



**CODEVINTEC**

Tecnologie per le Scienze della Terra e del Mare

45° 27' 39.384" N  
9° 07' 30.145" E

## **Centaur** A truly modern digital recorder

Deployment in Alaska: photo courtesy of Tim Bartholomaus, University of Idaho



**Centaur is ideal for multi-disciplinary science involving geophysical sensor applications.**

### **Highly configurable**

- > 3-channel or 6-channel versions
- > Dual sample rates, so user can choose any two
- > Configurable high-quality, low-pass and high-pass filters, up to 5th order
- > Options can be selected specifically to reduce latency
- > Firmware that's flexible enough to accommodate different filter designs



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## **Centaur** The best digital recorder on the market just got better

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The Centaur is an all-in-one digitizer, recorder, and telemetry instrument with advanced on-board data processing capable of data manipulation and detecting events in the field.

Whether your deployment is portable or permanent, standalone or networked, the choice of digital recorder has never been easier.

Available with 3 or 6 channels, which support sensors such as seismometers, microbarometers, and weather stations.

The extensive configurability is available via a web interface, which also provides real-time state of health and waveform viewing.

### **Exceptional Performance**

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- > Best-in-class dynamic range and low noise, up to 31 bit analog-digital conversion
- > Dual sample rates of up to 5000 sps supports high- and low-frequency applications
- > Hot-swap SD media card up to 64 GB for gap-free data retrieval
- > Onboard 8 GB memory is field-expandable up to 64 GB by adding an internal SD card
- > Support for GNSS (GPS + selectable constellation), PTP (Precision Time Protocol) or NTP time sources and can also act as a timing master
- > High accuracy voltage and current source calibration signal generator
- > Records calibration signal generator output as fourth time series channel
- > Sensor calibration using fully configurable sine and pseudo random binary waveforms or playback of user defined calibration files

### **Reliability**

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- > Redundant, fail-safe data archive with field swap capability
- > Rugged, waterproof field enclosure for harsh environments, rated for continuous submersion (IP68)
- > Excellent protection for ESD & lightning surge

### **Onboard data processing**

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- > Data backfill in case of communication interruptions
- > Fully configurable lowpass, highpass and bandpass digital filtering
- > The Centaur with Authentication (models CTR4-3A & CTR4-6A/S) has built-in hardware authentication of CD-1.1 message formats, providing a fully-integrated, compact solution ideally suited for test ban verification regimes
- > User configurable onboard 3-D data rotation for orientation correction of Azimuth and tilt rotation



## Technical specifications Centaur (CTR4 Series)

### Sensor inputs

<b>Channels</b>	Available with 3 or 6 channel inputs
<b>Sampling</b>	Simultaneous on all 3 or 6 channels
<b>Resolution</b>	24 bits per channel, full 24-bit range to clip level
<b>Input voltage range</b> (Peak-to-peak differential)	> 40 V, 20 V, 10 V, 4 V, 2 V, 1 V (standard) > 10 V, 5 V, 2.5 V, 1 V, 0.5 V, 0.25 V (high-gain)
<b>Input Impedance</b>	40 kΩ (standard digitizer) 1.8 MΩ (high-gain digitizer)

### Sensor compatibility

<b>Sensor Types</b>	Broadband seismometers, short period geophones, and microbarometers
<b>Control Lines</b>	6 per connector – typically used for calibration enable, mass center, mass lock/unlock, XYZ/UVW select
<b>Sensor Power</b>	> Supply power pass-through to sensor (9-36 VDC, 1A) > Over-current and surge protected
<b>Auto Mass Centering</b>	Configurable thresholds, intervals, retries
<b>Serial Interface</b>	Supports digital management of Nanometrics sensors and connectivity to weather stations

### Digitizer performance & capabilities

<b>Bit Depth</b>	ADC selectable from 24 to 31 bits
<b>Accuracy</b>	Nominal gain accuracy within $\pm 0.5\%$
<b>Dynamic Range</b>	142 dB @ 100 sps, 135 dB @ 500 sps (full-scale peak to RMS shorted-input noise)
<b>Preamp Gain</b>	> Standard: 1x, 2x, 4x, 10x, 20x, 40x > High Gain: 4x, 8x, 16x, 40x, 80x, 160x
<b>Digital Gain</b>	0.001 to 100 high precision DSP gain permits choice of any digitizer gain
<b>Sample Rates</b>	1, 2, 5, 10, 20, 40, 50, 80, 100, 125, 200, 250, 500, 1000, 2000, 5000 sps
<b>Dual Sample Rates</b>	A second sample rate can be selected from the sample rates above
<b>Decimation Anti-Aliasing Filter</b>	> Selectable linear phase (noncausal) or minimum phase (causal) > -140 dB (linear phase) or -120 dB (minimum phase) at Nyquist frequency, 0 dB at 80% Nyquist
<b>Digital Filters</b>	> User-configurable low-pass and high-pass > 1st to 5th order, 0.1 mHz to Nyquist > Different filters may be configured for primary and secondary sample rates and Sensor A and B
<b>Orientation Correction</b>	User configurable onboard 3-D data rotation for correcting azimuth and tilt

### Recording (continuous)

<b>Formats</b>	MiniSEED,
<b>Internal Memory</b>	8 GB internal memory (32 or 64 GB options available)
<b>Removable Media</b>	SD Card up to 64 GB statistics calculated on

### Recording (events)

<b>Triggers</b>	Bandpassed STA/LTA, threshold
<b>Captured Data</b>	MiniSEED, ASCII
<b>Data Products</b>	Peak Ground Motion (i.e PGA, PGV, PGD) statistics calculated on the instrument

### Calibration

<b>Signal Source</b>	16-bit DAC with 30 ksp/s output
<b>Calibration Mode</b>	> Voltage source, 1% accuracy from $\pm 10V$ to $\pm 5mV$ > Current source, 1% accuracy from $\pm 30mA$ to $\pm 30\mu A$
<b>Calibration Signal and Response Recording</b>	> Calibration signal digitized as a fourth 24-bit channel available to be streamed or archived > Calibration signal and the sensor response can be archived together as an event file
<b>Waveforms</b>	Synthesized sine, step, PRB signals Playback user defined calibration files User controllable amplitude, frequency, pulse width, duration, lead-in and lead-out silence

### State-of-health inputs

<b>Channels</b>	3 singled-ended inputs, $\pm 5 V$ range, 50 kΩ input impedance
<b>Sampling Interval</b>	Configurable from 1 to 3600 seconds
<b>Accuracy</b>	18 bits effective resolution

### Data retrieval

<b>File Transfer</b>	Via Ethernet, optional WiFi or Ethernet-connected DSL, VSAT, cellular, radio
<b>Media Exchange</b>	SD card field-swappable during continuous recording with no loss of data
<b>Response Metadata</b>	Generate and download full digitizer/sensor response files in RESP or Dataless SEED or StationXML format

### Data streaming

<b>Continuous</b>	Seismic data and State-of-Health data
<b>Formats</b>	SeedLink (not available when authenticating), Nanometrics NP, authenticating models have CD-1.1
<b>Events</b>	Triggered event data: email, secure file transfer, other options available

### Timing - GNSS & Precision network timing

<b>Timing System</b>	Internal DCXO clock disciplined to selectable timing source
<b>Timing Source</b>	Select from GNSS, PTP (Precision Timing Protocol), NTP or free-running
<b>Timing Server</b>	Serve PTP or NTP time to other Centaur, Titan SMA/EA or Meridian
<b>Timing Accuracy</b>	<5 $\mu$ sec (GNSS Always on) <100 $\mu$ sec (GNSS duty cycled, PTP or local NTP)
<b>GNSS Receiver</b>	Internal 32 channel GNSS receiver
<b>GNSS Constellations</b>	GPS + select one of Beidou, Glonass, Galileo, QZSS
<b>GNSS Power</b>	Selectable: always on, duty cycled or off

### Local user interface

<b>Removable Media</b>	SD card protected in waterproof media bay
<b>External LEDs</b>	System status, Ethernet link, time quality, media card status, sensor A & B
<b>Buttons</b>	WiFi wakeup, media eject, system shutdown



## Communications

<b>Web-based Graphical UI</b>	Supports standard PC, tablet and mobile devices. Used for waveform and state-of-health monitoring, configuration, maintenance, sensor management and calibration, downloading data and events
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## Communications (CONT'D)

<b>Interfaces</b>	10/100 Base-T Ethernet, WiFi (optional), Serial via USB (USB unavailable on)
<b>IP Addressing</b>	Static, dynamic (DHCP) or link-local IP
<b>Protocols</b>	UDP/IP unicast/multicast, HTTP data streaming

## Power

<b>Power Supply</b>	9-36 VDC isolated input
<b>Protection</b>	Electronic resettable fuse design, lightning surge, reverse battery and short circuit protection
<b>Battery Manage</b>	User-configurable low voltage shutdown and restart thresholds

## Power usage (Typical)

<b>3 chan. (standard)</b>	850 mW
<b>6 chan. (standard)</b>	1.2 W
<b>Ethernet</b>	Add 0.2 W for 10 Base-T, 0.3 W for 100 Base-T
<b>High Gain</b>	Add 0.2 W for every 3 high-gain channels
<b>Authentication</b>	Authenticating models add 1.2 W if enabled

## Connectors

<b>Sensor</b>	26-pin Mil. circular, shell size 16, femal
<b>Power</b>	3-pin Mil. circular, shell size 8, male
<b>Ethernet</b>	Watertight RJ-45
<b>USB</b>	2.0 Type A receptacle behind media bay door (USB unavailable on Authenticating models)
<b>GNSS Antenna</b>	TNC (female) with 3.3V supply for active antenna
<b>State-of-Health</b>	4-pin Mil. circular, shell size 8, female

## Physical characteristics

<b>Housing</b>	Aluminum
<b>Weather Resistance</b>	Rated to IP68 with connectors mated
<b>Humidity</b>	0 to 100%
<b>Operating Temperature</b>	-20°C to +60°C (Ultra-low temperature option available. Please contact us.)
<b>Storage Temperature</b>	-40°C to +70°C
<b>Weight</b>	2.1 kg (3-channel), 2.2 kg (6-channel), 2.2 kg (CTR4-3A), 2.4 kg (CTR4-6A/S)
<b>Size</b>	196 mm (L) x 137 mm (W) x 88 mm (H), except CTR4-6A/S which is 196 mm (L) x 137 mm (W) x 93 mm (H)

## Centaur with authentication

### Models: CTR4-3A, 6A/S

<b>Streaming</b>	CD1.1 format
<b>Digital Signature</b>	Hardware authentication provides > Digital Signature Algorithm (DSA, SHA-1) and > Elliptic Curve Digital Signature Algorithm (ECDSA P-256, SHA-256) > Authentication on Sensor A only
<b>Tamper Detection</b>	Authenticating models have case tamper switch or 3 external switches via SOH connector