

SL1035A/SL1036A Scienlab Battery Cell Test System

Low-current cell test system



Low-Current Cell Test System

Test up to 96 cells, with 6 V, ± 5 A

Add low current cell test capability to any lab with fast, accurate testing of up to 96 cells using the SL1035A/SL1036A low-current battery cell test system with 5 or 10 A channels. Three current ranges improve accuracy and resolution. Our purpose-built Energy Storage Discover software helps you automate common compliance, load, and endurance tests. Quickly gain insights into cell capacity, efficiency, internal resistance, and cell lifespan measurements. Further characterize cells using built-in EIS measurements - gain deeper insights into the benefits of your latest cell chemistry and design innovations. Get started quickly with one of three channel configurations.

Option 896	96 Channels	± 5 A	6 V
Option 860	60 Channels	± 5 A	6 V
Option 848	48 Channels	± 10 A	6 V

Three current ranges increase accuracy

Three current ranges increase measurement accuracy. The system uses the lowest range possible reducing the reading error by a factor of two. Ranges include 5 A, 1 A, and 0.4 A.

5.0 A	0.05% Reading + 0.5 mA
1.0 A	0.05% Reading + 0.35 mA
0.4 A	0.05% Reading + 0.25 mA

For higher current combine channels from the same module. Each module has four 5 A channels which can be combined for a max 20 A.

10 A Channels Combine two five-amp channels, creating two 10A channels per module. Option 848 is delivered with channels combined for a total of 48 – 10 A channels.

15 A Channels Combine three five-amp channels, leaving the fourth channel unused.

20 A Channels Combine all four five-amp channels in a module.

The Energy Storage Discover software allows you to define groups of parallel channels that act as a single channel for programming and reporting purposes.

Electrochemical impedance spectroscopy

You can gain deeper insights into the characteristics of your cells with the built-in Electrochemical Impedance Spectroscopy (EIS) capability. SL1035A/SL1036A provides integrated electrochemical impedance spectroscopy measurements on each test channel, which are independently programmable within a test sequence. Insights from an EIS analysis can be used to improve each component in a cell to improve its efficiency, durability, and lifetime.

Reference electrode connection

Perform cyclic voltammetry measurements using up to three electrodes per channel and providing voltage measurements between positive, negative, and a reference electrode. The measured values allow a separate analysis of the cathode's and anode's behavior, which helps to understand the overall cell's performance.

Safety and protection

The low-current tester includes layers of safety features, starting with the cabinet, which includes an emergency stop and a status light pole to visually indicate the system's status. A power switch can simultaneously power down all the channels and charge/discharge electronics while leaving the communication interface and processing (IPCs) powered up. A second switch allows a complete disconnect from the grid, powering down all the electronics in the cabinet. All high-voltage connections are contained within the power distribution unit.

The SL1035A/SL1036A protects your battery cells from overvoltage, overcurrent, and reverse polarity. Built-in temperature ports on each channel allow monitoring of each cell temperature, with the ability to establish limits. Our Energy Storage Software includes a safety tab that makes establishing safety limits for your cell easy. These limits can be temporally changed for fast charging or discharging. Add the optional PLC-based Test Bench Guard for the highest level of protection. Test Bench Guard independently monitors and supervises the test system, providing redundant protection.

Modular design for the highest uptime

Systems are built using multiple mainframes. Each mainframe can hold up to three modules. The modules have four 5 A channels, which provides 12 channels per mainframe. Each module and mainframe operate independently providing higher throughput and isolation. If a channel becomes damaged, it can be quickly repaired with a service replacement of the module.

SL1035A/SL1036A is a complete cell test system

The SL1035A/SL1036A provides electrical charge, discharge, and measurement capability for the cells you are testing. You can select current capacities ranging from ± 5 A to ± 20 A and the number of test system channels. Choose from three preconfigured systems: 48 10 A-channels, 60 5 A-channels, or 96 5 A-channels.

In a cell test application, the SL1035A/SL1036A will typically be combined with additional system resources, including Energy Storage Discover test system software, contacting, and fixturing for your cells, cables, environmental chambers, and redundant safety systems. The user or Keysight can provide the supporting equipment. Keysight can combine and integrate all the components to create a test solution. Contact Keysight to discuss complete customized test solutions incorporating one or more of these additional components that will meet your specific test needs for the number and types of cells you require.

SL1035A/SL1036A Technical Data

Voltage / current control and measurement

Voltage accuracy ¹	< ±1 mV (typ. < ±0.5 mV)		
Current accuracy: ¹			
5 A channel	Range	% of Reading	Offset
	0 to 5.0 A	0.05 %	0.50 mA
	0 to 1.0 A	0.05 %	0.35 mA
	0 to 0.4 A	0.05 %	0.25 mA
10 A channel	Range	% of Reading	Offset
	0 to 10.0 A	0.05 %	1.0 mA
	0 to 1.0 A	0.05 %	0.35 mA
	0 to 0.4 A	0.05 %	0.25 mA
Measurement type	4-wire		
Current dynamics	1 ms (10 to 90% of current step)		

1. Measurement and programming accuracy; Number of Power-Line-Cycles (NPLC) = 100.

Data acquisition and interface

Data acquisition rate	1 kHz
LAN	
External	10/100/1000 Ethernet RJ45
Internal for climate chamber	
Internal service port	
Channel enable for use with Test Bench Guard	1 per mainframe, block of twelve 5 A channels
System shutdown	
Local	E-stop
Remote	Relay control

Temperature measurement (4-wire)

Configuration dependent	5 A Channel	10 A Channel
Temperature Input Pt1000 (-40 to 120 °C)	1 per Channel	2 per Channel
Measurement accuracy	± 1 K	

Environmental conditions

Operating temperature	+15 to +30 °C
Storage temperature	-25 to 55 °
Relative air humidity	15 to 80%, non-condensing
Altitude	2000 m



Figure 1. SL1035A/SL1036A Cell Test System, from left to right: Front panel with emergency shutdown, and vented rear panel.

Operating characteristics

System AC power

SL1035A	96 Channels	60 Channels	48 Channels	Comments
Voltage	380 - 400 VAC Nominal, 3Φ, ±10%			50/60 Hz, 5-wire
Current	< 15 A	< 10 A	< 15 A	
Power	< 9 kW	< 5.5 kW	< 9 kW	
Connections	#10 (M5) Terminal block, 3Φ 5-wire			Direct to internal terminal block, power cord not included.
SL1036A	96 Channels	60 Channels	48 Channels	Comments
Voltage	208 VAC Nominal, 3Φ, ±10%			50/60 Hz, 5-wire
Current	< 28 A	< 19 A	< 28 A	
Power	< 9 kW	< 5.5 kW	< 9 kW	
Connections	#10 (M5) Terminal block, 3Φ 5-wire			Direct to internal terminal block, power cord not included.

Cabinet dimensions

Height	1690 mm	Includes connectors on top of rack including AC mains terminal block cover. Height is 1645 mm excluding top connectors.
Width	730 mm	Including the cable chase on the outside of the cabinet. The width is 600 mm without the cable chase.
Depth	905 mm	
Casters	4	Two are lockable.
Weight	296 kg	Option 896: 96 5 A channels and Option 848: 48 10 A channels.
	236 kg	Option 860: 60 5 A channels.

Cooling and Acoustic

Passive cooling	5.6 kW	Option 896: 96 5 A channels and Option 848: 48 10 A channels.
Estimate for 100% duty cycle	3.5 kW	Option 860: 60 5 A channels.
Acoustic – Estimated	72 dBA	Option 896: 96 5 A channels and Option 848: 48 10 A channels.
	70 dBA	Option 860: 60 5 A channels.

Documentation

- Test System Installation/Operating Guide in English
- CE Declaration of Conformity
- UL Declaration of Conformity
- Factory-Calibration-Report

Contact Keysight to discuss custom or special requirements.

Electrochemical impedance spectroscopy

Integrated Electrochemical Impedance Spectroscopy (EIS) per test-channel, independently programmable within a test sequence. Superposition of AC output current with a DC offset possible.

Specifications

Measuring method	Galvanostatic and potentiostatic
Measurement range	Up to 10 Ω
Measurement resolution	100 $\mu\Omega$
Excitation amplitude	< 5 A and 1 V
Frequency range	1 mHz to 10 kHz
Multi-sinusoid operation	for frequencies $\leq$ 1 Hz

Note: A parallel connection of several channels doesn't affect the EIS specifications.

The system characteristics below require a system calibration, including the cabling and fixtures, which requires a precision resistor that fits in the test fixture. Any changes to the fixtures or cabling can impact the previous calibration. Calibrated EIS measurements allow for comparing results over time and across channels. Without EIS calibration, relative results are still valid for monitoring the changes to a single DUT over a test cycle.

Supplemental characteristics

Electronics repeatability	Magnitude error term	$\pm 300 \mu\Omega$
	Phase error term ¹	± 2 degrees
Relative magnitude error term Kr		1%

System Configuration Guide

Quickly configure the SL1035A/SL1036A that is right for you. In a few easy steps, select the model with the input power, channel current, and number of channels that are right for you, accessories such as cable blocks, and Energy Storage Discover software that is right for you.

1. Select the model with the correct AC input voltage for your location
 - a. SL1035A 400 VAC 3-phase
 - b. SL1036A 208 VAC 3-phase
2. Select the required current and number of channels that fit your application.
 - a. Option 896: 96 – 5 A channels
 - b. Option 860: 60 – 5 A channels
 - c. Option 848: 48 – 10 A channels
3. Optional connector kits make connecting both the sense and load cables easy. The kit includes a protective shell, a D-sub connector and Phoenix style connector. Below are the required quantity and part numbers for each system configuration.

System Configuration	Kit Product Number	Quantity Required
Option 896: 96 – 5 A channels	Option 201	24
Option 860: 60 – 5 A channels	Option 201	15
Option 848: 48 – 10 A channels	Option 202	24

4. The cell test system software starts with the SL1091A Energy Storage Discover software which allows you to create test sequences, run tests and analyze results. Laboratories with many test systems can benefit by adding PathWave Lab Operations for Battery Test which enables efficient planning and coordination of many systems and batteries.
5. The SL1070A Test Bench Guard (TBG) safety system is a crucial safety feature. It adds redundant measurements and can connect and control additional system peripherals. Importantly, the SL1070A operates independently and does not rely on a PC or network connection. The SL1035A/SL1036A system is prewired with channel enable / disable for each block of twelve 5 A channels. Configure the TBG to independently control the channel enable signals.

Software to Control Cell Test Systems

Keysight provides cell test system software that starts with Scienlab Energy Storage Discover to control your individual cell test systems such as the SL1035A/SL1036A and extends to PathWave Lab Operations for Battery Test to manage and coordinate your entire battery testing laboratory with multiple systems used to test cells, modules, and battery packs.

SL1091A Scienlab Energy Storage Discover

Scienlab Energy Storage Discover (ESD) is the intuitive test-software environment for developing, performing, and analyzing tests for an individual test system.



Figure 2. Scienlab Energy Storage Discover controls individual test systems.

- Central controlling component for all Keysight Scienlab-brand energy storage test environments.
- Comprehensive overview, user-friendly operation, easy-to-learn.
- Powerful visualization of tests and results.
- ESD supports creating test programs even offline.
- Available simulation environment for offline test.
- Ethernet communication with the battery test system.
- Easy integration with external control and monitoring software via optional standardized remote-interface.
- Holistic vehicle emulation from the perspective of battery cell, module and pack levels.
- Support for Windows 10. Single software license per workstation.
- Integration of external components into the test environment and process, such as environmental chambers, cooling and heating equipment, or optional Scienlab-brand Measurement & Control Modules.

Find out more about Scienlab Energy Storage Discover [here](#).

EP1150A PathWave Lab Operations for Battery Test

PathWave Lab Operations for Battery Test enables efficient planning and coordination of your entire battery test laboratory. It manages all resources, including test facilities, test systems, and your test objects and Devices Under Test (DUTs). PathWave Lab Operations for Battery Test provides an integrated, web-based lab management platform that helps you modernize your test workflows, eliminating legacy paper-based processes, and increasing data integrity and traceability. This powerful tool helps you to improve test throughput for all the cells and batteries you need to test, to fulfill the testing requirements for your projects on-schedule, and to optimize test asset utilization.

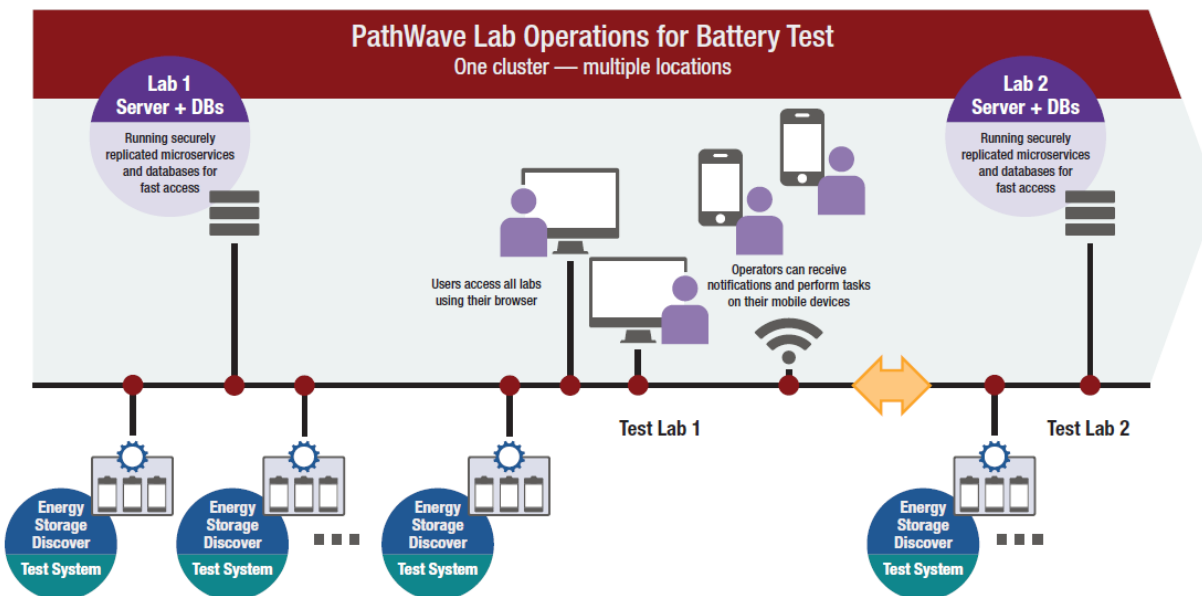


Figure 3. PathWave Lab Operations for Battery Test manages multiple test systems in a laboratory.

- Easily register and track test objects in your lab.
- Quickly analyze your data and statistics.
- Organize your test lab workflow, documents, lab orders, and tasks.
- Plan and optimize your test capacities and sequences.
- Improve collaboration by sharing test plans, results, data, and other documents.
- Remotely control your lab and its devices anywhere, anytime.
- Manage and route notifications to your preferred device or email service.
- Automated, networked, and scalable for any size of testing lab – up to thousands of channels.

Find out more about PathWave Lab Operations for Battery Test [here](#).

SL1070A Test Bench Guard

To use the Keysight Scienlab Test Bench Guard (TBG) redundant safety system with the SL1035A/1036A, you must separately order the Keysight SL1070A in a configuration that matches your cell test system configuration.

Project Management, Consulting and Installation Services

Service features depend on the facilities, customer expertise, and overall scope of the project. For that reason, it is not possible to give exact service efforts without knowing the customer's requirements and goals. Keysight offers the following services to secure a successful project execution and reduce ramp-up time for our customers.

PS-XPM-100-SL Project management services

Keysight recommends project management services for each battery test project. By ordering the project management services, an experienced project manager is dedicated to your project and acts as a direct communication interface from Keysight to the customer's project management team. The project manager takes over the responsibility:

- To develop and manage the project plan.
- To track project progress and milestones.
- Communication project status regularly and ensure any unscheduled project events or project deviations are communicated and promptly discussed with the customer project team.
- To provide complete and accurate project documentation to the customer.

PS-XINS-100-SL Project installation support services

Provide consulting on installing the battery test solution to ensure correct cable selection and routing. Share lab installation schematics and provide update meetings on the installation process.

PS-XENG-100-SL Project engineering services

Project engineering services provide specialized engineering services during project development and implementation. The customer's project team will have access to engineering expertise to aid in various tasks specific to their project including but not limited to – safety matrix and test bench guard, facilities and lab layout, special power requirements, etc.

PS-XCOM-100-SL Project commissioning services

Project commissioning services for the test solution provide an experienced test solution engineer to validate and complete the test solution setup in readiness for the customer's initial usage. It includes validating specific hardware and software configurations per the project requirements and any specific consulting agreed to beforehand, given the customer specific usage of the test solution. experts familiar with the instruments and software you are using and the challenges you face. And all the packages offer onsite options for large systems which cannot be moved.

KeysightCare for Solutions

KeysightCare for Solutions service goes beyond basic warranty, providing a priority-one connection between our resources and your teams. Every support tier includes access to the Keysight Support Portal and Knowledge Center where you can find answers, manage service requests, and interact with Keysight experts familiar with the instruments and software you are using and the challenges you face. And all the packages offer onsite options for large systems which cannot be moved.

- Warranty Plus – Reduce risk and avoid project delays with technical support coverage.
- Assured – Increase supportability to match your application needs with a committed turnaround time.
- Enhanced – Keep your project schedules on track and receive priority support and even faster turnaround times for repairs and calibration to optimize your solution.

Service deliverables

	KeysightCare Warranty Plus for Solutions	KeysightCare Assured for Solutions	KeysightCare Enhanced for Solutions
	Onsite R-55T-005- X ¹	Onsite R-55U-005-X ¹	Onsite R-55V-006-X ¹
Solution technical support (SW² & HW)			
Keysight Support Portal & Knowledge Center, 24x7	•	•	•
Remote technical support response time ³	2 business days	4 business hours	2 business hours
Onsite Technical Support ⁴		•	•
Solution hardware support			
Repair service coverage	Onsite	Onsite	Onsite
Onsite response time	No commitment	12 business days response time ⁶	5 business days response time ⁶
Solution calibration ⁷			Up to Keysight calibration + uncertainty + guard banding - Onsite
Calibration turnaround time			Scheduled
Proactive firmware release notifications		•	•

1. When ordering, update with the relevant (Solution Product Number (SPN) based on the length of service required (e.g. -1, -2, -3, or -5 for 1 year, 2 years, 3 years or 5 years).
2. KeysightCare Software Agreement required for software support.
3. Remote Technical Support Response time is measured from the time you contact the KTAS team to have an initial meaningful response from the case owner.
4. Onsite technical support is provided or at the discretion of Keysight.
5. 3rd party products are excluded for assured and enhanced packages.
6. Response time is measured from the date the service request is received to the date Keysight arrives at your site.
7. Recommended re-calibration period is 12 months.

Find out more about KeysightCare Service and Support [here](#).

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.



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