
# In This Issue



Welcome to *Time to Sync*—your source for the latest Timing and Synchronization industry news, products, events, and more! *Time to Sync* keeps you updated on the latest news in the timing and synchronization industry and helps you stay connected.

*Time to Sync* is intended to be informative and educational, and aims at helping you succeed in time and frequency synchronization! Please send any comments or questions, including suggestions for future articles, to timing@microsemi.com.

# Technology and Product Updates

## *Microsemi TimeProvider 5000 v3.1 Update*

The TimeProvider 5000 is a carrier-grade IEEE 1588 PTP grandmaster clock with a Network Time Protocol (NTP) server option and expansion shelf capabilities that include SyncE and advanced PTP profiles, making the timing and synchronization system capable of supporting network needs today and in the future. Microsemi's TimeProvider family has been installed in more than 350 networks across the globe, enabling communications service providers to build stable, high-performance, and reliable network infrastructures.

The product is particularly known for its robust architecture that provides fully redundant hardware, user-configurable PTP profiles, and Synchronous Ethernet (SyncE) support with optical small form-factor pluggable (SFP) modules. The redundant architecture provides the ability to replace any module on site without having to send the device to a service center, thereby increasing the network uptime.

Microsemi recently upgraded the TimeProvider 5000 to ensure a better reception and higher security in a wide variety of telecommunications applications. The update now supports Internet Protocol version 6 (IPv6) and multi-Global Navigation Satellite Systems (GNSS) constellation to ensure better reception and higher security in a wide variety of telecommunications network applications.

Key updates include:

- New IMC cards with GNSS support including GPS, GLONASS, and Galileo
    - Single GNSS input card
    - Dual GNSS input card
- New PTP Profiles
    - ITU-T G.8275.2 Phase Profile on TP5k
    - ITU-T G.8275.1 Phase Profile on TPe10
    - Optional support for IPv6 PTP profile operation
- PTP probe mode active monitoring (to set thresholds and trigger event crossings)
- Software fixes and update (refer to the Software Release Notice)

An increasing number of global operators are now looking at solutions like Microsemi's enhanced TimeProvider 5000, as the device supports multiple GNSS constellations in accordance with the directives in certain countries to remove their sole dependency on GPS. This provides multiple advantages like increasing reliability, integrity, continuity (more satellites in view), availability, and accuracy in locations such as urban canyons where it may be difficult to have direct view of the sky.

Support for GLONASS and Galileo constellations also makes systems more robust and secure to certain GNSS vulnerabilities. Galileo is gaining a lot of popularity and importance because it is the only civil-based GNSS system and operates in the same frequency band as GPS.

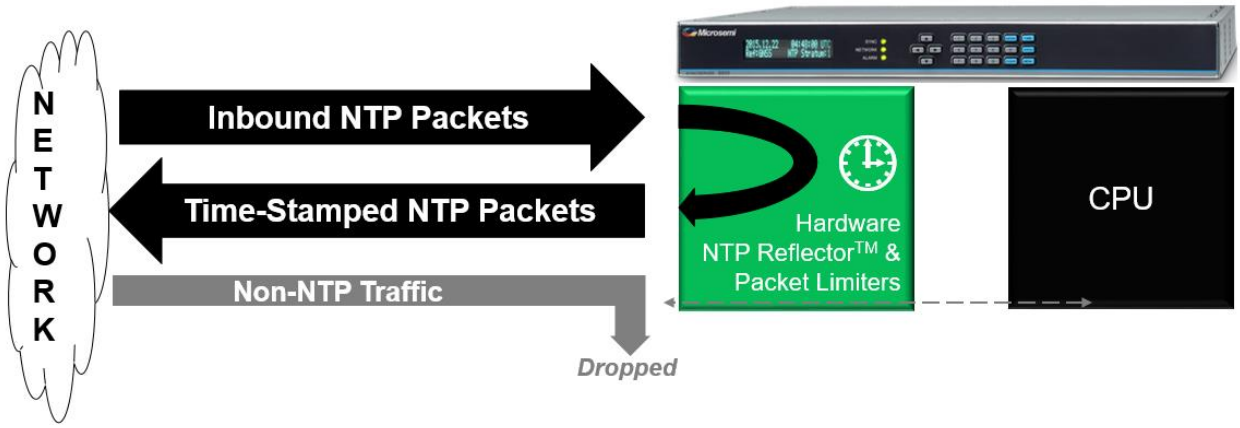
TimeProvider 5000 also seamlessly integrates into Microsemi’s network management system, TimePictra, thereby providing easy monitoring on the central console. The basic software comes with comprehensive support for the standard FCAPS capabilities: Fault Management, Configuration Management, Accounting (Inventory) Management, Performance Management, and Security Management.

The upgrades are compatible with every unit of TimeProvider 5000 family shipped. System release 3.1 is available for download from the Microsemi support portal, and the new IMC GNSS plugin cards are shipping today. With this

release, the TimeProvider cements its place as the industry standard IEEE 1588 Precision Time Protocol (PTP) Grandmaster Clock.

## *NTP Reflector® for Security-Hardened NTP Operations*

Microsemi implements real-time, hardware-based network packet processing in tandem with accurate hardware-based NTP time stamping, general packet limiting, and alarming. To achieve this high level of security, Microsemi uses its patented technology—the NTP Reflector.




The NTP Reflector® protects the time server from excessive network traffic and denial of service (DoS) attacks, while simultaneously providing extremely high-bandwidth, high-accuracy NTP server operations. The Reflector is a real-time, hardware-based NTP packet identification and time stamping engine. Received NTP client packets are identified at line speed, precise and accurate T2 and T3 time stamps are added and the packet is returned to the requesting NTP client.

Since the operations are in hardware operating at GbE line speed, the NTP packet capacity is more than 360,000 packets per second. The NTP Reflector also monitors packet flow for DoS detection and reporting, yet remains impervious to the level of network traffic as it operates at line speed.

The NTP reflector is also equipped with a user-defined alarm threshold for monitoring and notification purposes should NTP traffic exceed expected levels. The Reflector will always process all valid NTP time requests up to the full GbE line speed of the LAN port and is only limited by the GbE throughput of the network link.

The NTP Reflector and packet limiting/monitoring is part of SyncServer S600 Series Security Protocol License. Since all S600/S650 models are equipped with the necessary hardware and hardware time stamping capability, the Security Protocol License can be activated/purchased at any time.

Download the complete NTP Reflector application note
Learn more about the SyncServer S600 Network Time Server
Request a quotation

# End Market Corner

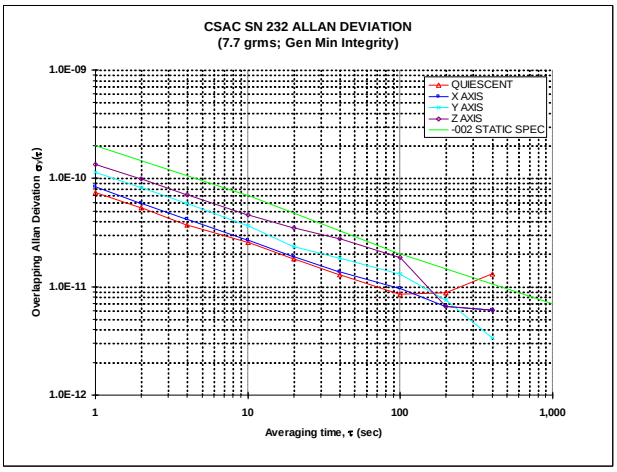
## *Microsemi CSAC for GPSDO Applications*

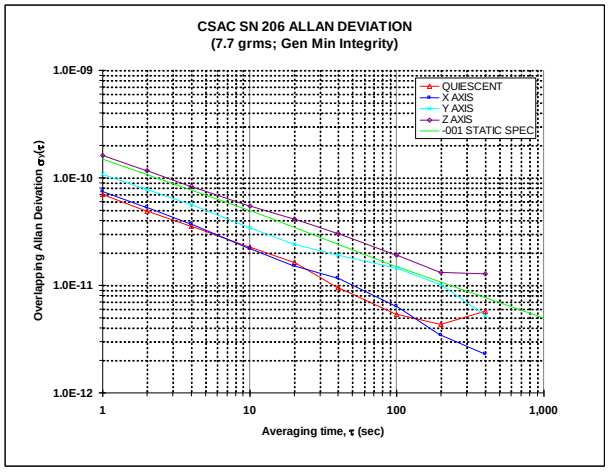
The Microsemi Chip Scale Atomic Clock (CSAC) is the world's smallest atomic clock successfully integrated into a Global Positioning System Disciplined Oscillator (GPSDO). The CSAC is known for its size, weight, and power (SWaP), which makes it the best possible option for applications demanding portability.

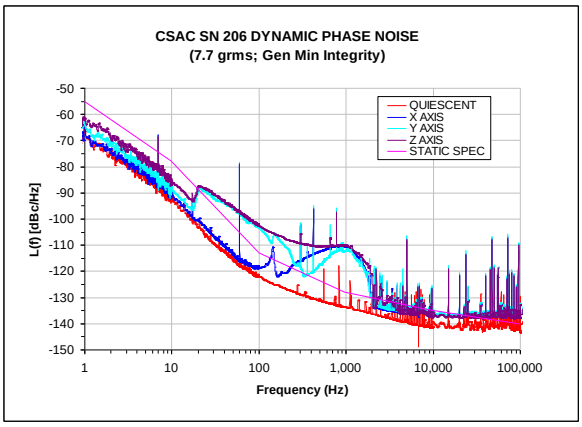
CSAC is an ideal fit for such applications that demand high portability, low power, and superior performance. Integrated into GPSDO, it has demonstrated >3x improvement in holdover capability compared to similar OCXO-based devices. An oscillator locked to the GPS signal will have the same superb long-term accuracy as the GPS signal itself (5.0E-13 over a 24-hour period is possible). The disciplined oscillator in this case acts as a holdover providing its local version of time.

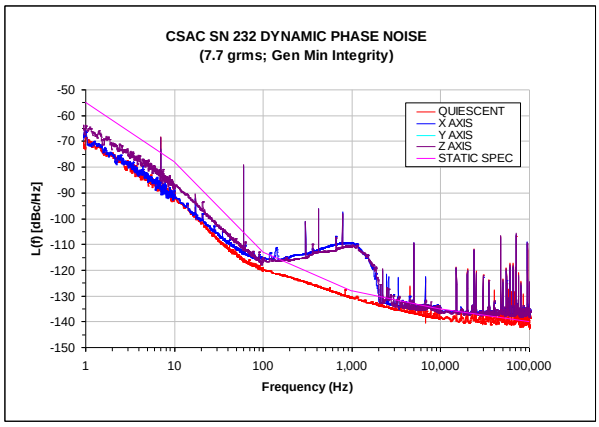
The following three reasons explain why CSAC is best suited for such an application:

1. **Vibration Tolerance**
   - 10x to 100x reduction in g-sensitivity
   - CSAC is designed to tolerate >1000g non-operational shock, and has been tested to 2000g
   - CSAC is designed to not lose lock when subjected to 7.7g random vibration profile, and units have been tested up to 15.4g (as noted in the shock and vibration white paper)
   - Frequency response is important, and ADEV remains quite good under vibration
   - Phase noise is degraded from 100 Hz to 3000 Hz with the following vibration profile:





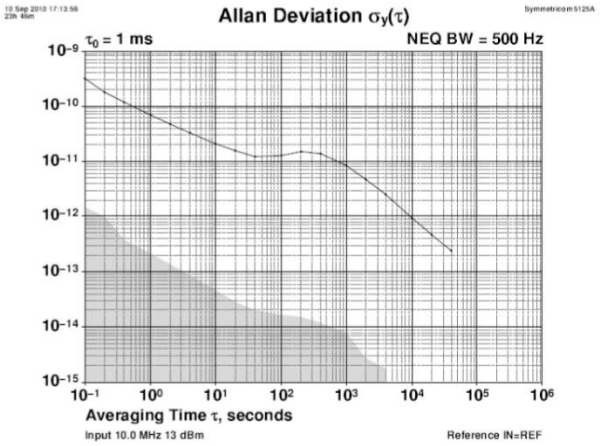




## 2. Physical Attributes

- Compact size
- Low height profile
- CSAC is one-third the size of existing lamp-based atomic oscillators
- Consumes low power (125 mW)
  - 20x lower than oven-controlled crystal oscillators (OXCOs), 500 mW up to 4 W
  - 40x lower than the MAC
- 1PPS input allows easy disciplining to GPS receivers

## 3. Frequency Stability

- Removes the large “sawtooth” type of jitter present on the GPS 1PPS signal
- Tempco 5E-10
- 3x improvement in stability and accuracy




The incorporation of the SA.45s CSAC in the CSAC GPSDO is suited for GPS-denied environments and is targeted for incorporation into dismounted IED jammers; unmanned aerial vehicles (UAVs); next-generation man-pack radios; and military handheld GPS units.

Microsemi has partnered with Jackson Labs to bring a number of GPSDOs to the marketplace. The following table briefly summarizes the offerings:

| Product | Image | Frequency | Size | Outputs | 1 PPS accuracy | Holdover Stability | Power Consumption | Frequency Stability over Temperature | Operating Temperature | Warmup Time |
|---|---|---|---|---|---|---|---|---|---|---|
| GPS-500 |  | 10 MHz | 1.6" x 1.9" x 0.63" | 10MHz=1, 1PPS=1 | ±35 ns | < ±15 µs over 24 hours at 25°C | <2.4W | ±5.0e-9 | -40 to 85°C | <9 min. |
| GPS-1000 |  | 10 MHz | 1.0" x 2.5" x 0.50" | 10MHz=1, 1PPS=1 | ±50 ns | < ±11 µs over 3 hours at 25°C | <1.8W | ±2.5e-8 | 0 to 60°C | <5 min. |
| GPS-2000 |  | 10 MHz | 1.5" x 3.0" x 0.65" | 10MHz=3, 1PPS=1 | ±50 ns | < ±60 µs over 24 hours at 25°C | <3.2W | ±1.5e-8 | 0 to 75°C | <45 min. |
| GPS-2500<br>GPS-2550 |  | 10 MHz | 1.5" x 3.0" x 0.80" | 10MHz=3, 1PPS=1 | ±30 ns | < ±7 µs over 24 hours at 25°C | <4.0W | ±2.5e-10 | 0 to 75°C<br>-25 to 75°C | <10 min. |
| GPS-2600<br>GPS-2650 |  | 10 MHz & 100 MHz | 1.5" x 4.0" x 0.80" | 10MHz=2, 100MHz=7, 1PPS=3 | ±30 ns | < ±7 µs over 24 hours at 25°C | <4.0W | ±2.5e-10 | 0 to 75°C<br>-25 to 75°C | <8 min. |
| GPS-2700 |  | 10 MHz & 5 MHz | 2.5" x 3.0" x 0.70" | 10MHz=4, 5MHz=1, 1PPS=1 | ±15 ns | < ±2 µs over 24 hours at 25°C | <1.4W | ±5.0e-10 | -10 to 70°C | <2 min. |
| GPS-3100<br>GPS-3300<br>GPS-3500 |  | 10 MHz | 3.4" x 4.4" x 1.0" | 10MHz=3, 1PPS=2 | ±10 ns | < ±0.6 µs over 24 hours at 25°C | <5.6W | ±7e-10<br>±1e-10<br>±0.7e-10 | -20 to 70°C | <8 min. |

For more information, see Microsemi Chip Scale Atomic Clock and GPS-2700 Microsemi 10 MHz CSAC-Based Disciplined Oscillator.

## *Synchronization for DOCSIS 3.1 Converged Cable Access Platforms (CCAP)*

Cable networks have recently evolved to IP-based next-generation networks with superior reliability, performance, scalability, and density to meet the ever-demanding customer SLAs. In this context, it is critical to ensure high availability of the modular CMTS and Edge QAM devices, and to maintain reliable, accurate, precise, and scalable synchronization in a Data Over Cable Service Interface Specification (DOCSIS) network.

Cable MSOs are moving to new DOCSIS 3.1 CCAP architectures approved by CableLabs. DOCSIS 3.1 Full Duplex is an innovative project to improve DOCSIS 3.1 to use the full spectrum of the cable plant (0 MHz to ~1.2 GHz) at the same time in both upstream and downstream directions.

The primary deployment options are a centralized CCAP architecture or distributed CCAP architecture. The distributed CCAP architecture requires PTP timing to synchronize remote PHY (RFD) elements. CableLabs has recommended deployment of the ITU standard G.8275.2 PTP profile, a unicast PTP profile that does not require on path support for PTP flows. The DOCSIS 3.1 standard requires 1 ms time/phase alignment between the CCAP core and the remote PHY, and 5 PPM frequency alignment.

The TimeProvider 5000 PTP Grandmaster Clock system is fully approved as the PTP grandmaster clock for distributed CCAP deployments, and has successfully completed recent cable industry interoperability testing engagements. For more information about timing and synchronization requirements and recommendations for Distributed CCAP deployment, please contact Microsemi.

# New Collateral

## *White Papers*

- Timing for cRAN Fronthaul LTE
  5G has introduced a decentralized/distributed approach, called Cloud RAN (cRAN), which consists of centralizing the RAN functionalities in a broadband unit (BBU) pool location where the digital processing is performed. This white paper describes the cRAN architecture and how timing is implemented in the Fronthaul.

- Financial Regulations with the Latest Timekeeping Technology
  The EU's European Securities and Markets Authority (ESMA) set new rules concerning the accuracy of time stamps. The Markets in Financial Instruments Directive (MiFID II) has mandated a set of standards to comply to a very specific level of time accuracy in all business clocks involved in the audit trail of stock transactions.

  This white paper describes a three-faceted timekeeping solution architecture—consisting of a timing master, timing slave, and time monitoring/auditing server—designed to address the growing need for a required level of accuracy.

## *Application Notes*

- Multi-GNSS Constellation Technology
  The term Global Positioning System (GPS) was once used to describe the satellite-based positioning, navigation, and timing system most widely used for civil applications. Tracking multiple GNSS satellites is now commonplace in the age of smart phones and vehicle navigation systems.

  This application note describes the typical use cases and benefits of Multi-GNSS technology and presents data showing achievable time accuracy.

- Dual Power Supply Units
  Power is a key concern in modern datacenter design and management. While efficiency and cooling are high priorities, so is reliability and surviving power fluctuations or outages to return to normal operations as fast as possible.

  This application note speaks about the advantages of dual-corded, dual power supplies used in the Microsemi SyncServer S6xx series.

# Event Calendar

You can find us at the following events to learn more about the products and solutions offered by Microsemi.

- Recent Events
  - Space Symposium
  - EFTF (UK)
  - NIST WSTS
  - CISCO Live
  - ISC West
  - Data Center World

- Upcoming Events
  - EFTF–IFCS (10–13 July)
  - IEEE–ISPCS (27–29 August)
  - ION GNSS (25–29 September)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