Constellation

Wireless Sensor Transmitters
Extending DAQ Performance

# Extending Data Acquisition Performance

Single-channel Constellation on wireless Qi charger

As demands for Data Acquisition become more rigorous in terms of performance and channels, Constellation wireless sensor transmitters make it fast and easy to add more sensor channels.

Combined with the Hi-Techniques Echelon receiver, Constellation channels are seamlessly added to the full complement of Echelon analog, digital, video, vehicle data and GPS measurement channels. All channels are synchronized and can be viewed in real-time or stored and analyzed in a variety of data formats.

Key Advantages:

- **Up to 32 Constellation modules are supported by a single Echelon receiver**
- **Dramatically simplifies sensor wiring and setup time and expense**
- **Data is digitized at the source, improving measurement performance especially in longer signal runs and/or high EMI environments.**
- **Uncompromising measurement performance with highly stable amplifiers featuring rates to 10 kS/s**
- **Synchronized sampling between wireless modules as well as other analog, digital, vehicle data and video inputs.**
- **Continuous recording, timed interval recording as well as average, peak hold, rainflow and peak/valley.**
- **Supports 350 Ω or higher strain gage based sensors including strain gages, load cells and torque sensors**
- **Low power architecture with high capacity battery, charging by mobile device Qi wireless or USB-C**
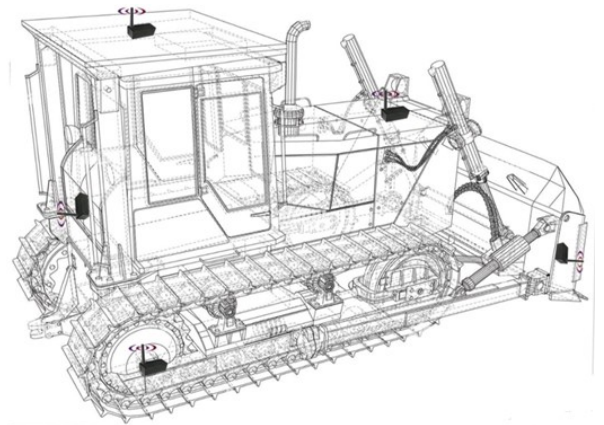
Constellation is available in two varieties:

Single Channel
Up to 10 kS/s sample rate
M8 field-wireable connector
Supports ¼, ½ and full bridge devices

Eight channels
Up to 1 kS/s per channel
62 pin D-sub connector
Supports ¼. ½ and full bridge devices

Constellation Wireless Sensor Transmitters expand traditional Data Acquisition System capabilities

Previous generations of wireless sensor transmitter devices have been extremely limited in capabilities. Channel time delays are generally unspecified, there is no ability to closely synchronize multiple channels, and there are A-D and D-A conversions before reaching your DAQ system, where the signal is digitized yet again, each conversion adding noise and distortion.

The Constellation Receiver supports up to 32 simultaneous wireless sensor modules at sample rates to 10 kS/s per channel. All data is synchronized between modules as well as with traditional wired sensor data at the Echelon and streamed to SSD.

Constellation supports most 350 Ω or higher quarter, half and full bridge devices including strain gages, load cells and torque transducers. An internal 350 Ω precision completion resistor simplifies quarter bridge connections. 3V fixed excitation provides the ability to resolve signals to less than ½ microstrain.

In addition to continuous streaming to the Echelon SSD at high or low sample rates, Constellation supports a number of data reduction capabilities including:

- Digital filtering for both time-domain and frequency-domain applications
- Timer-based burst acquisition for quasi-static measurements, with low power sleep mode between acquisitions
- Data reduction modes including average, peak hold, rainflow and peak/valley

Rugged By Design

IP 66 Environmental Rating
The sealed molded enclosure with internal gasketing and sealed connectors provides protection to the integrated electronics from harsh environmental conditions

Shock protection to 100g

Small physical size
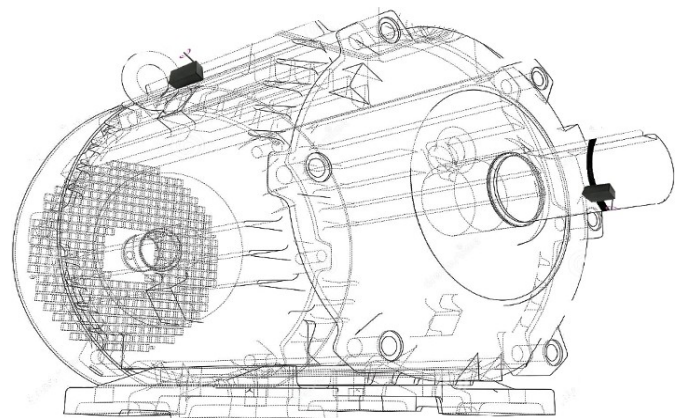Minimize mass effects on measurements

Power saving mode
Standby mode from remote receiver dramatically between measurements

Sealed Membrane Keypad
The sealed keypad provides power on/off as well as LED indicators of battery and wireless connection

Time Synchronous Data

Constellation Wireless Transmitters utilize a proprietary time synchronization capability similar to the IEEE 1588 Precision Time Protocol (PTPv2) which continuously measures and adjusts for delay times between sensors and between the Echelon receiver module to ensure transmitter modules remain synchronized with the receiver regardless of sensor position. The synchronization process involves time offset correction and sample rate correction between the Echelon master clock and the slave clocks on the Constellation Transmitters. The slave clocks synchronize with the master through event messages that are embedded with the sensor data. Acquired data is therefore continuously synchronous despite physical separation of measurements.

Timing uncertainty is also minimized due to the method of transmission to the Echelon Data Acquisition system. Competitive wireless transmitters digitize the data and subsequently send the data through a Digital to Analog Converter before digitizing the data again using a third party DAQ system. This method can cause significant time skew between wired and wireless sensors.

The Constellation Advantage

Constellation digitizes the data directly at the transmitter and sends digital data to the Echelon receiver, eliminating both time skew and induced noise on analog signal paths.

Particularly in the harsh EMI environment of electric vehicles where radiated noise can significantly affect measurement quality, a long cable is susceptible to radiated noise that overwhelms a microvolt-level strain gage signal. Constellation allows you to place the ADC close to the sensor and eliminate the long cable run!

To support a variety of installation requirements, Constellation transmitters include an internal antenna as well as a water resistant SMA connector for an external antenna. An optional cabled antenna provides coverage if the transmitter is located under a chassis or inside a compartment.


Optional Magnetic Mount Antenna
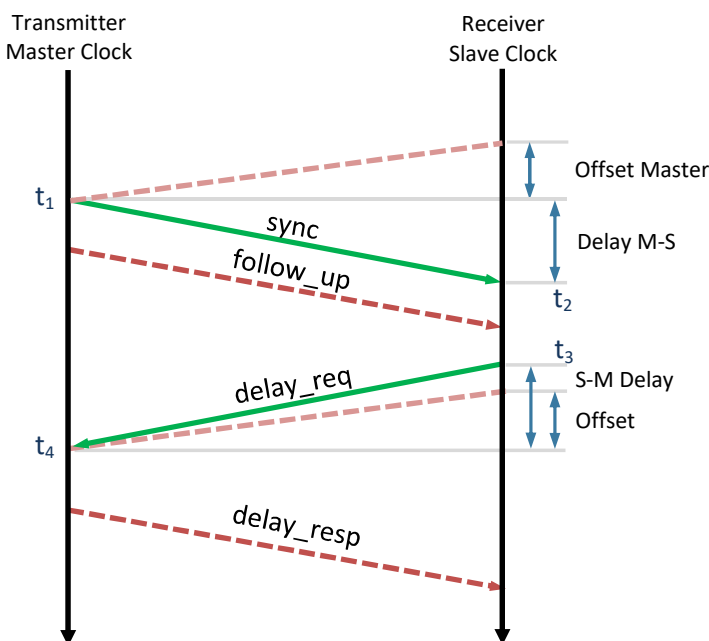
Setting up Constellation is fast and easy. The Receiver module is constantly in pairing mode searching for available Sensor Transmitters. Simply select available modules and drag them into the Channels dialog to pair them. Once paired, the modules will continue to be wirelessly linked to the Receiver unless disconnected by the user.

Receiver modules can be named to reflect their location or test points.
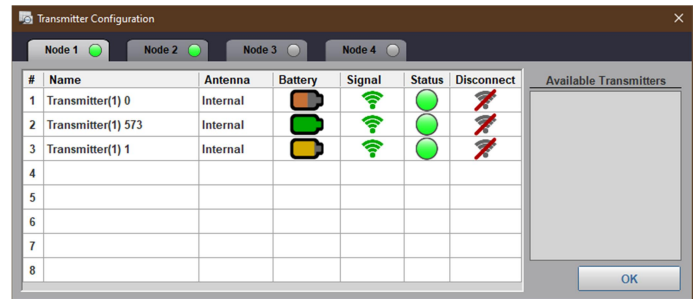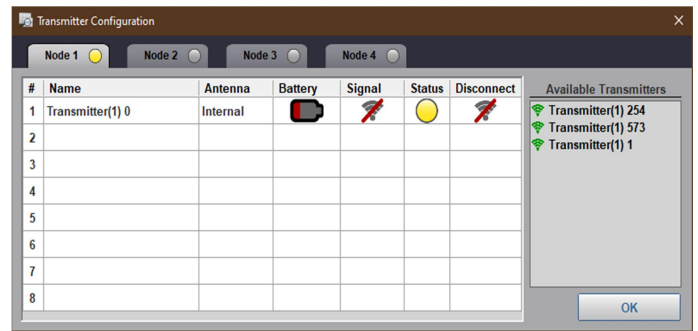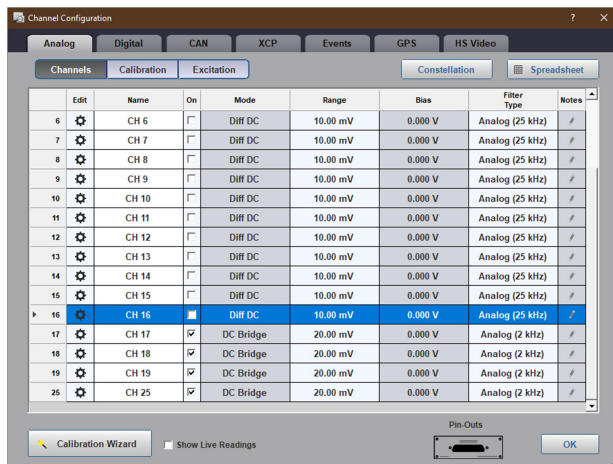
Setup software also provides for control of internal or external antenna selection, battery charge and signal status as well as link status. Status and setup is available for all 4 Receiver nodes.

Once the Transmitter is paired, it automatically appears in the Channels list with other wireless channels, wired analog and digital channels, vehicle bus data, video and GPS channels for display in Aspire software.

Aspire™ Software

Constellation modules are supported by Hi-Techniques Aspire software which provides simple setup, real-time data displays, analysis and data storage in any of 20 different file export formats.

Real-time scrolling data can be viewed in a variety of formats including stacked traces, overlaid traces, FFT, numerical values or meter displays.

Constellation wireless data is synchronized and displayed along with wired sensor data, vehicle bus data, video and GPS data.

Aspire is an easy to use, out of the box setup, display and analysis platform from sensor to solution. The purpose built software comes preconfigured for getting results fast. Quickly configure channels, view and analyze data in just a few keystrokes.

Visualize data in a variety of ways
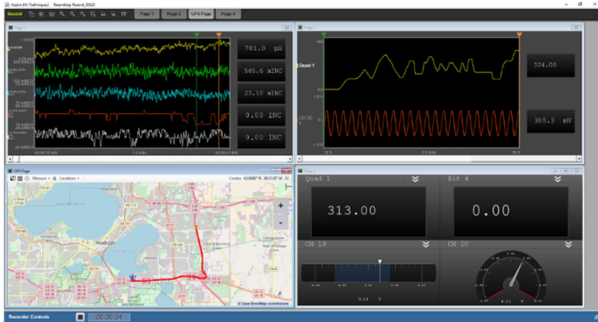
- Scrolling chart recorder displays
- Multi-channel oscilloscope
- Spectral displays including waterfalls, octave and FFT functionality
- Numeric displays with a choice of meter styles
- GPS position mapping with downloadable maps
- Multiple displays with cursor synchronization between analog sensors, digital and vehicle data bus, GPS and video inputs

Data Analysis and Data Export

Built-in Interactive analysis capability offers over 100 functions including trigonometry, calculus, timing, and spectral functions.
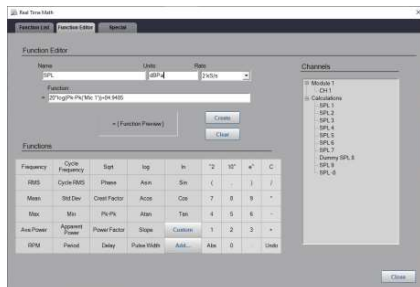
A **Formula Editor** enables functions to be combined to create custom analysis functions. Select the waveforms of interest, your measurement(s) and the region to analyze, and a new trace or numeric result appears. Functions can be defined to calculate and display with every subsequent acquisition.

Full custom analysis and test automation is available using Aspire's integrated remote command set and open source Python scripting capability. Many popular custom analysis programs are available free of charge.

The most common and useful measurements can be accessed by a single keystroke. At the touch of an icon, the **Waveform Calculator** instantly calculates statistics for all channels on screen such as Max/Min, RMS and Frequency. Results can easily be copied into Excel or Word for reporting.
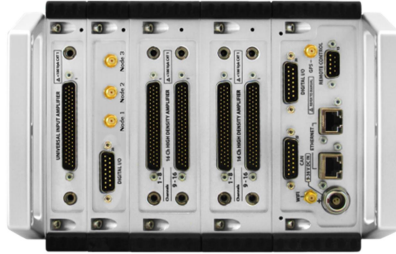

Aspire's **Sensor Database** maintains a record of all sensors including calibration constants, serial numbers and next calibration dates for quick and accurate setup. Sensor information ensures full measurement traceability from sensor to results. Sensors can be selected from the list and simply dragged into the Channels menu.

Echelon XE Data Acquisition System

The Constellation module inserts into the modular, best in class Echelon Data Acquisition System providing the following capabilities:

- Compact and ultra-rugged DAQ for the toughest in-vehicle use including IP67 environmental rating, 100 g shock withstand and -40 to +85° C operating temperature range

- Virtually limitless channel count. Each Echelon XE supports 4 input modules. A single Echelon may include up to 128 signal-conditioned analog channels, 32 wireless Constellation channels, 16 DI/counter/RPM channels, 1024 CAN channels, 64 isolated thermocouple channels, 6 video channels and 8 GPS channels

- Multiple Echelon systems can be operated via Precision Time Protocol (PTPv2, IEEE 1588) for microsecond synchronization of distributed systems. Start / stop all systems at the touch of a button. Data is combined into a single file.

- Sample rates to 1 MS/s per channel

- Streaming recording to internal Solid State Drive (SSD) up to 1 TB

- Ethernet, WiFi or wired remote control

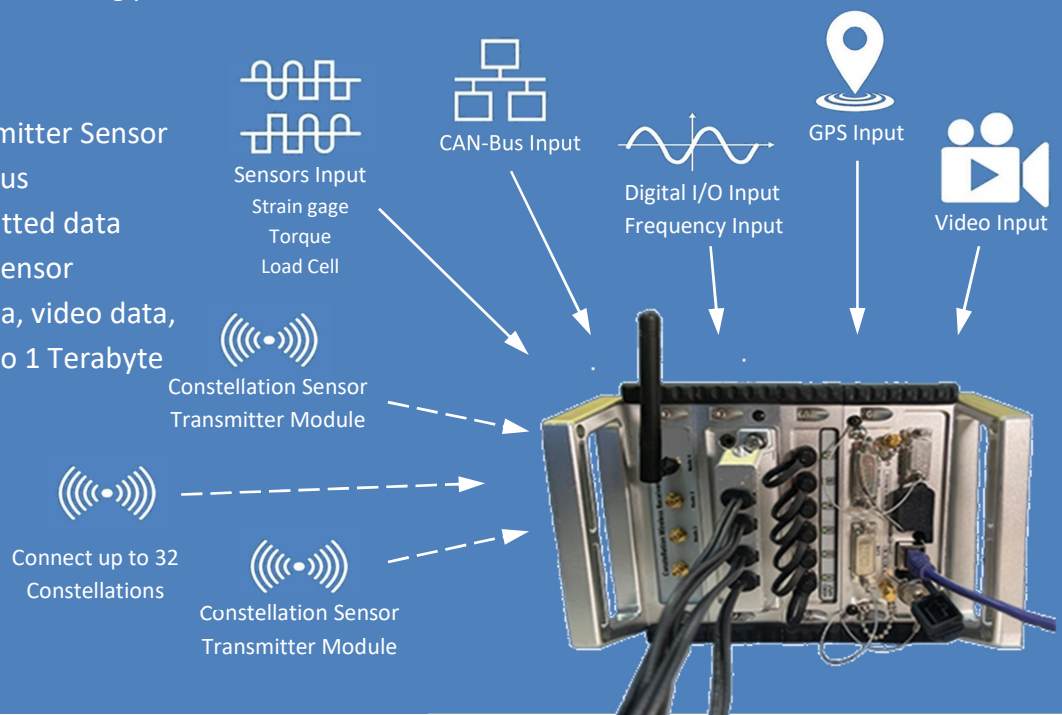- 9-36 Vdc power, optional battery pack for hours of standalone operation

Constellation Sensor Receiver Module

The Constellation Wireless Receiver Module supports up to 32 transmitter modules. It may be used with any combination of other Echelon input modules for wired signals such as voltages, currents, accelerometers, strain gages, thermocouples and frequencies.

Many lower capability, alternative wireless modules capture data through an Analog to Digital converter and subsequently re-convert the data back into analog signals at the receiver to once again be re-digitized by the DAQ system. In contrast, Constellation data is converted with a single A/D process near the signal source and transmitted digitally, dramatically reducing potential sources of error and noise.

Synchronize Data

The Constellation Wireless Transmitter Sensor Receiver Module allows continuous synchronization between transmitted data from the Constellation Wireless Sensor Transmitter and wired sensor data, video data, CAN bus data and GPS data. Up to 1 Terabyte storage is available.

Sensors Input
Strain gage
Torque
Load Cell

CAN-Bus Input

Digital I/O Input
Frequency Input

GPS Input

Video Input

Constellation Sensor
Transmitter Module

Connect up to 32
Constellations

Constellation Sensor
Transmitter Module

Specifications*

Battery Specifications

CS-STG-1 Single Channel Module
2400 mAh Lithium Ion
Run Time Highest Power Mode: 1 month
Run Time Lowest Power Mode: 1 year
CS-STG-8 Eight Channel Module
6000 mAh Lithium Ion
Run Time on Highest Power Mode: 1 week
Run Time on Lowest Power Mode: 2 years
Standby mode supports start on remote communication
Charging: Fast Charge via Qi Inductive Charger[1] or water resistant USB-C connector for external charging (5V, 800mA).
Charge Time: Approx. 2 hours (STG-1), 8 hours (STG-8)

Physical / Environmental

Environmental: IP 66 dust and water-resistant
Dimensions / Weight:
STG-1 Single Channel 3.1"x2.2"x1.6" (39x78x58mm)
Weight: 5.1 oz (150g)
STG-8 Eight Channel 4.1"x3.2"x1.5" (104x81x39mm)
Weight: 10.4 oz. (300 g)
Temperature: -20° to +70° C operating temp, 0° to +50° C charging
Shock: 100 g, 11 ms half-sine, Mil-Std -810F
Vibration: 20 g, 25-500 Hz, Mil-Std-810F
Housing: Hardened Polycarbonate
Mounting: M4 Screw, Magnetic mount available

Communications

Communication Method: Bluetooth 5.0 wireless
Internal IFA antenna and SMA connector for external antenna, software selectable
Wireless distance: Up to 50 m (Int or Ext antenna)

Input Specifications

Number of channels: 32 channels per Receiver (1 Receiver Module per Echelon)
Sensor types: Supports 350 Ω and higher full, half and ¼ bridge strain gages, load cells, torque transducers
Input Connector: Field wireable M8 Connector (STG-1), 62-pin Dsub connector (STG-8)
Sample Rates: 16-bit SAR A/D. Continuous from 1 S/s to 10 kS/s (CS-STG-1 Single Channel). from 1 S/s to 1 kS/s (CS-STG-8 Eight Channel)
Bandwidth: 250 Hz. Software selectable filtering
Excitation: 3V fixed excitation, up to 9mA per channel
Accuracy: Resolution to 1/2 microstrain

Storage
Location: Data stored in Echelon XE's internal SSD
Maximum Storage: 1 TB

Receiver

Wireless Nodes: 4 Front panel SMA female connectors

Ordering Information

CS-STG-1
Single channel Constellation transmitter. Supports 350 Ω and higher strain gages, load cells and torque sensors up to 10 kS/S. 50 meter transmission distance
CS-STG-8
Eight channel Constellation transmitter. Supports 350Ω and 1000Ω strain gages, load cells and torque sensors up to 1 kS/S per channel. 50 meter transmission distance.
EM-CS
Constellation Receiver module for Echelon DAQ system. Occupies 1 input module slot. 1 Constellation receiver module per Echelon. Four wireless nodes support up to 32 channels. Requires up to 4 antennas.
EM-CPU-XE
System Processor Module for Echelon IP-67 Ruggedized Data Acquisition System. One processor module accepts up to four input modules to support a variety of signal inputs. Standard support for 2 CAN, 16 DIO, 4 Quadratures, 2 mag pickup. Includes AC/DC adapter with DC power cable, 64 GB (upgradeable) temperature rated SSD, 2-Port CAN Breakout Cable, Ethernet Cable, 2 Dovetail End-caps and Aspire Software.

Accessories

Antenna options (Required for receiver, optional for transmitters)
CS-ANT -RD
5" Rigid Antenna. SMA connector

CS-ANT -MAG
7" Magnetic-mount antenna with 1m SMA cable

CS-MAG-1
Magnetic mount base for CS-STG-1 Single Channel Transmitter
CS-MAG-8
Magnetic mount base for CS-STG-8 Eight Channel Transmitter
CS-DC-CHG
External USB-C DC Charger (5V, 850ma) for Constellation Receivers 9-230Vac input, 50-400 Hz

For more information on Aspire software, including capabilities and supported products, or to schedule a demonstration, please contact us at support@hi-techniques.com or call +1-608-221-7500 to talk to a technical representative. Or visit us on the web at http://www.hi-techniques.com.

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*Specifications subject to change without notice
[1] Magnetic mounting plate disables internal Qi Inductive Charger. External DC charger still supported.