SL1002A Scienlab Battery Test System

Cell Level – 600 A

KEYSIGHT

Scienlab Battery Test System – Cell Level

Systems up to 6 V | 600 A | 3.6 kW per channel

The SL1002A is a capable cell tester with 0.05% accuracy and the ability to characterize cells: internal resistance, mechanical resistance, efficiency, capacity, cyclical life, and calendar life spans. Record the reaction to temperature with up to three temperature inputs per channel. The SL1002A is easy to configure; start by selecting one of three max currents for your cell and then choose the number of desired channels. Minimize energy costs with the environmentally friendly SL1002A, which offers greater than 90% efficiency, and a bidirectional power supply that returns energy to the power mains.

- Modular configuration – Adapt the number of channels to changing requirements.
- Scienlab Energy Storage Discover (ESD) Software – Easily control and monitor the system, including the climate chambers and devices under test (DUTs).
- Compact size – Save valuable laboratory space.
- Optional integrated electrochemical impedance spectroscopy (EIS) – Add EIS measurements directly into the test processes on any channel without changing the DUT contact.
- Flexible channels – Perform the same or different tests on each channel.

The following voltage, current and power options are available per channel:

Current options		**±100 A**	**±300 A**	**±600 A**	
Current accuracy[1]		±0.05% of measured value, ±20 mA (offset)	±0.05% of measured value, ±60 mA (offset)	±0.05% of measured value, ±120 mA (offset)	
Ripple		0.4 A	1.2 A	2.4 A	
Rise and fall time[2]		< 800 µs typ., max. 1 ms, -90 to +90%			
		-90 to +90 A	-270 to +270 A	-540 to +540 A	
0 to 6 V	Power options	0.6 kW	1.8 kW	1.8 kW	3.6 kW

1. Measurement and programming accuracy.

2. No switching times within power stage or channel at transition from positive to negative current and vice versa.

Measurement and control unit with real-time Linux PC

- Measurement and Control Unit (MCU) – Linux real-time PC
- Autonomous sequence control
- Capture and store data acquisition measurement
- Communication interface: Ethernet

Output characteristics

Voltage options	0 to 6 V
Voltage accuracy[1]	±1 mV (typ. 150 µV)

1. Measurement and programming accuracy.

- Analog data acquisition of voltage (four-wire measurement) and current
- Sample Rate: max. 20 kS/s (internally 625 kS/s)
- 3x temperature input: Pt100 4-wire, -50 to +130 °C, ±1 K per test channel
- Control of external components:
  - Temperature chamber, conditioning unit (Ethernet protocol required), etc.
  - Additional protocol implementation is possible if the component not yet supported

Inherent safety

- Inherent safety against overheating, overcapacity, short circuit and idling.
- Protection against reverse polarity by checking the polarity before output contactors can be closed.
- No hardware protection against reverse polarity.
- Monitoring of all internal voltages, currents and temperatures.
- DC output contactors capable to disconnect DUT at full load current.

Manual parallel operation

- Manual parallel operation of up to six output stages possible
- Output contacts including sense circuit have to be interconnected by the customer
- Director/follower definition via control software Energy Storage Discover (ESD)

Test system	Weight	Dimensions (H x W x D)[1]	Power class		
			0.6 kW	1.8 kW	3.6 kW
SL1002A	Approx. 500 kg per cabinet	2.6 m x 0.8 m x 0.8 m	1 to 12 channels	1 to 4 channels	1 to 2 channels
		2.6 m x 1.6 m x 0.8 m	14 to 36 channels	5 to 8 channels	4 to 6 channels
		2.6 m x 2.4 m x 0.8 m	-	10 to 12 channels	8 to 10 channels

1. Height includes rollers. Width and depth without accessories such as switches, etc.

- Protection type IP 54
- Ambient temperature: 10 to 40 °C
- Air humidity: 30 to 75% rel. H.
- Sound pressure level according to DIN EN 3744 < 70 dB(A) measured at 1 m distance from front

Active front end (AFE)

- Bidirectional power supply
- Reactive power compensation under load cos(φ) > 0.98
- Efficiency > 90%
- HV EMC filter
- Proven respect of limits for conducted interferences within the low voltage grid as per EN61000-6-4

Transformer

- Common potential separation of all output stages
- Output stages not potential separated themselves

Mains supply

- 3, N, PE 400 V (±10%), 50 Hz (±0.2 Hz)
- Functional earth (FE)

Safety

- Emergency stop switch/main switch (red/yellow) for all-pole disconnection
- Dual-channel fast stop (black push button)
- Door hinge mounted on the right side
- Door handles: Comfort handles with safety lock
- Parametrizable limits for the protection of the DUT
- Insulation monitoring device (Bender ISOMETER® IR425-D4-1)
- Signal light with magnetic mounting
- Red: Error; Yellow: Active, Green: Ready

Documentation

- Operating instructions in English
- CE declaration of conformity

System design and realization according to applicable safety and regulatory requirements (such as EU Directives). Special customer standards are not taken into account by default and require explicit agreement and quotation.

System Options

Electrochemical impedance spectroscopy (EIS)

SL1002A-001 Electrochemical impedance spectroscopy per channel

Integrated EIS per test-channel independent programmable within test sequence:

- Sinusoidal current up to 5 A
- Absolute Error |Phi| = 2°
- Measurement method: galvanostatic, 4-wire-measurement

Current options per test channel	±100 A	±300 A	±600 A
Frequency band	100 mHz to 2 kHz	100 mHz to < 5 kHz	
Accuracy	Relative Error |Z| = 2% Absolute Error |Z| = 200 µΩ	Relative Error |Z| = 1% Absolute Error |Z| = 200 µΩ	

Additional current range option class

SL1002A-401 Additional current range – 30 A

- Measuring range ±30 A, accuracy ±0.05% of measured value, ±6 mA (offset)
- Current range selection programmable within the test sequence
- Tester must be disabled to switch the measurement range

Note: Additional current range not available for ±100 A current option.

Output configuration option class

SL1002A-501 Automatic parallel switch enabling for two channels

- Parallel operation of two channels automatically controllable within the test sequence
- Parallel operation of channel 1 + 2 with DUT 1 or DUT

Note: Automatic parallel switch is not available for ±100 A option. The power leads between the test system and the DUT must be designed for double output current. Connecting two channels in parallel has no effect on the voltage accuracy. The offset of the current accuracy is multiplied by two. The error of the measured value [%] is not affected.

Cabinet base option class

SL1002A-701 Base stand

Cell Tester is placed on top of a 15 cm high base stand (reduces cabinet height by 10 cm).

SL1002A-702 Rollers

Cell Tester is placed on top of high rollers and can be moved flexible.

System cooling selection

SL 1002A-K02 Air cooling with compressor

- Roof fan IP54 for compression refrigeration
- Monitoring of interior temperature

SL 1002A-K03 Water cooling

- Water/air heat exchanger
- Heat transfer: max. 10% of total output power
- Intake: ¾ “, 6 to 20 °C
- Return: ¾ “, max. +30 °C
- Maximum inlet pressure 6 bar, without pressure impact, pressure difference > 1 bar

Test bench guard-ready enable kit

SL1079A-CM1 Manual parallel connection

- Support of manual parallel connection of up to two battery test channels by the Scienlab Test Bench Guard (TBG).
- Monitoring the current and voltage limit values of the respective director of the redundant measurement in parallel operation.
- Sum formation of the individual flows of the redundant measurement to the correct monitoring of the current limits in parallel operation.

SL1079A-CM2 Automated parallel connection of two channels

- Detection of the automatic parallel connection of two channels of each battery test bench about the state of the cross-contact.
- Automatic monitoring of the current and voltage limits of the respective director of the redundant measurement in parallel operation.
- Automatic totals of the individual flows of the redundant measurement for the correct monitoring of the current limits in parallel operation.
- Integration of standard input signals “status cross-contact channel x”.

Note: Requires “option automatic parallel connection” in the Battery test system as well as option “option integration redundant current and voltage measurement”. The power leads between the test system and the DUT must be designed for double the output current. Connecting two channels in parallel has no effect on the voltage accuracy. The offset of the current accuracy is multiplied by two. The error of the measured value [%] is not affected.

SL1079A-CM3 Redundant current/voltage measurement

Redundant DUT current and voltage measurement

- CAN Bus with 500 kBaud
- Data rate 16 2/3 Hz per measuring signal (connection via CAN-Bus controller)
- Measurement accuracy ±1% from measurement range of current and voltage

Note: Only in combination with the test bench guard option redundant current/voltage measurement.

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 SL1002A 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 1. 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 and 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 or 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 set of tools 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.

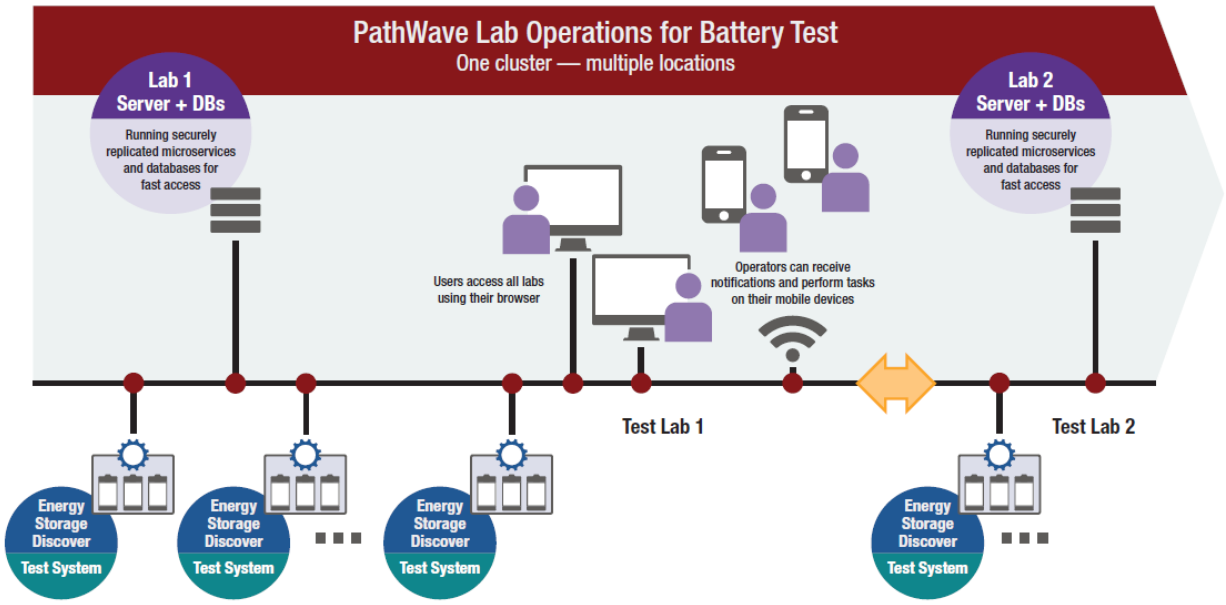

Figure 2. PathWave Lab Operations for Battery Test manages multiple test systems in a laboratory.

- 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.
- Improved collaboration: Share and control 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.

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 test bench 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 services

These services provide installation expertise to manage, deliver and coordinate local facilities installation for the test bench. Specific installation efforts depend on the customer's individual facility, the locally available power and cooling and the test bench being delivered.

PS-XENG-100-SL Project engineering services

Project engineering services provide specialized engineering services during project development and implementation. The customers 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 bench engineer to validate and complete the test bench 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 test bench's customer-specific usage.

KeysightCare for Solutions

KeysightCare for Solutions services 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 for Solutions Warranty Plus	KeysightCare for Solutions Assured	KeysightCare for Solutions Enhanced
	Onsite Upgrade R-55T-005- X[1]	Onsite Upgrade R-55U-005-X[1]	Onsite Upgrade R-55V-006-X[1]
Solution technical support (SW[2] & 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
Application of service notes	Safety and recalls	Recommended - during service	Recommended - proactive
Preventative maintenance[5]			•
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.