

Centaur - Release Notes

Firmware Version	Release Date
4.3.20	2018-09-19
4.3.19	2018-06-29
4.3.18	2018-04-30
4.0.10	2018-01-22
4.0.8	2017-11-02
3.4.14	2017-02-27
3.3.3	2016-11-08

Summary for Version 4.3.20

Firmware version 4.3.20 is a general availability release that introduces improvements and resolves some outstanding issues. This firmware release includes a workaround to address the GPS Week Number Roll Over limitation, a major GPS limitation that causes the week number to go back in time by approximately 20 years every 20 years. In addition, relative humidity has been added to weather parameters that can be acquired from the Gill Instruments Maximet GMX500 compact digital weather station (with built-in GPS). A new 6-channel Centaur (CTR4-6A/S) model has also been introduced which has three channels with Data Authentication capability and three standard channels. Firmware version 4.3.20 also resolves Web interface display issues and archiving issues that occurred in earlier firmware versions.

Summary for Version 4.3.19

Firmware version 4.3.19 is a general availability release to support a minor hardware update that is required for newly-manufactured Centaur instruments. Otherwise, this firmware version provides the same features and performance capabilities as Firmware version 4.3.18. If your instrument is currently running Firmware version 4.3.18, there is no reason to update to version 4.3.19.

Summary for Version 4.3.18

Firmware version 4.3.18 is an optional release that introduces new capabilities that support applications using micro-barometers and weather stations, seismic applications that benefit from real-time correction of sensor orientation and/or tilt, as well as applications

that require secure data authentication such as test ban monitoring. In addition, sensor calibration output and control is significantly enhanced. Several of the new enhancements are applicable to previous Centaur models, but some are enabled by the new CTR4 Centaur series models introduced this year.

The new CTR4 series models introduce a number of capabilities including calibration output enhancements that support broader sensor calibration capability. These new models support a current source mode in addition to voltage source mode and improved calibration output signal accuracy of $\pm 1\%$. The voltage mode maximum output range has been doubled to 20 Vpp.

The new CTR4 series models include the CTR4-3A which has built-in case tamper detection, supports external tamper switches, and has built-in hardware authentication of CD-1.1 message formats, providing a fully-integrated, compact and low-power digitizing solution ideally suited for monitoring stations streaming authenticated data for test ban verification regimes.

For all models of Centaur, firmware version 4.3.18 adds a new highly versatile sensor orientation correction feature unique to Nanometrics which performs full 3D real-time data rotation to correct for sensor Azimuth misalignment, sensor tilt, as well as axis remapping. To complement the existing calibration file playback capability, an onboard waveform synthesizer is now included to generate user-configurable Sine and PRB (Pseudo Random Binary) calibration waveforms. Both the playback and synthesized signals are now fully adjustable, including user control of gain, duration, lead-in and lead-out silence intervals. Support has been added for analog micro-barometers and digital weather stations to allow users to more easily deploy Centaurs in applications beyond seismic monitoring, such as infrasound.

New features and improvements in release 4.3.20 include:

- [Workaround for GPS Week Number Rollover](#)
- [Relative Humidity parameter added to Gill Maximet GMX500 Support](#)
- [Support for a new 6-Channel Centaur with Authentication capabilities](#)

New features and improvements in release 4.3.18 include:

- For all CTR4 series models:
 - [Support for new Centaur CTR4 calibration signal generator](#)
- For the CTR4 model with authentication (CTR4-3A):
 - [Support for built-in hardware authentication of CD-1.1 data using DSA and ECDSA digital signature](#)
 - [CD-1.1 Formats and Protocols for Continuous Data](#)

- [Support for built-in and external tamper detection](#)
- For all series models:
 - [Synthetic Sine and PRB waveform generation for calibration](#)
 - [Calibration playback files with adjustable gain, duration, lead-in and lead-out](#)
 - [Calibration command API](#)
 - [Increased maximum sampling rate for the external SOH ports to 1 sps](#)
 - [Introduced units of pressure \(Pa\) to support use of microbarometers](#)
 - [Seismowave MB3a microbarometer added to the Sensor Library](#)
 - [Support for Gill Instruments Maximet GMX500 Digital Weather station](#)
 - [Sensor 3D real-time orientation correction using orthogonal data rotation](#)
 - [Open/Close switch detection support via external SOH ports](#)
 - [2000 V/m/s Trillium 120QA seismometer added to sensor library](#)

Fixes and changes addressed in release 4.3.20 include:

- [Fixed 'Calibration underway' message to display only on channels being calibrated](#)
- [Fixed the Web interface to display correct default duration for Calibration Playback files](#)
- [Increased the interval time for CD-1.1 FrameSender reconnect requests](#)
- [Resolved continuous archiving issue on start up that prevented archiving of low sample rate channels](#)

Fixes and changes addressed in release 4.3.18 include:

- [Fixed problem with time-based SeedLink data retrievals](#)
- [Sample rate added to Dataless SEED instrument response](#)

New Features and Improvements released in 4.3.20 firmware

Workaround for GPS Week Number Rollover

The Global Positioning System (GPS) has a design limitation where the timing information from the satellites uses a 10 bit (0-1023) week number that cycles every 20 years. This is called Week Number Roll Over. Firmware version 4.3.20 introduces a workaround for this issue where the Centaur compares the week number received from the GPS satellite with a fixed minimum week number and adjusts the received week number if necessary. If the satellite week number is less than 2016 then firmware adds 1024 to the GPS receiver week number permitting operation until week 3040 (2038-04-10) when it will roll back to week 2016 (2018-08-25).

Relative Humidity parameter added to Gill Maximet GMX500 Support

Firmware version 4.3.20 adds support for relative humidity measurement acquisition from the Gill Instruments Maximet GMX500 compact digital weather station (with built-in GPS). As with the weather parameters that were introduced in firmware version 4.3.18, once

acquired, the relative humidity data is automatically associated with State of Health (SOH) time series data available for the data store, archiving on external SD media, and for streaming using the SEED channel code (LIO) Relative Humidity.

The Relative Humidity parameter is additional to the weather parameters that were introduced in firmware version 4.3.18. These include Wind speed (LWS), Wind direction (LWD), Outside barometric pressure (LDO), Outside Environment temperature (LKO).

Support for a new 6-Channel Centaur with Authentication capabilities

Firmware 4.3.20 supports a new 6-channel Centaur with Authentication (CTR4-6A/S). This model, which supports configuration of Authentication on 3 channels and standard digitization on 3 channels, can be used in instances where the user requires a single digitizer for one application, such as test ban monitoring and a second digitizer for a second application, such as earthquake early warning.

When Authenticating is enabled, the maximum archiving and streaming rate is limited to an aggregate sample rate of 500 Hz. This aggregate rate is the sum of the sample rates of the primary and secondary channels from all sensors, and can involve a combination of streaming over CD-1.1 and NP protocol as well as MiniSEED SD archiving. SeedLink streaming is not supported when Authentication is enabled.

New Features and Improvements released in 4.3.18 firmware

Support for new Centaur CTR4 calibration signal generator

The calibration output signal generator has been enhanced for Centaur CTR4 series models to enable the calibration of a broader range of geophysical sensors including seismic and infrasound sensors. The Centaur CTR4 calibration circuit now includes a ± 30 mA current source mode in addition to the existing voltage source mode, and also doubles the maximum voltage mode calibration signal amplitude to ± 10 V—an increase from the ± 5 V in previous Centaur models. Calibration output amplitude accuracy on Centaur CTR4 series models has been improved to $\pm 1\%$ for peak amplitudes from ± 10 V to ± 5 mV, and from ± 30 mA to ± 30 μ A. Note that when using current mode for calibration, the calibration signal should be fed one at a time into the calibration coil of individual channels to avoid dividing the current in undefined proportions.

Support for built-in hardware authentication of CD-1.1 data using DSA and ECDSA digital signature in Authenticating Centaur (CTR4-3A)

Firmware version 4.3.18 introduces support for the 3-channel Centaur digital recorder CTR4 with Authentication (model CTR4-3A). The Centaur CTR4-3A model includes built-in hardware authentication for applications that require digital signatures of data using Digital Signature Algorithm (DSA) or Elliptic Curve Digital Signature Algorithm (ECDSA). The digital

signature is optionally applied to the CD-1.1 streaming protocol for compatibility with test ban verification regimes.

CD-1.1 Formats and Protocols for Continuous Data in Authenticating Centaur (CTR4-3A)

Data streaming using CD-1.1 Formats and Protocols for Continuous Data (CD-1.1) has been added in firmware version 4.3.18 for compatibility with test ban verification regimes. This factory-enabled feature is provided on Centaur digital recorders with integrated hardware authentication (CTR4-3A). Encapsulation of authenticated time series data into CD-1.1 format is supported at sample rates of up to 200 sps from the primary digitizer channels and 1 sps for weather channels.

Support for built-in and external tamper detection in Authenticating Centaur (CTR4-3A)

The Centaur digital recorder with Authentication (CTR4-3A) includes a factory-installed internal case tamper switch and support for two external tamper switches, to detect attempts for unauthorized access to the digitizer for the purpose of intentional interference with the proper operation of the instrument.

Synthetic Sine and PRB waveform generation for calibration

A new synthetic waveform signal generator for calibration introduces the ability to generate on-demand sine wave and PRB signals. This feature allows the user to configure the frequency or pulse-width, duration, amplitude, as well as lead-in and lead-out silence intervals for the selected waveform.

The synthetic waveform generator also supports the current source output capabilities provided by the high accuracy calibration circuit in the new Centaur CTR4 series models.

This feature complements the existing waveform file playback feature; it does not replace it. The file playback feature allows you to generate any specific signals you wish to define and upload to the Centaur.

Calibration playback files with adjustable gain, duration, lead-in and lead-out

Calibration waveform files uploaded to the Centaur can now be played back with adjustable gain, duration, lead-in and lead-out silence, and in voltage source or current source modes (current source mode available on CTR4 series models). Gain is adjustable from 1.0 to 0.001 (or up to 2.0 times for CTR4 models). File playback can be limited to a specific duration instead of playing back the entire file. Lead-in and/or lead-out silence can be set from 0 to 3600 seconds.

Calibration command API

The new HTTP-based Calibration API provides the ability to create custom scripts or applications to initiate a calibration for a specified sensor. The Calibration API requests allows the user to specify the desired parameters for the required calibration output signal type: file playback or synthesized sine or PRB, current or voltage waveform, and other waveform parameters.

Increased maximum sampling rate for the external SOH ports to 1 sps

The sampling rate for the external SOH ports can now be set from 1 sample per second to 1 sample per hour (3600 s). Previously, the highest sampling rate was 1 sample per minute.

Introduced units of pressure (Pa) to support use of microbarometers

Sensor definitions and the waveform display now support units of pressure (Pa) in addition to velocity and acceleration. This feature also allows you to define microbarometer sensors in the Centaur by adding a custom sensor type to the sensor library.

Seismowave MB3a microbarometer added to Sensor Library

To support infrasound monitoring applications, a default sensor for the Seismowave MB3a analog microbarometer has been added to the sensor library, allowing you to connect the MB3a to a Centaur without having to define a custom sensor. The MB3a sensor profile defines key sensor attributes including sensitivity, units, calibration control lines, and power supply requirements. In addition, the MB3a transfer function is included, allowing the generation of complete RESP or dataless SEED response files for the Centaur and MB3a. All standard geophysical sensor digitizing, streaming, and recording capabilities of Centaur are available for the MB3a.

Support for Gill Instruments Maximet GMX500 Digital Weather station

Firmware version 4.3.18 supports the Gill Instruments Maximet GMX500 compact digital weather station with built-in GPS using Gill's native communication protocol to capture current environmental conditions. The acquired weather data is automatically associated with State of Health (SOH) time series data available for the data store, archiving on external SD media, and for streaming using the following SEED channel codes:

- LWS: Wind speed
- LWD: Wind direction
- LDO: Outside barometric pressure
- LKO: Outside Environment temperature

Optionally, the weather data can be mapped to CD-1.1 for the Authenticating Centaur CTR4-3A model by enabling the desired weather channels from the Data Streaming option.

Sensor 3D real-time orientation correction using orthogonal data rotation

A new feature has been added to firmware version 4.3.18 to perform real-time 3D seismic data rotation to correct sensor orientation for use cases in which the physical orientation of a deployed three-component geophysical sensor, such as a Trillium seismometer or a Titan accelerometer, is different than what is desired, and where the output X, Y and Z signals do not represent the desired directions of sensitivity (often intended to be East, North and Vertical). Examples of where the sensor orientation correction feature may be used include borehole sensor azimuth correction, sensor tilt correction, and vertical Titan output remapping. Please refer to the *Centaur User Guide* for detailed use case information.

Open/close switch detection support via external SOH ports

The external SOH channel functionality has been expanded to include the ability to define a channel as a simple open/close switch. A typical application for a switch is for a tamper detection where a switch is installed on a door and triggers a change in state on the SOH port when the door is open. The SOH port is sampled periodically at a user-selectable rate from one sample per second to one sample per hour. As part of the CD-1.1 feature, the switch state of each external SOH channel can be associated with the CD-1.1 channel status field bits for equipment housing, vault, or digitizer tamper switch.

2000 V/m/s Trillium 120QA seismometer added to sensor library

A default sensor definition has been added to the sensor library for the 2000 V/m/s Trillium120QA seismometer. Support for RESP or dataless SEED response file downloads for this seismometer has also been added.

Fixes and Changes released in 4.3.20 firmware

Fixed 'Calibration underway' message to display only on channels being calibrated

In previous firmware releases, for 6-channel Centaurs, the Channel status parameter in the data packet header would incorrectly display the message "Calibration Underway" for all six channels even if calibration was requested only for three channels. Firmware version 4.3.20 fixes this issue. The message "Calibration Underway" is only displayed for those channels being calibrated.

Fixed the Web interface to display correct default duration for Calibration Playback files

In the **Waveform** tab on Web interface, configuring a Playback type of calibration allows the user to select different sample calibration files from the **Filename** dropdown menu. Each sample calibration file has a default value for Duration that should change when you select a different Filename. For example, "Titan prb 20g 10ms 5min" has a default Duration

value of 300 and "Titan sine 2g 30s" has a default Duration value of 30. In previous firmware versions this Duration default value did not refresh when a different Filename was selected. Firmware 4.3.20 fixes this issue.

Increased the interval time for CD-1.1 FrameSender reconnect requests

In previous releases, in some instances the CD-1.1 sender would be unable to connect to a CD-1.1 receiver. In these instances, reconnect requests were sent every 1 second adding significantly to transmission traffic and preventing some data from being sent. This issue has been resolved by firmware version 4.3.20 with the increase of the reconnect request interval to 30 s. This change along with the data buffering capabilities of the CD-1.1 sender allows untransmitted data to be sent once the connection is re-established between the sender and the receiver.

Resolved continuous archiving issue on start up that prevented archiving of channels

In previous firmware versions, upon start up, some channels would not be included in continuous archiving. This was dependent on the condition of the Store when continuous archiving started and was most likely to occur if a Store had been recreated shortly before continuous archiving started. Firmware 4.3.20 fixes this issue. Channels that may have been missed on start up are now discovered and added to the continuous archive process.

Fixes and Changes released in 4.3.18 firmware

Fixed problem with time-based SeedLink data retrievals

In previous releases, in rare occurrences, time-based SeedLink data retrieval requests returned no data. Firmware version 4.3.18 fixes this issue.

Sample rate added to Dataless SEED instrument response

The currently configured sample rate is now correctly reflected in dataless SEED files generated by the instrument. The sample rate can be found in SEED blockette #52, field #18.

Upgrade Considerations and Dependencies

Ensure all default instrument passwords are changed to reduce the risk of unauthorized access

Nanometrics highly recommends that all instrument passwords are changed from the default values to improve network security and reduce the risk of unauthorized access. This includes the root password, calibration password, and admin password. Nanometrics technical note *How to Increase the Security of your Internet-connected Instruments (18109)* provides recommendations on how to ensure your instruments are secure, including how

to change these passwords to improve instrument security. This technical note can be obtained through our online knowledge base, or by contacting Nanometrics customer support.

User-uploaded calibration playback files are deleted when upgrading firmware

User-uploaded calibration playback files must be reloaded onto the instrument after a firmware upgrade, as these are deleted as part of the firmware upgrade process.

Firmware upgrade from 3.1.3 or earlier will cause the Linux root password to revert to the factory default password

If upgrading the firmware from version 3.1.3 or earlier to version 3.2.8 or later, the passwords for logging in to the Linux root or the calibration file upload accounts will revert to factory default passwords. The passwords to log on to the Web Interface are preserved.

Workaround: If you have previously changed the Linux passwords, you must use the factory default password to login and manually update them to the desired passwords. Search for “Calibration Password” in the online help or in the PDF User Guide.

Apollo Server and Apollo Project Version Dependency

If you are using Apollo Server and Apollo Project with the Centaur, be sure to use Apollo Server version 2.5.9 or higher and Apollo Project version 2.4.1 or higher. This is to support the default NP streaming format used in Centaur firmware version 3.1.x or later. Alternatively, the ‘Libra Compatibility Streaming’ option available in the Configuration menu can allow the Centaur to work with older versions of Apollo Server and Apollo Project.

Configurable Archive Filenames

For the Centaur, upgrading to firmware version 4.3.18 from a version prior to 4.0 will apply changes to configurable archive filename settings:

- File format extensions will be appended to all existing archive filename patterns. ‘.miniseed’ will be added to seismic data archive filenames, and either ‘.miniseed’ or ‘.csv’ will be added to existing SOH archive file names, depending on the configured SOH archive format.
- Seismic event archives will be reconfigured to use MiniSEED format, regardless of the current configuration. This format setting will have to be changed after firmware upgrade if another format is desired.
- Support for SOH archive files in NP format was removed in firmware version 1.5.28. If the Centaur is initially using an older firmware version and SOH archive files are configured to use NP format, this setting will be reconfigured to use MiniSEED format.

Other Considerations or Limitations

Some pages of alternate languages unavailable in Firefox

Newer versions of Firefox cannot display all of the Web Interface pages for all languages, and navigating to these unavailable pages returns the user to the **Summary** page.

Workaround: This issue is exclusive to newer versions of Firefox. Using an alternate browser (Chrome, Safari) will avoid this issue.

Context menu “paste” does not work properly in configuration menu

When configuring the instrument using the configuration menu in the Web Interface, the use of context menu paste (i.e. right-clicking the item and selecting “paste” from the subsequent menu) will insert text that visibly looks correct but will not be recognized by the configuration system.

Workaround: Use the keyboard shortcut ‘CTRL-V’ to paste the configuration instead of using the context menu paste.

HTTP based web service

The Web Interface and the APIs use the HTTP protocol for instrument access. Some browsers may show a security warning when attempting to access the instrument.

Additional columns present in exported state of health CSV files

When exporting CSV-based state of health data from Centaur hardware models CTR1 and CTR2, additional columns representing the external state of health channels that are available on hardware models CTR3 and CTR4 will be present.

Column names for Sensor State of Health in Exported CSV Files are no longer configurable

When defining a custom sensor in the instrument configuration it is possible to specify custom names for each of the Sensor SOH channels. Starting with firmware version 4.3, these custom channel names will appear on the **Sensors** page only, and will no longer be downloaded with the CSV-based state of health files.

USB Wi-Fi dongle fails to initialize when activated

On rare occasions the USB Wi-Fi dongle may fail to initialize when activated and the local wireless network associated with the instrument will not be visible on nearby wireless devices. The workaround for this issue is to restart the instrument.

Limitations on External SOH update frequency at high sample rates

When configuring a Centaur with sample rates greater than 1000 Hz, it will not reliably record and stream external SOH channel values when configured with an external SOH reporting period of less than 10 seconds.

CD-1.1 tamper switch configuration requires restart to take effect

Although it is possible to customize the default associations of the CD-1.1 “Digitizing equipment open”, “Equipment housing open”, and “Vault door open” to corresponding SOH channels on the Data Streaming -> CD1.1 Streaming -> Status page of the instrument configuration, it is not recommended to do this. Furthermore, the “Digitizing equipment open” association to external SOH channel 1 should not be changed due to the association with the corresponding tamper detection circuit inside the Centaur. If any of these tamper switch default associations are changed, then an instrument restart will be required for them to take effect.

Ext4 format no longer supported on external SD media, as of version 3.4

As of firmware version 3.4.x, Centaur no longer supports Ext4 formatting for the removable SD card. SD cards for archiving must be formatted as FAT32 SDHC. You can format an SD card when it is installed on the Centaur, or use a Windows, Linux or Macintosh PC to format an SD card as FAT32 SDHC. Note that Windows cannot format a 64GB SD card as FAT32 SDHC. SD cards preformatted as FAT32 SDXC will need to be reformatted as FAT32 SDHC on the Centaur instrument.

USB not supported on Centaur Authenticating Models

Use of the USB port located behind the media bay door is not supported on Centaur authenticating models CTR4-3A and CTR4-6A/S since the USB port is dedicated to data signing operations.

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