echelon

A New Era In Rugged Performance

Redefining Expectations in Ruggedized Data Acquisition

Powerful enough for the Lab - Rugged enough for the Field

The Hi-Techniques Echelon series of Data Acquisition Systems combines lab quality input amplifiers and signal conditioning with unparalleled connectivity in a rugged, portable package. Why be forced to compromise performance just to get a ruggedized data acquisition system? Echelon offers unrivaled capability.

Low power design, multiple internal and remote power options provide a go anywhere solution

Compact, modular design can be expanded for virtually any channel count

Up to 1MS/s per channel long term recording to rugged, removable storage media

Internal signal conditioning supports virtually any sensor type

View analog and digital inputs, video, vehicle data, GPS, and frequency signals

Real-time LiveCalc™ DSP based data analysis, filtering and data reduction

Designed for extreme environmental conditions including water, dust, shock vibration and extreme temperature

IP67

Distributed acquisition and scalability even across long distances

Remote setup and real-time display of data

Echelink™ Interface

Connectivity

Time Synchronization

Power over Ethernet

The Hi-Techniques Echelink™ interface provides remote control, power and system synchronization using a single Ethernet interconnect cable. Versus competitive mobile DAQ systems, Echelink™ increases configuration flexibility and dramatically reduces weight and setup complexity.

Key capabilities include:

Full system control and display of live streaming data in realtime with local data storage. Preview mode allows data to be viewed in realtime with single button recording operation. Acquired data can be rapidly transferred from local media post-acquisition.

Multi-box synchronization of Echelon systems provides for virtually limitless channel counts. Simply connect a single Ethernet cable to start/stop acquisition from any Echelon system, external PC or mobile wireless device. Time synchronicity is maintained even across long distances through built-in GPS/IRIG realtime clock or using any IEEE 1588 Precision Time Protocol (PTPv2) Grand Master device.

The Echelink™ interface supports Power over Ethernet allowing the Echelon system to operate or charge from a PoE source of up to 20 watts.

Extreme Environmental Performance

From its inception, the Echelon was designed to withstand extreme environmental conditions in harsh and mobile environments. **Key capabilities include:**

IP 67 Environmental rating protects against dust and water

Echelon modules are gasketed to guard against exposure to dust and water. Sealed front panel connectors can be further protected by water resistant covers when not in use

-40° to +85° C operating temperature

Design features low power/low heat architecture, specifically selected industrial temperature grade components and thermal mitigation techniques to provide high performance even in the harshest temperature conditions

Shock protection up to 100g on 3 axes

Design features low mass components, minimal internal interconnects, and small cards to withstand up to 100g shock

Low power architecture

Echelon capitalizes on advancements in mobile computing technology to provide maximum performance with minimal power use
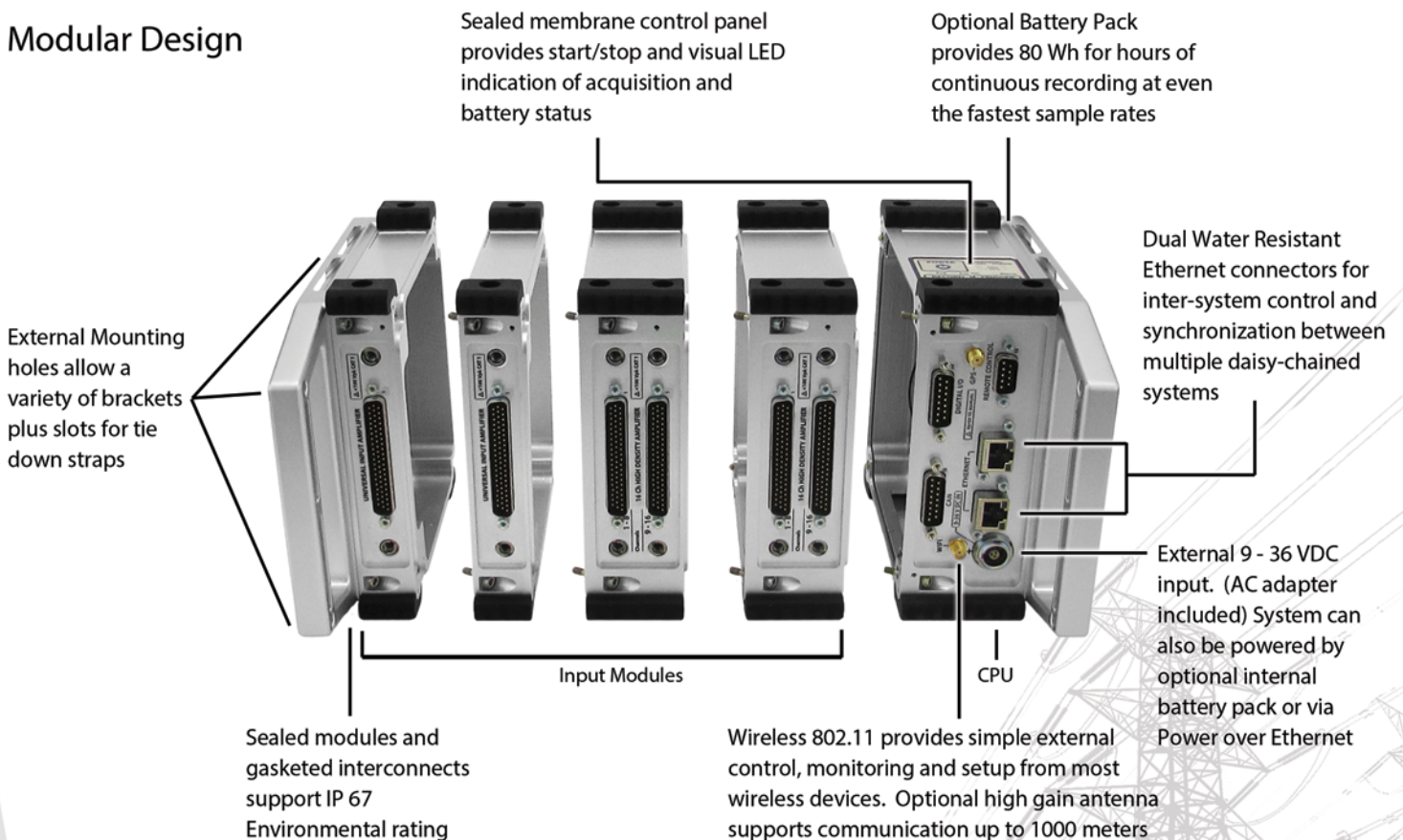
Small physical size

Offering best in class laboratory grade performance in the smallest possible package

Mounting options

Echelon offers a variety of mounting holes and accessories enabling secure physical attachment in any orientation

Modular Design

Sealed membrane control panel provides start/stop and visual LED indication of acquisition and battery status

Optional Battery Pack provides 80 Wh for hours of continuous recording at even the fastest sample rates

External Mounting holes allow a variety of brackets plus slots for tie down straps

Dual Water Resistant Ethernet connectors for inter-system control and synchronization between multiple daisy-chained systems

Input Modules

CPU

Sealed modules and gasketed interconnects support IP 67 Environmental rating

Wireless 802.11 provides simple external control, monitoring and setup from most wireless devices. Optional high gain antenna supports communication up to 1000 meters

External 9 - 36 VDC input. (AC adapter included) System can also be powered by optional internal battery pack or via Power over Ethernet

Small Package... Big Performance

The Processor/Control Module is the heart of the Echelon system offering laboratory performance in a ruggedized, power-efficient package. Utilizing advancements in mobile computing and mobile communications technology, Echelon was designed from the ground up to offer best-in-class performance.

Key capabilities include:

Streaming and disk management - Each Processor Module supports up to 4 input modules and a battery module. Need more channels? Simply add another Processor Module. The distributed processor architecture allows streaming at full sample rates to removable ruggedized media....regardless of channel count!

- Data is stored to removable, PC-readable storage with industrial temperature rated SSD. Easily transferable post-acquisition via standard Ethernet, USB or by simply removing the SSD

- Remote monitoring and control by PC, tablet or cell phone

- Integrated membrane keypad provides start/stop as well as indicators for acquisition, storage, and power status

- Capture and visualize data from a number of different sources including analog signals, vehicle bus, digital I/O, GPS time and position, and video
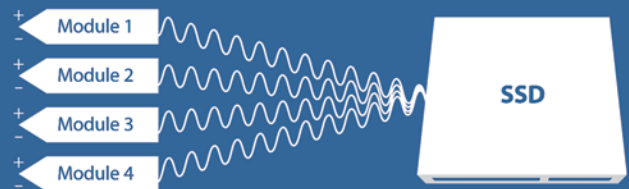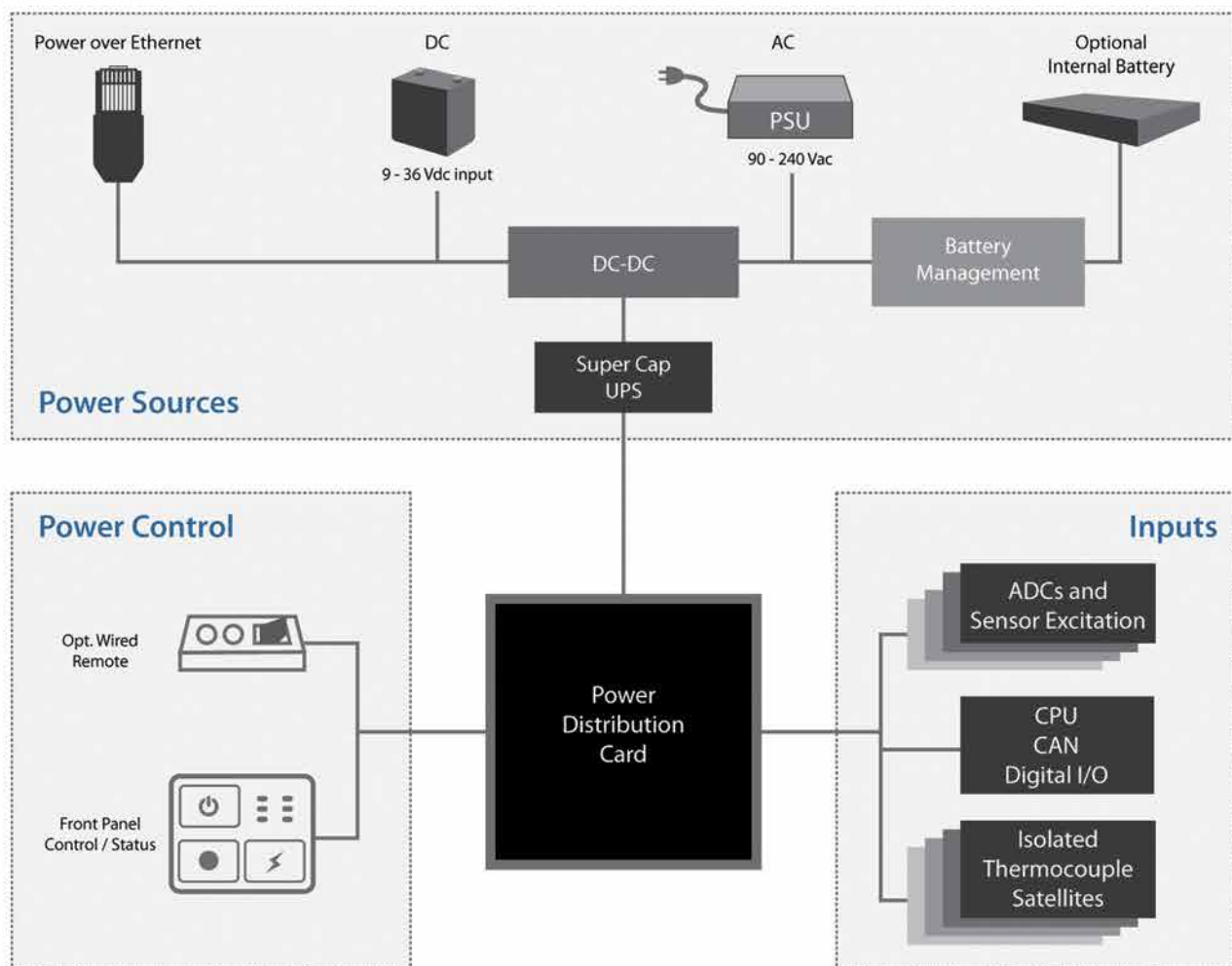

System Architecture
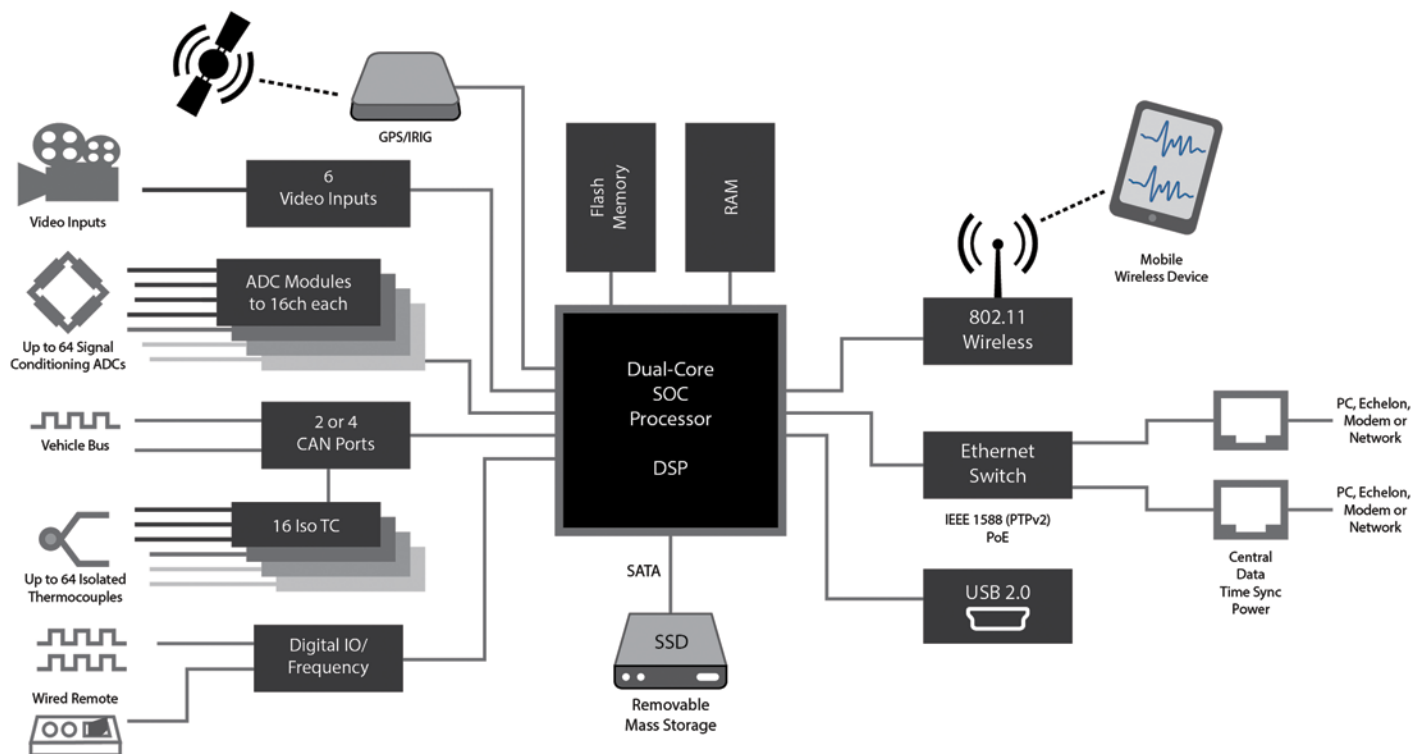
Power Management

Echelon's low power architecture is designed to be powered in a variety of ways:

- External DC input supports 9 - 36 Vdc. External AC/DC adaptor supports 90-240 Vac

- Power over Ethernet can remotely power or recharge batteries

- Optional battery module supports 80 Wh of continuous acquisition

- Built-in UPS protects against momentary power dips or vehicle starting loss

- Start recording upon key on ignition, wired or wireless ethernet, or wired remote

- Front panel indicators provide battery status, charge status, and power source

- Remote indication of battery status via wireless or wired external keypad

Power Sources

Power over Ethernet	DC	AC	Optional Internal Battery

9 - 36 Vdc input

PSU

90 - 240 Vac

DC-DC

Battery Management

Super Cap UPS

Power Control

Opt. Wired Remote

Front Panel Control / Status

Power Distribution Card

Inputs

ADCs and Sensor Excitation

CPU CAN Digital I/O

Isolated Thermocouple Satellites

Echelon Input Modules

A data acquisition system is only as good as its input capabilities. Echelon amplifiers are designed to the highest accuracy available. Differential zero drift amplifiers ensure stability of measurement across even the most extreme temperature range.

A range of input modules are configured for virtually any sensor or input type to allow for the ultimate in configuration flexibility. The modular design allows modules to be easily added or removed as test requirements change.

High Density Input Module   *8 or 16-Ch | EM-HD (O)*

The High Density Input Module offers 16 channels of 100kS/s, 24-bit bridge, thermocouple, IEPE, or voltage inputs in a single software selectable module. Supports ¼, ½, and full bridge devices with a zero drift amplifier. 1-10 V bipolar excitation per channel at up to 30 mA supports all bridge type sensors with 100 mA available on channel 1 and 9 of each module to support high current sensors such as LVDTs. Optional breakout cables support ICP/IEPE sensors with 20 V, 4 mA excitation and voltage inputs up to ±200 V. 8-channel input and analog out variants available.

High Level Input Module   *8 or 16-Ch | EM-HL (O)*

The High Level Input Module offers 16 channels of 100kS/s, 24-bit capability with up to 15V unipolar excitation per channel for high level sensors. Supports up to ±100 V input range. 8-channel input and analog out variants available.

High Speed Module   *4-Ch | EM-HS*

The High Speed Universal Input Module offers best in class performance including 4 individual 1 MS/s digitizers and internal support for virtually any sensor or signal type. Connect your strain gages, load cells, force, pressure and piezo-resistive sensors with support for ¼, ½, and full bridge. Directly connect bridge, thermocouple, flow, ICP/IEPE, and MEMS devices.

Video Input Module   *6-Ch | EM-VM*

The Video Input Module directly accepts up to 6 USB camera inputs for synchronized, realtime video display and storage. High speed video cameras can also be synchronized and displayed using IEEE 1588 (PTPv2) or IRIG/GPS. High speed video is stored directly to high speed media and can be viewed in Aspire software.

Isolated Thermocouple CAN Device   *16-Ch | HT-TCS*

The 16-channel Isolated Thermocouple Module provides low cost ruggedized 10 S/s thermocouple support and links to Echelon via a dedicated CAN connection. Up to 4 Thermocuple modules can be daisy chained to a single CAN port for up to 64 auxiliary thermocouple channels. Operates with Echelon, Hi-Techniques Synergy or may be used stand-alone via CAN.

Collect Data From A Number of Sources

Store and analyze sensor data, vehicle data, GPS, and video simultaneously in a single integrated solution.

	High Density Input Module	High Level Input Module	High Speed Input Module	Video Input Module
Model	EM-HD (O)	EM-HL (O)	EM-HS	EM-VM
Channels	8 or 16	8 or 16	4	6
Sample Rate/Ch	100 kS/s (10 µS)	100 kS/s (10 µS)	1 MS/s (1 µS)	up to 30 frames/sec
Resolution	24-bit SAR	24-bit SAR	16-bit SAR	up to 1280p
Ranges	±10 mV to ±5 V, Up to ±250 V*	±200 mV to ±100 V	±10 mV to ±100 V	N/A
Sensor Power	1 to 10 V bipolar	3 to 15 V unipolar	1 to 10 V bipolar, 3 to 15 V unipolar	5 V
Sensor Support	Voltage, Bridge, IEPE*, TC*	Voltage, IEPE*, Amplified Sensors	Voltage, Bridge, TC, IEPE, Amplified Sensors	USB Cameras
Cable Adapters	IEPE, AC, 20x, 50x, SLT	IEPE, AC, SLT	BNC, SLT	USB, Ethernet
Analog Out Option	Software Selectable ±5V or 0-10V Output	Software Selectable ±5V or 0-10V Output	N/A	N/A

*Requires external breakout

CPU Module

DIO, CAN, GPS/IRIG, WiFi | EM-CPU

The CPU Module is the heart of the Echelon system and provides module control, power management, SSD storage and DIO channels. Up to 4 analog input modules are supported with each CPU. Need higher channel counts? Add another CPU to support four additional input modules and four thermocouple modules. Systems can be controlled from a single start/stop command and data is synchronized between systems using a single Ethernet Cable.

The CPU also comes standard with 16 Digital/Frequency inputs and 4 Quadrature Encoder inputs for position measurements. Two CAN ports are standard (four optional), one of which may be used for up to four HT-TCS Thermocouple modules. Optional CCP, XCP, FlexRay and LIN support are available. IRIG, GPS, and WiFi control/monitoring also available.

Internal Battery Module

80 Wh | EP-BAT

The Battery Module provides 80 Wh of power to support hours of running time. The compact battery is also a UPS to ensure worry free operation should input power be temporarily unavailable. Battery modules can be recharged externally or charged in system.

Analysis and Display Software

The reason for using any Data Acquisition system is to get meaningful results as quickly as possible. For many competitive Data Acquisition systems, the software is the weakest link. The Echelon series offers a variety of dedicated software to help you get the most from your investment.

Aspire™ Software

The full featured Aspire™ software provides real-time setup, display and analysis from any remote PC or tablet. Combine and view analog data , vehicle bus data, video, GPS mapping and realtime calculations in a single, easy to use workspace. Integrated Sensor Wizard simplifies sensor configuration. Aspire Software exports to most popular third party analysis software packages including drag and drop support to Excel.

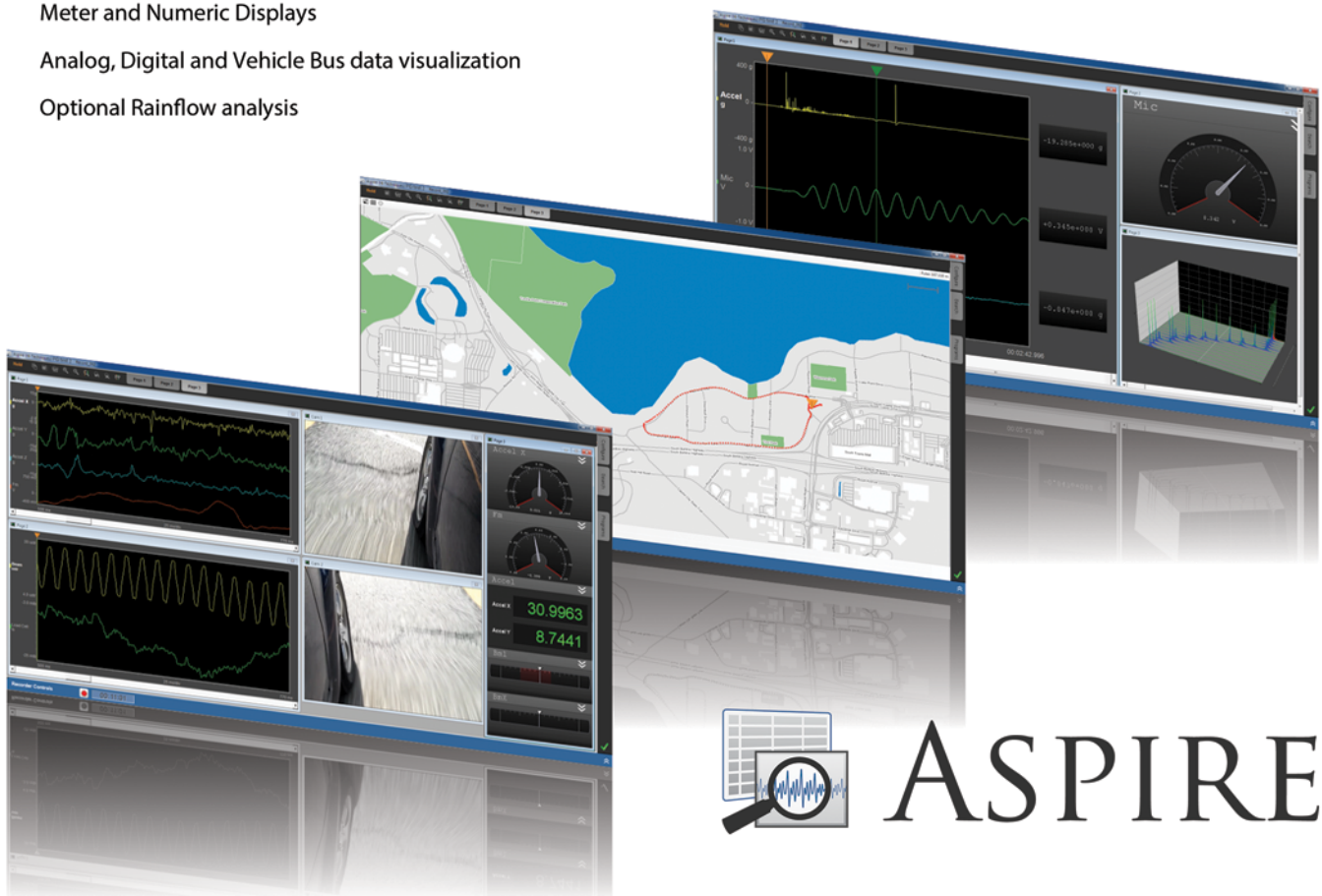- Time and Frequency Domain Displays
- Stacked and Overlaid Displays
- Video and GPS Mapping
- Fatigue Displays including Rainflow and Peak Valley
- Meter and Numeric Displays
- Analog, Digital and Vehicle Bus data visualization
- Optional Rainflow analysis

ASPIRE

LiveCalc™ Real-time DSP based Analysis, Filtering and Triggering

Each Echelon system features a powerful Digital Signal Processor directly in the data stream to perform sophisticated data reduction and analysis on-the-fly.

Digital Filtering
Echelon offers time and frequency domain filtering with selectable characteristics
Data Reduction
Conditional triggering, burst data collection, rainflow, mean, max, min, frequency, RMS and limit comparison

Sensor Database

The powerful Sensor Database provides an easy way to maintain and edit sensor information including calibration data.

Supports all sensor types
Maintains calibration information and monitors calibration intervals
Easily synchronizes with virtually all corporate sensor databases
Simplifies setup in Aspire by maintaining individual sensor setup and calibration information
Add user information on a sensor by sensor basis

CAN Configuration Software

The CAN Configuratation Tool simplifies integration of CAN, CCP and XCP messages into the Aspire Software. CAN messages can be correlated to other inputs, used as a trigger source or used in calculations.

E-Connect™ Wireless Setup and Display Software

Developed especially for the Echelon family of Data Acquisition systems, E-Connect™ software allows 802.11 WiFi control from almost any mobile PC or communications device. Use your mobile phone or tablet PC to change channel settings, view battery and memory status, or even view channel data on-the-fly.
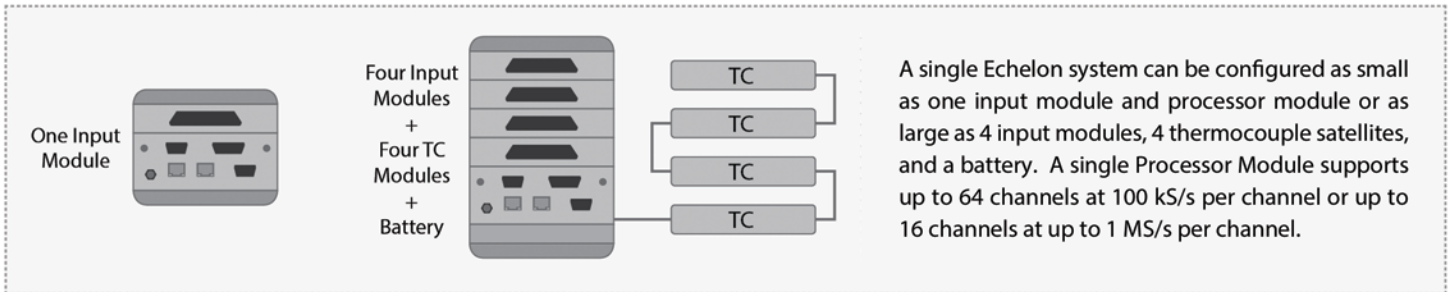
The web based application can be easily modified to enable a simplified user interface to match the capabilities required and the skill of the test operator.
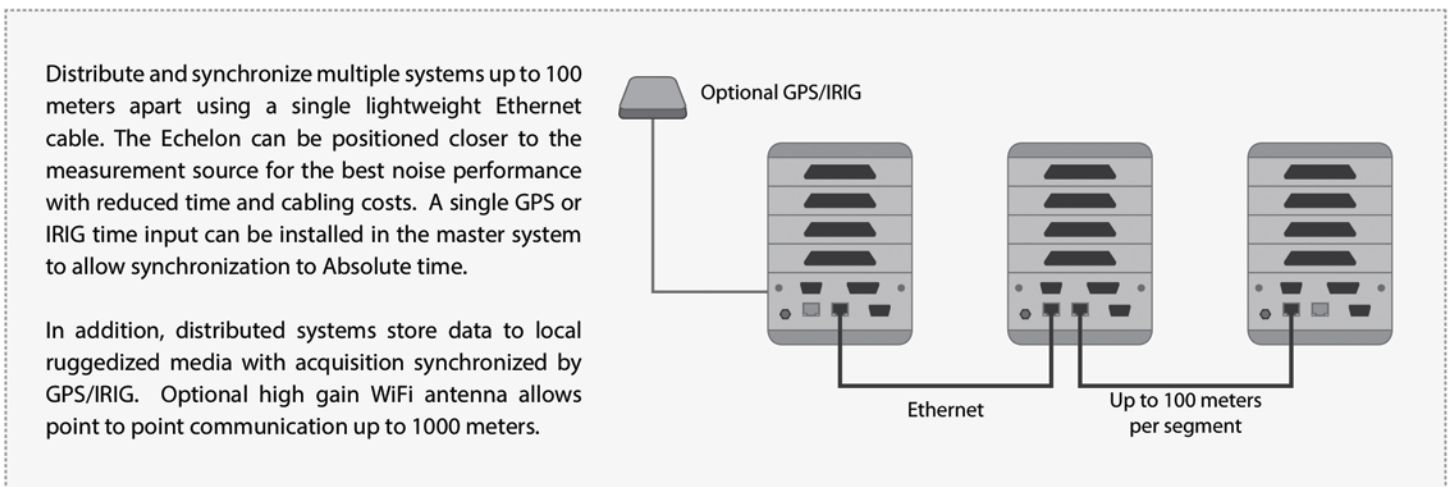
Each Echelon Processor and Control Module supports up to 4 input modules. The distributed architecture ensures full-speed streaming and real-time analysis regardless of channel count. Systems and modules can be easily re-configured in a variety of different ways.

Mount several complete Echelon systems together for virtually limitless channel counts. Simply use standard Ethernet cable to synchronize systems at distances up to 100 meters. Synchronized start/stop and data capture at the touch of a single button.
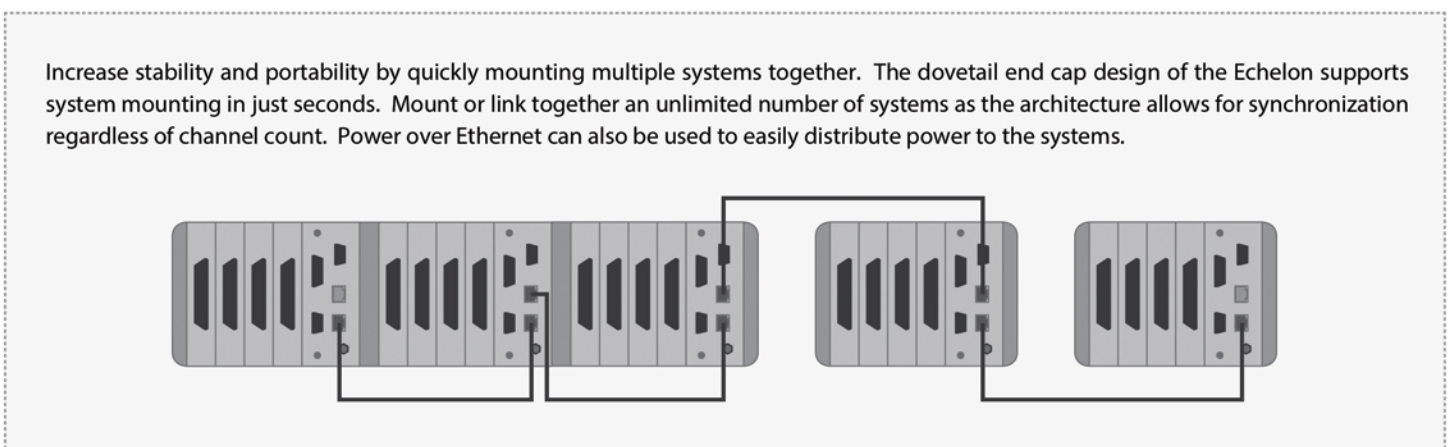
Single

One Input Module

Four Input Modules + Four TC Modules + Battery

TC
TC
TC
TC

A single Echelon system can be configured as small as one input module and processor module or as large as 4 input modules, 4 thermocouple satellites, and a battery. A single Processor Module supports up to 64 channels at 100 kS/s per channel or up to 16 channels at up to 1 MS/s per channel.

Distributed

Distribute and synchronize multiple systems up to 100 meters apart using a single lightweight Ethernet cable. The Echelon can be positioned closer to the measurement source for the best noise performance with reduced time and cabling costs. A single GPS or IRIG time input can be installed in the master system to allow synchronization to Absolute time.

In addition, distributed systems store data to local ruggedized media with acquisition synchronized by GPS/IRIG. Optional high gain WiFi antenna allows point to point communication up to 1000 meters.

Optional GPS/IRIG

Ethernet

Up to 100 meters per segment

Docked/Distributed

Increase stability and portability by quickly mounting multiple systems together. The dovetail end cap design of the Echelon supports system mounting in just seconds. Mount or link together an unlimited number of systems as the architecture allows for synchronization regardless of channel count. Power over Ethernet can also be used to easily distribute power to the systems.

Mobile Testing

Echelon's compact size and extreme environmental packaging make it ideal for a variety of mobile markets, including:

- Marine Vehicles
- Offroad and Heavy Machinery
- Recreational and Sport Vehicles
- Military Vehicles
- Aerospace Vehicles
- Agriculture, Lawn and Garden
- Automotive Road Load
- Aircraft
- Motorcycles and Bicycle

Typical Uses:

- Materials Testing and Fatigue
- Noise, Vibration and Harshness
- Component and Subsystem Testing
- Road Load
- Engine Analysis
- Electrical and Battery Systems
- Safety and Reliability
- Braking Systems

Monitoring

Echelon's low power design, distributed wireless and wired Ethernet architecture, and flexible signal conditioning support a range of monitoring applications:

- Test Cells
- Civil Engineering and Bridge Monitoring
- Material Degradation
- Machinery Monitoring
- Motor Drive Monitoring
- Power Fault Monitoring

Ballistics and Explosives

Echelon's high performance digitizers and rugged packaging support a variety of ballistics applications:

- IED Mitigation
- Arena Testing
- Near-field Ballistics
- Body Armor
- Slow Cook Off Testing
- Gun Testing

Specifications

Physical / Environmental

Power Input:

9-36 Vdc input via front panel connector

120/240 Vac External AC/DC adaptor provided

Power over Ethernet: up to 20 W

Opt. Battery Pack: 80 Wh

Standby mode supports start on remote or start on ignition

Typical Power Consumption: 10 - 30 W excluding sensor excitation

Enclosure: 1065 aluminum (approx. dimensions excluding bumpers)

Minimum Size (Processor, 4 Ch High Speed Module, End Caps)

5.63" L x 4.94" W x 4.35" H (143 x 126 x 110 mm)

64 Channel Size (Processor, 4 x 16 Ch High Density Modules, End Caps)

5.63" L x 4.94" W x 10.03" H (143 x 126 x 261 mm)

Environmental: Sealed IP67 enclosure

Operating Temperature: -40° to +85° C (-20° to 70° C with Battery Module)

Shock: 100 g, 11 ms half-sine, Mil-Std-810F Procedure 1

Vibration: 20 g, 25-500 Hz, Mil-Std-810F, Procedure 1

Altitude: <20,000 feet (6100 m)

Mounting: Handles accommodate 1.5" tie-down straps, opt. flange mount end caps for additional mounting

EMI: CE Certified

Communications

Dual 100 MB water resistant Ethernet connectors

Multiple systems can be daisy chained via Ethernet

Opt. Grand Master supports IEEE-1588 PTPv2 system synchronization

Wireless 802.11 b/g up to 100 meters

Optional high gain antenna provides up to 1000 m range

USB 2.0 connects as storage device to PC

Front panel membrane keypad enables start/stop and LED indicators for battery and memory status (25%, 50%, 100%) as well as LED alarm indicator

Optional wired keypad offers remote control up to 20 m

Storage

All channels stream directly to local, ruggedized media at full acquisition speeds to a removable 64 GB or larger industrial-rated Solid State Drive. Contact Hi-Techniques for additional storage options

Storage Modes: Continuous, Segmented Triggered Sweep, FFT

Input Capabilities

Clock Accuracy: <50 ppm standalone

Multibox syncronization: < 1 microsecond

GPS: Optional, precision time and 20 Hz location

IRIG: Optional IRIG-B timecode input

CAN: Up to 4 CAN inputs, Multiple protocols including version 2.0 part A+B, Baud rates to 1 Mbps

Up to 4 32-bit quadrature encoder inputs, 16 digital/frequency inputs, External Trigger, Manual Trigger

Isolated Thermocouple CAN Module   HT-TCS | 16-ch

CAN: Compatible with Echelon CAN ports. Up to 4 modules can be connected in series

Connector Type: Miniature blade type T/C

Environmental: IP67 compliant, -40° to +85° C operating temperature

Channels: Sigma-delta ADC per channel with CJC at 10 S/sec

Isolation: 500 V pk channel-to-channel, channel-to-ground

Thermocouple Types: J, K or T type

High Density Input Module   EM-HD | 8 or 16-ch

Amplifier Type: Zero-drift, autozeroing at 800 kHz, fully differential

Shunt Calibration: Fixed 100 KΩ 0.1%, A- to V-

Input range: ±10 mV to ±5 V, external 20x or 50x attenuator available

Anti-Alias Filter: 4-pole Butterworth @ 25 kHz plus selectable Steep or Gaussian at sample rates below maximum

Input Impedance: Single Ended 10 MΩ to ground, Diff 20 MΩ (+) to (-)

Coupling: DC, DC Differential, Ground, Bridge, IEPE, Thermocouple

Bridge Support: Full, ½, ¼ bridge software selectable, internal ultra-precision 350 Ω completion at .01%, .05 ppm/C per channel (120 Ω optional)

Excitation: Bipolar 1-10 Vdc excitation, up to 30 mA per ch. (Ch1, 9: 100 mA), Independent variable and fixed 10 V sources per module, selectable per ch

Connector Type: One or two sealed IP67 compliant 62-pin male connectors

Channels: 16 independent 24-bit, 100 kS/s oversampling SAR digitizers

Sample Rates: Decimal rates in 1, 2, 5 steps from 0.5 S/s to 100 kS/s, Binary rates from 0.512 S/s to 102.4 kS/s

Optional Breakouts: BNC, IEPE, 20x/50x Attenuator, Spring-Loaded Terminals required for thermocouple, Analog Output

Analog Out Option: Software selectable 0-10 V or ±5 V output

High Level Input Module   EM-HL | 8 or 16-ch

Amplifier Type: Zero-drift, autozeroing at 800 kHz, fully differential

Input range: ±200 mV to ±100 V

Anti-Alias Filter: 4-pole Butterworth @ 25 kHz plus selectable Steep or Gaussian at sample rates below maximum

Input Impedance: Single Ended 1 MΩ to ground, Diff 2 MΩ (+) to (-)

Coupling: DC, DC Differential, Ground, Bridge, IEPE

Excitation: Unipolar 3-15 Vdc excitation, 30 mA per channel (Ch1, 9: 100 mA)

Connector Type: One or two sealed IP67 compliant 62-pin male connectors

Channels: 16 independent 24-bit, 100 kS/s oversampling SAR digitizers

Sample Rates: Decimal rates in 1, 2, 5 steps from 0.5 S/s to 100 kS/s, Binary rates from 0.512 S/s to 102.4 kS/s

Optional Breakouts: BNC, IEPE, Spring-Loaded Terminals, Analog Output

Analog Out Option: Software selectable 0-10 V or ±5 V output

High Speed Input Module   EM-HS | 4-ch

Connector Type: Sealed IP67 compliant 78-pin male connector

Channels: Four independent 16-bit, 1 MS/s SAR type digitizers

Sample Rates: Decimal rates in 1, 2, 5 steps from 0.5 S/s to 1 MS/s, Binary rates from 0.512 S/s to 1.024 MS/s

Input Range: ±10 mV to ±100 V

Coupling: DC, DC Differential, Ground, AC, Bridge, ICP, Thermocouple

Anti-Alias Filter: 10-pole Bessel @ 200 kHz plus selectable Steep or Gaussian at sample rates below maximum

IEPE: Constant current source of 4 mA supports all IEPE sensors including accelerometers, microphones, pressure and force sensors

Thermocouple: Supports B, C, E, J, K, N, R, S, T thermocouples

Voltage: Software selectable single ended or differential. AC/DC coupling

Video Input Module   EM-VM | 6-ch

Inputs: Supports 6 simultaneous USB 2.0 cameras

Output: One Gigabit Ethernet

Connector: Inputs: 4- pin waterproof M8, Output: 8 pin waterproof M12

On-module storage: 64 GB non-volatile

Specifications subject to change. Please contact Hi-Techniques for more complete specifications.