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

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

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

XLi

Time and Frequency System

KEY FEATURES

- 12 Channel GPS Receiver with TRAIM

- Better Than 30 Nanoseconds RMS Accuracy to UTC

- Better Than 1x10^{-12} Frequency Accuracy

- Supports Primary and Secondary Reference Inputs (GPS, Time Code, IPPS)

- Configurable as Dual Redundant GPS Receiver in One Chassis

- Standard 10/100 Base-T Network Port

- Intuitive Web Based Management

- HTTP, Telnet, SNMP with MIB Standard

- Vacuum Fluorescent Display and Keypad

- Completely Modular with Plug-and Play Capability

- Numerous Field-Upgradeable, Plug-in Option Cards Available

- Time code reader/generator (IRIG A,B; IEEE 1344; NASA 36) AM and DC

- Auxiliary Reference Input Supports Lock to External Cesium to Enhance Holdover

- Standard Outputs: 1PPS, Selectable Pulse Rates and Alarm

- Flash Memory for Remote Software Upgrades

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

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

The XLi seemlessly integrates into a network centric environment. The 10/100 Base-T interface is standard. Remote management

is facilitated with the intuitive HTML web based interface as well as SNMP with an enterprise MIB. Command line interface is also supported via Telnet or the RS-232/422 serial port. The XLi can function as a Stratum 1 NTP server with addition of the NTS option.

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

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

XLi Time and Frequency System

XLi SPECIFICATIONS

GPS RECEIVER (OPTIONAL)

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

TIME CODE UNIT (TCU) SYNC GENERATOR

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

OSCILLATOR

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

STANDARD INPUT/OUTPUT SIGNALS

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

MECHANICAL/ENVIRONMENTAL

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

OPTIONS

See Options datasheet for details: XLi Options Datasheet

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

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

Rear View

SYMMETRICOM, INC., TTM DIVISION • 3750 Westwind Boulevard • Santa Rosa, California 95403 • tel: +1.707.528.1230 • fax: +1.707.527.6640
Toll free in the USA: 1-888-367-7966 (1-888-FOR-SYMM) • e-mail: ttm_info@symmetricom.com • www.symmetricom.com
SYMMETRICOM GLOBAL SERVICES • Toll free in the USA: 1-888-367-7966 • Worldwide: +1.408.428.7907 • Global e-mail: support@symmetricom.com   11

XLi SAASM GB-GRAM

Time and Frequency Receiver

KEY FEATURES

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

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

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

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

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

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

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

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

SYMMETRICOM

XLi SAASM GB-GRAM SPECIFICATIONS

GPS SAASM GB-GRAM RECEIVER

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

OSCILLATOR

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

STANDARD INPUT/OUTPUT SIGNALS

- Eight standard I/Os

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

ADDITIONAL STANDARD FEATURES

- External frequency measure

    Frequencies: 1, 5, 10 MHz
    Resolution: 1×10^{-12} @ 100 seconds
    Accuracy: 1×10^{-12} @ 1 day
- Time Interval/Event Timing

    Resolution: 5 nsecs
    Accuracy: ± 5 nsecs to XLi SAASM clock

MECHANICAL/ENVIRONMENTAL

- Time and frequency system

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

    Size: 4" x 3.75" x 1.6" (10.16 cm x 9.53 cm x 4.07 cm)
    Input: BNC female to GPS receiver. TNC on antenna
    Power: +12 Vdc
    Operating/storage temp: –55°C to +85°C (–67°F to +185°F)
    Humidity: 95%, non-condensing
    Certification: UL, FCC, CE, and C-UL

OPTIONS

See Options datasheet for details: XLi SAASM Options Datasheet

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

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

Rear View (1U model with two option modules)

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

XLi/XLi SAASM Options

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

OPTIONS

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

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

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

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

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

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

XLi Time and Frequency System

XLi SAASM Time and Frequency Receiver

Network Time Server on Standard Network Port

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

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

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

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

SPECIFICATIONS: NETWORK TIME SERVER OPTION 87-8017

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

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

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

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

Programmable Pulse Output

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

SPECIFICATIONS: PROGRAMMABLE PULSE OUTPUT (PPO) 87-8024

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

Frequency Measurement
(Standard with XLi SAASM)

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

SPECIFICATIONS: FREQUENCY MEASUREMENT 87-8025

INPUT FREQUENCIES
- Keypad selectable frequencies of 1, 5, 10 MHz.

    Input Level: 1.0 to 10 Vpp
    Input Impedance: 1kΩ, jumper selectable to 50Ω
    Measurement Range: $\pm 1 \times 10^{-5}$ maximum offset; compares the external frequency under test directly to the clock's disciplined oscillator
    Input Frequency: 1 MHz, 5 MHz, 10 MHz
    Resolution:

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

    High-stability quartz

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

    Rubidium

        4×10^{-11} @ 1 second
        6×10^{-12} @ 100 seconds
        1×10^{-12} @ 1 day

    High-stability Rubidium

        4×10^{-11} @ 1 second
        6×10^{-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: TIME INTERVAL/EVENT TIMING (TI/ET) 87-8026

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

TIME INTERVAL FEATURE
- Measurement

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

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

EVENT TIMING FEATURE
- Measurement

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

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

** For clock accuracy see accuracy of host unit.

SYMMETRICOM

Oscillators

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

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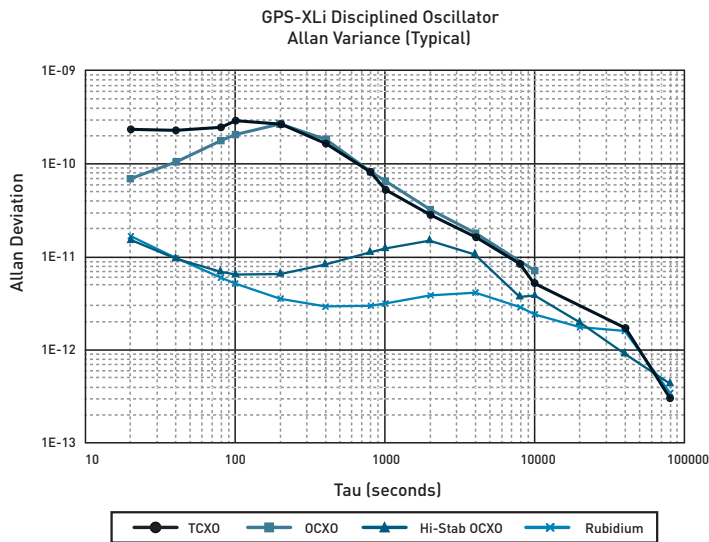
OSCILLATORS SPECIFICATIONS (TYPICAL)

TCVCXO (Standard in XLi)
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Frequency/timing Allan Deviation
- Stability

  1×10^{-9} @ 1 sec
  2×10^{-10} @ 1000 sec
  1×10^{-12} @ 24 hours

- Temperature: 5×10^{-7}, over 0°C to 50°C when not locked to a reference

Note: Not available in XLi SAASM

OCXO OSCILLATOR OPTION 87-399-18
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Frequency/timing Allan Deviation

  Stability:

  1×10^{-10} @ 1 sec
  1×10^{-10} @ 1000 sec
  1×10^{-12} @ 24 hours

- Temperature: 1×10^{-8}, over 0°C to 50°C when not locked to a reference
- Drift rate: 5×10^{-9} per 24 hours

HIGH STABILITY OCXO OSCILLATOR OPTION 87-399-19 (Standard in XLi SAASM)
- Accuracy: Function of input synchronization source
- Frequency/timing Allan Deviation

  Stability:

  4×10^{-11} @ 1 sec
  4×10^{-11} @ 1000 sec
  1×10^{-12} @ 24 hours

- Temperature: 1×10^{-9}, over 0°C to 50°C when not locked to a reference
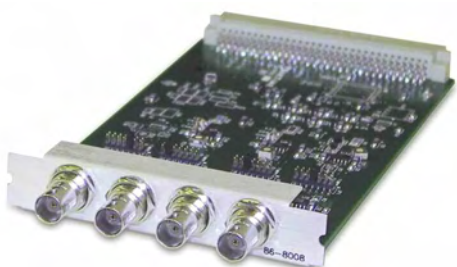- Drift rate: 1×10^{-10} per 24 hours

RUBIDIUM OSCILLATOR OPTION 87-399-RB1U, 87-399-RB2U
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Frequency/timing Allan Deviation

  Stability:

  4×10^{-11} @ 1 sec
  6×10^{-12} @ 1000 sec
  1×10^{-12} @ 24 hours

- Temperature: 3×10^{-10}, over 0°C to 50°C when not locked to a reference
- Drift rate: 5×10^{-11} per month (720 hours)

HIGH PERFORMANCE RUBIDIUM OSCILLATOR OPTION 87-399-RB2UA
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Frequency/timing Allan Deviation

  Stability:

  4×10^{-11} @ 1 sec
  6×10^{-12} @ 1000 sec
  1×10^{-12} @ 24 hours

- Temperature: 3×10^{-10}, over 0°C to 50°C when not locked to a reference
- Drift rate: 1×10^{-11} per month (720 hours)

GPS-XLi Disciplined Oscillator
Allan Variance (Typical)

SYMMETRICOM, INC., TTM DIVISION • 3750 Westwind Boulevard • Santa Rosa, California 95403 • tel: +1.707.528.1230 • fax: +1.707.527.6640
Toll free in the USA: 1-888-367-7966 (1-888-FOR-SYMM) • e-mail: ttm_info@symmetricom.com • www.symmetricom.com
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1, 5, 10 MHz/MPPS

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

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

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

1, 5, or 10 MHz OUTPUT
- Amplitude: 1 Vrms into 50Ω
- Harmonic distortion: –30 dBc
- Synchronization: Phase locked to the clock 10 MHz
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Connector: Female, BNC

1, 5, or 10 MPPS OUTPUT
- Amplitude: TTL into 50Ω
- Duty cycle: 50%
- Synchronization: Phase locked to the clock 10 MHz
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)

Expansion Module

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

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

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

General
Connector: Female BNC
Quantity: 4
Options Slots:
- 1 slot (87-8034-1)
- 2 slots (87-8034-2)

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

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

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

Programmable Pulse (Optional)
- On time edge: Rising
- Amplitude: TTL Levels into 50Ω

Alarm Relay 87-8034-2
- Connection: Terminal strip, COM, NO, NC
- Max Voltage: 48 VAC/VDC
- Max Current: 2A @ 24 VDC

SYMMETRICOM

Enhanced Low Phase Noise 10 MHz Output

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

SPECIFICATIONS: ENHANCED LOW PHASE NOISE OUTPUT 87-8040

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

Low Phase Noise Output (5 MHz, 10 MHz)

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

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

LOW PHASE NOISE 10 MHz OUTPUTS 87-8009-10
- Provides four 10 MHz frequency output signals
- Signal type: Analog sine wave
- Synchronization: Phase locked to the clock 10 MHz
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Amplitude: +13dBm (±1dBm)
- Output impedance: 50Ω
- Quantity: 4
- Connector: BNC female
- Option Slots: 1
- Harmonic distortion: –30dBc (2nd harmonic)
- Spurious: –90dBc (10 Hz - 10 kHz SSB)
- Isolation: –70dBc
- Phase noise
    - –85 dBc/Hz @ 1 Hz offset
    - –115 dBc/Hz @ 10 Hz offset
    - –140 dBc/Hz @ 100 Hz offset
    - –145 dBc/Hz @ 1 kHz offset
    - –150 dBc/Hz @ 10 kHz offset

LOW PHASE NOISE 5 MHz OUTPUTS 87-8009-5
- Provides four 5-MHz frequency output signals
- Signal type: Analog sine wave
- Synchronization: Phase locked to the clock 10 MHz
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Amplitude: +13dBm (±1dBm)
- Output impedance: 50Ω
- Quantity: 4
- Connector: BNC female
- Harmonic distortion: –30dBc
- Spurious: –90dBc
- Isolation: –70dBc
- Phase noise
    - –85 dBc/Hz @ 1 Hz offset
    - –115 dBc/Hz @ 10 Hz offset
    - –140 dBc/Hz @ 100 Hz offset
    - –145 dBc/Hz @ 1 kHz offset
    - –150 dBc/Hz @ 10 kHz offset

N.1 Frequency Synthesizer

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

SPECIFICATIONS: N.1 FREQUENCY OUTPUTS 87-8022

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

N.8 Frequency Synthesizer

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

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

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

SYMMETRICOM

Have Quick/1PPS Time and Frequency Reference Input

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

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

1PPS Input

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

Have Quick Input

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

Have Quick Output

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

SPECIFICATIONS: HAVE QUICK OUTPUT 87-8016-6

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

Multicode Output

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

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

SPECIFICATIONS: MULTICODE OUTPUT 87-6002-XL1

- Amplitude modulated;

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

IRIG A 130	IRIG A 133	IRIG B 120	IRIG B 123
IRIG E 111	IRIG E 112	IRIG E 121	IRIG E 122
IRIG G 141	IRIG G 142	IRIG H 111	IRIG H 112
IRIG H 121	IRIG H 122	2137	XR-3
NASA-36 (All codes in 24 hour format)			
- Time references: Standard, UTC, GPS, or Local

DC Power Supplies

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

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

SPECIFICATIONS: DC POWER SUPPLIES

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

12 Vdc POWER INPUT 87-8012-12
- Input voltage range: 12-18 VDC for nominal 12 volt input
- Input current, maximum: 7.5 amps @ 12 volts input
- Output specifications:

  +5 V ±2%, 20 watts, 4 amps
  +12 V ±2%, 24 watts, 2 amps
  -12 V ±2%, 24 watts, 2 amps

24 Vdc POWER INPUT 87-8012-24
- Input voltage range: 18-36 Vdc for nominal 24 volt input
- Input current, maximum: 6 amps @ 18 volts input
- Output specifications

  +5 V ±2%, 25 watts, 5 amps
  +12 V ±2%, 30 watts, 2.5 amps
  -12 V ±2%, 24 watts, 2 amps

48 Vdc POWER INPUT 87-8012-48
- Input voltage range: 36-72 VDC for nominal 48 volt input
- Input current, maximum: 3 amps @ 36 volts input
- Output specifications:

  +5 V ±2%, 25 watts, 5 amps
  +12 V ±2%, 30 watts, 2.5 amps
  -12 V ±2%, 24 watts, 2 amps

SYMMETRICOM

Telecommunications Interface

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

T1 Option: 87-6000T1-8

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

E1 Option: 87-6000E1-6

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

General Specification (T1 and E1 Options)
- Synchronization
  Phase locked to the XLi 10 MHz reference clock
  Accuracy: Function of input synchronization source
  (GPS, IRIG, 1PPS, Have Quick)
- Synchronization Status Messaging (SSM): not supported
- Major and minor alarm relay closures
  Format: Form-C normally open and normally closed contacts
  Interface: Wire wrap pins
  Contacts: Rated to 115 VAC/150 VDC at 2 A
- CE Compliant: No

Second Serial Talker or T1/E1 Output

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

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

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

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

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

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

T1
- Frequency: 1544 kbit/s
- Interface: Balanced, RS-422 levels into 120 Ω
- Synchronization: Phase locked to the clock 10MHz
- Qty: Four outputs
- Connector: Two Male 9-pin D
- Physical: Single high option bay.

E1
- Frequency: 2048 kbit/s
- Interface: Balanced, RS-422 levels into 120 Ω
- Synchronization: Phase locked to the clock 10MHz
- Qty: Four outputs
- Connector: Two Male 9-pin D
- Physical: Single high option bay

General Specification (T1 and E1 Configurations)
- Accuracy: Function of input synchronization source
  (GPS, IRIG, 1PPS, Have Quick)
- Synchronization Status Messaging (SSM): not supported
- CE Compliant: Yes

PTTI BCD Output

SPECIFICATIONS: PTTI BCD OUTPUT 87-8045

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

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

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

MECHANICAL
- Option Slots: 2

Parallel BCD Output

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

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

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

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

SPECIFICATIONS: PARALLEL BCD OUTPUT

Parallel BCD mSec with Time Quality 87-8090
- Outputs:
  - Milliseconds through day-of-year, (4) time quality bits, (2) strobes (1PPS, 1kPPS)
- Output Drive (TTL): LVTTL levels, 4mA source or sink
- Logic Levels: Low **<**0.4V, High **>**2.4V
- Connector: 50 pin 'D' female
- Option Slots: 1
- Compatibility: Legacy XL-DC Parallel BCD Millisecond Module (86-390)

Parallel BCD uSec with Time Quality 87-8090-1
- Outputs:
  - Microseconds through day-of-year, (4) time quality bits, (3) strobes (1PPS, 1kPPS, 1MPPS)
- Output Drive (TTL): LVTTL levels, 4mA source or sink
- Logic Levels: Low **<**0.4V, High **>**2.4V
- Connectors: 50 pin 'D' female, 25 pin 'D' female
- Option Slots: 2
- Compatibility: Legacy XL-DC Parallel BCD Microsecond Module (86-390-1)

Parallel BCD mSec 87-8090-2
- Outputs: Milliseconds through day-of-year, (2) strobes (1PPS, 1kPPS), Unlock status
- Output Drive (TTL): LVTTL levels, 4mA source or sink
- Logic Levels: Low **<**0.4V, High **>**2.4V
- Connector: 50 pin 3M ribbon type connector male
- Option Slots: 1
- Compatibility: Legacy ExacTime 6000 GPS_Option_13A - Parallel BCD

SYMMETRICOM

Frequency and Time Deviation Monitor (FTM)
(Available for XLi Only)

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

• Frequency Deviation – The instantaneous difference between the locally generated frequency (typically 50 or 60 Hz) and the precision frequency of the host Synchronized Clock.

• System Frequency – The user's locally generated frequency.

• Time Deviation – The accumulated difference in time between a clock locked to the locally generated frequency and the precise time of the Synchronized Clock.

• System Time – (Hours, minutes and seconds) as defined by a clock running off the user's locally generated frequency.

• Local Time – Local corrected UTC time seconds through days.

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

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

Displays for XLi-FTM

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

SPECIFICATIONS: FREQUENCY AND TIME DEVIATION MONITOR 87-8023

GENERAL SPECIFICATIONS

• Measurement input: 95–260 VAC, 40–70 Hz; user-selectable 50 or 60 Hz operation.

• Signal conditioning: RFI input filter; multistage low-pass filter. Line fused; varistor protected 2500 VAC rms isolation. Transformer coupled.

• Remote display port: RS-422. Each output term has individual address codes.

FREQUENCY DEVIATION

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

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

TIME DEVIATION

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

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

SYSTEM FREQUENCY

• Current measurement of input reference frequency.

> Range: 40 - 70 Hz

> Measurement Resolution: 30 µHz
> Output Data Resolution: 1 mHz

SYSTEM TIME

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

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

XLi IEEE 1588 Grandmaster (PTP V2)

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

KEY FEATURES

· Better Than 50 Nanosecond Time Stamp Accuracy to UTC

· Supports IEEE 1588-2008 (PTP v2)
  - Default PTP Profile
  - Two step clock operation
  - Multicast addressing

· Optional Master & Slave in Same Chassis for Network Measurements

· Time Interval Measurements of Slave Clock Accuracy

· Synchronized with a 12 Channel GPS Receiver

· Better Than $1x10^{-12}$ Frequency Accuracy

· Supports Primary and Secondary Reference Inputs

· Standard 10/100 Base-T Ethernet

· Telnet, SNMP & Enterprise MIB

· Standard Vacuum Fluorescent Display and Keypad

· Flash Memory for Remote Software Upgrades

· Time Code Input/Output (IRIG A,B; IEEE 1344; NASA 36)

· Standard 1PPS, Selectable Pulse Rate Outputs, Alarm, Auxiliary Reference, and Various Time Code In/Out

KEY BENEFITS

· Nanosecond Caliber Synchronization Accuracy Possible Between Clocks over Ethernet Network Infrastructure.

· Time Interval Measurements to Characterize Network Element Induced Time Transfer Rrrors.

· GPS for Precise UTC Time Accuracy.

· Operate as IEEE 1588 Protocol Grandmaster Clock for IEEE 1588 Slaves, Boundary Clocks, and Ordinary clocks.

· Plug and Play Compliant with IEEE 1588-2008.

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

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

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

The XLi Grandmaster operating as a slave is extremely useful for network time transfer

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

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

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

XLi IEEE 1588 Grandmaster

XLi IEEE 1588 GRANDMASTER (PTP V2) SPECIFICATIONS

IEEE 1588 SUBSYSTEM (per port)

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

GPS RECEIVER

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

STANDARD INPUT/OUTPUT SIGNALS

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

OSCILLATOR

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

MECHANICAL/ENVIRONMENTAL

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

TIME INTERVAL MEASUREMENT

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

PRODUCT INCLUDES

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

OPTIONS

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

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

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

Related products: SyncSwitch TC100 Transparent Clock

Rear view: Single 1588 port, Model 1510-712

Rear view: Dual 1588 port, Model 1510-713

SyncSwitch TC100

IEEE-1588 Transparent Clock/Managed Ethernet Switch

KEY FEATURES

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

KEY BENEFITS

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

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

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

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

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

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

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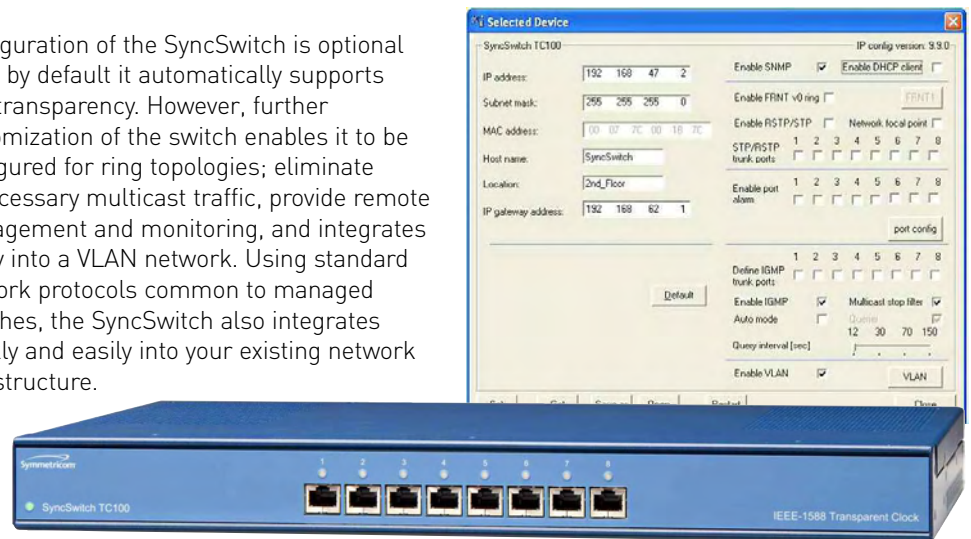
SyncSwitch TC100 SPECIFICATIONS

TIMING FUNCTIONS

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

SWITCHING PERFORMANCE

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

STANDARDS

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

NETWORK CONNECTORS

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

MECHANICAL/ENVIRONMENTAL

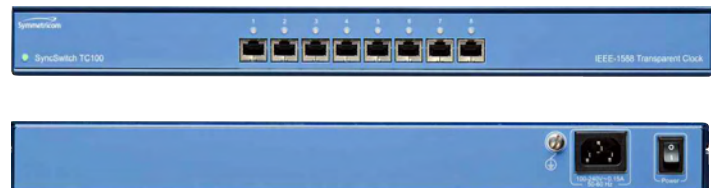|	
• Size	1.75" x 17" x 11.25" (4.5 cm x 43.2 cm x 28.6 cm) 1U rack mount
• Power	100-240 VAC, 50-60 Hz, 15 watts
• Operating Temperature	0°C to +50°C (+32 to +122°F)
• Storage Temperature	-20°C to +85°C (-4 to +185°F)
• Humidity	To 95%, noncondensing
• Certifications	FCC, CE (RoHS), UL
• Server weight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

PRODUCT INCLUDES

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

OPTIONS

Three configurations:

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

SYMMETRICOM, INC., TTM DIVISION • 3750 Westwind Boulevard • Santa Rosa, California 95403 • tel: +1.707.528.1230 • fax: +1.707.527.6640

Toll free in the USA: 1-888-367-7966 (1-888-FOR-SYMM) • e-mail: ttm_info@symmetricom.com • www.symmetricom.com

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XL-GPS

Time and Frequency Receiver

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

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

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

A variety of standard time and frequency outputs include a one pulse-per-second (1PPS), IRIG B/IEEE 1344 time code (AM & DC),

programmable pulse rates up to 10 MPPS, and an alarm output. A Programmable Pulse Output (PPO) option generates a synchronized "trigger pulse" at a specific time of day. An optional Expansion Module provides four, user configurable outputs to fan out signals.

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

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

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

XL-GPS Time and Frequency Receiver