPUTS

- 1PPS output: TTL into 50 Ω , rising edge on time. 20-microsecond pulse width. Rear panel BNC.
- IRIG B output: 1 kHz amplitude modulated carrier. 3 Vpp high, into 600 Ω . Rear panel BNC. DC level shift format optionally available.
- Serial I/O: Bidirectional port at RS-232 levels

MECHANICAL/ENVIRONMENTAL

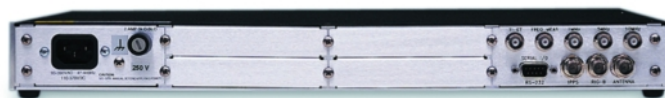
- Receiver
 - Power: 95-260 Vac, 47 to 440 Hz, <15 watts
 - Size: 1.75" x 17" x 10.38" (4.4 cm x 43.2 cm x 36.4 cm)
 - Operating temperature: 0°C to +50°C
 - Storage temperature: -40°C to +85°C
 - Humidity: To 95% noncondensing
- Antenna
 - Size: 3" Dia. x 3" H (7.62 cm x 7.62 cm)
 - Operating temperature: -55°C to +85°C
 - Storage temperature: -55°C to +85°C
 - Humidity: To 95% noncondensing
 - Certification: UL, FCC, CE, C-UL
 - Contact Symmetricom for the certification of specific options.

- Alphanumeric front panel display: Initialization parameters, time of year, as well as alarm/status messages may be viewed on the 2-line, 32-character LCD.
- Keypad: 0-9; up, down, left, and right arrows; CLR, FUNC/ENTR, TIME, STATUS, POSITION.
- Serial I/O: Full user-selectable RS-232 communication protocol up to 19200 baud.
- Front panel time display: LCD type, 10 digits, 1 line. Default is time-of-year.
Size: 6.9" x 0.85" (17.53 x 2.16 cm)

OPTIONS

(See Options pages for complete details.)

- Network time server
- Telecommunication interface: Primary Reference Source 1.544 Mbps (T1) or 2.048 Mbps (E1), Status/Alarm
- 1, 5, 10 MHz frequency outputs
- Multiple time code outputs
- Selectable output pulse rates
- N.8 data rate outputs
- Low phase noise frequency outputs
- Oscillator upgrades
- External oscillator control
- Network interface card for Telnet remote control
- Frequency measurement
- Time interval/event timing
- Precision Time and Time Interval Interface (PTTI)
- Have Quick II
- Parallel BCD
- 3.5" height, 10 option bay chassis
- AC/DC Power Input: 95-260 Vac/18-36 Vdc; 95-260 Vac/36-72 Vdc; 110 or 220 Vac/10.5-32 Vdc
- IEEE-488 Interface
- 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
- Fiber optic antenna link (up to 2 km)
- Frequency and time deviation monitoring
- Loss of lock alarm



Rear View

Mark V

GPS P(Y) Code Time and Frequency Receiver with SAASM

KEY FEATURES

- 10 Nanoseconds rms Accuracy to UTC
- Uses the Precise Positioning Service (PPS)
- Dual Frequency
- Receiver Autonomous Integrity Monitoring (RAIM)
- Versatile and Modular Architecture
- SAASM PPS GPS Receiver

Symmetricom's Mark V™ offers ultra-precise timing performance by using the GPS Precise Positioning Service (PPS) that takes full advantage of the accuracy and anti-spoofing capabilities of the P(Y) code. The Mark V corrects for Selective Availability and uses Y-code augmented with Receiver Autonomous Integrity Monitoring (RAIM) to protect against satellite/system anomalies and spoofing. In addition, it incorporates the latest Selective Availability Anti-Spoofing (SAASM) technology. U.S. Department of Defense and Government customers obtain the most reliable GPS-based timing possible with accuracy better than 10 nanoseconds to UTC.

The superior performance levels achieved by the Mark V are the result of a complete strategy based on accurate position determination, dual frequency GPS tracking, system integrity monitoring, multi-satellite ensembling techniques, and a high-stability ovenized oscillator.

Standard timing outputs from the Mark V include a 1PPS accurate to less than 10 nanoseconds rms to GPS/UTC, analog IRIG B time code, and serial I/O time

strings. Using the keypad or RS-232 port, users have control over a variety of time formats, configurations, and output options, including GPS and oscillator status and controls.

The very modular backplane architecture of the Mark V supports multiple time and frequency output options to address specific needs. These plug-in output modules can be incorporated at any time and significantly increase the clock adaptability to changing mission requirements. See the Options section for a list of the currently supported options. The base models support up to four single-height plug-in modules. Using the optional 3.5" high chassis, up to ten single-height modules can be accommodated.

The features of the Mark V make it the instrument of choice for critical mission applications such as:

- C⁴I
- Range Timing
- Satellite Communication Stations
- T1/E1 Primary Reference Sources
- Network Synchronization



Mark V GPS P(Y) Code Time and Frequency Receiver

Mark V Specifications

RECEIVER/GENERAL

- Receiver input: L1/L2, P(Y) code (PPS), SAASM
- Tracking: Twelve parallel, dual-frequency channels
- Crypto key input: DS-102. Compatible with KYK-13, KOI-18, AN/CYZ-10. Black/red key support. Front panel connector.
- Security: SAASM GPS receiver
- Position update rate: Once per second
- Time to first fix: 1.5 minutes nominally
- Antenna/preamplifier: L1 1575 MHz and L2 1227 MHz microstrip with 40dB gain, all-weather, outdoor mounting.
- Lead-in cable: 50' (15 m) of RG-59/U supplied with the system
Longer cable runs can be accommodated optionally by:
Lower-loss cable
Fiber optic cable
In-line amplifier

TIMING OUTPUTS

- 1PPS output: TTL into 50 Ω , rising edge on time
20-microsecond pulse width
Rear panel BNC
- IRIG B output: 1 kHz amplitude modulated carrier
3 Vpp high, into 600 Ω
Rear panel BNC
- Serial I/O: Bidirectional port at RS-232 levels
Full user-selectable protocol
DB9 connector

ADDITIONAL STANDARD FEATURES

- External frequency measurement
 - Frequencies: 1, 5, or 10 MHz
 - Resolution: 6 x 10⁻¹¹ at 1 second intervals
 - Accuracy: 1 x 10⁻¹²
- Time interval/event timing
 - Resolution: 30 ns, single shot
 - Accuracy: 100 ns \pm 30 ns
- Loss of lock alarm: Open collector type alarm output

PERFORMANCE (AUTHORIZED USERS)

- Dynamics
 - Velocity: 0-400 m/sec (800 knots)
 - Acceleration: 4 g
- PPS position accuracy (WGS84)
 - 3-D, 10 meters SEP in dynamic model 3-D
 - 3 meters 2d rms in static mode after completing 24-hour initialization position averaging
- Altitude
 - PPS: -400 to 21,500 meters (70,000')
 - SPS: -400 to 18,200 meters (60,000')
- Timing accuracy, 1PPS
 - To GPS: <10 ns rms (<100 ns peak)

- Internal oscillator: 10MHz high-stability OCXO
- Accuracy: <2x10⁻¹³ when tracking satellites
- Stability: 1x10⁻¹¹ at 1 second
1x10⁻¹¹ at 100 seconds
<2x10⁻¹³ at one day
- Stability when not tracking satellites: 3.5x10⁻¹¹/°C

FRONT PANEL CONTROLS

- Alphanumeric front panel display
 - Initialization parameters, time of year, as well as alarms/status messages can be viewed on the 2-line, 32 character LCD
- Keypad: 0-9; up, down, left and right arrows; CLR, FUNC/ENTR, TIME, STATUS, POSITION
- Front-panel time display: LCD type, 10 characters, 1 line; default is time-of-year

MECHANICAL/ENVIRONMENTAL

- Receiver
 - Size: 1.75" x 17.0" x 17.0" (4.4 cm x 43.2 cm x 43.2 cm)
 - Power: 95-260 Vac, <40 watts, 47-440 Hz
 - Operating temperature: 0°C to +50°C
 - Storage temperature: -40°C to +85°C
 - Humidity: To 95% noncondensing
- Antenna
 - Operating temperature: -55°C to +85°C
 - Storage temperature: -55°C to +85°C

OPTIONS

- Telecommunication interface: Primary Reference Source 1.544 Mbps (T1) or 2.048 Mbps (E1), Status/Alarm
- 1, 5, or 10 MHz frequency outputs
- Multiple time code outputs
- Selectable output pulse rates
- N.8 data rate outputs
- Low phase noise frequency outputs
- Oscillator upgrades: Rubidium, High stability Rubidium
- External oscillator control
- Network time server
- Network interface card for telnet remote control
- Precision time and time interval interface (PTTI)
- Have Quick II
- Parallel BCD
- 3.5" height, 10-option bay chassis
- AC/DC power input
 - 95-260 Vac/18-36 Vdc
 - 95-260 Vac/36-72 Vdc
 - 110 or 220 Vac/10.5-32 Vdc
- IEEE-488 interface
- Fiber optic antenna link (up to 2 km)

Note: U.S. Government policy restricts the sale of Precise Positioning Service (PPS) equipment to those authorized by the U.S. Department of Defense. Non-U.S. authorized users must purchase PPS equipment through the Foreign Military Sales (FMS) process. Made in the U.S.A.



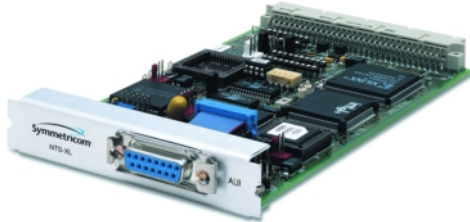
XL-DC/Mark V Options

You can customize the XL DC and Mark V products by selecting option cards that suit your specific application needs. The matrix to the right identifies the major options that are available for each of these products. Additional minor options can be added. Contact Symmetricom for details.

	XL-DC	Mark V
Network Time Server	x	x
Telecommunications Interface	x	x
Frequency Measurement	x	standard
Time Interval/Event Timing	x	standard
FTM III Frequency & Time Monitor	x	x
Multicode Output	x	x
1, 5, 10 MHz/MPPS	x	x
PTTI Interface	x	x
Low Phase Noise Output	x	x
Network Interface	x	x
Loss of Lock Alarm	x	standard
Programmable Pulse Output	x	x
Slow Code Output	x	x
N8 Frequency Synthesizer	x	x
IEEE-488 Interface	x	x
Parallel BCD (millisecond resolution)	x	x
Parallel BCD (microsecond resolution)	x	x
Have Quick II	x	x

Network Time Server

For XL-DC and Mark V



- Synchronize computer clocks over a network
- 1-10 millisecond typical client accuracy
- Time referenced to XL-DC or Mark V GPS clock
- SNMP Enterprise MIB support
- MD5 Security Protocol

Symmetricom's NTS Network Time Server distributes time to precisely synchronize client computer clocks over a network. Time is acquired from the host XL-DC/Mark V and distributed over the network using the Network Time Protocol (NTP). Client computer clocks can be synchronized to 1 to 10 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 module shown above fits directly into the rear of the GPS-based XL-DC and Mark V and supports a 15-pin AUI network connector. Initialization of the NTS card is done via the standard RS-232 port or via the front panel keypad.

Specifications

NETWORK PROTOCOLS

- Network time protocol:
 - NTP (RFC 1305)
 - SNTP (RFC 1361)
 - TIME (RFC 868)
 - MD5 (RFC 1321)
 - SNMP v1 Enterprise MIB II
- Network transport protocol: UDP/IP
- Simple Network Management (SNMP): SNMP provides the network administrator with the NTP Time Server Protocol, network status, and statistics. This feature implements SNMP version 1 and Management Information Base (MIB) II.
- Network interface: UDP/IP (TCP/IP) Ethernet or IEEE 802.3; 15-pin AUI connector. Optional MAUs for 10Base-T and 10Base-2 support. The AUI supports 1640' connections while the 10Base-T and 10Base-2 support 328' and 607' respectively.
- Timing accuracy
 - Network: 1 to 10 milliseconds typical
 - GPS: <1 microsecond to UTC
- Internal oscillator: 10 MHz VCXO
 - Accuracy: Function of input synchronization source
 - Stability: 25×10^{-6} over 0°C to +50°C when not externally synchronized

CLIENT SOFTWARE

- An NTP client/daemon is required for client-side synchronization with any network time server. Visit <http://www.symmetricom.com> for an extensive list of software time clients for various operating systems.

Telecommunications Interface

For XL-DC and Mark V



- Provides T1, E1 and status alarm outputs for network synchronization
- Composite clock, logic level, RS-422, and sine wave formats available.*

Specifications

FRAMED OUTPUTS

- Quantity 2 T1 or 2 E1s (specify at time of order).
 - DS1 (T1): 1.544 Mbps framed all ones Superframe (D4) or Extended Superframe (ESF) user-selectable (D4 is the default). AMI (Alternating Mark Inversion) using B8ZS (Bipolar Eight Zero Substitution).
Balanced 100 Ω on wire-wrap pins.
Alarm Indication Signal (AIS) is output as a function of the Major Alarm status.
 - E1: 2.048 Mbps framed all ones output. 16-frame multiframe. AMI using HDB3 (High-Density Bipolar 3rd Order).
Single-ended 75 Ω on BNC, or 120 Ω balanced on wirewrap pins.
Alarm Indication Signal (AIS) can be enabled as a function of the Major Alarm status and user-selectable jumper.
- Logic level
 - Number of drivers: Four (must specify at time of order)
1, 5, 10 Mbps; 8, 64 kbps; 1.544/2.048 Mbps
(1.544/2.048 Mbps is a function of T1/E1 option selection.)
Balanced 100 Ω RS-422 on wire-wrap pins or single-ended TTL into 50 Ω on BNC.
Outputs can be disabled as a function of the Major Alarm status and user-selectable switch.
- Analog sine wave: Four drivers (must be specified at time of order).
1, 5, 10 MHz, 1.544/2.048 MHz (1.544/2.048 MHz is a function of T1/E1 option selection.)
Single-ended 50 or 75 Ω on BNC or 120 Ω balanced on wirewrap pins. Outputs can be disabled as a function of the Major Alarm status and user-selectable switch.
- Composite clock: 64 kbps and 8 kbps
Bipolar return to zero (BRTZ). Balanced 135 Ω on wirewrap pins.
Outputs can be disabled as a function of the Major Alarm status and user-selectable jumper.
Adding the Composite Clock option reduces the Logic Level/Analog Drivers to three.
- Status: RS-232 I/O
- Alarms: Major and minor, 2A Form C relay contacts on wirewrap pins.

* Formats must be specified at time of order.

Frequency Measurement For XL-DC and Mark V

The Frequency Measurement option provides the ability to precisely measure the frequency of an externally applied 1, 5, or 10 MHz signal. Measurement resolution to UTC is better than 6×10^{-11} 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

INPUT FREQUENCIES

- Keypad selectable frequencies of 1, 5, 10 MHz.
 - Input Level: 1.0 to 10 Vpp
 - Input Impedance: 1k Ω , jumper selectable to 50 Ω
 - Measurement Range: $\pm 1 \times 10^{-5}$ maximum offset; compares the external frequency under test directly to the clock's disciplined oscillator
 - Resolution: 1 MHz, 5 MHz, 10 MHz
 - 6×10^{-11} @ 1 second
 - 6×10^{-13} @ 100 seconds
 - 6×10^{-14} @ 1000 seconds
- Accuracy: These specifications are subject to change depending on the specific oscillator installed in the GPS receiver.*
 - TCXO
 - 1×10^{-9} @ 1 second
 - 3×10^{-10} @ 100 seconds
 - 1×10^{-12} @ 1 day
 - Ovenized quartz
 - 1×10^{-10} @ 1 second
 - 3×10^{-10} @ 100 seconds
 - 1×10^{-12} @ 1 day
 - High-stability quartz
 - 1×10^{-11} @ 1 second
 - 1×10^{-11} @ 100 seconds
 - 1×10^{-12} @ 1 day
 - Rubidium
 - 3×10^{-11} @ 1 second
 - 1×10^{-11} @ 100 seconds
 - 1×10^{-12} @ 1 day

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

Time Interval/Event Timing For XL-DC and Mark V

TIME INTERVAL

The Time Interval function 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. Continuous timing of up to approximately 100 events per second is available in the "burst" mode. The collected data is available via the RS-232 port.

Specifications

INPUT REQUIREMENTS

- Rate: 1PPS
- Amplitude: TTL low-TTL high
- Active edge: Rising
- Pulse width: 100 nanoseconds minimum
- Input impedance: >1k Ω , jumper selectable to 50 Ω

TIME INTERVAL FEATURE

- Measurement
 - Rate: 1 per second
 - Resolution: 30 nanoseconds
 - Accuracy: ± 30 nanoseconds (+ clock accuracy**)
 - Range: 0.0 to 0.999, 999, 99
- 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: 30 nanoseconds
 - Accuracy: ± 30 nanoseconds (+ clock accuracy**)
 - Range: 0.0 to 1 year in 30-nanosecond increments
- 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.



FTM III Frequency & Time Monitor

For XL-DC and Mark V



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 XL-FTM III

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

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 μ Hz
 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 nanoseconds
 Output data resolution: 1 millisecond
 Time offset input: ± 99.999 seconds maximum. Entry via keypad or communication port.

SYSTEM FREQUENCY

- Current measurement of input reference frequency.
 Range: 50 Hz nominal, 40.000 Hz to 59.999 Hz
 60 Hz nominal, 50.000 Hz to 69.999 Hz
 Measurement Resolution: 30 μ Hz
 Output Data Resolution: 1 MHz

SYSTEM TIME

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

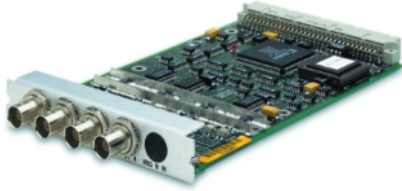
OPTIONS

- Analog output: Current time deviation and frequency deviation in analog output format. ± 5 V or 0–10 V full scale. Data ranges are user selectable.
- Parallel output: Time deviation and frequency deviation. Local time (UTC time).

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

Multicode Output

For XL-DC and Mark V



- Programmable formats
- Up to four carrier outputs
- Carrier outputs can be time codes or sine waves
- Up to four DC shift outputs
- DC shift outputs can be pulse rates or time codes
- Optional synchronized generator code input

Select the various time code formats by using the front panel keypad and display (XL and Mark V units). The currently available time code format menu contains IRIGs A, B, E, G, H, XR3/2137 and NASA 36. Sine waves of 100 kHz, 10 kHz, 1 kHz, 250 Hz and 100 Hz can replace the modulated time codes. The DC Shift code outputs can be replaced by pulse rates of 1 kPPS, 100 PPS, 10 PPS and 1PPS.

An optional input port allows the host clock to operate in the synchronized generator mode using IRIG B as the reference code input.

Specifications

- Amplitude modulated carrier and DC Shift outputs are paired:
 - Amplitude into 600 Ω : 0 V to 10 Vpp
 - Amplitude into 50 Ω : 0 V to 3 Vpp (3 Vpp as shipped)
 - Ratio: 2:1 to 5:1 (3:1 as shipped)
 - Connector: BNC
 - DC shift code outputs and pulse rate: RS-422 0 V to >+2.5 Vdc into 100 Ω .
 - Can be used as single-ended TTL. Pulse rates have 50% duty cycles.
 - Connector: DB9 or BNC or TRIAX (optional, two card slot solution).

AVAILABLE PULSE RATE OUTPUTS

- 1 kPPS, 100 PPS, 10 PPS, 1PPS (A pulse rate replaces a DC Shift code output and the respective carrier output is zero.)

AVAILABLE FREQUENCY OUTPUTS

- 100 kHz, 10 kHz, 1 kHz, 250 Hz, 100 Hz (A reference frequency output replaces a modulated carrier output and the respective DC Shift output is set to zero.)

XL-DC AND MARK V CONFIGURATIONS

- Standard configuration: Occupies one card slot. Four modulated carrier outputs.
- Option 1: Occupies one card slot. Two modulated carrier outputs. Four DC Shift outputs on DB9.
- Option 2: Occupies two card slots. Four modulated carrier outputs. Four DC Shift outputs on BNC connector.
- Option 3: Occupies two card slots. Four modulated carrier outputs. Four DC Shift outputs on triax connectors.

OPTIONS

- DC shift outputs can be specified to be single-ended, >2.5 Vdc into 50 Ω . For other output combinations, consult factory.
- IRIG B synchronized generator code input

1, 5, 10 MHz/MPPS

For XL-DC and Mark V



The 1, 5, 10 MHz/MPPS Output option* provides you with three precise sine wave or square wave outputs. These outputs are phase locked to the host receiver's disciplined reference oscillator. They are automatically enabled upon power-up with no configuration setup required.

Specifications

1 MHz, 5 MHz OUTPUTS

- Amplitude: 1 Vrms into 50Ω
- Harmonic distortion: -50dBc
- Accuracy: The accuracy of the host's reference oscillator
- Connector: BNC

10 MHz OUTPUTS

- Amplitude: 1 Vrms into 50Ω
- Harmonic distortion: -40dBc
- Accuracy: The accuracy of the host's reference oscillator
- Connector: BNC

1 MPPS, 5 MPPS, 10 MPPS OUTPUTS

- Amplitude: TTL into 50Ω
- Duty cycle: 50%
- Accuracy: The accuracy of the host's reference oscillator
- Connector: BNC

PTTI Interface

For XL-DC and Mark V



This option provides a precise BCD time code output and both 1PPS and 1 PPM outputs.

The BCD code contains 40 bits of UTC time of day plus the TFOM (Time Figure of Merit). For compatibility with older equipment, a jumper may be placed to remove the TFOM and day of year information.

A second, identical PTTI port, including its companion 1PPS and 1 PPM pulse rate outputs, may be added as an extra-cost option at the time of order.

Applications include military timing and communications systems.

Specifications

BCD TIME CODE

- Data: 40-bit serial BCD output containing seconds through days data plus TFOM. The TFOM and day of year information may be deleted using a jumper. The data and TFOM formats conform to ICD-GPS-060.
- Output: ±5 V differential. Complies with ICD-GPS-060 and MIL-STD-188-114A, Type I generator. Can be configured as a Type II generator at the time of order.
- Connector: MS3470L8-33S

1PPS TIME ROLLOVER PULSE

- Output: 10 Vdc, ±1 V into 50Ω
- Pulse width: 20 microseconds, ±1 microsecond
- Rise time: <20 nanoseconds
- Fall time: <1 microsecond
- Connector: BNC

1 PPM TIME SYNCHRONIZATION SIGNAL

- Output: 10 Vdc, ±1 V into 50Ω
- Pulse width: 20 microseconds, ±1 microsecond
- Rise time: <20 nanoseconds
- Fall time: <1 microsecond
- Connector: BNC

MECHANICAL

- Panel space: Requires two vertical slots in XL-DC and Mark V chassis for 2 PTTI channels.

* User specifies at time of order either MHz outputs or MPPS outputs

Low Phase Noise Output For XL-DC and Mark V



This option provides three or four* isolated, 50 ohm frequency output signals with exceptional spectral purity. Isolation from the receiver's internal digital signal noise and power supply noise enables the same high-performance phase noise and spurious noise characteristics as the oscillator source.

Oscillator selection for the XL-DC or Mark V Receivers can include the Symmetricom Standard Quartz, High-Stability Quartz, Rubidium, or a user-supplied external oscillator.

Contact Symmetricom for specific oscillator performance characteristics.

Specifications

LEVEL

- 1 Vrms $\pm 10\%$ into 50 Ω

CONNECTOR*

- Rear panel BNC. Three or four connectors for 5 MHz or 10 MHz output*; three connectors for 1, 5, 10 MHz output.

WAVEFORM

- Sine, harmonics $< -30\text{dBc}$

OPTIONS

- Low phase noise option (5 MHz or 10 MHz):

SSB Phase Noise: f	Standard Quartz Osc. £ (f)	High-Stability Quartz Osc. £(f)	Rubidium Oscillator £(f)
1 Hz	-80dBc	-90dBc	-85dBc
10 Hz	-110dBc	-120dBc	-105dBc
100 Hz	-125dBc	-140dBc	-130dBc
1000 Hz	-130dBc	-145dBc	-135dBc
10000 Hz	-130dBc	-145dBc	-140dBc

All specifications are measured at the Low Phase Noise Option card output.

- Spurious:

30 Hz $< f < 300$ Hz	-100dBc	-115dBc	-110dBc
300 Hz $< f < 3000$ Hz	-90dBc	-125dBc	-125dBc
3000 Hz $< f < 25000$ Hz	-90dBc	-100dBc	-90dBc

* Connector quantity; 10 MHz output or 1, 5, & 10 MHz outputs and oscillator selection must be specified at time of order.

Network Interface For XL-DC and Mark V



- Remote control of XL-DC/Mark V over a local network or the Internet
- Telnet protocol

The Network Interface provides remote control of the XL-DC or Mark V over a local network or the Internet. Supported protocols include Telnet and DHCP. The plug-in card supports a 10 Base-T Ethernet connection and an RS-232 port.

Using Telnet, users can remotely check the status and/or configure the XL-DC/Mark V receiver over a network. This capability can be a tremendous time- and labor-saving resource when the receiver is not readily accessible or when it is inconvenient to attach a computer for local RS-232 operation. Most operations possible via the standard XL-DC/Mark V RS-232 port are also available via Telnet. Command syntax is the same for both interface modes. Password protection is provided to maintain secure access to the unit.

DHCP (Dynamic Host Control Protocol) is built into the Network Interface Card. An XL-DC or Mark V equipped with the Network Interface card can automatically be configured with network address information when connected to a network that has a DHCP server in operation.

The Network Interface option is installed at time of order and replaces the standard RS-232 port on the XL-DC/Mark V. Due to the nature of the interface, the precision RS-232 time strings are disabled. Time to the second is still available via RS-232 or Telnet.

Specifications

NETWORK INTERFACE

- Autodetecting: 10 Base-T (Ethernet, TCP/IP)
- Network protocols: Telnet, DHCP
- Serial I/O: Bidirectional RS-232, 9600, N, 8, 1



Loss of Lock Alarm

For XL-DC and Mark V

The Loss of Lock Alarm output provides a signal to external monitoring equipment when the receiver has lost lock on the GPS system. Corrective action can then take place whether it is automatic or manual in nature. Two versions of the option are available. The first provides an open collector type impedance output and is supplied via a rear panel BNC. The second provides relay contact outputs and is supplied via a plug-in option card.

Specifications

OPEN COLLECTOR ALARM

- Normal operation: Low impedance
- Fault condition: High impedance
- Max voltage: 25 Vdc
- Max current: 50 mA
- Connector: BNC

RELAY CONTACT ALARM

- Contact ratings
 - Max Resisting Load: 60 VA
 - Max Switching Voltage: 150 Vdc
 - Max Switching Current: 2.0 A
 - Max Carry Current: 2.0 A
- Connector: NO, NC and COM provided on barrier strip
- Physical: One slot plug in card for XL-DC/Mark V chassis only

Programmable Pulse Output

For XL-DC and Mark V

The Programmable Pulse Output option is a software option that provides a user configurable HCMOS 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 millisecond resolution for fine control. The periodic pulse rates achievable are 1PPS, 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. The pulse width is also adjustable. The pulse amplitude is TTL levels into 100 ohms and is supplied via a rear panel BNC.

IEEE-488 Interface

For XL-DC and Mark V



The IEEE-488 Interface option is a versatile byte-wide communication port that provides precise time on demand and remote control of most clock functions. This option is electrically and mechanically compatible with the IEEE-488 Standard 488-1978.

The IEEE-488 interface codes listed below fully define the interface capabilities. Full descriptions of these functions are included in the IEEE Standard 488-1978.

Interface Codes

SH1	Source Handshake	Full capability
AH1	Acceptor Handshake	Full capability
T8	Talker	Basic talker, serial poll unaddress if MLA (My Listen Address)
L4	Listener	Basic listener, unaddress if MTA (My Talk Address)
SR1	Service Request	Full capability
RL0	Remote Local	No capability
PP2	Parallel Poll	Local configuration
DC1	Device Clear	Full capability
DT1	Device Trigger	Full capability
CO	Controller	No capability
E1	Driver Electronics	Open collector

Specifications

NETWORK PROTOCOLS

- The time output format is as follows:


```
<SOH>DDD:HH:MM:SS.tttQ<CR><LF>
```

DDD	Day of year (three digits)
HH	Hours (two digits)
MM	Minutes (two digits)
SS	Seconds (two digits)
ttt	Milliseconds (three digits)
Q	Time quality (one digit); estimate of time base drift after loss of signal lock. Specific trip points are user configurable.

<CR> and <LF> are ASCII control characters.
<SOH> is an ASCII start of header.
":" and "." are ASCII delimiters.
- You can address additional functions using a simple command syntax of the form:


```
F<xx><data><CR><LF>
```

F<xx> "F" followed by the function number
<data> You can enter data to modify a function value. If you do not enter data, the current function value is returned.
<CR> and <LF> are ASCII control characters.
- Data transfer rate: Maximum transfer rate for a 19-character string (such as the Time string) is 1 millisecond.
- Command functions: Bidirectional control of all applicable receiver functions.
- Software input time freeze: Time resolution is to 1 millisecond.
- Hardware input time freeze: TTL level, positive edge causes the time to be latched. Input is latched until time transfer is completed. Time resolution is to 1 microsecond. BNC input connector on rear panel of IEEE option plug-in.



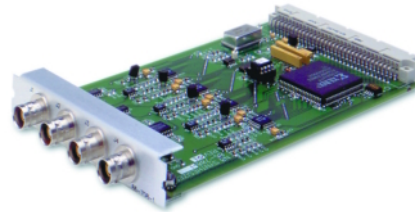
Slow Code Output

For XL-DC and Mark V

The Slow Code Output option provides up to three pulse outputs primarily for initiating timing marks for drum or strip chart recorders. The available output pulses are 1 PPM, 1 PPH, 1 PPD. Each pulse's rising edge is aligned to within a few nanoseconds of the receiver's 1PPS signal. The output levels are TTL levels into 100 ohms via a rear panel BNC. The pulse widths can be adjusted from 1 to 59 seconds.

N8 Frequency Synthesizer

For XL-DC and Mark V



The N8 Frequency Synthesizer provides pulse rates from 8 kPPS through 8192 kPPS in 8 kPPS steps, with the output frequency locked to the system oscillator. This option card offers four independently programmable frequency synthesizers that provide pulse rates from 8 kPPS through 8192 kPPS in 8 kPPS steps.

Specifications

- Channels per PCB: 4, independently programmable
- Input reference frequency: System 1 MPPS
- Output pulse rates: 8 kPPS through 8192 kPPS in 8 kPPS steps
- Output drive: RS-422 or single ended TTL into 50 Ω (factory set)
- Wave form: Square wave
- Jitter cycle-to-cycle <10ns
- Output connector Options: Triax, Wire-wrap, 9 pin-D, BNC

Parallel BCD

Millisecond and Microsecond Resolution

The parallel BCD time output option provides an interface to synchronize external pieces of equipment. There are two 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 12 additional lines to cover hundreds of days through units of microseconds. It also provides one additional data valid strobe.

The millisecond resolution version requires one XL-DC/Mark V option card slot, while the microsecond version requires two slots.

Specifications

OUTPUTS

- Millisecond version: ms through day-of-year, (4) time quality bits, 1PPS strobe and 1 kPPS strobe.
- Microsecond version: μ s through day-of-year, (4) time quality bits, 1PPS strobe, 1 kPPS strobe and 1 MPPS strobe.
- Drive: +5 Vdc at HCMOS levels

PHYSICAL

- Millisecond version: 1-slot card with 50-pin D connector. Mating connector provided.
- Microsecond version: 2-slot card with 50-pin D connector and 25 pin D connector. Mating connector provided.

Have Quick II

The Have Quick II 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 used to synchronize military radio systems.

Specifications

- Format: Have Quick II (ICD-GPS-060)
- Bit period: $600\mu\text{s} \pm 10\mu\text{s}$
- Bit rate: Approximately 1667 BPS
- Output level: HCMOS (standard) on RS-422 (optional)
- Frame rate: 1 frame/second
- Frame length: 504 Bits
- Accuracy: First bit starts within $10\mu\text{s}$ of leading edge of 1PPS
- Connector: Isolated female BNC



ExacTime 6000

GPS Time & Frequency Generator

KEY FEATURES

- GPS Time and Frequency Reference
- Disciplined Quartz Oscillator Time Base
- Optional Disciplined Rubidium Oscillator
- Rapid Acquisition and Time Stabilization
- Six Programmable Output Signals
- 1PPS Time Interval Measurement to 1 Nanosecond
- Automatic Daylight Saving Time Update
- External Frequency Measurement to 10^{-14}
- External Event Time Logging - Up to 256 Event Storage
- Over 40 Signal Output and Function Options
- RS-232 Input/Output Port
- RS-232 Printer Port
- Free Remote Control Software for Windows 95/98/2000/XP

INTRODUCTION

Symmetricom's ExacTime™ Time and Frequency Generators are full featured GPS receivers that offer three time base oscillator options and a wide range of "off-the-shelf" optional features. ExacTime fits virtually any GPS time and frequency application.

The ExacTime 6000 is a 1U rack mount chassis that is configured to meet or exceed the demands of many applications, including test and measurement, metrology, range instrumentation and telecommunications. The extreme flexibility of this instrument allows configurations including time codes, low phase noise frequencies, pulse rates, parallel time and many other outputs to support specific needs. The internal quartz time base oscillator can be upgraded to an oven quartz oscillator or to a rubidium oscillator. A time zone offset control is included with 1/2-hour resolution, and a daylight saving time capability

can be set for ten years. These controls affect the LCD display, time code output and the time in the RS-232 outputs. The year can be preset to any value for test purposes. For situations in which it is desirable to disable the oscillator disciplining process temporarily, a "flywheel" mode is provided. While in flywheel mode, the oscillator loop is opened, and the natural purity of the oscillator is not perturbed by the disciplining function.

The basic unit provides six output BNC ports and one input BNC port. The six output ports are user selectable via box pin jumpers and front panel controls to generate frequency (10 MHz), pulse rates (1 PPM to 10 MPPS) and time code (IRIG B). Other frequency and time code outputs can be optionally added. A front panel LCD panel gives the user a simple and intuitive control interface. Remote control software for Windows is included upon request.



ExacTime GPS Time & Frequency Generator

BASIC CONFIGURATION

ExacTime units are optionally equipped with a variety of Oscillators designed to suit your precise needs. Table 1 lists the part numbers and specifications for these Oscillator Options. Please contact the factory for guidance in configuring the ExacTime to meet your requirements. For more information, contact Global Services or your local Sales Rep.

SPECIFICATIONS

The capability of selecting any of several signals as inputs and outputs to and from the basic ExacTime unit make it possible to meet most requirements with a basic unit without the necessity for adding options. Figure 1 illustrates the capability. Four pulse rate multiplexers each produce a selected output of 1 PPM, 0.1 PPS, 1PPS, 10 PPS, 100 PPS, 1 KPPS, 10 KPPS, 100 KPPS, 1 MPPS, 5 MPPS, 10 MPPS, IRIG B (DC), GPS status (Locked, Tracking), or +5 V. These outputs are selected either through the LCD menu or by remote control over the RS-232 input/output port. A 10 MHz sine wave can be chosen by internal jumper for any (or all) of the six output connectors. Likewise, IRIG B (AC) can be chosen for any (or all) of the six output connectors. The factory default function of J10 is 1PPS (TTL) input for displacement measurement, but it can be selected as the input to the Event Log Counter or as an External Frequency Measurement input. J9 is factory set to output IRIG B (DC), while J8 is factory set to output IRIG B (AC). J6 is factory set to output Mux #3 digital signals with Mux #3 set to output 1PPS. Finally, J5 and J4 can either be used to output GPS status or as duplicate outputs of Mux #2 and/or Mux #1. Additional signal outputs are generated by the ExacTime 6000 through the option bay, which uses the “J3” area shown in Figure 2.

OSCILLATOR OPTION	TCXO	OCXO	RUBIDIUM
Part number	ET6000-TCXO	ET6000-OCXO	ET6000-RB1
Aging rate	1E-7/Day	5E-10/Day	5E-11/Month
Phase noise			
1Hz	-72dBc/Hz	-94dBc/Hz	-82dBc/Hz
10Hz	-93dBc/Hz	-115dBc/Hz	-91dBc/Hz
100Hz	-115dBc/Hz	-136dBc/Hz	-134dBc/Hz
1KHz	-126dBc/Hz	-144dBc/Hz	-144dBc/Hz
Stability			
1 Sec	2E-10	3E-11	3E-11
10 Sec	2E-10	2E-11	1E-11
100 Sec	1E-9	4E-11	3E-12

TABLE 1 ExacTime Oscillator Options

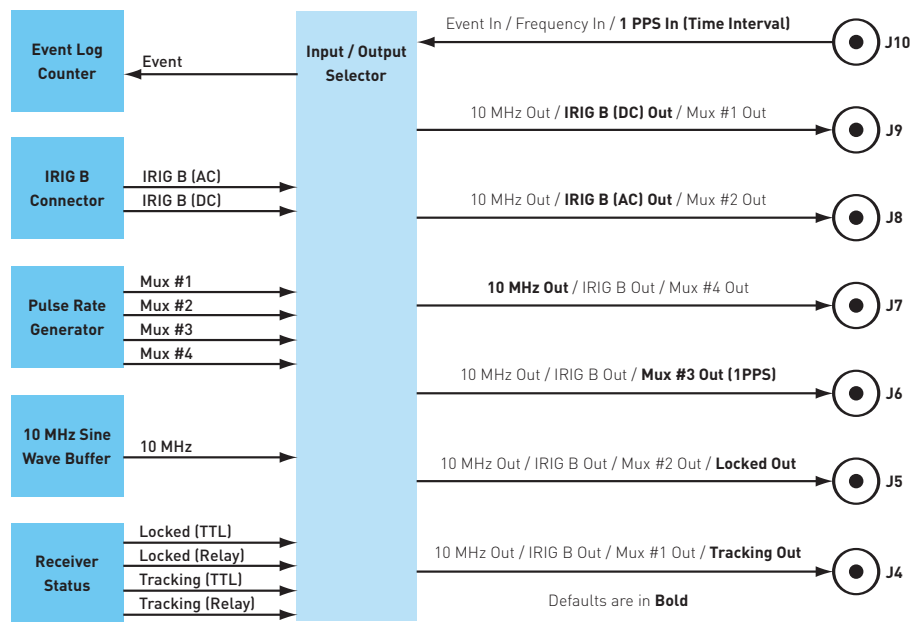


FIG.1 Flexible input/output signal selection

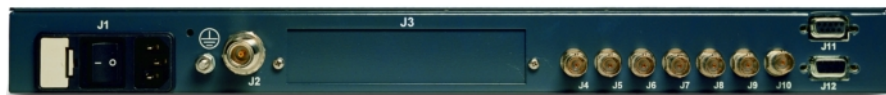


FIG.2 Rear View (1U chassis)



OPTIONS GUIDE

This guide is designed to assist the user in customizing the ExacTime 6000 Time and Frequency Generator. The BNC connectors on the rear panel are configurable to provide the outputs listed on the data sheet. The factory selections are:

- J4 = Tracking (TTL)
- J5 = Locked (TTL)
- J6 = 1PPS (TTL)
- J7 = 10 MHz (sine)
- J8 = IRIG B (AC)
- J9 = IRIG B (DCLS, TTL)
- J10 = Time Interval Input (1PPS, TTL)

The ExacTime unit has a plug-in option motherboard with four (4) option pads (refer to the Option Motherboard, GPS Option 40x). Options are implemented with plug-in modules. The following information identifies available options. Some option modules may be stacked to provide additional functionality. Always consult the factory for assistance with stacked option configurations.

01 MULTIPLE TIME CODE OUTPUT

This option is described in detail in a separate data sheet. Three (3) simultaneous modulated time code outputs can be programmed with either the same or different time code formats.

- Option slots: 2 / Prerequisite: Option 40
- Connectors: J3A, B & C or J3D, E & F

01A MULTIPLE TIME CODE DC LEVEL OUTPUT

If Option 01 is selected, this option provides DC level shift outputs for the output time codes.

- Option slots: 0 / Prerequisite: GPS Option 01
- Connectors: J3D, E & F

06A 1 MHz SINE WAVE OUTPUT

The 1 MHz Sine Wave output is derived from the internal disciplined oscillator by frequency division. The long term accuracy and stability is the same as the internal crystal oscillator.

- Option slots: 1 / Prerequisite: Option 40
- Connectors: J3A, B, D or E

07A 5 MHz SINE WAVE OUTPUT

The 5 MHz Sine Wave output is derived from the internal disciplined oscillator by frequency division. The long term accuracy and stability is the same as the internal crystal oscillator.

- Option slots: 1 / Prerequisite: Option 40
- Connectors: J3A, B, D or E

08G -48 VDC POWER

Negative 48 VDC input power is connected via a 4-pin nylon Molex connector. The input connections are completely isolated from the chassis and the signal ground the unit into the DC/DC converter power supply. Not available with Option 15A.

- Option slots: 0 / Prerequisite: None
- Connectors: J1

08CE 10 to 32 VDC POWER

DC input power is connected via a nylon Molex connector. The input connections are completely isolated from chassis and the signal ground of the the DC/DC converter power supply. Not available with Option 15A.

- Option slots: 0 / Prerequisite: None
- Connectors: J1

13A PARALLEL BCD OUTPUT (D-ms)

Time is output by parallel BCD digits representing days, hours, minutes, and three digits of fractional seconds (millisecond resolution). The outputs standard HCMOS compatible. Each capable of sinking and sourcing 4 mA. Included in the output is a strobe signal is normally low, going high when the data is being updated, and going low the data is stable. This signal's falling can be used as a clock to load data external registers.

- Option slots: 2 / Prerequisite: Option 40A

14A IEEE-488 BUS INTERFACE

This option provides the same remote control commands and responses as the standard RS-232 I/O.

- Option slots: 2 / Prerequisite: Option 40D
- Connectors: J3

21A 10 MHz SINE WAVE OUTPUT

The 10 MHz Sine Wave output is derived directly from the internal disciplined oscillator. The long term stability is the same as the internal oscillator.

- Option slots: 1 / Prerequisite: Option 40
- Connectors: J3A, B, D or E

25 RACK MOUNT SLIDES

The ExacTime 6000 and is provided with rack mount flanges, but body support should be provided to avoid twisting the mounting flanges and front panel. The slides are furnished with hardware for mounting front and rear RETMA rails.

- Option slots: 0 / Prerequisite: None

33A 1.544/2.048 MHz SQUARE WAVE OUTPUT

This module provides a square wave frequency output of either 1.544 MHz or 2.048 MHz (selected by DIP switch) that is phase locked to the internal disciplined oscillator. The ET6000-TCXO will provide Stratum III performance, Stratum II with the OCXO, and Stratum 1 with the rubidium oscillator (RB1).

- Option slots: 1 / Prerequisite: Option 40

33B T1 (1.544) FRAMED ONES OUTPUT

Provides an output of framed all ones T1 signal to operate in telecommunications systems typically within the United States. The ET6000-TCXO will provide Stratum III performance, Stratum II with the OCXO, and Stratum 1 with the rubidium oscillator (RB1).

- Option slots: 2 / Prerequisite: Option 40B
- Connectors: J3A

33C E1 (2.048) FRAMED ONES OUTPUT

Provides an output of framed all ones E1 signal to operate in telecommunications systems typically outside the United States. The ET6000-TCXO will provide Stratum III performance, Stratum II with the OCXO, and Stratum 1 with the rubidium oscillator (RB1).

- Option slots: 2 / Prerequisite: Option 40B
- Connectors: J3A

40x OPTION MOTHERBOARD

This assembly provides the GPS unit with four option slots. It is required for most of the option modules described in this Configuration Guide. There is more than one version of this motherboard, so care must be taken to select the Option Motherboard that is required to support a particular option.

- Option slots: 0 / Prerequisite: None

LONG ANTENNA CABLE

Cable type is Belden 9104 (RG59) cable with BNC & TNC terminations at each end.

- Option 340-75-5 = 75 foot cable
- Option 340-100-5 = 100 foot cable
- Option 340-125-5 = 125 foot cable
- Option 340-150-5 = 150 foot cable
- Option 340-200-5 = 200 foot (60 m) cable*
- Option 340-250-5 = 250 foot (75 m) cable*
- Option 340-275-5 = 275 foot cable*
- Option 340-300-5 = 300 foot cable*
- Option slots: 0
- * Requires In-line Amplifier (option 150-200)

LIGHTNING ARRESTOR WITH CABLE

The lightning arrestor option provides an inline unit that protects the GPS receiver from lightning surges. It is provided with 25 or 50 feet low loss cable. This option is desirable in lightning areas of the country. Connectors are Type TNC at both ends of the cable.

- Option 150-709 = 25' (7.5 m) cable
- Option 150-710 = 50' (15 m) cable
- Option slots: 0 / Prerequisite: None

ADDITIONAL GPS ANTENNA OPTIONS

- GPS in-Line Amplifier for extended cable runs up to 300' (91m)
- GPS Antenna Down/Up Converter for long cable runs up to 1500' (457 m)
- GPS Antenna splitter kit

ET6000 Specifications

ELECTRICAL SPECIFICATIONS

- Outputs

10 MHz sinusoid:	1 Vrms into 50Ω
1PPS digital output:	TTL level into 50Ω
Selectable pulse rates:	TTL level into 50Ω, 1PPM to 10 MPPS in decade steps, and 5 MPPS
Time code:	IRIG B into 50Ω, 3V P-P (AC & DC) IEEE 1344 compliant. Time code output is suppressed until accurate time is established.
Status:	TTL* Relay**
+5 VDC	X -
LOCKED	X X
TRACKING	X X

*TTL level into 50Ω
**Relay N.O. Contact, 100 mA

Printer outputs:	RS-232, 9-pin 'D' connector
Format A:	Year, time, status, position and interval at a programmed interval
Format B:	Time (D:H:M:S), CR on-time, every second
- Inputs

1PPS time interval	
Signal:	TTL level, pos or neg edge select
Resolution:	1 nanosecond
Accuracy:	<10 nanoseconds
External event log	
Signal:	TTL level, pos or neg edge select
Resolution:	100 nanoseconds
Storage:	Up to 256 events
External frequency measurement	
Square wave:	Logic "0" +0.2 ±0.2 VDC Logic "1" +2.4 to +15 VDC 1 Hz to 10 MHz
Sine wave:	1 to 5 V P-P, 100 kHz to 10 MHz
Offset range:	nnnnX10-9 to nnnnX10-14 Autoranging
- GPS subsystem

Time accuracy:	After power-up, when LOCKED and using 200 position averages, will be better than ±125 nanoseconds relative to UTC with SA on within: 3 hour using Rubidium oscillator 2 hours using Oven oscillator 1 hour using TCXO oscillator
Frequency accuracy:	90% of time, better than: 1.0E-9 (TCXO) 1.5E-10 (OCXO) 1.0E-11 (Rubidium)
Position accuracy:	100m 2drms with SA. Less than 25m SEP without SA
Maximum velocity:	515 meters/second (1,000 KPH)
Tracking channels:	12 parallel
Receiver frequency:	L1, 1.575 GHz, C/A code
Acquisition time:	Typically <5 minutes to first fix.

- Oscillator aging

TCXO (standard):	Aging: 1.0E-7/day
OCXO LPN (optional):	Aging: 5.0E-10/day
Rubidium (optional):	Aging: 5.0E-11/month
- Input/output

Remote control and data output:	RS-232, 9-pin 'D'
---------------------------------	-------------------
- Front panel

Display:	LCD, 2x40 characters. Displays time, status, satellite position data, frequency and control menu
Keypad:	0-9, Menu. Provides control of all functions

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature

Operating	
Unit:	0°C to 50°C
Antenna:	-40°C to 85°C
Storage	
Unit:	-20°C to 70°C
Antenna:	-55°C to 100°C
Humidity	
Unit:	0-95% relative, non condensing
Antenna:	Unlimited
 - Power requirements: 85-264 VAC, 47-440 Hz, <-40 watts
 - Dimensions

H (in/cm)	W (in/cm)	D (in/cm)
1.75/4.45	17/43.18*	12/30.48
*19/48.26 with rack mount ears		
 - Standard equipment
 - GPS Antenna
 - 50' (15 m) of Beldon 9104 antenna cable
 - 18" (45.72 cm) antenna mast
 - Complete antenna mounting kit
 - User's manual
 - Power cord
- * See ExacTime Options Guide for additional options and option details.



GPS-605

GPS Synchronized Clock and Time Code Generator

KEY FEATURES

- IRIG B Time Code Output
- Precise 1PPS Output
- GPS Synchronization
- Compact Size
- Manual Setup Controls
- RS-232 I/O Interface

Symmetricon's GPS-605 is a low-cost, high-performance GPS receiver and time display. Time is precisely referenced to UTC and displayed in days, hours, minutes and seconds. The primary outputs of the GPS-605 are an IRIG B time code and a precise 1PPS. Time and status information are also available via the RS-232. The GPS-605 combines the performance and key features usually found in large, expensive units in a cost-effective configuration.

The GPS-605 is ideal for providing time to range control rooms, launch facilities, air-field control towers, power utilities and data collection or reduction installations. It is an effective time display for operators, while outputting the necessary timing signals for accurate and reliable system synchronization. The easily visible display includes twelve 0.5" LED digits for time and status. The GPS-605 can also be used to drive other time displays.

The IRIG B serial time code output is either analog or digital with an accuracy of 2 microseconds to UTC. The 1PPS pulse rate also is accurate to 2 microseconds. The RS-232 interface provides control functions, GPS status, and time to the millisecond either on demand or automatically once per second. Time is referenced to UTC with user-configurable daylight saving and local time offsets provided. Display and receiver configurations are easily adjusted with either manual or RS-232 control.

The GPS-605 is quick and easy to install; simply install and connect the GPS antenna and connect the power unit to a wall outlet, then the unit is ready to run. IRIG time code and 1PPS output is automatic. The unit includes a bracket for easy mounting to a desk or ceiling.



GPS-605 GPS Synchronized Clock and Time Code Generator

GPS-605 Specifications

RECEIVER/GENERAL

- Timing accuracy: ± 2 microseconds to UTC (with SA)
- Position accuracy: 25 meters (without SA)
- Receiver input: 1575 MHz L1 C/A code
- Tracking: Six parallel channels
- Acquisition time: Warm start (has ephemeris data and position) typically <3 minutes. Cold start typically <20 minutes.
- Internal oscillator
 - Accuracy: 5×10^{-8} when disciplined to GPS
 - Stability: 1 PPM, 0°C to +50°C
- UTC to local offset: User selectable
- Daylight saving: Programmed by user to select time, day and month when DST begins and ends.
- Leap second: Automatically inserted
- Antenna: L1 GPS, 40dB gain. RG-59/U cable, 50' (15 m) supplied; maximum cable length 150' (46 m). For longer cable runs, see Options.

FIXED OUTPUTS

- IRIG B serial code output (Analog)
 - Amplitude: Adjustable, 0–6 Vpp into 600 Ω , factory set to 3 Vpp
 - Ratio: Adjustable, 2:1 to 6:1, factory set to 3:1
 - Connector: BNC
- IRIG B serial code output (RS-422)
 - Amplitude: TTL levels
 - Connector: RJ11
- 1PPS
 - Logic level: 0–5 Vdc
 - Output impedance: 50 Ω
 - Timing: Positive edge on time
 - Duty cycle: 50%
 - Connector: BNC
- RS-232 I/O
 - Baud rate: User-selectable protocol. 1200 to 38400 baud. Factory set to 9600 baud.
 - Output data: Time, status and current setting of control parameters
 - Input data: Time preset, mode control, local offset, display parameter setup, local offsets, daylight savings
 - Connector: RJ11; RJ11-DB9 adapter included
- Manual controls: Serial I/O (baud rate, data, stop parity), intensity, local offset (\pm HH:MM), days display on/off, year, daylight saving, 12/24 hour mode, switch/remote lockout, firmware version, time broadcast on/off, GPS status
- DC input power voltage: 9–20 Vdc at 10 watts maximum
- AC input power voltage: 115 Vac +20% at 10 watts maximum (230 Vac input optionally available)

MECHANICAL/ENVIRONMENTAL

- Receiver
 - Display digit height: 0.56" (1.42 cm)
 - Display digit type: Numeric LED
 - Display digit quantity: 12 (DDD:HH:MM:SS)
 - Display digit color: Red, adjustable intensity
 - Display digit viewing distance: 25' (7.62 m)
 - Chassis size: 7.5" W x 1.64" H x 3.6" D (19 cm x 4.2 cm x 9.1 cm); with desk/wall mount: 9" W x 2.7" H x 5.25" D (22.9 cm x 6.9 cm x 13.3 cm) [4.25" (10.8 cm) deep with connectors].
 - Operating temperature: 0°C to +50°C
 - Storage temperature: -20°C to +85°C
 - Humidity: To 95%, noncondensing
- Antenna
 - Size: 3" Dia x 3" H (7.62 cm x 7.62 cm)
 - Weight: 0.55 lb. (0.25 kg)
 - Operating temperature: -40°C to +70°C
 - Storage temperature: -55°C to +85°C
 - Humidity: 100%, condensing
- Certification: FCC, CE

RS-232 PROTOCOL

- Standard Symmetricom serial I/O commands: Commands and responses are ASCII. Responses are terminated with carriage return/line feed.

F01:	Time zone entry/request
F02:	12/24 hour format entry/request
F06:	Keypad lockout enable
F08:	Continuous time once per second enable (Mode C automatic once per second transmission)

<SOH>DDD:HH:MM:SSQ<CR><LF>*

Where:

DDD	Day of year
HH	Hours
MM	Minutes
SS	Seconds
Q	Is the time quality indicator; Locked = space, unlocked = ?

F09: Time on request enable

<SOH>DDD:HH:MM:SS:mmmQ<CR><LF>

F18: Software version request

F50: Position request

F60: Satellites list request

F66: Daylight saving enable/request

F68: Year entry (GPS epoch management)

F69: Select local/standard/GPS/UTC time

- * Note the first zero-to-one transition of the carriage return is the beginning of the second.

- Symmetricom TL-3 Compatible Commands: The GPS-605 supports the full range of Symmetricom TL-3 setup and query commands, including those listed below.

QA: Request lock status

QC: Current date and time request

QD: Current date request

QT: Current time request

OPTIONS

- 230 Vac input module
- GPS antenna down/up converter for long cable runs. Contact Symmetricom for application-specific details.
- Wall-mount kit (standard unit includes only desk/ceiling brackets)

TymMachine 7000

KEY FEATURES

- Dual-Function Time Code Generator and Time Code Translator
- Most Options Easily Added or Removed in the Field
- Continuous Uninterruptible Time Code Generator
- Synchronized Time Code Generator with Oscillator Disciplining
- Generates IRIG A132, B122, G142, NASA 36, 2137, XR3 or ANG & Q53 (250 Hz) [BCD TIME ONLY]
- Generates IRIG B120 (with Control Functions & Straight Binary Seconds)
- Selectable Filters Improve Translator Performance
- RS-232 Input/Output Control/Data Port
- RS-232 Burst Time Word Output
- Setup/Control Utility Program for Windows 95/98/NT/2000
- Operating Parameters Saved Through Power Loss
- Battery Backed Clock Keeps Time for 30 Days Without Power
- Independent Generator and Translator Pulse Rates
- Dedicated 0.6" LED Time Display
- Automatic Self-Test Diagnostics

INTRODUCTION

Symmetricom's TymMachine™ 7000 is both a time code generator and a time code translator that can easily be switched to function as a synchronized time code generator. An integral serial RS-232 port allows control of many of the variables via the utility program. Optional capabilities, such as Video Time Insertion, Parallel Time Output, and Tape Search & Control are provided by means of plug-in modules that are easily installed in option slots in the rear of the chassis.

The Time Code Generator outputs IRIG B120 (with Control Functions and Straight Binary Seconds) via a BNC connector, and also outputs a selected code (either IRIG A132, B122, G142, NASA 36, 2137, XR3 or ANG & Q53 (250 Hz) [BCD TIME ONLY] via another BNC connector. The generator can be set to operate independently, even

while the translator is processing a time code input. The Time Code Translator reads any of 14 different time codes at various speeds (tape speed-up and slow-down) and both forward and reverse directions. The time code input is conditioned by both a lowpass filter and a phase-locked tracking filter to provide the ultimate in performance when translating time codes that are contaminated by noise and distortion.

Most operating parameters are stored in non-volatile memory, making initialization after a power loss unnecessary. A rechargeable battery prevents time loss after an external power failure. The unit runs automatic self-test diagnostics each time power is turned on. Any abnormal test result is displayed on the front panel to aid in determining the proper corrective action.



TymMachine 7000

SPECIFICATIONS

COMMON FUNCTIONS

The TymMachine 7000 is built with a generous complement of built in functions, and a four slot option bay to allow optional functions to be added in the field merely by inserting the desired option module. The TymMachine 7000 Configuration Guide includes a comprehensive list of all options available.

OPERATOR CONTROLS

A two-row, 40-character LCD display provides a menu-oriented selection of all controllable functions. Control selections are entered via the keypad, located below the display.

TIME DISPLAY

Time is displayed via a digital LED display on the front panel. Either Generator time or Translator time is displayed, depending on selections made via the menu/keypad.

Format

Days/ID : Hours : Minutes : Seconds

Digit height:

0.6" (1.52 cm)

DIAGNOSTIC TOOLS

The TymMachine 7000 performs an automatic self-diagnostic test each time power is applied. The last test passed is displayed for easy troubleshooting in the event of a failure.

RS-232 INPUT/OUTPUT (PORT A)

Most functional parameters can be set and the status checked by a computer via this serial port. ASCII character strings are used to form the commands to the unit. Time to the nearest 0.1 millisecond can also be output upon request.

RS-232 TIME WORLD OUTPUT (PORT B)

This serial port outputs time (days - milliseconds) at a periodic rate as determined by DIP switch settings. Alternatively, the time word output can be triggered by receipt of any 8-bit character, as set by a DIP switch.

INTERFACE CONNECTORS

The interface connectors for the basic TymMachine 7000 are provided on the rear panel, as shown below. The connectors for each plug-in module are located on the module.

PRIMARY POWER

Voltage: 85-264 VAC
Frequency: 47-440 Hz
Consumption: <30 watts

ENVIRONMENT

Temperature: 0°C to 50°C
Humidity: 0 to 95% RH, without condensation

Dimensions

Chassis: 1.75" H x 19" W x 17" D
(4.45 cm x 48.26 cm x 43.18 cm)

OPTIONS

PARALLEL BCD TIME OUTPUT MODULE

Outputs time as days, hours, minutes, seconds and fractions of seconds to the nearest 10 microsecond at real time tape speed and any speedup ratio from 2:1 to 16:1 (up to 8:1 for IRIG G).

MULTI-CODE TIME CODE ENCODER MODULE

Generates one of seven time codes as determined by operator selection via the LCD panel. This module also regenerates translator codes. The regenerate mode tracks IRIG A, B, G, NASA 36, 2137, XR3 or AN/GSQ-53 time code.

VIDEO TIME INSERTION MODULE

NTSC, RS-170 and PAL video can be processed with a time tag to the nearest millisecond.

50Ω DISTRIBUTION MODULE

Three groups of "1 in X 3 out" are provided on this module. The inputs can be bussed to provide any grouping desired. Multiple modules can be supported in the same chassis.

CHASSIS SLIDES

Chassis slides mount on standard RETMA rails (both front and rear rails are required).

TIME CODE GENERATOR FUNCTIONS

The TymMachine 7000 Time Code Generator develops a standard IRIG B serial function code with BCD seconds through days, 27 control function bits and 17 bits of straight binary seconds (IRIG B120). A selected time code is also output that produces IRIG A132, B122, G142, NASA 36, 2137, XR3 or AN/GSQ-53 as determined by operator input. Both time code outputs are output as amplitude modulated sine wave carriers, and the DC level shift (DCLS) code form.

Other time code outputs can be generated by adding one or more plugin option modules.

GENERATOR TIME BASE OSCILLATOR

Crystal oscillator (standard)
Aging rate: 1X10⁻⁷/day (0°C to 50°C)
Oven controlled quartz oscillator (option)
Aging rate: 5X10⁻¹⁰/day (0°C to 50°C)

EXTERNAL OSCILLATOR INPUT

An external frequency source can be used as a time base instead of the internal oscillator. If the external signal is interrupted, clocking automatically switches to the internal oscillator.

Either a sine wave or a square wave input is automatically accepted of 1 MHz to 10 MHz. The frequency must be an integral number of MHz, such as 2 MHz, 3 MHz or 4 MHz and so on. Input impedance is 50Ω. Signal amplitude can be between 1.0 - 5.0 V P-P.

TIME CODE OUTPUT

Format: IRIG B120 (fixed), IRIG A132, B122, G142, NASA 36, 2137, XR3, AN/GSQ-53 (selected)
Amplitude: 0 to 5 V P-P into a 50Ω load, adjustable
Modulation: 2:1 to 6:1, adjustable (3:1 normal)

BATTERY BACKED CLOCK

Timekeeping operation is maintained for up to 30 days after loss of primary power (with a full battery charge). When primary power is restored, the generator starts running with the correct time.

PULSE RATE OUTPUTS

Rates: 1PPS, 10 PPS, 100 PPS, 1 KPPS
Duty cycle: 50%
On-Time: Rising edge is on-time
Output level: Logic "0" = 0.4 VDC
Logic "1" = 2.4 VDC



Rear View

J1 - Power Input
J2 - RS-232 Input/Output
J3 - Pulse Rates, Translator Status
J4 - Multicode Time Code Output (DCLS)
J5 - External Time Base Input/10 MHz Out
J6 - 1PPS / External Start Input
J7 - AGC Time Code Output
J8 - Time Code Input
J9 - RS-232 Burst Time Output
J10 - IRIG B120 Time Code Output (AC)
J11 - IRIG B000 Time Code Output (DCLS)
J12 - Multicode Time Code Output (AC)
M1 - Bottom Left Option Module
M2 - Bottom Right Option Module
M3 - Top Left Option Module
M4 - Top Right Option Module



EXTERNAL START

The generator can be started from a preset time by a DC pulse from an external source. The trigger can be either a positive-going or a negative-going edge.

SYNC/VERIFY PRESET

This function allows the translator section to preset and start the generator, based on the time code currently being read. Once started, the generator continues running independently from its internal (or external) time base.

ADVANCE/RETARD

The phase of the internal clock can be manually advanced or retarded in increments ranging from 1 microsecond to 100 milliseconds per second. This provides a convenient and accurate means of aligning the generator outputs to an external time standard.

GENERATOR SPEEDUP

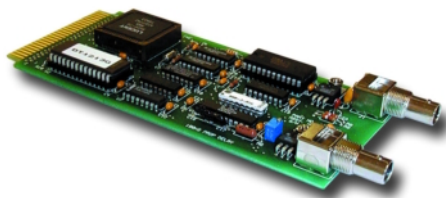
The generator can be set via the front panel to run at any speedup ratio from 2:1 to 32:1.

SYNCHRONIZED TIME CODE GENERATOR

This mode of operation uses the translator to read an input time code, which is used as a reference to steer and synchronize the generator. It can be within ± 250 nanoseconds of the reference time code, depending on the quality and type of code. In this mode the TymMachine 7000 tracks IRIG A, B, G, NASA 36, 2137, XR3 or AN/GSQ-53 time code.

OPTIONS GUIDE

Each option for the TM7000 is identified by an option number, which is listed on the following pages. The options are provided by means of a plug-in module that is installed into any available slot in the rear expansion bay. An option can occupy one or two adjacent slots. Each description given below indicates the size of the option in terms of slots. For example, the Tape Search Module (Option 02A) is a wide plug-in that occupies two option slots (side-by-side). Another example is the 50 Ω Distribution Module (Option 39A), which is a single width module that has large components that require that the module be installed in a bottom slot and that the slot directly above be empty. Every option is annotated with the number of slots required for installation.



Single Time Code Encoder Module

02A TAPE SEARCH

Double width module that provides direct motion control to an instrumentation tape drive to replay a selected segment of the tape based on time code recorded on the tape. Includes auxiliary outputs (START pulse, STOP pulse, INTERVAL level/relay, EARLY CLOSURE relay) and tape speed selection relays.

Slots: 2 (Horizontal)

04B MULTISPEED BCD (D-hms)

Single width module that outputs days through 0.00001 second resolution while translating any time code. This module will also provide the same resolution while replaying a time code from a tape at fast replay speeds. This module operates at real time speeds and faster.

Slots: 1

07A RS-232 TIME OUTPUT

The basic TM7000 provides one Time Output port; however, multiple ports can be installed via this option module. Single width module provides time output only. A time request is triggered by assertion of the RTS signal by the external device or upon receipt of a single character (set by DIP switch).

Slots: 1

14 SINGLE CODE SERIAL ENCODER

Single width module that generates one serial time code. Both the modulated (AC) and unmodulated (DC) forms of the code are output. Codes that are available are:

- Option 14A= IRIG A
- Option 14B= IRIG B
- Option 14C= IRIG E (100 Hz)
- Option 14D= IRIG E' (1 kHz)
- Option 14E= IRIG G
- Option 14F= IRIG H (100 Hz)
- Option 14G= IRIG H' (1 kHz)
- Option 14H= NASA 28
- Option 14I= NASA 36
- Option 14J= XR3
- Option 14L= 2137

Slots: 1

15 MULTICODE SERIAL ENCODER

The basic TM7000 provides one Time Output port, however, multiple ports can be installed via this option module. Single width module that generates either IRIG A, B, G, XR3, 2137 or NASA 36 by operator selection. In the TM7000 this module can regenerate any of its codes from the time code input to the Translator.

Slots: 1

17 READ DC TIME CODE

Single width module that provides the capability to translate an unmodulated time code (DC level shift).

Slots: 1

18 FIVE-RATE SLOW CODE

Single width module that outputs a pulse width/amplitude modulated DC level shift time code at one of five operator-selected pulse/frame rates. Used for annotating strip charts.

Slots: 1

20B OVEN-CONTROLLED CRYSTAL OSCILLATOR (OCXO)

An oven-controlled quartz oscillator for the time code generator time base. The aging rate of the oscillator is 1.0E-9/day.

Slots: 0

27 VIDEO TRANSFER INSERTER

Single width module that processes either a composite video (NTSC or RS-170) signal to add time as 365:23:59:59:999 in the video field. Time is stored upon detection of the vertical frame pulse.

Slots: 1

32A 600 Ω DISTRIBUTION MODULE

Single width module that provides three groups of "1-in X 3-out" distribution buffer amplifiers. Signal inputs and outputs are via miniature SMB coax connectors. Jumper pads are provided to connect a common input to two or three groups simultaneously. Mating SMB connectors are furnished.

Slots: 1

39A 50 Ω DISTRIBUTION MODULE

Double height module that provides three groups of "1-in X 3-out" distribution buffer amplifiers. Signal inputs and outputs are via miniature SMB coax connectors. Jumper pads are provided to connect a common input to two or three groups simultaneously. Mating SMB connectors are furnished.

Slots: 2 (Vertical)

45 50 Ω DISTRIBUTION

Provides one group of 1-in X 3-out distribution amplifier buffers on BNC connectors. The module provides a wide range of selectable pulse rates not available on the basic TM7000 unit. Jumpers on the module are used to select the desired pulse rate. Three configurations are available. Option 45A is a single-ended DC coupled amplifier with DC to 10 MHz bandwidth. Signal input and outputs are on BNC connectors. Option 45B accepts a TTL logic level input and outputs RS-422 levels. Signal input is on a BNC connector and outputs are on triax connectors. Option 45C is a transformer coupled buffer with 300 Hz to 300 kHz bandwidth. Signal input is on a BNC connector and outputs are on triax connectors.

- Option 45A - DC to 10 MHz Buffers
- Option 45B - TTL/RS-422 Buffers

Slots: 1

48 CHASSIS SLIDES

Chassis slides are available for the TM7000 for convenient rack mounting.

- Option 48A Chassis Slides

Slots: 0

TIME CODE TRANSLATOR FUNCTIONS

The Translator reads time code signals in either forward or reverse direction. The "infinite bypass" time code validation function provides digital noise rejection, allowing the time outputs to remain unaffected by noise, distortion, momentary signal loss and other anomalies in the incoming time code signal.

High frequency noise is rejected at the input by a selectable lowpass filter. The corner frequency of the filter is automatically selected as a function of the selected time code and the tape replay speed ratio.

A phase-locked tracking filter generates a digital clock that is phase locked to the time code carrier frequency. This provides reliable time base reconstruction in the presence of signal distortion, baseline variations, and momentary signal losses. The center frequency of this filter is also automatically selected as a function of the code and of the tape replay speed ratio.

• Input code

Code format:	IRIG A, B, E, E', G, H, H', NASA 28, NASA 36, XR3, 2137, GSQ-53
Carrier frequency:	30 Hz to 2 MHz
Amplitude:	100 mV to 10 V P-P without adjustment
Input impedance:	Greater than 40K
Modulation ratio:	2:1 to 6:1 without adjustment
Direction:	Forward or reverse (automatic)

• Fail safe

The TymMachine 7000 inherently protects against periodic loss of the input time code signal.

• Pulse rate outputs

Frequencies:	Input carrier rate Carrier rate divided by 10, 100, & 1000
Duty cycle:	50%
On-time:	Rising edge on-time
Output levels:	Logic "0" = 0.4 VDC Logic "1" = 2.4 VDC

DC CODE INPUT MODULE

Accepts an input time code signal that is the envelope of the modulated code (DCLS), with positive true or ground true level characteristics. Tape Search & Control Module A control interface to an instrumentation tape drive, allowing a selected segment of a recorded tape to be replayed based on a time code recorded on the tape. Virtually all instrumentation tape drives are accommodated, provided that they are equipped with a parallel unitary remote control interface. Contact Symmetricom for additional information about compatibility with a specific tape drive.

700

Miniature Time Code Generator

KEY FEATURES

- IRIG B Generator and Synchronized Generator
- Compact Size
- Light Weight
- Internal Batteries Allow Output of IRIG B Time Code Through Power Interruptions of Up to Eight Hours
- Alphanumeric Display

Symmetricom's model 700™ Miniature Time Code Generator suits applications where compact size, light weight and ease of operation are required. Generator time is set automatically using the IRIG B synchronized generator input. Internal batteries enable the generator to output IRIG B time code even if power is interrupted for up to ten hours. The time base of this self-contained unit is maintained by a precision crystal oscillator. A small alphanumeric display provides instant visual feedback of the 700's operation. Options are available to add video time insertion, other time codes, or parallel BCD output.

Standard features include an IRIG B synchronized generator input for rapid synchronization to a master generator. This feature makes the 700 ideal for flightline or remote field applications. IRIG B serial time code (1 kHz amplitude modulated carrier) is output via an SMA connector to drive data recorders, remote displays, or other peripheral timing instrumentation.

The 700 operates on 10.5 to 32 Vdc input via a 6-pin MS connector. A locking toggle switch turns power on/off. Once power is "on," synchronization to an external IRIG B input code is automatic. A red LED lights when power is on or if the 700 system is not locked to the input code, and a green LED lights when input code synchronization is complete.

Optional features allow the 700 series to be configured to the user's specific requirements. These options include Video Time Inserter, 1×10^{-7} TCXO, and Parallel BCD output. Other input/output codes and AC power adapters are also available. Because of the unit's compact size, space reservations may limit the number of options that can be installed. Please consult the factory or your local Symmetricom sales representative with your specific requirements.

Using the 10-digit LED time-of-year display or optional Video Time Inserter, you can preset the generator time in the absence of an external IRIG B input code using the push-button switches and operate the unit as a stand-alone IRIG B generator. The push-button switches also set the operating mode, display intensity, and video time insertion parameters.



Model 700 Miniature Time Code Generator

700 Specifications

GENERAL SPECIFICATIONS

- Synchronized generator input: Synchronizes to a user-supplied 1 kHz amplitude modulated IRIG B time code. 0.1 to 10 Vpp. Approximately 10k Ω to ground input impedance. Synchronizes to within 10 microseconds of reference code input.
- LED indicator: Red indicates power is on. Green indicates locked to IRIG B input code. Flashes red/green when operating on internal battery.
- LED display: Seconds through day of year (DDDDHMMSS) with selectable intensity
- Manual controls: Locking type on/off switch
- Left and right arrows, Enter: Controls for optional display, time preset and Video Time Inserter
- Internal oscillator: 10 MHz, stability 5×10^{-5} , 0°C to +50°C

OUTPUTS

- Time code: 1 kHz amplitude modulated IRIG B days, hours, minutes and seconds, serial time code, 0 to 6 Vpp into 600 Ω
- 1PPS: Test point on front panel
- Size: 2.65" H x 3" W x 5.65" D (6.73 cm x 7.62 cm x 14.35 cm)
- Finish: Matte black paint with white lettering

MECHANICAL/ENVIRONMENTAL

- Power: 10.5–32 Vdc
- Battery: Provides 4 to 8 hours of operation at 25°C ambient temperature (dependent upon display operation and options)
- Operating temperature: 0°C to +50°C
- Storage temperature: -60°C to +70°C
- Humidity: To 95%, noncondensing
- Weight: 1.7 lbs. (0.77 kg)

OPTIONS

- TCXO oscillator: 10 MHz, stability 5×10^{-7} , 0°C to +50°C
- Video Time Inserter: Inserted time, milliseconds through days, on user's RS-170/A composite video signal. Character size, color, background, and screen placement are user-selectable. Up to two video time inserters can be installed.
- Parallel BCD: Outputs 42 bits of binary coded decimal (BCD) time-of-year, milliseconds through days plus data strobe, via subminiature connector.
- IRIG A time code generation in addition to standard IRIG B
- IRIG G time code generation in addition to standard IRIG B
- AC Power adapter
- Extended battery: 24- to 48-hour generator operation (dependent upon options selected)
- Large capacity chassis height: 3.75" (9.52 cm) Used when more than one option is installed and/or when extended battery option is installed.
- Expanded temperature range: -40°C to +70°C

Note: Because of the unit's size, space reservations may limit the number of options that can be installed. Please consult Symmetricom or your local Symmetricom sales representative with your specific requirements.



“The Boeing Delta 4 and Lockheed Martin Atlas 5 rockets both use Symmetricom products to support their rocket launches. Delta 4 uses 9611A Distribution Amps as well as ET6000’s and TS2100RB1 for exact timing and transport of all GPS and IRIG Time Code. Symmetricom time and frequency products have performed two very successful launches and we look forward to two others scheduled this year.”

Ed Lamkin

Southern Marketing Associates

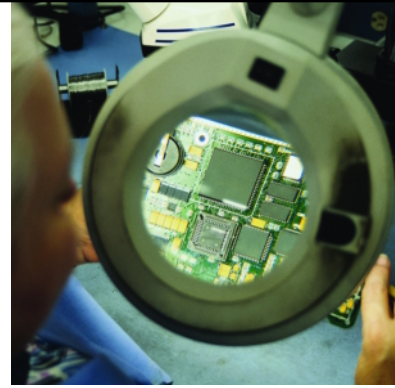
(Manufacturers’ Representative)

Time & Frequency Distribution

Symmetricom delivers the biggest selection of time and frequency distribution receivers and modules in the marketplace.

In order to maintain the highest level of precision and reliability throughout the system, we offer the most accurate centralized reference signal with the best quality, lowest noise and the most uptime to an assortment of communication infrastructures.

Coupled with Symmetricom's GPS receivers, frequency standards and oscillators, our time and frequency modules are extremely effective solutions to 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

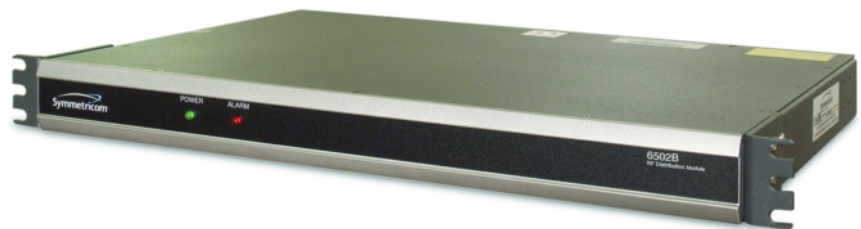
KEY FEATURES

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

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 0.1 MHz to 10 MHz 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.

The 6502B is also available in custom configurations. Please contact Symmetricom with any specific requirements.



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	-120dBc
10 Hz	-135dBc
100 Hz	-145dBc
1,000 Hz	-155dBc
10,000 Hz	-160dBc
- 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 (±15%):	120 or 230 V AC, <10W
DC input (optional):	22 to 70 V DC, 10W
- Dimensions

Height:	1U (~1.75"/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

- | 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



6504B

IRIG B Distribution Module

KEY FEATURES

- Superior IRIG B Signal Distribution
- High Channel Isolation
- Ten Channel Output Distribution
- Daisy Chain for More Than 100 Outputs

The Symmetricom 6504B Distribution Module is a ten channel, IRIG B 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 6504B units to give almost infinite expansion capability with virtually no signal degradation.

The 6504B standard configuration accepts an IRIG B time code signal and provides 10 buffered IRIG B outputs. Each output and input has an alarm indicator that warns of either a loss of time code or a time code of insufficient amplitude.

The 6504B is also available in custom configurations. Please contact Symmetricom with any specific requirements.



6504B IRIG B Distribution Module

6504B Specifications

ELECTRICAL SPECIFICATIONS

- Time code outputs (ten)
 - Code format: IRIG B
 - Modulation frequency: 1 kHz
 - Modulation ratio: 3:1
 - Amplitude: ≤ 3 V P-P
- Time code input
 - Code format: IRIG B
 - Modulation frequency: 1 kHz
 - Modulation ratio: 3:1
 - Amplitude: ≤ 3 V P-P
- Controls & indicators
 - Power: Green LED, power is connected
 - Alarm: Red LED, signal output failure
- Alarm Output
 - Summary alarm indicates failure of any output signal or power loss
 - Each output and main: Red LED
 - Non-alarm condition: Relay energized (fail safe)
 - C Form contacts
 - Alarm output disable: Panel switch
 - Connector: 9 pin D-male

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature (operating): 0°C to 55°C
- Relative humidity: 0 to 95%, non-condensing
- Power requirements
 - AC input ($\pm 15\%$): 120 or 230 V AC, <10W
 - DC input (option): 22 to 70 V DC, 10W
- Dimensions
 - Height: 1U (~1.75"/4.44 cm)
 - Width: 19" (48.26 cm)
 - Depth: 12" (30.48 cm)
- Weight: <10 lbs (4.5 Kg)
- MTBF: >500,000 hrs

ORDERING INFORMATION

- 6504B **Part No.**
14366-101



Rear View

6520A

Telecom Distribution Module

KEY FEATURES

- E1/T1 Frequency Distribution
- High Channel Isolation
- Twelve Channel Output Distribution
- Daisy Chain for Up to 48 Outputs

Symmetricom's 6520A Telecom Distribution Module is a twelve channel distribution amplifier packaged in a 1U rack mount chassis. It is comprised of twelve low phase noise amplifiers that maintain high channel isolation (>60dB). Up to four units can be daisy chained together to give up to 48 outputs with virtually no signal degradation.

The 6520A standard configuration takes a single telecom clock signal, either T1 or E1, and provides twelve buffered T1 or E1 outputs. Each output and input has an alarm indicator that warns of either a loss of signal or a signal of insufficient amplitude.

The 6520A is ideal for manufacturers who need to distribute high quality telecom reference signals to multiple locations.

The 6520A is available with either AC or DC input power and DB9 or RJ-45 I/O connectors.



6520A Telecom Distribution Module

6520A Specifications

ELECTRICAL SPECIFICATIONS

- Output (12)

Frequency:	T1 (1.544MHz) or E1 (2.048MHz)
Level:	per G703/2 or G703/9/13
Isolation:	>60db
Connectors:	9-Pin, D-Male Optional: RJ45
- Additive SSB phase noise

(1 Hz Bandwidth)	Offset from carrier
1 Hz	-120dBc
10 Hz	-135dBc
100 Hz	-145dBc
1000 Hz	-155dBc
10000 Hz	-160dBc
- Input

Frequency:	1.544MHz or 2.048MHz per G703/2 or G703/9/13
Input impedance:	110Ω (T1) or 120Ω (E1)
Connectors:*	(2) 9-Pin D-Female Optional: (2) RJ45 *(1 Input, 2nd to daisy chain off)
Ground:	#8 Stud post
Switch:	Two position slide for HI Z and 50Ω input impedance terminus
- 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
Connector:	9-Pin D-Male Optional: RJ45

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature: 0°C to 50°C
- Relative humidity: 0 to 95% (non-condensing)
- Power requirements

AC Input (±15%):	120 or 240 VAC, <10W
DC Input (optional):	22 to 70 VDC, 10W
- Dimensions

Height:	1U (~1.75"/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. |
|---|-----------|
| • 6520A Standard Configuration | 14265-101 |
| • 6520A with DC input | 14265-102 |
| • 6520A with RJ-45 connectors | 14265-103 |
| • 6520A, DC input plus RJ-45 connectors | 14265-104 |



Rear View



6602B

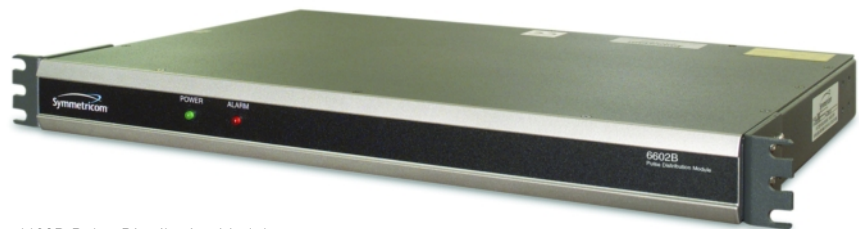
Pulse Distribution Module

KEY FEATURES

- Compact Rack Mount 1U High Package
- Ten Channel Output Distribution
- Daisy Chain for Up to 100 Outputs
- 9 ns Differential Delay Between Output

Symmetricom's 6602B Pulse Distribution Module is a ten-channel, pulse distribution amplifier packaged in a 1U rack mount chassis. The 6602B buffers and provides one pulse per second signal distribution to ten separate locations. The module's summary fault alarm output feature indicates an alarm whenever there is a single output fault condition.

The 6602B preserves input phase characteristics over a wide range of environmental conditions. A daisy chain of up to ten Symmetricom 6602B modules provides up to 100 output signals or with each output of one module as the input signal for other modules it provides almost infinite expansion capability with minimal signal degradation.



6602B Pulse Distribution Module

6602B Specifications

ELECTRICAL SPECIFICATIONS

- 1PPS Output (ten)
 - Repetition rate: 1PPS
 - Output impedance: 50Ω
 - Load impedance: 50Ω
 - Logic one: +4.5 volts minimum
 - Logic zero: +0.8 volts maximum
 - Pulse width: 20 μs nominal
 - Rise time: <5 ns
 - Fall time: <5 ns
 - Propagation delay: 25 ns
 - Differential delay: <9 ns between any two outputs
 - Jitter: 1 ns rms
 - Connectors: BNC female
- 1PPS input
 - Repetition rate: 1PPS
 - Input impedance: 50Ω
 - Logic one: +2.7 to 10.0 volts
 - Logic zero: +0.0 to 0.8 volts
 - Pulse width: 20 μs Nominal
 - Rise time: <5 ns
 - Fall time: <5 ns
 - Connector: BNC female
- Alarm output
 - Summary alarm indicates failure of any signal.
 - Each output & main: Red LED
 - Non-alarm condition: Relay energized (fail safe)
Form-C 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

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature (operating): 0°C to 55°C
- Relative humidity: 0 to 95%
- Power requirements
 - AC Input (±15%): 120 or 230 V AC, 10W
 - DC Input (optional): 22 to 70 V DC, 10W
- Dimensions
 - Height: 1U (~1.75"/4.44 cm)
 - Width: 19" (48.26 cm)
 - Depth: 12" (30.48 cm)
- MTBF: >500,000 hrs

ORDERING INFORMATION

- 6602B

Part No.

14369-101



Rear View



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

Symmetricom's 9611 Switch & Distribution Unit is an intelligent switching, monitoring and distribution system, packaged in a 1U rack mount chassis. 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 criteria (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

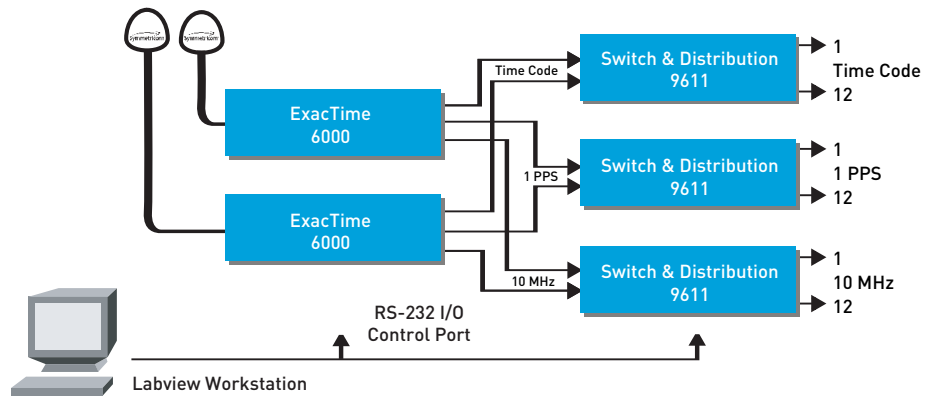
- Output levels: 0-6 volts p-p, DC-10 MHz
(3 volts p-p above 5 MHz)
- Output impedance: 10Ω, 50Ω or 600Ω (selectable)
- Input levels: 0-6 volts p-p, DC-10 MHz
- Input impedance: 50Ω or 1K, selectable
- Time period selection
Range: 300 ns to 100 seconds in decade steps
- Distortion: Total harmonic at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

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature
Operating: 0°C to 50°C
Non-operating: -40°C to +70°C
- 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



Rear View



Working Diagram



58502A

Broadband Distribution Amplifier

KEY FEATURES

- 12-Channel Broadband (0.1 to 10 MHz) Sine Wave Distribution
- Low Output Phase Noise
- High Isolation/Low Cross-Talk Between Output Channels
- Autoswitching Between Two Inputs
- Easy-to-Read Front Panel Status Lights
- Channel Fault Alarm

INTRODUCTION

The Symmetricom 58502A Broadband Distribution Amplifier is the one frequency standard distribution system that provides multiple features to ensure continuous distribution of your critical signals. It is designed to meet today's demanding requirements for frequency distribution in manufacturing, R&D, and standards lab environments. It also provides economical distribution of precision signals from cesium, rubidium, quartz or GPS frequency standards.

The 58502A Broadband Distribution Amplifier features low signal distortion and high isolation between output channels. Low output phase noise also helps maintain signal integrity.

CONTINUOUS AVAILABILITY OF CRITICAL FREQUENCIES

The 58502A Broadband Distribution Amplifier has two important features that ensure your critical frequencies are always present.

- **Autoswitch** When the unit detects one of its inputs is removed or the amplitude of the input is greatly reduced, it will automatically switch to the other input.

- **Alarm-inputs feature** The 58502A is compatible with the alarm signals from the 58503A GPS Time and Frequency Reference Receiver and the 5071A Primary Frequency Standard. If the alarm of one of these sources is active, and this source is driving the distribution amplifier outputs, the 58502A will automatically switch to a backup source. In addition, this change will be reflected in the 58502A alarm outputs so it may be monitored by external equipment.

Autoswitching between two inputs ensures continuous availability of critical frequencies, and a fault alarm is activated when the system does not function correctly.

These alarm and switching features can also be monitored and controlled through the RS-232C interface.



58502A Broadband Distribution Amplifier

SIMPLIFIED VERIFICATION OF SYSTEM HEALTH

The RS-232C interface allows you to query the individual distribution input and output channels for the presence or absence of a signal. Easy-to-read front panel status lights also provide you with a quick visual indication of individual channel health. These features greatly simplify monitoring the system.

PERFORMANCE FOR YOUR DEMANDING APPLICATIONS

While cost per channel has been lowered, no compromises have been made in signal distribution quality. The amplifier provides high channel-to-channel isolation and low phase noise for demanding applications. The 58502A has an internal automatic gain control that ensures extremely low AM-to-PM conversion.

SYMMETRICOM'S COMPLETE SOLUTION

The 58502A is an excellent companion to the 58503B. Combined, they give you a very stable, redundant frequency reference.

58502A Specifications

ELECTRICAL SPECIFICATIONS

- Input, A or B

Frequency range:	0.1 MHz to 10 MHz
Impedance:	50 Ω nominal
	SWR <1.5
Amplitude:	+15dBm maximum
	+7dBm minimum
Connector:	BNC (female)
- Outputs (Into 50 Ω)

Amplitude:	+13dBm, +1dB/-3dB
Harmonics:	<-32dBc
(for Option 010)	<-20dBc
Spurious:	<-110dBc, <-113 typical
(for Option 010)	<-80dBc
Connectors:	BNC (female)
- Mechanical specifications

Weight:	2.95 kg
Shipping weight:	6.35 kg
Dimensions:	45 mm H x 426 mm W x 344 mm D

SUPPLEMENTAL CHARACTERISTICS

- Outputs: Single sideband phase noise (1 Hz bandwidth)
- Offset frequency **Phase noise**

100 Hz	<-127dBc/Hz
1 kHz	<-142dBc/Hz
10 kHz	<-148dBc/Hz
- Port-to-port isolation <-100dBc typical (measured by switching between open and short loads on output port and measuring associated phase noise on adjacent output port)

ENVIRONMENTAL SPECIFICATIONS

- Temperature

Operating:	0°C to +55°C
Non-operating:	40°C to +70°C
EMI:	CISPR 11, Group 1, Class c
- Remote system interface and control

Data communications:	RS-232C, DTE
Connector:	DE-9P (male)
- Alarm/status input and output

Connector:	DE-9P (male)
Normal state:	TTL high
Alarm state:	TTL low
Output configuration:	Open-collector output, 10k Ω pull-up to 5 Vdc
- Power requirements

AC input:	100 to 132 or 175 to 240 Vac
	47 to 63 Hz
	80 VA Max
- Warranty: 12 months

AVAILABLE OPTIONS

- Option 010: Internal backup oscillator (10 MHz Precision oven controlled quartz crystal) – replaces Input B
- Stability

Temperature stability	6×10^{-9} (0°C to +55°C)
Aging/day	5×1^{-10}
Aging/year	1×10^{-7}
Tuning range	7×10^{-7} (minimum)
- Option: AX4: rack mount kit

ORDERING INFORMATION

- | ORDERING INFORMATION | Part No. |
|---|------------|
| • 58502A Broadband Distribution Amplifier | 58502A |
| • Option 010 Backup Oscillator | 58502A-010 |
| • Rack Mount Kit | 58502A-AX4 |



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

INTRODUCTION

The 5087B Wideband Distribution amplifier is an economical solution for distributing signals from various frequency standards such as Caesium, 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 outputs² (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
- Isolation⁶

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
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- Altitude

Operating:	15,000 ft
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- 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:	426 mm (standard 19-inch rack)
Depth:	320 mm
- 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

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 daisy-chained 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 Data Rate Generation and 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 \pm 20% power supply
- Dual 90 ~264 Vac/-48 Vdc \pm 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



“Clearly, there is not another rubidium frequency product available that delivers the tremendous value of the 8040C. The 8040C offers total flexibility with each output user configurable into a sine or square waveform, and even 1PPS output can be selected. The 1PPS sync input provides an ‘autocalibration’ feature to 8040C internal Rb oscillator, and for our manufacturing clients, is a key factor, dramatically lowering the lifetime cost of ownership, maintaining highest possible unit availability in production, and providing continuous adherence easily to ISO9000 series and other manufacturing quality standards.”

Antero Leinonen
CEO, Positron Oy Finland
(Distributor)

Precision Frequency Reference

Symmetricom designs, manufactures and markets hydrogen, cesium and rubidium standards, and quartz oscillators in numerous configurations for multiple markets and applications.

These products are the result of many years of research and development performed in the areas of atomic physics, electronics engineering and software design.

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.





Cesium Product Matrix



CsIII



Cs-4000



5071A

	CsIII / CsIII-EP	Cs4000 / Cs4000-EP	5071A
Accuracy (standard perf./high perf.)	<1E-12 / <5E-13	<1E-12 / <5E-13	<1E-12 / <5E-13
Stability (10S) (standard perf./high perf.)	<8E-12 / <2.7E-12	<1E-12 / <2.7E-12	<8.5E-12 / <3.5E-12
Stability (sat flicker floor) (standard perf./high perf.)	<5E-14 / <1E-14	<5E-14 / <1E-14	<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		
1PPS output	1	3	3
1PPS sync input	1	2	2
Custom outputs		optional	
Operating voltage	AC/DC	AC/DC	AC/DC
Battery backup		optional	standard
Time of day		optional	standard
Warranty electronics/tube	2 yr./6 yr. (12 yr. optional)	2 yr./12 yr.	2 yr./12 yr.
Warranty electronics/high perf. tube (EP models)	2 yr./3 yr.	2 yr./3 yr.	2 yr./5 yr.
RS-232 control and monitoring	standard	standard	standard
Monitor 2 software	standard	standard	
Telecom synthesizer T1/E1	optional	optional	
Time display and keypad		optional	standard
Portability kit	optional		
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	>226,000 hours	>105,000 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

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: $\pm 5 \times 10^{-13}$
 - 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 1-PPS 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 shortterm 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 5071A Option 001 will power up to within $\pm 5 \times 10^{-13}$ 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 Option 001 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 1×10^5 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 ($\sigma_y(2, \tau)$) does not change with longer averaging. The 5071A Option 001 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 5×10^{-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 Option 001 High-Performance CBT will drift no more than 5×10^{-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 high performance 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 frequency measurement and analysis system (FMAS). 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 (5071A Option 001)

The 5071A Option 001 high-performance cesium beam tube is optimal for the most demanding operations. The Option 001 tube offers a full-environment accuracy specification of $\pm 5 \times 10^{-13}$ —two times better than the specification for the standard tube. Stability is also significantly improved. The high-performance tube reaches a Flicker floor of 1×10^{-14} or better, and long-term measurements at NIST show that the flicker floor is typically better than 5×10^{-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.



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) Output	BNC TTL High, normal TTL low, fault
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Circuit is TTL open collector with internal pull-up resistor. Circuit can sink up to 10mA

Location	rear panel
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• 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 ²
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
Stability		
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	≤ -151dBc
1,000	≤ -150dBc	≤ -156dBc
10,000	≤ -154dBc	≤ -160dBc
100,000	≤ -154dBc	≤ -160dBc

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, 120Vac +/-10%
	200, 220Vac +/-10%
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

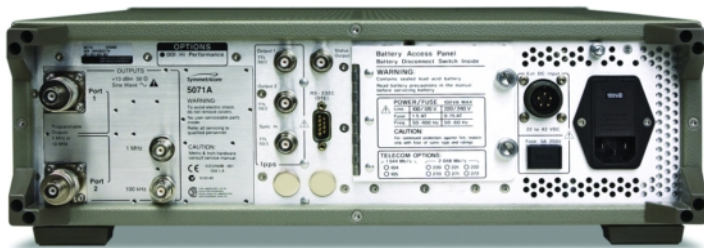
Dimensions/weight

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.



Rear View



Cs4000

Cesium Frequency Standard

STANDARD FEATURES

- Multiple RF Outputs
- CsIII Technology
- AC & DC Inputs
- Remote Monitoring and Control
- 30 Minute Warm-Up to Full Specifications

OPTIONAL FEATURES

- High Performance Tube
- Internal Battery Back-Up
- Front Panel LCD Display Interface
- T1/E1 Outputs

The Symmetricom Cs4000 is a new cesium frequency standard platform that provides exceptional performance in a configurable 3U rack mount chassis.

Until now, many manufacturers embedded numerous features that may have been unnecessary for your application but were part of a standard configuration attempting to serve diverse market needs. The Cs4000 is different. This product offers a well-equipped, economical base configuration that can be fitted with options to serve your particular requirement. The standard outputs provided include 100 kHz, 1, 5, 10 MHz and 1PPS. The configurable back panel can be easily adapted to provide additional standard outputs or customer defined outputs. A list of optional accessories can be added to build out the unit to satisfy your application while staying within your budget.

While the Cs4000 may be economical and practical, the technology utilized is anything but ordinary. Advanced Cesium III digital technology is at the core of the Cs4000. The accuracy and stability achievable with this technology is commensurate with any Cesium standard available in the world today.

The Cs4000 meets the challenges of laboratory standards, SATCOM terminals, and a wide variety of field applications.



Cs4000 Cesium Frequency Standard

Cs4000 Specifications

ELECTRICAL SPECIFICATIONS

- Frequency outputs
 - Frequency: 1 ea 100 kHz & 1 MHz 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: (2) 9-pin male rectangular D subminiature type
 - Location: rear panel (1)
front panel (1)
 - 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

	Standard Perf.	High Perf.
• Performance		
Accuracy:	±1.0E-12	±5.0E-13
Warm-up time: (typical)	30 Min	30 Min
Reproducibility:	±2.0E-13	±2.0E-13
Stability		
Range:	±1.0E-9	±1.0E-9
Resolution:	1.0E-15	1.0E-15
• Stability	Standard Perf.	High Perf.
AvgTime (s)	Allan Deviation	Allan Deviation
1	≤1.2E-11	≤5.0E-12
10	≤8.5E-12	≤2.7E-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
Floor	≤5.0E-14	≤1.0E-14

SSB Phase noise	5 MHz Output	5 MHz Output
Offset (Hz)		
1	≤-95dBc	≤-102dBc
10	≤-130dBc	≤-130dBc
100	≤-145dBc	≤-145dBc
1,000	≤-155dBc	≤-155dBc
10,000	≤-155dBc	≤-155dBc
100,000	≤-160dBc	≤-160dBc

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- General environment
 - Operating
 - Temperature: 0°C to 50°C
 - Humidity: 95% up to 50°C
 - 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
 - 85 to 264 VAC
 - 47 to 63 Hz
 - 70VA, 64W (Operating)
 - 90VA, 80W (Warm Up)
- DC Power requirements
 - 36 - 75VDC*
 - 60W (Operating)
 - 70W (Warm Up)
- * 24VDC (18 - 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: 1 hour @ 25°C from full charge
 - Charge time: 16 hours maximum from fully discharged state
 - Charge source: AC or DC
- Weight: 45 lbs. (20.4 Kg)
- MTBF: >105,000 hrs.

OPTIONS

Options	Part No.
• Internal batteries	BAT
• High performance tube	EP
• Rack slides	6013
• T1 outputs	T1
• E1 outputs	E1
• LCD front panel display	LCD
• 18 - 36VDC input	24DC



Rear View



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 Minute Warm-Up to Full Specifications
- <30lbs

OPTIONAL FEATURES

- High Performance Tube
- T1/E1 Outputs
- Portability Kit
- Extended Tube Warranty

OVERVIEW

Symmetricon'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 Symmetricon's proprietary Monitor2 software.

Packaged in a 2U, 19-inch rack mounted chassis, the CsIII weighs less than 30lbs. 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 6-year tube warranty for standard performance tubes and a 2-year electronics and 3-year tube warranty for high performance tubes. A twelve-year tube warranty is optionally available on standard performance units.

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: 0μs 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	Standard Performance	High Performance
Accuracy:	±1.0E-12	±5.0E-13
Warm-up time (typical):	30 minutes	30 minutes
Reproducibility:	±2.0E-13	±2.0E-13
Stability		
Range:	±1.0E-9	±1.0E-9
Resolution:	1.0E-15	1.0E-15
Control:	Via RS-232 port	

• Stability		Standard Performance	High Performance
	Averaging Time(s)	Allan Deviation	Allan Deviation
	1	<1.2E-11	<5.0E-12
	10	<8.5E-12	<2.7E-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
	floor	<5.0E-14	<1.0E-14
• SSB Phase noise			
	Offset (Hz)	5MHz output	5MHz output
	1	<-95dBc	<-102dBc
	10	<-130dBc	<-130dBc
	100	<-145dBc	<-145dBc
	1,000	<-155dBc	<-155dBc
	10,000	<-155dBc	<-155dBc
	100,000	<-160dBc	<-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: 85 to 264 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: >226,000 hrs.

ORDERING INFORMATION

• Std Perf, 24VDC, 6 Yr. Warranty	Part No. 14534-105
• Std Perf, 48VDC, 6 Yr. Warranty	14534-106
• Std Perf, 24VDC, 12 Yr. Warranty	14534-110
• Std Perf, 48VDC, 12 Yr. Warranty	14534-109
• High Perf, 24VDC, 3 Yr. Warranty	14534-103
• High Perf, 48VDC, 3 Yr. Warranty	14534-104



Rear View

8130A

Militarized Rubidium Oscillator

KEY FEATURES

- Modern Militarized Design
- 5 or 10 MHz Sinewave Outputs
- RS-232 Digital Control and Monitoring
- Ruggedized High Performance Rb Physics Package
- Separate Heater and Electronic Power Lines
- Low Phase Noise Option
- Internal Temperature Compensation Option

The Symmetricom 8130A is an enhanced version of our popular M-100 rubidium oscillator. This modern, off-the-shelf militarized rubidium oscillator is ideal for use in tactical applications where shock, vibration, humidity and other environmental factors are a challenge. The circuit boards are conformal-coated for moisture resistance, and special precautions are taken for improved shock and vibration hardening. Use of a filtered power/monitor connector minimizes EMI emissions and susceptibility. Designed for ease of integration into frequency and timing systems, the Symmetricom 8130A offers a smaller size MIL atomic frequency reference with a heritage of over 25 years of proven experience in the design, qualification and production of atomic frequency references.

The long life rubidium lamp and extended crystal oscillator control range of the Symmetricom 8130A minimizes maintenance requirements.

The 8130A provides a stable frequency with good short and long-term stability, and excellent overall performance. The unit includes an RS-232 digital interface for monitoring and frequency adjustments.

Suitable applications include ground, shipboard and airborne navigation, timing and other tactical applications that need the performance level associated with rubidium technology in a militarized off-the-shelf package.



8130A Militarized Rubidium Oscillator

8130A Specifications

ELECTRICAL SPECIFICATIONS

- Output frequency/waveform: 5 or 10 MHz sine or square wave
- Output level (2 outputs): +7.0 ±1.5dBm (each output)
0.5 V rms nominal into 50Ω
- Output impedance: 50Ω nominal @ 5 or 10 MHz
- Quiescent Phase noise (SSB), E(f), dBc/Hz

SB Freq	Standard 10 MHz	Low Noise 5 MHz	Low Noise 10 MHz
1 Hz	-70	-95	-85
10 Hz	-90	-125	-115
100 Hz	-120	-140	-140
1 kHz	-135	-150	-150
10 kHz	-140	-150	-150
100 kHz	-140	-150	-150
- Spectral purity
 - Harmonics: <-30dBc
 - Non-harmonics: <-80dBc
- Aging
 - Monthly (after 1 month): <5.0E-11/month
 - 10 years: <1E-9
- Frequency accuracy at shipment: 1E-11 (@ +25°C)
- Frequency retrace: <5E-11
- Short term stability s (τ)

t (sec)	Standard 10 MHz	Low Noise 10 MHz
1	<3.0E-11	< 3.0E-11
10	<1.0E-11	< 3.0E-11
100	<3.0E-12	< 3.0E-12
- Frequency control
 - Analog freq. adj. range: 1E-9
 - Digital freq. adj. res: 3.4E-13
- Warm-up

	at -40°C	at +25°C
Time to lock:	<14 min	<8 min
Time to 2.0E-10:	<19 min	<12 min
5.0E-10:	<17 min	<10 min
Max. input (Watts) @ 28 V:	<35 Watts	<35 Watts
Steady-state (Watts) @ 28 V:	<22 Watts	<15 Watts
- Input voltage range: +22 to 32 Vdc, protected against reverse polarity and transients
(Separate heater and electronic power lines)
- Voltage sensitivity: 5.0E-12 (10% voltage change from nom. 28 Vdc)
- Input power, quiescent: +28 Vdc <12W @ +25°C baseplate
+28 Vdc <8W @ +68°C baseplate
- Status indicators (TTL logic): Lock (BITE) Oven demand
RF O/P
Light
- Analog monitors (0-12Vdc): Light Control voltage
Lamp oven Cavity oven
Signal
- 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 ambient to +68°C baseplate
 - Storage: -62°C to +85°C
 - Sensitivity: <3.0E-10 over op. temp. range
- Thermal shock (non-operating)
 - MIL-STD-202, Method 107, Test Condition A, 10 cycles -40°C to +68°C
- Orientation sensitivity: <5E-11 for any orientation
- Pressure sensitivity: <1E-13/mbar
- Altitude
 - Operating: Sea level to 40,000' (12,192 meters)
 - Non-operating: Sea level to vacuum
- Static acceleration: <5E-11 for 10 g in any direction
- Magnetic field sensitivity: <2E-11/Gauss
- Relative humidity (operating): 0 to 95% RH per MIL-STD-810, Method 507.1, Procedure II
- Salt fog: MIL-STD-810, Method 509.1, Procedure 1
- Vibration
 - Operating: MIL-STD-810E, Method 514.4, Category 10
 - Non-operating: MIL-STD-202, Method 204, Test Condition A, 0.3 in. DA (Sine) 10g to 500 Hz
- Shock
 - Non-operating: MIL-STD-202, Method 213, Test Condition J, 30g, 11msec, half-sine
- Acoustic noise: MIL-STD-810, Method 512.2
- EMI
 - MIL-STD-461
 - Emissions: CE102, RE102
 - Susceptibility: CS101, CS114, RS103
- MTBF
 - MIL-HDBK-217F, 90,000 Hrs. @+40°C baseplate
- On-Off cycling endurance: 3600 cycles at any temperature
- Life: 20 years
- Dimensions
 - Height: 2.87" (7.28 cm)
 - Width: 2.92" (7.41 cm)
 - Depth: 4.04" (10.26 cm)
- Weight: <2.0 lbs. (0.90 Kg) maximum
- Warranty: 1 year

ORDERING INFORMATION

- | | Part No. |
|-------------------------------|-----------|
| • 8130 STD Configuration | 13633-101 |
| • 8130 with M100 Adapter | 13633-104 |
| • 8130 with (2) 10MHz Outputs | 13633-106 |
| • 8130LN (2) 10MHz Outputs | 13633-102 |
| • 8130LN (2) 5MHz Outputs | 13633-109 |



8040C

Rubidium Frequency Standard

STANDARD FEATURES

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

OPTIONAL FEATURES

- Twelve Configurable Outputs
- Low Phase Noise

OVERVIEW

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 20 dB improvement in close in phase noise.

The 8040C is designed around Symmetricom's award winning X72 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 impedance:	50Ω	50Ω
Location:	rear panel	rear panel
• Timing inputs		
Sync input:	1PPS	1PPS
Amplitude:	TTL compatible	TTL compatible
Connector:	BNC	BNC
Load impedance:	50Ω	50Ω
Location:	rear panel	rear panel

PERFORMANCE PARAMETERS

• Accuracy at shipment:	<±5E-11	<±5E-11
• Retrace:	<±2E-11	<±2E-11
• 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	<8.0E-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	8 data bits
	1 stop bit	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 Telecordia (Bellcore) SR232, 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



Rear View (shown with 12 output option)

8100

Ruggedized Rubidium Oscillator

KEY FEATURES

- Superior Shock and Vibration Performance Characteristics
- 48-Hour Holdover
- Aging $<5.0E-11$ per Month
- Single PWB With Surface Mount Technology
- Superior Ease of System Integration
- Meets GSM Frequency Requirements

The Symmetricom 8100 is an enhanced version of our popular commercial LPRO rubidium oscillator. This ruggedized COTS rubidium oscillator is ideal for use in tactical applications where shock, vibration sensitivity, excess relative humidity and other environmental effects are a challenge. Designed for ease of integration into frequency and timing systems, the Symmetricom 8100 offers a low profile and single circuit board construction that uses surface mount technology. The circuit board is conformal-coated for increased moisture resistance, and special precautions are taken for improved shock and vibration tolerance. The height and footprint easily meet the requirements for 1U VME applications. Use of both a filtered D-Connector for I/O signals and an outer mu-metal cover minimizes EMI emissions and susceptibility. For ease of integration, the Symmetricom 8100 only needs one input supply voltage and will allow direct plug-in into another circuit board.

The long life rubidium lamp and extended crystal control range of the 8100 helps extend operating periods, minimize maintenance and gives acceptable performance of more than a decade. By design, the Symmetricom 8100 provides a stable frequency with good short and long-term stability, and excellent spur performance. A 5V CMOS-compatible alarm signal derived from the basic physics operation indicates when output frequency is outside roughly $+5.0E-8$ of absolute frequency offset. The low temperature coefficient and excellent frequency stability extend holdover performance.

Suitable applications include shipboard, airborne, navigation timing, range timing and other tactical applications that need the performance level associated with rubidium technology in a commercial off the shelf (COTS) package.



8100 Ruggedized Rubidium Oscillator

8100 Specifications

ELECTRICAL SPECIFICATIONS

- RF output
 - Output: 10 MHz Sinewave
 - Amplitude: 7.0 - 9.5dBm
 - Output impedance: 50Ω @ 10 MHz
 - Harmonic signals: ≤-40dBc
 - Non-harmonic signals: ≤-80dBc
- Short term stability
 - τ = 1 s <2.5E-11
 - τ = 10 s <8.0E-12
 - τ = 100 s <2.5 E-12
- Phase noise [SSB]
 - 1 Hz -75dBc
 - 10 Hz -89dBc
 - 100 Hz -128dBc
 - 1000Hz -140dBc
 - 10 kHz -147dBc
- 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: <±2.5E-11
(after 24 hrs power on @ 25°C & up to 48 hrs power off)
- Frequency control
 - Internal trim range (trimpot): ±1.5E-9
 - External trim range (electronic): ±1.5E-9(0V to +5V)
- Warm-up

	(at -20°C)	(at 25°C)
Time to lock:	<8.7 min	<5.4 min
Time to <1.0E-9:	<10.2 min	<7.3 min
Time to <4.0E-10:	<12.7 min	<10.6 min
Max. input (Amps) @ 24 V:	<1.45 amps	<1.43 amps
- Input voltage range: +19 TO 32 Vdc
- Voltage sensitivity: .72.0E-11/V (over input voltage range)
- Input power, quiescent: +24Vdc <13W @ 25°C
+19Vdc <7W @ 65°C
- Status monitor
 - Analog: VCXO volts, lamp volts
(20 kΩ impedance, filtered)
 - Digital: LOCK monitor: 5V CMOS load
 - Lock: 0.2V (CMOS Low)
 - Unlock: >2.5V (CMOS High)

ENVIRONMENTAL & SPECIFICATIONS

- Operating temperature: -25°C baseplate to +70°C BP
0°C to +50°C
- Temperature coefficient
 - ly (70°C)-y (-25°C) <6.0E-10
 - ly (50°C)-y (0°C) <3.0E-10
- Storage temperature: -55°C to +85°C
- Altitude
 - Operating: -200' to 70,000' [-60.96 m to 21,336 m]
 - Non-operating: -200' to 70,000' [-60.96 m to 21,336 m]
- Magnetic field sensitivity, dc (±2 GAUSS) ±4.0E-11/GAUSS
- Relative humidity: 0 to 95% RH per MIL-STD-810, Method 507.1, Procedure II
- Vibration
 - Non-operating: Mil Std 202 Method 214 Test Cond. 1-3 G1s RMS Random
- 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: Per Bellcore TR-NWT-00332, (Ground Fixed, Controlled)

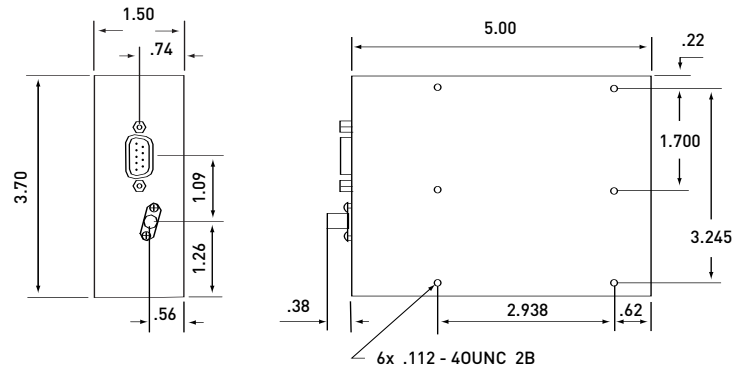
Amb. Temp	20°C	25°C	30°C	40°C	50°C	60°C
MTBF (hrs)	81,000	351,000	320,000	253,000	189,000	134,000

(RELEX software V5.1, part stress, MET 1 case 3)

PHYSICAL SPECIFICATIONS

- Weight: 1.10 lbs. (0.49 Kg) maximum
- Size: 3.7" x 5.0" x 1.5" (9.93 cm x 12.7 cm x 3.81 cm)
- Warranty: 1 year
- Extended warranty: Consult factory

Note: Consult factory for application support, test reports or special requirements.



Outline Dimensions



RubiSource T&M

Portable Rubidium Timing Signal Reference

KEY FEATURES

- Cost-Effective Timing Source for Metrology and Calibration Laboratories
- Test & Measurement Applications
- Multiple Frequency Outputs
- Compact, Robust & Lightweight
- Easy Handling
- Cesium Reference Input with Auto-Calibration Feature
- 1PPS Output
- 1PPS Synchronization Input
- CE Compliant

INTRODUCTION

The RubiSource® T&M is a portable timing reference based on Symmetricom's well known rubidium oscillator technology for universal use in test and measurement applications. A variety of coherent standard frequencies are provided:

- Sine wave 10 MHz, 5 MHz & 1 MHz
- Square wave 10 MHz & 5 MHz

The RubiSource T&M's 1PPS output signal provides exact timing information. This output can be synchronized to an external 1PPS input signal.

The reliable output signals are based on the highly accurate and stable rubidium oscillator inside. The rubidium's fast warm-up eliminates the need for bulky backup batteries.

The RubiSource T&M can be locked to an external primary source such as a cesium standard for automatic calibration of the rubidium clock.

APPLICATIONS

The sine wave and square wave outputs of the RubiSource T&M are typically provided for metrology and calibration laboratory equipment such as:

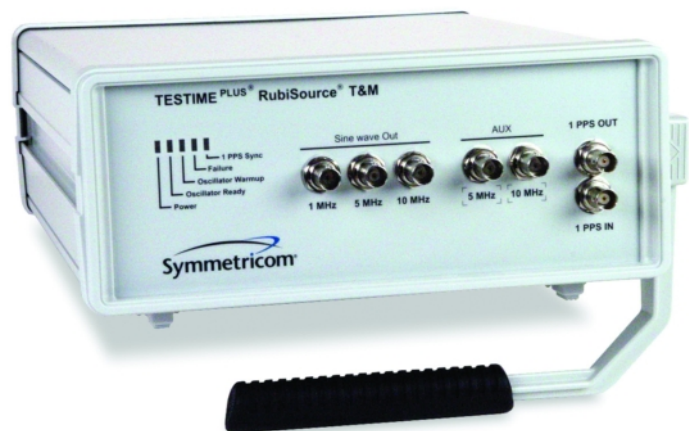
- Universal Counter
- Spectrum Analyzer
- Synthesized Signal Generator

1PPS INPUT/OUTPUT SYNCHRONIZATION

The 1PPS output can be synchronized to an external reference 1PPS. The RubiSource T&M integrity checks the signal at the 1PPS input and synchronizes its output to better than 100ns. A front panel LED indicates successful synchronization. The LED turned off indicates loss of synchronization.

AUTOMATIC FREQUENCY ADJUSTMENT

Calibration of the RubiSource T&M has been made extremely simple. There is no need for external frequency difference meters or phase comparators. Just connect a 5 MHz or 10 MHz reference signal from a



RubiSource T&M

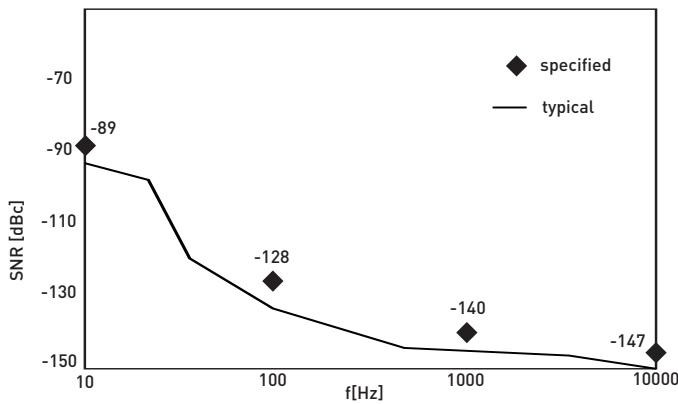
primary standard (Cesium, GPS disciplined rubidium) to the rear panel input. The RubiSource T&M will automatically sense the signal, evaluate its stability and slowly (typically within 10 minutes) tune the output signals to a frequency accuracy of 2.0E-11. The unit will continue to operate with the excellent performance of the internal rubidium oscillator until a new calibration cycle is started. The calibration parameters will be retained in a non-volatile memory.

Automatic frequency adjustment can be disabled with a recessed slide switch. Switch tampering can be prevented by placing a calibration sticker across its access opening.

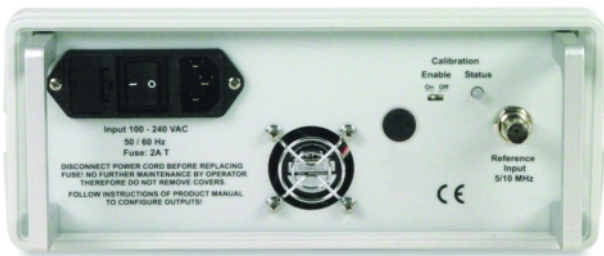
Allan Deviation (10 MHz sine wave)

t = 1 second	<2.5 x 10 ⁻¹¹ typically <1.0 x 10 ⁻¹¹
t = 10 seconds	<0.8 x 10 ⁻¹¹
t = 100 seconds	<0.25 x 10 ⁻¹¹

PHASE NOISE (10 MHz sine wave)



Non-harmonic spurs < -68 dB



Rear View

RubiSource T&M Specifications

PHYSICAL SPECIFICATIONS

- Size (WxHxD): Maximum 260 x 120 x 365 mm
10.24 x 4.72 x 14.37 inch
- Weight (without handle): Maximum 4.3 kg

ENVIRONMENTAL CONDITIONS

- Stationary use: 5°C ... 40°C operating with specified accuracy
-10°C ... 55°C operating with de-rated accuracy (EN 300 019-1-3 class 3.1)
- Transportation: -25°C ... 70°C (EN 300 019-1-2 class 2.2)
- Storage: -40°C ... 85°C (EN 300 019-1-1 class 1.2)
- Humidity: 95 % non-condensing

REGULATIONS AND STANDARDS

- EN 61326-1:1997
- EN 61010-1:1993

MTBF VALUE

- 65,000 hours (based on field experience)

RubiSource T&M P/N 81710000

- Power supply
 - Voltage: 100 ... 240 VAC, 50 ... 60 Hz
 - Current consumption: maximum 1.0 A
 - Power consumption: typically 30 W at 230 VAC, 22 W at 110 VAC
- Inputs
 - 1 x external reference: 5 MHz or 10 MHz sine wave or square wave, 0.5 ... 5.0 Vpp into 50Ω / BNC, MTIE (200 s) < 1 ns
 - 1 x 1PPS signal: 1 Hz ±1 x 10⁻⁸ square wave, 1...10 Vpp into 50Ω/ BNC, pulse length minimum 150 ns, slope < 15 ns
- Outputs
 - 1 x 1 MHz sine wave: 1 Vrms into 50Ω, BNC
 - 1 x 5 MHz sine wave: 1 Vrms into 50Ω, BNC
 - 1 x 10 MHz sine wave: 1 Vrms into 50Ω, BNC
 - 1 x square wave *): minimum 2.4 V into 50Ω, BNC (factory setting: 10 MHz TTL)
 - 1 x square wave *): minimum 2.4 V into 50Ω, BNC (factory setting: 5 MHz TTL)
 - 1 x square wave 1PPS: minimum 2.4 V into 50Ω, BNC (pulse length typ. 10 us)
- * user configurable to
 - 10 MHz TTL
 - 5 MHz TTL
 - 1 MHz TTL
 - 8 kHz TTL
 - 100 Hz TTL
 - 1PPS (pulse length typ. 10 us)
- Frequency accuracy
 - Factory shipment: < 5 x 10⁻¹¹ @ 25°C
 - With primary reference adjusted: < 2 x 10⁻¹¹ relatively to the reference
- Internal time base: Symmetricom's rubidium oscillator
 - Aging < 5 x 10⁻¹¹ / month
 - < 1 x 10⁻⁹ over 10 years

ACCESSORIES

- Transport Case P/N 81700001
- Balun Transformer P/N 80719011



5401 & 5402

Disciplined Rubidium Oscillator

KEY FEATURES

- Primary Standard Time & Frequency Accuracy
- Six Buffered Low Phase Noise 10 MHz Outputs
- Six Buffered 1PPS Outputs
- RS-232 Input/Output Control Port
- Rugged Airborne Package - Model 5401
- Rack Mount Chassis - Model 5402

INTRODUCTION

Symmetricom's Model 5401 and Model 5402 Disciplined Rubidium Oscillators track a 1PPS reference input to provide frequency outputs (1PPS and 10 MHz) with the stability and accuracy of a primary standard, provided that the reference input is exact. Typically, the 1PPS input would be obtained from a GPS receiver that outputs a corrected 1PPS epoch.

The difference between the 1PPS reference input and the internally generated 1PPS (derived from the rubidium oscillator) is measured and then used to continuously correct the oscillator frequency.

The correction algorithm compensates for oscillator error. It smooths jitter from the GPS receiver module due to ephemeris and satellite switching errors. The result is a smoothed, coherent 1PPS reference and 10 MHz frequency.

The 1PPS reference (rising edge on time) is buffered and output via six SMA connectors on the front panel of the Model 5401 and via six BNC connectors on the rear panel of the Model 5402. The 10 MHz frequency from the rubidium oscillator is used to discipline an oven-stabilized quartz oscillator. The oven oscillator is the source of the low phase noise frequency outputs, which are buffered and output via six SMA or BNC connectors. An RS-232 input/output port is provided for setup and control input as well as for status output.

The Model 5401 is built in a rugged airborne package, and is powered by +28 VDC, standard aircraft power voltage. The Model 5402 is built in a standard 3.5-inch rack mountable chassis, and is powered by 90 to 240 VAC for world-wide utility. The performance specifications for both configurations are identical.



5401 & 5402 Disciplined Rubidium Oscillator

5401 & 5402 Specifications

10 MHZ SINE WAVE OUTPUTS

- Signal level: 1.6 to 3.0 V P-P into 50, adjustable
- Output impedance: 50 Ω
- Short term accuracy: <3.0x10⁻¹¹ RMS @ 1 sec
- Long term accuracy: <5x10⁻¹² RMS @ 1000 sec (while disciplining)
- Short term stability: t=100 sec: <2.5x10⁻¹² (Alan Deviation)
- Quiescent phase noise:

	5401	5402
1 Hz	-94dBc	-85dBc
10 Hz	-110dBc	-100dBc
100 Hz	-140dBc	-130dBc
1000 Hz	-147dBc	-140dBc
10kHz	-152dBc	-145dBc
- Spurs: <40dBc harmonic
<50dBc non-harmonic
- Port-to-Port isolation: >99dB
- Coherence: <2 ns (zero crossing of the 10 MHz sine wave relative to 1PPS input)
- Connector type

Model 5401:	SMA (isolated)
Model 5402:	BNC (isolated)

1PPS OUTPUT

- Rise time: <5 ns (20% to 80%)
- Fall time: <1 μ s (80% to 20%)
- Pulse width: 20 μ s \pm 0.1 μ s
- Level: >4VDC peak into 50 Ω (TTL compatible)
- Output impedance: 50 Ω
- Coherence: <10 ns relative to mean 1PPS input
- Port-to-Port isolation: >90dB
- Isolation: >90dB (ref 1PPS in)
- Connector type

Model 5401:	SMA (isolated)
Model 5402:	BNC (isolated)

1PPS REFERENCE INPUT

- Rise time: <20 ns (10% to 90%)
- Fall time: <1 μ s (90% to 10%)
- Pulse width: 20 ns to 100 μ s
- Level: TTL or +10 VDC \pm 1 VDC, selectable via RS-232 I/O
- Input impedance: 50 Ω
- Connector type

Model 5401:	SMA (isolated)
Model 5402:	BNC (isolated)

RS-232 INPUT/OUTPUT

- Baud rate: 9600
- Parity: None
- Word length: 8
- Stop bits: 1
- Connector type

Model 5401:	MS27499E10B35S
Model 5402:	DB9(F)

POWER INPUT

- Model 5401

Voltage:	+28 VDC, MIL-STD-704A
Power:	<80 W (power on) <40 W (after warmup)
- Connector type: MS27499E10B5P
- Model 5402

Voltage:	90-240 VAC, 47-440 Hz
Power:	<80 W (power on) <40 W (after warmup)
- Connector type: Commercial IEC

ENVIRONMENT

- Temperature

Operating:	-20°C to + 50°C
Storage:	-55°C to + 85°C
- Humidity: 0 to 95% (non-condensing)
- EMI: FCC and CE (EN55022) Class B for Conducted and Radiated Emissions (5401 only)
- Vibration

Operating:	MIL-E-5400, per Curve IIA & IIIB (remains locked to 5G) (5401 only)
Crash safety shock:	30 g's for 11 ms
- MTBF: Approximately 100,000 hours

CHASSIS

- Model 5401

Dimensions:	6.0"H x 5.0"W x 10.0"D
Weight:	Approximately 8 pounds
- Model 5402

Dimensions:	3.5"H x 17"W x 12"D
Weight:	Approximately 12 pounds

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. 1PPS 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

* 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

	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 |



Rear View

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
- High Reliability Available
- 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 1.0E-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 $<5.0E-9$. An oven temperature indicator (10mV per degree K) is provided at the power connector.

The oscillator circuit produces phase noise of -116dBc at 1 Hz and -160dBc 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

	[-103]	[-115]
• Frequency:	(4) 5MHz	(4) 10MHz
• Amplitude:	(2) 1Vrms, (2) 0.5 Vrms	(4) 1Vrms
• Harmonic distortion:	<-40dBc	<-40dBc
• Spurious signals:	<-80dBc	<-70dBc
• Short term stability:		
1s	<1.0E-12	<1.0E-12
10s	<1.0E-12	<1.0E-12
• Aging per day (see note 1) (after 30 days of operation)	<1.0E-10	<1.0E-10
• Phase noise [-dBc/Hz]:		
1	<-116dBc	<-108dBc
10	<-140dBc	<-134dBc
100	<-150dBc	<-144dBc
1000	<-157dBc	<-150dBc
10kHz	<-160dBc	<-153dBc
100kHz	<-160dBc	<-153dBc
• Temperature coefficient:	<1.0E-9	<5.0E-9
• Frequency adjustment range		
Tuning slope:	Positive	
Control range:	0 to 10V	
• Load change (50Ω +/-10%)	<5.0E-11	<5.0E-11
• Input voltage		
Oven supply:	18 to 30VDC	18 to 30VDC
Electronics supply:	18 to 30VDC	18 to 30VDC

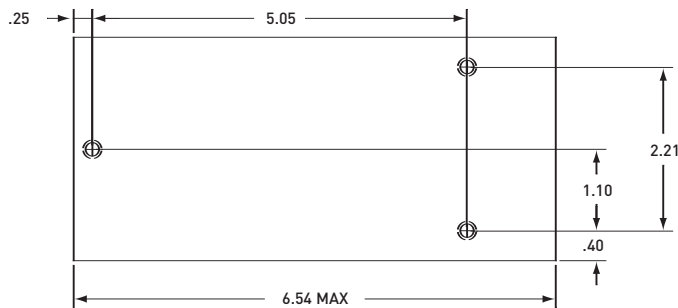
ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- 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: -28°C to 90°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 3.66"D x 3.0"H
- Weight: <1.5lbs (0.67kg)
- Connectors
 - RF (J1 - J4): SMA
 - Power (J5): 9 pin D-subminiature

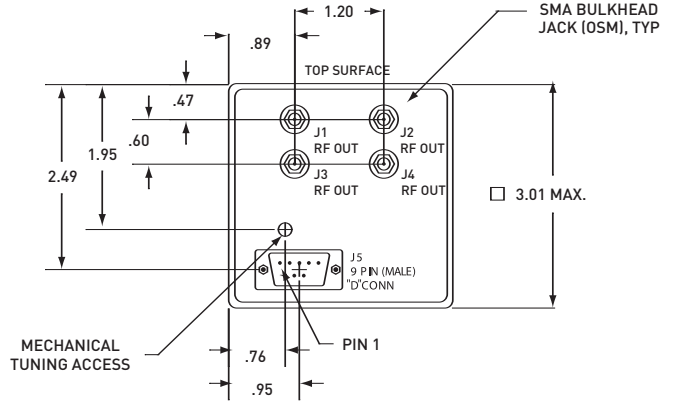
ORDERING INFORMATION

- | | |
|--------------------------------|------------------------------|
| • 1000B with (4) 5MHz outputs | Part No.
05818-103 |
| • 1000B with (4) 10MHz outputs | 05818-115 |

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 Quadrupole 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

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	5.0E-14
100s	1.3E-14
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 50 Ω(TTL compatible)
- Pulsewidth: 20 μs
- Rise time: <5 ns
- Jitter: <1 ns RMS

TIMING INPUT

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

PHASE NOISE

- 5 MHz outputs

1 Hz	-90dBc
10Hz	-110dBc
100 Hz	-130dBc
1 kHz	-140dBc
10 kHz	-150dBc
100 kHz	-155dBc

POWER

- Operating voltage: 85 to 264 VAC
- Frequency range: 47 to 63 Hz
- Peak power: 150 W
- Operating power: 75 W
- 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

OPTIONS

- 100 MHz output/13dBm
- 1PPS

Part No.

- 102
- 103



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 $\pm 1.0E-7$, with a fractional resolution of $1.0E-19$. 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.



AOG-110 Auxiliary Output Generator

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 Specifications

PERFORMANCE

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

TIMING OUTPUT

- Format: 1PPS (positive going pulse)
- Amplitude: $>3\text{ V}$ into 50Ω (TTL compatible)
- Pulsewidth: $20\ \mu\text{s}$
- Rise time: $<5\text{ ns}$
- Jitter: $<1\text{ ns RMS}$

TIMING INPUT

- Sync input: 1PPS
- Amplitude: $>3\text{ V}$ into 50Ω (TTL compatible)
- Pulsewidth: $\geq 20\ \mu\text{s}$
- Rise time: $<5\text{ ns}$
- Jitter: $<1\text{ ns RMS}$
- Synchronization input to output: $<15\text{ ns}$

POWER REQUIREMENTS

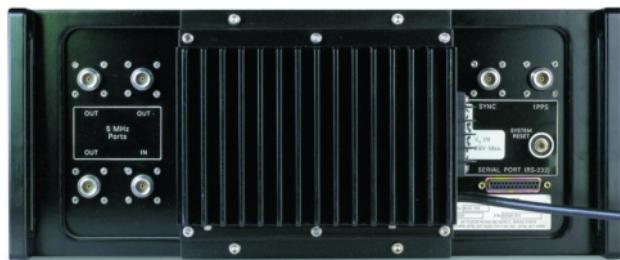
- Universal supply: 85-265 VAC, 47-440 Hz
- Secondary DC input: 18-30 Vdc
- 20 Watt operational power, 40 Watt start-up

DIMENSIONS

- 7.0" x 16.75" x 21.0"
(17.78 cm x 42.54 cm x 53.34 cm) rack-mount chassis
- Weight (approximately): 40 lbs. (18 Kg)

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



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.



“The United States Navy relies on Symmetricom to continue delivering a premier integrated weapon system to the fleet. We pride ourselves on diligently researching and selecting the best-value suppliers to deliver a superior product to our customers.”

Orlando Carvalho

Vice President of Surface Systems

Lockheed Martin Maritime Systems & Sensors

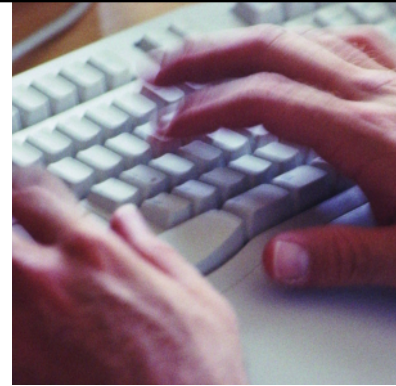
Bus Level Timing

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/VXI, and PC. And, with one of the best software suites available to support our boards, we provide you with a complete and customizable solution that is easy for you to integrate into most development environments.

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 cards are configurable; use our example code to synchronize multiple interconnected computers, provide precise

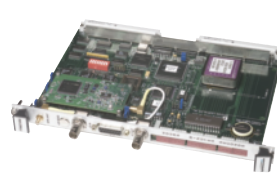
time to a single computer, or act as a source for timing outputs. They can synchronize a computer clock to an input reference as well as act as a synchronized time generator for other connected boards or devices. Use one of the many driver kits to create your own, unique application.

Customize your timing system with any of our available software packages. An interrupt driven algorithm, using the configurable feature sets provided on these cards, will satisfy most any time and frequency requirement.

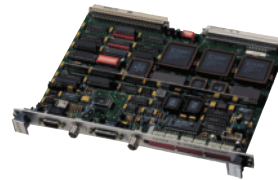




VME Card Matrix



TTM637VME



bc635VME



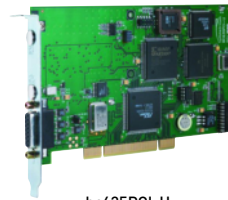
VME-SG 2



PC03V

		TTM635VME	bc635VME	VME-SG 2	PC03V
Sync Inputs	GPS	optional (TTM637VME)	optional (bc637VME)		
	1PPS	x	x		
	IRIG A	x	optional		AM only
	IRIG B	x	x	x	AM only
	IRIG G				AM only
	NASA 36		optional		AM only
	2137	AM only	AM only		AM only
	XR3	AM only	AM only		AM only
Sync Outputs	1PPS	x	x	x	x
	IRIG B	x	x	x	
	IRIG H	DCLS only	DCLS only		
Timing Functions	1 Microsecond accuracy	x	x	x	
	100ns resolution	x	x	1 microsecond	1 microsecond
	non-realtime resolution				carrier resolution/ forward & reverse
	non-realtime translation				125 Hz - 500kHz
	Propagation delay compensation	x	x	x	
	BCD Time	x	x	x	x
	Unix/Binary time	x	x		
	1, 5, 10 MPPS output	x	x		1PPS only
	Programmable rate generation outputs/interrupts	2.3 mHz to 2.5 MHz	2.3 mHz to 2.5 MHz	x	x
	Event time capture/interrupts	x	x	x	x
	Time compare (alarm) outputs/interrupts	x	x	x	x
	Real time clock (in the event of a power failure)	battery backed	battery backed		
	Flywheeling/Holdover	x	x	x	
	OCXO for extended flywheel accuracy	optional	optional		
	External frequency input – disciplining local oscillator	1PPS, 10 MHz	1PPS, 10 MHz		
	External frequency input – cesium/rubidium direct	10 MHz	10 MHz		
	6U – single width	x	x	x	x
	Optional C-size configuration	x	x		
	Display	x	x		

PCI Card Matrix



bc635PCI-U



PCI-SG 2U

	bc635PCI-U	PCI-SG 2U
Sync Inputs	GPS	optional (bc637PCI-U)
	1PPS	x
	IRIG A	x
	IRIG B	x
Sync Outputs	IEEE 1344	x
	1PPS	x
	IRIG B	x
	IEEE 1344	x
Timing Functions	Accuracy	1 microsecond
	100ns resolution	x
	BCD Time	x
	Unix/Binary time	x
	1, 5, 10 MPPS output	x
	Programmable rate generation outputs/interrupts	<1 hz - 250 kHz
	Event time capture/interrupts	x
	Time compare (alarm) outputs/interrupts	x
	Real time clock (in the event of a power failure)	battery backed
	Flywheeling/Holdover	x
	OCXO for extended flywheel accuracy	optional
	External frequency input – disciplining local oscillator	1PPS, 10 MHz
	External frequency input – cesium/rubidium direct	10 MHz
	3.3V and 5.0V universal signaling on PCI local Bus	x
Software & Drivers	PCI-X compatible	x
	Standard half size card (4.2" x 6.875")	x
	Windows NT/2K/XP SDK	x
	Solaris	x
	VxWorks	x
Linux	x	
Other UNIX	x	



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
- 1PPS 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

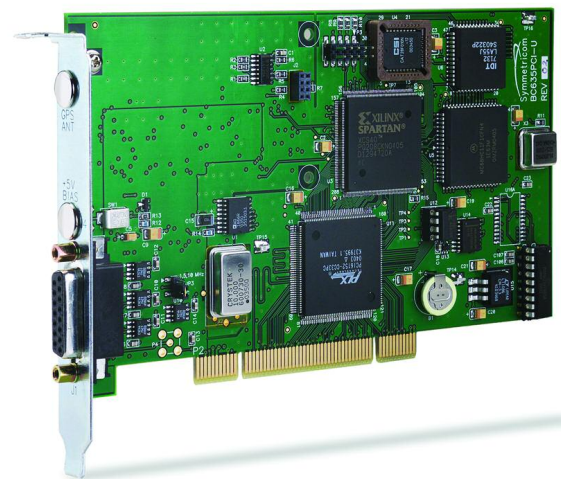
Symmetricom's bc635PCI-U timing module provides precision time and frequency reference to the host computer and peripheral data acquisition systems. Time is typically acquired from time code signals such as IRIG B. The bc635PCI-U automatically supports both the 3.3V and 5.0V signaling of the PCI bus.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



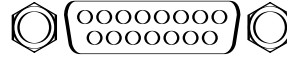
bc635PCI-U Time & Frequency Processor

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 μ S (modulated) <1 μ S (DCLS)
 - Modulation ratio: 3:1 to 6:1
 - Input amplitude: 500 mV to 5V P-P
 - Input impedance: >10K Ω , AC coupled
- Time code generator
 - Time code format: IRIG B
 - Modulation ratio: 3:1
 - Output amplitude: 4 V P-P (fixed) into 50 Ω
 - DC level shift: TTL/CMOS, 50 Ω
- Timing functions
 - Pulse rate synthesizer (TTL, 50 Ω): <1 Hz to 250 kHz
 - Time compare (TTL, 50 Ω): Programmable 1 μ Sec through hours
 - Event capture (TTL, 50 Ω): 100 nSec resolution, zero latency
 - 1PPS pulse rate (TTL, 50 Ω): 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, 1PPS, 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
 - 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: +5 V @ 350 mA +12 V @ 400 mA -12 V @ 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	1PPS 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 1PPS input
15	output	Periodic Pulse output

- Complete specifications can be found in the manual located at <http://www.symmtm.com/pdf/Bus/bc635-637PCI-U.pdf>

ENVIRONMENTAL SPECIFICATIONS

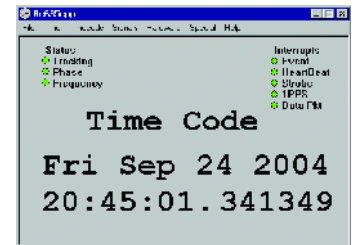
- Environment

	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%
Operating altitude:	Up to 18,000 meters MSL	

SOFTWARE

- The bc635PCI-U includes the Symmetricom Demonstration driver, bc635cpp, an application program for Windows NT/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-U datasheet at http://www.symmtm.com/pdf/Bus/DS_bc637PCI-U.pdf
- Ovenized crystal oscillator for extended holdover
- 'D' connector (J1) to BNC adapter
- Drivers: Windows NT/2000/XP, Linux, Solaris, VxWorks (PPC target) Contact factory for additional driver support

bc637PCI-U

GPS Synchronized, PCI Time & Frequency Processor

KEY FEATURES

- PCI Local Bus Operation
- 3.3V and 5.0V Universal Signaling
- GPS Synchronized with 1 Microsecond Accuracy to UTC
- IRIG A, B, and IEEE 1344 Time Code Inputs
- 1PPS 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 Capture/Interrupt
- Programmable Time Compare Output/Interrupt
- Zero Latency Time Reads
- Battery Backed Clock
- Extensive Software Drivers/SDKs Available
- Optional OCXO Upgrade

Symmetricom's GPS referenced bc637PCI-U receiver module provides precision 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 such as IRIG B. GPS synchronization provides 1 microsecond accurate time to UTC and enables the bc637PCI-U to be an ideal master clock for synchronizing multiple computers to UTC.

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

Central to the operation of the module is a GPS 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 bc637PCI-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 bc637PCI-U to slave to the 10 MHz output from a Cesium or Rubidium standard. This creates an extremely stable PCI based clock for all bc637PCI-U timing functions and is superior to any disciplining technique.



bc637PCI-U GPS Synchronized, Time & Frequency Processor

bc637PCI-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 μ S (modulated) <1 μ S (DCLS)
 - Modulation ratio: 3:1 to 6:1
 - Input amplitude: 500 mV to 5V P-P
 - Input impedance: >10K Ω , AC coupled
- Time code generator
 - Time code format: IRIG B
 - Modulation ratio: 3:1
 - Output amplitude: 4 V P-P (fixed) into 50 Ω
 - DC level shift: TTL/CMOS, 50 Ω
- Timing functions
 - Pulse rate synthesizer (TTL, 50 Ω): <1 Hz to 250 kHz
 - Time compare (TTL, 50 Ω): Programmable 1 μ Sec through hours
 - Event capture (TTL, 50 Ω): 100 nSec resolution, zero latency
 - 1PPS pulse rate (TTL, 50 Ω): 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, 1PPS, 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
 - 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: +5 V @ 470 mA +12 V @ 400 mA -12 V @ 70 mA
- Connector
 - J2 - GPS ANT: SMB socket
 - J1 - Module I/O: 15-pin 'DS'

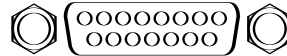
ENVIRONMENTAL SPECIFICATIONS

- Environment

Temperature	Module	Ant/Rcvr
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%*	95%
	*non-condensing	
Operating altitude:	Up to 18,000 meters MSL	

CONNECTOR

- J2 - GPS ANT: SMB socket
- J1 - Module I/O: 15-pin 'DS'



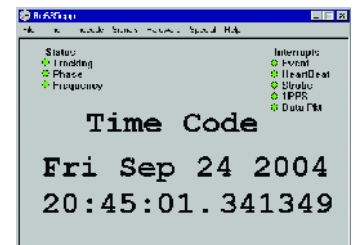
Pin	Direction	Signal
1	input	External 10 MHz input
2	n/a	Ground
3	output	Strobe output
4	output	1PPS output
5	output	Time Code output (AM)
6	input	External Event input
7	input	Time Code input (AM)
8	n/a	Ground (Recommended Time Code return)
9	output	Oscillator Control Voltage output
10	input	Time Code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

- Complete specifications can be found in the manual located at <http://www.symmttm.com/pdf/Bus/bc635-637PCI-U.pdf>

SOFTWARE

- The bc637PCI-U includes two Symmetricom Demonstration drivers, bc635cpp and bc637PCI GPS demo. Bc635cpp is an application program for Windows NT/2000/XP. Using this program you can review the bc637PCI-U card status and adjust board configuration and output parameters. Bc637PCI GPS demo provides direct access to the GPS receiver used on the bc637PCI-U board. 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 bc637PCI-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

- bc637PCI-U Time & Frequency Processor board, one year warranty, PCI User's Guide, Windows Demonstration software CD, GPS Antenna Mounting Guide, 50 foot (15 m) RG58 RF GPS cable, Bullet style RF GPS antenna, 17 inch (43 cm) antenna mounting mast, x2 pipe straps, x2 hose clamps, x4 wood screws, and x4 screw anchors.

OPTIONS

- Extended length GPS antenna cable
- 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' (475 m)
- Lightning arrester
- GPS Antenna splitter kit
- Ovenized crystal oscillator for extended holdover
- 'D' connector (J1) to BNC adapter
- Isolation transformer time code input
- Drivers: Windows NT/2000/XP, Linux, Solaris, VxWorks (PPC target) 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

Symmetricon'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 μ S (modulated)
<1 μ S (DCLS)
 - Modulation ratio: 3:1 to 6:1
 - Input amplitude: 500 mV to 5V P-P
 - Input impedance: >10K Ω

* 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 50 Ω
 - 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, 50 Ω): Programmable Periodic, <1 Hz to 250 kHz
 - Time strobe (TTL, 50 Ω): Programmable 1 μ Sec through hours
 - Event capture (TTL, 50 Ω): 100 nSec resolution, zero latency
 - 1PPS pulse rate (TTL, 50 Ω): 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, 1PPS, 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
- GPS Subsystem (bc637PMC only)
 - Time accuracy: <1 μ Second
 - 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
	Storage:	-30°C to 85°C
• Humidity	Operating:	5% to 95%*
		*non-condensing

OPTIONS

- ACUTIME GPS firmware**
 - ACUTIME antenna/receiver**
 - 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
- **included with bc637PMC

ORDERING INFORMATION

• BC12073-1000	bc635PMC Time & Frequency Processor
• 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)
• ACUFIRM-PCI	GPS firmware upgrade
• GPS-ACU/2K	Spare antenna/receiver
• 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

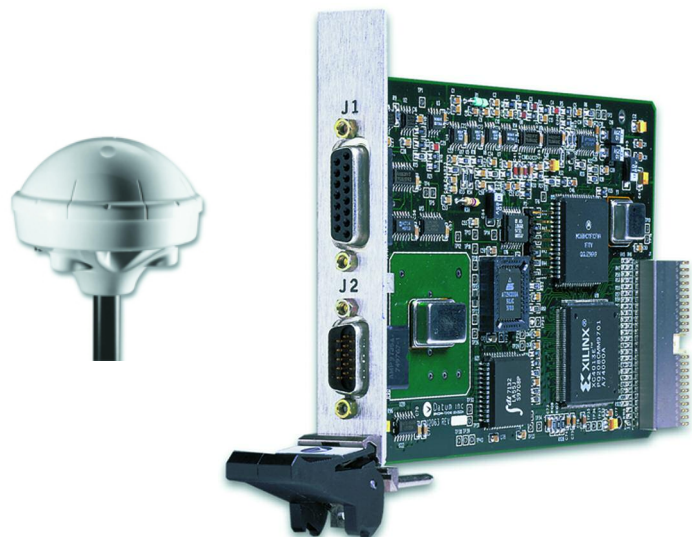
- CompactPCI™ Bus Operation
- GPS or Time Code Inputs
- Time Code Outputs
- Pulse Rate Outputs
- Frequency Outputs (1, 5, or 10 MHz)
- External Event Capture Register/Interrupt
- Programmable Periodic Output/Interrupt
- Programmable Time Strobe Output/Interrupt
- IEEE 1344 Compliant IRIG B Time Code
- 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 μ S (modulated) <1 μ S (DCLS)
 - Modulation ratio: 3:1 to 6:1
 - Input amplitude: 500 mV to 5V P-P
 - Input impedance: >10K Ω
 - * 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 50 Ω
 - 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, 50 Ω): Programmable Periodic, <1 Hz to 250 kHz
 - Time strobe (TTL, 50 Ω): Programmable 1 μ Sec through hours
 - Event capture (TTL, 50 Ω): 100 nSec resolution, zero latency
 - 1PPS pulse rate (TTL, 50 Ω): 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, 1PPS, 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 μ Second
 - 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

	Module	Ant/Rcvr
• Temperature	Operating:	0°C to 70°C
	Storage:	-30°C to 85°C
	Humidity	
Operating:	5% to 95%*	95%
Operating altitude:	Up to 18,000 meters MSL	

OPTIONS

- ACUTIME GPS firmware**
 - ACUTIME antenna/receiver**
 - 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
- **included with bc637CPCI

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)
• ACUFIRM-PCI	GPS firmware upgrade
• GPS-ACU/2K	Spare antenna/receiver
• 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.



Windows SDK for bc635/637PCI-U

Software Development Kit for Windows NT/2000/XP and Symmetric bc635/637PCI-U and CPCI/PMC Cards

KEY FEATURES

- Windows NT/2000/XP SDK
- Full-Featured Function Set for Faster PCI Timing Card Integration
- Windows NT/2000/XP Kernel Mode Driver
- Code Examples
- Test Application Program
- Complete Documentation

The PCI SDK for Windows® is a full-featured software development kit that speeds integration of Symmetric PCI products into an application. The SDK is an easy-to-integrate and highly reliable alternative to writing lower-level code to address a card's memory registers directly. The function calls and device drivers in the SDK make interfacing to a Symmetric PCI card straightforward and help keep your software development focused on the end application. Included in the SDK is the Windows NT/2000/XP kernel mode device driver for the 32-bit PCI interface. The SDK includes .h, .lib, and DLL files for linking applications to drivers.

The SDK functions address each Symmetric PCI timing card feature, and the function names and parameters provide intuitive insight into the capability of each function. The target programming environment is Microsoft® Visual C++. Programmers will find the SDK an invaluable resource in accelerating the integration

of Symmetric PCI cards into applications, saving both time and money. By using the SDK, you can leverage Symmetric's timing expertise and confidently integrate a Symmetric PCI card into your application.

Included in the SDK is Symmetric's bc635cpp application program, which can be used to ensure proper operation of the PCI card, as well as the TrayTime application allowing the user to update the system clock in which the card is installed. Source code for these programs as well as smaller example programs are included.



PCI-WINSDK Software for bc635/637PCI-U and CPCI/PMC cards

SDK Function Reference List

BASIC FUNCTIONS

- **bcStartPCI:** Opens underlying device layer.
- **bcStopPCI:** Closes underlying device layer.
- **bcStartInt:** Starts the interrupt thread to signal interrupts.
- **bcStopInt:** Stops the interrupt thread and releases any used resources.
- **bcSetInts:** Enables an interrupt source.
- **bcReqInts:** Returns the interrupt value currently enabled.
- **bcGetReg:** Returns requested register contents.
- **bcSetReg:** Set requested register contents.
- **bcGetDPRReg:** Returns requested register contents
- **bcSetDPRReg:** Sets requested register contents.
- **bcSetPciCard:** Resets module manufacturer's settings.
- **bcCommand:** Send SW reset command to board.
- **bcSpecialBoot:** Commands TFP to ignore multiple reset pulses after power-on.
- **bcReadBinTime:** Reads TFP major time in binary format.
- **bcReadDecTime:** Reads TFP major time in BCD format.
- **bcSetTmfmt:** Format major time to binary or grouped decimal.
- **bcSetBinTime:** Sets TFP major time in binary format.
- **bcSetBCDTime:** Sets TFP major time in BCD format.
- **bcSetYear:** Programs year value.
- **bcYearAutoInc:** Enables or disables year auto-increment features that occurs at the beginning of the year.
- **bcSetLocalFlag:** Enables or disables local time offset in conjunction with **bcSetLocOff**. Commands board to report time at an offset relative to UTC.
- **bcSetDaylightFlag:** Adjusts TFP time by one-hour (if IEEE time format is used).
- **bcSetLeapEvent:** Inserts or deletes leap second data (in non-GPS modes).
- **bcSetMode:** Selects TFP operating mode.
- **bcSetTcIn:** Selects time code format and modulation for timecode decoding mode.
- **bcReqTimeData:** Returns selected time data from the board.
- **bcReqTimeCodeData:** Returns selected time code data from the board.
- **bcReqOtherData:** Returns selected data from the board.
- **bcReqVerData:** Returns firmware version data from the board.
- **bcReqManufData:** Returns manufacturer's data from the board.

EVENT FUNCTIONS

- **bcReadEventTime:** Latches and returns TFP time caused by an external event.
- **bcSetHbt:** Selects a user programmable periodic output.
- **bcSetPDelay:** Programs propagation delay compensation.

OSCILLATOR FUNCTIONS

- **bcSetClkSrc:** Enables or disables on-board oscillator.
- **bcSetDac:** Modifies oscillator DAC value.
- **bcSetGain:** Modifies on-board oscillator frequency control algorithm.
- **bcSetDis:** Modifies on-board oscillator frequency control algorithm.
- **bcSetJam:** Enables or disables jamsynch feature.
- **bcForceJam:** Forces TFP oscillator to jamsynch.
- **bcAdjustClock:** Advances or retards TFP internal clock.
- **bcReqOscData:** Returns TFP oscillator data.

GENERATOR MODE FUNCTIONS

- **bcSetGenCode:** Selects time code generator format.
- **bcSetGenOff:** Commands an offset to the on-board timecode generation function.

GPS MODE FUNCTIONS

- **bcGPSReq:** Returns a GPS data packet.
- **bcGPSSnd:** Sends a GPS receiver data packet.
- **bcGPSMan:** Manually sends and retrieves GPS receiver datapackets.
- **bcGPSOperMode:** Directs the GPS receiver to function in static or dynamic mode.
- **bcSetUtcCtl:** Commands TFP to use GPS or UTC time base.

RTC FUNCTIONS

- **bcSyncRtc:** Synchronizes RTC to current TFP time.
- **bcDisRtcBatt:** Commands RTC circuit and battery to disconnect after power is turned off.

The PCI cards have different user-configurable operating modes. Some of the above functions may not be available depending on the mode selected or if GPS is installed.

LICENSING

The Symmetricom PCI SDK is sold as a seat license. Distribution of embedded Symmetricom software in customer applications is royalty free.

MINIMUM SYSTEM REQUIREMENTS

- **Software:** Microsoft Visual C++
- **Operating System:** Microsoft Windows NT/2000/XP
- **Hardware:** PC-compatible system with a Pentium or faster processor (bc635PCI and bc637PCI are also compatible with SDK)
- **Memory:** 24 Mb

ORDERING INFORMATION

- **PCI-WINSDK** PCI-U, CPCI or PMC Windows Software Developer's Kit
- **PCI-WINSDK-U** PCI-U, CPCI or PMC Windows SDK Upgrade

The SDK includes the interface library, example programs and source code utilizing the interface library, and a User's Guide containing the library definitions.

Linux Software for bc635/637PCI-U

Software Kit for Linux and Symmetricom bc635/637PCI-U/CPCI/PMC Cards

KEY FEATURES

- Linux Software Kit
- Full-Featured Function Set for Faster PCI Timing Card Integration
- Linux Kernel Mode Driver
- Code Examples
- Test Application Program
- Complete Documentation

The PCI Linux[®] Software Kit is a full-featured software kit that speeds integration of Symmetricom PCI products into an application. The SW Kit is an easy-to-integrate and highly reliable alternative to writing lower-level code to address a card's memory registers directly. Interfacing the Linux SW function calls to a Symmetricom PCI card is straightforward and helps keep your software development focused on the end application. The SW Kit includes a 32-bit PCI kernel mode device driver, an interface library accessing all bc635/637PCI features, and example programs with source code.

The SW Kit functions address each Symmetricom PCI timing card feature, and the function names and parameters provide intuitive insight into the capability of each function. The target programming environment is GNU, GCC, C/C++.

Programmers will find the SW Kit an invaluable resource in accelerating the integration of Symmetricom PCI cards into applications, saving both time and money. By using the SW Kit, you can leverage Symmetricom's timing expertise and confidently integrate a Symmetricom PCI card into your application.

Symmetricom's Linux SW Kit includes pcdemo, an application program to ensure proper operation of the PCI card. The example program includes sample code, exercising the interface library, and conversion examples of the ASCII format data objects passed to and from the device into a binary format suitable for operation and conversion. The example program was developed using discrete functions for each operation, allowing the developer to clip any useful code and use it in their own applications.



PCI-LXDRV Software

Linux SW Function Reference List

BASIC FUNCTIONS

- bcStartPCI: Opens underlying device layer
- bcStopPCI: Closes underlying device layer
- bcStartInt: Starts the interrupt thread to signal interrupts
- bcStopInt: Stops the interrupt thread and releases any used resources
- bcSetInt: Enables an interrupt source
- bcReqInt: Returns the interrupt value currently enabled
- bcShowInt: Interrupt service routine

- bcReadReg: Returns requested register contents
- bcWriteReg: Set requested register contents
- bcCommand: Send SW reset command to board

- bcReadBinTime: Reads TFP major time in binary format
- bcReadDecTime: Reads TFP major time in BCD format
- bcSetTimeFormat: Format major time to binary or grouped decimal
- bcReqTimeFormat: Returns selected time format
- bcSetBinTime: Sets TFP major time in binary format
- bcSetDecTime: Sets TFP major time in BCD format
- bcSetYear: Programs year value
- bcSetYearAutoIncFlag: Enables or disables year auto-increment features that occurs at the beginning of the year
- bcSetLocalOffsetFlag: Enables or disables local time offset in conjunction with bcSetLocOff
- bcSetLocOff: Commands board to report time at an offset relative to UTC
- bcSetLeapEvent: Inserts or deletes leap second data (in non-GPS modes)
- bcSetMode: Selects TFP operating mode
- bcSetTcIn: Selects time code format for time code decoding mode
- bcSetTcInMod: Selects time code modulation for time code decoding mode

- bcReqYear: Returns current year
- bcReqTimeData: Returns selected time data from the board
- bcReqTimeCodeData: Returns selected time code data from the board
- bcReqOtherData: Returns selected data from the board
- bcReqVerData: Returns firmware version data from the board
- bcReqSerialNumber: Returns board serial number
- bcReqHardwareFab: Returns hardware fab part number
- bcReqAssembly: Returns assembly part number
- bcReqModel: Returns TFP model identification
- bcReqTimeFormat: Returns selected time format

EVENT FUNCTIONS

- bcSetHbt: Selects a user programmable periodic output
- bcSetPropDelay: Programs propagation delay compensation
- bcSetStrobeTime: Sets strobe function time

OSCILLATOR FUNCTIONS

- bcSetClkSrc: Enables or disables on-board oscillator
- bcSetDac: Modifies oscillator DAC value
- bcSetGain: Modifies on-board oscillator frequency control algorithm
- bcSetJam: Enables or disables jamsynch feature
- bcForceJam: Forces TFP oscillator to jamsynch
- bcAdjustClock: Advances or retards TFP internal clock
- bcReqOscData: Returns TFP oscillator data

GENERATOR MODE FUNCTIONS

- bcSetGenCode: Selects time code generator format
- bcSetGenOff: Commands an offset to the on-board timecode generation function

GPS MODE FUNCTIONS

- bcGPSReq: Returns a GPS data packet
- bcGPSsnd: Sends a GPS receiver data packet
- bcGPSMan: Manually sends and retrieves GPS receiver datapackets
- bcSetGPSOperMode: Directs the GPS receiver to function in static or dynamic mode
- bcSetGPSTmFmt: Commands TFP to use GPS or UTC time base

RTC FUNCTIONS

- bcSyncRtc: Synchronizes RTC to current TFP time
- bcDisRtcBatt: Commands RTC circuit and battery to disconnect after power is turned off

The PCI cards have different user-configurable operating modes. Some of the above functions may not be available depending on the mode selected or if GPS is installed.

LICENSING

The Symmetricom PCI LXDRV is sold as a seat license.

MINIMUM SYSTEM REQUIREMENTS

- Software/operating system: Linux Kernels 2.2, 2.4, 2.6
- Hardware: PCI/CPCI/PMC x86 processor
- Memory: 32 Mb
- Development environment: Any 32-bit C based development environment

ORDERING INFORMATION

- PCI-LXDRV

GPS-PCI 2U

Multi-function GPS Synchronized, Time and Frequency PCI Plug-in Card

KEY FEATURES

- 1 Microsecond Accuracy to UTC
- GPS, IRIG A or B or 1PPS Input
- IRIG B and 1PPS Outputs
- 1PPS to 1 MPPS Programmable Rate Synthesizer Output/Interrupt
- 1, 5, 10 MPPS Rate Generator Output/Interrupt
- External Event Input/Interrupt
- Programmable Time Compare Input/Interrupt
- Real Time Clock Backup
- Windows Control Panel Interface Software
- Optional Windows Software Developer's kit
- Zero Latency Time Reads
- 3.3V and 5.0V Universal Signaling

The GPS-PCI 2U provides very precise time to the bus of a PCI-compatible host computer. Time is derived from the GPS satellite system with an accuracy of 1 microsecond to UTC. The GPS-PCI 2U is an ideal master clock solution for synchronizing one or more computers to the UTC time reference.

Time can also be derived from an IRIG A or B time code input or the internal oscillator in the stand-alone generator mode. Synchronization to an external 1PPS is also possible. The frequency of the internal oscillator is precisely disciplined to that of the external synchronization input.

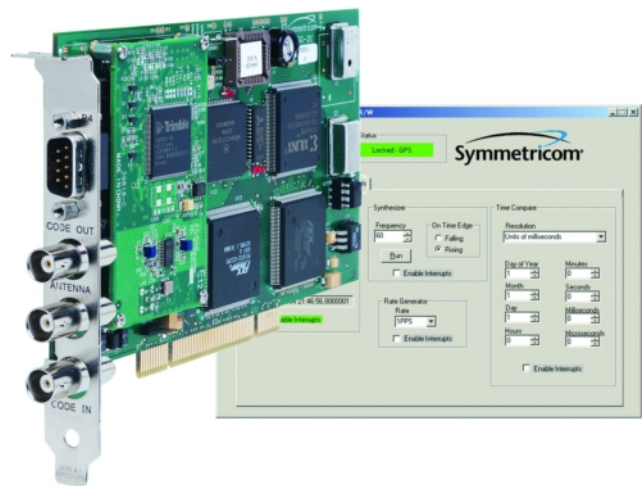
Time, microseconds through years, and status information and position are supplied on demand over the 32-bit PCI bus. In addition to time and status, the GPS-PCI 2U provides a 1PPS pulse rate, a programmable time compare register, a programmable frequency pulse rate, an external event time capture, and an IRIG B serial time code output.

Rear panel BNC connectors are used for the IRIG code input/output and the antenna input for the GPS. A rear panel mounted multipin connector provides the 1PPS pulse rate output, the programmable pulse rate output, the external event input signal and

the input/output connections for the RS-422 versions of the input/output IRIG time code. You can also configure the analog input code with various input impedance choices.

The GPS-PCI 2U automatically supports both the 3.3V and 5.0V signaling of the PCI bus. Information provided over the PCI bus includes time, status, antenna position and the time of occurrence of the external event. Interrupts generated by the programmable rate generator, the rate synthesizer, the occurrence of an external event input, and the time compare occurrence are also provided. Depending upon the operating mode, you can program the hours offset from UTC, leap second, year and daylight savings time. Year and leap second insertion are automatically provided when GPS mode is specified. An on-board, capacitor-powered clock maintains time during a power failure condition for up to 48 hours.

Integration of the module is easily facilitated with the optional driver developer's kit for Windows®.



GPS-PCI 2U GPS Synchronized Time & Frequency Processor

GPS-PCI 2U Specifications

GPS SYNCHRONIZATION MODE

- Timing accuracy: 1 microsecond to UTC
- Position accuracy: 25 meters SEP
- Receiver: 1575 MHz L1 C/A code; 8 parallel channels
- Acquisition time: Warm start (has ephemeris data and position) <3 minutes. Cold start <20 minutes.
- UTC to local offset: User selectable in hours and minutes
- Daylight saving: User selectable, U.S.DST only.
- Leap second: User programmable, automatic in GPS mode.
- Antenna: L1 GPS, 40 dB gain. RG-59/U cable, 50' (15 m) supplied; maximum cable length 200' (61 m). For longer cable runs, see Options.

SYNCHRONIZED GENERATOR MODE

- Analog input code: IRIG A or B
 - Modulation ratio: 2:1 to 5:1
 - Input amplitude: 0.5 – 10 Vpp into 50-600-10kΩ, selectable
 - Timing accuracy: 3 microseconds
- RS-422 input code: IRIG A or B
 - Timing accuracy: 1 microsecond
 - Connector: 9 pin D subminiature, selectable to BNC
- Error bypass: Factory set to three frames
- External 1 PPS input¹: 1 microsecond timing accuracy

STAND-ALONE GENERATOR MODE

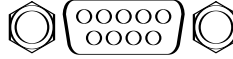
- Allows the user to preset, start and stop the GPS-PCI 2U over the PCI bus.

ELECTRICAL SPECIFICATIONS

- IRIG B Serial code output (analog)
 - Amplitude: 3 Vpp into 600Ω
 - Ratio: 3:1
 - Connector: BNC
- IRIG B Serial code output (RS-422)
 - Amplitude: RS-422 levels
 - Input termination: Selectable, 120Ω or none
 - Connector: 9 pin D subminiature, selectable to BNC (ACMOS)
- Oscillator
 - Accuracy: 5x10E-8 (when disciplined to IRIG Code or GPS)
 - Stability: 2.5 PPM, 0°C to +50°C, unlocked
- 1PPS Pulse rate output
 - Amplitude: 0 – 5 Vdc², positive edge on time, 50% duty cycle
 - Connector: 9 pin D subminiature, selectable to BNC
- Programmable pulse rate generator output
 - Rates: 1PPS, 10 PPS, 100 PPS, 1 kPPS, 10 kPPS, 100 kPPS, 1 MPPS, 5 MPPS, 10 MPPS
 - Outputs: Interrupt and pulse, 0 – 5 Vdc²
 - Connector: 9 pin D subminiature, selectable to BNC
- Pulse rate synthesizer output
 - Rates: 1PPS to 1 MPPS, step size 1 PPS
 - Outputs: Interrupt and pulse, 0 – 5 Vdc²
 - Connector: 9 pin D subminiature, selectable to BNC
- External event time capture
 - Resolution: 100's ns – years
 - Output: Interrupt and time/event capture
 - Event input: Selectable positive or negative edge of 2 – 5 Vdc pulse into approximately 2kΩ
 - Connector: 9 pin D subminiature
- Time compare output
 - Resolution: 100's ns – years
 - Outputs: Interrupt and pulse at compare time
 - Amplitude: +5 Vdc² on compare
 - Connector: 9 pin D subminiature
- Real time clock
 - Bus request resolution: 100's ns
 - Latency: Zero
 - Time format: BCD

MECHANICAL/ENVIRONMENTAL SPECIFICATIONS

- Connector
 - Code out: BNC
 - Antenna: BNC
 - Code in: BNC
 - P4-module I/O: 9-pin D



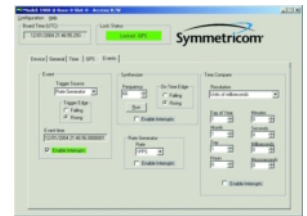
Pin	Direction	Signal
1	input	External Event/1 PPS
2	n/a	GND
3	Input +	DC Reference Code or TTL
4	Input -	DC Reference Code
5	Output	1PPS
6	Selectable:	Time Compare or Rate Synthesizer
7	Output	Rate Generator
8	Output +	DC Generator Code or TTL
9	Output -	DC Generator Code

- 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
 - Size: Single-width (4.2" x 6.875")
 - Device type: PCI Target, 32 bit, 5V universal signaling
 - Data transfer: Byte, Half Word, Word
 - Power: +12VDC @ 200 mA
-12VDC @ 50 mA
+5VDC @ 1500 mA
 - Operating temperature: 0°C to +50°C
 - Storage temperature: -17°C to +85°C
 - Humidity: To 95%, noncondensing
 - Antenna
 - Size: 3" Dia. x 3" H (7.62 cm x 7.62 cm)
 - Weight: 0.55 lb. (0.25 kg)
 - Operating temperature: -40°C to +70°C
 - Storage temperature: -55°C to +85°C
 - Humidity: 100%, condensing
 - Certification: FCC, CE, UR
 - Real time clock: On board capacitor-powered clock maintains time during power fail conditions for up to 48 hours

• Complete specifications can be found in the manual located at http://www.symmtm.com/pdf/Bus/um_PCI-2U.pdf

SOFTWARE

The GPS-PCI 2U includes the Symmetricom PCI_Panel application program Windows NT/2000/XP. Using this program you can review the GPS-PCI 2U card status and adjust board configuration and output parameters. The program can also operate as a background task keeping the host computer clock synchronized to the GPS-PCI 2U card.



PRODUCT INCLUDES

- GPS-PCI 2U GPS Synchronized Time & Frequency card, L1 GPS antenna, 50 feet (15m) antenna cable, PCI_Panel application program, Windows .dll and .sys drivers, manual, 9-pin D connector kit, one year warranty

OPTIONS

- Windows Software Developer's Kit
- Extended cable up to 300-1500' (91-457 m); may require signal amplification
- Antenna options: lightning arrestor, splitter kit, inline amp, down/up converter
- Transformer coupled input or output code

¹ When external 1PPS is used as sync input, the external event is not available.

² 5 Vdc outputs have ACMOS levels.

PCI-SG 2U

Multi-Function Time and Frequency PCI Plug-in Card

KEY FEATURES

- IRIG A, B or 1PPS Input
- IRIG B and 1PPS Outputs
- 1PPS to 1MPPS Programmable Rate Synthesizer Output/Interrupt
- 1, 5, 10MPPS Rate Generator Output/Interrupt
- External Event Input/Interrupt
- Programmable Time Compare Input/Interrupt
- Real Time Clock Backup
- Windows Control Panel Interface Software
- Zero Latency Time Reads
- NEW: 3.3V and 5.0V Universal Signaling

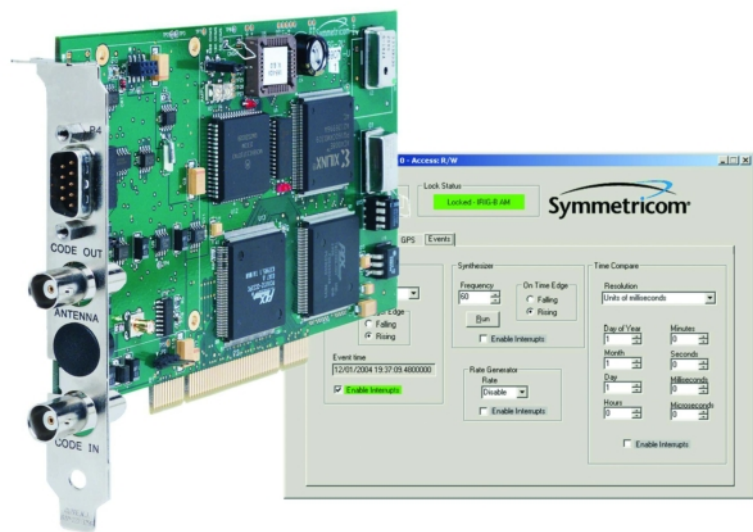
The PCI-SG 2U provides precise time to computers that have PCI expansion slots. The time is derived from an IRIG A or B time code input or the internal oscillator in the standalone generator mode. The frequency of the internal oscillator is precisely disciplined to that of the external synchronization input. Synchronization to an external 1PPS is also possible.

Time, microseconds through years, and status information is supplied on demand over the 32-bit PCI bus. In addition to time and status, the PCI-SG 2U provides a 1PPS pulse rate, a programmable time-compare register, a programmable frequency pulse rate, an external event time capture, and an IRIG B serial time code output.

Rear panel BNC connectors are used for the IRIG code input/output. A rear panel mounted multipin connector provides the 1PPS pulse rate output, the programmable pulse rate output, the external event input

signal and the input/output connections for the RS-422 versions of the input/output IRIG time code. You can also configure the analog input code with various input impedance choices.

The PCI-SG 2U automatically supports both the 3.3V and 5.0V signaling of the PCI bus. Information provided over the PCI bus includes time, status, and the time of occurrence of the external event. Interrupts generated by the programmable rate generator, the rate synthesizer, the occurrence of an external event input, and the time compare occurrence are also provided. Depending upon the operating mode, you can program the hours offset from UTC, leap second, year and daylight savings time. An on-board, capacitor-powered clock maintains time during a power failure condition for up to 48 hours.



PCI-SG 2U Time & Frequency Processor

PCI-SG 2U Specifications

SYNCHRONIZED GENERATOR MODE

- Analog input code: IRIG A or B
 - Modulation ratio: 2:1 to 5:1
 - Input amplitude: 0.5 – 10 Vpp
 - Impedance: 50-600-10kΩ, selectable
 - Connector: BNC
 - Timing accuracy: 3 microseconds
- RS-422 input code: IRIG A or B
 - Timing accuracy: 1 microsecond
 - Connector: 9 pin D subminiature, selectable to BNC
- Error bypass: Factory set to three frames
- External 1PPS input¹: 1 microsecond timing accuracy (uses external event input port)

STAND-ALONE GENERATOR MODE

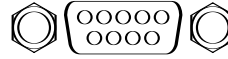
- Allows the user to preset, start and stop the PCI-SG 2U over the PCI bus.

ELECTRICAL SPECIFICATIONS

- IRIG B Serial code output (analog)
 - Amplitude: 3 Vpp into 600Ω
 - Ratio: 3:1
 - Connector: BNC
- IRIG B Serial code output (RS-422)
 - Amplitude: RS-422 levels
 - Input termination: Selectable, 120Ω or none
 - Connector: 9 pin D subminiature, selectable to BNC (ACMOS)
- Oscillator
 - Accuracy: 5x10E-8 (when disciplined to IRIG Code)
 - Stability: 2.5 PPM, 0°C to +50°C, unlocked
- 1PPS Pulse rate output
 - Amplitude: 0 – 5 Vdc², positive edge on time, 50% duty cycle
 - Connector: 9 pin D subminiature, selectable to BNC
- Pulse rate generator output
 - Rates: 1PPS, 10 PPS, 100 PPS, 1 kPPS, 10 kPPS, 100 kPPS, 1 MPPS, 5 MPPS, 10 MPPS
 - Interrupt and pulse, 0 – 5 Vdc²
 - Connector: 9 pin D subminiature, selectable to BNC
- Pulse rate synthesizer output
 - Rates: 1PPS to 1 MPPS, step size 1PPS
 - Outputs: Interrupt and pulse, 0 – 5 Vdc²
 - Connector: 9 pin D subminiature, selectable to BNC
- External event time capture
 - Resolution: 100's ns-years
 - Output: Interrupt
 - Event input: Selectable positive or negative edge of 2 – 5 Vdc pulse into approximately 2kΩ
 - Connector: 9 pin D subminiature
- Time compare output
 - Resolution: 100's ns – years
 - Outputs: Interrupt and pulse at compare time
 - Amplitude: +5 Vdc² on compare
 - Connector: 9 pin D subminiature
- Real time clock
 - Bus request resolution: 100's ns
 - Latency: Zero
 - Time format: BCD

MECHANICAL/ENVIRONMENTAL SPECIFICATIONS

- Connector
 - Code out: BNC
 - Code in: BNC
 - P4-module I/O: 9-pin D



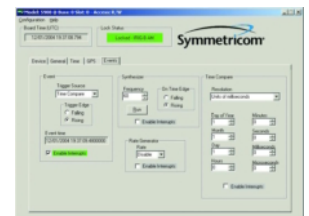
Pin	Direction	Signal
1	input	External Event/ 1PPS
2	n/a	GND
3	Input +	DC Reference Code or TTL
4	Input -	DC Reference Code
5	Output	1PPS
6	Selectable:	Time Compare or Rate Synthesizer
7	Output	Rate Generator
8	Output +	DC Generator Code or TTL
9	Output -	DC Generator Code

- 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
- Size: Single-width (4.2" x 6.875")
- Device type: PCI Target, 32 bit, 5V universal signaling
- Data transfer: Byte, Half Word, Word
- Power: +12VDC @ 100 mA
-12VDC @ 50 mA
+5VDC @ 1300 mA
- Operating temperature: 0°C to +50°C
- Storage temperature: -17°C to +85°C
- Humidity: To 95%, noncondensing
- Certification: FCC, CE, UR
- Real time clock: On board capacitor-powered clock maintains time during power fail conditions for up to 48 hours

• Complete specifications can be found in the manual located at http://www.symmttm.com/pdf/Bus/PCI-SG_2U.pdf

SOFTWARE

- The PCI-SG 2U includes the Symmetricom PCI_Panel application program Windows NT/2000/XP. Using this program you can review the PCI-SG 2U card status and adjust board configuration and output parameters. The program can also operate as a background task keeping the host computer clock synchronized to the PCI-SG 2U card.



PRODUCT INCLUDES

- PCI-SG 2U Time & Frequency card, PCI_Panel application program, Windows .dll and .sys drivers, manual, 9-pin D connector kit, one year warranty

OPTIONS

- For GPS synchronization, see the GPS-PCI 2U data sheet
- Transformer Coupled Input Code (single-ended or balanced)
- Transformer Coupled Output Code (balanced)

¹ When external 1PPS is used as sync input, the external event is not available.



Windows SDK for PCI-SG 2U/GPS-PCI 2U

Software Development Kit for Windows 2000/XP and Symmetricom PCI-SG 2/2U & GPS-PCI 2/2U Cards

KEY FEATURES

- Windows 2000/XP SDK
- Full-Featured Function Set for Faster PCI Timing Card Integration
- Windows 2000/XP Kernel Mode Driver
- Code Examples
- Test Application/Control Program
- Complete Documentation

Windows® SDK for PCI is a full-featured software development kit that speeds integration of Symmetricom PCI-SG 2U/GPS-PCI 2U products into an application. The SDK is an easy-to-integrate and highly reliable alternative to writing lower-level code to address a card's memory registers directly. The function calls and device drivers in the SDK make interfacing to the Symmetricom PCI card straightforward and help keep your software development focused on the end application.

Included in the SDK is the Windows 2000/XP kernel mode device driver for the 32-bit PCI interface. The SDK includes .h, .lib, and DLL files for linking applications to drivers.

The SDK functions address each Symmetricom PCI timing card feature, and the function names and parameters provide intuitive insight into the capability of each function. The target programming environment is Microsoft® Visual C++.

Programmers will find the SDK an invaluable resource in accelerating the integration of Symmetricom PCI cards into applications, saving both time and money. By using the SDK, you will leverage Symmetricom's timing expertise and confidently integrate the Symmetricom PCI card into your application. Included in the SDK is Symmetricom's TT_PCI_Panel.exe application program source code, which may be used to ensure proper operation of the PCI card.



PCI-SG 2U / GPS-PCI 2U WINDSK Software

SDK Function Reference List

BASIC FUNCTIONS

- **TT_OpenDevice:** Attaches the calling application to the specified Symmetricom device.
- **TT_ReadTime:** Retrieves the current time value from the device. In GPS mode, time is always maintained in UTC. In other modes, time is application specific.
- **TT_FileTimeToSystemTimeEx:** Converts a 64-bit file time to system time format.
- **TT_SystemTimeExToFileTime:** Converts a system time to 64-bit file time format.
- **TT_GetDeviceInfo:** Returns static information about the board.
- **TT_GetMode:** Retrieves the board's current operating mode.
- **TT_SetMode:** Sets the board's current operating mode.
- **TT_CloseDevice:** Detaches the calling application from the specified Symmetricom device. It performs resource de-allocation and other cleanup operations.
- **TT_GetRegister:** Returns the contents of the register at the address specified.
- **TT_SetRegister:** Sets the contents of the register at the address specified.
- **TT_ConfigurationSettings:** Allows the saving and restoring of board configuration settings.
- **TT_GetOutputBNCSource:** Returns the source setting that will be available on the output BNC.
- **TT_SetOutputBNCSource:** Sets the source that will be available on the output BNC.
- **TT_GetHardwareStatus:** Returns the contents of the status register.

EVENT FUNCTIONS

- **TT_Callback:** Placeholder for a user-defined callback routine to be executed upon external, periodic, or time compare events.
- **TT_GetExternalEvent:** Returns the current status of the external input event.
- **TT_GetExternalEventTriggerEdge:** Returns the rising or falling trigger status of the external event.
- **TT_GetExternalEventTriggerSource:** Returns the source setting of the trigger for the external event.
- **TT_GetSynthesizerOnTimeEdge:** Returns the polarity of the on time edge of the synthesizer.
- **TT_GetRateGenerator:** Returns the current settings of the rate generator.
- **TT_GetSynthesizer:** Returns the current status of the synthesizer settings.
- **TT_GetSynthesizerRunStatus:** Returns the current status of the synthesizer Run/Stop.
- **TT_GetTimeCompare:** Returns the current settings for the time compare event.
- **TT_RegisterCallback:** Registers a callback routine to be executed upon external, periodic, or time compare events.
- **TT_SetExternalEvent:** Enables/disables the external input event.
- **TT_SetSynthesizer:** Sets the current synthesizer settings.
- **TT_SetSynthesizerRunStatus:** Sets Run/Stop status of the synthesizer.
- **TT_SetSynthesizerOnTimeEdge:** Sets the polarity of the on time edge of the synthesizer.
- **TT_SetTimeCompare:** Enables/disables the time compare event.

EXTERNAL 1PPS MODE FUNCTIONS

- **TT_GetLeapSecond:** Returns the current status of the hardware to add a leap second at the end of the current day.
- **TT_PresetTime:** Sets the current time in the device.
- **TT_ReadDiagnosticRegister:** Returns the error and oscillator values from the diagnostic register.
- **TT_SetLeapSecond:** Enables/disables the hardware to add a leap second at the end of the current day.

GENERATOR MODE FUNCTIONS

- **TT_StartGenerator:** Starts the free-running time generator (clock).
- **TT_StopGenerator:** Stops the free-running time generator (clock).

GPS MODE FUNCTIONS

- **TT_ReadGpsInfo:** Returns the GPS position consisting of latitude, longitude, and elevation, and satellite signal information.
- **TT_PresetPosition:** Used to preset the GPS position. Presetting an initial position will speed up acquisition time.

TIME CODE MODE FUNCTIONS

- **TT_GetPhaseCompensation:** Gets the current phase compensation for the device.
- **TT_ReadTimecodeInfo:** Reads the Locked/Valid status for the time code input.
- **TT_SetPhaseCompensation:** Sets the phase compensation for the device.

The PCI cards have different user-configurable operating modes. Some of the above functions may not be available depending on the mode selected or if GPS is installed.

LICENSING

The Symmetricom Windows SDK for PCI is sold as a seat license. Distribution of embedded Symmetricom software in customer applications is royalty free.

MINIMUM SYSTEM REQUIREMENTS

- **Software:** Microsoft Visual C++
- **Operating System:** Microsoft Windows 2000/XP
- **Hardware:** PC-compatible system with a Pentium or faster processor; one free standard height PCI slot required for PCI-SG 2U/GPS-PCI 2U (PCI-SG 2U/GPS-PCI 2 are also compatible with the Windows for SDK driver).
- **Memory:** Minimum 128 Mbytes; 256 Mbytes recommended

ORDERING INFORMATION

- 183-0021 PCI-SG 2U / GPS-PCI 2U Windows Developer's Kit
- 183-0021-U PCI-SG 2U / GPS-PCI 2U Windows SDK Upgrade

The SDK includes the interface library, TT_PCI_Panel.exe application program source code, utilizing the interface library, and a User's Guide containing the library definitions.



TTM635/637VME & TTM350/357VXI

VME/VXI Time & Frequency Processors

KEY FEATURES

- 6U, Single Width VME or VXI Module
- Optional VXI C-Size Configuration
- GPS or 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

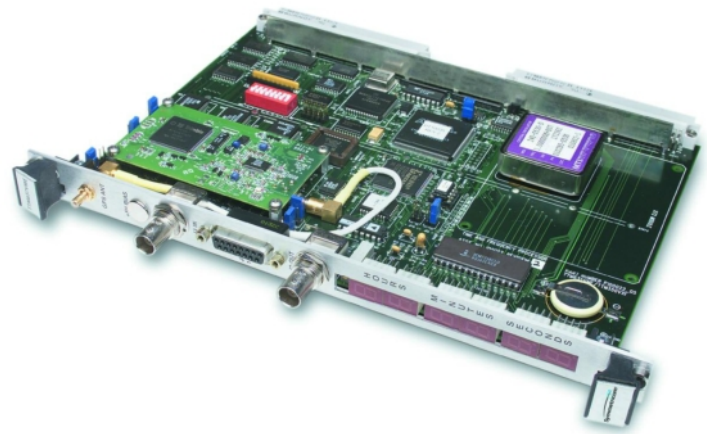
Symmetricom's TTM635/637VME and TTM350/357VXI time and frequency processor modules provide precision time and frequency reference to the host computer and peripheral data acquisition systems. Time is acquired from either the GPS satellites using a supplied antenna/receiver (TTM637VME and TTM357VXI only) or from time code signals, typically IRIG B. Integration of the module is facilitated with optional drivers for several operating systems (see Options). 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 (shown with optional on-board GPS receiver, TTM637VME)

TTM635/637VME - TTM350/357VXI 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/VXI Bus
 - Size: 6Ux160 mm; B size, single width
Optional VXI-C configuration
 - 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 & bc357VXI only)
 - Time accuracy: <±1 microsecond
 - Position accuracy: 10 to 20 meters SEP (SA off)
 - Maximum velocity: 300 meters/second
(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 min.
(1, 3 and 4 satellites)
 - Solution modes: 1, 3 and 4 satellites
- Environment

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

OPTIONS

- GPS Upgrade Kit
- Spare or Extended Antenna Cable³
- Spare RF Antenna
- Spare GPS Receiver
- GPS In-line amplifier for cable runs up to 300' (91 m)
- GPS Antenna down/up converter for cable runs up to 1500' (457 m)
- GPS Antenna splitter kit
- Lightning Arrestor
- ACUTIME GPS Antenna/Receiver
- ACUFIRM GPS Firmware
- VXI C-size Extender
- 'D' Connector (J1) to BNC Adapter
- Ovenized Crystal Oscillator
- Isolation Transformer Time Code Input
- Conformal Coat
- Ruggedized Version
- VxWorks Real Time OS Driver⁴

ORDERING INFORMATION

- TTM635VME-VCXO VME IRIG board w/Standard Crystal Oscillator
- TTM637VME-VCXO VME GPS board w/Standard Crystal Oscillator¹
- TTM350VXI-VCXO² VXI IRIG board w/Standard Crystal Oscillator
- TTM357VXI-VCXO² VXI GPS board w/Standard Crystal Oscillator¹
- TTM635VME-OCXO VME IRIG board w/Ovenized Crystal Oscillator
- TTM637VME-OCXO VME GPS board w/Ovenized Crystal Oscillator¹
- TTM350VXI-OCXO² VXI IRIG board w/Ovenized Crystal Oscillator
- TTM357VXI-OCXO² VXI GPS board w/Ovenized Crystal Oscillator¹
- TTM637VME-L-VCXO VME GPS board w/Acutime antenna/receiver option¹

¹ includes GPS antenna/receiver and 50' (15 m) cable

² please specify VXI-B or VXI-C to ensure system compatibility

³ contact factory regarding longer cabling requirements

⁴ contact factory for additional driver support

VME and VXI cards all use a common design. The main difference is that the VXI modules do not include the P2 bus connector. The VXI-C module is functionally identical to the VXI-B module, the only difference being the length of the module. When ordering, please specify VME, VXI-B or VXI-C to ensure system compatibility.



TTM637VME, TTM350VXI-C and TTM357VXI cards



bc635/637VME & bc350/357VXI

VME/VXI Time & Frequency Processors

KEY FEATURES

- 6U, Single Width VME or VXI Module
- Optional VXI C-Size Configuration
- GPS or 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

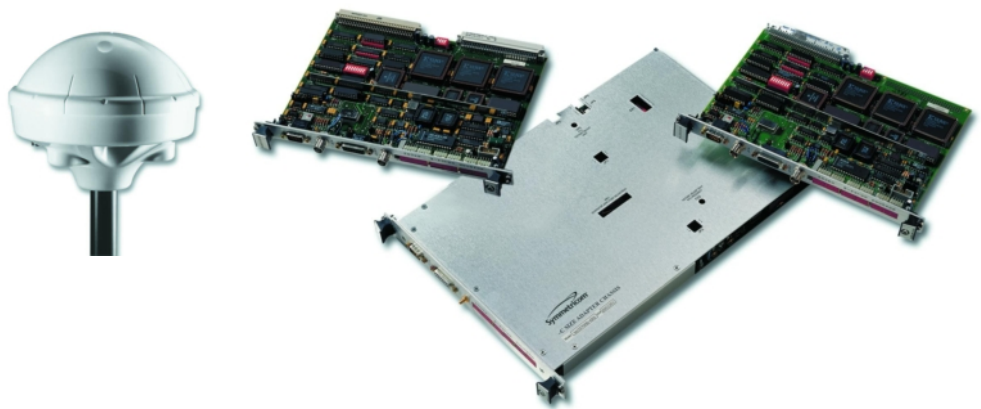
Symmetricon's bc635/637VME and bc350/357VXI time and frequency processor modules provide precision time and frequency reference to the host computer and peripheral data acquisition systems. Time is acquired from either the GPS satellites using a supplied antenna/receiver (bc637VME and bc357VXI only) or from time code signals, typically IRIG B. Integration of the module is facilitated with optional drivers for several operating systems (see Options). 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.



bc637VME, bc357VXI-C & bc357VXI Time & Frequency Processors (shown with optional antenna/receiver)

bc635/637VME - bc350/357VXI 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, 1PPS, 10 MHz
- VME/VXI Bus
 - Size: 6Ux160 mm; B size, single width
Optional VXI-C configuration
 - 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 & bc357VXI only)
 - Time accuracy: <±1 microsecond
 - Position accuracy: 10 to 20 meters SEP (SA off)
 - 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

Temperature	Module	Ant/Rec
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	

OPTIONS

- IRIG A decoding
- NASA 36 decoding
- ACUFIRM GPS firmware¹
- ACUTIME GPS antenna/receiver¹
- Antenna cable
- Extender modules
- Isolation transformer time code input
- Ovenized crystal oscillator
- 'D' connector (J1) to BNC adapter
- VxWorks Real Time OS Driver²

¹ included with bc637VME or bc357VXI-B & C

² contact factory for additional driver support

VME and VXI cards all use a common design. The main difference is that the VXI modules do not include the P2 bus connector. The VXI-C module is functionally identical to the VXI-B module, the only difference being the length of the module.

ORDERING INFORMATION

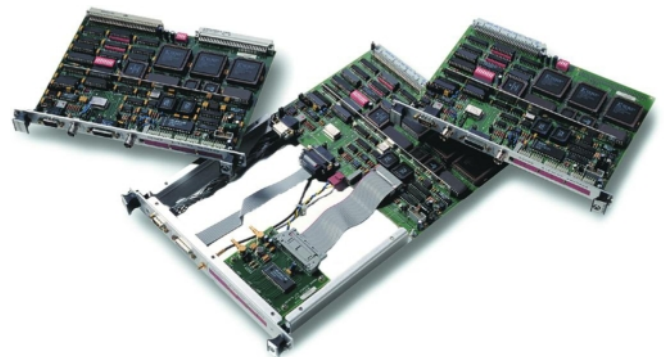
- | | |
|-------------------------|---|
| • bc635VME | VME Time & Frequency Processor |
| • bc637VME | VME GPS Time & Frequency Processor ¹ |
| • bc350VXI ² | VXI Time & Frequency Processor |
| • bc357VXI ² | VXI GPS Time & Frequency Processor ¹ |
| • VME-VXDRV | VME/VXI VxWorks Driver ³ |
| • BC11736-1000 | Ovenized oscillator option (factory installed) |
| • BC11576-1000 | 'D' to BNC adapter (provides IRIG in, IRIG out,
1 pps out, event in, periodic out) |
| • ACUFIRM-VME | GPS firmware upgrade |
| • GPS-ACU/2K | Spare antenna |
| • 812597-050 | Spare RS422 50' (15m) antenna cable ⁴ |
| • 812597-100 | Spare RS422 100' (30m) antenna cable ⁴ |
| • 812597-200 | Spare RS422 200' (60m) antenna cable ⁴ |

¹ includes GPS antenna/receiver and 50' (15 m) cable

² please specify VME, VXI-B or VXI-C to ensure system compatibility

³ contact factory for additional driver support

⁴ contact factory regarding longer cabling requirements



bc635VME, bc350VXI-C and bc357VXI cards

PC03V

VMEbus Time Code Reader

KEY FEATURES

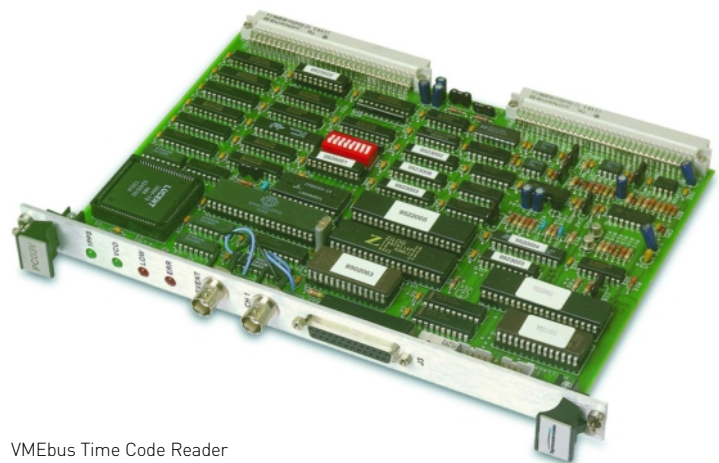
- Translates IRIG A, IRIG B, IRIG G, 2137, XR3, NASA 36
- Translates Codes Forward, Reverse, High Speeds, Low Speeds
- Accepts Carrier Frequencies from 125 Hz to 500 kHz
- Zero Latency Access to Decoded Time
- Two Programmable Time Coincident Strokes/Interrupts
- Programmable Heartbeat Pulse/Interrupt
- 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 requestor 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: >10K Ω
- Time data
 - Bus request resolution: 4 ms - XR3
1 ms - IRIG B, 2137 & NASA 36
100 μ s - IRIG A
10 μ s - 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 μ S 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: >10K Ω (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, 50 Ω): Programmable periodic 10 MHz to 3 Hz
- Event capture (TTL, 50 Ω): 100 ns resolution, zero latency
- Enhanced event (TTL, 50 Ω): 10 ns resolution, 50 μ s latency
- Event compare (TTL): Programmable, 1ms - hours
- 1PPS pulse rate (TTL, 50 Ω): 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 = \pm 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



bc620/627AT

PC Time & Frequency Processor

KEY FEATURES

- PC, XT or AT Bus Operation (ISA/EISA Compatible)
- GPS or 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
- Supplied with FREE Windows Driver
- Battery Backed Clock

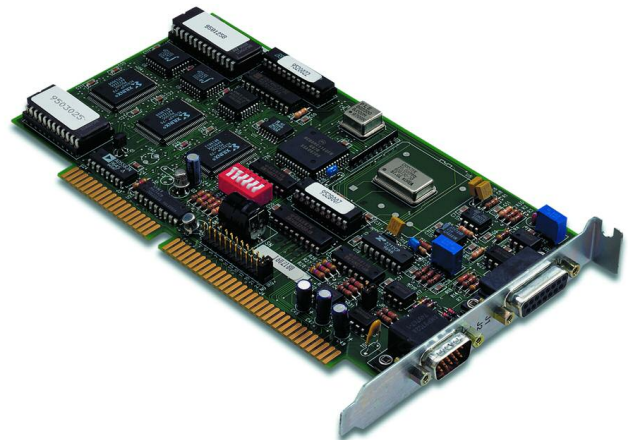
Symmetricom's bc620/627AT time and frequency processor modules provide precision time and frequency reference to the host computer and peripheral data acquisition systems. Time is acquired from either the GPS satellites using a supplied antenna/receiver (bc627AT only) or from time code signals, typically IRIG B. Integration of the module is facilitated with a driver for MS DOS that is included at no cost. Optional software development kits are available for Windows 95/98, Windows NT and Windows 2000.

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 (shown with optional antenna/receiver, bc627AT)

bc620/627AT 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: >10K Ω (AC coupled)
 - Carrier frequency: \pm 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 50 Ω
 - DC level shift: TTL/CMOS
- Timing functions
 - Heartbeat (TTL, 50 Ω): Programmable periodic 2.3 MHz to 2.5 MHz (adjustable pulse width)
 - Time strobe (TTL, 50 Ω): Programmable, 1 mS through hours (1 mS pulse width)
 - 1PPS output (TTL, 50 Ω): 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, 1PPS
- 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

- GPS subsystem (bc627AT only)
 - Time accuracy: ± 2 microseconds
 - 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 min (1-4 SV)
Worst case: 5 to 15 min
 - Solution modes: 1, 3, and 4 satellites
- Environment

	Module	Antenna/Receiver
Operating temperature:	0 $^{\circ}$ C to 70 $^{\circ}$ C	-30 $^{\circ}$ C to + 70 $^{\circ}$ C
Storage temperature:	-50 $^{\circ}$ C to 100 $^{\circ}$ C	-55 $^{\circ}$ C to +100 $^{\circ}$ C
Humidity		
Operating:	5% to 95%*	95%

*non-condensing
- Connector Types
 - J1 - module I/O signals: 15-pin 'DS'
 - J2 - GPS Interface: 15-pin high-density 'DP' (bc627AT)
- Software support
 - "C" demo program: Free, supplied on CD
 - Windows driver: Free, supplied on CD

OPTIONS

- IRIG A decoding
 - ACUTIME GPS firmware**
 - ACUTIME antenna/receiver**
 - Antenna cable extender module
 - Isolation transformer time code input
 - Ovenized crystal oscillator
 - 'D' connector (J1) to BNC adapter
 - WINDSDK for Windows 95/98/NT/2000
- **included with bc627AT

ORDERING INFORMATION

- | | |
|---------------|--|
| • bc620AT | ATbus Time & Frequency Processor |
| • bc627AT | ATbus GPS Time & Frequency Processor* |
| • 620-WINDSDK | Windows Software Developer's Kit |
| • OVEN | Ovenized oscillator option (factory installed) |
| • BNC | 'D' to BNC adapter (provides IRIG in, IRIG out, 1 pps out, event in, periodic out) |
| • ACUFIRM-AT | GPS firmware upgrade |
| • GPS-ACU2K | Spare antenna |
| • 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** |

* includes GPS antenna/receiver & 50' (15 m) cable

** contact factory regarding longer cabling requirements



“We basically lost faith in the various organizations that deliver free time over the Internet. We don’t know the people who manage the servers on the other end. What if they have a disgruntled employee or someone who wants to play a joke? Precise time is outside of our control on the Internet. We chose Symmetricom’s NTS-200 network time server because of its GUI (graphical user interface), precision capabilities and failover features.”

David Devlin

Senior Systems Administrator

Capital Health

Network Timing

Business transactions, security controls, and system performance can be trusted only if they have time that is accurate, secure and protected. Symmetricom's comprehensive network time synchronization products provide automated time distribution solutions to accurately and consistently set time on enterprise servers and desktops — critical support to the integrity of any business.

Symmetricom is the only supplier of comprehensive network time synchronization solutions that include the dedicated network time servers and the necessary synchronization, management and monitoring software that synchronizes the time on IT devices such as workstations, servers and routers.





Time Server Matrix



	NTS-150	NTS-200	S200	S250	TS2100	S100	
Time Protocols	NTP Server	x	x	X	X	x	x
	NTP Broadcast Server/Client		x	X	X	x	x
	NTP Peering/Client		x	X	X		x
	NTP Multicast Server/Client			X	X		x
	NTP Manycast Server/Client			X	X		
	SNTP	x	x	X	X	x	x
	Time	x	x	X	X	x	x
	Daytime	x	x	X	X	x	x
Time References (inputs)	GPS Reference	x	x	X	X (1)	x (1)	x
	NTP Peering reference		x	X	X		x
	ACTS Dial-up reference					x (5)	x
	IRIG B Input reference				X	x	x
	External 10MHz input reference				X		x
	1PPS Input reference				X	x	x
Network Protocols	Number of 10/100Base-T ports	1	1	3	3	1	2
	HTTP (web i/f)		x	X	X		x
	SSL/HTTPS (secure web pages)			X	X		x
	Telnet (w/disable fcn.)	x	x	X	X	x	
	SNMP V1, V2c, V3	v1	v1	X	X	v1	x
	Custom MIB II	x	x	X	X	x	
	DHCP (w/disable fcn.)	x	x	X	X	x	x
	SSH/SCP (w/disable fcn.)			X	X		x
	MD5	x	x	X	X	x	x
	IPv6			X	X		
User Interface	Vacuum florescent display/multi-line	Opt. LED	LED	X	X	LED	
	Numeric keypad		x	X	X	x	
	Sync LED	x	x	X	X	x	x
	Network LED			X	X		
	Alarm LED			X	X		
	NTP LED			X	X		
	USB			X	X		
	RS-232	x	x	X	X	x	x
Osc.	OCXO upgrade			X	X	x	
	Rubidium upgrade			X	X	x	x
Timing Outputs	Timing accuracy	(4)	(4)	(2)	(2)	(3)	(4)
	1PPS Output				X	x	x
	IRIG B Output				X	x	x
	Sysplex output (dedicated port)			X	X	x	x
	10MHz output				X	x	
Misc.	General server status logs			X	X		
	Autocheck for firmware upgrades			X	X		
	Email alerts			X	X		x

(1) Available without GPS (2) ± 50 Nanoseconds (3) ± 2 Microseconds (4) ± 1 Microseconds (5) Requires external modem

SyncServer S200

High Performance, Enterprise Class GPS Network Time Server



KEY FEATURES

- Next Generation, High-Bandwidth NTP Time Server
- Stratum 1 Operation Via GPS Satellites
- 3 Independent 10/100Base-T Ports
- High-Resolution Vacuum Florescent 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 high performance 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 Wizard step-by-step set-ups 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 <10 microsecond 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, Broadcast, Multicast, Manycast
- SNTP Simple Network Time Protocol (RFC1769)
- TIME (RFC868)
- DAYTIME (RFC867)
- HTTP/SSL/HTTPS (RFC2616)
- SSH/SCP (Internet Draft)
- SNMPv3 (RFC3584)
- MIB II (RFC1213)
- DHCP (RFC2131)
- Telnet (RFC854)
- MD5 Authentication (RFC1321)
- SMTP Forwarding
- IPv4
- IPv6 and IPv6 Hybrid

Protocols can be individually disabled on a port-by-port basis.
 LAN 1: Management & Time protocols; LAN 2 & LAN 3: Time protocols only.

SERVER PERFORMANCE

- Stratum 1: 5000 NTP packets per second while maintaining time stamp accuracy of <10 microseconds. Client synchronization accuracy to server on a LAN is 0.5 - 2 milliseconds (typical). 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/Stability ($\tau = 100s$)

TCXO (standard):	21 milliseconds/day	<1E-06
OCXO (optional):	1 milliseconds/day	<2E-09
Rubidium (optional):	25 microseconds/day	<3E-10

GPS RECEIVER/ANTENNA

- 12 channel parallel receiver
- Minimum 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).
- Includes 12V L1 GPS antenna 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: 1.75" 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, 40 watts. IEC 320 connector, power switch.
- Operating temperature: 0°C to +50°C
- Storage temperature: -20°C to +70°C
- Humidity: To 95%, noncondensing
- Certifications: FCC, CE, UL, PSE
- 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 and free firmware upgrades for life of product.

OPTIONS

- Rubidium or OCXO oscillator upgrade for extended holdover
- 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

Ultra Precise & Versatile GPS Network Time Server



KEY FEATURES

- Next Generation, 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 Florescent 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 high performance 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 Wizard step-by-step set-ups 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 <10 microsecond 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, 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, Broadcast, Multicast, Manycast
- SNTP Simple Network Time Protocol (RFC1769)
- TIME (RFC868)
- DAYTIME (RFC867)
- HTTP/SSL/HTTPS (RFC2616)
- SSH/SCP (Internet Draft)
- SNMPv3 (RFC3584)
- MIB II (RFC1213)
- DHCP (RFC2131)
- Telnet (RFC854)
- MD5 Authentication (RFC1321)
- SMTp Forwarding
- IPv4
- IPv6 and IPv6 Hybrid

Protocols can be individually disabled on a port-by-port basis.
 LAN 1: Management & Time protocols; LAN 2 & LAN 3: Time protocols only.

SERVER PERFORMANCE

- Stratum 1: 5000 NTP packets per second while maintaining time stamp accuracy of <10 microseconds. Client synchronization accuracy to server on a LAN is 0.5 - 2 milliseconds (typical). 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/Stability ($\tau = 100s$)

TCXO (standard):	21 milliseconds/day	<1E-06
OCXO (optional):	1 milliseconds/day	<2E-09
Rubidium (optional):	6 microseconds/day	<5E-11

GPS RECEIVER/ANTENNA

- 12 channel parallel receiver
- Minimum 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).
- Includes 12V L1 GPS antenna 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: 1.75" 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, 40 watts. IEC 320 connector, power switch.
- Operating temperature: 0°C to +50°C
- Storage temperature: -20°C to +70°C
- Humidity: To 95%, noncondensing
- Certifications: FCC, CE, UL, PSE
- 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 in: BNC IRIG B 123, IEEE-1344
500 mV to 8V p-p, >10K Ω
- IRIG B out: BNC IRIG B 123, IEEE-1344
Modulated 3:1, 3V p-p, 50 Ω
Accurate to 10 μ S to input
TTL, Active rising edge
- 1PPS-in: BNC TTL, Rising edge on-time, 50 Ω
- 1PPS-out: BNC Sine wave or square wave,
1Vpp to 5Vpp, >10K Ω
- 10MHz-in: BNC Sine wave >3Vpp & <5Vpp into 50 Ω
- 10MHz-out: BNC

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 and free firmware upgrades for life of product.

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 and free firmware upgrades for life of product.

OPTIONS

- Rubidium or OCXO oscillator upgrade for extended holdover
- 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 LED



Rear View



Front View

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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 10 Milliseconds
- 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 optical UTC time display shows full date information to the second for visual reference.

Symmetricom also offers the full featured NTS-200 and SyncServer® S100 network time servers. Some of the additional features found in these servers include back-up time references, including other NTP servers or ACTS dial-up to provide the confidence that the network has accurate time; HTTP web interface for remote access via common browser, and a display and keypad to quickly and easily review or configure the unit from the front panel without having to communicate via the RS-232 port or telnet.



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

- The NTS-150 can support an estimated 48,000 NTP clients while maintaining client synchronization accuracy of 1-10 milliseconds to UTC (typical). The number of clients is a computed value based on a sustainable requests per second metric for a given accuracy level. The NTS-150 can also be configured to serve GPS time in lieu of UTC time. GPS time does not account for leap second offsets to UTC.

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 to 1-10 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

TymServe 2100

GPS Network Time Server



KEY FEATURES

- Stand-alone NTP Time Server
- Network Management Protocol
- Telnet and RS-232 Remote Access
- Independent Time Acquisition From:
 - GPS Satellite
 - IRIG Time Code
 - Dial-up Time Service
- 1U Height, Rack Mount Unit
- Convenient Front Panel Display and Keypad
- Versatile Input/Output:
 - IRIG B Time Code Input/Output
 - 1PPS TTL/CMOS Output
 - 10 MHz Output
 - Sysplex Timer Output
- MD5 Access Authentication for Security
- HTTP Status Page
- Rubidium Oscillator Upgrade
- Two-Year Warranty

Symmetricom's TymServe™ 2100 network time server acquires time from the GPS satellite constellation, IRIG Time Code or Dialup Time Services (NIST, USNO) and distributes time using the Network Time Protocol, NTP. TymServe simplifies the task of implementing an enterprise network synchronization system, offers better timing accuracy, conserves WAN bandwidth, decreases security risk and provides lower cost of ownership.

Network managers and system integrators appreciate the fact that the TymServe is a complete time server in a convenient, self-contained rack mountable configuration. Configuration is simply a matter of entering the unit's IP address via either the front panel keypad or the RS-232 remote programming port. In addition, the unit has IRIG time code and 1PPS reference inputs and outputs as well as one

10 MHz output. Network management tools include Simple Network Management Protocol (SNMP) with a custom MIB II extension, remote Telnet access, Dynamic Host Configuration Protocol (DHCP), Bootstrap Protocol (BOOTP) and MD5 access authentication.

The GPS configuration offers a robust concept in network synchronization. GPS satellites continually provide an easily accessible source of high accuracy UTC time. Combining GPS with the standard IRIG B and ACTS dial up service, the TymServe 2100 incorporates a solid time reference redundancy scheme. Couple this with an oscillator upgrade to an OCXO or Rubidium oscillator and the TymServe 2100 becomes a very stable and reliable source of time for your network.



TymServe 2100 Network Time Server

TymServe 2100 Specifications

ELECTRICAL & TIMING SPECIFICATIONS

- Outputs

Time code:	BNC	IRIG B, Modulated 3:1, 3V p-p, 75Ω
	DB9	IRIG B, Differential TTL, DCLS, 50Ω
1PPS:	BNC	TTL, Rising edge on-time, 50Ω
Frequency:	BNC	10 MHz, 50Ω (clock reference only) Square wave with VCXO Sine wave with OCXO and Rubidium

 - Inputs

Time code:	BNC	IRIG A, IRIG B, NASA 36 (Modulated 2:1 to 6:1) 500 mV to 10 V p-p, >10KΩ
	DB9	IRIG A, IRIG B, NASA 36 Differential TTL, DCLS, 1KΩ
1PPS:	HD-15	TTL, Active rising or falling
GPS:	SMA	Antenna/preamp

 - Input/output connections

Network:	10BaseT	Ethernet
Serial port A:	RS-232 / DB9	DTE, Sysplex Timer, Ext. Modem
Serial port B:	RS-232 / DB9	DCE, Configuration and status

 - Front panel

Front panel keypad:	0 to 9, Menu
Front panel display:	LCD, 2 x 40 character
Front panel indicators:	LED, 'Locked', 'Tracking', 'Power'

 - Timing accuracy

Network:	1-10 milliseconds, typical
GPS:	<2 microsecond, relative to UTC
IRIG B and NASA 36 Time Code:	<5 microseconds, relative to code input
Dial up service:	<10 milliseconds, on sync
1PPS:	1 microsecond to input pulse

 - Oscillator stability

VCXO (standard):	48 milliseconds/day long term "flywheeling"
OCXO (optional):	5 milliseconds/day long term "flywheeling"
Rubidium (optional):	6.5 milliseconds/month long term "flywheeling"
- Note: IRIG B time code input supports IEEE-1344 Leap Second, Year and Time Figure of Merit enhancements.

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Power requirements: 100 to 240 Vac, 50 to 60 Hz, <22 watts (including Rubidium oscillator if installed)

- Dimensions

	Inches	Cm
Height:	1.75	4.45
Width:	17	43.18
Depth:	12	30.48

- Weight: <10 lbs <4.5 kg

- Operating temperature: 0°C to 50°C

- Relative humidity: 0 to 95% (non-condensing)

NETWORK PROTOCOLS

- NTPv2 (RFC 1119) & NTPv3 (RFC 1305)
- SNTP (RFC 1361)
- Time protocol (RFC 868)
- SNMP w/custom MIB II extension
- MD5 authentication (NTP)
- BOOTP, DHCP & TFTP
- Telnet
- NIST ACTS and USNO

- GPS (optional)

GPS receiver:	Eight channel, C/A code
Antenna size:	3.04" D X 2.94" H 7.72 cm X 7.47 cm
Antenna operating temp.:	-40°C to +85°C
Acquisition:	<5 minutes
Cable type:	50' (15 m) / RG58

CLIENT SOFTWARE

- An NTP client/daemon is required for client-side synchronization with any network time server, including the TymServe 2100. Included with the 2100 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

- TymServe 2100 Network Time Server, two-year warranty, power cord, manual, MIB II software, SNTP client software. GPS Option adds: L1 GPS antenna, 50' (15 m) RG-58 antenna cable, 1' (30 cm) antenna mast, two (2) mounting brackets.

OPTIONS

- OCXO - Ovenized crystal oscillator (3.0E-9/day)
- LPRO - Rubidium oscillator (5.0E-11/mo)
- Extended cable lengths (Belden 9104)
- GPS In-line amplifier for extended cable runs up to 300' (90 m)
- GPS antenna down/up converter for cable runs to 1500' (457 m)
- Lightning arrestor
- GPS Antenna splitter kit
- -48Vdc Power supply
- Rack mount slides
- XFMEXT - External transformer input option
- NTP Network Time Displays
 - 2" (5 cm), 6 digit, red LEDs
 - 4" (10 cm), 6 digit, red LEDs



Rear View of TymServe 2100

SyncServer S100

GPS Network Time Server



KEY FEATURES

- Dedicated Secure NTP Time Server
- Supports NTP Versions 2 - 4
- Synchronizes with Another SyncServer or An External Time Source
- Independent Time Acquisition from GPS, Dial-Up Service, or NTP Servers
- Secure Web-Based Setup and Management
- Secure Shell (SSH) and RS-232 Remote Interface
- Dual, Ethernet 10/100Base-T Interface
- Supports SNMP
- 1U Height, Rack-Mountable Unit
- High Performance Oscillator
- Convenient Front Panel Connections
- Web-Based Help
- Email Alerts for Alarms or Errors
- IRIG B Output
- 1PPS Output
- Rubidium Oscillator Upgrade
- Two-Year Warranty

Your systems need to know what time it is. Business transactions, security controls, digital signatures, and system performance tools can't be trusted unless they all run on the same time, and unless that time is accurate and secure. Provide time that your systems can trust with Symmetricom's SyncServer® S100.

SyncServer S100 is a network time server. It acquires time either from a non-network source or from another SyncServer and delivers it to computers and other devices on a network. One SyncServer needs to acquire time from a known good source for all other SyncServers within the network to synchronize with that source.

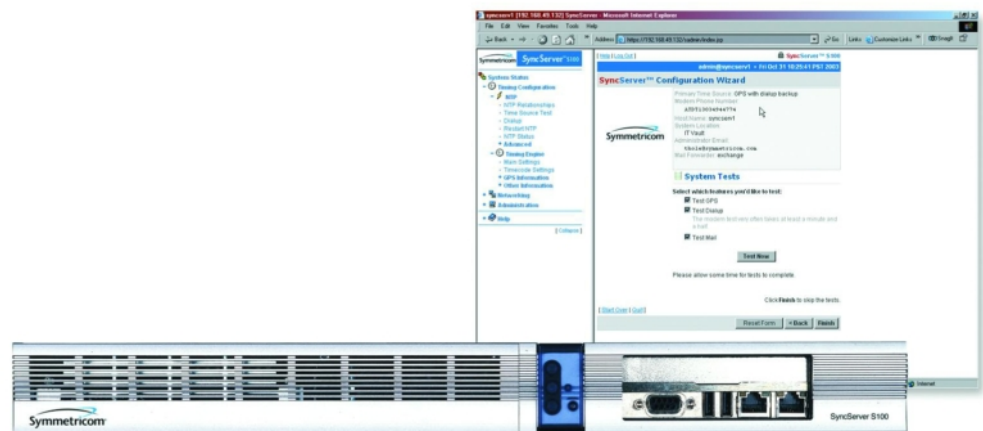
SyncServer S100 is accurate. It acquires UTC (Coordinated Universal Time) from GPS signals or by dial-up to the National Institute of Standards and Technology (U.S.) or other UTC source. Only one SyncServer S100 in your network need acquire UTC directly, although SyncServers are typically deployed in pairs for high reliability.

SyncServer S100 is secure. Computers on a network synchronize with a local time source, such as SyncServer, using NTP, the Network Time Protocol, to exchange packets of time. SyncServer implements NTP Version 4. This minimizes the ability of

hackers to spoof time packets and use NTP to gain access to your systems. Unlike previous versions, NTP Version 4 implements asymmetric encryption – the same technique used by secure Web sites to protect credit card numbers from unintended interception.

SyncServer S100 management is Web-based. Set up and configure all SyncServers from any point on the Web using a standard, secure browser. SyncServer S100 also supports SNMP (Simple Network Management Protocol) for easy integration into your existing management hierarchy. For maximum flexibility, SyncServer S100 can also be set up, configured and managed using Secure Shell (SSH) or a RS-232 serial connection.

SyncServer S100 is easy to set up. It's not always convenient or possible to receive GPS signals at each location but not all SyncServers need to be connected to an external time source so multiple antennas are not necessary.



See www.symmetricon.com for full SyncServer S100 specifications.



NTS-200

GPS Network Time Server



KEY FEATURES

- 10/100Base-T Autosensing Ethernet
- 12 Channel GPS Receiver
- Single Satellite Timing Mode
- Web-Based Status and Control Interface
- SymmTime NTP Client Software
- SNMP Enterprise MIB
- MD5 Security Protocol
- Upgradable Flash Memory
- Stratum 1 Operation Via GPS Satellites
- Stratum 2 Operation Via NTP Servers
- Two-Year Warranty

KEY BENEFITS

- Improve Network Log File Accuracy to Speed Network Fault Diagnosis and Forensics
- Thousands of Client Computer Clocks Can Be Synchronized Typically to Within 1 to 10 Milliseconds
- Reliable and Secure Source of Time for Your Network
- Accurate Time References to: The Atomic Clocks aboard the Global Positioning System (GPS) Satellites and Up to Ten Back-up NTP Servers
- Web Interface for Easy Control
- Very Easy to Install and Maintain
- Accurately Synchronize Mission Critical Network Operations and Applications Across Thousands of Network Clients
- Secure Source of Time Inside Your Firewall
- Window or Roof Mounted Antenna for Easy Installation

Symmetricom's NTS-200™ Network Time Server is used to synchronize clocks on servers and workstations across entire enterprise networks. Accurately synchronized clocks are critical for network log file accuracy, billing systems, electronic transactions, database integrity, software development, and many more essential applications. The NTS-200 provides reliable and secure network synchronization technology by combining a NTP protocol support, versatile GPS timing receiver technology, web-enabled user interface, and a wide range of network protocol support for seamless integration into an existing network.

Ease of use and remote access are key attributes of the NTS-200 state-of-the-art user interface. Designed with the network administrator in mind, the NTS-200's built-in web pages offer current status information and full control of the server via a standard browser interface. Many network protocols are supported for easy management. The rack-mounted unit is easily installed and quickly brought online with a few front panel keystrokes. An autosensing 10/100Base-T Ethernet interface easily integrates with existing network equipment.

The Stratum 1 level NTS-200 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.

If the GPS reference signal is lost entirely, the NTS-200 can automatically revert to a Stratum 2 mode and retrieve time from other user designated internal or external network time servers. This prevents disruption of time service to the network and the network administrator is notified immediately via SNMP of the change in time reference status.



See www.symmetricom.com for full NTS-200 specifications.



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

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.

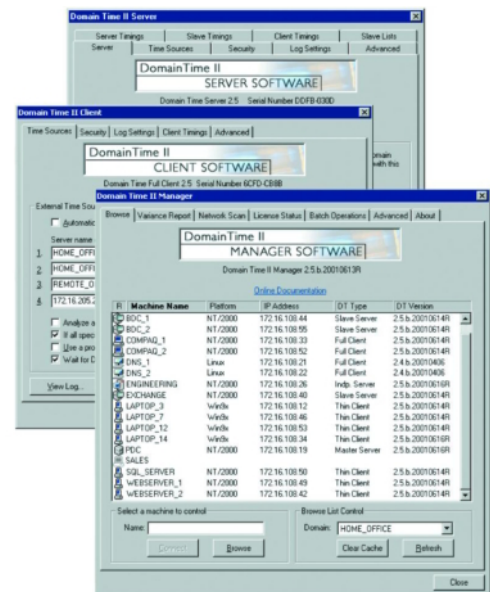
Domain Time II is a comprehensive software solution that simplifies time synchronization across the network. Versatile time clients and software servers keep the network hierarchy synchronized to a GPS referenced network time server. Easy to use management tools simplify and automate many tasks related 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.
- **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

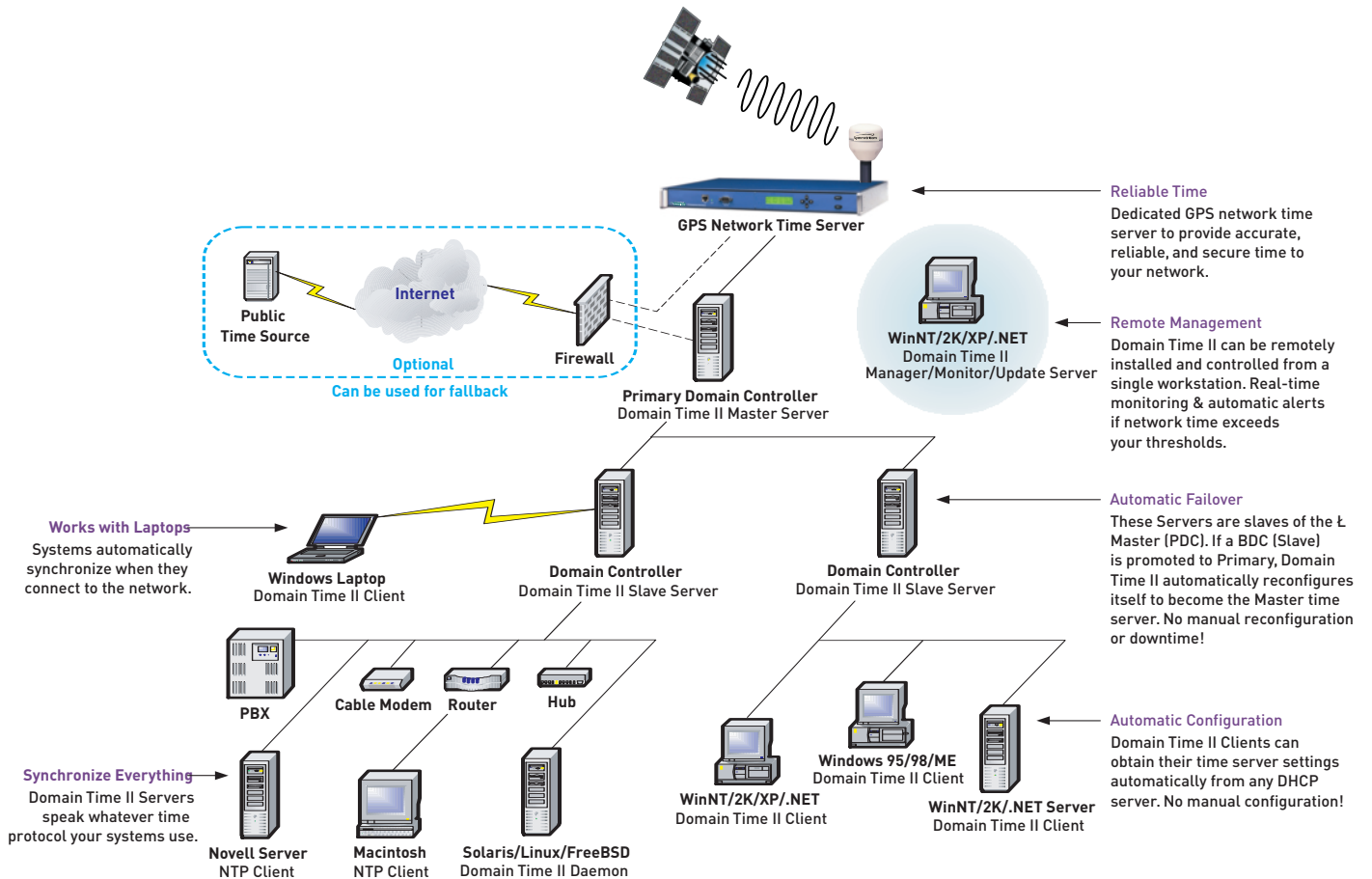
- Domain Time II Manager remotely installs or updates Domain Time components from a central workstation. It also provides software license information, time variance reports, and remote configuration of Domain Time II components. The monitor function tracks the status of your clocks system-wide and sends 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) Windows 95/98/ME/NT/2K/XP/2003 (NT on Alpha or Intel).
Clients also available for Solaris 7/8, FreeBSD, Linux (Intel x86 Architecture with RedHat/ Mandrake, SuSE, TurboLinux, Debian/Stormix).
- **Server:** Windows NT (Intel or Alpha) and 2K/XP/2003 (Intel only).
- **Management tools:** Windows NT (Intel or Alpha) and 2K/XP/2003 (Intel only).
- **Product includes:** Starter kit which includes one (1) Manager license, one (1) Server license, and 20 Client licenses. Additional licenses are available. Also includes technical support and free software updates for 1 year.



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

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.

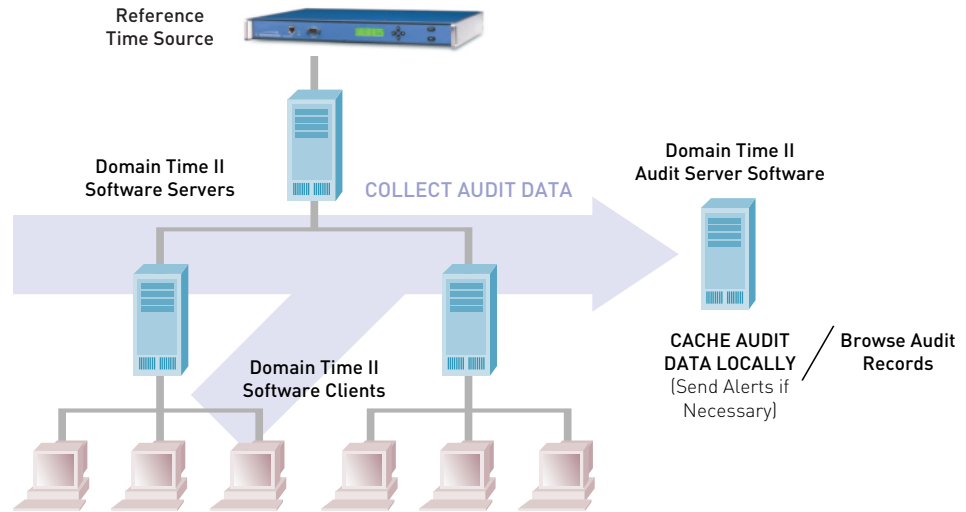


FIG. 1 Audit Server gathers data from Domain Time II clients and servers, generates alerts if necessary, and makes audit records available for browsing and archiving.

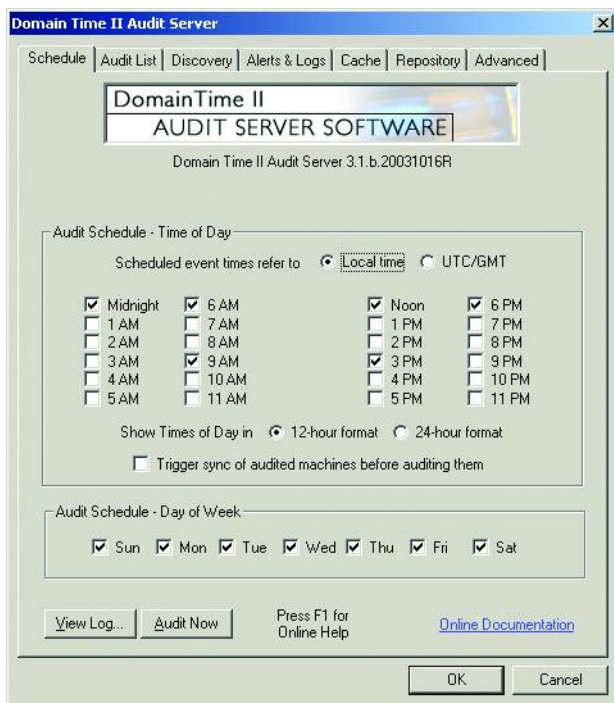


FIG. 2 Specify the schedule when you want Audit Server to audit your network time synchronization.

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.

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.

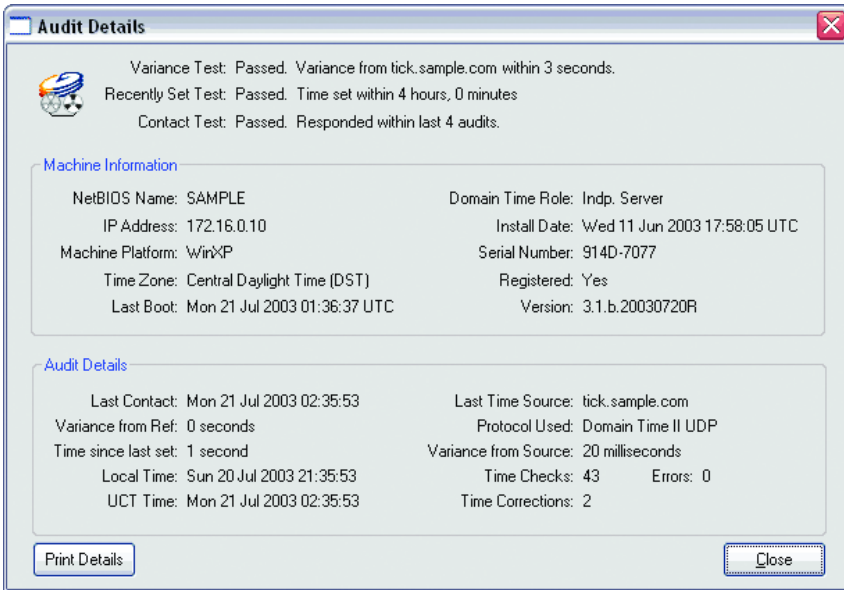


FIG. 3 Sample of the information contained in an individual audit record.

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.

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.



FIG. 4 Numeric log data can also be viewed graphically as well as in text form to analyze time drift data.

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 3.1 or later) to be installed.
- Windows NT/2K/XP/2003

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

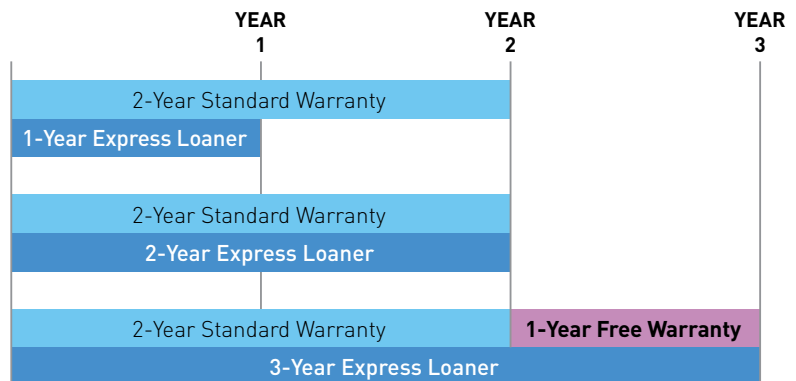
Here is how simple it is to get back on synchronized time once you sign up with a 1 to 3 year Express Loaner contract.

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 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.



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.

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.

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/Products/Global_services. 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



“The Naval Air Weapons Center has recently installed a number of Symmetricom Remote Time Displays in their new Range Operations Control Facility (ROC). These displays provide quick and easy visual detection of Range Distributed Time Codes representing local and regional time-of-day information as well as countdown time. Symmetricom’s Time Displays come in a number of different sizes and configurations. This gave NAWC the flexibility in selecting a display that would best fit their needs.”

Gary Geil
President
Geil Corporation
(Manufacturers’ Representative)

Time Displays

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.



Remote Time 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" LEDs display day of year through seconds.

RD-1 Remote 19" rack-mount time code display. One-inch-high LED digits are easily visible up to 40'. Adjustable intensity.

RD-2 Remote rack-, wall- or ceiling-mount time code display. Two-inch-high LED digits are visible from up to 85'. 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'.

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

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 (\pm 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 to 50°C

RD-1 1" 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 (\pm 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 \pm 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)



Network Time Displays

KEY FEATURES

- Digital Clock Automatically Synchronizes with NTP Network Time Servers Over an Ethernet Network
- 2 or 4 Inch Digit Sizes
- High Visibility with Adjustable Brightness
- Multiple Time and Date Formats
- Remote Network Configuration Management
- All International Time Zones
- Daylight Savings Support
- High Quality, Professional Appearance

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. The ND-2 and ND-4 use existing Ethernet network infrastructure and the standard network time protocol (NTP) to keep the time correct. Select between several time display formats including 12 or 24 hour format. All international time zones are supported as well as daylight savings time transitions so that the display should never need the time adjusted.

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. This 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. Using wireless network connections can also make display installation in out-of-the-way locations even easier.

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 ND-2 and ND-4 displays lend themselves to a variety of applications. These displays look great in lobbies, manufacturing facilities, break rooms, equipment racks anywhere accurate time needs to be presented. Multiple displays also work well as time zone clocks in control rooms.



ND-2 and ND-4 Network Time Displays

Network Time Display Specifications

NETWORK PROTOCOLS

- NTP
- SNTP
- Telnet
- DHCP
- TCP/IP
- UDP

INPUT/OUTPUT CONNECTIONS

- Network: 10Base-T Ethernet; RJ-45
- Serial: Bi-directional RS-232, 9600, N, 8, 1; 9-pin D

INPUT/OUTPUT CONNECTIONS

- ND-2 Network Time Display
 - Digits: Six 2.3" (5.8 cm) LED digits; red
 - Size: With rack mount ears: 18.9" W x 3.5" H x 6.2" D (48 x 8.9 x 15.7 cm)
Without rack mount ears: 16.9" W x 3.5" H x 6.2" D (42.9 x 8.9 x 15.7 cm)
 - Weight: 8.0 lbs. (3.64 Kg)
 - Power: 120-240 Vac 50/60 Hz, <10 watts
 - Certification: FCC



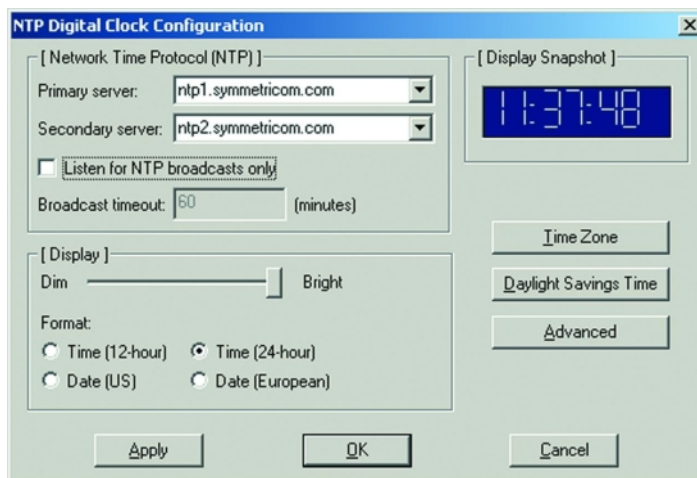
ND-4 Network Time Display

- Digits: Six 4.0" (10.1 cm) LED digits; red
- Size: 25.2" W x 7.6" H x 4.1" D (64 x 19.3 x 10.4 cm)
- Weight: 8.6 lbs. (3.91 Kg)
- Power: 120-240 Vac 50/60 Hz, <10 watts
- Certification: FCC
- Mounting holes 16" (40.6 cm) apart centered on top rear of chassis.



TIME/NETWORK CONFIGURATION

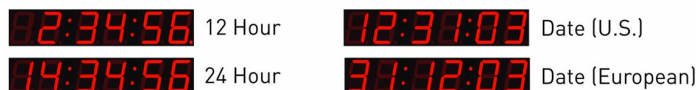
- All international time zones
- Daylight savings
- Two NTP time sources
- Multiple time formats (see below)
- 14 levels of brightness control
- Manual time set option
- DHCP or manual network configuration
- Password protected access
- Remote clock status including time adjustment statistics
- Automatic discovery of displays via UDP broadcast



Remotely discover displays and configure all parameters from a single PC over the network.

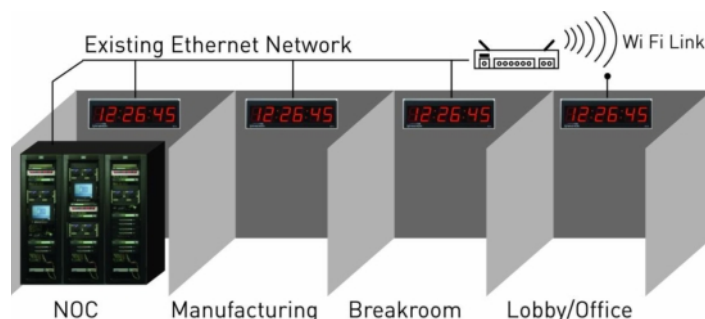
TIME FORMATS

Example time shown below is 2:34:56 pm on December, 31, 2003



PRODUCT INCLUDES

Display; power cord, manual; MS Windows based configuration software. ND-2 includes rack mount removable brackets.



Attractive, professional and very visible synchronized time is easily distributed throughout the facility using existing Ethernet networks. Wireless network connections are possible where network cabling is not readily available.



“For our government and military customers, availability of a reliable crystal oscillator coupled with dependable customer support is essential. We have grown to depend on the high performance and reliability of Symmetricom’s wide range of time and frequency products, including the 9600, and now with their new, faster delivery time, the product is unmatched in the industry.”

Scott Williams

President

G.L. Williams Associates, Inc.

(Manufacturers’ Representative)

Space, Defense & Avionics

Over 30 Years of Space Heritage and Proven Reliability.

The capabilities of the new Symmetricom in timing systems and precise frequency references such as cesium and militarized oscillator standards address and exceed the complex, high reliability requirements in the Space, Defense and Avionics markets.

We are proud of our track record of supplying frequency and timing solutions that meet or exceed the qualifications of the most hostile and demanding environments, whether they be on earth or in the universe.

No matter how demanding and sophisticated the application, our solutions are designed for relative ease of use and absolute success. Their small size, low power demand, fast warm-up capability, superior stability and superior spectral purity make these devices ideal for critical and tactical aerospace applications like radio navigation, satellite transmission, and tracking and guidance systems.



4415

Digital Cesium Frequency Standard

KEY FEATURES

- Cesium Accuracy
- Microprocessor Control
- Comprehensive State of Health Indicators
- Remote Monitoring and Control Via Telemetry
- Low Power Ion Pump Only Mode
- Compact Size
- Qualified for Launch and Operation in Space
- Ten Year Operational Life

Symmetricom's 4415™ Cesium Frequency Standard is a compact, self-contained module that produces accurate, stable and spectrally pure sinusoidal signals. The 4415 satisfies system applications with stringent requirements for precision time and frequency in ground based satellite communication systems, telecommunications synchronization systems and satellite-based timing systems.

The instrument uses the technology of Symmetricom's 5045A, a second generation, microprocessor controlled, cesium module found extensively in commercial communications and timing applications. It combines the 5045A's capabilities with the ruggedness of a Symmetricom space qualified cesium to create a robust frequency standard with impressive performance that can also satisfy the need for extended life operation in space.

An environmentally hardened microprocessor supports the 4415's primary frequency lock loop servo and several background servos that control signal gain, level of interrogating microwave power and C-field. The 4415 exhibits virtually no environmental sensitivity.

Other key features include:

- Adaptive servos that compensate for temperature, aging and the effects of radiation
- Wide dynamic range circuits that provide long life without the need for external intervention
- Comprehensive diagnostics that continuously measure the state of the clock and digital telemetry of measured parameters
- Rugged mechanical construction will withstand launch conditions
- Comprehensive thermal design permits continuous operation in a vacuum environment
- Designed and constructed to withstand harsh radiation space environment
- Designed in reliability based on stress and worst case analysis performed
- Component rating in accordance with MIL-STD-1547
- Component selection in accordance with MIL-STD-1546B, MIL-STD-975 and PPL-21, Grade 1
- MTBF of 350K hours per MIL-HDBK-217



4415 Digital Cesium Frequency Standard

4415 Specifications

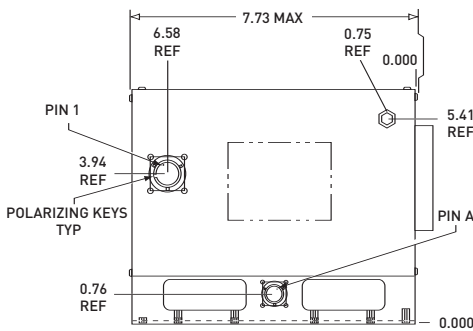
ELECTRICAL SPECIFICATIONS

- Output accuracy: 1.0E-11
- Retrace (reproducibility): 2.0E-12
- Output frequency
 - Nominal (In-orbit frequency): 10.23 MHz
 - Adjustment range: $\pm 1.0E-9$
 - Adjustment resolution: 1.0E-15
- Frequency change
 - Operating temperature: $< 5.0E-14/^{\circ}C$
 - DC magnetic field: $< 1.0E-12/gauss$
 - Power supply: 1.3E-13/Volt
- Stability – averaging time(s)

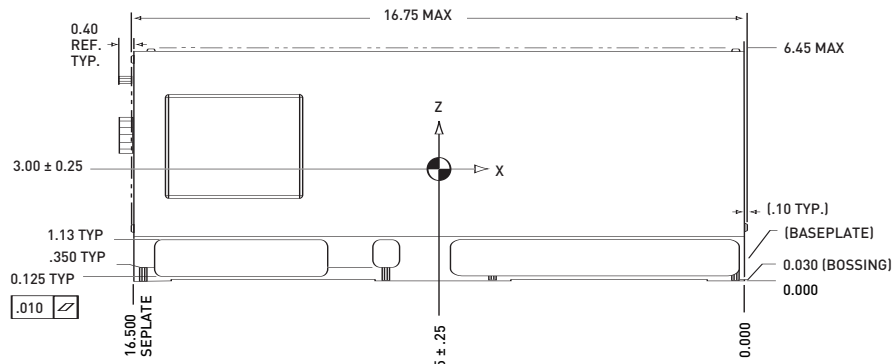
1	1.0E-11
10	6.0E-12
100	2.0E-12
1,000	6.0E-13
10,000	2.0E-13
100,000	6.0E-14
1,000,000	6.0E-14
- Additive SSB phase noise – (1 Hz Bandwidth) Offset from carrier

1	-85dBc
10	-110dBc
100	-140dBc
1,000	-150dBc
10,000	-155dBc

- Spectral purity
 - Harmonics: $< -30dBc$
 - Spurious, 5 kHz – 10 MHz: $< -85dBc$
 - Spurious, 10 MHz – 20 MHz: $-50dBc$
- Sinusoidal RF-outputs
 - Amplitude: $18 \pm 1.5 dBm$
- Power requirements
 - Input voltage range: 24 to 32 Volts
 - Warm up power: 50 Watts
 - Operating power: 33 Watts
- Dimensions
 - Height: 6.25" [158.75 mm]
 - Width: 7.5" [190.5 mm]
 - Depth: 16.50" [419.1 mm]
- Environmental
 - Operating temperature: $10^{\circ}C$ to $40^{\circ}C$
 - Radiation: 100 Krad (Si)
 - Random vibration: 12gs rms
- Weight: $< 33 lbs.$ (15.1 kg)



Front View



Side View



9400

Satellite Master Oscillator

KEY FEATURES

- Output Frequency: 5 MHz - 25 MHz
- Power Consumption: 2.6W @ 25°C
- Radiation Rated to: >100 krad (Si)
- Frequency Aging @ 5MHz:
5.0E-11/Day, 1.5E-8/Year
- Temperature Range: -25°C to +60°C

Symmetricon's 9400 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 compromise of performance or reliability. All discrete components manufactured to military standards are purchased from a military certified and qualified vendor. The environmentally rugged 9400 features an ovenized SC-cut quartz resonator and sustaining electronics to achieve temperature insensitive performance. The satellite 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 challenges 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 and timing base, satisfying a range of applications such as:

- Shipboard timing references
- Satellite system's on board timing and frequency standard
- Land-mobile system frequency reference
- Receivers/transmitters/LO



9400 Satellite Master Oscillators

9400 Specifications

ELECTRICAL SPECIFICATIONS

- Output level
(TTL outputs available): 7.0 dBm into 50 Ω
- Electrical frequency control (EFC) range: $\pm 4.0E-7$ Typical
- Short-term stability @ 5 MHz
 - 1 second (Allan Deviation): 3.0E-12
 - 10 second (Allan Deviation): 1.0E-12
- Frequency aging @ 5 MHz
 - Per day: 5.0E-11
 - Per year: 1.5E-8
- Phase noise @ 5 MHz:

Offset frequency	L (f)
1 Hz	-116dBc/Hz
10 Hz	-140dBc/Hz
100 Hz	-150dBc/Hz
1 kHz	-157dBc/Hz
10 kHz	-160dBc/Hz
100 kHz	-160dBc/Hz
- Frequency vs. temperature: $\pm 4.0E-9$
- Harmonic distortion: -40dBc
- Non-harmonic distortion: -90dBc
- Frequency retrace: $\pm 1.0E-8$
(After up to 24 hrs. off & 1 hour on at 25°C)
- Input voltage
 - Range: 15 to 18 Vdc
 - Sensitivity
(Ripple, variation): 60 mVpp, $\pm 10\%$

- Power
 - Steady state: 3.6 Watts @ 25°C
 - Vacuum: 2.4 Watts @ 25°C
- Warm-up power: 6 Watts
- Warm-up time from +25°C: 15 minutes to 2.0E-8
- Operating temperature range: -25°C to +60°C
- Storage temp. (Non-operating): -40°C to +100°C
- Acceleration sensitivity @ 5 MHz:
 - Typical: 4.0E-9 per g
 - Option 1: 7.0E-10 per g
(worst case axis)
- Random vibration: 20 grms
- Radiation rated: >100 krad (Si)
- Mean time between failure: >10 million hours
(MIL-HDBK-217E)
- Physical
 - Size: 1.49" x 1.86" x 3.6" (3.78 cm x 4.72 cm x 9.14 cm)
 - Weight: 8.1 ounces (0.24 Kg)
 - Volume: 9.98 cu inches (163.67 cubic cm)

OPTIONS

- Lower phase noise performance
- Power conditioning
- Mechanical isolation systems
- Multiple outputs
- Crystal radiation preconditioning



9500

Satellite Master Oscillator

KEY FEATURES

- Output Frequency: 4 MHz - 25 MHz
- Power Consumption: 3.6W @ 25°C
- Size: 4.25" x 6.0" x 8.62"
- Radiation Rated to: 100 K Rad
- Frequency Aging @ 5 MHz:
5.0E-11/Day, 1.5E-8/Year
- Temperature Coefficient
Standard: <math><1.0E-11/</math>°C
Optional: <math><3.0E-12/</math>°C
- Temperature Range: -20°C to +60°C
- Observed Allan Variance: 1.0E-13,
1-100 Second
- DAC Frequency Tuning

Symmetricon's 9500 is a master oscillator that produces a highly stable, low noise reference frequency output. Particularly suited to space applications, it delivers superior stability performance unsurpassed in the commercial community.

A mixture of through-hole and surface mount technology is enclosed in an insulating dewar to minimize environmental effects making this high performance oven-controlled quartz crystal oscillator ideal for satellite installations.

The oscillators EEE part selection is in accordance with MIL-STD-975/PPL-21 for Grade 1 or Grade 2 applications. The manufacture of these parts is in accordance with military specifications and are procured from approved QML/QPL sources of supply. The environmentally rugged 9500 features a SC-cut quartz resonator and sustaining electronics controlled at precise temperature to achieve temperature insensitive performance, excellent short term stability, phase noise and aging characteristics.

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 and time base.

The 9500 series satisfies a range of applications that include:

- A navigation payload frequency reference
- A GPS space borne frequency reference
- A land-mobile system frequency standard
- A satellite system on board frequency standard
- A remote station primary frequency standard



9500 Satellite Master Oscillators

9500 Specifications

ELECTRICAL SPECIFICATIONS

• Output level/load (duty cycle): (Optional TTL) (Capable of multiple outputs)	7.0dBm
• Electrical frequency control (EFC) Range:	±2.0E-7 Typical
• Short/long 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
• Frequency aging @ 5 MHz	
Per day:	5.0E-11
Per year:	1.5E-8
• Phase noise @ 5 MHz:	
Offset frequency	L (f)
1 Hz	-116dBc/Hz
10 Hz	-140dBc/Hz
100 Hz	-150dBc/Hz
1K Hz	-157dBc/Hz
10K Hz	-165dBc/Hz
100K Hz	-165dBc/Hz
• Frequency vs. temperature:	±3.0E-10
• Harmonic distortion:	-100dBc
• Non-harmonic distortion:	-90dBc
• Frequency retrace: (After up to 24 hrs. off & 1 hour on at 25°C)	±2.0E-8
• Input voltage	
Range:	22 to 38 Vdc
Sensitivity (Ripple, variation):	200 mVpp, ±2%

• Power	
Steady state:	3.6 Watts @ 25°C
Vacuum:	2.9 Watts @ 25°C
• Warm-up power:	8 Watts
• Warm-up time from +25°C:	≤120 minutes to 2.0E-8
• Operating temperature range:	-20°C to +60°C
• Storage temp. (non-operating):	-40°C to +100°C
• Acceleration sensitivity @ 5 MHz:	
Typical:	4.0E-9 per g
Option 1:	2.0E-9 per g (worst case axis)
• Random vibration:	20 grms
• Pyrotechnic shock:	3000 gs.
• Radiation rated:	100 krad (Si) Min.
• Mean time between failure: (MIL-HDBK-217E)	>10 million hours
• Physical	
Size:	4.25" x 6.0" x 8.62" (10.97 cm x 15.24 cm x 21.89 cm)
Weight:	96 ounces (2.72 Kg)
Volume:	219.81 cu inches (3604.8 cubic cm)

OPTIONS

- Serial DAC tuning
- Discrete telemetry and control
- Shock/vibration isolation



9600

Aerospace Oscillators Series

KEY FEATURES

- Output Frequency: 4 MHz - 60 MHz
- Fast Warm-Up: 5 Minutes
From -55°C
- 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,
1.5E-8/year
10 MHz:3.0E-10/day
4.0E-8/year
- Temperature Coefficient: $\pm 4.0E-9$
(-20°C to 60°C)
- Fast Warm-Up Option Available
- Low g Sensitivity Option

Symmetricon's 9600 is an ultra-miniature ovenized crystal oscillator designed to provide a high stability RF sine wave output.

The use of hybrid circuitry allows for the greatest reduction in size possible without compromise of the 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 2 requirements per MIL-STD-975.

The environmentally rugged 9600 features a SC-cut quartz resonator and sustaining electronics which are controlled at precise temperature to achieve temperature insensitive performance, excellent short term stability, phase noise and aging characteristics.

Backed by an extensive oscillator legacy, the 9600 series meets the challenges of military specifications for time and frequency, even under the most adverse environmental conditions.

The 9600 oscillator series delivers high end crystal oscillator precision required for both time and frequency in a wide variety of applications such as:

- Radio navigation
- Radar warning receiver
- 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 is required.



9600 Aerospace Oscillators Series

9600 Specifications

ELECTRICAL SPECIFICATIONS

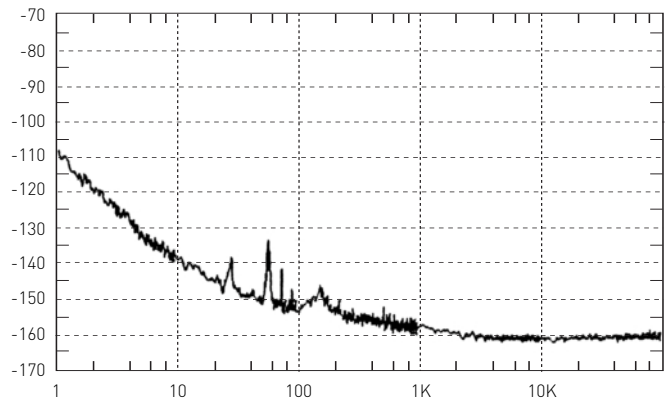
• Output level (TTL option):	7.0dBm	
• Short-term stability	5 MHz	10 MHz
1 second (Allan Deviation):	2.0E-12	5.0E-12
10 second (Allan Deviation):	2.0E-12	5.0E-12
• Frequency aging	5 MHz	10 MHz
Per day:	5.0E-11	3.0E-10
Per year:	1.5E-8	4.0E-8
• Phase noise (dBc/Hz)	5 MHz	10 MHz
1	-112dBc/Hz	-100dBc/Hz
10	-140dBc/Hz	-125dBc/Hz
100	-145dBc/Hz	-145dBc/Hz
1,000	-157dBc/Hz	-150dBc/Hz
10,000	-160dBc/Hz	-155dBc/Hz
100,000	-160dBc/Hz	-155dBc/Hz
• Frequency vs. temperature:	±4.0E-9	
• Harmonic distortion:	-30dBc	
• Non-harmonic distortion:	-90dBc	
• Frequency retrace:	±1.0E-8	
(After up to 24 hrs. off & 1 hour's use at 25°C)		
• Input voltage		
Range:	12 to 24 Vdc	
Sensitivity:	5.0E-10, ±5%	
• Power, steady state:	1.3 Watts @ 25°C (In Vacuum)	
• Warm-up power:	4-8 Watts	

• Load change sensitivity:	±1.0E-9, ±5%
• Warm-up time from -40°C:	≤5 minutes to 2.0E-8*
• Electrical frequency control (EFC) range:	±4.0E-7 minimum
• EFC voltage input:	0 to +5Vdc, (+) Sensing
• Operating temp. range:	-54°C to +76°C
• Storage temperature:	-55°C to +100°C
• Acceleration sensitivity	
Typical:	4.0E-9 per g
Option 1:	≤2.0E-9 per g (worst case axis)
• Random vibration:	20 grms
• Pyrotechnic shock:	3000 gs
• Radiation rated:	100 krad (Si)
• EMI/EMC specification:	For performance levels contact the factory
• Reliability specification:	MIL-HDBK-217E
• Mean time between failure:	>4 million hrs. @ 55°C
• Physical	Option 1 Option 2
Size:	1.33" x 1.33" x 1.33" 1.9" x 1.5" x 1.0"
	(3.37 cm x 3.37 cm x 3.37 cm) (4.82 cm x 3.81 cm x 2.54 cm)
Weight:	3.5 ounces (0.09 Kg) 5.5 ounces (0.15 Kg)
Volume:	2.35 cu in. (38.54 cu cm) 2.55 cu in. (41.82 cu cm)

OPTIONS

- Space qualified
- Low g-sensitivity

*Fast warm-up option available



Typical test results for the 10 MHz oscillator



9700

Aerospace Oscillator Series

KEY FEATURES

- Output Frequency: 4 MHz - 60 MHz
- Low Power Consumption: 1.3W @ 25°C (Vacuum)
- Compact Sizes: 1.33" x 1.33" x 1.31"
- Frequency Aging:
 - 5 MHz: 5.0E-11/day,
1.5E-8/year
 - 10 MHz: 3.0E-10/day,
4.0E-8/year
- Temperature Coefficient: $\pm 4.0E-9$
- Radiation Rated: 100 krad (Si)

Symmetricon's 9700 is an ultra-miniature ovenized crystal oscillator designed to provide a high stability RF sine wave output.

The use of hybrid circuitry allows for the greatest reduction in size possible without compromise of the performance or reliability.

Assembly is performed by skilled operators certified to NASA approved workmanship standards. Hybrid circuits produced at facilities qualified to MIL-PRF-38534C. All discrete components are manufactured and tested to Grade 1 requirements per MIL-STD-975.

The environmentally rugged Symmetricon 9700 features a SC-cut quartz resonator and sustaining electronics which are controlled at precise temperature to achieve temperature insensitive performance, excellent short term stability, phase noise and aging characteristics.

Backed by an extensive oscillator legacy the 9700 series meets the challenges of aerospace specifications for time and frequency, even under the most adverse environmental conditions.

The 9700 series oscillator delivers high end crystal oscillator precision required for both time and frequency in a wide variety of applications including:

- Radio navigation
- Satellite transmission
- Satellite tracking and guidance



9700 Aerospace Oscillators Series

9700 Specifications

ELECTRICAL SPECIFICATIONS

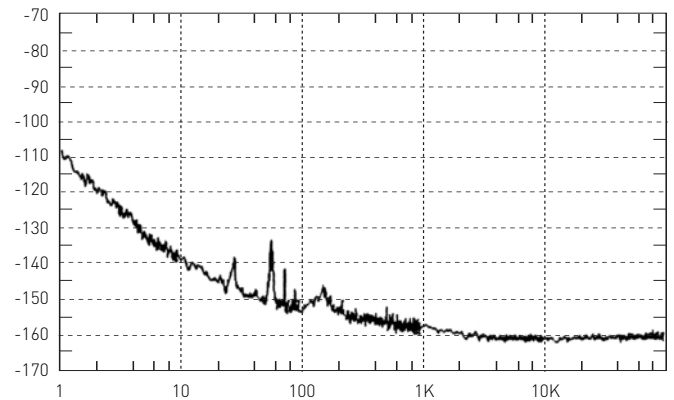
• Output level/load (TTL Option):	7.0dBm TTL (40% to 60%)	
• Short-term stability	5 MHz	10 MHz
1 second (Allan Variance):	2.0E-12	5.0E-12
10 second (Allan Variance):	2.0E-12	5.0E-12
• Frequency aging	5 MHz	10 MHz
Per day:	5.0E-11	3.0E-10
Per year:	1.5E-8	4.0E-8
• Phase noise (dBc/Hz)	5 MHz	10 MHz
1	-112dBc/Hz	-100dBc/Hz
10	-140dBc/Hz	-125dBc/Hz
100	-150dBc/Hz	-145dBc/Hz
1,000	-157dBc/Hz	-150dBc/Hz
10,000	-160dBc/Hz	-155dBc/Hz
100,000	-160dBc/Hz	-155dBc/Hz
• Frequency vs. temperature:	±4.0E-8	
• Harmonic distortion:	-30dBc	
• Non-harmonic distortion:	-90dBc	
• Frequency retrace:	±1.0E-8	
(After up to 24 hrs. Off & 1 hour's use at @ 25°C)		
• Input Voltage		
Range:	12 to 24 Vdc	
Sensitivity:	1.0E-10, ±5%	
• Power, steady state (mW):	1.3 Watts @ 25°C (Vacuum)	
• Warm-up power:	4-28 Watts	

• Load change sensitivity:	±1.0E-9, ±5%	
• Warm-up time from -40°C:	≤5 minutes to 2.0E-8*	
• Elec. freq. cont. range (EFC):	±4.0E-7 minimum	
• EFC voltage input:	0 to +5Vdc, (+) Sensing	
• Operating temp. range:	-54°C to +76°C	
• Storage temp. (non-op):	-55°C to +100°C	
• Acceleration sensitivity		
Typical:	4.0E-9 per g	
Optional 1:	2.0E-10 per g (worst case axis)	
• Random vibration:	20 grms	
• Pyrotechnic shock:	3000 gs	
• Radiation:	100 K Rad (Si)	
• EMI/EMC specification:	For performance levels contact the factory	
• Reliability specification:	MIL-HDBK-217E	
• MTBF:	>6 million hrs.	
• Physical	Option 1	Option 2
Size:	1.33" x 1.33" x 1.33" (3.37 cm x 3.37 cm x 3.37 cm)	1.9" x 1.5" x 1.0" (4.82 cm x 3.81 cm x 2.54 cm)
Weight:	3.5 ounces (0.09 Kg)	5.5 ounces (0.15 Kg)
Volume:	2.35 cu in. (38.54 cu cm)	2.55 cu in. (41.82 cu cm)

OPTIONS

- Space qualified
- Low g-sensitivity

*Fast warm-up option available



Typical test results for the 10 MHz oscillator



9800

Hi-Reliability VHF Oscillators

KEY FEATURES

- Output Frequency: 50MHz - 200MHz
- Fast Warm-Up: 5 Minutes From -30°C
- Low Power Consumption: 1.7W @ 25°C (Vacuum)
- Compact Sizes
Typical: 1.33" x 1.33" x 1.31"
Optional: 1.9" x 1.5" x 1.2"
- Frequency Aging @ 100 MHz: 2.0E-6/First Year
- Temperature Coefficient: $\pm 5.0E-7$
- Low Acceleration Sensitivity: $< 8.0E-10/g$ Typical
- Temperature Range: -30°C to +70°C
- Component Quality: B-Level S-Level Optionally Available

MAJOR APPLICATIONS

- Radio Navigation
- Radar Warning Receiver
- Satellite Transmission
- Satellite Tracking and Guidance

Symmetricom's 9800 is an ultra-miniature ovenized crystal oscillator that provides a high stability RF sine wave output. The use of hybrid circuitry allows for the greatest reduction in size possible without compromising 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.

The environmentally rugged 9800 features an SC-cut quartz resonator and sustaining electronics that are controlled at a precise temperature to achieve temperature insensitive performance, excellent phase noise and aging characteristics.

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 of low frequency aging which extends the period of time needed between synchronization.

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 Hi-reliability VHF Oscillators

9800 Specifications

ELECTRICAL SPECIFICATIONS

• Output level/load:	7.0dBm, min./50Ω
• Frequency aging:	2.0E-6 first year after 30 days operation
• Phase noise @ 100MHz	
Offset frequency	L(f)
1 Hz	-60dBC/Hz
10 Hz	-90dBC/Hz
100 Hz	-120dBC/Hz
1 kHz	-150dBC/Hz
10 kHz	-160dBC/Hz
100 kHz	-160dBC/Hz
• Frequency vs temp:	± 5.0E-7
• Harmonic distortion:	-30dBc
• Non-harmonic distortion:	-90dBc
• Frequency retrace:	±1.0E-8 (After up to 24 hrs. off and 1 hour's use at @ 25°C)
• Input voltage	
Range:	12 to 18 V
Sensitivity:	1.0E-7, ±5%
• Power, steady state:	1.7 Watts @ 25°C vacuum
• Warm-up power:	4-7 Watts
• Load change sensitivity:	±5.0E-8, ±5%
• Warm-up time from -30°C:	10 min. typical to 2.0E-8*
• Elec. freq. cont. range (EFC):	±6ppm
• EFC voltage input:	-10 to +10Vdc, (-) sensing

Physical	Typical	Optional
Size:	1.33" x 1.33" x 1.31" (3.37 cm x 3.37 cm x 3.32 cm)	1.9" x 1.5" x 1.2" (4.82 cm x 3.81 cm x 2.54 cm)
Weight:	3.5 ounces (0.09 Kg)	6.5 ounces (0.18 Kg)
Volume:	2.32 cu inches (37.8 cubic cm)	3.42 cu inches (55.97 cubic cm)
• Operating temp. range:	-30°C to +70°C	
• Storage temp. (non-op):	-55°C to +100°C	
• Acceleration sensitivity (typical):	8.0E-10 per g	
• Random vibration:	20 Grms	
• Radiation:	100K Rad	
• EMI/EMC specification:	For performance levels contact the factory	
• Reliability specification:	MIL-HDBK-217E	
• MTBF:	>6 million hours	

*Fast warm-up option available



9210B

Military OCXO

STANDARD FEATURES

- 5 or 10MHz Output
- $<1E-10$ per day aging
- $<3E-10$ G Sensitivity
- 30grms random vibration

OVERVIEW

As the military moves toward implementing more advanced communications, navigation and targeting systems, precision oscillators that can withstand a wide range of operating environments is becoming more critical.

The Symmetricom 9210B is a COTS military OCXO designed for ground tactical and airborne applications where superior frequency stability and phase noise are required. The 9210B is well suited for these applications as it provides superior phase noise performance, which is critical for radar applications and precise frequency accuracy and stability which is critical for secure communication and navigation applications.

The standard oscillator is available in either 5 or 10MHz output configurations, both of which provide excellent frequency stability and phase noise performance in static or dynamic environments.

For more challenging dynamic applications where phase noise under vibration is a key specification, a low G sensitivity option is available that improves g sensitivity to $< 2E-10/g$.

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.



9210B Military OCXO

9210B Specifications

ELECTRICAL SPECIFICATIONS

- Frequency
 - Standard output
 - Frequency: 10MHz
 - Format: Sinewave
 - Amplitude: 7.5 to 10.5dBm
 - Harmonic: <-30dBc
 - Non harmonic: <-80dBc
 - Load impedance: 50Ω
 - Optional output
 - Frequency: 5MHz
 - Format: Sinewave
 - Amplitude: 7.5 to 10.5dBm
 - Harmonic: <-30dBc
 - Non-harmonic: <-80dBc
 - Load impedance: 50Ω

PERFORMANCE PARAMETERS

- | Stability | 10MHz | 5MHz |
|--------------------------|----------|----------|
| Avg time (s) | | |
| 1 | <5.0E-12 | <2.0E-12 |
| 10 | <5.0E-12 | <2.0E-12 |
| Aging (per day): | <3E-10 | <1E-10 |
| Retrace: | ±1E-8 | ±1E-8 |
| Acceleration sensitivity | | |
| Standard: | ±3E-9 | ±4E-9 |
| Low g option: | ±2E-10 | ----- |
| SSB Phase noise | | |
| Offset (Hz) | 10MHz | 5 MHz |
| 1 | -100dBc | -110dBc |
| 10 | -130dBc | -140dBc |
| 100 | -145dBc | -150dBc |
| 1,000 | -155dBc | -157dBc |
| 10,000 | -157dBc | -160dBc |
| 100k | -157dBc | -160dBc |
| Temp vs Freq | | |
| -30°C to -70°C: | <±1E-8 | <±1E-8 |
| 0 to 50°C: | <±5E-9 | <±5E-9 |
| Tuning range | ±5E-7 | ±5E-7 |
| Linearity | 5% | 5% |

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

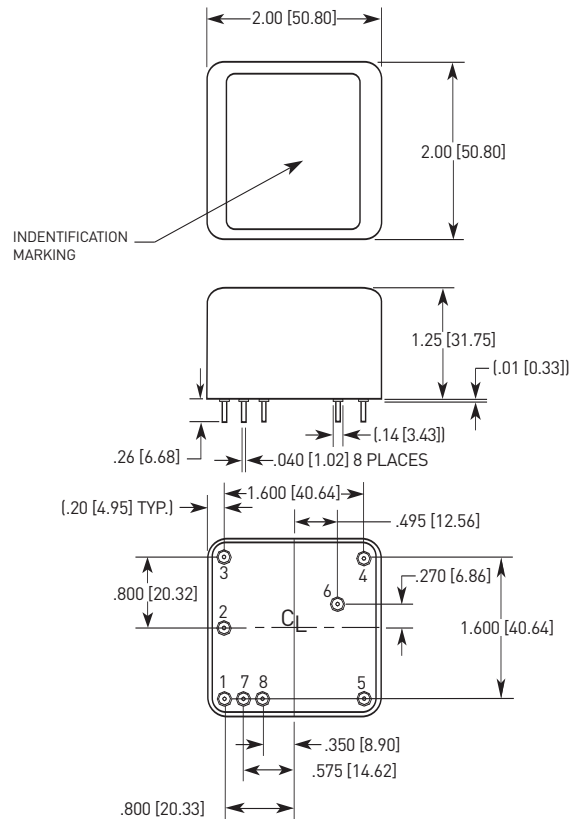
- General environment
 - Operating temperature: -30°C to 70°C
 - Storage temperature: -55°C to 100°C
 - Humidity: 95% up to 50°C
 - Altitude (operating): 0 to 50,000 feet
- Random vibration
 - Operating: 30 grms, 10 Min, 3 axis (80Hz - 1kHz)

- DC Power requirements: 12 - 18VDC
<3W operating power at 12Vdc
<5W warm-up power at 12Vdc
- Dimensions/weight: 2.0"x2.0"x1.25"
<120 grams

OPTIONS

- 5MHz output
- Low g sensitivity

Pin number	Function
1	EFC tuning input (0 to +6 VDC)
2	Reference voltage out (+8.5 to +9 VDC)
3	RF output
4	GND
5	Supply (+12 to +18 VDC)
6	GND
7	NC
8	NC



1. DIMENSIONS IN [] BRACKETS ARE METRIC MM.
2. DIMENSIONS & TOLERANCING PER ANSI Y14.5M.
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES
TOLERANCES:
XX DECIMALS .03 .010



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 other synchronization 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.



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 at http://www.symmttm.com/products_pfr_drcbt.asp.

Calibration Service

Calibration service is available for selected cesium, rubidium and quartz instruments. Since these products are normally deployed in 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 be quickly resolved, they will also be 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), Northampton (United Kingdom), 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 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.

Contact Us

Please visit us online at http://www.symmetricom.com/Products/Global_services.

Your Symmetricom sales representative has more information on all our products and services. You can also contact any of our regional offices.

USA

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(1-888-FOR-SYMM) or 1-408-428-7907
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Germany

Phone: +49 700 3288 6435
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Email: emeasupport@symmetricom.de



Terms & Conditions

These terms and conditions shall govern the sale of all Goods by Symmetricom, Inc. ("Symmetricom"), notwithstanding any conflicting, contrary, or additional terms and conditions in any purchase order or other document or communications ("Purchase Order") from Buyer. These terms and conditions may only be waived or modified in a written agreement signed by any authorized representative of Symmetricom.

ACCEPTANCE

Inspection and acceptance of the Goods are Buyer's responsibility. Buyer is deemed to have accepted unless Symmetricom receives written notice of rejection within 10 days after delivery of Goods.

DELIVERY

Buyer acknowledges that delivery dates provided by Symmetricom are estimates only, and that Symmetricom is not liable for failure to deliver 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 the acknowledged ship date, except where such delay is due to failure to timely receive export license approval or a result of force majeure event, Buyer's sole remedy is to cancel the Purchase Order.

EXPORT CONTROL

Goods provided hereunder are subject to United States ("U.S.") export control laws, including the U.S. Export Administration Act and its associated regulations, and may be subject to export or import regulations in other countries. Diversion contrary to licensed destination is prohibited. Buyer agrees to comply strictly with all such regulations and agrees that it shall not directly or indirectly export any Goods and related technical data to any party or to any country to which such export or transmission is restricted or prohibited. 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.

FORCE MAJEURE

Neither party will be liable to the other for any delay or failure in performance due to fires, strikes, threatened strikes, stoppage of work, delays by suppliers or subcontractors, embargoes, government regulations, acts of God or public enemies, or other causes that are beyond the reasonable control of a party ("Force Majeure event"). If such an event occurs, the affected party will give immediate written notice to the other party. In the event Symmetricom is the affected party, Symmetricom may elect to suspend performance hereunder for the duration of the Force Majeure event.

HAZARDOUS/TOXIC SUBSTANCES

Symmetricom will provide Buyer with any Material Safety Data Sheets (MSDS) applicable to the Goods offered hereunder upon Buyer's request.

INDEMNITY

Symmetricom will defend, indemnify, and hold harmless Buyer, its officers, directors, and employees, from and against all damages, claims or liabilities and expenses (including reasonable attorneys' fees) arising out of or resulting from any personal injuries, including death or damage to property caused by any negligent or willful act of Symmetricom, its agents, employees, suppliers or subcontractors. Buyer will promptly notify Symmetricom in writing of any claim or demand for which Symmetricom is responsible and will cooperate with Symmetricom to facilitate the defense or settlement of such matter.

INFRINGEMENT

Symmetricom will defend, indemnify, and hold harmless Buyer, its officers, directors, employees and customers from and against all claims, losses, damages, expenses (including reasonable attorneys' fees and costs), suits, and liabilities resulting from any infringement or alleged infringement of a U.S. or United Kingdom patent, copyright, or other proprietary right, in countries having membership in the Berne convention, based on Buyer's use of Goods; provided, however, that such indemnity will not apply if such infringement arises out of Symmetricom's compliance with Buyer's designs, specifications or instructions or the use or combination of any Goods with other materials or components not provided by Symmetricom. Buyer will promptly notify Symmetricom in writing of any claim or demand for which Symmetricom is responsible under this indemnity, and will cooperate with Symmetricom to facilitate the defense or settlement of such matter. If the use of Goods by Buyer or any of its customers is enjoined, Symmetricom will, at its option and using commercially reasonable efforts, either (1) obtain the right for Buyer to continue use of such Goods, or (2) replace such Goods with other Goods of comparable form, fit, and function, or (3) modify such Goods so that they are no longer infringing or (4) refund the purchase price of such Goods upon return of the Goods if within one (1) year of delivery, or the net book value of the Goods thereafter, or (5) any combination of (1) through (4) above.



INTELLECTUAL PROPERTY RIGHTS

If a Purchase Order includes software or other intellectual property, such software or other intellectual property is provided by Symmetricom to Buyer subject to the copyright and user license, the terms and conditions of which are set forth in the license agreement accompanying such software or other intellectual property. No title to or ownership of such software or intellectual property in hardware acquired hereunder is transferred to Buyer. Symmetricom owns and retains all such title and ownership of all intellectual property rights in the Goods, including all documentation and related materials.

INVOICES AND PAYMENTS

Symmetricom will send an invoice for each shipment of Goods hereunder to Buyer at the address specified by Buyer in its purchase order. Subject to Symmetricom's credit approval, full payment for the Goods is due net thirty (30) days from date of invoice, notwithstanding any order for services to be performed. Overdue payments shall bear interest of one and one-half percent (1.5%) per month or the maximum rate allowable by law.

ISO 9001/2000 COMPLIANCE

Symmetricom will utilize quality assurance procedures consistent with ISO 9001/2000, and will provide evidence of such compliance upon Buyer's request.

LIMITATION OF LIABILITY

The remedies set forth in these terms and conditions are the Buyer's sole and exclusive remedies. Notwithstanding "INDEMNITY" and "INFRINGEMENT" above, in no event will Symmetricom be liable to Buyer for indirect, special, incidental or consequential damages, including, without limitation, loss of revenues or profits, business interruption costs, loss of data or software restoration, removal or reinstallation costs or damages relating to Buyer's procurement of substitute products or services. 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 TO ALL BUYERS.

ORDERS

All Purchase Orders are subject to acceptance by Symmetricom. Except as stated in "DELIVERY", Orders accepted by Symmetricom may not be canceled without Symmetricom's consent, which consent maybe given by Symmetricom in its sole discretion.

SHIPPING

Goods will be 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 and the specifications of Buyer, if any. Buyer's Purchase Order number will be identified on all packages, shipping papers, and other subordinate documents. Shipments may be made from any Symmetricom factory location or its suppliers' factory location. Symmetricom will ship Goods "best way" unless specified otherwise in Buyer's purchase order. Buyer shall pay all transportation charges, in addition to the price of the Goods. Unless otherwise agreed in advance by Symmetricom, shipment terms for U.S. and Canada are FOB Factory, freight, duty and taxes collect. For all other location shipment terms are FCA Seller's Factory, freight, duty and taxes collect.

SUPPORT

Technical telephone support and on-site support is not included with purchases hereunder, unless otherwise agreed in a Master Purchase Agreement or contract with Buyer. Symmetricom Customer Assistance Center may be reached by telephone 24 hours per day, 7 days per week at (408) 428-7907, or toll-free in the USA at (888) 367-7966.

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 will 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 will first provide Symmetricom with a validly issued exemption or resale certificate acceptable to the appropriate taxing authority.

TITLE AND RISK OF LOSS

Title (except for Software) and risk of loss shall pass to Buyer upon delivery to the carrier at the factory.

WARRANTY

The warranty period begins on date of shipment by Symmetricom.

Hardware and embedded software – For a period of one (1) year, Symmetricom warrants that the Goods will (i) be free from defects in design, material, and workmanship; and (ii) will conform to and perform in accordance with the Symmetricom's specifications. Symmetricom further warrants that the Goods will have good and valid title, and will be free and clear of any and all liens and encumbrances. This warranty will survive inspection, acceptance, and payment by Buyer.



Symmetricom does not warrant that the operation of the Goods will be uninterrupted or error free. This warranty does not cover failures caused by acts of God, electrical or environmental conditions; abuse, negligence, accident, loss or damage in transit; improper site preparation.

This warranty shall be null and void in the event (i) Buyer or any third party attempts repair of the Goods without Symmetricom's advance written authorization; or (ii) defects are the result of improper or inadequate maintenance by Buyer or third party; (iii) of damage to said products 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 products are shipped to any country other than that originally specified in the Buyer's purchase order.

Goods not meeting this warranty will be repaired or replaced, at Symmetricom's option, upon return to Symmetricom's factory freight prepaid; provided, however that Buyer has first obtained a return materials authorization number ("RMA Number") from Symmetricom authorizing such return. The RMA Number shall be placed on the exterior packaging of all returns. Symmetricom will pay shipping costs to return repaired or replacement Goods to Buyer.

Software – Symmetricom warrants that for a period of ninety (90) days the accompanying media will be free from defects in materials and workmanship under normal use. The physical media warranty does not apply to defects arising from misuse, theft, vandalism, fire, water, acts of God or other similar perils. Symmetricom will not be liable for any damages caused by the Buyer's failure to fulfill its responsibilities as stated above.

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.

NOTE: Symmetricom's GPS positioning products for navigation are an AID TO NAVIGATION only and MUST be used in conjunction with normal navigation practices.

GENERAL

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.

Assignment – Orders, payments, warranties and other rights or obligations hereunder may not be assigned or delegated by either party without prior written consent of the other party. Any such assignment without prior written consent of the other party shall be void and of no force and effect whatsoever, except that Symmetricom reserves the right to assign any service line item to its wholly owned subsidiary, where Buyer's consent is not required. Without limiting the generality of the foregoing, these terms and conditions will be binding upon and will inure to the benefit of the parties' respective successors and assigns.

Attorneys' Fees And Costs – In the event of litigation arising out of any order hereunder, the prevailing party will be entitled to reimbursement of reasonable attorneys' fees and costs in addition to any other relief awarded.

Choice Of Law – Unless otherwise specifically agreed in a master purchase agreement with Buyer, 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.

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 will immediately notify the other party in writing.

Entire Agreement – These terms and conditions 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.

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.

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 and conditions shall continue in full force and effect.

Survival of Obligations – Such terms and conditions that are intended by their meaning to survive termination hereof will survive such termination.

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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