

OVERVIEW

xStrain® is a distributed bridge sensor digitizer unit designed for Structural Health Monitoring (SHM) applications. It enables precise digitization of Wheatstone bridge sensors, such as strain gauges, load cells, pressure cells, and displacement sensors, all of which are common in SHM projects. By capturing microvolt-level signals with high fidelity, xStrain ensures accurate monitoring of structural loads, stresses, and deformations.

DESCRIPTION

The xStrain unit employs a high-quality 24-bit Delta-Sigma ADC tailored for mV/V measurements, supporting up to 16 single-ended channels, 8 full-bridge channels (4-wire), or 4 sensed full-bridge channels (6-wire) with voltage sense compensation. This flexibility allows accurate monitoring of strain gauges while also supporting geotechnical and civil engineering sensors with ultra-low voltage outputs, such as load cells, pressure cells, and earth pressure transducers.

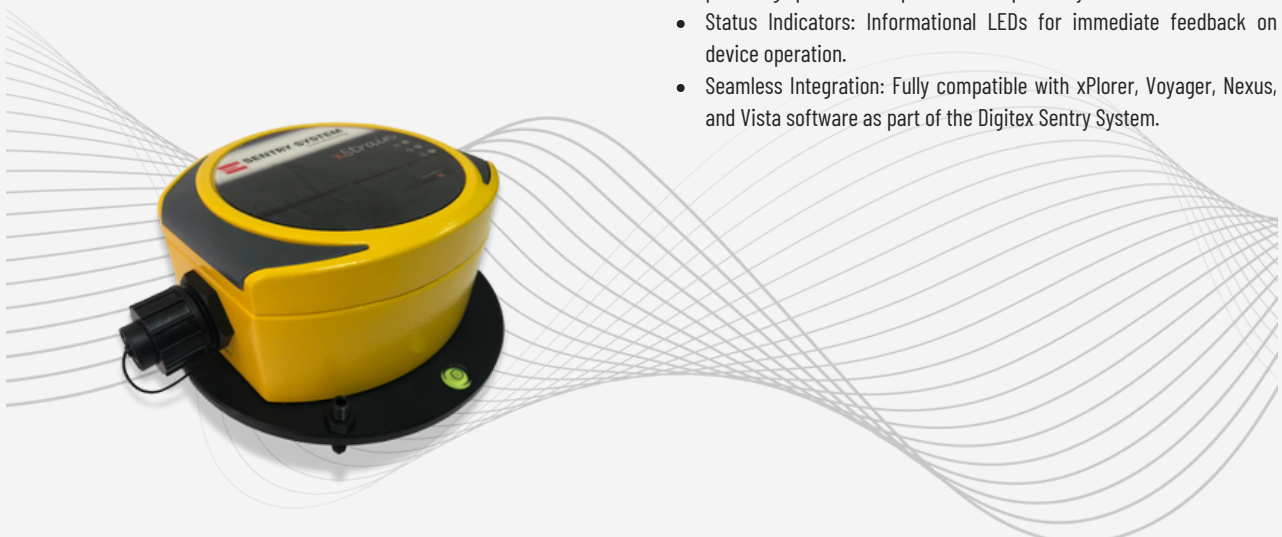
Key design features include a built-in anti-aliasing filter, configurable sampling rates from 1 sps up to 1000 sps, and Store&Forward® capability for uninterrupted data acquisition. Data can be stored locally on SD/eMMC in MiniSEED format or streamed in real time via Ethernet, Wi-Fi, DigiMESH®, or GSM/4G communication. GPS or DigiSync® provides precise time synchronization across all connected units.

APPLICATIONS

- Bridge and building strain monitoring
- Load measurement in structural members
- Earth pressure monitoring and geotechnical applications
- Pipeline and tank pressure monitoring
- Displacement and deformation monitoring
- Research and testing requiring precise bridge sensor digitization

KEY FEATURES

- High-Precision Bridge Digitization: 24-bit Delta-Sigma ADC optimized for mV/V inputs, capturing even the smallest strain and load variations.
- Flexible Channel Configurations: Up to 16 single-ended channels, 8 full-bridge (4-wire) channels, or 4 sensed full-bridge (6-wire) channels with sense wire compensation.
- Broad Sensor Compatibility: Works with strain gauges, load cells, displacement sensors, pressure cells, and other Wheatstone bridge-based sensors.
- Signal Quality: Built-in anti-aliasing filters and precision digitization at the sensor point reduce noise and improve accuracy.
- Advanced Data Handling: Store&Forward® technology prevents data loss; supports MiniSEED and proprietary Digitex compression formats.
- Flexible Communication: Standard Ethernet, with optional Wi-Fi, DigiMESH®, or GSM/4G modules for remote and distributed installations.
- Configurable Sampling Rates: From 1 SPS up to 1000 SPS for both static strain monitoring and dynamic load analysis.
- Time Synchronization: GPS or DigiSync® ensures sub-millisecond precision across distributed SHM networks.
- Local Storage: Optional SD/eMMC card for standalone operation and secure event logging.
- Device Management: Embedded web interface for easy configuration, live charting, and OTA firmware updates.
- Rugged Design: Compact IP67 aluminum enclosure with wide operating range (-40°C to +55°C), optimized for field deployment.
- Low Power Operation: low power consumption; PoE and 12-24VDC powering options with optional backup battery.
- Status Indicators: Informational LEDs for immediate feedback on device operation.
- Seamless Integration: Fully compatible with xPlorer, Voyager, Nexus, and Vista software as part of the Digitex Sentry System.



SPECIFICATIONS

Sensor

Type: External full-bridge (Wheatstone) sensor interface compatible with various strain gauges and load cells.

Supported Models : Full-bridge, half-bridge, and quarter-bridge strain gauges, load cells, pressure, force, and torque transducers (mV/V output).

Digitizer

Channels: Up to 4 pseudo differential, 24-bit, internally temperature-compensated inputs; programmable gain; software or hardware configurable.

Resolution: 24-bit Sigma-Delta ADC per channel

Sampling Rates: User-selectable from 1 to 1000 samples per second (SPS)

Anti-alias Filter: Integrated anti-aliasing filters. User configurable (SINC1, SINC2, SINC3 and SINC4)

Digital Filter: Software-selectable Butterworth and Chebyshev types; per-channel configurable.

Trigger

Modes: Above Max, Under Min, Over Relative, Over Absolute

Pre-/Post-Event: User configurable

Configuration: Voting logic with user-defined weighting per channel

Interface

Connectivity: Ethernet (10/100 Base-T), Wi-Fi, DigiMESH®, GSM/4G (model dependent)

Led Interface: Power, Streaming Type, State of Health, Battery Voltage, and Charging Status

Embedded Web server: Integrated HTTP interface for configuration, data retrieval, real-time visualization, and basic frequency analysis. Provides access to device logs, user actions (reboot, backup, restore, and configuration management), and sensor diagnostics.

Synchronization

Time Base: GPS-disciplined oscillator or DigiSync® network synchronization protocol

Accuracy: Sub-microsecond (GPS mode) or sub-millisecond (DigiSync® mode) timing precision across distributed networks.

Communications & Output

Data Modes: Continuous real-time streaming; user-configurable ON/OFF operation in standalone mode

Protocols: Embedded SeedLink protocol for data redundancy via Nexus application

Internal Storage: Optional 32 GB non-volatile SDHC card.

Operation Mode: Ring Buffer and Triggered Event modes; miniSEED format

Stream Compression DigiWLC®, miniSEED STEIM1 or Uncompressed

Data Reliability: Store&Forward® buffering - retains data during communication loss and automatically forwards upon link restoration, ensuring zero data loss

Power

Supply Voltage: 9 – 28 V DC (typ. 12 V) PoE compatible

Power Consumption: ~ 2.5 W (average)

Backup: Optional Li-Ion battery pack (~12 h autonomy)

Protection: Reverse voltage, over/under voltage, surge protection up to 2 kV DC (optional)

Physical

Dimensions: 130 × 120 × 65 mm (5.12 × 4.72 × 2.56 in)

Weight: 0.7 kg

Enclosure: Rugged coated aluminum housing, IP67 rated

Mounting: Horizontal or vertical using mounting plate; single anchor point, three leveling bolts, and integrated bubble level

Environmental

Operating Temp.: -20 °C to +60 °C

Humidity: 0 – 100 % RH (non-condensing)

Certification & Calibration

Standards: CE, RoHS, ISO9001, ISO14001

Calibration: Factory calibrated; individual calibration certificate included

Software Updates

Firmware: Over-the-air (OTA) updates via Voyager® or embedded HTTP server

AVAILABLE OPTIONS

SSWiFi: Wi-Fi Communication Module

SSGPS: GPS Module for time and data synchronization

SSGSM: 4G GSM module for streaming and/or SMS alarming

SSPW: Power protection module (2.25KV, 10-36V Input)

SSSDG: SD Memory Module (Non detachable 32GB SD card)

SSBAT: Battery option (12h autonomy)

SSDO: Digital Relay Outputs Module with ext. JB (4, NO/NC)

SSDSP: Informational display (2.8 Inch at the top)

SSPOE: Power Supply: 24VDC; 1A; 24W and POE Injector

BENEFITS

- Provides high-resolution strain and load monitoring essential for SHM
- Supports diverse bridge-based sensors, enabling flexible instrumentation
- Reduces noise and ensures reliability with local digitization and filtering
- Operates reliably in harsh environments with robust IP67 housing
- Enables distributed monitoring with Ethernet, Wi-Fi, DigiMESH®, and GSM/4G
- Works seamlessly with the Digitex ecosystem (xPlorer, Voyager, Nexus, Vista)