



## 65210E

### Inertial Measurement System with External Inputs Data Acquisition - TM Kit

#### \*Significant Military Equipment (SME)

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The Measurement Specialties 65210E can be supplied as a user-configurable 6 DoF (six degree of freedom) Inertial Measurement System containing three internal accelerometers, three internal rate gyros, two temperature sensors, battery voltage and current monitor, signal processor, IRIG encoder, optional FM transmitter, and high-capacity Li-Ion battery in a small, easy-to-install package.

Additionally, external signal inputs can be accommodated with a variety of available Signal Conditioning Modules (SCMs).

All channels are measured simultaneously with each sampled at 16 bits, filtered, ranged, and calibration compensated at up to 42,500 samples/sec/channel by the built-in digital signal processor. The output range, filter frequency and calibration of each channel, as well as the PCM configuration, can be set by the user.

A frame counter and CRC cyclic redundancy check can be included in each telemetry frame to allow dropped frames and data corruption to be detected.

### Configurable Data Acquisition & Inertial Measurements

#### FEATURES AND BENEFITS

##### Data Acquisition via External Inputs

Data from external sensors and signals can be input to the 65210E via plug-in Signal Conditioning Modules. Modules are available for many standard transducer types and additional modules can be quickly developed to meet specific customer requirements.

##### User Programmable Settings

When configured as a 6 DoF, the output range and low-pass filter of each 65210E accelerometer and rate gyro axis can be set via a built-in RS-485 interface, as can the IRIG-106 encoded PCM output configuration. The carrier frequency for the optional built-in multi-channel S band transmitters can also be set by the user.

##### IRIG-106 Compatible

Calibrated, ranged, and filtered data can be streamed out at up to 3Mbit/sec via RS-485 or IRIG-106 encoded PCM.

**Built-in Calibration**

Calibration data for each internal sensor and Signal Conditioning Module is maintained in the instrument.

**High Accuracy and Linearity over Wide Temperature Range**

Accelerometer accuracy is improved by minimizing variations due to temperature and aging effects. Each axial sensor has been tested over the -40 to +85°C temperature range.

**Built-in Calibration**

Calibration data for each sensor is maintained in the accelerometer. All digital data output is fully calibrated and in user specified engineering units.

**Communication Integrity**

A cyclic redundancy check (CRC) is available to validate communications. Telemetry also supports a frame counter to ease detection of missing frames.

**Self-Test**

Self-test and fixed level outputs simplify installation and system check out by verification of channel integrity and ground station setup.

**Small Cylindrical Package**

Package has a 2.75 inch diameter and 7.93 inch overall length. Optional spline mount parabolic mounting adapter available. The unit will fit in a standard MK-80 fuse well.

**Built-In High Capacity, Fast-Charging Battery**

Complete recharge in less than two hours provides up to three hours of operation with transmitter powered.

**Suitable for Harsh Environments**

The 65210E is robust and can be used in harsh environments. The unit will survive 100 g shock while powered.

## SPECIFICATIONS FOR 65210E - improved specifications available upon request

Parameter	Min	Typical	Max	Units	Conditions/Notes
<b>Accelerometers A010</b>					
Range, Option A010		±10		g	User configurable
Sensitivity Drift (25°C to Tmin or Tmax)			±2	%	% of sensitivity at 25°C
Zero Bias Drift (25°C to Tmin or Tmax)		±0.016	±0.04	g	
Nonlinearity		0.15	0.5	% FSR	Max deviation from best fit straight line
Upper Cutoff Frequency			1000	Hz	Additional prog DSP poles, -3dB pt.
Noise Density		0.01		mg/√Hz	
Alignment		±1		degrees	Typical orthogonality < 0.5°
Transverse Sensitivity		±2	±3	%	Inherent sensor error, excluding misalignment
<b>Accelerometers A040</b>					
Range, Option A040		±55		g	User configurable
Sensitivity Drift (25°C to Tmin or Tmax)		±0.5		%	% of sensitivity at 25°C
Zero Bias Drift (25°C to Tmin or Tmax)		±0.06		g	
Nonlinearity		0.2	2.0	% FSR	Max deviation from best fit straight line
Upper Cutoff Frequency	360	400	440	Hz	2-pole bessel in sensor; additional prog DSP poles
Noise Density		1.4	3	mg/√Hz	10 Hz to 400 Hz
Alignment		±1		degrees	Orthogonality < 0.5°
Transverse Sensitivity		±0.25		%	Inherent sensor error, excluding misalignment
<b>Accelerometers A050</b>					
Range, Option A050		±55		g	User configurable
Sensitivity Drift (25°C to Tmin or Tmax)			±2	%	% of sensitivity at 25°C
Zero Bias Drift (25°C to Tmin or Tmax)		±0.08	±0.2	g	
Nonlinearity		0.15	0.5	% FSR	Max deviation from best fit straight line
Upper Cutoff Frequency			2000	Hz	Additional prog DSP poles, -3dB pt.
Noise Density		0.05		mg/√Hz	
Alignment		±1		degrees	Typical orthogonality < 0.5°
Transverse Sensitivity		±2	±3	%	Inherent sensor error, excluding misalignment
<b>Accelerometers A100</b>					
Range, Option A100			±100	g	User configurable
Sensitivity Drift (25°C to Tmin or Tmax)			±2	%	% of sensitivity at 25°C
Zero Bias Drift (25°C to Tmin or Tmax)		±0.08	±0.2	g	
Nonlinearity		0.25		% FSR	Max deviation from best fit straight line
Upper Cutoff Frequency			2500	Hz	Additional prog DSP poles, -3dB pt.
Noise Density		0.1		mg/√Hz	
Alignment		±1		degrees	Typical orthogonality < 0.5°
Transverse Sensitivity		±2	±3	%	Inherent sensor error, excluding misalignment
<b>Rate Gyros</b>					
Range, Options G1k0, G1k2			±1200	°/sec	User configurable
Sensitivity Drift (25°C to Tmin or Tmax)		±2.5		%	
Zero Rate Drift (25°C to Tmin or Tmax)		±2.0	±6.0	°/sec	
Nonlinearity		0.1		% FSR	
Upper Cutoff Frequency (90°)		100		Hz	User configurable low pass filter
Noise Density		0.05		°/sec/√Hz	To 100 Hz
<b>Temperature Sensor (Internal)</b>					
Accuracy		±2.0		°C	For general instrument health monitor ±25°C resolution
<b>Battery (Vs)</b>					
Operating Time with 0.5 W Transmitter		4		hrs	At 25°C
Operating Time with Transmitter Off		15		hrs	At 25°C
Charge time at 20°C		2		hrs	Uncharged to full capacity. Must charge 0-45°C
<b>IRIG-106 PCM Output Rate</b>		1.5	3.0	Mbit/sec	Based on NRZ
<b>Optional FM Transmitter (S Band)</b>					
Transmit Power		0.5	2	W	Frequency settable in 0.5 MHz steps, IRIG-106 compliant Power specified with order, see Option Tnnn
<b>Temperature Range (Ta)</b>					
Li-Ion Battery Ratings	-40		+85	°C	
Transmitter Ratings	-10		+60	°C	Tested over wider range for one-time use
	-20		+70	°C	
<b>Mass</b>		1520		grams	With parabolic adapter and four SCM cards
<b>Shock Survival</b>	-100		100	g	Limited by transmitter

## ORDERING INFORMATION

65210E	A040	G1K2	T01S	M2	Sabcd
<b>Instrument</b> <b>Accelerometers</b> A000 : None A010 : $\pm 10$ g    1000 Hz A040 : $\pm 40$ g    400 Hz A050 : $\pm 50$ g    2000 Hz A051 : $\pm 50$ g    400 Hz A100 : $\pm 100$ g   2500 Hz <b>Rate Gyros</b> G000 : None G1k0 : $\pm 1000^\circ/s$ gyros G1k2 : $\pm 1200^\circ/s$ gyros GS00 : $\pm 20000^\circ/s^2$ gyros <small>*on roll axis only, <math>\pm 1200^\circ/s</math> on other two axes</small> <b>Transmitter</b> T000 : None T00S : 0.5 W, 272 kb/s, 2.2-2.3 GHz, S band T01S : 0.5 W, 1.5 Mb/s, 2.2-2.3 GHz, S band T03S : 0.5 W, 3.0 Mb/s, 2.2-2.3 GHz, S band TA1S : 1.0 W, 1.5 Mb/s, 2.2-2.3 GHz, S band TA1B : 1.0 W, 1.5 Mb/s, 2.2-2.4 GHz, S band T11S : 1.5 W, 1.5 Mb/s, 2.2-2.3 GHz, S band T13S : 1.5 W, 3.0 Mb/s, 2.2-2.3 GHz, S band T20S : 2.0 W, 272 kb/s, 2.2-2.3 GHz, S band T20U : 2.0 W, 272 kb/s, 2.3-2.4 GHz, S band	<b>Installed Modules in Slots</b> (a=100, b=200, c=300, d=400) 0=None 1=85201A 2-ch strain, 5 V exc 2=85202A 3-ch ICP XL, 16 V exc 3=85203A 3-ch 0-5 V in, 9 V exc 4=85204A 3-ch strain, com 5 V exc 5=85205A 3-ch 0-5 V in, 5 V exc 6=85206A 1-ch 4X ovsmpl 0-5 V in, 5 V exc 7=85207A 1-ch 0-500 VAC in (FZU) 8=85208A 1-ch FZU-48 2X simulated load 9=85209A 4-ch 10k thermistor Z=85203B 4-ch 0-5 V in, 9 V exc <b>Adapter</b> M1 : Parabolic Mounting M2 : (DSU33) Radome Ring				

## ACCESSORIES

**65250A Activation & Setup Adapter / RS232 to RS485**

A toggle switch and LED allow a 65250A Setup Adapter to activate a Measurement Specialties Inertial Measurement System (IMS) and converts RS485 signals used by 65210 Series systems to the RS232 signals used by computer serial ports. The 65250AK2 Programming Kit includes a 65210 cable (Lemo to DB9F) and a 6' M-F straight cable that connects to a PC. The 65250A also allows for connection of the 65280A battery charger.

**65260A S-Band Monopole Antenna**

The 65260A antenna is reliable and rugged, designed to be used with the 65210 Series instruments. Operating over the 2200 to 2300 MHz S-band frequency range, the 65260A maintains a VSWR of less than 1.5:1, providing excellent efficiency. The rugged nature of the 65260A makes it suitable for automotive, aerospace, and military applications.

**65251E Activation Plug**

Measurement Specialties' 65251E Activation Plug provides an alternate power on/off control to a 65210E IMS. Connecting an activation plug to an IMS which is off causes the power up to be initiated. Connecting to a powered system will cause the system to power down when the plug is removed. A bicolored LED indicates the operational status. The activation plug will also optionally power up the transmitter on systems where it is not enabled.

**65280A Battery Charger**

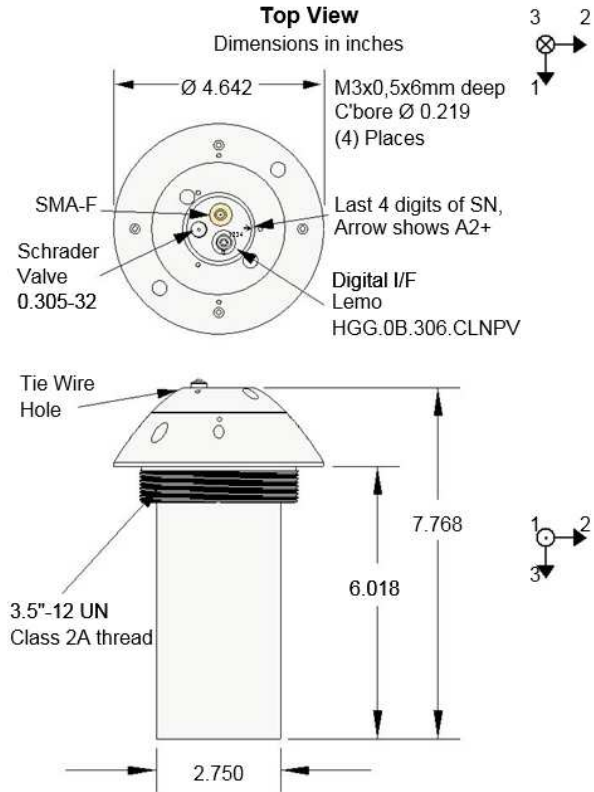
The 65280A Battery Charger plugs into any 110 VAC outlet and displays recharging status through an LED indicator. Designed to plug into the 65250A adapter.

**35290A RS232 to USB 2.0 Adapter**

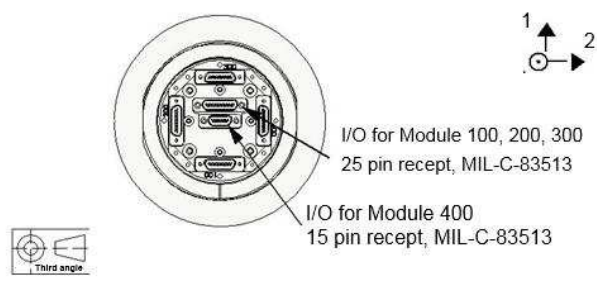
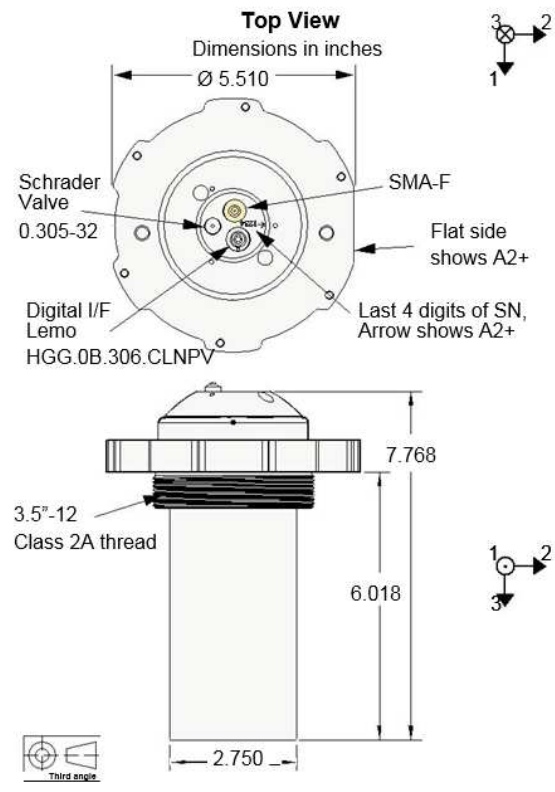
Easily connect serial devices to a PC via the USB port, with maximum data transfer rates of over 1 Mb/s. Includes extension cable, manual and driver for Windows, Mac and Linux.

DIMENSIONS

**M1: PARABOLIC MOUNTING**



**M2: RADOME RING (DSU33)**



**STANDARD CONNECTOR**



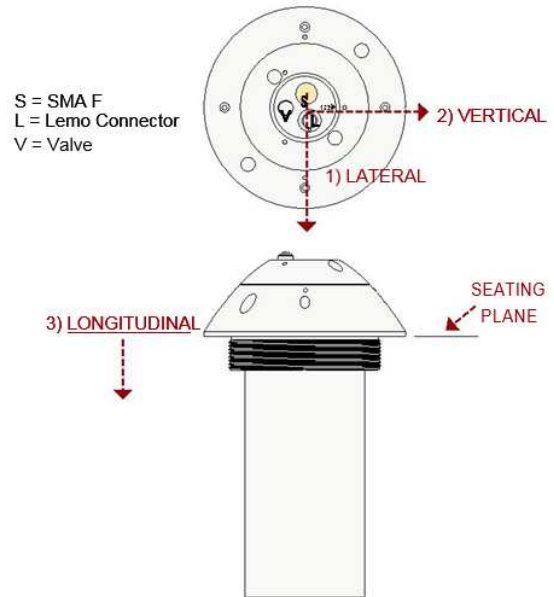
Pin	Signal
1	Aux
2	RS485-
3	RS485+
4	Power Enable L
5	Ground
6	+V Power
SMA-F	RF Out



SENSOR LOCATIONS FOR 65210E

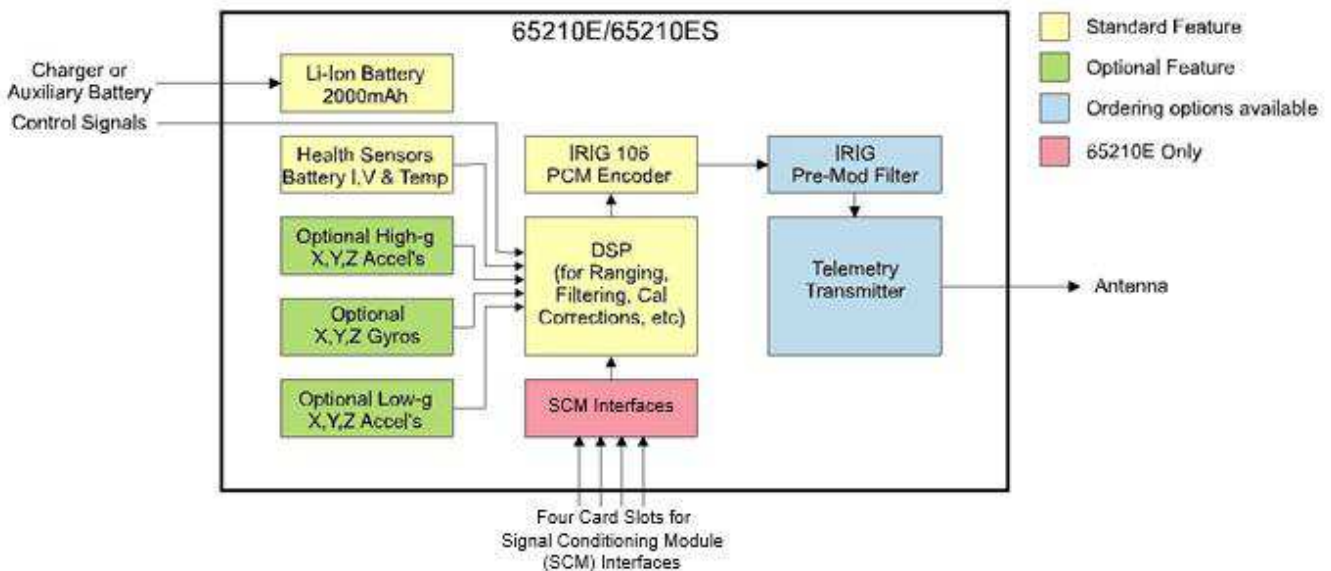
**ACCELEROMETER AND GYRO POSITIONS (INCHES) WITH ADAPTER (Parabolic or Radome Ring DSU33)**

Axis			
<b>Accelerometer-Option A040</b>	1: Lateral	2: Vertical	3: Longitudinal
A1 Lateral	-0.112	+0.518	+0.084
A2 Vertical	+0.315	+0.518	-0.342
A3 Longitudinal	-0.112	+0.944	-0.342
Accelerometer Position ±0.025 typical			
<b>Accelerometer-Option A010/A050/A100</b>	1: Lateral	2: Vertical	3: Longitudinal
A1 Lateral	+0.301	+0.518	-0.342
A2 Vertical	-0.112	+0.930	-0.342
A3 Longitudinal	-0.112	+0.518	+0.070
Accelerometer Position ±0.050 typical			
<b>Gyro- Option G1k0/ G1k2</b>	1: Lateral	2: Vertical	3: Longitudinal
G1 Lateral	+0.370	-0.518	-0.342
G2 Vertical	-0.112	-0.999	-0.342
G3 Longitudinal	-0.112	-0.518	+0.139
Gyro Position ±0.050 typical			
OPTIONAL:			
<b>Accelerometer-Low g</b>	1: Lateral	2: Vertical	3: Longitudinal
A1 Lateral	-0.920	+0.635	+1.820
A2 Vertical	-0.920	+0.635	+1.820
A3 Longitudinal	-0.920	+0.635	+1.820
Accelerometer Position ±0.050 typical			



Axis 3 (longitudinal) position adjustments (per installation): Will be increased by up to 0.083" when the main instrument assembly is screwed into 12 TPI adapter, as up to one turn back-off may be required (average increase will be 0.042").

BLOCK DIAGRAM



## CONFIGURABILITY FEATURES OF 65210E

### ICU Configurability

Instrument Configuration Utility™ (ICU) is downloadable, Windows-based software used to configure 65210 Series inertial measurement systems. Settings are stored in the unit's non-volatile memory, and displayed in ICU when the unit is attached to a PC. New values, within sensor limits, may be written to the instrument's memory, with password-protection to safeguard any established settings. Reports, including TMATS, are easily obtained to review setup parameters.

Download ICU at [precisionsensors.meas-spec.com](http://precisionsensors.meas-spec.com).

Users can configure many parameters, including:

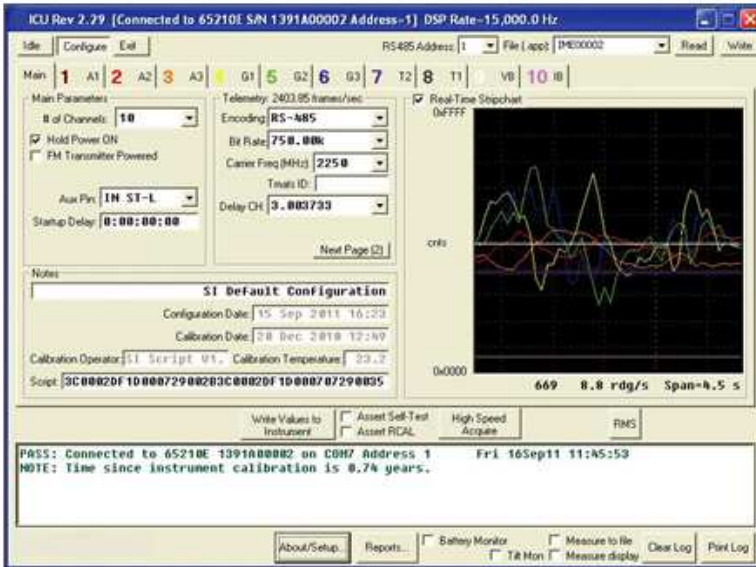
- output range
- filter frequency
- calibration
- number of channels
- encoding format
- bit rate up to 3 Mbit/second (limited by transmission method)
- carrier frequency
- startup delay
- frame components such as sync length and CRC to detect data corruption

### Configurable Telemetry

ICU's pre-set drop down menus make it easy to build telemetry frames to suit specific needs. Parameters include:

- Encoding type
- Bit rate
- Carrier frequency
- Sync
- S/N
- CRC
- Frame ID
- Pad
- Comm ID

Each channel can be assigned an IRIG word position and number of telemetry word bits. A frame counter up to 32 bits and Cyclic Redundancy Check (CRC) may be used to verify data integrity. Subcommutation and supercommutation are available for more efficient data transmission. A Custom Telemetry setting is also provided to override presets if necessary. A convenient telemetry report simplifies verification of the configuration, including producing a TMATS report for ground station configuration.



### High Speed Acquire

High Speed Acquire mode allows ICU to receive inertial measurement data at a much higher rate than other I/O, as specified by the Bit Rate telemetry setting. Simply choose RS-485 encoding; final output is a .csv file which can be imported by common spreadsheet or database programs. Post-processing of binary data files is fast and intuitive, and files greater than 2 GB are supported.

### Programmable Filter and Range

Use ICU to fine tune the inertial measurement system. Each channel's filter may be adjusted, and this may be necessary to accommodate a change in bit rate. ICU shows the ranges for the internal accelerometers and gyros. The range for each sensor can be modified within the sensor's limits.

### Easy Entry of External Sensor (SCM) Parameters

ICU software can be used to configure external Signal Conditioning Module parameters in 65210E models in the same ways as the unit's internal sensors (as described above).

### Pinout Report for SCMs

ICU contains a complete pin-out table for Signal Conditioning Modules in any slot. Signal names, connectors, pin & wire colors are available on 65210E manufacturing reports.

### Data Delay

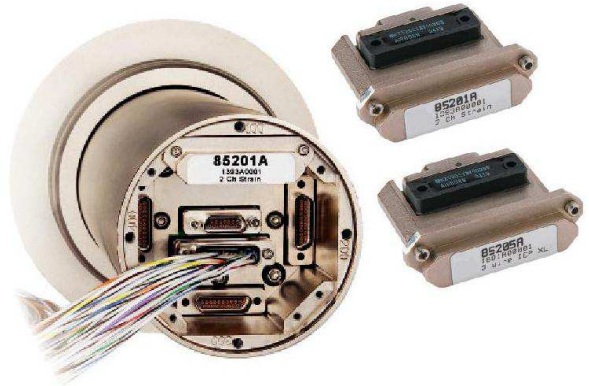
Channel delay is a flexible feature in which individual channels can be delayed within the DSP. Current and delayed channels may then be encoded into the same telemetry stream for improved redundancy and immunity to dropouts.

## SIGNAL CONDITIONING MODULES (SCM) FOR USE WITH 65210E

## Measure External Signals and Sensors with Signal Conditioning Modules (SCM)

External dynamic sensors and signals can be integrated to the Measurement Specialties 65210E by installing up to four Signal Conditioning Modules (SCMs) in the slots provided.

A variety of Signal Conditioning Modules are available for specific requirements. Measurement Specialties can tailor SCMs for use with the 65210E to meet your needs. Please feel free to contact us to discuss your specific requirements.



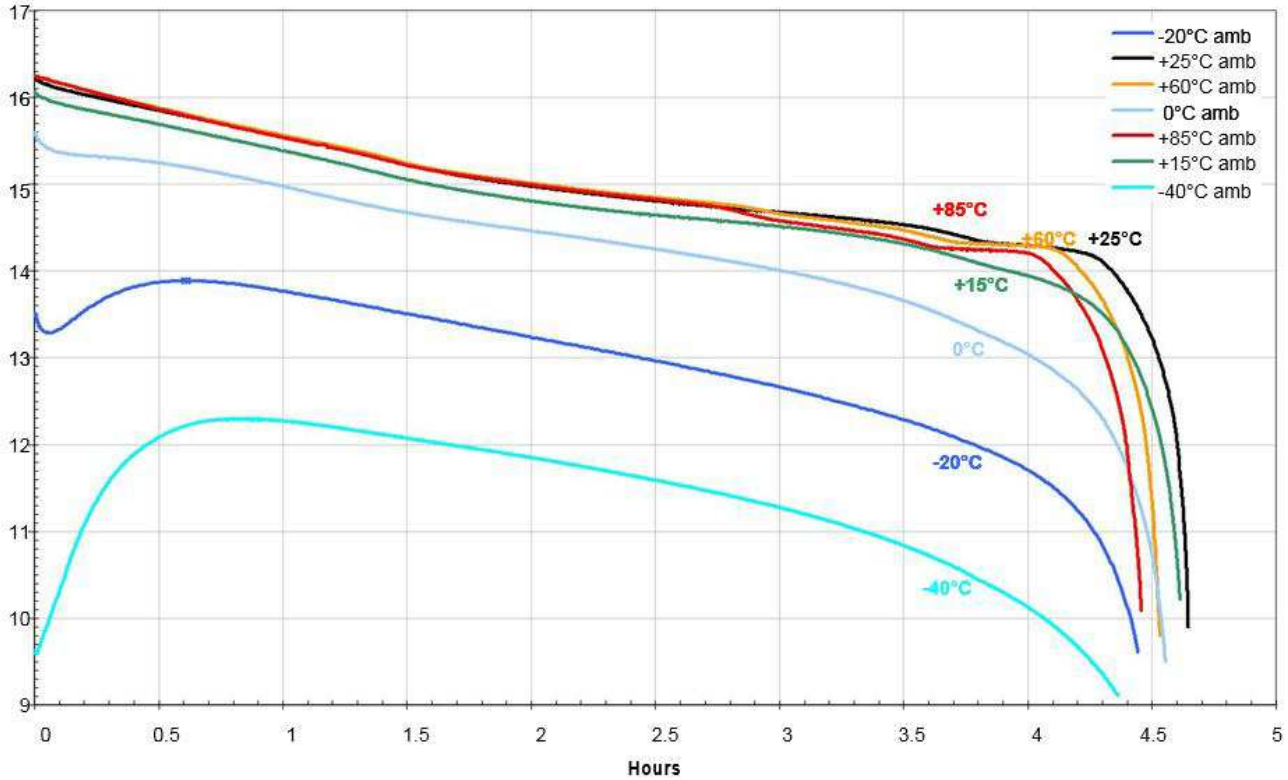
SCM Model #	# Channels	Excitation	SCM Length	Description	Factory Programmability		
					Gain	Filter	AC/DC
85201A	2	5 V @ 25 mA	Short	Full bridge high impedance strain inputs; ranges $\pm 25$ mV, $\pm 50$ mV, $\pm 100$ mV, $\pm 200$ mV; 5-pole Butterworth low-pass filter settable to 10 kHz	Yes	Yes	Yes
85202A	3	13-16.5 V @ 4.7 mA $\pm 20\%$	Short	ICP accelerometer module with battery voltage excitation; AC coupled; 5-pole Butterworth low-pass filter settable to 10 kHz; works with Endevco 27AM5-5	No	Yes	AC only
85203B	4	9 V @ 25 mA	Short	General purpose 0-5 V analog input	No	Yes	Yes
85204A	3	5 V @ 150 mA	Short	Full bridge low impedance (120 or 350 ohm) strain inputs; custom ranges available; standard is $\pm 2.5$ nom.; 5-pole Butterworth low-pass filter settable to 10 kHz; common excitation for all bridges	Yes	Yes	Yes
85205A	3	5 V @ 25 mA	Short	General purpose 0-5 V analog input	No	Yes	Yes
85206A	1	5 V @ 1 mA	Long	General purpose 0-5 V analog input with 4X oversampling for high-speed applications; has 5.1k pullup	No	Yes	DC only
85207A	1	None	Short	ACV true RMS input SCM; $\pm 1000$ VAC nom. 5 kHz; also includes DC-coupled channel with 5-pole Butterworth low-pass filter settable to 10 kHz; also includes 10k thermistor input; ideal for FZU monitoring; use with 85208A if load required	No	No	Ch 1 AC Ch 2 DC
85208A	1	None	Short	FZU-48 2X simulated load; simulates loads typically seen from both forward and aft fuzewell (i.e. double load); use with 85207A if load required; may be added to IMS with no impact; module may also be used stand alone	No	No	No
85209A	4	4.87 V @ 25 uA max per thermistor	Short	10k thermistor input module; provides series resistor and pullup to form divider; 28 Hz nom. low-pass filter	No	No	No

Data subject to change without notice



TYPICAL BATTERY TIME FOR 65210E

65210E Battery Operational Time vs Ambient Temperature  
 (All data points during operational instrument, T01S transmitter ON, avg current ~410mA)



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