



# StarClock 200E

## System Overview Expandable Synchronization Timing

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The CXR Larus StarClock 200E™ Expandable Synchronization Timing System is designed as a fully redundant wander and jitter free source of framed ones, square waves, or composite clock synchronized to an accurate framed input reference source. The StarClock 200E is comprised of a series of plug-in cards which are designed for mounting in 19/23-inch NEBS compliant 18- and 22 slot rack mount Model 54500 Master and Model 54510 Expansion shelves, respectively. The system is available in GPS Stratum 1/PRC, Stratum 2/TNC and Stratum 3E/LNC versions. Each card provides its own conversion from office battery to logic power level (this allows cards to be hot swappable) as well as alarm contacts to the shelf fuse alarm bus. Two -48V power buses supply redundant power to each card. All cards are equipped with a front panel alarm indicator and a GMT power fuse.

Output driver cards are available for DS1, Composite Clock (CC), E1, 2.048MHz Square Wave, RS-422 1.544MHz or 8kHz Square Wave, and Network Time Protocol, (NTP). In a properly configured system up to 3,062 outputs can be obtained utilizing a Master and 8 Expansion shelves. The Master shelf by itself can supply up to 200 outputs, 100 when wired in protection mode, and each Expansion shelf can supply up to 360 additional outputs, 180 when wired in protection mode. .

The DS1 and E1 output driver cards provide Sync Status Messaging (SSM) in compliance with BellCore GR-378 and ANSI T1X1.3 TR33.

The system provides two bridging or terminating reference inputs. The average bit rate of the input reference must be in the range of  $\pm 7.1$  bits/sec for Stratum 3E or  $\pm 0.02$  bits/sec for Stratum 2 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 both inputs are lost, the worst case output drift results in less than two frame slips in the first 24 hours (Stratum 3E) while not locked to a network source of timing. For Stratum 2, 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 card) to drive the outputs directly.

The optional Network Time Server Card, Model 54580, is available only with a system equipped with GPS track and hold capability. Precision timing inputs are automatically provided when the card is plugged into the shelf behind a



working GPS track and hold card. Outputs include optional IRIG-B, 1PPS (accurate to 130 nanoseconds), and 10MHz sine (on rear access BNC connectors as well as an NTP output through a RJ-45 connector on the backplane); Output also includes alarm status. Initial setup commands are integrated into the command set for the entire StarClock 200E timing shelf.

The optional Model 54581 Timing Insertion Unit allows legacy equipment not equipped with an external timing input to be properly timed to Stratum levels by re-timing the DS1 signal. Two DS1s can be retimed per card.

Performance monitoring and alarm reporting functions are controlled by the T1 or E1/2.048MHz Synchronization Monitor Card, Information Management Card, and Alarm Interface Card. These cards provide system status, data collection, and alarm functions. The StarClock 200E complies with Bellcore TANPL-000436, AT&T Pub 60110, ANSI/T1.101-1994, and CCITT G.703-1998. Wander and jitter attenuation conforms to Bellcore TATS-000378.

### Input Cards

#### (All Models) 54511, 54512, 54513, and 54514

The 54511, 54512 and 54513 bridges or terminates existing DS1 circuits, E1/2.048MHz or CC, respectively, to extract data and timing information for use by the 54522 (Stratum 3E/LNC), 54523 (Stratum 2/TNC), 54591 and 54593 (Stratum 1/PRC) Track and Hold Clock Cards and sends clock to the output cards (used only if both track and hold cards fail). The 54514 card is used with the 54510 Expansion shelf.

#### 54511 DS1 Input Card

The 54511 card forwards monitoring and alarm information to the 54560 card to report loss of input signal, loss of frame, or excess bipolar violations. The framing format SF



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(D4) or ESF is automatically selected by the corresponding track and hold card or set from the 54550 Information Management Card. Line coding is AMI or BBZS, with automatic selection on each input. Output signals are 1.544MHz from either DS1 input selected by the corresponding track and hold card.

## **54512 E1/2.048MHz**

Operates similarly to 54511 with these exceptions: The framing format CAS or CCS and CRC ON or OFF (for E1 inputs only) is automatically selected by the corresponding track and hold card or set from the 54550 remove. Line coding is HDB3 on each E1 or 2.048MHz input selected by the corresponding track and hold card, are converted to 1.544MHz.

## **54513 CC/5 and 10MHz**

Operates similarly to 54511 with these differences: The 54513 is factory set through hardware to 64/8kHz CC, 5MHz (sine or square), or 10MHz (sine or square). No framing or line coding is supported.

## **54514 Expansion Shelf Input Card**

This card is specifically designed to be used with the 54510 Expansion shelf and accepts DS1, E1, CC, or Square Wave inputs depending on the List option chosen.

## Track & Hold Clock Cards

### **54522 Stratum 3E/LNC**

### **54523 Stratum 2/TNC**

The 54522 (Stratum 3E/LNC) and 54523 (Stratum 2/TNC) operate from either direct DS1, E1, 2.048MHz or CC inputs or the outputs from the bridging input cards (54511/54512/54513). The 54522 and 54523 process the information to derive a stable 1.544Mbps timing signal for the output cards. The 54591 (GPS Stratum 1/PRC Track and Stratum 3E/LNC Hold) operates similar to the 54522 but takes primary input from its integral GPS or CDMA receiver and direct wire inputs if the radio signal fails. The 54593 (GPS Stratum 1/PRC Track and Stratum 2/TNC Hold) operates similar to the 54523 but also takes primary input from its integral GPS receiver with direct wire inputs as back up if the radio signal fails. GPS is traceable to Universal Time Coordinated (UTC). The 54591 GPS and 54593 GPS operate to specifications while tracking as few as one satellite.

Both cards accept 1.544MHz data. The 54522 accepts clock data from a corresponding 54511, 54512, or 54513 input card. The 54523 uses two 1.544MHz input reference signals and extracts the timing. Both cards provide smooth and jitter free tracking. The 54522 tracks signal to the output cards and the 54523 tracks rubidium oscillator signal to the output cards.

The 54522 and 54523 both monitor inputs for framing and CRC-6 errors. An out of specification input signal forces the unit to switch to the other input card. If neither input is valid, the 54522 and 54523 both hold to the last known reference. The signal to the output cards is continuous during any switch from track to hold or any switch of input refer-

ence. There is no phase hit during the switch. The 54523 has an alternative 10MHz input for a high stability timing source such as a GPS receiver or a cesium clock. With this input, phase tracking of the input reference does not occur.

### **54591 GPS Stratum 1/PRC Track & Stratum 3E/LNC** **54593 GPS Stratum 1/PRC Track & Stratum 2/TNC**

Both Hold cards integrate GPS receivers to realize a primary reference source for Stratum 1/PRC operation (Backup Stratum 3E/LNC performance during a GPS failure for the 54591). The 54593 maintains long term frequency accuracy ( $1 \times 10^{-11}$  or better) per Bellcore GR-2830-CORE and ITU-G.811. The 54591 also accepts and monitors two 1.544 MHz signals from the input cards, (54511/54512/54513). For the 54593, the card accepts and monitors two 1.544MHz reference input signals and extracts timing for Stratum 2/TNC operation.

The system will switch to the 1.544MHz inputs in the event of a GPS failure and the 54591 and 54593 will both automatically switch back to GPS tracking when the failure clears. When not in GPS mode, the cards monitors the input reference signals for framing and CRC-6 errors if so configured. An out of specification input signal forces the unit to switch to the other input. If neither input is valid, the unit holds to the last known reference. The cards provides a smoothed, essentially jitter free tracking crystal oscillator signal (54591) or rubidium oscillator signal (54593) 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.

## Synchronization Monitor Cards

### **54541 T1 or 54542 E1/2.048MHz Square Wave**

The Synchronization Monitor Card Unit (SMU) measures the performance of the two reference DS1 or E1/2.048MHz inputs and three external DS1 or E1/2.048MHz inputs. The addition of a second SMU provides performance monitoring of five additional inputs. The 54541 Synchronization Monitor Card measures DS1 input performance while the 54542 measures E1/2.048MHz input performance. The 54550 Information Management Card supplies local and remote status reporting and control through RS-232 and ethernet TCP/IP ports. Alarm status information from other cards is gathered by the 54560 Alarm Interface Card which transmits relay contact closures.

The cards are microprocessor-controlled input signal testing and measurement synchronization monitor units 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. Two independent phase detectors allow two of the five inputs to be measured simultaneously. The five are input references A and B and three external inputs on the primary SMU. The second SMU card (optional) monitors five additional external inputs.

## Information Management Card

### 54550 Information Management Card

Card features include local and remote status reporting, performance monitoring, and alarm reporting through an RS-232 or TCP/IP port to a local type craft terminal operating at 1200 to 9600 baud asynchronous. A separate RS-232 or ethernet TCP/IP port for remote access connection to a Network Management System can be configured to interface with an X.25 synchronous network with menu or TL1 language messages.

The Information Management 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 cards sets A-B input selection, functions, and configuration. Serial port information is available through TL1 or menu option. Optionally, a Simple Network Management Protocol (SNMP) interface module can be ordered which attaches to the rear of the shelf.

## Alarm Interface Card

### 54560 Alarm Interface Card

The 54560 card collects alarm status information from all the other cards in the system and determines whether the overall alarm state is major or minor. The card provides floating relay contact closure for major, minor, audible, and visual summary alarms.

## Output Driver Cards

### All models (54571 through 54577)

Output Cards receive the timing signal from the track and hold cards and furnish multiple outputs for driving channel banks or other equipment. The input signal to the 54571 through 54579 output cards is differential 1.544MHz TTL clock sync from one of the two 54522/54523/54591/54593 Track and Hold Cards. The input signal is automatically obtained from one of the two input reference signals should both track and hold clock cards fail. One or more failed outputs activate an alarm. Most output cards allow for 1-for-1 protection with hitless digitally controlled switching.

### 54571 T1 Output Driver

Card provides (20) DS1 DSX compatible framed ones drive signals with either SF or ESF framing. The 54571 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. An alarm output signal notifies the 54560 Alarm Interface Card when one or more outputs have failed.

### 54572 Composite Clock Output Driver

Card provides (20) Composite Clock (CC) outputs for driving D4 channel banks and other equipment that require composite 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.

### 54573 E1 Output Driver

Card provides (20) outputs supporting bipolar E1 framed all ones at 2.048MHz CAS, CCS, or CRC-4 framing (switch 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.

### 54574 2.048MHz Square Wave Output Driver

Card provides (20) 2.048MHz square wave outputs. The card accepts a differential 1.544MHz TTL clock signal from one of the two track and hold cards or from one of the two input reference signals if both track and hold cards have failed. The 2.048MHz square wave meets the CCITT G.703 standard.

### 54575 RS-422 Output Driver

Card provides (10) EIA/TIA RS-422 differential TTL square wave outputs. List options are available for 1.544MHz or 8kHz outputs.

### 54577 5/10MHz Output Driver

Card provides (2) 5MHz and (2) 10MHz sinewave outputs at 1.0V Peak to Peak, with automatic selection of input references. Automatic selection can be overridden by manual/remote selection.

## Special Purpose Cards

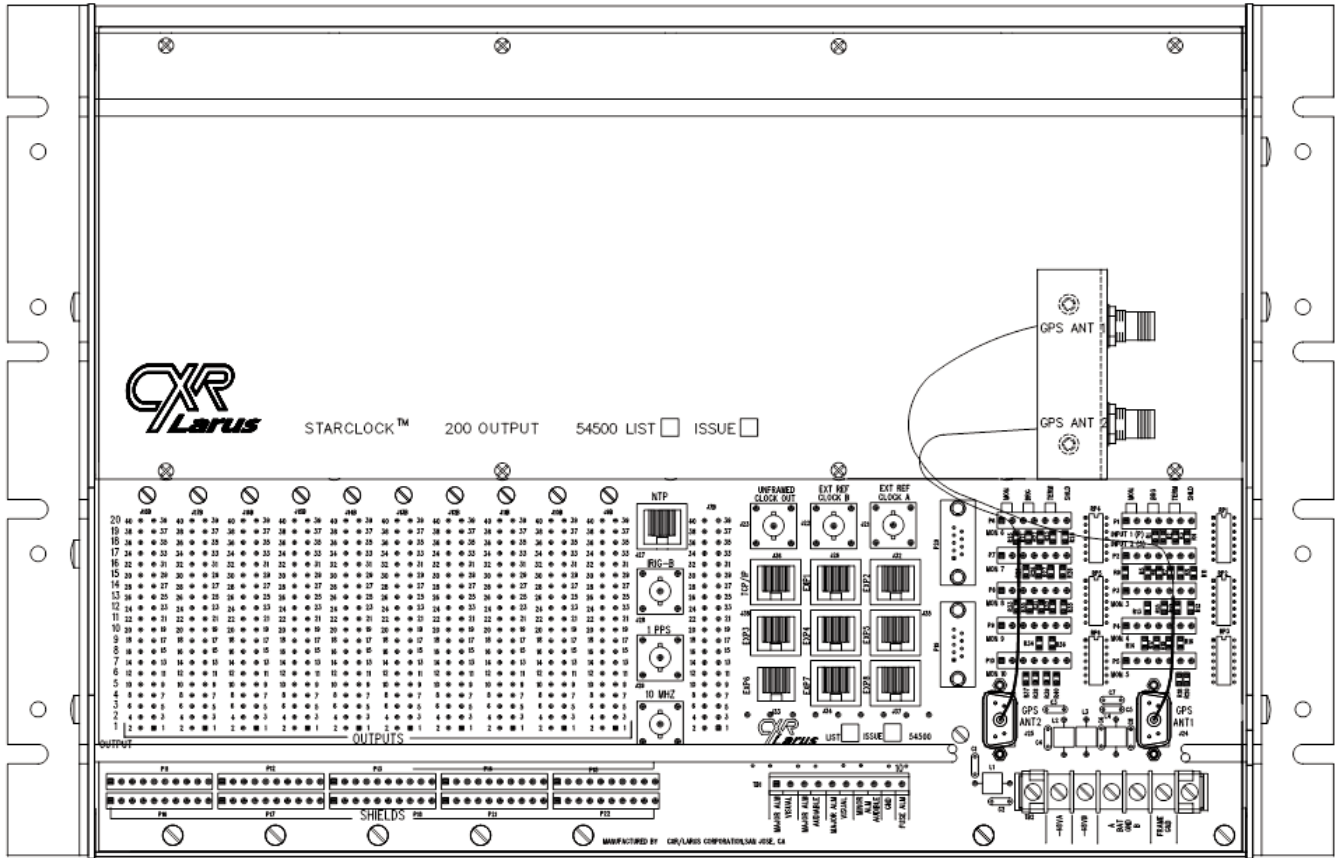
### 54580 Network Time Protocol / IRIG-B Server Card

The 54580 card, in conjunction with the GPS track and hold modules, distributes time for precise synchronization of client computer clocks over a network. Timing is acquired from GPS satellites and distributed to the customer's network using NTP. The card also provides 1PPS and 10 MHz sinewave outputs and an IRIG-B output as an option.

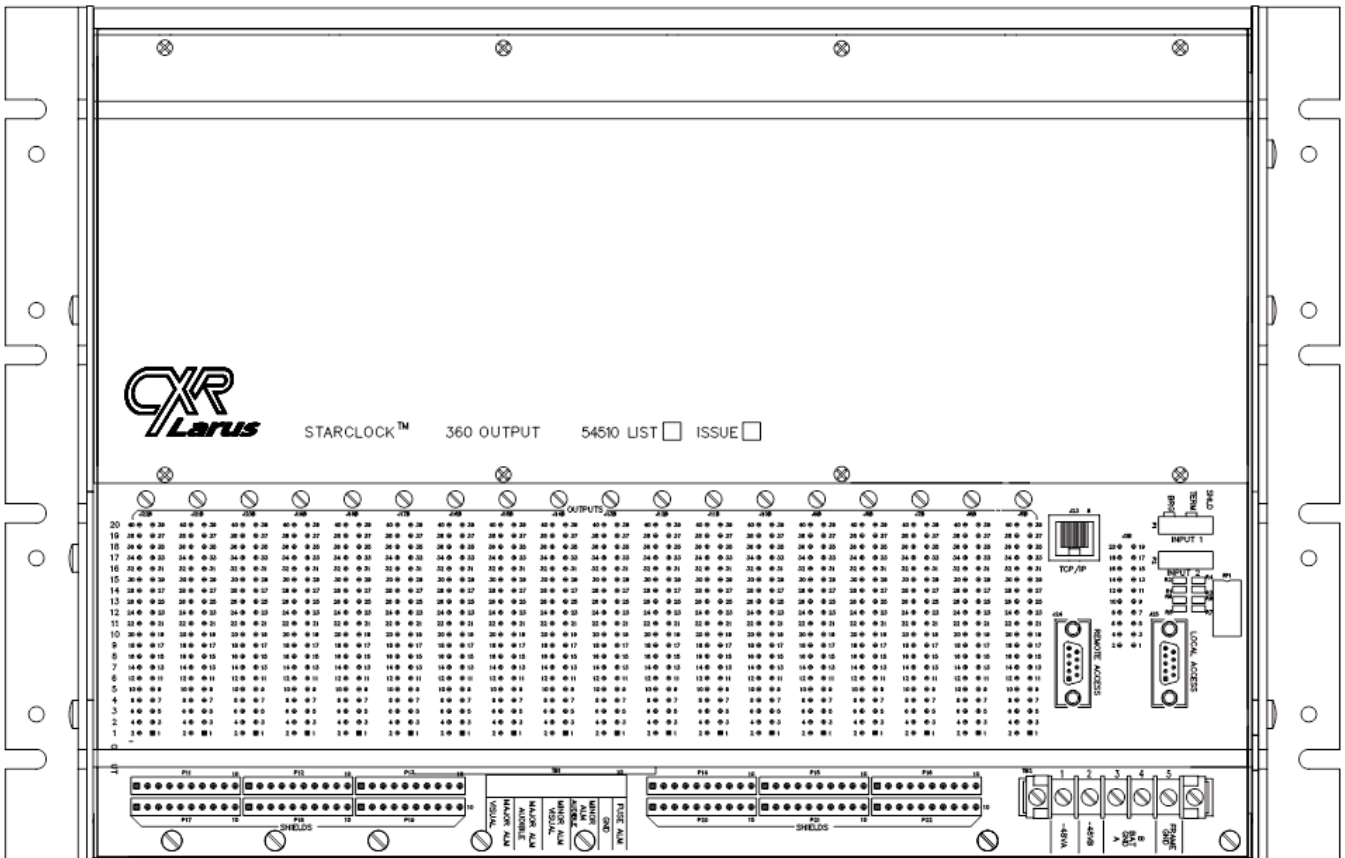
### 54581 Timing Insertion Unit Card

The 54581 Timing Insertion Unit card takes two external DS1 inputs, re-times then outputs the signal signal to the same Stratum level as the installed active Clock Card. This is used generally for legacy equipment that must be timed from an incoming traffic bearing DS1 signal, or the equipment does not have provisions for external timing inputs.

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Rear View, Master Shelf



Rear View, Expansion Shelf

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