

Scienlab Dynamic DC Emulator

High-Power Series – Up to 180 kW

SL1042A



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System Description

The Scienlab Dynamic DC Emulator (DCE) is an electric system designed to emulate batteries or other components for automotive applications.

The following voltage, current and power options are available:

Voltage	50 to 600 V or 0 to 600 V*	50 to 850 V or 0 to 850 V*	50 to 1000 V or 0 to 1000 V*	
Current options	300 A or 600 A			
Power options	90 kW	120 kW	150 kW	180 kW

*Extended voltage range of 0 to 50 V with 4 QS option

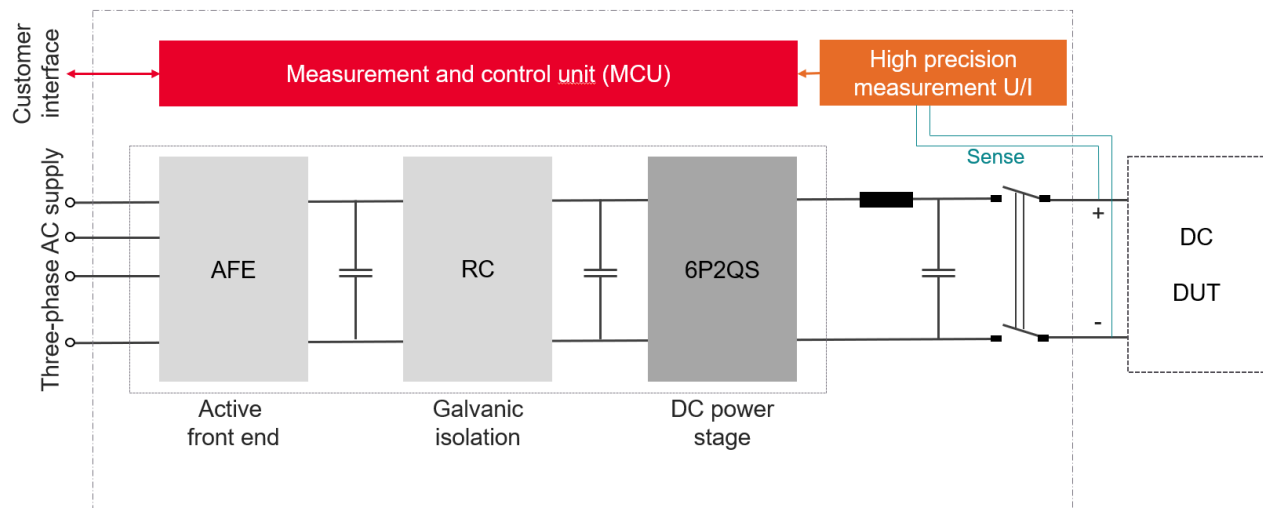


Figure 1. Scienlab Dynamic DC Emulator system block diagram

Note: The Dynamic DC Emulator can be controlled with the Software Emulator Control which is included in the position Machine Emulator.

Controller unit with power stage

Measurement Controller Unit (MCU) real-time control module provides:

- real-time computer controlling electrical output variables
- adjustable RLC-battery simulation model
- communication interface: Ethernet, incl. software interface description

Integrated battery model as per following equivalent circuit diagram:

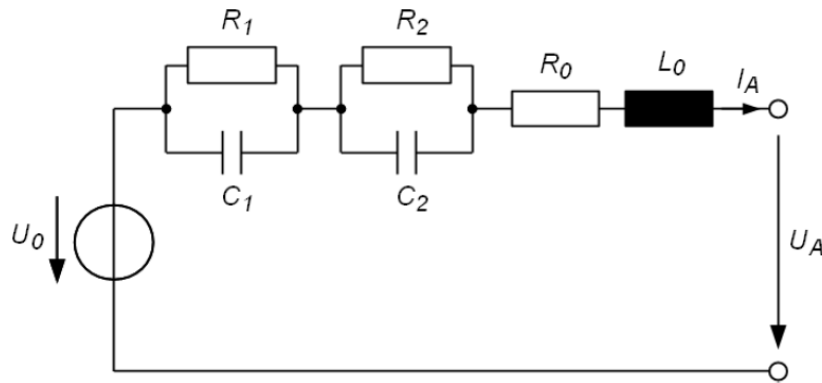


Figure 2. Battery model

The model shall only be active in voltage source operation.

Customer-settable parameters:

- U_0 : nominal voltage source value [V]
- R_0 : internal voltage source resistance [Ω]
- R_1 : resistance within 1st RC link [Ω]
- C_1 : capacity within 1st RC link [F]
- R_2 : resistance within 2nd RC link [Ω]
- C_2 : capacity within 2nd RC link [F]
- L_0 : internal inductance [H]

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

	600V	850 V	1000 V
Voltage accuracy	± 0.05 % of measured value, ± 200 mV (offset)		± 0.05 % of measured value, ± 300 mV (offset)
	300 A	600 A	
Current accuracy	± 0.05 % of measured value, ± 60 mA (offset)	± 0.05 % of measured value, ± 120 mA (offset)	

- resolution: 32 bit
- sample rate: max. 20 kS/s (internal 625 kS/s)
- DC measure and control accuracy are the same

Note: Connecting two systems 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.

Output characteristics

	300 A	600 A
Voltage ripple	300 mV _{eff} typ., 500 mV _{eff} max. at measuring range of 500 kHz	
Output capacity	1600 µF (800 µF optional*)	3200 µF (1600 µF optional*)
Load stability	< 80 V (typ. < 40 V) @ 400 V, 0 → 250 A < 1ms, 400 µF	< 80 V (typ. < 40 V) @ 400 V, 0 → 400 A < 1ms, 400 µF

* For changing the output capacity please refer to operation instructions.

Explanation of load stability:

- @ 400 V → output voltage of 400 V
- 0 → 250 A, < 1 ms → current rise from 0 A to 250 A in less than 1 ms
- 500 µF → load capacity (typical DUT input capacity)
- typically 40 V → average overvoltage of 40 V
- < 80 V → maximum 80 V overvoltage/undervoltage

Regenerative power stage

- A modular rack-mounted system which is easy to maintain.
- Figure 3 (2 quadrant system) shows the default current and voltage ranges.
Note: For optional voltage range extension to 0 V to V_{max} see Figure 4 (4 quadrant system).

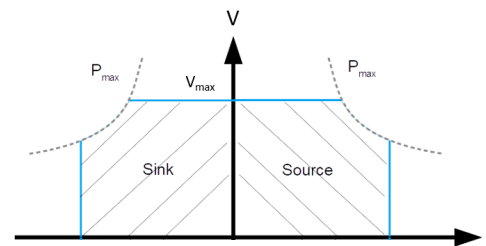
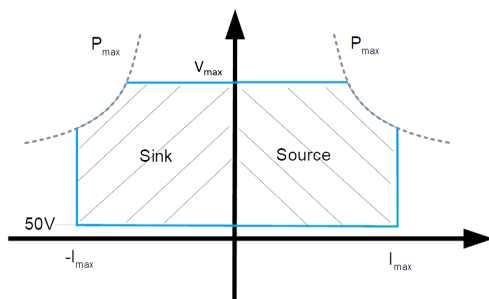


Figure 3. Max. power of 50 V to V_{max} (2 quadrant system) Figure 4. Max. power of 0 V to V_{max} (4 quadrant system)

Intrinsic safety

- built-in safeguards against overheating, overcapacity, short circuit and idling
- protection against reverse polarity by monitoring the polarity secured by software
- no hardware protection against reverse polarity before output contactors have been closed
- monitoring of all internal voltages, currents and temperatures
- DC output contactors capable of disconnecting at full load current
- mains side power contactors ensuring the absence of voltage
- discharge of all internal high voltage sources upon emergency stop

System Cabinet

Basic dimensions (H x W x D)	2.4 m x 2.8 m x 0.8 m placed on rollers plus overlap by switches etc.
Weight	1400 to 1700 kg
Protection class	IP 54
Control cabinet color	RAL 7035
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	

Documentation

- operating instructions in English
- CE declaration of conformity
- acceptance and calibration protocol

Active Front End (AFE)

- regenerative
- mains recovery (eff. > 90 %)
- idle power compensation $\cos(\varphi) > 0.98$
- HF EMC filter
- 2 kHz filter
- proof of limits having been respected for line-bound failures within low voltage mains as per EN61000-6-4:2007

Resonance converter

- all-pole isolation of power stages to supply mains

Mains supply

- 3, PE 400 V (+10 %/-5 %), 50 Hz ($\pm 0,2$ Hz)
- Functional Earth (FE)
- roof-top cable routing with EMC screw connection

System	90 kW	120 kW	150 kW	180 kW
Back-up fusing provided by customer	200 A gG	224 A gG	315 A gG	315 A gG

Power electronics cooling

- water/water heat exchanger with internal water circuit to ensure dew protection
- limitation of the water amount inside of the cabinet
- monitoring of water temperature and internal controller
- metal jacketed cooling water hoses

System cooling

System	90 kW	120 kW	150 kW	180 kW
Max. heat discharge	9 kW	12 kW	15 kW	18 kW
Throughput (full load) ($\vartheta_Z = 15\text{ °C}$, $\vartheta_R = 30\text{ °C}$, $\Delta\vartheta = 15\text{ K}$)	0.14 l/s (0,5 m ³ /h)	0.19 l/s (0.7 m ³ /h)	0.24 l/s (0.9 m ³ /h)	0.29 l/s (1.0 m ³ /h)

- temperature of supply flow: 3/4", $\vartheta_Z = 6$ to 20 °C
- temperature of return flow: 3/4", $\vartheta_R = \text{max. } 30\text{ °C}$
- max. input pressure 6 bar, without pressure impact, differential pressure: 1.5 to 3.0 bar
- flow control meeting the specific demands
- water stop valve

Safety

- shut down for emergency stop: $U = 0\text{ V}$ or $I = 0\text{ A}$ selectable
- emergency stop-delay adjustable between 0 to 30 s
- emergency stop/ main switch for all-pole disconnection
- fast stop push button
- external fast stop input for Test Bench Guard integration
- key switch for enabling the output contactors
- door hinge mounted on the right side
- door handles: Comfort handles with safety lock
- parameterizable limits for the protection of the device under test
- insulation guard monitor
- evaluation of the insulation resistance via interface
- insulation guard can be switched off

Note: While the monitoring unit is switched off it must be ensured that the isolation monitor unit of the DUT is active and embedded within the emergency chain. The user is responsible for the safety of the test bench.

Display Elements

	Red	Error
Signal light on the control cabinet with magnetic base	Yellow	Operation
	Green	Ready for operation
Indicators	Power coil instrument in front door to indicate the terminal output voltage: 0 to 1000 V	

Interface to the supervisory system on the terminal block:

- release AC input contactor
- release DC output contactors
- signal output contact open / closed
- message of limit value violation
- message sums error
- emergency stop message
- release system
- emergency stop input

Test bench guard ready – high-power DC emulator

The Test Bench Guard (SL1020A) can be used as an additional device because it manages the emergency stop signals and several external signals. The cut-out scenarios are defined by a safety matrix.

System Options

Cabinet base option class

SL1042A-701 Base Stand

Control cabinet is placed on top of a 15 cm high base stand.
(total height including base stand: 2.38 m)

SL1042A-702 Rollers

Control cabinet stands on top of 25 cm high rollers and can be moved.
(total height including rollers: 2.48 m)

Interface options beyond Ethernet

The DCE supports the most common communication interfaces (Ethernet and EtherCat).

SL1042A-030 Additional EtherCat Interface

Control cabinet is equipped with an extra EtherCat interface.

Service Options

Service features depend on the facilities, expertise of the customer, 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

Project Management and Technical Consulting is recommended for each test bench project. By ordering the Project Management Service, 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 occasions with relevance for the project 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 offered Installation Service depends on the customer facility. Please share all relevant information and requirements regarding test bench components that require installation. Such requirements include connection to the local grid and local water supply. This allows your local field engineer to calculate scope of service personnel and material costs for installation.

Note: Installation can also 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 basis. Keysight recommends at least two days of Commissioning Service for each test bench project.

HS0002A-100 Productivity Support Service

The Productivity Support Service 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, on the other hand with regards to any unexpected system behavior during the test bench life cycle. Productivity Support Service is executed remotely (phone or 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 Support Service for each test bench project.

Learn more at: www.keysight.com

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