



# echelon-XE

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 and to a remote PC via Ethernet



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



Distributed acquisition and scalability even across long distances



Remote setup and real-time display of data

## Echelink™ Interface

Connectivity

Time Synchronization

### Key capabilities include:

Full system control and display of live streaming data in realtime to local SSD data storage and/or to a remote PC via Gigabit Ethernet. 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.

Synchronization of multiple 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 Echelon's integrated IEEE1588 Precision Time Protocol Capability.

## Simple and Easy CAN Configuration

Echelon's integrated CAN detection capability automatically detects CAN / CAN FD port activity and dynamically adjusts baud rate, termination, and polarity to ensure proper connection. An integrated software bus monitor shows CAN bus data in realtime and Aspire's setup software allows configuration of any number of channels.

# 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

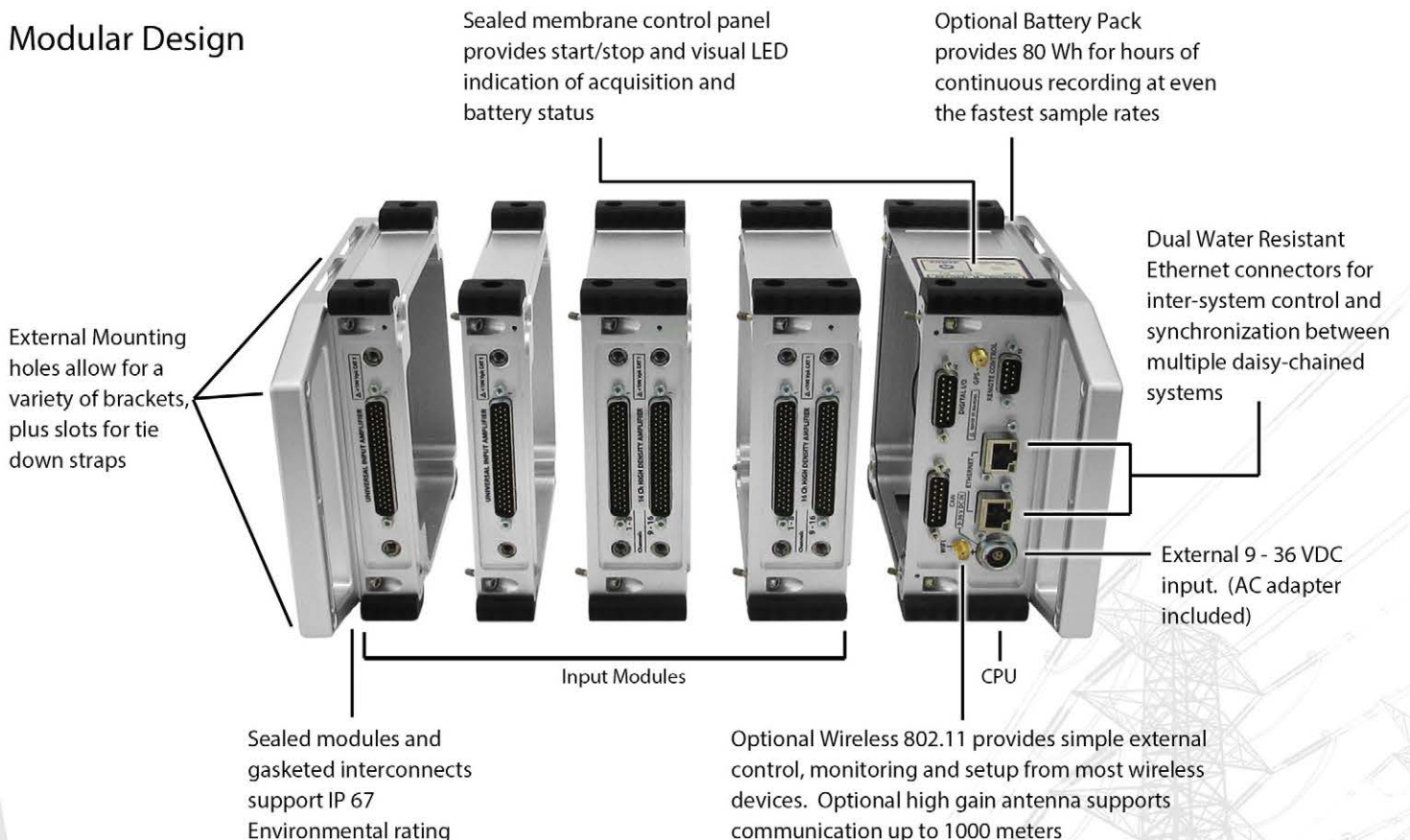
Offering best in class laboratory grade performance in the smallest possible package



## Mounting options

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

## Modular Design





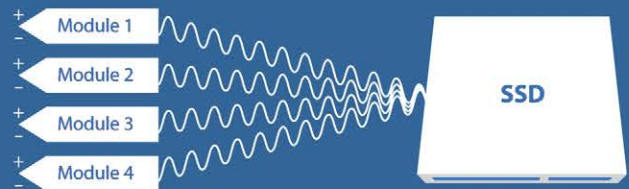
# Small Package... Big Performance

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.

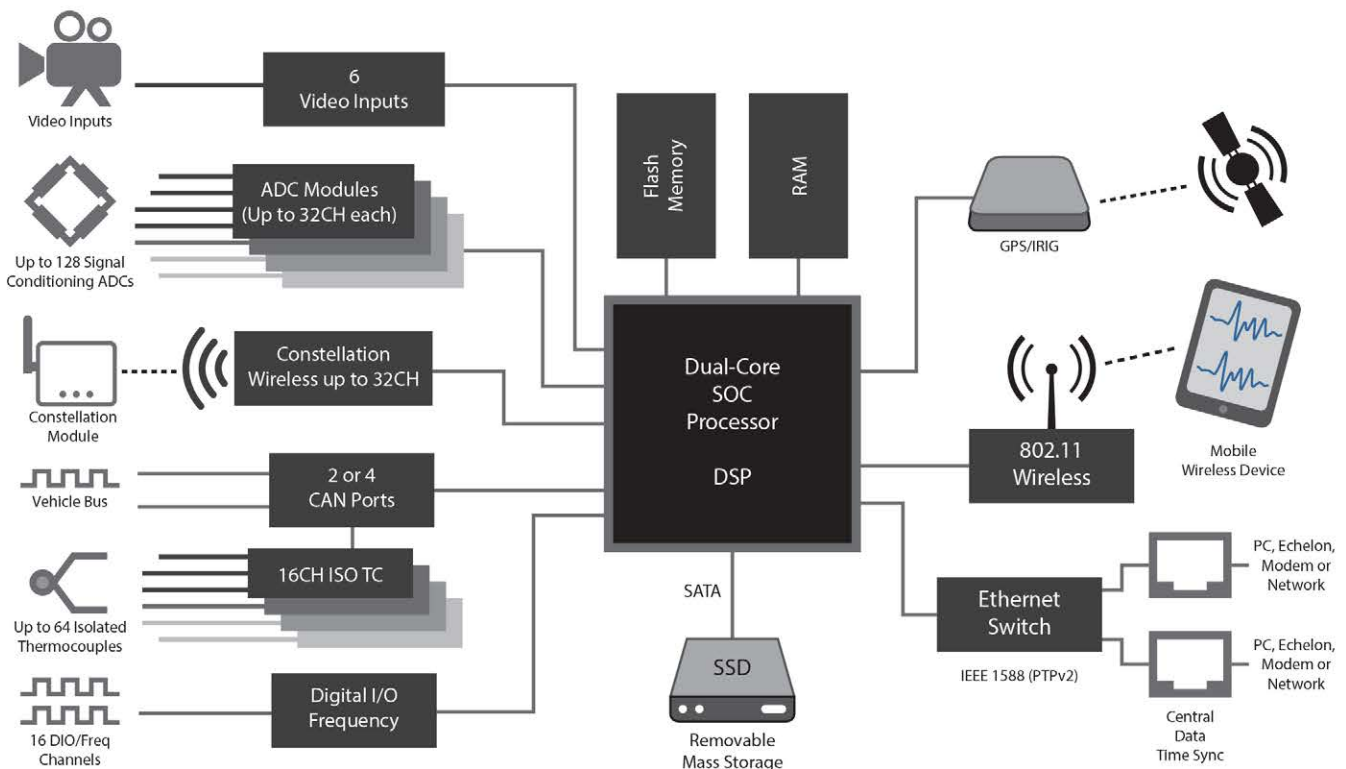
## Key capabilities include:

**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 and/or external host PC. Easily transferable post-acquisition via standard Ethernet 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



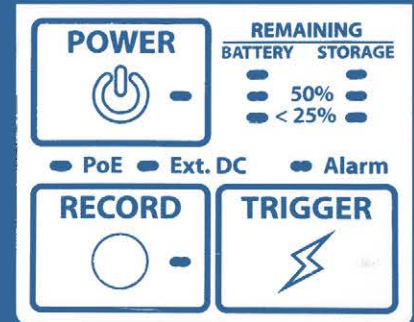
## System Architecture



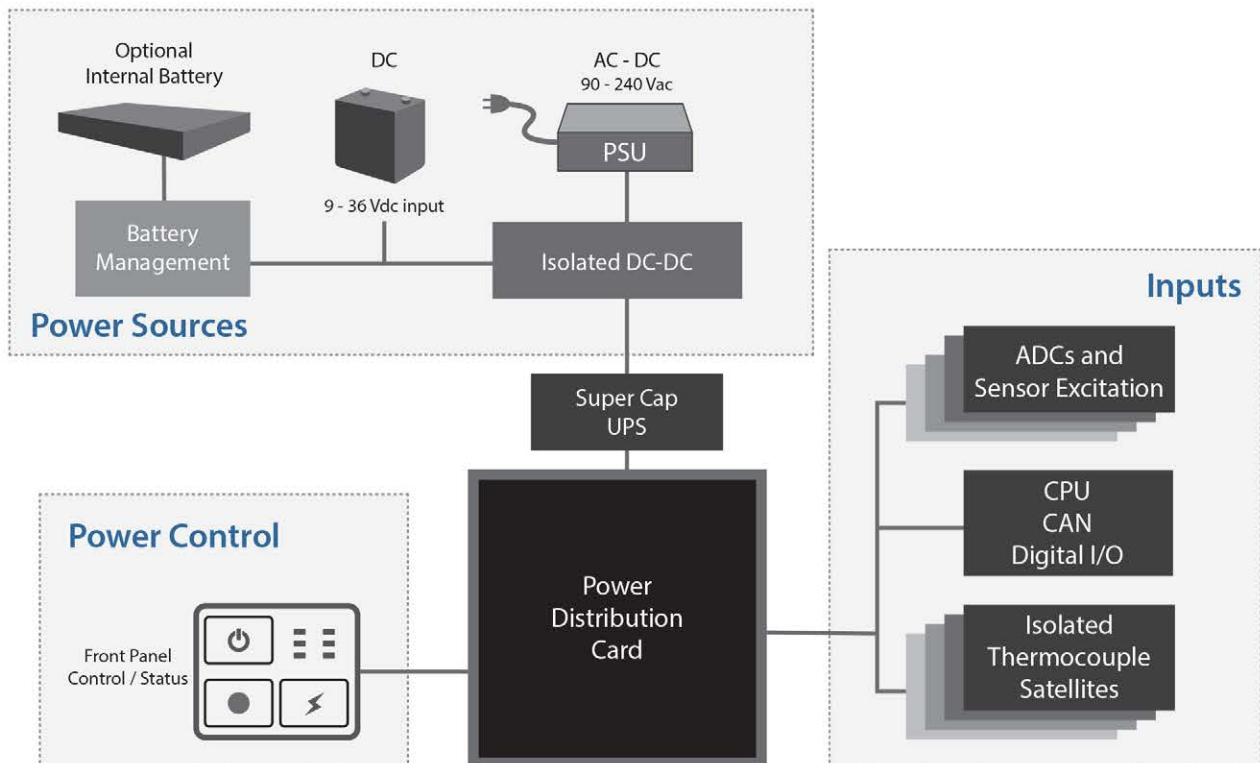
# Power Management

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
- 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 interface



## Power Distribution Diagram



# 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 can be 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/High Level - Input Module

16-Ch

The High Density Input Module offers 16 channels of 100kS/s, 24-bit software selectable bridge, IEPE, thermocouple, or voltage inputs in a single module. Supports 1/4, 1/2, and full bridge devices with a zero drift amplifier. 1-10V bipolar excitation per channel 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 20V, 4 mA excitation and voltage inputs up to  $\pm 200V$ . Analog out variants available. The High Level variant supports up to 15V unipolar excitation per channel and up to  $\pm 100V$  direct input range.



## Ultra High Density - Input Module

32-Ch

The Ultra High Density Input Module offers 32 channels of 20kS/s, 24-bit software selectable bridge, thermocouple, IEPE, or voltage inputs in a single module. Supports 1/4, 1/2, and full bridge devices with a zero drift amplifier. 5 or 10 V unipolar excitation per 8 channel group at up to 250mA per 16 channels. Optional breakout cable interfaces with HD/HL breakouts.



## High Speed - Input Module

4-Ch

The High Speed Universal Input Module offers best in class performance including 4 individual 1 MS/s 16-bit 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 1/4, 1/2, and full bridge. Directly connect bridge, ICP/IEPE, and MEMS devices.



## Constellation Receiver - Input Module

32-Ch

The Constellation Receiver Module Supports our Constellation Wireless Transmitters. The transmitters support bridge type sensors including, strain, load, pressure, etc. Data is digitized at the source and synchronized with other analog, digital, vehicle data and video inputs. Four front panel antenna connectors support up to 32 wireless channels and sample rates up to 10 kS/s.



## Video - Input Module

6-Ch

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



## Internal Battery Module

80 Wh

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.



## Isolated Thermocouple CAN Device







16-Ch

The 16-channel Isolated Thermocouple Module provides low cost ruggedized 100 S/s thermocouple support and links to Echelon via a dedicated CAN connection. Up to 4 Thermocouple modules can be daisy chained to a single CAN port for up to 64 distributed temperature 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	Ultra High Density Input Module	High Speed Input Module	Constellation Receiver Module	Video Input Module
						
<b>Model</b>	EM-HD (O)	EM-HL (O)	EM-UHD	EM-HS	EM-CS	EM-VM
<b>Channels</b>	16	16	32	4	Up to 32	6
<b>Sample Rate/Ch</b>	100kS/s (10 µsec)	100kS/s (10 µsec)	20kS/s (50 µsec)	1MS/s (1 µsec)	Up to 10kS/s	30 frames/sec
<b>Resolution</b>	24-bit SAR	24-bit SAR	24-bit SAR	16-bit SAR	16-bit SAR	Up to 1080p
<b>Ranges</b>	±10mV to ±10V, Up to ±250V*	±200mV to ±100V	±20mV to ±5V	±10mV to ±100V	N/A	N/A
<b>Sensor Power</b>	1 to 10V bipolar	3 to 15V unipolar	5 or 10V unipolar	1 to 10V bipolar, 3 to 15V unipolar	3V fixed excitation	5V
<b>Sensor Support</b>	Voltage, Bridge, IEPE*, TC*	Voltage, IEPE*, Amplified	Voltage, Bridge, IEPE*, TC*	Voltage, Bridge, IEPE*, Amplified	Strain Devices	USB Cameras
<b>Cable Adapters</b>	IEPE, AC, 20x, 50x, SLT	IEPE, AC, SLT	IEPE, AC, 20x, 50x, SLT	BNC, SLT	M8 or 62-pin D-Sub (8Ch)	USB
<b>Analog Out Option</b>	Software Select ±5V or 0-10V Out	Software Select ±5V or 0-10V Out	N/A	N/A	N/A	N/A

\*Requires external breakout

## XE CPU Module

*DIO, CAN/CAN-FD, GPS/IRIG, WiFi | EM-CPU-XE*

The CPU is the heart of the Echelon system providing real time analysis, control, power management, SSD storage, and communication capabilities. Any combination of 1-4 input modules can be attached, offering up to 128 analog channels. An additional 4 daisy-chained ruggedized thermocouple modules can be added, offering up to 64 more thermocouple channels, for a total of 192 analog channels.

**Sixteen Digital Inputs** are provided for Boolean, Frequency, RPM, Period, Pulse Width, Duty Cycle, Encoder Count and Mag Pickup RPM inputs.

**Two built-in CAN Ports** (optionally four) include auto-sensing bitrate configuration for easy setup.

**Dual GbE Ethernet Ports** provide IEEE-1588 PTP2 time synchronization between distributed systems and connection to an optional host PC.

**Powerful on-board DSP** analysis provide real-time on-the-fly calculations, filtering and triggering.

**Sealed Membrane Keypad** provides standalone start/stop capture with LED indicators for power, battery and storage.

**Direct streaming** of all data channels regardless of sample rate to included 64GB industrial-grade SSD or 256GB, 1TB optional SSDs.

### Available CPU Options Include

- Internal GPS receiver adds 20 Hz recording of location, speed, heading and distance
- Two additional CAN ports for a total of four, including two CAN-FD ports
- Built-in Wi-Fi for simple remote control and status on any phone, tablet or PC
- Multi-Box capability with time synchronization and data merging between multiple Echelon chassis
- Industrial-grade SSDs in 256GB or 1TB (100g, -40 to +85°)



# 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 Calibration Wizard and Sensor Database 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





# 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

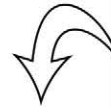
Echelon offers time and frequency domain filtering with selectable characteristics

## Data Reduction

Conditional triggering, event detection, burst data collection, rainflow, mean, max, min, frequency, RMS and limit comparison

## Spectral Analysis

Live FFT calculations, including spectral displays



Description: ICP® Accelerometer  
 Manufacturer: PCB Method: Back-to-Back Comparison AT401-3

Calibration Data

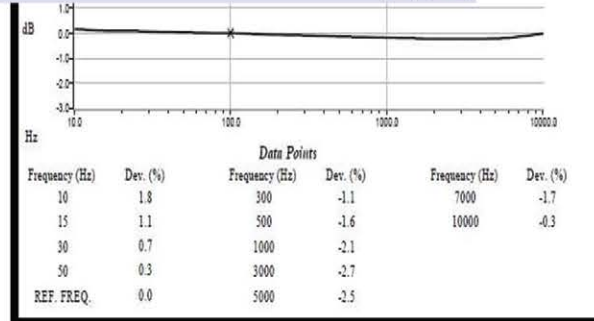
Sensitivity @ 100 Hz: 101.4 mV/g Output Bias: 11.0 VDC  
0.6 %  
57.7 kHz

# Sensor Database

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

Serial	Serial #	Manufacturer	Model	Description	Calibration	Range	Units	Other	Multiple	Bridge Type	Bridge Parameters	Units	Sensitivity	Stability	Full Scale	Last Cal
101401	101401	PCB	352C02	Accelerometer, ICP®	101.4	0.00000 - 0.00000	mV/g			ICP	101.4	mV/g	101.4	0.6%	11.0	2014.04.25

- Supports all sensor types with drag-and-drop setup
- 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



# Spreadsheet Setup

The spreadsheet setup allows for quick and easy setup of large channel tests. Exports and Imports Microsoft Excel spreadsheets for simple offline test preparation.

# CAN Configuration Software

The CAN Configuration Tool simplifies integration of CAN 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

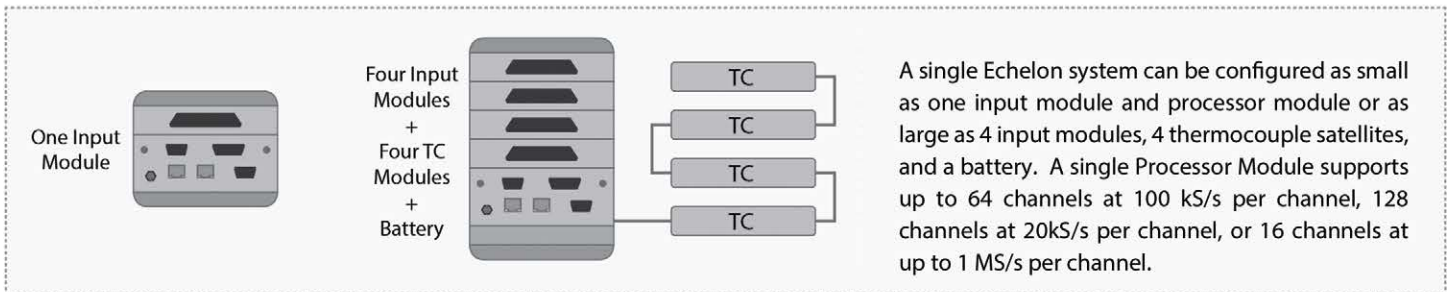
Developed especially for the Echelon family of Data Acquisition systems, E-Connect™ software allows 802.11 WiFi control from almost any mobile PC or communications device. Use your mobile phone or tablet PC to change channel settings, view battery and memory status, or even view channel data on-the-fly from your favorite web browser.

# Configurations

Each Echelon Processor Module supports any mix of 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 of hundreds of channels at the touch of a single button.

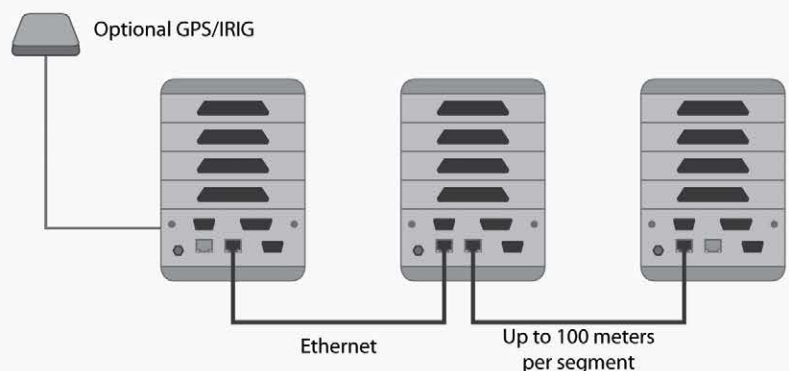
## Single



## Distributed

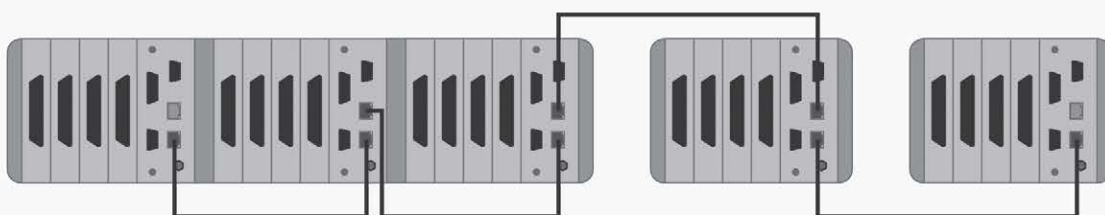
Distribute and synchronize multiple systems up to 100 meters apart using a single lightweight Ethernet cable. The Echelon can be positioned closer to the measurement source for the best noise performance with reduced time and cabling costs. A single GPS or IRIG time input can be installed in the master 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 communication up to 1000 meters.



## 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.





## Mobile Testing

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

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



## Typical Uses:

- |                                 |                                |
|---------------------------------|--------------------------------|
| Materials Testing and Fatigue   | Engine Analysis                |
| Noise, Vibration and Harshness  | Electrical and Battery Systems |
| Component and Subsystem Testing | Safety and Reliability         |
| Road Load                       | 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                              | Machinery Monitoring   |
| Civil Engineering and Bridge Monitoring | Motor Drive Monitoring |
| Material Degradation                    | Power Fault Monitoring |



## Ballistics and Explosives

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

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



# Specifications

## Physical / Environmental

### Power Input:

9-36 Vdc input via front panel connector, Opt. 80 Wh Battery Pack  
90-240 Vac External AC/DC adaptor provided

Typical Power Consumption: 15 - 45 W excluding sensor excitation

### Enclosure:

1065 aluminum (approx. dimensions excluding bumpers)  
Minimum Size: 6.95" L x 6.15" W x 4.75" H (177 x 156 x 120 mm)  
Maximum Size: 6.95" L x 6.15" W x 13.3" H (177 x 156 x 337 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

Mounting: Handles accommodate 1.5" tie-down straps, opt. flange mount

end caps for additional mounting

EMI: CE Certified

## Communications

Dual water-resistant Ethernet connectors

Multiple systems can be daisy-chained via IEEE1588 PTPv2 synchronization

Optional Wireless 802.11 b/g up to 100 meters

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

## Storage

All channels stream directly to local, ruggedized media, at full acquisition speeds to a removable SSD.

Capacity: Included 64GB, optional 256GB or 1TB available

Storage Modes: Continuous, Segmented, Triggered Sweep

## Input Capabilities

Clock Accuracy: <50 ppm standalone, <1 ppm with GPS Sync

Multibox synchronization: < 2 microseconds

GPS: Optional precision time and 20 Hz location

IRIG: Optional IRIG-B12X time code input

CAN: Up to 4 CAN inputs, two FD-capable, Baud rates to 4 Mbps

Digital: Up to 4 32-bit quadrature encoder inputs, 16 digital/frequency inputs, 4 magnetic pickup RPM channels

Trigger: External In/Out, Manual

### Isolated Thermocouple CAN Module HT-TCS | 16-ch

CAN: Compatible with Echelon CAN ports. Up to 4 modules can be connected in series for 64 TC channels.

Connector Type: Miniature blade type T/C

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

Channels: Independent ADC per channel at 10 or 100 S/sec with CJC

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

Thermocouple Types: J, K, or T type

### Video Input Module EM-VM | 6-ch

Inputs: Supports 6 simultaneous UVC compliant USB 2.0 cameras

Connector Type: Four 4-pin waterproof M8

On-module storage: 500 GB non-volatile, upgradeable

### Constellation Wireless Receiver Module EM-CS | 32-ch

Channels: 4 receivers, supports up to 32 wireless input channels from Constellation Bluetooth transmitters

Sample Rates: Decimal 0.5 S/s to 10 kS/s, Binary 0.512 S/s to 10.24 kS/s. Fully synchronous with all internal analog, digital and video channels.

Connector Type: Four SMA female antenna connectors

### High Density Input Module EM-HD | 16-ch

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

Shunt Calibration: Fixed 100 K $\Omega$  0.05%, A- to V-

Input range:  $\pm 10$  mV to  $\pm 10$ V, external 20x or 50x attenuator available

Input Impedance: Single Ended 10 M $\Omega$  to ground, Diff 20 M $\Omega$  (+) to (-)

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

Bridge Support: Full,  $\frac{1}{2}$ ,  $\frac{1}{4}$  bridge software selectable, internal ultra-precision 350  $\Omega$  completion at 0.2 ppm/ $^{\circ}$ C per channel (120  $\Omega$  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: Two sealed IP67 compliant 62-pin male connectors

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

Sample Rates: Decimal 0.5 S/s to 100 kS/s, Binary 0.512 S/s to 102.4 kS/s

Analog Out Option: Software selectable 0-10 V or  $\pm 5$  V output per channel

### High Level Input Module EM-HL | 16-ch

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

Input range:  $\pm 200$  mV to  $\pm 100$  V

Input Impedance: Single Ended 1 M $\Omega$  to ground, Diff 2 M $\Omega$  (+) to (-)

Coupling: DC, DC Differential, Ground, Full Bridge, IEPE\*

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

Connector Type: Two sealed IP67 compliant 62-pin male connectors

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

Sample Rates: Decimal 0.5 S/s to 100 kS/s, Binary 0.512 S/s to 102.4 kS/s

Analog Out Option: Software selectable 0-10 V or  $\pm 5$  V output per channel

### Ultra High Density Input Module EM-UHD | 32-ch

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

Shunt Calibration: Fixed 100 K $\Omega$  0.05%, Between Ch- and Ex+ or Ex-

Input range:  $\pm 20$  mV to  $\pm 5$  V

Input Impedance: Single Ended 10 M $\Omega$  to ground, Diff 20 M $\Omega$  (+) to (-)

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

Bridge Support: Full,  $\frac{1}{2}$ ,  $\frac{1}{4}$  bridge software selectable per channel

350  $\Omega$  completion at 0.2 ppm/ $^{\circ}$ C per channel (120  $\Omega$  optional)

Excitation: 5 or 10V unipolar, selectable by 8-channel groups

Connector Type: Two sealed IP67 compliant 104-pin male connectors

Channels: 32 independent 24-bit, 20 kS/s oversampling SAR digitizers

Sample Rates: Decimal 0.5 S/s to 20 kS/s, Binary 0.512 S/s to 20.48 kS/s

### High Speed Input Module EM-HS | 4-ch

Input Range:  $\pm 10$  mV to  $\pm 100$  V

Coupling: DC, DC Differential, Ground, AC, Bridge, IEPE\*

Bridge Support: Full,  $\frac{1}{2}$ ,  $\frac{1}{4}$  bridge software selectable per channel

Excitation: Two independent sources: 0.5 - 10.0 V variable bipolar and 3.0 - 15.0 V variable unipolar, selectable by channel.

Connector Type: Sealed IP67 compliant 78-pin male connector

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

Sample Rates: Decimal 0.5 S/s to 1 MS/s, Binary 0.512 S/s to 512 kS/s

## Please see individual input module data sheets for more complete information

\*Requires external breakout

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