ALLEGATO 2

SCHEDE TECNICHE DEI PRINCIPALI COMPONENTI DELLA STRUMENTAZIONE DI MONITORAGGIO

KINEMETRICS

Advancement through Innovation

ANTELOPE

Antelope

Environmental Monitoring Software

Antelope Environmental Monitoring Software is a commercial-off-the-shelf data acquisition, analysis, and management software designed to provide a comprehensive set of environmental monitoring data and processed information in real-time. With growing data volumes and aggressive service level expectations, Antelope maximizes the potential of your IT organization while delivering real-time enterprise computing.

Antelope runs under Linux & Mac OS X environment. It is finely engineered, as an all-in-one package, through state-of-the-art technology and scientific advances, making it ideal for real-time monitoring of seismic events from local/regional, national and global networks. It, also, includes arrays for monitoring explosions, nuclear tests, and induced events from oil/gas exploration. Antelope takes full advantage of the extensive support services provided by Linux/UNIX environments and standard TCP/IP network utilities over multiple physical interfaces.

Antelope consists of two major sub-systems:

- **ARTS**, the Antelope Real-Time System
- **ASIS**, the Antelope Seismic Information System
- **Bighorn**, real-time structural health monitoring

The current generation of Antelope provides full functionality for seismic network and array operations, command and control, including real-time data acquisition from field digitizers, interactive control of field equipment, system state-of-health monitoring (SOH), real-time automated data processing (detection, rapid event association, event location, and archiving). It also offers interactive and batch processing, information system functions, automated distribution of raw data and processed results, batch mode seismic array processing, and a powerful development toolkit for extending and customizing the software. The Antelope Seismic Information System uses the relational database (RDBMS) formalism and the CSS 3.0 schema for information organization. Bighorn use time-domain filters to calculate in real-time strong-motion response spectra. The integrated alert processing issues demand spectra exceedances as soon as they occur providing now-casting capability on possible damages.

Antelope runs on RHEL, CentOS, and Mac OS X. In addition to providing specific functionality for seismic monitoring systems, Antelope offers a robust and versatile substratum of generic functions that can be used to support other non-seismic monitoring applications.

The latest release includes GIS capability and an AI event detector.

**Outside of Japan*

FEATURES

- Distributed real-time data acquisition and processing capability
- Unique data neutral and entirely data-driven architecture
- Lowes processing latency, suited for earthquake early warning systems (EEWS)
- Tie-in capability of virtually any seismic network in the world
- Distributed real-time system SOH monitoring and command & control capability
- Comprehensive automated seismic event information including an AI event detector
- Network size independent - software scales with hardware
- Writes data in real-time to a non-volatile disk ring buffer
- Size of ring buffer limited only by the maximum file size of OS
- Real-time system uses client/server TCP/IP paradigm
- Supports all telemetry links with standard TCP/IP Level 4 protocol over multiple physical interfaces including standard duplex serial interfaces
- A unique set of online and off-line processing tools
- Information system interfaces and functionality
- Offers RDBMS tools for rapid access to earthquake information
- Provides a rich development toolkit (e.g., Python, Perl, C, and C++)
- Highly configurable and adaptable to any monitoring system requirements
- 64-bit open-architecture modular design concept throughout
- Used by the largest seismic networks and major data centers in the world today*

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05-19-20

KINEMETRICS

Advancement through Innovation

OBSIDIAN

Obsidian

Next Generation of Web Based, High Dynamic Range, GPS/PTP Ready Accelerographs

Ready for the *right tool* for the job?

The **Obsidian** accelerograph is Kinemetrics' NEW product matched to Kinemetrics' exemplary EpiSensor accelerometer performance. It represents a new paradigm in open-architecture seismic data acquisition systems defining the *World's Next Generation* of seismic products.

It is designed to give you the flexibility required by the earthquake monitoring solutions of tomorrow capturing very-small to very-large earthquake sequences with a single sensor while being the *most versatile* accelerograph of today. No more and no less than you need.

You expect outstanding data fidelity and spectral purity. High accuracy data timing is of course required. But it goes beyond that. There are several standard recorded data formats to select from, or you can add your own. On the fly processing of parametric data using your algorithms. Interface to major data center software packages using *their* protocols. For timing use GPS where it makes sense and/or PTP when several units are connected via Ethernet along with DC power.

And when you're ready to get into Earthquake Early Warning Systems (EEWS), the **Obsidian** is ready too. Balance communications bandwidth and data latency with not one but two mechanisms to deliver *ultra-low* latency data.

Why struggle with limited keypads and hard to read displays when you're usually not there anyway? Access the system using your favorite web browser remotely or locally and wirelessly. Where it makes sense to retrieve data locally, do it with a simple thumb drive without commands or buttons.

And for those whose job it is to maintain the station we developed Streamlined Station Maintenance (SSM) that allows you to use your browser to log maintenance activities such as software updates, site inspections, or battery replacements right on the unit. These logs can be automatically uploaded to your data center for archiving, reducing paper work in the field.

Choose from a suite of built-in Kinemetrics features, add-on packages from trusted providers or expand the capabilities of the system yourself. It's the *open-architecture* seismic data acquisition system!

Quanterra and Kinemetrics data acquisition products provide *data availability* of over 99% in several large networks year after year. Our users will tell you so.

FEATURES

- 3 +1 sensor channels w/internal EpiSensor triaxial deck
- 24-bit Delta Sigma converter, one per channel
- Matched to Kinemetrics outstanding EpiSensor accelerometer performance
- Built-in GPS, built-in PTP
- Record and communicate multiple sample rates
- Multiple data formats and telemetry protocols
- Ultra-Low latency data for Earthquake Early Warning Systems
  - * 0.1sec data packet
  - * 0.01sec DFS at 100sps
- Streamlined Station Maintenance (SSM)
- Data offloaded automatically to removable thumb drives connected to a USB host port. Parallel recording (mirroring) data on an external USB thumb drive.
- Wireless communications via USB based Wi-Fi
- Extensive state-of-health monitoring, including input and system voltages, internal temperature, humidity, communication link diagnostics
- Application Programming Interface (API) to develop your own add-on software modules. You can customize real-time data processing, file formats, stream data using your own protocol, shape data with a custom filter, and so on.
- IP Security through SSH and SSL
- Transient and EMI/RFI protection on all connections
- System Status LEDs
- Rugged aluminum extruded case designed for 1m drop and 1m temporary immersion (IP67)
- Designed for RoHS Compliance and easy re-cycling
- Designed for the lowest Total Cost of Ownership (TCO)

Continued

KINEMETRICS

Advancement through Innovation

OBSIDIAN

SPECIFICATIONS

Channels

Obsidian:	3 +1 sensor channels w/internal sensor
Sensor type:	Triaxial EpiSensor force balance accelerometer, Orthogonally oriented, Internal
Full scale range:	User selectable at ±2g or ±4g
Bandwidth:	DC to 200 Hz
Dynamic range:	155 dB+
Calibration & test:	Calibr. Coil Functional Test; Calibr. Coil Response Test
Input level:	5Vpp, 10Vpp, 40Vpp Differential Input

Data Acquisition

Type:	Individual 24-bit Delta Sigma converter per channel
Anti-alias filter:	Double Precision FIR Filter Causal/Acausal; >140 dB attenuation at output Nyquist
Dynamic range:	200 sps ~127 dB (RMS clip to RMS noise - Typical) 100 sps ~130 dB (RMS clip to RMS noise - Typical)
Frequency response:	DC to 80 Hz @ 200 sps
Sampling rates:	1, 10, 20, 50, 100, 200, 250, 500, 1000, 2000, 5000 sps
Channel skew:	None – simultaneous sampling of all channels
Acquisition modes:	Continuous, triggered, time windows
Output data format:	24 bit signed (3 bytes) in user selectable format
Parameter calculations:	Calculations of key parameters in real- time, including JMA intensity
Real time digital output:	Ethernet or RS-232 output of digital stream

Trigger

Type:	IIR bandpass filter (three types available)
Trigger selection:	Independently selected for each channel
Threshold trigger:	Selectable from 0.01% to 100% of full scale
Trigger voting:	Internal, external and network trigger votes with arithmetic combination
Additional trigger:	STA/LTA, Time Window

Timing

Type:	Oscillator digitally locked to GPS or PTP: Integrates completely with system, providing timing, internal oscillator correction and position information.
Shared timing:	3 Ports for shared timing for multiple local units
Timing: accuracy:	<1 microseconds of UTC with GPS or PTP

Storage

Data slot:	Internal SDHC Card Slot, standard 32 GB
System slot:	Internal SDHC Card Slot, 4 GB
Recording capacity:	Approximately 42 kB per channel per minute on Memory Card of 24-bit data @ 200 sps. (33 days of 4x200sps recording on 8GB Data card)
SDHC Format:	Linux EXT4
Data:	Offloaded automatically to removable thumb drives connected to a USB host port. Parallel recording (mirroring) data on an external USB thumb drive. USB drives format: FAT32

Communications

Ethernet interface:	Real Time Telemetry (Multiple destinations TCP/IP Protocol), Parameter set up, and event retrieval (FTP/ SFTP) RS-232 interface: Real Time Telemetry (over modem, radio, etc.), Parameter set up, and event retrieval
Modem:	Built in modem, Remote access, initiated by user or by the Obsidian
Telemetry:	Real-time data via DFS, SEEDLink, Earthworm, Antelope compatible ORB server, or Altus SDS protocols.

Instrument Software

Type:	Multi-tasking operating system supports simultaneous acquisition and interrogation; allows remote and automatic firmware upgrades
Security:	Supports SSH and SSL
System control:	Configure sample rate, filter type, trigger type and voting, maintains communications and event storage
File formats:	Kinemetrics EVT, MiniSEED, SAC, COSMOS, MATLAB, SUDS, SEISAN, ASCII, others
Intelligent alerting:	Initiate communications when an event is detected or if ar
Auto-diagnostics:	Continuously check system voltages, temperature, humidit and timing system integrity
Rapid setup:	Can be configured from a parameter file
System timing:	Supports PTP Slave and PTP Master timing (Using Internal GPS as Master clock), NTP and External 1PPS

I/O and Display

Power input:	Mil-style connector for DC power input, external battery connection, Power over Ethernet (Option)
Interfaces: (M12 connectors)	10/100 BaseT Ethernet Port 3 x USB 2.0 Host Ports USB 2.0 Device 3 x RS-232 DFS Port (RS232) Linux Console (RS232) POTS Modem 3 x Time/Power Ports (1PPS In/Out, Switched Power) GPS Antenna (TNC)
EMI/RFI protection:	All I/O lines EMI/RFI and transient protected
LED:	System, power and event status, Ethernet Link & Data

Continued

KINEMETRICS

Advancement through Innovation

OBSIDIAN

SPECIFICATIONS

Power Supply

Type:	Internal high efficiency switched power supply and battery charger system with extensive SOH outputs
DC input:	9-28 VDC (>15.5VDC for Battery Charger Operation)
External AC/DC:	Universal Input 100-250 VAC 50/60 Hz
Power module:	Output 15.5 VDC
Internal battery charger:	Digitally temperature compensated output for External Valve Regulated Lead Acid (VRLA) batteries with reverse protection and deep discharge recovery.
Fuses:	None. Uses resettable Polyswitch protection
Current drain:	Current drain: 215ma @12V (w/o 4th channel sensor)

Environment

Operating temp: -20° to 70°C Operation
Humidity: 0-100% RH (Non-condensing)

Physical

Size: 13.25" (L) x 7.25"(D) x 6.8"(H)
Enclosure rating: IP67 Equivalent
Environmental: RoHS Compliant Unit

Support Software

Altus File Viewer:	Multiplatform program for rapid review of waveforms and event information.
Antelope:	Comprehensive commercial network operational and management system for medium and large networks
Earthworm:	Comprehensive public domain network operational and management system for medium and large networks
NMS:	Commercial PC-based network management system for small to medium sized networks via modem or real-time data
RockTalk:	Multiplatform program for command and control
Rockhound:	Commercial open architecture user-extensible real-time data collection and processing software that runs on a variety of computers
PSD:	Commercial Pseudo Spectral Density software for earthquake data analysis
SMA:	Commercial Strong Motion Analyst software for earthquake data analysis and processing
K2COSMOS:	Conversion software from Altus EVT fi le format to COSMOS v1.20 format (COSMOS format can also be produced natively from the Obsidian)
Miscellaneous:	Format converters to ASCII and other formats. Web Server for command and control, Optional Software Development Kit and Compilers. Contact Kinemetrics for other options.

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05-01-18

KINEMETRICS

Basalt 4X/8X

High Dynamic Range, IP Aware, Communication Centric Multi-Channel Accelerograph

Basalt 4X/8X represents the next evolution in Kinemetrics Multi-Channel Recorder Instrumentation. Offering exceptional high dynamic range, matched to Kinemetrics' outstanding **EpiSensor** accelerometer performance, and with exemplary timing accuracy and spectral purity, the **Basalt 4X/8X** again advances the standards of strong motion data recording. Complementing this outstanding data fidelity is a new suite of communication capabilities offering multiple real time data streams to multiple clients.

As a member of Kinemetrics **Rock** platform, the **Basalt 4X/8X** is easy to integrate with other **Rock** and Quanterra instruments allowing users to develop highly flexible earthquake monitoring solutions.

The **Basalt 4X/8X** offers greatly enhanced ease of use over existing instruments as only a web browser is required to modify operation parameters, change recording and telemetry modes and formats, view or retrieve recorded files. Functions can be accessed worldwide via a WAN, or via a local wireless interface with the optional Bluetooth interface.

FEATURES

- 3 +1 sensor channels recorder (Basalt4X) or 2 x (3+1) sensor channels recorder (Basalt8X)
- 24-bit Delta Sigma converter, one per channel
- Built-in GPS
- Record and communicate multiple sample rates
- Multiple data formats and telemetry protocols
- Power Management for ultra-low power operation
- Rugged aluminum extruded case designed for 1m drop and 1m temporary immersion (IP67)
- Extensive state-of-health monitoring, including input and system voltages, internal temperature, humidity, communication link diagnostics
- Optional Terminal strips for easy sensor connection
- Transient and EMI/RFI protection on all connections
- System Status LEDs
- Designed for RoHS Compliance and easy re-cycling
- Designed for low total cost of ownership

SPECIFICATIONS

Channels

Basalt:	3 +1 sensor channels digital recorder Also available with 2 x (3+1) channels (Basalt8X)
Input level:	5Vpp, 10Vpp, 40Vpp Differential Input

Data Acquisition

Type:	Individual 24-bit Delta Sigma converter per channel with Black Fin DSP
Anti-alias filter:	Double Precision FIR Filter Causal/Acausal; >140 dB attenuation at output Nyquist
Dynamic range:	200 sps ~127 dB (RMS noise to RMS clip - Typical) 100 sps ~130 dB (RMS noise to RMS clip - Typical)
Frequency response:	DC to 80 Hz @ 200 sps
Sampling rates:	1, 10, 20, 50, 100, 200, 250, 500, 1000, 2000 sps
Channel skew:	None – simultaneous sampling of all channels
Acquisition modes:	Continuous, triggered, time windows
Output data format:	24 bit signed (3 bytes) in user selectable format
Parameter calculations:	Calculations of key parameters in real-time, including JMA intensity
Real time digital output:	Ethernet or RS-232 output of digital stream (contact factory for available formats)

I/O and Display

Power input:	Mil-style connector for DC power input, external battery connection, 1-W power LAN
RS-232/USB input:	Mil-style connector with full RS-232C interface with modem control, USB 1.1 Device connection, RS232 Console connector
Ethernet Connection:	10 Base-T Ethernet Interface
EMI/RFI protection:	All I/O lines EMI/RFI and transient protected
LED:	System, power and event status, Ethernet Link & Data

Power Supply

Type:	Internal high efficiency switched power supply and battery charger system
Input:	8-18 VDC
Int. Charger Operation:	15.5VDC Required
Ext. Power Module:	Input 100-250 VAC 50/60 Hz Output 15.5 VDC
Internal Battery Charger:	Digitally temperature compensated output for VRLA battery with reverse protection and deep discharge recovery.
Fuses:	None uses resettable Polyswitch protection
Batteries:	External Valve Regulated Lead Acid (VRLA) Battery Optional battery housing.
Curent drain:	~145ma @12V (w/o sensors)

Continued

KINEMETRICS

SPECIFICATIONS

Sensor

Type:	Triaxal EpiSensor Force Balance Accelerometer, Orthogonally oriented, Internal
Full scale range:	User selectable at ±2g or ±4g
Bandwidth:	DC to 200 Hz
Dynamic range:	155 dB+
Calibration & test:	Calibr. Coil Functional Test; Calibr.Coil Response Test

Trigger

Type:	IIR bandpass filter (three types available)
Trigger selection:	Independently selected for each channel
Threshold trigger:	Selectable from 0.01% to 100% of full scale
Trigger voting:	Internal, external and network trigger votes with arithmetic combination
Additional trigger:	STA/LTA, Time Window

Storage

Primary slot:	Internal Compact Flash Slot, standard 4 GB up to 64 GB
Secondary slot:	Internal SD Card Slot
Storage Module: (Option)	Additional User Accessible Compact Flash Slot Accessible SD Card Slot (Replaces internal slot) Hard Drive (Additional Option)
Recording capacity:	Approximately 42 kB per channel per minute on Memory Card of 24-bit data @ 200 sps.
Recording format:	Main CF Card Linux EXT3 Removable Media DOS File System

Firmware

Type:	Multi-tasking operating system supports simultaneous acquisition and interrogation; boot loader allows remote and optionally automatic firmware upgrades
System control:	Configure sample rate, filter type, trigger type and voting, maintains communications and event storage
Supported File Formats:	Kinemetrics EVT, MiniSEED, SAC, COSMOS, MATLAB, SUDS, SEISAN, ASCII
User interface:	1 x 10BaseT Ethernet Port 3 x RS-232 1 x USB 1.1 Device 2 x USB 2.0 Ports (1 OTG/1 Host) (optional in Storage Module) Bluetooth Interface (optional)
Intelligent alerting:	System can be configured to initiate communications when an event is detected or if an auto-diagnostic failure occurs
Auto-diagnostics:	System can be configured to continuously check system voltages, temperature, humidity, and timing system integrity
Rapid setup:	Unit can be configured from parameter file stored on Compact Flash

Timing

Type:	Oscillator digitally locked to GPS or *RockNet*
GPS:	Integrates completely with system, providing timing, internal oscillator correction and position information.
RockNet:	Shared timing for two units over CAT-5 cable
Timing:	Accuracy: <1 microseconds of UTC with GPS Power: Power consumption: <100mW (active)

Communications

Ethernet interface:	Real Time Telemetry (Multiple destinations TCP/IP Protocol), Parameter set up, and event retrieval (FTP/SFTP)
RS-232 interface:	Real Time Telemetry (over modem, radio, etc.), Parameter set up, and event retrieval
Modem:	Built in modem, Remote access, initiated by user or by the Basalt

Support Software

*Altus File Viewer**:	Multiplatform program for rapid review of waveforms and event information.
Antelope:	Comprehensive commercial network operational and mgmt system for medium and large networks
Earthworm:	Comprehensive public domain network operational and management system for medium and large networks
NMS:	Commercial PC-based network management system for small to medium sized networks via modem or real-time data
*RockTalk**:	Multiplatform program for command and control
Rockhound:	Commercial open architecture user-extensible real-time data collection and processing software that runs on a variety of computers
PSD:	Commercial Pseudo Spectral Density software for earthquake data analysis
SMA:	Commercial Strong Motion Analyst software for earthquake data analysis and processing
*K2COSMOS**:	Conversion software from Altus EVT file format to COSMOS v1.20 format (COSMOS format can also be produced natively from the Granite)
Miscellaneous:	Format converters to ASCII and other formats. Web Server for command and control, Optional Software Development Kit and Compilers. Contact Kinemetrics for other options.

*No charge

Environment

Operating temperature:	-20° to 70°C Operation
Humidity:	0-100% RH (Non-condensing)

Physical

Size & Weight:	Basalt4X: 14" (L) x 5.5" (D) x 6.8" (H), 10 lbs Basalt8X: 19" (L) x 7.5" (D) x 6.8" (H), 16lbs
Enclosure Rating:	IP67 Equivalent
Environmental:	RoHS Compliant Unit

*Specifications subject to change without notice

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09-09-13

KINEMETRICS

Advancement through Innovation

ETNA 2

Next Generation of Web Based, Cost Effective, Strong Motion Accelerographs

Kinemetrics' **ETNA** accelerograph established the world's standard for strong motion recording for almost two decades with more than 6000 installations worldwide. The **ETNA 2** represents the next generation of ETNA-class accelerographs offering NEW and cost effective, web based monitoring capabilities paired with another Kinemetrics' established world standard, the exemplary **EpiSensor** accelerometer.

The ETNA 2 is easy to use since it was designed around the Rockhound application software first implemented on the Basalt instruments and continued now on the new Obsidian instruments.

ETNA 2 offers the most essential accelerograph features supporting a wide range of earthquake monitoring applications in a small, lightweight, and simple to use package. If you are interested in Earthquake Early Warning, in structural monitoring, in aftershocks surveys or even in induced earthquake monitoring related to oil and gas, and geothermal fluid injection activities, the ETNA 2 is the right product for you.

And for those whose job it is to maintain large number of stations, we implemented Streamlined Station Maintenance (SSM) that allows you to use your browser to log maintenance activities such as software updates, site inspections, or battery replacements right on the unit. These logs can be automatically uploaded to your data center for archiving, reducing paper work in the field, and eliminating human error.

FEATURES

- 3 sensor channels with an internal EpiSensor triaxial deck
- 24-bit Delta Sigma converter, one per channel
- Matched to Kinemetrics outstanding EpiSensor accelerometer performance
- Built-in GPS and PTP timing options
- Record and communicate multiple sample rates
- Earthquake Early Warning low latency 0.1s packets ready
- Multiple telemetry protocols: ORB natively or public domain Earthworm and SeedLink
- Streamlined Station Maintenance (SSM)
- Data offloaded automatically to removable thumb drive connected to the USB host port. Parallel recording (mirroring) data on an external USB thumb drive.
- Wireless communications via USB based Wi-Fi or cellular modem
- State-of-health monitoring, including input and system voltages, internal temperature, communication link diagnostics, available storage
- IP Security through SSH and SSL
- Reverse voltage protection and self resettable fuses
- System Status LEDs
- Surviving temporary immersion at 1 m depth (rated IP67)
- Designed for RoHS Compliance and easy re-cycling
- Designed for the lowest Total Cost of Ownership (TCO)

Continued

KINEMETRICS

Advancement through Innovation

ETNA 2

SPECIFICATIONS

Sensor

Type:	Triaxial EpiSensor force balance accelerometers, orthogonally oriented, internal
Full scale range:	User selectable at ±1g, ±2g or ±4g
Bandwidth:	DC to 200 Hz
Dynamic range:	155 dB+
Offset:	Factory set, software re-zeroing

Digitizer

Channels:	3 sensor channels for the internal sensors
Dynamic range:	~130 dB at 100 sps (defined as RMS dip to RMS shorted-input noise) or ~139 dB at 100 sps (defined as full scale peak to peak to RMS shorted-input noise)
Primary sample rates:	1, 10, 20, 50, 100, 200, 250, 500 sps
Secondary sample rates:	A second lower sample rate can be selected from the primary sample rates above
Acquisition modes:	Continuous (ring buffer) and triggered
Calibration & test:	Pulse and Sensor Response Test

Trigger

Trigger selection:	Independently selected for each channel Internal
Trigger:	Threshold, selectable from 0.01% to 100% of full scale or STA/LTA algorithm
Trigger voting:	Internal and network trigger votes with arithmetic combination

Timing

Type:	Oscillator digitally locked to GPS or to PTP master
Timing: accuracy:	<1 microseconds of UTC with GPS locked

Storage

Data storage:	Internal SDHC Card, 32 GB
System storage:	Internal SDHC Card, 2 GB
Data:	Offloaded automatically to removable thumb drive connected to the USB host port. Parallel recording (mirroring) data on an external USB thumb drive. File formats: MiniSEED, EVT, and ASCII USB drive file system: FAT32

Interfaces and Digital Control

Interfaces:	1 x Ethernet 10/100BaseT
(M12 connectors)	1 x USB 2.0 Device Port for data access 1 x USB 2.0 Host Port for peripherals 1 x RS-232 for factory use only
Relays:	2 x SPDT relays, software configurable
LEDs:	System, power and event status, Ethernet Link

Communications

Ethernet interface:	Real Time Telemetry (Multiple destinations TCP/IP Protocol), web server for parameter setup, event retrieval via FTP/SFTP; supports Point of Contact (POC) name service Modem: External, cellular or POTS, connected via the USB 2.0 Host interface; consult factory for details
Protocols:	Real-time data streaming via Antelope compatible ORB server or via public domain SEEDLink and Earthworm protocols
State-Of-Health:	Input voltage, Super Capacitor voltage, Time synchronization, internal temperature, available storage
Low latency:	1s and 0.1s data packets i.e, for EEWS applications
Data visualization:	Waveform Viewer for continuous waveform display and File Viewer for triggered event display; consult factory for other support software

Power Requirements

Consumption:	<3W operational
Voltage range:	9-28 VDC
Protections:	Reverse voltage, over/under voltage, self resettable fuses

Physical

Mounting:	Central bolt, 3 adjustable feet, air bubble leveling
Dimensions:	6" x 6" x 3" (15cm x 15 cm x 7.5cm)
Volume:	1.6 liters
Weight:	3.3 lbs. (1.5 kg)

Environmental

Temperature range:	-20° to 70°C operational
Humidity:	0-100% RH (non-condensing)
Enclosure rating:	IP67

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05-01-18

KINEMETRICS

Advancement through Innovation

EPISENSOR

ES-T

EPISENSOR

Force Balance Accelerometer

The EpiSensor ES-T: A Flexible, Versatile Value

Kinemetrics announces its latest line of earthquake sensors – EpiSensor force balance accelerometers. Model FBA ES-T is a triaxial surface package useful for many types of earthquake recording applications. The unit consists of three EpiSensor force balance accelerometer modules mounted orthogonally in one small convenient package. With fullscale recording ranges of ± 0.25 to ± 4g (user selectable) the EpiSensor provides on-scale recording of earthquake motions even at nearfault locations and in a wide variety of structure types.

The significantly improved bandwidth of DC to 200 Hz allows engineers and scientists to study motions at higher frequencies while maintaining the very important DC response that allows simple field calibration and reduces post-processing confusion.

Output circuitry is also significantly enhanced. Several types of outputs can be field-selected by the user: ± 2.5V single-ended output for use with traditional Kinemetrics earthquake recording instruments: ± 10V single-ended or ± 20V differential output for use with Kinemetrics digital recorders and other 24-bit digital recorders currently on the market.

EpiSensor force balance accelerometers are also available in uniaxial (the FBA ES-U) and borehole (the FBA ES-SB shallow and FBA ES-DH deep) packages.

FEATURES

- Low noise
- Extended bandwidth - DC to 200Hz
- User-selectable full-scale range
- Calibration coil (standard)
- Single-end or differential output (user selectable)
- Double-stage transient protection

Continued

KINEMETRICS

Advancement through Innovation

EPISENSOR

ES-T

SPECIFICATIONS

Dynamic range:	155 dB+
Bandwidth:	DC to 200Hz
Calibration coil:	Standard
Full-scale range:	User selectable at ± 0.25g, ± 0.5g, ± 1g, ± 2g or ± 4g
Outputs:	User selectable at: ± 2.5V single-ended ± 10V single-ended ± 5V differential ± 20V differential
Zero adjust:	Three user-friendly access holes for simple, safe, efficient adjustment
Linearity:	< 1000 µg/g2
Hysteresis:	< 0.1% of full scale
Cross-axis sensitivity:	< 1% (including misalignment)
Zero point thermal drift:	< 500 µg/°C (1g sensor)
ESD, RF, EMI protection:	Double stage transient protection with gas arrester elements
Power consumption:	100mA from Single 12VDC power supply 35mA from +/- 12VDC power supply
Physical size:	13.3 cm diameter (cylinder), 6.2 cm high Weight less than 1.8 kg
Mounting:	Single bolt mounting, three adjustable leveling feet and bubble level
Connection:	Single military-style metal connector
Operating Temperature:	-20° to 70°C (0° to 160°F)
Housing:	Watertight enclosure

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09-07-22

SIERRA WIRELESS

AirLink® RV50X Industrial LTE Gateway

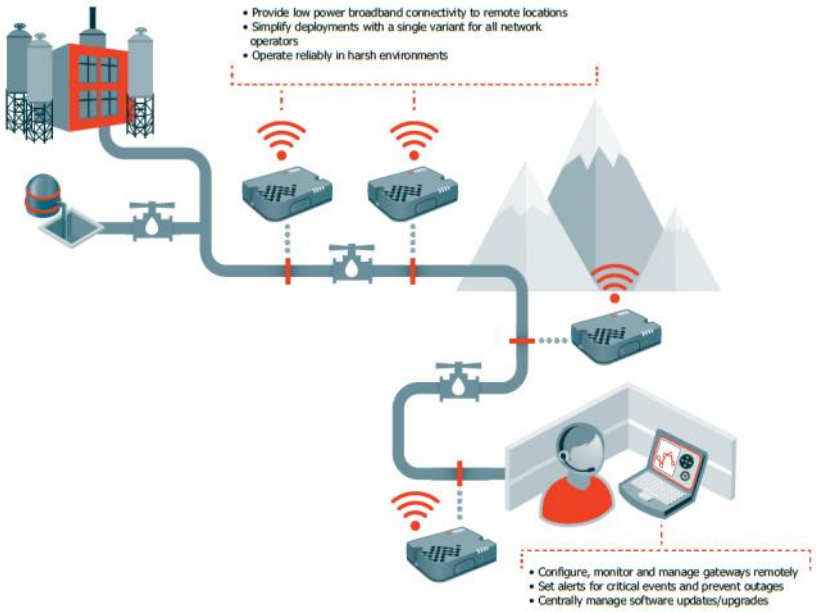
FEATURES

- LTE performance at 2G power consumption (less than 1W in idle mode)
- State-of-the-art LTE coverage spanning 21 LTE frequency bands worldwide
- Two product variants cover the globe
- Fully automatic network operator switching: just insert the SIM
- Provides network connectivity via Ethernet, Serial and USB
- Remote configuration, software update, and monitoring with cloud-based AirLink Management Service (ALMS) or on-premises with AirLink Mobility Manager (AMM)
- Dual-SIM functionality to enable automatic failover between SIMs (CANADA/EMEA/APAC)
- Meets industrial-grade certifications including Class 1 Div 2, MIL-STD-810G, IP64 ingress protection
- Supports up to 5 VPN tunnels for secure cellular communications
- Events Engine for alert reporting to third party server platforms
- Application Framework (AAF) offers real-time onboard data processing; RV50X's dual-core processor provides added performance for advanced edge computing applications.
- GPS for tracking equipment

Industrial Grade, LTE-Advanced Performance, Low Power

The AirLink RV50X is the industry's lowest power and most rugged LTE gateway. Simple to install and easy to manage, this industrial-grade gateway is designed to connect critical assets and infrastructure. Ideal for energy, utilities and smart-city applications, the RV50X provides real-time remote connectivity for SCADA, distribution management systems and metering.

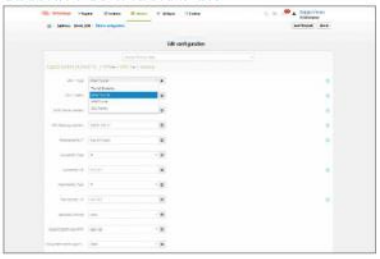
With the lowest power consumption available on the market, the RV50X dramatically reduces infrastructure costs when running on battery or solar power. The RV50X supports an extensive range of LTE bands worldwide, and its LTE-Advanced capabilities deliver up to 300 Mbps downlink speeds. For deployments in areas with limited LTE coverage, the RV50X provides fallback to 3G networks. Furthermore, the RV50X provides programmability to enable edge computing applications, using the ALEOS Application Framework (AAF).



DASHBOARD

MONITOR CONNECTIVITY

SECURITY CONFIGURATION



SOFTWARE UPGRADES/UPDATES

RUGGED DESIGN FOR DEMANDING ENVIRONMENTS

The RV50X is designed to withstand harsh industrial conditions, and is capable of surviving 5 V brownouts and spikes from -600 VDC to 200 VDC.

Certified as Class I Div 2, it is ideal for hazardous environments. The die cast aluminum housing is sealed to meet IP64 for resistance to dust and water ingress.

The RV50X is tested to meet and exceed the MIL-STD-810G specification for shock, vibration, temperature and humidity. The built-in power supply protection make it suitable for harsh electrical environments such as compressors, generators, and excavators.

ULTRA-LOW POWER CONSUMPTION

The RV50X offers best-in-class power consumption combined with LTE performance, and is optimized for battery and solar applications. It is the industry's only LTE gateway with 2G power consumption, operating at 900 mW in idle mode. For 3G deployments migrating to LTE, the RV50X will work with existing power infrastructure, eliminating the need to invest in replacement solar panels or batteries. Standby Mode provides additional protection for batteries by dropping power consumption to 53 mW, and can be triggered by timers, low voltage detection or I/O.

SIMPLIFIED DEPLOYMENT

The RV50X automatically configures the radio based on the SIM, which provides versatility and simplicity when changing operator networks.

Ideal for global deployments, the RV50X provides worldwide LTE coverage with just two product variants; one for North America and EMEA, and one for Asia-Pacific.

BEST-IN-CLASS REMOTE MANAGEMENT

Network Management solutions for the RV50X allow over-the-air registration, configuration and software updates, and can be deployed either as a cloud-based service, or as a licensed software platform in the enterprise data center. Both options provide a centralized and remote view of an entire fleet and enable simplified management, control and monitoring of connected RV50Xs and critical infrastructure.

AirLink Management Service (ALMS) is a secure, centralized cloud-based service that remotely monitors and manages signal strength, network technology and location. ALMS provides dashboards with up-to-date views of an entire deployment, and custom alerts to monitor and report critical events, to increase efficiency and prevent downtime.

AirLink Mobility Manager (AMM) is a licensed, unified software platform which can

SIERRA WIRELESS

BENEFITS

- Provides LTE broadband connectivity to remote locations and in harsh environments
- Ultra-low power consumption, ideal for solar or battery powered installations
- Maximizes longevity of deployed equipment and protects investments with LTE
- Improves ROI by supporting multiple network operators without additional hardware costs
- Powerful remote management solutions
- Built-in, class-leading voltage transient protection provides superior reliability and continuous operation
- Proven reliability and over 2 million AirLink routers and gateways deployed
- Industry leading warranty includes support, software updates and advance replacement

be deployed in the enterprise data center, and provides a consolidated network view of an entire fleet, using a virtual dashboard to monitor, report, manage, and troubleshoot all mobile resources as required.

INSTANT INTEGRATION

The RV50X is designed to install directly into existing infrastructure. Offering both serial and Ethernet connectivity, it can be used to connect devices like PLCs and RTUs, and transmit a wide variety of protocols like Modbus/DNP3 with ease. RV50X can also be integrated directly into existing management systems via SNMP.

INTELLIGENCE AT THE EDGE

The RV50X provides an application framework which allows customers to apply intelligence at the edge of the network. The RV50X offers a dual core processor which enhances the performance of edge applications.

SECURE INDUSTRIAL COMMUNICATIONS

The RV50X supports secure communications to multiple back-end systems by providing up to five concurrent VPN sessions. Remote authentication management allows enterprise-grade systems to manage access to devices in the field. Port filtering and trusted IP protect the devices connected to RV50Xs from unwanted access. Secure signing and authentication of software images offers end-to-end protection of the software upgrade process, protecting the RV50X against unwanted malware.

	RV50X	
	North America & EMEA	Asia Pacific
LTE CATEGORY	Cat 6	
Peak D/L	(Up to 300 Mbps DL)	
Peak U/L	(Up to 50 Mbps UL)	
4G LTE Frequency Bands*	2100(B1), 1900(B2), 1800(B3), AWS(B4), 850(B5), 2600(B7), 900(B8), 700(B12), 700(B13), 800(B20), 1900(B25), 850(B26), 700(B29), TDD B41	2100(B1), 1800(B3), 850(B5), 2600(B7), 900(B8), 850(B18), 850(B19), 1500(B21), 700(B28), TDD 38, TDD 39, TDD 40, TDD 41
3G HSPA/HSPA+ Frequency Bands*	2100(B1), 1900(B2), 1800(B3), AWS(B4), 850(B5), 900(B8)	2100(B1), 850(B5), 800(B6), 900(B8), 1700(B9), 850(B19),
3G TD-SCDMA Frequency Bands*		B39
APPROVALS		
Regulary	FCC, IC, PTCRB, R&TTE, GCF, CE	RCM, JRF/JPA, Anatel
Carrier	Verizon, AT&T, T-Mobile USA, Southern Linc, Sprint, US Cellular, Rogers, Telus, Bell	Telstra
PART NUMBERS	1103052	1103045 1103973 (China)

**For carrier specific band support please refer to the hardware user guide.*

SIERRA WIRELESS

Sierra Wireless
AIRLINK RV50X

	Specification
HOST INTERFACES	10/100/1000 Ethernet (RJ45)
	RS-232 serial port (DB-9)
	USB 2.0 Micro-B Connector
	3 SMA antenna connectors (primary, diversity, GPS)
	Active GPS antenna support
INPUT/OUTPUT	Configurable I/O pin on power connector • Digital Input ON Voltage: 2.7 to 36 VDC • Configurable Pull-up for dry contact input • Digital Open Collector Output > sinking 500 mA • Analog Input: 0.5-36 VDC
LAN (ETHERNET/USB)	DNS, DNS Proxy
	DHCP Server
	IP Passthrough
	VLAN
	Host Interface Watchdog
	PPPoE
SERIAL	TCP/UDP PAD Mode
	Modbus (ASCII, RTU, Variable)
	PPP
	DNP3 Interoperability
NETWORK AND ROUTING	Network Address Translation (NAT)
	Port Forwarding
	Host Port Routing
	NEMO/DMNR
	VRRP
	Reliable Static Route
	Dynamic DNS
	Policy Routing
	Verizon ANTM
	IPv6 Gateway
VPN	IPsec, GRE, and OpenVPN Client
	Up to 5 concurrent tunnels
	Split Tunnel
	Dead Peer Detection (DPD)
	Multiple Subnets
EVENTS ENGINE	Custom event triggers and reports
	Configurable interface, no programming
	Event Types: Digital Input, Network Parameters, Data Usage, Timer, Power, Device Temperature and Voltage
	Report Types: RAP, SMS, Email, SNMP Trap, TCP (Binary, XML, CSV)
	Event Actions: Drive Relay Output
DIMENSIONS	119 mm x 34 mm x 85 mm (94 mm including connectors)
	4.69 in x 1.34 in x 3.35 in (3.70 in including connectors)
SECURITY	Remote Authentication (LDAP, RADIUS, TACACS+)
	DMZ
	Inbound and Outbound Port filtering
	Inbound and Outbound Trusted IP
	MAC Address Filtering
	PCI compatible
APPLICATION FRAMEWORK	ALEOS Application Framework (AAF)
	LUA Scripting Language
	Eclipse-based IDE
	Integrated with AirVantage®
	Dual-Core Processing

	Specification
SATELLITE NAVIGATION (GNSS)	12 Channel GPS and GLONASS Receiver
	Acquisition Time: 1 s Hot Start
	Accuracy: <2 m (50%), <5 m (90%)
	Tracking Sensitivity: -145 dBm
	Reports: NMEA 0183 V3.0, TAIP, RAP, XORA
	Multiple Redundant Servers
	Reliable Store and Forward
NETWORK MANAGEMENT	Secure network management applications available in the cloud or licensed platform in the enterprise data center
	Fleet wide firmware upgrade delivery
	Router configuration and template management
	Router staging over the air and local Ethernet connection
	Over-the-air software and radio module firmware updates
	Device Configuration Templates
	Configurable monitoring and alerting
	Remote provisioning and airtime activation (where applicable)
GATEWAY MANAGEMENT INTERFACES	ALMS
	Local web user interface
	AT Command Line Interface (Telnet/SSH/Serial)
	SMS Commands
	SNMP
POWER	Input Voltage: 7 to 36 VDC
	LTE Idle Power: 900mW (75 mA @ 12VDC)
	Standby Mode Power: 53 mW (4.4 mA @ 12 VDC) triggered on low voltage, I/O or periodic timer
	Low voltage disconnect to prevent battery drain
	Built-in protection against voltage transients including 5 VDC engine cranking and +200 VDC load dump
	Ignition Sense with time delay shutdown
	Configurable features and ports to optimize power consumption
ENVIRONMENTAL	Operating Temperature: -40°C to +70°C / -40°F to +158°F
	Storage Temperature: -40°C to +85°C / -40°F to +185°F
	Humidity: 90% RH @ 60°C
	Military Spec MIL-STD-810G conformance to shock, vibration, thermal shock, and humidity
	IP64 rated ingress protection
INDUSTRY CERTIFICATIONS	Safety: IECEE Certification Bodies Scheme (CB Scheme), UL 60950
	Vehicle Usage: E-Mark (UN ECE Regulation 10.04), ISO7637-2, SAE J1455 (Shock & Vibration)
	Hazardous Environments: Class 1 Div 2
	Environmental: RoHS, REACH, WEEE
SUPPORT AND WARRANTY	Includes 1st Year AirLink Complete: • AirLink Management Service (ALMS) • Direct 24/7 Technical Support • 3-year standard warranty; optional 2-year warranty extension 1-day Accelerated Hardware Replacement available through participating resellers
ACCESSORIES	In the Box: DC Power Cable and Quick Start Guide Other Accessories (sold separately): 2000579 AC Adapter, 12VDC 6000659 DIN Rail Bracket For antenna options visit: sierrawireless.com/antennas

About Sierra Wireless

Sierra Wireless (NASDAQ: SWIR) (TSX: SW) is the leading IoT solutions provider that combines devices, network and software to unlock value in the connected economy. Companies globally are adopting IoT to improve operational efficiency, create better customer experiences, improve their business models and create new revenue streams. Whether it's a solution to help a business securely connect edge devices to the cloud, or a software/API solution to help manage processes associated with billions of connected assets, or a platform to extract real-time data to make the best business decisions, Sierra Wireless will work with you to create the right industry-specific solution for your next IoT endeavor. Sierra Wireless has more than 1,300 employees globally and operates R&D centers in North America, Europe and Asia. For more information, visit www.sierrawireless.com.

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