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SyncServer S650

Accurate, Secure, and Flexible Time and Frequency Standard



S650 with two optional Timing I/O modules

Key Features

- <15 ns RMS to UTC (USNO)
- <1x10^{-12} Frequency accuracy
- Modular timing architecture with unique and innovative FlexPort™ technology
- Most popular timing signal inputs/outputs are standard in the base Timing I/O module (IRIG B, 10 MHz, 1 PPS, etc.)
- Four GbE ports standard, all with patented NTP hardware timestamping
- Web-based management with high-security cipher suite
- -20°C to +65°C operating temperature, shock & vibration qualified
- IPv6/IPv4 on all ports
- Rubidium Atomic Clock or OCXO oscillator upgrades
- Dual power supply option
- PTP and GLONASS ready, no additional hardware required

Key Benefits

- FlexPort™ timing technology efficiently and cost-effectively adds innovative "any signal, any connector" technology, eliminating the wasted space inherent with legacy style fixed-signal modules/BNCs
- Multiple GbE network ports for easy network configuration and adaptation
- Reliable and rugged design for long product life and wide application scope
- Many security-hardened, network-based features for stringent IA requirements.

Unparalleled Flexibility

The modular Microsemi SyncServer S650 combines the best of time and frequency instrumentation with unique flexibility and powerful network/security-based features.

The base Timing I/O module with 8 BNC connectors comes standard with the most popular Timing I/O signals (IRIG B, 10 MHz, 1 PPS, and so on). When more flexibility is required, the unique Microsemi FlexPort™ Technology option enables 6 of the BNCs to output any supported signal (time codes, sine waves, programmable rates, and so on), all configurable in real time via the secure web interface. This incredibly flexible BNC-by-BNC configuration makes very efficient and cost-effective use of the 1U space available. Similar functionality is applied to the 2 input BNCs as well. Unlike legacy modules with fixed count BNCs outputting fixed signal types per module, with FlexPort™ technology you can have up to 12 BNCs output in any combination of supported signal types.

This level of timing signal flexibility is unprecedented, and can even eliminate the need for additional signal distribution chassis as there is no degradation in the precise quality of the coherent output signals.

Robust Timing and Design

The 72-channel GNSS receiver coupled with Microsemi's patented Active Thermal Compensation Technology provides excellent accuracy of <15 ns RMS to UTC (USNO). Backstop this with a durable hardware design subjected to MIL-STD-810G testing, high-reliability components extending the operating temperature range to a very wide -20°C to +65°C, and a dual power supply option. Further, upgrading to a high performance oscillator, such as a Rubidium atomic clock, keeps the S650 accurate for long periods in the event of a GNSS service disruption.

Secure Networking

Security is an inherent part of the SyncServer S650. In addition to many security features and protocols, unsecure access protocols are deliberately omitted while remaining services can be disabled.

The four standard GbE ports accommodate more than 10,000 NTP requests per second using hardware time stamping and compensation. All network traffic to the S650 CPU is bandwidth-limited for protection against denial-of-service (DoS) attacks. For more secure NTP operations, enable the optional Security-Hardened NTP Reflector™ with line speed, 100% hardware-based NTP packet processing*. The Reflector is also a CPU-protecting firewall, bandwidth limiting non-NTP traffic to the CPU. It is also equipped with DoS detection, notification, and protection against abnormally high network traffic.

Leverage Built-In Hardware

The SyncServer S650 includes additional built-in hardware features that are enabled through software license keys, such as the Security-Hardened NTP Reflector™. Anticipated future software enabled hardware options are GbE PTP operations and GLONASS support.

The SyncServer S650, the future of time and frequency, today.

** NTP Reflector is part of the Security Protocol License and will appear in version 1.1 due April 2016.*

Four GbE Ports for Performance, Flexibility, and Security

The S650 has four dedicated and isolated GbE Ethernet ports, each equipped with NTP hardware time stamping. These are connected to a very high-speed microprocessor with microsecond accurate time stamps to assure high-bandwidth NTP performance. This more than meets the need of servicing 10,000 NTP requests per second.



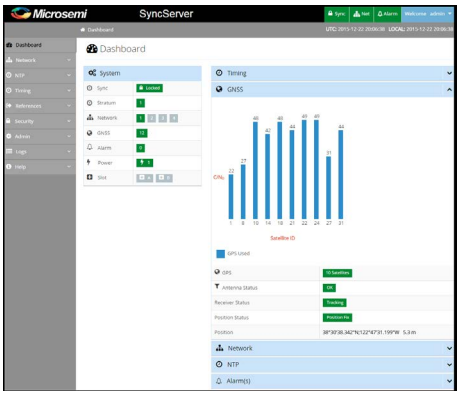
Four GbE ports provide network configuration flexibility and enhanced security. "Multiple" isolated and synchronized time servers can also be configured.

Multiple ports provide the flexibility to adapt to different network topologies as networks grow and change. An S650 can be the single time-source to synchronize clients on different subnets and physical networks. Since each port is independent, it can appear as though there are four clocks available, even though there is only a single time reference.

NTP can be served on all 4 ports. The highly secure web-based management interface is only available on port 1 so that administrators may choose to keep that IP address private and secure. Unique access control lists per port can govern server response to client requests for time.

Intuitive, Secure and Easy to Use Web Interface

The modern web interface is the primary control interface of the S650. Once the keypad and display are used to bring the unit online, complete status and control functions are easily found via the well organized left side-expanding/collapsing navigation menu.



At a glance dashboard presentation combined with logical organization and intuitive controls make configuring the S650 quite easy.

Standard Management Access Security

All of the expected network management protocols are standard in the S650. These include mandatory password access, HTTPS/SSL only (using the high encryption cipher suite), SSH, access control lists, service termination, SNMPv2/v3, and NTP MD5 authentication. All traffic to the S650 CPU is bandwidth-limited for protection against DoS attacks. The local keypad on the server can be password-protected to prevent tampering.

Security-Hardening Option

The SyncServer S650 can be seriously hardened from both an NTP perspective and an authentication perspective through the Security Protocol License Option, which includes the Security-Hardened NTP Reflector.

Operational Hardening—via the 120,000 NTP packet per second NTP Reflector™ with 100% hardware based NTP packet processing also works with a CPU-protecting firewall by bandwidth limiting all non-NTP traffic. The 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.

Authentication Hardening—is available for NTP client/server authentication through the NTP Autokey function or user access authentication via TACACS+, RADIUS and LDAP. (See the *SyncServer Options datasheet* for more detail on the Security Protocol License Option).



An entire drop down menu in the S650 is dedicated to security related protocols.

Unprecedented NTP Accuracy

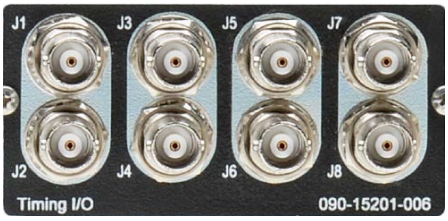
The Stratum 1 level S650 derives nanosecond accurate time directly from the atomic clocks aboard the GNSS satellites. By using an integrated, 72-channel GNSS receiver, every visible satellite can be tracked and used to maintain accurate and reliable time. Even in urban canyon environments where direct satellite visibility can be limited, manually inputting the position can be sufficient to acquire accurate time from as few as one intermittent satellite.

Ultra High Performance NTP

The S650 can effortlessly support hundreds of thousands of network clients while maintaining microsecond caliber NTP timestamp accuracy. NTP request throughput rates exceed 10,000 requests/second while maintaining NTP timestamp accuracy. If the Security License option is enabled, the NTP Reflector™ can process over 120,000 NTP requests per second with 15 nanosecond caliber time stamp accuracy with the added benefit of security hardening the network port. This can easily translate into sub-millisecond typical NTP client synchronization accuracy on a LAN.

More Timing I/O Standard

The Base S650 can host two modules. The Timing I/O module is equipped with 8 BNC connectors for timing signal input and output. The standard configuration offers a broad yet fixed selection of signal I/O including IRIG B, 10 MHz, 1 PPS, and so on.



FlexPort™, the Ultimate in Timing Flexibility

Microsemi's unique FlexPort™ Technology efficiently and cost-effectively adds innovative "any signal, any connector" technology, eliminating the wasted space inherent with legacy style fixed signal modules/BNCs.

The FlexPort™ Technology option enables the 6 output BNCs (J3-J8) to output any supported signal (time codes, sine waves, programmable rates, and so on.) all configurable in real time through the secure web interface. The 2 input BNCs (J1-J2) can support a wide variety of input signal types. (See the *S650 Option datasheet* for full details).

This level of timing signal flexibility is unprecedented and can even eliminate the need for additional signal distribution chassis as there is no degradation in the precise quality of the coherent signals.



Serial Time Outputs

The dedicated Data/Timing port is provided to output NMEA-0183 or NENA PSAP strings. If NENA is selected, the serial Console port also supports the two-way timing aspects of the standard. In addition, the F8 and F9 Microsemi legacy time strings are also available.



Oscillator Upgrades Improve Holdover Accuracy and Save Valuable Time

The standard S650 is equipped with a crystal oscillator that keeps the S650 accurate to nanoseconds when tracking GNSS. However, if GNSS connectivity is lost, thereby placing the server in holdover, the oscillator will begin to drift impacting timing accuracy. Upgrading the oscillator improves the holdover accuracy significantly. For example, consider the drift rates below for the standard oscillator compared to the OCXO and Rubidium upgrades:

Oscillator Holdover Drift
(1st 24 hours)

- Standard 400 microseconds
- OCXO 25 microseconds
- Rubidium <1 microsecond

The value of the upgraded oscillator is that if the GNSS signal is lost the S650 can continue to provide very accurate time and frequency. This provides personnel time to correct the problem with only gradual degradation or disruption in time synchronization accuracy.

Specifications

GNSS Receiver/Antenna

- 72 parallel channel GNSS receiver
- GPS time traceable to UTC (USNO)
- Acquisition time: 30 seconds (cold start)
- Cable length: up to 900 ft. (275 m). See Options below.

Time Accuracy

< 15 ns RMS to UTC (USNO) at 1PPS output

After 1 day locked to GNSS; evaluated over normal environment (test range <+/- 5°F) defined in GR-2830

Oscillator Aging (Monthly)

Standard	+/- $1e^{-7}$
OCXO	+/- $5e^{-9}$
Rb	+/- $1e^{-10}$

After 1 month of continuous operation

Holdover Accuracy

1 day holdover, microseconds

Standard Oscillator	400 µs
OCXO Oscillator	25 µs
Rubidium Oscillator	< 1 µs

Evaluated over normal environment (test range <+/- 5°F) defined in GR-2830 after 3 days locked to GNSS

Frequency Ouput Accuracy and Stability

After 1 day locked to GNSS
Frequency output accuracy: < $1x10^{-12}$ @ 1day

Network Protocols

NTP
NTP Unicast, Autokey, MD5
SNTP
SNMP v2c, v3
Custom MIB
DHCP/DHCPv6
TACACS+
LDAPv3
RADIUS
HTTPS/SSL
SMTP Forwarding
SSHv2
IPv4/IPv6
Syslog 1 to 8 servers
Key management protocols can be individually disabled.
PORT 1: Management & Time protocols
PORT 2, 3, and 4: Time protocols only

NTP Server Performance

- 10,000 NTP requests per second while maintaining accuracy associated with reference time source.
- Stratum 1 via GNSS: overall server timestamp accuracy of 5 microseconds to UTC with 1-sigma variation of 15 microseconds (typical). All NTP time stamps are hardware based or have real-time hardware compensation for internal asymmetric delays. The accuracy is inclusive of all NTP packet delays in and out of the server as measured at the network interface. The SyncServer easily supports many hundreds of thousands of NTP clients
- NTP Reflector option: 120,000 NTP client mode 3 requests per second. NTP packets time stamped 100% in hardware with prevailing clock accuracy. All non-NTP packets provided to the CPU on a bandwidth limited basis. The NTP Reflector included as part of the Security Protocol License Option*.

Mechanical/Environmental

- Size: 1.73" x 17.24" x 15.88" (4.4 cm x 43.8 cm x 40.3 cm) 1U rack mount , including BNCs
- Power: 110/220 VAC, 50-60 Hz, 65 watts
  Optional 2nd power supply
- Operating temperature: Non Rb: -20°C to +65°C
  Rb: -5°C to +55°C
- Storage temperature: -40°C to +85°C (IEC 60068-2-1Ab (low temp soak), IEC 60068-2-2Bb (hi-temp soak), IEC 60068-2-14Nb (change of temp) IEC 60068-2-78Cb (humidity storage), IEC 60068-2-30Db (humidity condensation)
- Operational Humidity: <= 95%, non-condensing, IEC 60068-2-78Cb, IEC 60068-2-30Db
- Certifications: FCC Part 15, Class A, CISPR 22, Class A, UL/CSA 60950-1, IEC 60950-1, EN 60950-1, PSE, VCCI, RoHS 6/6
- Server weight: 12.5 lbs (5.7 kgs),
- Shipping package: 16.3 lbs (7.4 kgs)

Shock and Vibration:

• Operational:	ETSI EN-300 019-2-3, Mil-STD-810G
• Storage:	IEC 60068-2-6 Fc (sinusoidal vib) Mil-Std-810G, figure 514.6C-3
• Transportation:	
Bounce	IEC 60068-2-27Ea (shock 18g)
Vibration	IEC 60068-2-64Fh (random vib)
Package drop	IEC 60068-2-31 Ec
• Seismic:	EN300 019-2-3 NEBS GR-63-CORE.

Front Panel

Display: Sharp, high-resolution 160x32 vacuum-fluorescent.
Keypad: 0-9 numeric, up, down, left, right, ENTER, CLR, TIME, STATUS, MENU. Keypad lockout.
LEDs (tri-color green/red/orange)

- Sync: Time reference status
- Network: Network connection status
- Alarm: Fault condition

Rear Panel

Network:	Four RJ-45 100/1000Base-T Ethernet, Speed/Duplex: Auto, 100/1000 full
Serial Data/Timing:	NMEA-0183; ZDA/GGA/GSV/RMC messages; NENA 04-002 messages; DB9-F RS-232, user selectable rate to 115.2 kbps
1PPS-Out:	BNC, Rising edge on-time, TTL into 50 Ω
GNSS:	BNC L1, 1575 MHz
Console:	DB9-F RS-232
Alarm Relay:	SPST ,maximum 300 mA and 32 V
Power:	IEC 60320 C14 connector, optional second power supply/connector, hitless switching.

Timing Input/Output Module (090-15201-0006)

	Input BNCs		Output BNCs					
Configuration	J1	J2	J3	J4	J5	J6	J7	J8
Standard	IRIG B AM 124 or 1PPS	10 MHz	IRIG B AM 124	10 MHz	IRIG B B004 DCLS	1PPS	off	off
FlexPort Option	IRIG B124 IRIG B004 IRIG B120 IRIG B000 IEEE-1344 1PPS 10MPPS	1 MHz 5 MHz 10 MHz	FlexPort J3-J8 Software Selectable Outputs per BNC (Configured via the web interface): a) Pulse: i) Fixed Rate: 10/5/1MPPS, 100/10/1/kPPS, 100/10/1/0.5PPS ii) Programmable Period: 100 ns to 2 sec, step size of 10 ns b) Timecode: IRIG B 000/004/1344 DCLS, 120/124/1344 AM c) Sine: 1/5/10 MHz					

Signal Levels	
IRIG-In	AM: Ratio 2:1 to 3.5:1 Amp: 1 V to 8 V p-p, into 50 DCLS: <1.5 V for logic 0, >2 V for logic 1
IRIG-Out	AM: Ratio 10:3, Amp: 3.5 ± 0.5 Vpp, Zout 50 Ω DCLS: <0.8 V for logic 0, >2.4 V for logic 1, Zout 50 Ω for logic 0, >2.4 V for logic 1, Zout 50 Ω
1PPS-In	Rising edge active, TTL into 50 Ω
Rate/Pulse/1PPS-Out	Rising edge on-time, TTL into 50 Ω
1,5,10 MHz-In	Sine wave, 1 Vpp to 8 Vpp, into 50 Ω
1/5/10 MHz-Out	Sine wave 2.6 Vpp into 50 Ω
10 MPPS In	< 1 V for logic 0, > 2 V for logic 1, into 50 Ω

Output Stability (10 MHz)

(Measured on any 10MHz output) module

Oscillator	1S	10S	100S	1kS	10kS
Standard	$<1e^{-9}$	$<2e^{-10}$	$<1e^{-10}$	$<1e^{-11}$	$<1e^{-12}$
OCXO	$<1e^{-9}$	$<5e^{-11}$	$<5e^{-11}$	$<7e^{-12}$	$<7e^{-13}$
Rubidium	$<2e^{-10}$	$<3e^{-11}$	$<3e^{-11}$	$<5e^{-12}$	$<5e^{-13}$

Options

- Timing Input/Output Module
- FlexPort Option to enable software selectable signals on Timing I/O module BNCs
- Security License Upgrade option for Security-Hardened NTP Reflector*, RADIUS, LDAP, TACACS+, NTP Autokey
- Dual power supplies (with dual connectors)
- Rubidium or OCXO oscillator upgrade for extended holdover
- Antenna kits, cables, lightning arrestors, inline amplifiers, etc. are documented in the SyncServer S600/S650 Options Datasheet
- Domain Time II Comprehensive time client, server & management software for easy distribution, management and monitoring of time across Windows networks.



SyncServer S650 shown with two optional Timing I/O Modules

** NTP Reflector is part of the Security Protocol License and will appear in version 1.1 due April 2016.*

Product Includes

SyncServer S650 (no option modules installed in base unit), locking power cord, and rack mount ears. Two-year hardware warranty. Current manual and MIB are available online at *www.microsemi.com.*

SyncServer S650 (base)+Timing I/O Module: 090-15200-651
SyncServer S650 (base) +Timing I/O Module+Rubidium: 090-15200-652

To add more options or Configure-to-Order, contact factory.

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