

This technical data sheet states the performance specifications and operating conditions for the Interrogator™ 4210 ElectroChemical Battery Analyzer.

The Interrogator™ 4210 is an advanced battery test instrument for accurately measuring chemical and electrical battery health in terms of Sulfation, Dryout, Voltage and Impedance. All four parameters are measured simultaneously in a single measurement using CEL-Scan™ Technology – a proprietary measurement technique that uses broadband, swept frequency response analysis in conjunction with proprietary algorithms and traceable calibration standards to accurately measure the Chemical and Electrical Layer conditions of batteries. For further information about the benefits, applications, operation, equipment configuration and service products of the Interrogator™ 4210, please refer to the Product Brief, Brochure, Quick Start Guide, User’s Manual, Application Notes and Ordering Guide.



Performance Specifications and Operating Conditions

Test Method	CEL-Scan™ Frequency Response Analysis. Completely non-intrusive.
Data Trending	Available but not required for measurement and detection of battery health degradation. (Battery health is determined from a single measurement).
Battery Health	Determined in a single measurement in terms of Sulfation, Dryout, Voltage and Impedance. (Battery data trending is not necessary).
Amp-Hour Capacity Range for Batteries Under Test	5 Ah to 2,000 Ah, Specified Performance Range 1 Ah to 9,999 Ah ¹ , Operating Range ¹ Amp-hour measurement capabilities depend upon whether or not the battery impedance is within the measurement range of the Interrogator™. Typically, the larger a battery’s Ah capacity, the lower its impedance.
Measures Battery on Float Voltage	Yes – (battery must be fully charged and at equilibrium)
Measures Batteries on Open-Circuit (not on float voltage)	Yes – (battery must be fully charged and at equilibrium)
Impedance	
Measurement Range	50 $\mu\Omega$ to 1 Ω
Resolution	0.001 mOhms for all measurable impedance values
Accuracy	$\pm 1.0 \%$ (for Impedance > 1 m Ω to 1 Ω) $\pm 1.0 \%$ (for Impedance > 100 $\mu\Omega$ to 1 m Ω)
Accuracy Traceability	Through NIST traceable standards
Repeatability	$\pm 1.0 \%$ (for Impedance from 100 $\mu\Omega$ to 1 Ω)
Voltage	
Range	0 to 17 VDC
Resolution (Display)	10 mV
Accuracy	$\pm 0.5 \%$
Accuracy Traceability	Through NIST traceable standards
Repeatability	$\pm 0.5 \%$

Sulfation	
Battery Charge Capacity Loss (specified for Impedance > 100 $\mu\Omega$ to 1 Ω)	
Range	0 to 100% (relative to the amount of battery charge capacity degradation due to Sulfation)
Accuracy	$\pm 5\%$ (using a Class-One Calibration Factor ²) $\pm 2.5\%$ (using a Class-Two Calibration Factor ³)
Accuracy Traceability	Test methodology traceable to NIST standards
Repeatability	$\pm 1.0\%$
Dryout	
Battery Charge Capacity Loss (specified for Impedance > 100 $\mu\Omega$ to 1 Ω)	
Range	0 to 100% (relative to the amount of battery charge capacity degradation due to Dryout)
Accuracy	$\pm 5\%$ (using a Class-One Calibration Factor ²) $\pm 2.5\%$ (using a Class-Two Calibration Factor ³)
Accuracy Traceability	Test methodology traceable to NIST standards
Repeatability	$\pm 1.0\%$
Cell Terminal Strap Impedance (mOhms)	
Measurement Range	50 $\mu\Omega$ to 1 Ω
Resolution	0.001 mOhms for all measurable impedance values
Accuracy	$\pm 1.0\%$ (for Impedance > 1 m Ω to 1 Ω) $\pm 1.0\%$ (for Impedance > 100 $\mu\Omega$ to 1 m Ω)
Accuracy Traceability	Through NIST traceable standards
Repeatability	$\pm 1.0\%$ (for Impedance from 100 $\mu\Omega$ to 1 Ω)
Measurement Pass/Warning/Fail Indicators	Yes (visual and audio)
Specific Gravity	Manual Logging
Calibration	
Automatic System Calibration upon Turn-on	Available (Std)
Annual Instrument Calibration	Not Required (Due to auto calibration routines build-in. An Annual Calibration Certificate can be provided for regulatory compliance if needed).
Test Battery Calibration Factor (for Sulfation and Dryout measurements)	Available (Std) Class-One Calibration Factors can be generated by the operator using new batteries, old batteries and battery load test data as the reference standard in the field. Class-Two Calibration Factors provide maximum accuracy and are generated by World Energy Labs Algorithm Design Services.
Test Battery Impedance Baseline Value	Available (Std) Calibration Baseline Values can be generated by the operator using new batteries and old batteries as the reference standard in the field.
Can Be Upgraded to the Interrogator™ 5210A Fuel Cell Analyzer	Yes (Subject to final quotation)

2) A Class-One Calibration Factor can be generated in the field using 3 to 10 "new batteries" of the same make and model as the battery that is being tested. A known Calibration Factor can also be manually entered or electronically downloaded to the Interrogator. Refer to the User's Manual for further information.
3) A Class-Two Calibration Factor offers the highest measurement accuracy and uses a Class-Two Algorithm which is generated by World Energy Labs.

Display	
Type	LCD FSTN
Display Viewing Area	3.07 x 2.32 in (78 x 59 mm)
Resolution	320 x 240 Graphical LCD
Backlight	LED Back-Light
Memory	
Type	Read/Write Flash RAM
Supported Size	8 MB (std)
String/Cell Data Storage Capacity	3,000 Individual Cells, Blocks (Batteries) or Single-Cell Batteries
Communications	RS-232, cable (USB compatible with adapter)
Internal Battery	
Type	Lithium-Ion
Voltage	12 VDC
Capacity	4.4 Ah
Typical Instrument Battery Run Time	6 to 8 hrs
Charge Time	3.0 to 4.5 hrs
AC Adapter Charger	
Input Voltage	90-250 VAC
Output Voltage	12.6 VDC
Output Current	1.4 Amps
Frequency	47-63 Hz
DC Vehicle Adapter Charger	
Input Voltage	12.0 VDC
Input Current	8 Amp max
Output Voltage	115 VAC
Output Frequency	60 Hz
Output Power	60 Watts Continuous (75 Watts – 5 Min.)
Environment Conditions	
Operating Temp Range	0° to 45° C
Storage	-20° to 60° C
RH Non-Condensing	90%
Key Pad	Stainless Steel Dome with Polycarbonate Overlay
Upload New Software from Internet or CD	Yes – Using WELSoft™ 8850A Interface and Reporting Software
Data Collection and Reporting Software	Yes – Using WELSoft™ 8850A Interface and Reporting Software
User Programmable Functions	
Number of preset battery/string configurations that can be stored	100 Typical
Voltage Alarms	Yes

Impedance Alarms	Yes
Sulfation End of Battery Life Criteria	Yes
Dryout End of Battery Life Criteria	Yes
Manual Push Button Test Mode and Hands-Free Auto-Start Test Mode	Yes
Safety Features	
Over-Voltage Auto-Reset Breaker	Trigger Point: 17 VDC Warning: 50 VDC Damage Point: 600 VDC max.
Reverse Polarity Protected	Yes
Weight	3 lb (1.3 kg)
Dimensions	3.31 x 10.31 x 2.02 in (262 x 84 x 51 mm)
Warranty	1-Year Limited Warranty
Cable Connector Assemblies	
Standard Kelvin Clips	Yes (with removable jaws)
Standard Spike Probes	Yes
Custom Probe/Cable Assemblies	Yes (by quotation)
Service Support	
Instrument Training Seminars	Yes
Customer Support Website	Yes
24/7 Tech Support Hotline	Yes
72-Hour Repair/Replacement Program	Yes
WELCare™ Certified Battery Care and Replacement Programs	Yes

ORDERING RECOMMENDATION: WEL KIT9010A Interrogator™ PRO-KIT Bundled Configuration which includes:

- One WEL 4210 Interrogator™ ElectroChemical Battery Analyzer equipped with Lead-Acid Battery Measurement Software Package for measuring sulfation, dryout, voltage and impedance.
- One WEL 8850A WELSoft™ Computer Interface/Reporting Software CD.
- One WEL A002 Kelvin clips (includes 6-ft leads).
- One WEL A003 Serial Cable for connecting the Interrogator to a PC.
- One WEL A004 Infrared Thermometer.
- One WEL A005 Li-Ion Battery Pack Charger Unit and Cable.
- One WEL A006 DC-AC automobile converter to enable in vehicle charging.
- One WEL A008 Hard-Carrying Case (18"x14"x12") watertight, airtight, dustproof, crushproof, with pre-cut foam protective insert for Interrogator and all accessories.
- One WEL A009 Soft Pouch for shoulder / utility belt (includes shoulder strap).

WORLD ENERGY LABS (WEL) is a global, electrochemical diagnostic software and instrumentation company.

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Leading companies around the world are advancing their business in batteries, fuel cells, corrosion testing and life sciences through the benefits of the Interrogator™ 4200, 5200, 6200, 7200 and 8200 series analyzers and software products. Contact World Energy Labs or visit our website for further information.

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