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# XLi

## Time and Frequency System




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
- Modularity of many timing options
- Standard outputs: 1PPS, selectable pulse rates and alarm
- Supports primary and secondary reference inputs (GPS, time code, 1PPS)
- Many high performance oscillator upgrades
- Configurable with dual redundant GPS receivers in one chassis
- Time code reader/generator (IRIG A,B; IEEE 1344; NASA 36) AM and DC
- Standard network interface port
- Web interface, Telnet, SNMP with MIB standard
- Vacuum fluorescent display and keypad
- Auxiliary reference input supports lock to external cesium to enhance holdover

### Key Benefits

- Many timing signals standard
- Modular customization with plug-and-play capability
- Configure to meet your exact timing requirements and behaviors
- Numerous field-upgradeable, plug-in option cards available
- Intuitive web-based management

The modular ultra precision XLi Time and Frequency System is the most versatile and flexible solution for timing and synchronization requirements. The XLi modularity with its wide variety of easily configured option cards is complimented by a generous collection of standard timing outputs/inputs. Leveraging a wide range of option cards makes 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 instrument, or as a time code unit (TCU). Deploy the Microsemi® GPS technology to generate ultra high precision time and frequency outputs for a wide range of synchronization requirements, or leverage Microsemi's years of expertise in Time Code technology, which is built into the heart of the XLi system.

The versatile range of timing signals available coupled with oscillator choices enables the XLi to excel in a broad variety of mission critical applications including mobile and satellite communications, military and defense, power utilities, metrology and broadcasting.

The XLi seamlessly integrates into a network centric environment with its standard network interface. Remote management is facilitated with the intuitive web based interface as well as monitoring via SNMP with an enterprise MIB. A command line interface is supported via Telnet or the RS-232/422 serial port for local or remote management and system integration. With the addition of the NTS option the XLi functions as a Stratum 1 NTP server.

The standard XLi provides an unmatched range of time and frequency inputs/outputs such as: 1PPS output; time code input/output (IRIG A, B; IEEE 1344; NASA36) in both modulated (AM) and demodulated (DCLS) formats; pulse rates; auxiliary reference input; open collector alarm; front panel keypad and display; and more. From there the modularity allows for further customization.

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.



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# XLi

## 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 x $10^{-12}$ @ 1 day
- Frequency/timing Allan Deviation stability (TCXO): 1 x $10^{-9}$ @ 1 sec
  3 x $10^{-10}$ @ 10 sec
  3 x $10^{-10}$ @ 100 sec
  2 x $10^{-10}$ @ 1000 sec
  1 x $10^{-12}$ @ 1 day
- Stability when not tracking satellites (TCXO): 5 x $10^{-7}$ ( 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: 60/40% (±10%).
  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

### 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
- N.8 Frequency Synthesizer
- 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 (FTM)
- 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).






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# XLi

## NETWORK TIME SERVER ON STANDARD NETWORK PORT




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

The NTS distributes time to precisely synchronize client computer clocks over a network. Time is acquired from the host XLi 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 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 and UDP/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. Comprehensive time client, server & management software for easy distribution, management and monitoring of time across the network is also available.

Visit http://www.microsemi.com for software time clients for various operating systems.



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# XLi

## 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 support 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. 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

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

## SPECIFICATIONS: FREQUENCY MEASUREMENT 87-8025

### INPUT FREQUENCIES

- Keypad selectable frequencies of 1, 5, 10 MHz.
  Input Level: 1.0 to 10 Vpp
  Input Impedance: 1kΩ, jumper selectable to 50Ω
  Measurement Range: ±1 x $10^{-5}$ maximum offset; compares the external frequency under test directly to the clock's disciplined oscillator
  Input Frequency: 1 MHz, 5 MHz, 10 MHz
  Resolution:
  120x$10^{-12}$ @ 1 second
  12x$10^{-12}$ @ 10 seconds
  1x$10^{-12}$ @ 100 seconds

- Accuracy: These specifications are subject to change depending on the specific oscillator installed in the XLi.*

**TCXO**

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

**Ovenized Quartz**

1x$10^{-10}$ @ 1 second
1x$10^{-10}$ @ 100 second
1x$10^{-12}$ @ 1 day

**High-stability Quartz**

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

**Rubidium**

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

**High-stability Rubidium**

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

* For oscillator information, refer to the oscillators section.



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# XLi

## TIME INTERVAL/EVENT TIMING

### TIME INTERVAL

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

### EVENT TIMING

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

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

#### INPUT FREQUENCIES

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

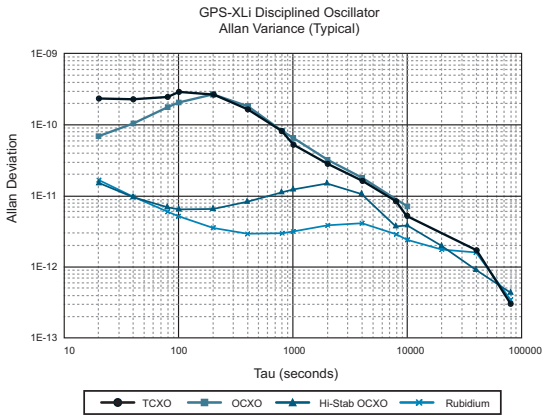
#### TIME INTERVAL FEATURE

- Measurement:
  - Rate: 1 per second
  - Resolution: 5 nS
  - Accuracy: ±5 nS (+ clock accuracy**)
  - Range: 0.0 to 1 year
- Display: Time into the second, updated once per second, is displayed to the nanosecond until another event occurs or until the "TIME", "STATUS", or "POSITION" push-button is pressed.

#### EVENT TIMING FEATURE

- Measurement
  - Rate: 10/second or 100/second burst
  - Resolution: 5 nS
  - Accuracy: ±5 nS (+ clock accuracy**)
  - Range: 0.0 to 1 year
- Display: Event Time occurrence, hundreds of days through nanoseconds, is displayed until another event occurs or until the "TIME", "STATUS", or "POSITION" push-button is pressed.

** For clock accuracy see accuracy of host unit.




## OSCILLATORS

Microsemi'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.

Microsemi 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.

For all oscillators the accuracy is a function of the input synchronization source (GPS, IRIG, 1PPS, Have Quick).

## OSCILLATORS SPECIFICATIONS (TYPICAL)

#### TCVCXO (Standard in XLi)

- Frequency/timing Allan Deviation
- Stability
  - $1 \times 10^{-9}$ @ 1 sec
  - $2 \times 10^{-10}$ @ 1000 sec
  - $1 \times 10^{-12}$ @ 24 hours
- Temperature: $5 \times 10^{-7}$, over 0°C to 50°C when not locked to a reference

#### OCXO OSCILLATOR OPTION 87-399-18

- Frequency/timing Allan Deviation
- Stability:
  - $1 \times 10^{-10}$ @ 1 sec
  - $1 \times 10^{-10}$ @ 1000 sec
  - $1 \times 10^{-12}$ @ 24 hours
- Temperature: $1 \times 10^{-8}$, over 0°C to 50°C when not locked to a reference
- Drift rate: $5 \times 10^{-9}$ per 24 hours

#### HIGH STABILITY OCXO OSCILLATOR OPTION 87-399-19

- Frequency/timing Allan Deviation
- Stability:
  - $4 \times 10^{-11}$ @ 1 sec
  - $4 \times 10^{-11}$ @ 1000 sec
  - $1 \times 10^{-12}$ @ 24 hours
- Temperature: $1 \times 10^{-9}$, over 0°C to 50°C when not locked to a reference
- Drift rate: $1 \times 10^{-10}$ per 24 hours

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

- Frequency/timing Allan Deviation
- Stability:
  - $4 \times 10^{-11}$ @ 1 sec
  - $6 \times 10^{-12}$ @ 1000 sec
  - $1 \times 10^{-12}$ @ 24 hours
- Temperature: $3 \times 10^{-10}$, over 0°C to 50°C when not locked to a reference
- Drift rate: $5 \times 10^{-11}$ per month (720 hours)

#### HIGH PERFORMANCE RUBIDIUM OSCILLATOR OPTION 87-399-RB2UA

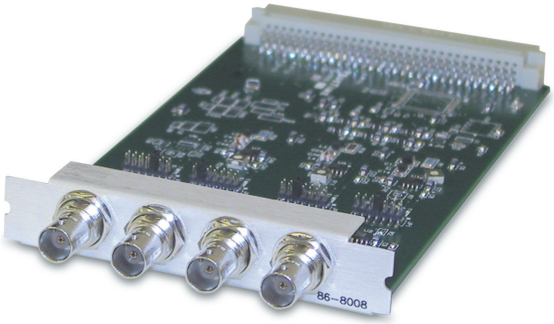
- Frequency/timing Allan Deviation
- Stability:
  - $4 \times 10^{-11}$ @ 1 sec
  - $6 \times 10^{-12}$ @ 1000 sec
  - $1 \times 10^{-12}$ @ 24 hours
- Temperature: $3 \times 10^{-10}$, over 0°C to 50°C when not locked to a reference
- Drift rate: $1 \times 10^{-11}$ per month (720 hours)



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# XLi

## 1, 5, 10 MHZ/MPPS




The 1, 5, 10 MHz/MPPS Output card provides four precise sine waves or square waves 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.

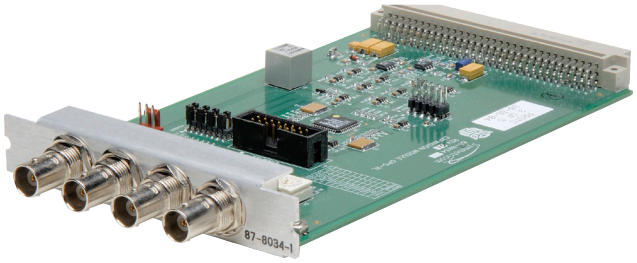
Outputs are preconfigured at the factory. Please specify desired outputs on the sales order.

### 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: BNC Female

**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 (87-8134-2)

### SPECIFICATIONS:
### - EXPANSION MODULE 87-8034-1
### - EXPANSION MODULE W/ ALARM RELAY 87-8134-2

**GENERAL**
- Connector: Female BNC
- Quantity: 4
- Options Slots:
  1 slot (87-8034-1)
  2 slots (87-8134-2)

**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 87-8134-2**
- Connection: Terminal strip, COM, NO, NC
- Max Voltage: 48 VAC/VDC
- Max Current: 2A @ 24 VDC



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# XLi

## ENHANCED LOW PHASE NOISE 10 MHZ OUTPUT

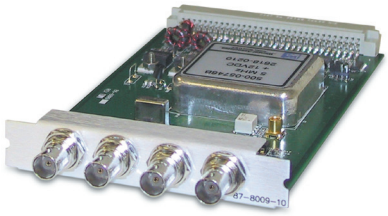


This module provides the lowest phase noise frequency outputs from the XLi. Four isolated, 10 MHz frequency output signals with exceptional spectral purity. Isolation from the receiver's internal digital signal noise and power supply noise enables the high-performance phase noise and spurious noise characteristics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

### SPECIFICATIONS: ENHANCED LOW PHASE NOISE OUTPUT 87-8040

- 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: 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 versions 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 system, such as an OCXO, High Stability OCXO, Rubidium or High Stability Rubidium.

### 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

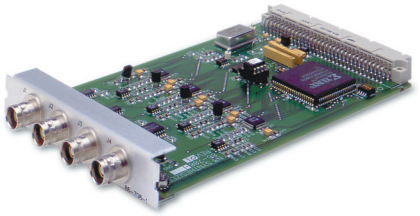
- Provides four 5-MHz frequency output signals
- Signal type: Analog sine wave
- Synchronization: Phase locked to the clock 10 MHz
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Amplitude: +13dBm (±1dBm)
- Output impedance: 50Ω
- Quantity: 4
- Connector: BNC female
- 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



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# XLi

## N.1 FREQUENCY SYNTHESIZER

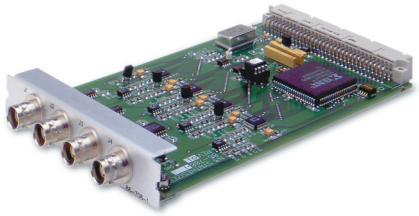


The N.1 Frequency Synthesizer provides pulse rates from 1PPS through 50 MPPS in 1PPS steps, with the output locked to the system oscillator. This option card offers four independently programmable frequency synthesizers.

### 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)



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## HAVE QUICK/1PPS TIME AND FREQUENCY REFERENCE INPUT




The Have Quick and/or 1PPS Time and Frequency reference is configurable to synchronize the XLi 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 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**

- 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 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

## 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

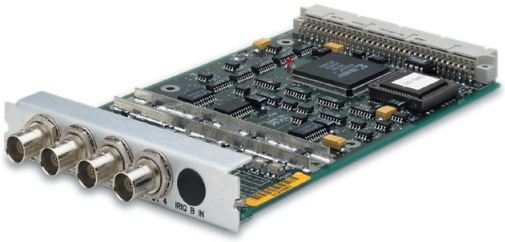
- Format: Have Quick II (ICD-GPS-060)
- Bit period: 600µs ±10µs
- Bit rate: Approximately 1667 BPS
- Frame rate: 1 frame/second
- Frame length: 512 bits or 504 bits with no TFOM
- Accuracy: 1 µs
- Connector: 4 Isolated female BNC
- High Level: >4.5 and Max 5.5V
- Low Level: <0.5V and Min 0V



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# XLi

## 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 Female
- 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 | RIG 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**

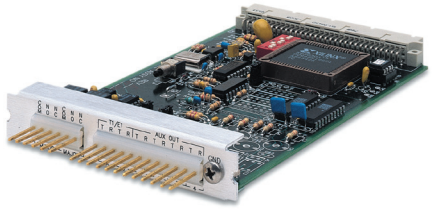
- Input voltage range: 36–72 VDC for nominal 48 volt input
- Input current, maximum: 3 amps @ 36 volts input
- Output specifications:
  - +5 V ±2%, 25 watts, 5 amps
  - +12 V ±2%, 30 watts, 2.5 amps
  - –12 V ±2%, 24 watts, 2 amps



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# XLi

## 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 SuperFrame), 24-frame multiframe (ESF or Extended SuperFrame), and 16-frame multiframe (E1) formats. In addition, when the XLi 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

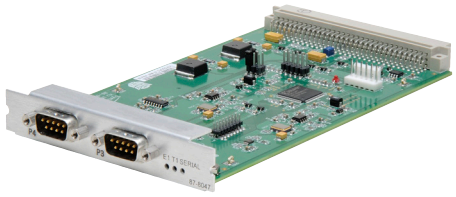
### E1 OPTION: 87-6000E1-6

- 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, an XLi 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)

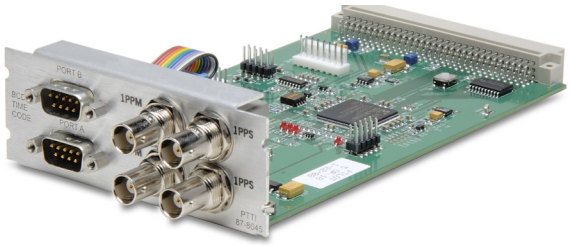
- Accuracy: Function of input synchronization source (GPS, IRIG, 1PPS, Have Quick)
- Synchronization Status Messaging (SSM): not supported
- CE Compliant: Yes



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# XLi

## 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 Female

**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

**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

**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



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# XLi

## FREQUENCY AND TIME DEVIATION MONITOR (FTM)




This plug-in card meets the specific needs of the electrical power industry by providing 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, the communication port, and the remote display driver RS-422 port.

## 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.

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