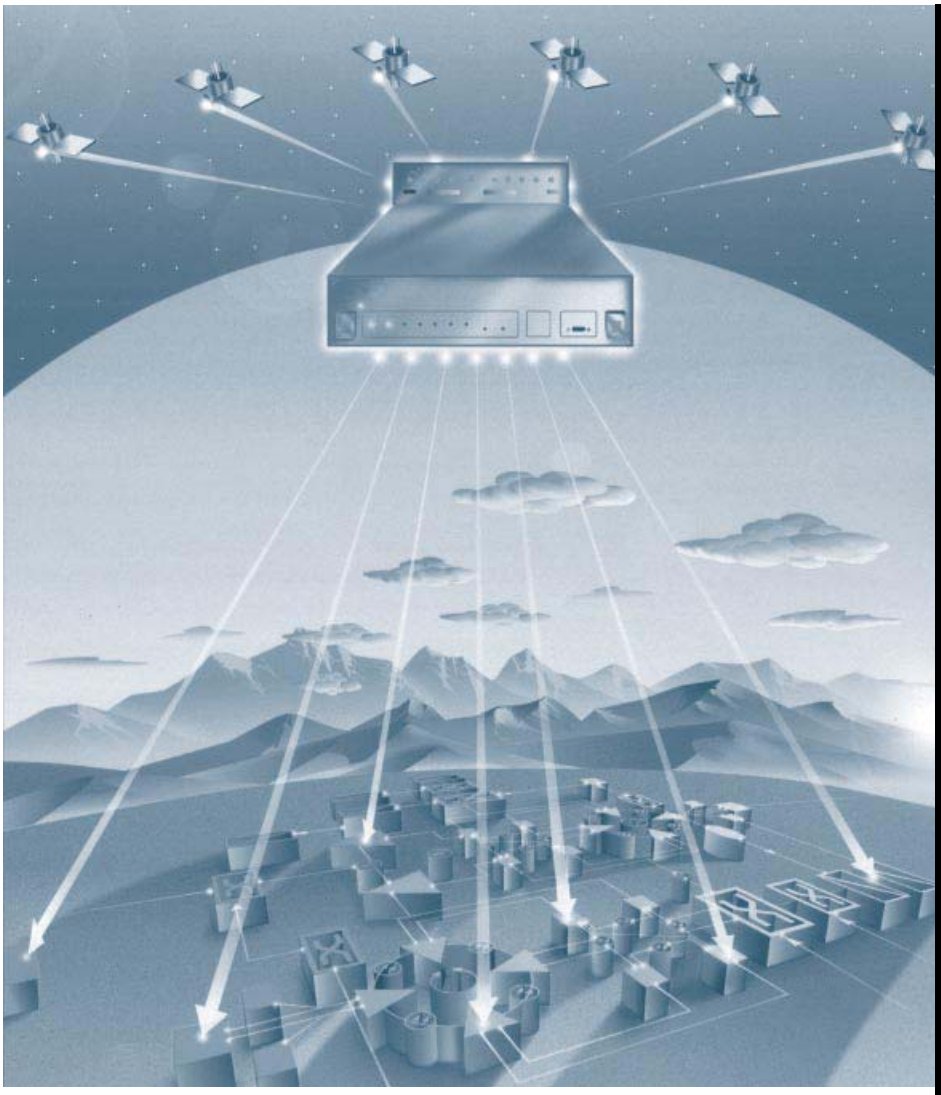
55300A Makes Stratum 1 Timing Affordable



Symmetricom Innovation for 21st Century Network Synchronization

55300A Telecom
GPS Primary
Reference Source

Symmetricom™
Heartbeat of the Net

55300A GPS Telecom Primary Reference Source

The 55300A GPS Telecom Primary Reference Source makes stratum 1, cesium-quality timing affordable at every node on a telecommunications network. This modular unit converts GPS satellite signals into a stable timing source. It then provides this highly-reliable, low-cost source of precise frequency to networks previously dependent on high-cost cesium clocks.

The 55300A uses SmartClock technology in combination with a high quality quartz oscillator to give performance that exceeds ITU and ANSI requirements.

Ideally suited for SDH or SONET networks, the unit is available in both 2048 kHz/kbps (E1) and 1544 kHz/kbps (T1) versions and also provides 10 MHz, 1-pps and time-of-day outputs. This general purpose unit is compatible with any BITS or SSU and can be used to upgrade synchronization in any office.

The 55300A is available in two versions, the T1 model (top), which operates at 1544 kHz/kbps, and the E1 model (bottom), which operates at 2048 kHz/kbps.

55300A Provides the Accurate Timing Needed by SONET/SDH Networks

Your goal as a service provider is to keep your network up and running and to deliver high-quality, reliable service to your customers—all at a cost that allows you to be profitable.

But the unique timing problems that occur on SONET/SDH networks—such as timing loops, short-term jitter and excessive wander accumulation—often result in poor quality of service and customer complaints. Wireless networks also experience quality of service problems when poor timing causes delayed handoffs, dropped calls and lost data. (See table below.)

ATM Constant Bit Rate (CBR) services and Voice over IP (VoIP) services also requires proper timing.

Addressing your need for better timing, Symmetricom engineers have developed a breakthrough technology called SmartClock that improves the performance and reliability of oscillators that are referenced to GPS. A proprietary filtering technology removes jitter to further improve the GPS signal. By placing this low-cost, highly accurate GPS timing wherever it is needed in your network, you can eliminate your dependence on embedded network element clocks, that are insufficient to support next-generation technologies.

The development of SmartClock is a continuation of Symmetricom's innovation and leadership in timing synchronization.

Symmetricom has leveraged this experience into products that will prepare your communications network for deployment of SONET/SDH, ATM CBR, VoIP, DSL, and wireless infrastructure technologies. The benefits that follow respond to your need for affordable, improved timing.

You can afford to place cesium-quality timing everywhere in your network.

Stratum 1 performance at every site

The 55300A makes cesium-quality timing affordable throughout your network. The following features work together to achieve unparalleled accuracy when the unit is locked to GPS.

Wireline	
Voice	Low impact or occasional click
Fax	Distorted, unreadable faxes
Data	Corrupted or lost data, or frequent transmission causing delays
Video Phone	Dropped video portion
Encrypted Data	Dropped session, retransmission compromises security
SSP Networks	Errored data
Wireless	Dropped calls and delayed handoffs

Figure 1. Impact of Poor Synchronization on Quality of Service

You get maximum uptime with superior holdover and quartz reliability.

SmartClock

Proprietary SmartClock technology adds intelligence in the form of firmware algorithms to oscillators that are referenced to GPS. When locked to a GPS reference signal, SmartClock compares the frequency of the oscillator to the reference signal and uses this information to adjust the oscillator frequency to match the reference signal.

Enhanced GPS digital filter

A digital filter, called Enhanced GPS, minimizes the effects of short-term jitter on the GPS signal, further improving the quality and performance of the unit.

TRAIM protection from bad satellites

Multiple levels of error detection are built into the 55300A to maximize the time the unit is locked to GPS and providing stratum 1 timing. If three or more satellites are being tracked and one of them begins to transmit bad data, a Time RAIM (Receiver Autonomous Integrity Monitoring) algorithm identifies and removes the bad satellite from the tracking list. (See details on page 6, "When GPS transmits inaccurate signals, TRAIM takes over.")

By placing this low-cost, cesium-like timing at lower levels of your network, you can make stratum 1 timing available at every office, thereby "flattening" your network from three levels of timing down to one level. (See diagram on page 5).

Maximum uptime

Before SmartClock, you had to make tradeoffs between performance, reliability and cost. With SmartClock, those tradeoffs are no longer needed. You get all the holdover and long-term stability you need from low cost quartz.

Stratum 2 holdover

In the unlikely event that the incoming GPS reference signal is lost, SmartClock automatically switches the node's timing system into an intelligent holdover mode, providing unparalleled accuracy while not locked to GPS.

SmartClock takes control of the oscillator so that it continues to distribute highly stable synchronization outputs. Having learned the oscillator's behavior (aging rate and effects of temperature) when it was locked to the reference signal, SmartClock adjusts the oscillator as needed. When the reference signal is restored, the unit automatically relocks.

Flatten the Network with "Cesium" Performance at Every Node

Carriers need the best possible performance and reliability throughout their networks at the lowest possible cost. On most telecommunications networks today, cesium timing is available only at the top of the network hierarchy. Less accurate stratum 2 and 3 timing is available at lower offices in the network. (See Figure 2.)

Symmetricom recommends "flattening" the network by making cesium-quality GPS SmartClock timing available at every location, with distributed timing used for backup. (See Figure 3.)

Our new SmartClock technology, described above, improves the reliability of GPS to create low-cost timing solutions that rival cesium performance when locked and rubidium performance during holdover. As a result, you can afford to have stratum 1 accuracy everywhere on your network. We call this "flattening the network."

By putting cesium-quality timing at every node, you can shorten the synchronization distribution chain so that the serious timing problems caused by jitter, timing loops and pointer adjustments are minimized. You gain the flexibility to more easily expand your network to support faster digital technologies and a larger subscriber base.

The 55300A provides stratum 2 holdover for up to five days—giving you plenty of time to repair the source of the problem.

Superior quartz reliability

The 55300A quartz oscillator's unmatched reliability of greater than 500,000 hours MTBF means the unit will operate longer before failure. More time between failures means greater uptime throughout your network.

Practical antenna design

The GPS receiver is located inside the building and not on the antenna. This configuration lets you place a filter on the cable between the antenna and the receiver to remove interference. By filtering out unwanted signals, you will avoid being knocked off line. The filter also removes harmonic signals, enabling you to receive GPS next to transmitters that operate near harmonics of GPS.

Built-in management

Over the long term, perhaps the most important feature that leads to maximum uptime for each network office is the built-in management link.

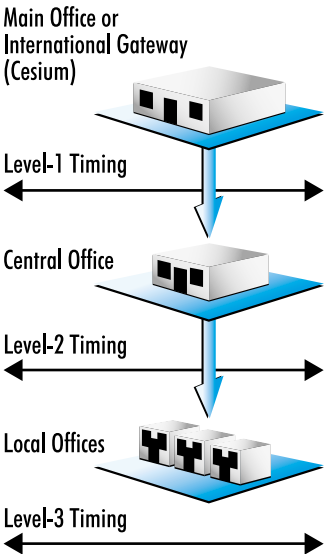
TL1 commands and hard-wired, programmable alarms make the 55300A ready for a future of network management that goes far beyond simple alarm management.

You get low cost of ownership because the 55300A needs virtually no maintenance.

Once you deploy open-system synchronization network management software, you'll be able to manage all of the timing sources on your system to immediately identify the precise cause of timing synchronization problems, as well as the source and degree.

From your network management system, you can manage not only the PRS alarms, but also PRS configuration, performance and security. An important, programmable

Figure 2. BEFORE: The Multilevel Network



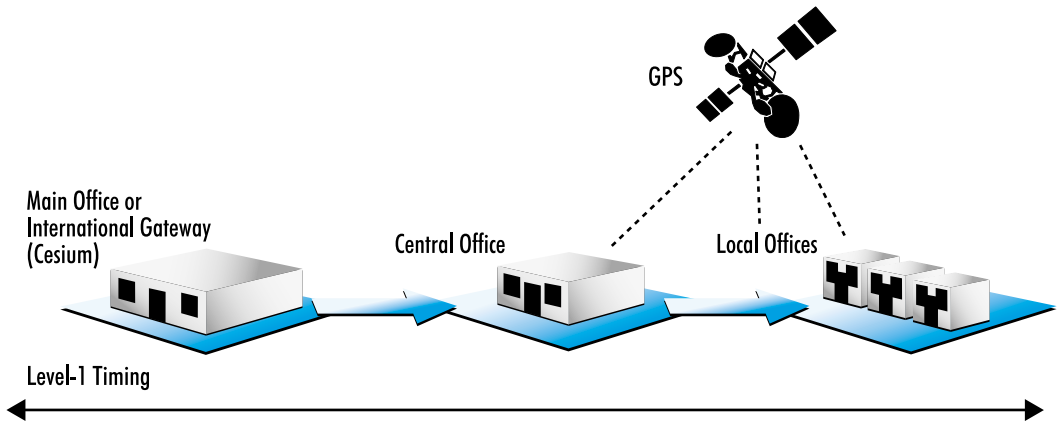


Figure 3. AFTER: Symmetricom's "Flattened" Network

Your investment really pays off when you use the network management capabilities.

"squelch time" feature lets you suppress an alarm. This enables the PRS to ignore short GPS interruptions or occasional cable disconnects, thereby improving network performance. Network management also lets you continuously monitor the interconnectivity of your entire timing network, detect timing loops and know when to reconfigure your timing for maximum efficiency and uptime.

Low cost of ownership

The best news of all is that you can afford to deploy this superior timing module anywhere it is needed in your network because the cost of ownership is low.

Cesium quality at one-tenth the cost

By adding Enhanced GPS digital filters, the 55300A makes GPS perform at the level of cesium—but at one-tenth the cost of a cesium clock.

Low-cost antenna

Unfortunately, storm damage and vandalism create the need to replace antennas. Replacement cost for Symmetricom's antenna is low because it is small and does not house the receiver.

Low maintenance

Virtually no periodic maintenance is required for the 55300A.

Also provides time of day

When you need time of day you won't have to buy another piece of equipment. The 55300A offers IRIG-B format and can be attached to a workstation running Network Time Protocol (NTP).

Ready for network management

Nothing will reduce the cost of operating your network more than network management. The unit is ready to be managed from a central location through RS-232 or a LAN converter. You'll no longer need a staff of technicians to monitor and maintain your network's timing.

When GPS transmits inaccurate signals, TRAIM takes over

Early in the use of GPS for accurate timing, Symmetricom discovered that occasionally one of the 24 GPS satellites will transmit inaccurate timing signals. To protect against the use of inaccurate timing, Symmetricom uses a Time RAIM (Receiver Autonomous Integrity Monitoring) algorithm.

TRAIM firmware detects those satellites that are transmitting errored data and removes them from the tracking list. If three or more satellites are being tracked and one of them begins to transmit bad data, TRAIM isolates and removes the bad satellite until the satellite has recovered. If only one or two satellites are being tracked, TRAIM detects a jump in time and puts the 55300A into holdover until the GPS satellite recovers.

Users determine how far off the satellite can be before TRAIM rejects it. You simply set the threshold that is acceptable for time interval error after the TRAIM technology has identified poor signal integrity.

Summary of Key Specifications and Features

Symmetricom's large installed base of thousands of units gives you the assurance that these GPS sources are field proven. The OEM units we have built for major network equipment manufacturers have been performing to the specifications listed below—on real networks—since 1995.

Symmetricom supports the 55300A with comprehensive warranty, training, service and support services.

55300A Telecom GPS Primary Reference Source

Features

- Highly-reliable, low-cost source of precise timing
- Exceeds published specifications for primary reference clocks
- Conforms to ITU-T G.811, ETS 300 462-2 (formerly DE/TM-3017-6) and ANSI T1.101-1994 standards
- Highly-reliable quartz oscillator with SmartClock technology
- Network time protocol synchronizes networked computers
- Complies with new standards for SDH/SONET
- Built-in management includes hard-wired, programmable alarms and TL1 commands

Specifications

- Locked accuracy: $<1 \times 10^{-12}$ using a 1-day average (when locked to GPS)
- Holdover stability: $<1 \times 10^{-10}$ /day
- Outputs: 1544 kHz/kbps, 2048 kHz/kbps, 10 MHz or 1 pps
- Time of Day (TOD): RS-232 UNIX Network Time Protocol or IRIG-B (BNC)
- Framing: Industry-standard formats
- Oscillator MTBF: >500,000 hours
- Cold startup: GPS lock in <30 min (assumes "normal" view of sky)
- Mechanical: ETSI and NEBS form factors

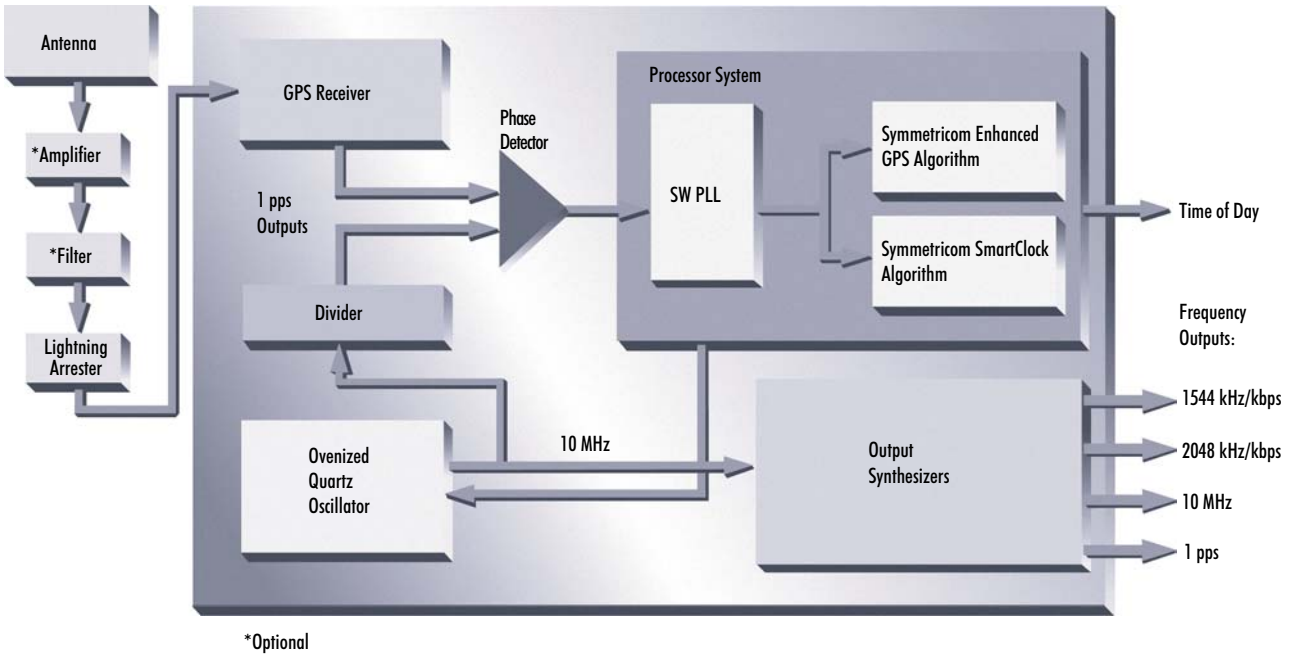


Figure 4. 55300A Block Diagram shows the path of the GPS signal from the antenna to the multiple frequency outputs.

Specifications and Characteristics of the 55300A

Primary Reference Source (PRS) features:

- Cesium-like (Stratum 1) performance at one-tenth the cost meets the requirements of GR-2830-CORE, ITU-T G.811, and ANSI T1.101-1994
- Highly reliable quartz oscillator with SmartClock technology
- Six-channel, parallel tracking GPS engine with Enhanced GPS technology
- Time-of-day (TOD) features to synchronize computer systems using Network Time Protocol

Performance Specifications

Description	Specification
Stratum 1/Level 1 - Accuracy	$< 1\times10^{-12}$ when locked to GPS (24 hour average)
Holdover Stability	$< 1\times10^{-10}$ /day (See Notes 1 and 2)
Outputs Available (as specific options)	Opt 104, 1544 kbps, 100Ω balanced, D4 Opt 105, 1544 kbps, 100Ω balanced, ESF Opt 220, 2048 kbps, 120Ω balanced, CCS Opt 221, 2048 kbps, 120Ω balanced, CAS Opt 222, 2048 kbps, 120Ω balanced, CCS-CRC4 Opt 270, 2048 kbps, 75Ω unbalanced, CCS Opt 271, 2048 kbps, 75Ω unbalanced, CAS Opt 272, 2048 kbps, 75Ω unbalanced, CCS-CRC4
Standard Outputs	1544 kHz or 2048 kHz, 1 PPS and 10 MHz
MTBF of Oscillator (typical characteristic)	> 500,000 hours
Cold Startup	Achieves GPS lock in less than 30 minutes (assumes "normal" view of sky)[3]
Time of Day (TOD) - Standard connector	RS-232 UNIX Network Time Protocol or IRIG-B
Port 1 (local access port - front of module)	DE-9S, DCE female
Monitor Port (front of module)	Standard telecommunication bantam jack
Weight of 55300A module	3.7 lbs (1.7 kg)

Note 1. This specification has a 95% probability, and is based on the availability of four or more GPS satellites during three days of locked operation with a fixed antenna location. The temperature must remain within a 10° range between 10° C and 40° C.

2. When a quartz crystal oscillator has not been operated for a period of time, or if it has been subjected to severe thermal or mechanical shock, as might be encountered during product shipment, the oscillator may take some time to stabilize. In most cases, the oscillator will drift and then stabilize at or below its specified rate within a few days after being turned on. In isolated cases, depending upon the amount of time the oscillator has been off and the environmental conditions it has experienced, the oscillator may take up to one week to reach its specified aging rate and to operate without significant frequency "jumps."

3. The 55300A GPS receiver, when it is initially turned on and locked to the GPS satellite system, will achieve GPS lock within 30 minutes of operation. The longer the GPS receiver (and its quartz oscillator) operates, the better its stability and unlocked (holdover) performance becomes.

Specifications for Outputs

DESCRIPTION	SPECIFICATION
1544 kbps (DS1) Output (Options 104, 105)	Framed all 1s, ESF or D4, switch selectable AMI (B8ZS) Traceable to UTC ITU-T G.703, Table 4, Fig 10
Impedance	100Ω Balanced
MTIE & TDEV	Meets requirements of GR-2830 for PRS
1544 kHz Output	
Output Type	1544 kHz per ITU-T G.703, Table 10, Fig 21
Wave Form	75Ω:1.5 Volts peak maximum, 0.75 Volts peak minimum
Wave Shape	Square Wave
Impedance	75Ω unbalanced
10 MHz Output	
Frequency Accuracy - Locked	$< 1\times10^{-12}$, one day average
Holdover aging	$< 1\times10^{-10}$/day (See Notes 1 and 2.)
Frequency Stability (1 second averaging)	5×10^{-12} Root Allan Variance (RAV) @ 1 sec
Waveform	Sinewave, > 1 Volt pk-pk into a 50Ω load
Harmonic Distortion (Typical)	< –25 dBc (typical)
Non-Harmonic Signals (Typical)	< –60 dBc (typical)
Source Impedance (nominal)	50Ω
Coupling	AC
1 PPS Output	
Jitter of leading edge	Pulse-to-pulse jitter of leading edge: <750 ps with at least one satellite in view
Accumulated time error	< 8.6 μs per day unlocked, for 24 hours. (See Notes 1 and 2.)
Waveform - Pulse width	26 μs - 2.4 Volts minimum into 50Ω load (TTL compatible)
Time Accuracy	< 110 ns with respect to UTC with Selective Availability on –95% probability when unit is properly installed, calibrated, and locked to GPS.
2048 kbps Output (Options 220, 221, 222, 270, 271, 272)	
Output Type	2048 kbps, framed per ITU-T G.703, Table 6; all 1s, CCS, CAS, CRC4 switch selectable AMI (HDB3)
Waveform	Options 270, 271, 272: 2.37 ± 0.237 Volts peak (75Ω) Options 220, 221, 222: 3.0 ± 0.3 Volts peak (120Ω)
Wave Shape	Rectangular, pulse width 244 ns ± 25 ns, pulse interval 488 ns per ITU-T G.703, Table 6, Fig 15
Impedance	Options 270, 271, 272: 75Ω unbalanced Options 220, 221, 222: 120Ω balanced
2048 kHz Output	
Output Type	2048 kHz per ITU-T G.703. Table 10, Fig 21
Wave Form	75Ω:1.5 Volts peak maximum, 0.75 Volts peak minimum
Wave Shape	Square Wave
Impedance	75Ω unbalanced

Specifications and Characteristics for Alarm Output

Description	Specification
Alarms available	Critical, Major, and Minor; alarm causes are selectively assignable to alarms.
Alarm Relay Contact Ratings:	
Switching Power	60 W maximum
Switching Voltage	30 Vac or 60 Vdc maximum
Switching Current	2 A maximum
Alarm Relays (6):	
3 Critical, Major, Minor	Normally open and normally closed contacts
3 Critical, Major, Minor with alarm cutoff	Normally open and normally closed contacts
Alarm causes	Power failure, Output failure, Oscillator failure, Synthesizer failure, Loss of GPS signal (holdover), Self-test failure

Commands/Status

Commands and status returns are compatible with TL1 as specified in GR-833-CORE, TR-NWT-000834, and GR-199-CORE.

Rack Mount Shelf Specifications and Characteristics

55310A GPS NEBS/EIA Rack Mount Shelf—100W Balanced Outputs
(Used with 55300A Options 104, 105)

Description	Specification
Rack Mount Configuration	Compatible with standard NEBS 23" or EIA 19" racks
Size–W×H×D–in (mm)	16.73×3.35×11.19 (425×85.1×284.3)
Weight of Rack Mount Shelf	4.4 lbs (2.0 kg)
Power Requirements	Dual redundant power inputs (A and B) –48 Vdc, nominal
Connectors on back of rack mount:	
10 MHz Output	BNC, 50Ω nominal
1 PPS	BNC, 50Ω nominal
TOD IRIG-B	BNC, 50Ω nominal
1544 kHz Output	BNC, 50Ω nominal
GPS Antenna	Type N (female)
Power Inputs	Augat Snap-on pressure clamp
1544 kbps Output	Wire-wrap pins, 100Ω balanced
1 PPS (RS 422)	Wire-wrap pins
Alarms	Wire-wrap pins
Time of Day (TOD)	RS-232 DE-9P DTE, male (1 PPS DCD included)
Remote Access Port	RS-232 DB-25S DTE, female

55320A GPS ETSI Rack Mount Shelf—75W Unbalanced Outputs
(Used for 55300A Options 270, 271, 272)

Description	Specification
Rack Mount Configuration	Compatible with standard ETSI 535 mm or EIA 19" racks
Size–W×H×D–mm (in)	425×168.4×257.3 (16.73×6.63×10.13)
Weight of Rack Mount	6.1 lbs (2.8 kg)
Power Requirements	Dual redundant power inputs (A and B) –48 Vdc nominal
Connectors on Shelf:	
10 MHz Output	BNC, 50Ω nominal
1 PPS	BNC, 50Ω nominal
TOD IRIG-B	BNC, 50Ω nominal
2048 kHz Output	BNC, 75Ω nominal
GPS Antenna	Type N (female)
Power Inputs	Augat Snap-on pressure clamp
2048 kbps Output	BNC, 75Ω balanced
1 PPS	BNC (2) RS-422 (differential pair)
Alarms	DB-25P, male
Time of Day (TOD)	RS-232 DE-9P, DTE male (1 PPS DCD included)
Remote Access Port	RS-232 DB-25S DTE, female

55322A GPS ETSI Rack Mount Shelf—120Ω Balanced Outputs (Used with 55300A Options 220, 221, 222)

DESCRIPTION	SPECIFICATION
Rack Mount Configuration	Compatible with standard ETSI 535 mm or EIA 19" racks
Size–W×H×D - mm (in)	425×168.4×257.3 (16.73×6.63×10.13)
Weight of Rack Mount	6.1 lbs (2.8 kg)
Power Requirements	Dual redundant power inputs (A and B) –48 Vdc nominal
Connectors on Shelf	
10 MHz Output	BNC, 50Ω nominal
1 PPS	BNC, 50Ω nominal
TOD IRIG-B	BNC, 50Ω nominal
2048 kHz Output	BNC, 75Ω nominal
GPS Antenna	Type N (female)
Power Inputs	Augat Snap-on pressure clamp
2048 kbps Output	DE-9S, 120Ω balanced
1 PPS	DE-9S (2) RS-422
Alarms	DB-25P, male
Time of Day (TOD)	RS-232 DE-9P, DTE male (1 PPS DCD included)
Remote Access Port	RS-232 DB-25S DTE, female

Environmental Specifications

DESCRIPTION	SPECIFICATION
Power Requirements	–48 Vdc nominal, 700 ma startup; 350 ma steady state –37 to –60 Vdc operating range, –46 Vdc required to start
Temperature Range	Operating: 0° C to +50° C Storage: –40° C to +70° C

Specifications for GPS Antenna & Antenna Cable

DESCRIPTION	SPECIFICATION
Active Antenna	30 dB (typical) active gain with dielectric filter
Antenna Power Requirements	5 V (nominal); 50 ma maximum (supplied by 55300A)
Temperature Range	Operating: –30° C to +80° C Storage: –40° C to +85° C
Antenna Cable Types	RG-213 cable is recommended for lengths up to 175 ft (53 m). A line amplifier is required with RG-213 cable when lengths exceed 175 ft (53 m). LMR-400 cable is recommended for lengths greater than 175 ft (53 m); it is a lower loss cable. A line amplifier is required with LMR-400 for distances greater than 377 ft (110 m).
Cable connectors	Type N male connector at the 55300A Type N male at the antenna

Antenna Installation

For optimum performance, the antenna should be installed in a location which gives it a clear view of the entire sky. The 55300A requires at least four satellites to be visible in order to determine latitude, longitude, elevation and time.

Up to 377 feet (110 meters) of LMR-400 cable may be used between the antenna and the 55300A before an antenna line amplifier is required (if using RG-213 cable, one is needed at 175 feet/53 meters). For applications which require longer cable runs, please consult your Symmetricom representative. Lower loss cable and antenna line amplifiers are available to meet most needs.

Accessories Available

58532A	GPS Antenna
58521A	Cable and ground
58539A	GPS L1 Lighting Arrester
58529A	GPS Line Amplifier with L1 Bandpass Filter

Antenna Cables and Configuration Guide

For details concerning cables, connectors and other accessories, refer to the following Symmetricom publications:

GPS Antenna Cables and Interconnect Cables	DataSheet #DS/GPS-ACIC
GPS Antenna Systems	Configuration Guide #QCG/58503B
58529A GPS Line Amplifier with L1 Bandpass Filter	DataSheet #DS/58529A
Lightning Arrestors for GPS Systems	DataSheet #DS/58538A-39A

(Available from your local Symmetricom Sales Office)

Notes

Notes

In addition to this 55300A brochure, application notes, product brochures and specifications are available. Contact your local Symmetricom sales office for the following:

Product	Description
55460A	Network Sync Audit Service and Planning
5071A	Primary Frequency Standard ("Cesium Primary Reference")
GPS-ACIC	GPS Antenna Cables
58503B	Quick Configuration Guide
55400A	Network Synchronization Unit
55450A/ 55451A/ 55452A	SmartView Synchronization Management/PC, NT, UX

Application Note	Title
APP/STN-BC	Synchronizing Telecommunications Networks: Basic Concepts
APP/STN-SDH/SONET	Synchronizing Telecommunications Networks: Synchronizing SDH/SONET
APP/STN-FSP	Synchronizing Telecommunications Networks: Fundamentals of Synchronization Planning
APP/SCT	Symmetricom SmartClock Technology: Improving Oscillator Long-Term Stability for Synchronization Applications

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B/55300A/D/0700/2M