

# Scienlab Battery Test System

## Cell Level

SL1002A    SL1003A



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## Battery Test System | Cell Level

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

The Battery Test System – Cell Level is an electric system designed to emulate sink and source for battery cells for automotive and industrial applications.

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

| Current Options      |               | ±100 A                                     | ±300 A                                     | ±600 A                                      |        |
|----------------------|---------------|--|--|---|--------|
| Current accuracy*    |               | ±0.05 % of measured value, ±20 mA (offset) | ±0.05 % of measured value, ±60 mA (offset) | ±0.05 % of measured value, ±120 mA (offset) |        |
| Rise and fall time** |               | < 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 |

\* Measurement and programming accuracy

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

### Control unit and power amplifier

Measurement and Control Unit (MCU) – Linux real-time PC

- Embedded system for autonomous sequence control
- Measurement data acquisition
- Communication-interface: Ethernet

### Analog acquisition of voltage and current data acquisition (4-wire measurement)

| 4 QS              |                     |
|-------------------|---------------------|
| Voltage options   | 0 to 6 V            |
| Voltage accuracy* | ±1 mV (typ. 150 µV) |

\* Measurement and programming accuracy

- Resolution: 32 Bits
- Sample Rate: max. 20 kS/s (internally 625 kS/s)
- 3x temperature input: Pt100 4-wire, -50 °C to +130 °C, ±1 K per test channel
- Control of external components:
  - Temperature chamber, conditioning unit (Ethernet protocol required), etc.
  - Additional protocol implementation possible if component not yet supported

### Intrinsic safety

- Intrinsically safe 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)

| Product No. | Dimensions (H x W x D) | Power class       |                   |                  |
|-------------|------------------------|-------------------|-------------------|------------------|
|             |                        | 0.6 kW            | 1.8 kW            | 3.6 kW           |
| SL1003A     | 1.4 m x 0.8 m x 0.8 m  | 1 to 6 channels   | 1 channel         | 1 channel        |
| SL1002A     | 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 |

**Note:** 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 % relative humidity.
- 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  $\cos(\varphi) > 0.98$
- Efficiency >90 %
- HV EMC filter
- Proven respect of limits for power-related disturbances 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 %/-5 %), 50 Hz ( $\pm 0,2$  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 / SL1003A-001 Electrochemical impedance spectroscopy per channel

Integrated impedance-spectroscopy per test-channel independent programmable within test sequence

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

| Current options per test channel | $\pm 100$ A  | $\pm 300$ A  | $\pm 600$ A |
|----------------------------------|--|--|-------------|
| Frequency band                   | 100 mHz to 2 kHz   | 100 mHz to < 5 kHz   |             |
| Accuracy                         | Relative Error $ Z  = 2\%$<br>Absolute Error $ Z  = 200 \mu\Omega$ | Relative Error $ Z  = 1\%$<br>Absolute Error $ Z  = 200 \mu\Omega$ |             |

### Ripple Test Function

#### SL1002A-R01 Ripple Test per channel

Programmable AC ripple on top of the output DC current

- Max. amplitude 30 A,pp
- Max. frequency 2.4 kHz

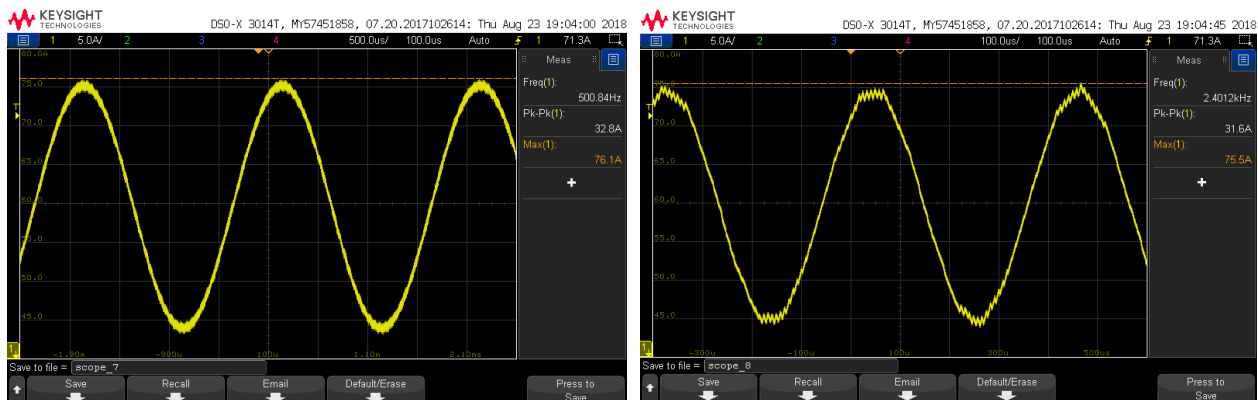


Figure 1: Sinus signal quality @ 500 Hz (left) and 2.4 kHz (right) with 30 App,ac on top of 60 A,dc

**Note:** This option is not available for cell testers with 100 A output current. Keysight advises that the quality of the sinusoidal signal decreases with increasing frequency, as shown in Figure 1.

## Additional Current Range Option Class

### SL1002A-401 Additional current range 30 A

- Measuring range  $\pm 30$  A, accuracy  $\pm 0.05$  % of measured value,  $\pm 6$  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  $\pm 100$  A current option

## Output Configuration Option Class

Only available for SL1002A Cell Level

### 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  $\pm 100$  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 / SL1003A-701 Base stand

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

### SL1002A-702 / SL1003A-702 Rollers

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

## System Cooling Selection

### SL1003A-K01 Air cooling

- Only available for SL1003A Compact Cabinet

### SL 1002A-K02 / SL1003A-K02 Air cooling with compressor

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

### SL 1002A-K03 / SL1003A-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

Only available for SL1002A Cell Level

### SL1079A-CM1 Manual parallel connection

- Support of manual parallel connection of up to two Battery Test channels by the 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  $\pm 1$  % from measurement range of current and voltage

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

## Service

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 requirements and goals of the customer. Keysight offers the following services to secure a successful project execution and to reduce the ramp-up time for our customers.

### PS-XPS-100 Project management and technical consulting

Keysight recommends Project Management and technical consulting for each test bench project. By ordering the project management, an experienced project manager is dedicated to your project and acts as direct communication interface from Keysight to the customers project management team.

The project manager takes over the responsibility:

- To observe internal project progress and ensure that project schedule/ project milestones are kept.
- That any unscheduled project events are immediately communicated and discussed with the customer.
- To provide complete and accurate project documentation to the customer.

### R9001A-201 Installation service

The scope of the Installation service depends on the customer's facility. Share all relevant information and requirements regarding test bench components that require installation, such as connection to the local grid and the local water supply, with your local field engineer so that the scope of service personnel and material costs for installation can be calculated.

**Note:** Installation can be executed by the customer.

## R9001A-202 Commissioning service

The Commissioning service is offered to guide the customer during first usage of the test bench after installation. Commissioning is recommended for each test bench project. It includes:

- Local presence of experienced test bench engineer during first usage of the test bench.
- Consulting of customer personnel with regards to intended usage of the test bench (e.g. initial test with customer specimen)
- Review of executed hardware installation of Keysight products.
- Review and consulting to software settings of operation software if ordered
- Travel expenses

**Note:** Commissioning is offered on a daily base. Keysight recommends at least two days for each test bench project.

## HS0002A-100 Productivity assistance

The Productivity assistance is offered to support, consult, and train the customer's operation personnel to reduce the ramp-up time for initial usage of a new test bench and for any unexpected system behavior during the test bench life cycle. Productivity assistance is executed either remotely (phone/internet) or on site (on request). It includes:

- Direct access to an experienced system specialist via Phone/Internet.
- Support for failure analysis and trouble shoot
- Software and programming support and consulting

**Note:** Keysight recommends at least two days of Productivity assistance for each test bench project.

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