EndRun TECHNOLOGIES
"Smarter Timing Solutions"

SONOMA D22/N22 *Network Time Server*

GPS-Synchronized, Dual Gigabit Ports

The Sonoma is a high-performance Time Server that provides a secure and reliable source of network time inside your firewall or air-gapped network. We've been designing network time servers since 2000 and Sonoma is the 4th-generation in that standard-setting line. It can serve accurate time to any system running an NTP or SNTP client. With dual-gigabit ports and a quad-core microprocessor for high-capacity throughput (>50,000 NTP requests/second), Sonoma can support hundreds of thousands of NTP clients on your network(s).

Management - Status & Control

You can easily manage Sonoma using either of the two network ports or USB serial port. A secure Web Interface (HTTPS) is provided for status monitoring using your Internet browser. With the Sonoma D22 model you can also use the vibrant display and keypad. The cost-effective Sonoma N22 model has no display/keypad.

Reliable Hardware Design

The superior reliability of the Sonoma is the result of the highly-integrated, efficient hardware design that is unique to our products. This design achieves an estimated MTBF of over 25 years (16 years with Rubidium). We do not use general-purpose CPU boards (sometimes referred to as single-board computers (SBC)). Instead, by using the latest semiconductor technologies we have created a thermally efficient design with an optimal combination of reliability, performance and power consumption. The quad-core CPU and the circuitry around it is consolidated with only essential componetry. The chassis is sealed to keep air currents and dust off sensitive frequency control components. No fans are needed due to the efficiency of the design. This built-in reliability is combined with a production process that integrates stringent quality assurance inspections and rigorous performance verification.

PTP/IEEE-1588 (Future Release)

Grandmaster Clock Option

The Sonoma can be optionally configured as a PTP Grandmaster Clock by enabling the PTP/IEEE-1588 option on one or both of the gigabit ports. Using both ports enables Sonoma to service two independent PTP sub-domains.

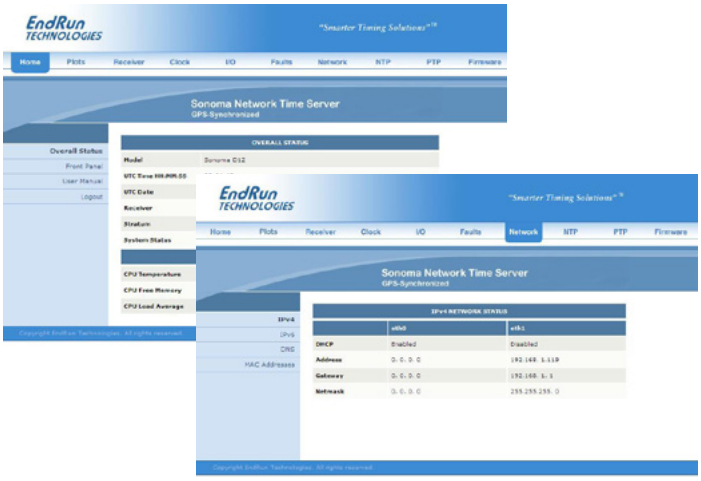
Each Sonoma is shipped from the factory hardware ready for PTP timestamping with 8-nanosecond resolution. When available (~Dec 2025), you can purchase this option either before or after Sonoma is shipped from the factory. Hardware timestamping delivers the level of performance that is required in today's high-speed, low-latency systems. For detailed information on this option, see the PTP-IEEE-1588 datasheet.

FEATURES

- GPS-Synchronized.
- Dual gigabit ports.
- NTP server throughput of >50,000 requests per second.
- Optional PTP/IEEE-1588 with hardware timestamping (future)
- SNMP v3, SSH, HTTPS and more.
- TACACS+, RADIUS, LDAP secure access authentication
- IPv6 and IPv4 compliant.
- Secure Web Interface to monitor status via your Internet browser.
- Optional dual power supplies.
- Daily and weekly data plots: CPU, NTP, GPS and Oscillator Statistics.
- Serves NTP Stratum 1 time for 24 hours if GPS signal is lost. Up to 35 and 140 days with Premium and Rubidium Oscillator Upgrade Options.
- Three-Year Warranty.
- 60-Day Money-Back Guarantee.
- Free technical support and software upgrades for life.

BENEFITS

- Accurate and secure source of network time inside your firewall or air-gapped network.
- Hundreds of thousands of NTP clients can be reliably synchronized to within ½ - 2 milliseconds of each other.
- Easy to operate and maintain.
- Low total-cost-of-ownership.



Web Interface (HTTPS)
for Status Monitoring & Firmware Upgrades

Web Interface

The Sonoma web interface is designed with security in mind, so it is used for status information and firmware upgrades only – not for configuration and control. Firmware upgrades are enabled only after an authentication process. The web interface is disabled by default to ensure the highest level of security out-of-the-box.

The tabbed panels offer easy access to information about the Receiver, Clock, I/O, Faults, NTP, PTP and the Firmware. Firmware upgrades are easy with the point & click upgrade process.

Charts available for NTP, Oscillator and CPU statistics

Measurement Statistics and Charting

Real-time charting of NTP, Oscillator, GPS and CPU statistics is available via the Web Interface. Measurements are continuously computed and displayed in real-time with daily and weekly charts. The charts are automatically archived into month and year directories that remain resident for up to ten years.

The Oscillator statistics chart shows the internal chassis temperature, oscillator electronic frequency control value and the offset of the receiver subsystem to the GPS reference. It is useful for verifying that the unit was locked to the GPS system at a certain time. The NTP statistics chart shows the NTP packets sent, packet rate and the accuracy of the NTP/System Time relative to UTC. The CPU statistics chart shows the free memory, processor load and CPU temperature.

Network Security Hardened

Extra care has been taken with Sonoma to "harden" it against network attacks. It was developed with the latest version of the Linux operating system and security protocols. The Linux distribution is based on Slackware, a distribution that is famed for its stability and security.

In a purpose-built appliance like the Sonoma, there are only a few settings that need to be made, and they typically need to be set only once in the lifetime of the product. Since this is a set-it-and-forget-it box, extraneous protocols and services have been eliminated to minimize the attack surface. You can change settings securely via SSH and monitor the alarm/status information using SNMP, SSH, or HTTPS (when enabled). Security-conscious users can disable any unneeded protocols or restrict access to specific hosts.

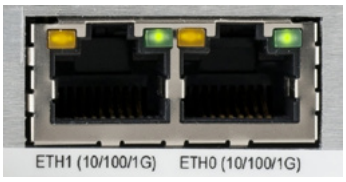
Users familiar with Linux can perform advanced configuration of various aspects of Sonoma's operation to meet network and security requirements.

Full User Control

Configuration and control is accomplished securely through the network and USB serial ports. Sonoma D22 customers can also configure via the convenient front-panel keypad/display.

A handful of simple commands and interactive wizards are all that is needed to configure and control this product. There is no need to be proficient at Linux. Online help for all of the Sonoma-specific commands is available, as well as the standard help files for all of the available Linux commands.

Sonoma provides Linux experts with root-level access to the operating system for high-level of control over the entire product. Since Linux systems are configured via human-readable ".conf" files located in the */etc* directory of the file system, Sonoma allows you to modify these files and copy to a non-volatile area of the file system. At boot time, these files are copied over the factory defaults, allowing you to customize virtually all aspects of the operation. Should you need to revert back to the factory configuration, all you need to do is delete the modified files from the non-volatile area.



Dual Gigabit Ports

Dual Gigabit Ports

Two independent 100/1000 Base-T Ethernet ports are available. The ports are capable of providing 50,000 NTP packets per second second while maintaining a timestamp accuracy of better than 10 microseconds. For PTP/IEEE-1588 applications, you can purchase the option to enable Grandmaster functionality on one or both ports.

Sonoma rear panel with single power supply (dual AC and DC power supplies available).
Two gigabit Ethernet ports. Antenna input TNC connector on upper left.
USB Micro-B serial port. Three spare BNC connectors for optional hardware outputs on left.

Extended Stratum 1 Operation if Signal Lost

The Sonoma will continue to serve NTP Stratum 1 time for some period if the GPS reference signal is lost. This is called the holdover period and it is dependent upon the quality of the internal reference oscillator and the software control algorithms. Sonoma with a base-level TCXO (Temperature Compensated Crystal Oscillator) will continue to serve accurate Stratum 1 time for 24 hours after signal loss. The popular Premium OCXO (Oven Controlled Crystal Oscillator) provides 35 days of Stratum 1 holdover and the Rubidium atomic oscillator provides 140 days.

The holdover period is important for NTP users but especially for PTP users. When the GPS reference signal is lost, Sonoma begins to drift away from "perfect time", accumulating timing errors as it operates without a signal. This means your PTP timestamps become less and less accurate while in holdover. We highly recommend the Premium OCXO or Rubidium upgrade for PTP customers.

Why would Sonoma lose its lock to the GPS signal? First, the GPS antenna and cabling may be inadvertently damaged compromising the signal. The signal may also be intentionally or unintentionally jammed. GPS antennas must have a clear view of the sky to operate. A roof-mounted GPS antenna is vulnerable to lightning strikes and damage due to maintenance activities or vandalism. Although rare, these situations do occur. If you are using a GPS window-mount antenna, the signal is often missing because of poor sky visibility. Therefore a Premium OCXO or Rubidium upgrade is highly recommended as well. Note GPS signal reception via a window is not guaranteed.

Again, the factors that determine drift rate and holdover period are the quality of the oscillator and software control algorithm quality. Our experience in precision frequency control and OCXO technologies makes the Sonoma performance the best in the market.

Oscillator	Holdover Drift Rate	Holdover Period*
TCXO	*10 milliseconds per first day*	*24 hours*
*Premium OCXO***	*80 microseconds per first day*	*35 days*
Rubidium	*5 microseconds per first day*	*140 days*

*Time to accummulate 10 milliseconds of error if GPS signal is lost.
**EndRun designed and manufactures this specialized OCXO.

Easy Installation

The rackmount unit is easily installed and the 100/1000 Base-T Ethernet ports smoothly integrate with existing network equipment. The unit is up and running in a few minutes on networks supporting DHCP. Without DHCP, the unit can be configured with just a few front-panel keystrokes (D22) or a simple USB serial port command.

Three-Year Warranty and Free Technical Support for Life

The Sonoma has a 3-year parts and labor warranty. Free technical support is available via phone or email for as long you own this product. No support contracts required. Our technicians at the EndRun Technologies facility are highly-trained to help you, and your phone call will be answered by a person, not by an answering machine. Software upgrades are also available free on the EndRun website.

Risk-Free Guarantee

If you are not satisfied with the Sonoma for any reason, simply return it within 60 days for a full refund less shipping fees. For details see:
endruntechnologies.com/support/money-back-guarantee

Optional GPS Antenna Kit
Mounting pipe, ring clamps, 50 ft (15m) cable, antenna & adapter

SONOMA D22/N22 Network Time Server Specifications
GPS-Synchronized

GPS TIMING RECEIVER:
- L1 Band - 1575.42 MHz.
- 12 Channels, C/A Code.
- 15 dB minimum gain at receiver input.
- Single-satellite mode.
- Static and dynamic (shipboard only) modes.
- Timing Receiver Autonomous Integrity Monitoring (TRAIM).
- Proprietary GPS sub-frame error checking and filtering.
- TNC connector (female) on rear panel, Zin = 50Ω. 5 VDC to antenna.

TIME TO LOCK:
- < 5 minutes, typical (TCXO - base-level configuration).
- < 10 minutes, typical (OCXO/Rb).

SYNCHRONIZATION ACCURACY:
- GPS Receiver Accuracy: < 25 nanoseconds RMS to UTC(USNO) when locked*.
  < 10 nanoseconds RMS to UTC(USNO) with calibration option.
- NTP Timestamp Accuracy: < 10 microseconds @ 50,000 requests/second.
- NTP Client Synchronization Accuracy: Network and client clock factors can often limit LAN synchronization accuracy to ½ - 2 milliseconds, typical.

  * See GPS-UTC Timing Specifications for details.

HOLDOVER ACCURACY:
- TCXO (standard): 10 millisecs/day. Serves Stratum 1 time for 24 hours after signal loss.
- Premium OCXO: 80 microsecs/day. Serves Stratum 1 time for 35 days after signal loss.
- Rubidium: 5 microsecs/day. Serves Stratum 1 time for 140 days after signal loss.

SUPPORTED PROTOCOLS:
- SNTP, NTPv4, SHA-1/SHA-256/MD5 authentication, broadcast/multicast mode and autokey.
- SSH client/server with "secure copy" utility, SCP.
- SNMP v1, v2c, v3 with Enterprise MIB.
- HTTPS TLS v1.3/v1.2 (Web Interface).
- TACACS+, RADIUS, LDAP secure access authentication.
- DHCP client.
- SYSLOG.
- IPv4/IPv6.
- Optional PTP/IEEE-1588-2008 (v2) Grandmaster. (Future Release)

NTP CLIENT AND PTP SLAVE SOFTWARE:
- NTP client software is freely available. Refer to:
  endruntechnologies.com/products/ntp-time-servers/ntp-client-software
- For information about PTP slave software see:
  endruntechnologies.com/products/grandmaster-clocks/ptp-slaves

NETWORK I/O:
- Two rear-panel RJ-45 jacks.
- Two 100/1000 Base-T Ethernet.

MAINTENANCE CONSOLE:
- Serial I/O on rear panel USB Micro-B connector for secure, local terminal access.
- 115200 baud, 8 data bits, no parity, 1 stop bit, Flow Control Xon/ Xoff.

SYSTEM STATUS INDICATORS:
- Sync LED: Amber LED pulses to indicate lock status.
- Alarm LED: Red LED indicates a serious fault condition.

ALPHANUMERIC DISPLAY/KEYPAD:
- Display: Brilliant 16x280 graphical, dot-matrix, vacuum-fluorescent.
- Keypad: Enter, Back, Edit, Right, Left, Up, Down, Help.
- Display/keypad is provided with the Sonoma D22 model. Sonoma N22 has no display/keypad.
- Note: The only difference between Sonoma D22 and Sonoma N22 is the display/keypad.

FIRMWARE UPGRADES:
- Software is field-upgradeable and provided free-of-charge.

POWER:
- 22 watts with TCXO (standard configuration). 27-29 watts with OCXO. 36-38 watts with Rb.
- 90-264 VAC, 47-63 Hz, 1.0A maximum.
- 3-Pin IEC 320 on rear panel, 2-meter cord included.

SIZE:
- Chassis: 1.75"H x 17"W x 10.75"D (19" rackmount).
- Weight: < 8 pounds.
- Antenna: 3.25"H x 3.0" diameter.

ENVIRONMENTAL:
- Operating Temperature/Humidity: 0° to +50° C / 5% to 90% RH, non-condensing.
- Storage Temperature/Humidity: -40° to +85° C / 5% to 95% RH, non-condensing.

COMPLIANCE:
- CE, FCC, RoHS, WEEE, TAA. UL for many Sonoma configurations.

OPTIONS:
- GPS Antenna Kit, Premium OCXO, Rubidium, IEEE-1588v2 (PTP), Time Code Output, 1 PPS Output, DC Power Supply (12,24,48,125 VDC), Dual Power Supplies, Open-Collector Alarm Output, 10 MPPS, Programmable Pulse Output, Serial Time/Sysplex Timer Output.

ANTENNA KIT OPTION (Standard and Anti-Jam):
- TNC connector (female), Z_{out} = 50Ω. 5 VDC input.
- +40/+38 dB gain (std/anti-jam) LNA and bandpass filter for out-of-band interference rejection.
- Rugged, all-weather housing capable of operation over -40° to +85°C.
- Mounting via 18" long," aluminum pipe with clamps.
- 50' low-loss RG-59 downlead cable is typical. Other lengths are available, up to 1000'.
- Anti-Jam Antenna option: endruntechnologies.com/products/antennas-accessories/gps-anti-jam-antenna
- Window-mount antenna kit is optional.

PTP/IEEE-1588 GRANDMASTER OPTION (Future availability):
- IEEE-1588–2008 (v2) with hardware timestamping.
- Parameters: Default Profile. Multicast or Hybrid (mixed Unicast/Multicast). Two-Step Clock.
  Delay Mechanism: E2E or P2P. Delay Interval: 32 seconds. Transport: UDP/IPv4.
  Sync Interval: 1, 2, 4, 8, 16, 32, 64 or 128 packets / 1 second.
  Announce Interval: 1 packet per 1, 2, 4, 8 or 16 seconds.
- PTP Timestamp Resolution: 8 nanoseconds.
- PTP Timestamp Accuracy: 33 nanoseconds RMS to UTC(USNO)
  18 nanoseconds with calibration option.
- For more information see: endruntechnologies.com/pdf/PTP-IEEE-1588.pdf

1 PPS OUTPUT OPTION:
- Commonly ordered with the PTP/IEEE-1588 option.
- 1 PPS: Positive on-time TTL pulse @ 50Ω or RS-422 levels.
- User-Selectable Width: 20 us, 1ms, 100 ms, 500 ms.
- Stability: TDEV < 20 ns, $\tau < 10^5$ seconds.

DUAL POWER SUPPLIES OPTION:
- Dual-Redundant Power Supplies with alarm indication in case of failure.
- AC/AC, AC/DC, or DC/DC is available.

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