



StarClock TiemPo 6400

NextGen Synchronization Timing System

The New Standard for the Converged Network

VoIP TDM IPTV SONET SDH PSTN



Phone shown for size comparison only

"The TiemPo offers the highest port density per rack space of any BITS Clock of its size, and has all of the features that both current and NextGen networks demand"

System Overview

The CXR Larus StarClock TiemPo 6400 NextGen Synchronization Timing System is designed as a fully manageable and redundant wander and jitter free source of framed ones, square waves, composite clock or sinewave signals, synchronized to a highly accurate framed input reference source. The TiemPo offers the highest port density per rack space of any BITS clock of its size, and has all of the features that both current and Next Gen networks demand, including support for IPv6.

With the TiemPo's remote software upgrades downloadable through a network you can be sure that your next generation timing source will remain state-of-the-art, even as standards evolve.

The rugged **-30° to +65° C wide temperature range** of the TiemPo means that it is fully suited for the most harsh outside pedestal and vault requirements, without the need for expensive air conditioning.

Each output driver card can output DS1, Composite Clock (CC), E1, or 2.048MHz Square Wave, and is **software programmable per port, with, eight ports per card**. Other output cards are available for RS-422 1.544MHz or 8kHz Square Wave, 1, 5 or 10 MHz, IRIG-B, or 1 PPS, 1PPM or 1PPH. The DS1/ E1 output driver cards provide Sync Status Messaging (SSM) in compliance with BellCore GR-378 and ANSI T1X1.3 TR33.

In a single system **up to 64 (32 1:1 protected) outputs** can be obtained from the single 2U (3.5 in., 88.9 mm) high ANSI standard 19/23-inch NEBS compliant rack mounting master shelf. By utilizing a master (Model 6400A) and 4 expansion shelves (Model 6400AX), **up to 576 (288 1:1 protected) outputs are available**, while only occupying as little as 10U (17.5 in, 44.5 cm) of valuable rack space. For international applications, ETSI compliant versions of both shelves are also available.

The system is available in fully redundant **GPS or CDMA** engine driven **Stratum 1/PRC, Stratum 2E, Stratum 2/TNC and Stratum 3E/LNC** versions. It is also available as a low cost and simple clock distributor with no holdover functionality. There are also no less than two GPS engine versions available, a low cost Standard version (Model 6401-0) and a High Accuracy version, (Model 6401-1).

Also available is an RJ-45 ethernet output port to provide optional Simple Network Time Protocol (SNTP V4).

Future features will include support for Timing over Packet (ToP) per the evolving IEEE-61588 standard.

The system provides for five bridging or terminating reference inputs, which are software programmable. The average bit rate of the input reference must be in the range of ± 7.1 bits/sec for Stratum 3E/LNC or ± 0.04 bits/sec for Stratum 2/TNC oscillators to "pull-in". Digitally controlled phase-lock oscillators track separate DS1 or E1 framed input signals, if so configured, while the inputs are within the above limits. When one input is lost, its oscillator holds to the last known phase and the outputs are switched to the oscillator that is still tracking. If all inputs are lost, the worst case output drift results in less than two frame slips in the first 24 hours (Stratum 3E/LNC) while not locked to a network source of timing. For Stratum 2/TNC, the time to the first frame slip is typically 36 hours. In the event of catastrophic failure of both oscillators, the system will use either input defined as valid (by the qualification circuitry in the input/controller card) to drive the outputs directly.

The optional Model 6414 Retiming Timing Insertion Unit (RTIU) card allows legacy equipment not equipped with an external timing input port to be properly timed to Stratum levels by re-timing the DS1 signal. Two DS1s can be retimed per card.

Real time performance monitoring functions are controlled by the optional -SM Synchronization Monitor Option. This option provides system status and data collection for critical parameters, such as TIE, MTIE and Jitter. The StarClock TiemPo 6400 complies with Bellcore TANPL-000436, AT&T Pub 60110, ANSI/T1.101-1994, CCITT G.703-1998, Bellcore GR-63 and 1089 (NEBS Level 3). Wander and jitter attenuation conform to Bellcore TATS-000378. The TiemPo supports IPv6.



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Input/Controller Card

(Standard for all models, Master shelf only)

The TiemPo utilizes a modular integrated Input and Control card containing state-of-the-art electronics for enhanced reliability.

The TiemPo bridges or terminates, via software control, up to 5 existing DS1 circuits (SF or ESF, AML or B8ZS), E1 (CAS, CCS, CRC-4 on or off) / 2.048MHz square wave, or 64/8 KHz Composite Clock), to extract data and timing information for use by the patented PrecisionTime™ track and hold circuitry, and sends the refined clock signal to the output cards. The TiemPo also has a 5 or 10 MHz (software selectable) reference input to feed from a Cesium or other Stratum 1 standard.

The TiemPo's integrated alarm circuitry card collects alarm status information from all the other cards in the system and determines whether the overall alarm state is critical, major or minor. The card provides floating relay contact closure for critical, major, minor, audible, and visual summary alarms.

The TiemPo features include local and remote status reporting, performance monitoring, and alarm reporting through a front mounted RS-232 craft port, and a 10 or 100Base-T ethernet port which can connect to a Network Management System. The system can be configured to interface with an X.25 synchronous network with menu or TL1 language messages, or you can select to use the optional **StarLink** Element Management System (EMS) software. Also available is **CXRView**, a GUI interface for local or ethernet port control.

There are four levels of security provided for external monitoring and configuration of the system through a craft or telnet operation, and the system supports up to 10 simultaneous telnet sessions.

The Information Management feature of the Input/Controller card provides a serial data link to set alarm thresholds, measurement intervals, scanning mode, and configuration. A serial data link to the track and hold circuitry sets A-B input selection, functions, and configuration. Serial port information is available through TL1 or menu option with a Simple Network Management Protocol (SNMP) interface.

The system will switch to the external reference inputs in the event of a GPS failure and the internal clocks will both automatically switch back to GPS tracking when the failure clears. When not in GPS mode, the cards monitor the input reference signals for framing and CRC errors if so configured. An out of specification input signal forces the unit to switch to one of the other inputs. If no input is valid, the unit holds to the last known reference. The cards provides a smoothed, essentially jitter free tracking crystal oscillator signal or rubidium oscillator signal, (depending on how equipped) to the output cards. The phase of the output signal is continuous during any switch from track to hold. There is no output phase hit during the switch.

User Installed Options:

Output Driver/Retimer Cards

The Output Cards receive the timing signal from the track and hold modules and furnish multiple outputs for driving channel banks or other equipment. Each output card is supplied a differential 1.544MHz TTL clock sync signal from one of the two track and hold modules. The input signal is automatically obtained from one of the five input reference signals should both track and hold clock cards fail. Most output cards allow for 1-for-1 protection (programmable) with hitless digitally controlled switching. An alarm output signal is sent when one or more outputs have failed.

Model 6410-0

5/10MHz Output Driver

This card provides eight 5 MHz or 10 MHz sinewave outputs (programmable per port) at 1.0V Peak to Peak into 100 ohms. This is useful in lab environments, and is a great low cost alternative to a costly cesium beam reference standard.

Model 6411-0

IRIG-B Output Driver Card

This card offers eight IRIG-B outputs per card meeting all of the requirements of IRIG Standard 200-98, B122, PWM. This card requires that at least one GPS receiver card be equipped in the chassis. (The Model 6401-1 High Accuracy version is recommended)

Model 6412-0

Time Code Output Card

This card provides eight outputs with a programmable selection of 1 pulse per second (PPS), 1 pulse per minute (PPM), or 1 pulse per hour (PPH). Output pulse impedance is 100 ohms resistive, with output jitter of less than 25 ns. This card requires that there be at least one GPS receiver card (the Model 6401-1 High Accuracy version is recommended) equipped in the chassis. All outputs meet the requirements of Bellcore GR-2861

Model 6413-0

T1/E1/CC/2.048 Square Wave Output Driver Card

This card provides eight "programmable per port" outputs providing DS1/E1/CC or 2.048 Square Wave (G.704) compatible framed ones drive signals with fully selectable framing formats.

When a port is configured in the DS1 mode, the 6413 will drive any standard DS1 receiver through up to 655 feet of cable. Outputs allow card-to-card protection. Output jitter is less than 0.03 UI peak-to-peak (p-p) from 10Hz to 40MHz. The output pulse amplitude of $3\text{ V} \pm 0.3\text{ V}$ peak meets AT&T CB119 and CCITT G.703 requirements. Both SF and ESF framing formats are supported.

When the output ports are provisioned for Composite Clock (CC) outputs for driving D4 channel banks and other equipment that require CC clock inputs, the output signals are 64/8kbps, 5/8 duty cycle pulses, with bipolar pulse violation every eight pulses. The output waveshape meets CCITT G.703. Outputs are byte phase synchronized to within less than 520nS per GR378 CORE. Each output can drive up to 1500 feet of 22 AWG cable. All composite clock outputs are phase locked whether in one shelf or multiple shelf arrangements.

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The individual output ports can also be configured for bipolar E1 framed all ones at 2.048MHz CAS, CCS, or CRC-4 framing (selectable). Outputs are common frame and multi-frame synchronized with other E1 output cards. Output signals meet CCITT G.703 and output jitter is less than 0.03 UI p-p from 20Hz to 100kHz. Each output will drive a 120 ohm load through up to 655 feet of 22 AWG cable.

The individual output ports can also be provisioned for 2.048MHz square wave outputs. The card accepts a differential 1.544MHz TTL clock signal from one of the two track and hold modules, or from one of the five input reference signals if both track and hold cards have failed. The 2.048MHz square wave meets the CCITT G.703/704 standards.

Model 6414-0 Retiming Timing Insertion Unit (RTIU)

The Model 6414 Retiming Timing Insertion Unit card takes two external DS1 inputs, re-times, then outputs the signal to the same Stratum level as the installed active Clock Module. This is used generally for legacy equipment that must be timed from an incoming traffic bearing DS1 signal, or equipment that does not have provisions for external timing inputs. Up to 8 of these cards can be installed in a TiemPo Master shelf, so that up to 16 DS1s can be re-timed to Stratum standards. When Expansion shelves are added, up to 32 additional DS1s can be re-timed per shelf.

Model 6415-0

1.544MHz / 8KHz RS-422 Output Card

This card provides 8 EIA/TIA RS-422 differential TTL square wave outputs. The outputs are software programmable for either 1.544MHz or 8kHz outputs. This card can be used to provide timing to Nortel DMS-10 switches and others.

RF Input Reference Module Options

The Tiempo can be equipped with a variety of RF Reference Input reference modules, depending on the customer's technical requirements and budgetary limitations. These modules provide the primary reference signal for the TiemPo system. Both GPS based versions offer Stratum 1 accuracy. For full redundancy two modules of any type can be installed in a TiemPo system, and are hot swappable. There are also a variety of antenna and coaxial cable options available for any system requirement.

Model 6401-0

GPS Receiver Module- Economy Class Accuracy

The Model 6401-0 provides Stratum 1 level performance at an economy class price, and is perfect for systems that do not require ToP or NTP absolute time precision. This GPS receiver module has 20 parallel receiver channels, and accuracy is specified to be within 1 us to UTC.

Model 6401-1

GPS Receiver Module- High Accuracy

The Model 6401-1 provides additional features not found on the Economy Class version. These features include the ability to set initial position, (which means it will lock onto Stratum 1 mode much quicker), antenna short protection, Leap Second prediction, and Time Receive Autonomous Integrity Monitoring (TRAIM) support. This GPS receiver module has 16 high performance parallel receiver

channels, and is accurate to within 30ns of UTC. This makes it ideal for NextGen precise NTP and ToP applications.

Model 6401-3

CDMA Receiver Module

The Model 6401-3 CDMA Receiver Module extracts timing information from terrestrial CDMA based cellular providers. This module can be used in cases where sky access to GPS signals is impractical, undesirable, or unavailable. There are no subscriber fees to deal with to use the CDMA signals for timing, however, the signal received for timing may not be as accurate or as stable as GPS based timing. Accuracy is typically within 10 uS of UTC. The module comes complete with a chassis mounted stub antenna. Options include external antennas and coaxial cable.

Factory Installed Options:

Clock Module Options -A1 thru -C3

The TiemPo has the widest range of Clock Module options available. There is a low cost ovenized crystal oscillator providing Stratum 3E (LNC) holdover, a double ovenized crystal oscillator which provides economy Stratum 2 (TNC) holdover, and a premium rubidium oscillator which will provide Stratum 2E (Enhanced, near Stratum 1) holdover performance. All oscillators can be mixed and matched in redundant configurations, depending on your requirements and budget.

Synchronization Monitor Option -SM

The Synchronization Monitor Card Unit (SMU) measures the performance of the five reference DS1 or E1/2.048MHz inputs. It performs microprocessor-controlled input signal testing and measurements which provide TIE, MTIE, and JITTER information. The card allows for local or remote selection of alarm thresholds, inputs to be monitored, observation interval, number of consecutive intervals, and manual or automatic mode. The default mode is an automatic scan with observation intervals of 100 seconds per input. Other available intervals are from one to 100,000 in decade steps. Five independent phase detectors allow all five inputs to be measured simultaneously.

Network Time Server Option -NT

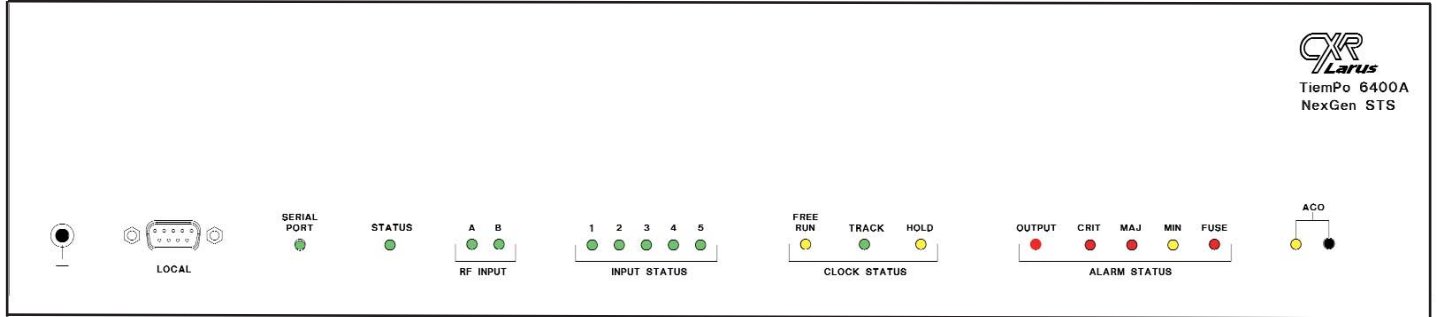
The TiemPo 6400 can act as a SNTP time server and provides not only automated time distribution, but also provides critical support to the integrity of a business, ensuring that IT operations can effectively and systematically manage the setting of time on their domain systems. Output is provided with a chassis mounted RJ-45 jack. This option requires that you have at least one High Accuracy GPS Module installed. Accuracy to UTC is within 2 ms and the TiemPo currently supports SNTP Version 4.

Timing over Packet (ToP) Option -TP

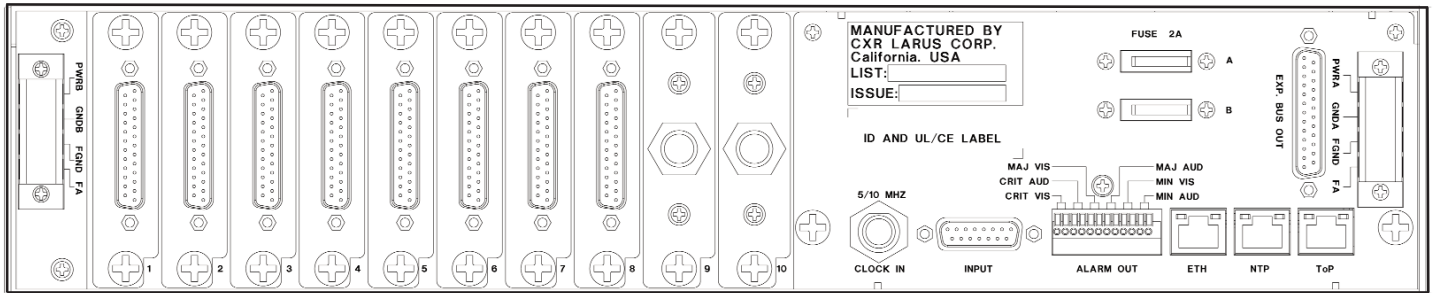
(Available 2007)

The TiemPo will be able to support NextGen Timing over Packet per IEEE-61588 through a chassis mounted RJ-45 connector. Upgrading a TiemPo to add ToP at a later date can be performed at the factory for a nominal fee.

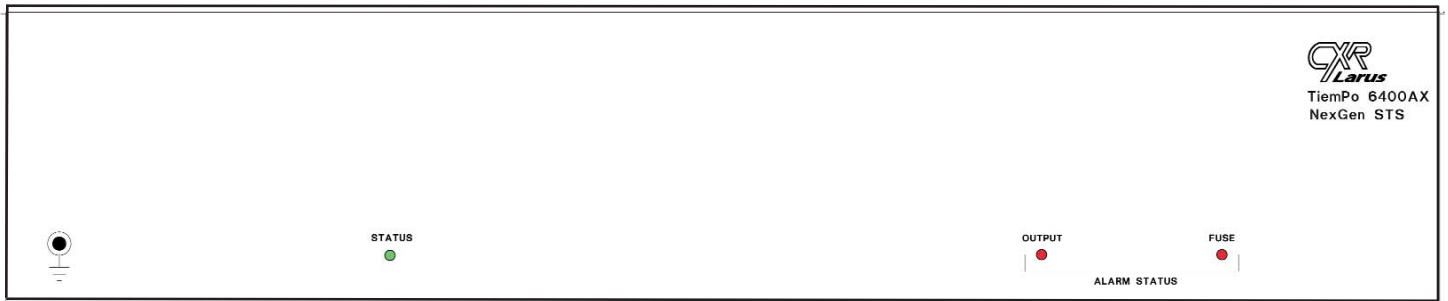
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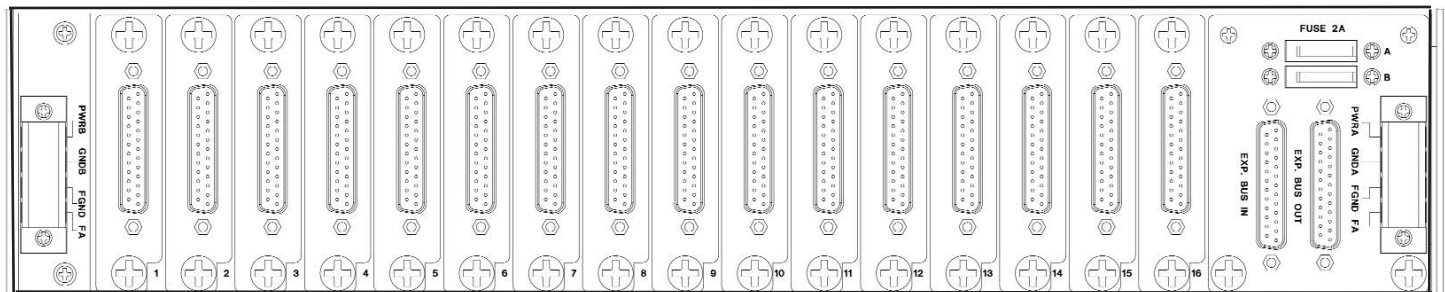
Front View, ANSI Master Shelf, Model 6400A



Typical Rear View, ANSI Master Shelf, Model 6400A



Front View, ANSI Expansion Shelf, Model 6400AX



Typical Rear View, ANSI Expansion Shelf, Model 6400AX