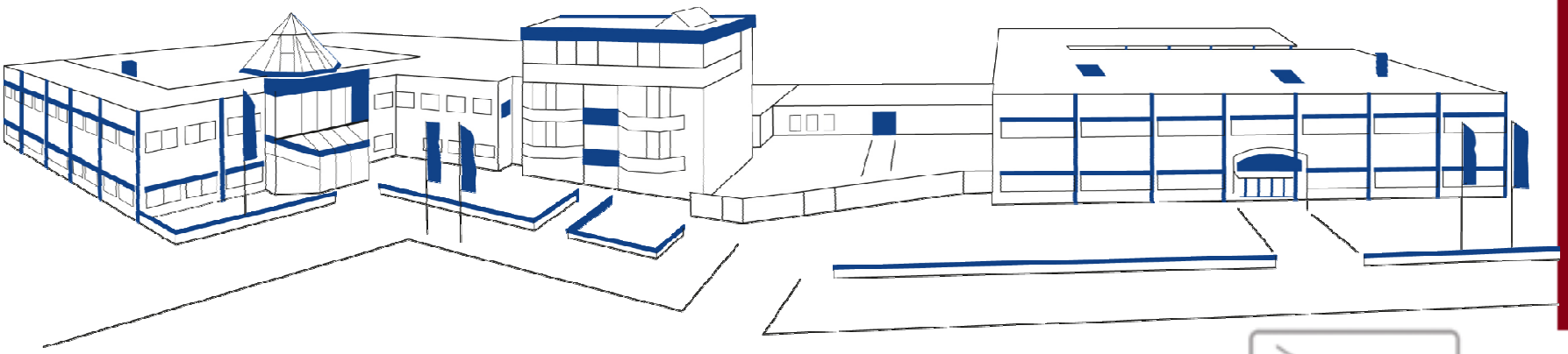
EA-Elektro-Automatik

The Power-Supply Company



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The Power-Supply Company

EA-Elektro Automatik GmbH & Co. KG
Helmholtzstrasse 31 – 37, 41747 Viersen (NRW)
Germany, European Community

www.elektroautomatik.de

ea1974@elektroautomatik.de

Ownership
EA-Elektro-Automatik is a 100% owner-managed enterprise

Main Activities
R&D and manufacturing of power electronics for energy conversion focusing on:

- Programmable Laboratory Power Supplies (DC)
- Programmable Electronic loads (DC), conventional any regeneratives
- Programmable 19” Power Racks 15U, 24U, 38U, 42U, 47U

Important fact: And what power range do we supply? Anything between:

0… 2000V DC, 0…5000A, 0…1MW Is fully standard (!)

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The Power-Supply Company

Facts:

Foundation in 1974 in Viersen (North Rhine-Westphalia), Germany (EC)
near-by Düsseldorf (30 km) and Cologne (60 km
Total number of employees including facilities abroad: Approx. 300

Main Factory (R&D, production)

- Viersen (Germany) staff: Approx. 210

Branches Abroad:

- EA Elektro-Automatik China (Shanghai) with branch offices Shenzen, HK and Taipei (TW ROC)
- EA Elektro-Automatik USA (San Diego/CA)
- EA Liaison/Sales office Russia (Moskow)

China Production Joint Ventures:

- Shanghai, German-Chinese partner, staff: 80 with 50 constantly engaged for EA
- Zhang Mu Tou (Guandong province), Austrian partner, staff: 200 with 40 constantly engaged for EA

Extract of main customers in distribution and industry:

RS Components, Farnell/element14, Distrelec, Conrad, Datatec, Equipement Scientifique,
Robert Bosch, Kostal, TRW, Delphi, Hella, Continental, Denso, Lear, Daimler, VW, Audi, Porsche, Valeo,
Panasonic, Daimler, BMW, Siemens, Thales, SMA and many more

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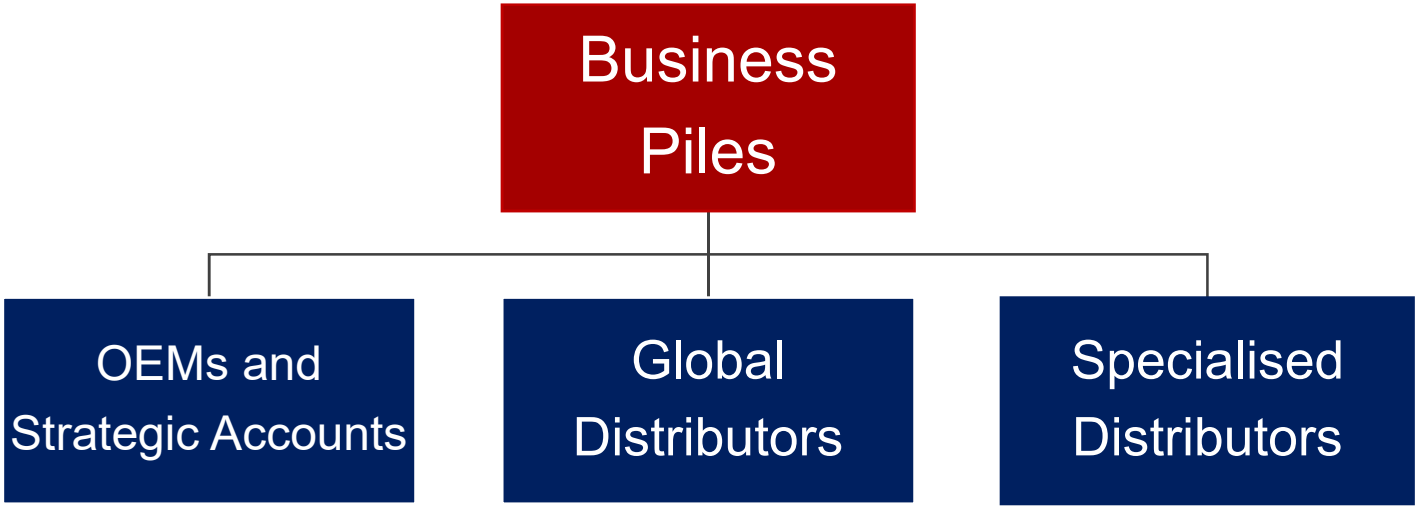
Business Piles



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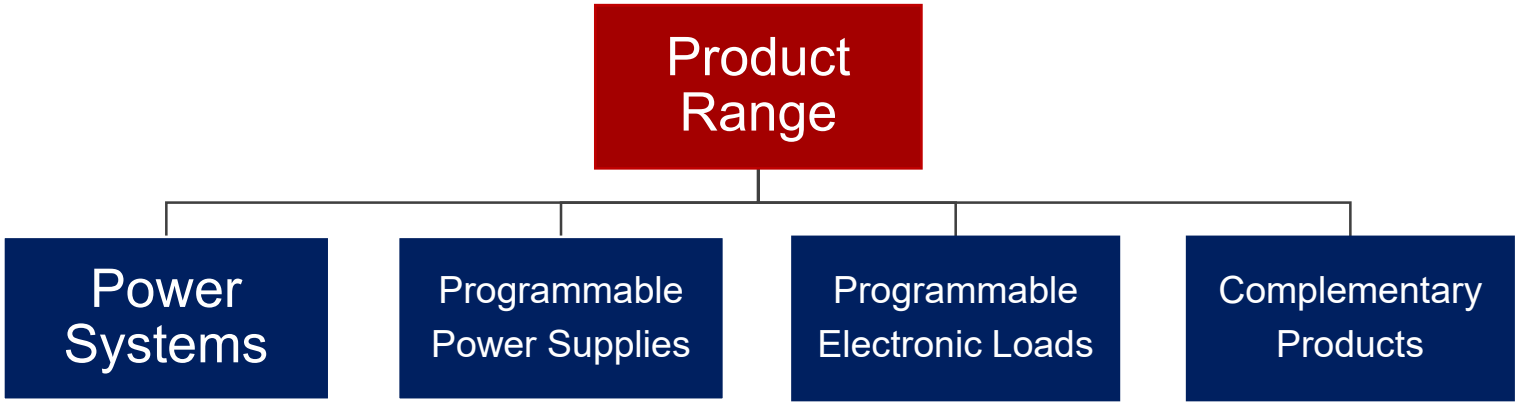
Product Range



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Typical user areas

- R&D - Research & Development
  - Of analogue and digital circuits
  - Of electrical- and electronic components, active and passive
- Industrial automated testing, - test benches,
  - Burn-in installations
  - ATE(auto-testing) systems
- Electro-chemical processing installations
- Control and automation - quality validation, - cycle and ageing testing
- Service, repair and maintenance
- Technical training and vocational-education in institutes and universities

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Typical markets and branches

- Aerospace and Aeronautical industry
- Automotive industry engine, electric engine (EV)
- Chemical industry (electro-chemical processing, electro plating, water purification, corrosion protection, degaussing)
- Communication industry, radio frequency (RF) and microwave, telecom (GSM/UMTS/LTE), radar
- Component-, appliance- and machine manufacturing industry
- Control- and automation Industry
- Defence (military) industry
- Regenerative energy (photovoltaic, wind, water)
- Electro-chemical energy storage (batteries, capacitors, fuel cells)
- Universities, technical schools, research institutes, vocational education, technical training

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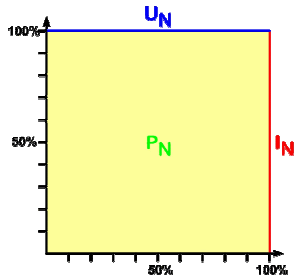
What is Autoranging? Typical example see below

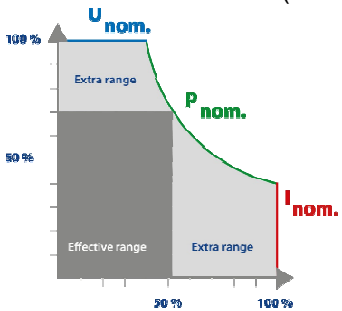
Investment-saving example when comparing TDK Lambda source GEN series with EA source PS 9000 1U series:

For testing three devices (EUT) of same kind, with a nominal power consumption of 2.4kW but different nominal (input) voltages, three different input currents (current consumption) need to be provided by the source to serve the ETs:

(P / U = I)
1) EUT 2.4kW, nominal voltage 24V = requires 100A input current (24Vx100A = 2.4kW)
2) EUT 2.4kW, nominal voltage 48V = requires 50A input current (48Vx 50A = 2.4kW)
3) EUT 2.4kW, nominal voltage 60V = requires 40A input current (60Vx 40A = 2.4KW)

U-I rectangular output characteristic versus U-I-P flexible output characteristic
TDK Lambda Genesys (3.3kW) EA-PS 9080-100 1U (3kW)





U-I- rectangular output characteristic requires:
GEN-30-110 0-30VDC, 0-110A, 3.3kW
GEN-60-55 0-60VDC, 0- 55A, 3.3kW
Or GEN-80-125 0-80VDC, 0-125A, 10kW (!)

U-I-P flexible characteristic requires::
Source 1) 0…80VDC, 0…100A, 3kW
This source, PS 9080-100 1U can fully cover all three equipements under test (EUT).

Conclusion: Using a conventional DC source such as TDK-Lambda GEN series, it requires min. two (2) different 3.3kW power sources to test all three ETUs, (24V, 48V and 60V) or, one much oversized and overpriced 80V 10kW source. The 3.0kW source of EA with the flexible auto-ranging output however, can power all three ETUs. Moreover, it still operates on a single-phase 220/230/240V~ mains supply, whilst the TDK Lambda units will require 3-phase 400V~ mains.

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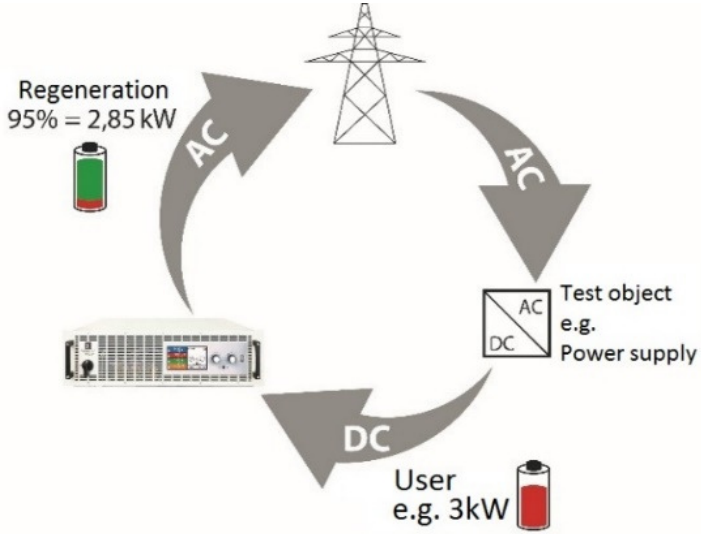
Conventional vs. regenerative electronic loads

Generally said, under a permanent, several-hours lasting utilization per working day, a regenerative electronic load will completely amortize within just few years owing to the enormous reduction in electricity bill, (Ø 2-4 Y). Subsequently, it will even start generating revenue once reached the ROI, similar to a PV (solar) inverter.
Take as a best example „our 145kW submarine“ fuel cell, with a long-time testing of up to 16 h per day.
Investment of the high-power load system was: € 180,000.00. The cost reduction in electricity bill was about € 102,600.00 in the first year and approx. € 51,300 in the consecutive years. A full amortization (ROI) was already achieved after approx. 2.5 years of operation. Revenue thereafter and per year: **€ 54.000,00.**

By the way: The price difference between a regenerative load as compared to a conventional (heat-dissipating) electronic load, is typically compensated for within 1-2 years, owing to the daily saving in electricity bill.



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Our main product lines

DC Laboratory Power-Supplies

Low-cost	
EA-PS 2000B (µ)	100…332W @ up to 168V & 20A
Medium-grade	
EA-PS 3000C(µ)	160…650W @ up to 150V & 40A
High-end	
EA-PS 9000 T (µ)	320W…1.5kW @ up to 500V & 60A
EA-PSI 9000 T (µ)	320W…1.5kW @ up to 500V & 60A
EA-PSI 9000 DT (µ)	320W…1.5kW @ up to 750V & 60A
EA-PS 9000 1U (µ)	1.5kW…3kW @ up to 750V & 100A
EA-PS 9000 2U (µ)	1kW…3kW @ up to 750V & 120A
EA-PSI 9000 2U(FPGA)	1kW...3kW @ up to 750V & 120A
EA-PS & PSE 9000 3U (µ)	5/10/15kW @ up to 1500V & 510A
EA-PSI 9000 3U (FPGA)	5/10/15kW @ up to 1500V & 510A
EA-PSI 10000 4U (FPGA)	30kW @ up to 2000V & 1000A

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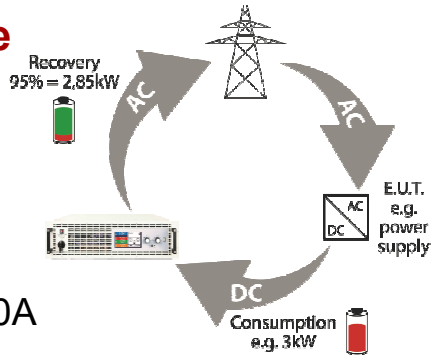
Our main product lines

DC Electronic Loads, Conventional & Regenerative



EA-EL 3000 B	400W @ up to 500V & 60A
EA-EL 9000 T	300W…1.2kW @ up to 750V & 60A
EA-EL 9000 DT	300W…1.2kW @ up to 750V & 60A
EA-EL 9000 B	1.5kW…14.4kW @ up to 750V & 1020A
EA-ELR 9000 & 10000	3.5…30kW @ up to 2000V & 1000A
EA-ELR 5000	320W up to 3.2 kW @ up top 200V, up to 25A

Bi-Directional Power Supplies

EA-PSB 9000 & PSB 10000 5…30kW @ up to 200V & 1000A

“Green” Recovery load (feed back into the local grid)

EA-PS/PSI/EL/ELR Power Racks up to 2000V, 5000A and 1MW,

19” 15U up to 47U

Unidirectional sink or source (conventional and regenerative) or combined

Bi-directional source/sink regenerative (PSB 9000 based racks)

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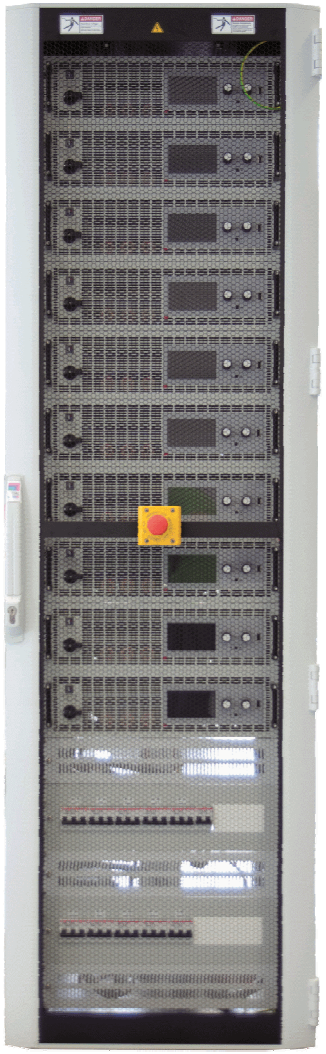
Our main product lines:



About our DC Power-Racks and in general

Anything between

0 - 2000 VDC

0 - 5000 A

0 - 1MW

Is our standard "off-the-shelf" product !

Power racks	30kW – 1MW @ up to 2000V & 5000A
EA-PS/PSI/EL/ELR Racks	19" 15U up to 47U

Unidirectional source or sink (conventional and regenerative) or combined

Bi-directional source/sink regenerative (PSB 9000 based racks)

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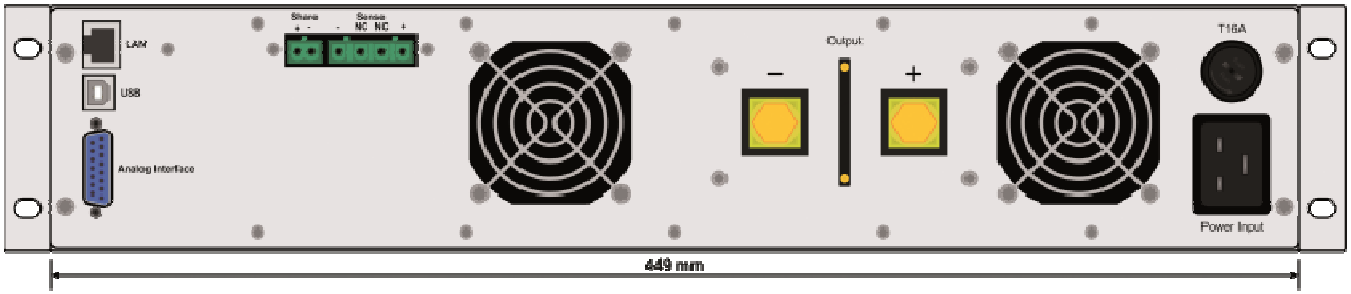
EA-PS 9000 2U

Cortex M3 µ-processor



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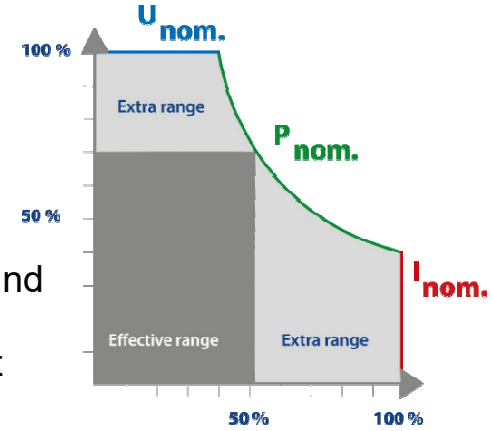
EA-PS 9000 2U

Cortex M3 µ-processor

High-end DC laboratory power-supplies PS 9000 2U featuring:



- ***1kW, 1.5kW, 3kW with flexible (auto-ranging) output***
- 0-40V, up to 0-750V
- 0-4A up to 0-120A
- Highly isolated built-up of HMI, power boards, µ-processor and communication unit, eliminating major potential problems such as ground loops
- Controller (16 bit) with high-performance µ-processor (Cortex M3), fast stimulus-response for programming and performing of settings
- Operation modes constant voltage-, power-, current adjustable 0…100% by digital encoders
- Flexible auto-ranging output with auto-cross-over between CV, CC, CP
- Fast-discharge of output capacitance (DC OFF) to IEC1010 (<10 sec. for <60V)
- Insulated analogue interface (0-5V/0-10V), USB and Ethernet on board
- Share-bus for power sharing in parallel operation mode
- Share-bus to form a source-sink system with e-load series EL9000B & ELR 9000
- Protections: OTP, DC OVP, over-current, short-circuit, overload
- Large DOT Matrix LC-display (5 digit) with memory functions
- Housing 19” rack 2U, 466 mm depth
- Option HS “high-speed” allowing 10-20 times faster up- and down ramping
- Software “ea-power-control” free-ware version and professional version

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EA-PS 9000 2U

Cortex M3 µ-processor

Typical Usage:

- R & D laboratories in universities, research institutes and industry.
- Automated testing in end-of-line and burn-in test benches (low-to-medium power applications)

Typical applications:

- As described under series PS/PSI 9000 T, testing of components and devices and as replacement for electro-chemical storage sources, for under- and over-voltage testing, performance and quality validation.

Specific advantages of series EA-PS 9000 2U

- The analogue interface is fully insulated and thus not sensitive to e.g. ground loops or mains potential variations.
- Fast reaction time of the output upon a manual setting, external trigger or command (fast stimulus-response) owing to a high-performance Cortex M3 µ-processor.
- High insulation of human-machine interface (HMI), communication unit, micro-controller and power boards towards mains potential, for enhanced operator safety and high operational reliability
- Built-in three-way interface: Insulated analogue interface (0-5V/0-10V), USB and Ethernet on board for the remote control, bringing about a wider scope of usage in digital control environment.

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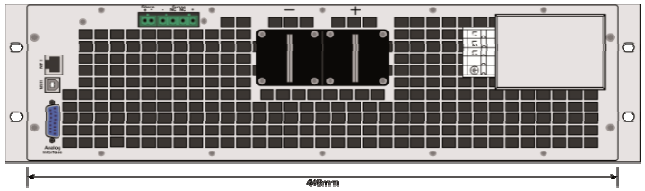
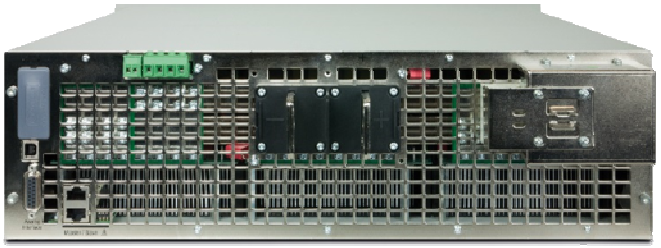
EA-PS (& PSE) 9000 3U

Cortex M3 µ-processor

5-15 kW



PS 9000 3U backside



PSE 9000 3U backside

Example 15U, 24U, 34U

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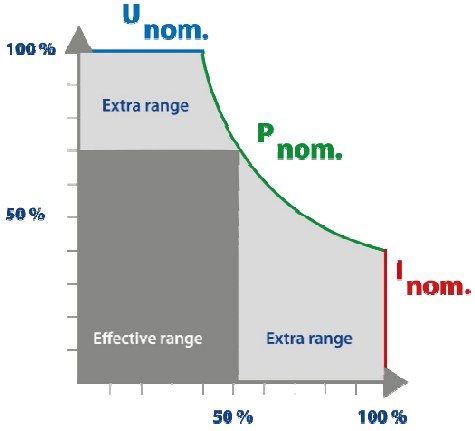
EA-PS (& PSE) 9000 3U

Cortex M3 µ-processor

High-end DC laboratory power-supplies featuring:

- ***5kW, 10kW, 15kW with flexible auto-ranging output, expandable to up to 150 kW and more***
- 0-40V, up to 0-1500V, V (all auto-ranging)
- 0-30A up to 0-510A
- Highly isolated built-up of HMI, power boards and communication unit, eliminating major potential problems such as ground loops
- µ-processor controller (16 bit) with high-performance (Cortex M3), fast stimulus-response for programming and performing of settings
- Operation modes constant voltage-, power-, current, adjustable 0…100% by digital encoders
- Flexible auto-ranging output with auto-cross-over between CV, CC, CP
- Fast-discharge of output capacitance (DC OFF) to IEC1010 (<10 sec for <60V)
- PS : Insulated analogue interface (0-5V/0-10V), USB and Ethernet
- PSE: Insulated analogue interface (0-5V/0-10V), USB, and “plug n’ play slot to host various optional plug-in interfaces (see IF-AB-XX options) such as RS232 CAN, Ethernet, Profibus/Profinet, Ethercat, Modbus, Devicenet.
- Share-bus for power sharing in parallel operation mode
- PSE: Includes summary function (total current and power) in parallel mode
- Share-bus to form a source-sink system with e-load series EL9000B & ELR 9000
- Protections: OTP, DC OVP, over-current, short-circuit, overload
- Large DOT Matrix LC-display (5 digit) with memory functions
- Housing 19” rack 3U, 675 mm depth
- Option HS “high-speed” allowing up to 5 times faster up and down ramping
- Software “ea-power-control” free-ware version and professional version



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EA-PS (& PSE) 9000 3U

Cortex M3 µ-processor

Typical Usage:

- Heavy-duty applications (5kW- 150kW and more) in the industrial sector, were “pure” DC laboratory power quality (mV regulation and mV ripple) is indispensable.
- Research and development at high-power loads in universities, research institutes and industry
- Automated testing in end-of-line and burn-in facilities (high power applications 5kW to 150kW)

Typical applications:

- Charging of Li-Ion power-packs and high-power ultra-caps.
- Endurance testing of heavy-duty components such as DC rectifier bridges, FET (field-effect transistor) IGBT (bi-polar transistor), thyristor blocks, high-power halogenous lamps and LED bundles.
- Development and testing of large resistive, inductive and capacitive loads and appliances such as DC motors (electric engines), electric ballasts, magnetics, DC/AC commercial and photovoltaic inverters, indirect converters in UPS or PFC circuits (heavy duty)

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EA-PS (& PSE) 9000 3U

Cortex M3 µ-processor

Typical applications:

- Development and testing of high-power active and passive components, digital and analogue circuits, electrical and electronic appliances and devices in industrial, automotive, military, aeronautical, telecommunication and solar environment (heavy duty)

- In replacement of a battery e.g. for under- and over-voltage and under- and over-current testing of battery powered equipment in automotive, military and aeronautical environment i.e. on all sensitive heavy-duty DC electronic devices contained therein (control electronic, hydraulic, breaking systems, lightning).

- Simulation of high power sources such as alternators for commercial and electrical vehicles of up to 1500V

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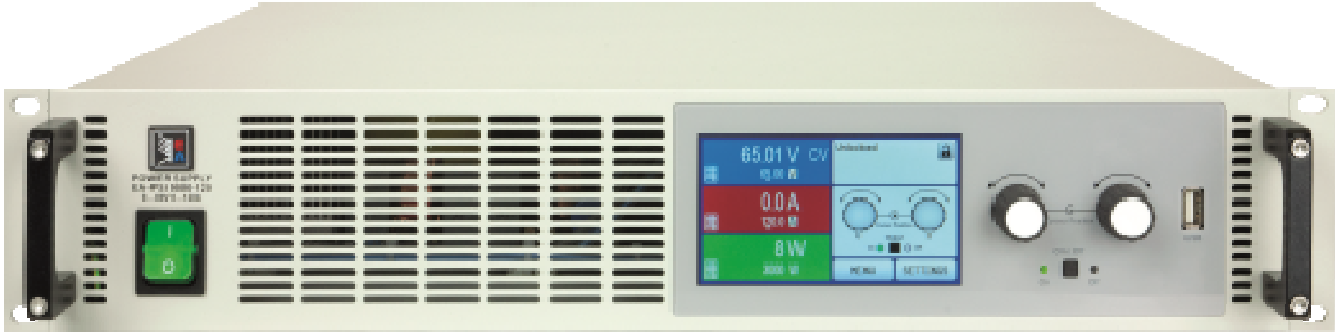
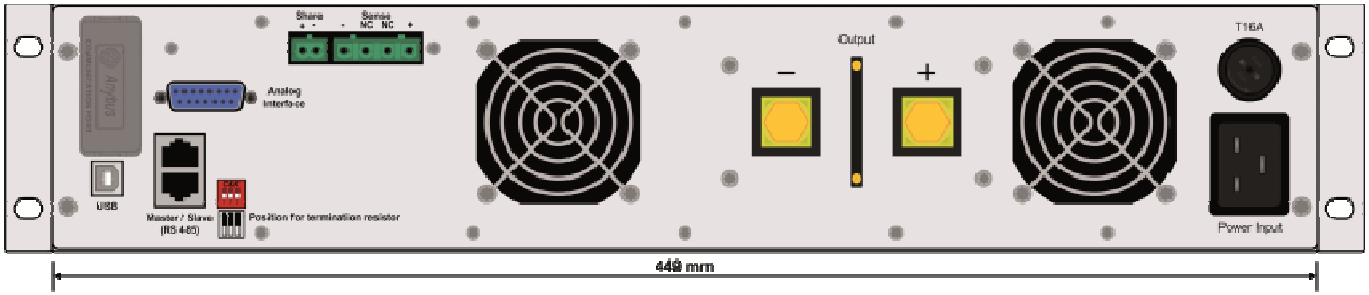
EA-PSI 9000 2U (intelligent)

FPGA controler
(Field Programmable Gate Array)



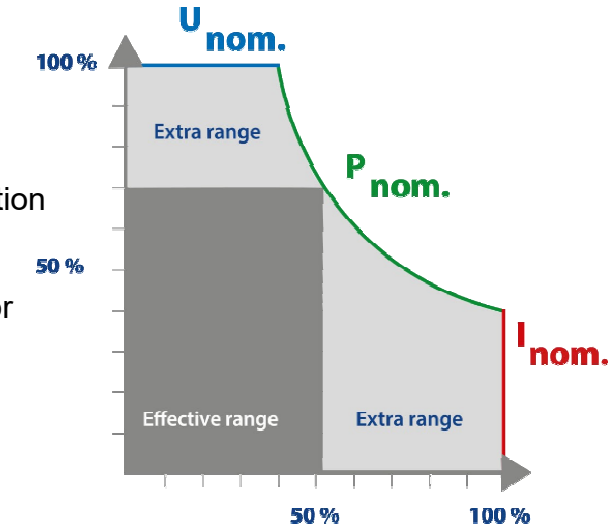


Elektro-Automatik

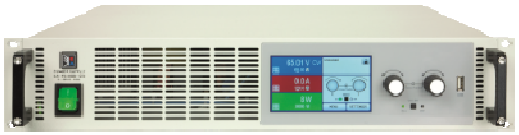
EA-PSI 9000 2U (intelligent)

FPGA controler
(Field Programmable Gate Array)

High-end DC laboratory power-supplies featuring:



- 1.0kW, 1.5kW, 3.0kW with flexible (auto-ranging) output
- 0-40V up to 0-750V
- 0-4A up to 0-120A
- Highly isolated built-up of HMI, power boards, µ-processor and communication unit, eliminating major potential problems such as ground loops
- Controller (16 bit) unit based upon FPGA with integrated sequencer, arbitrary and with default wave forms, extremely fast stimulus-response for programming and performing of settings
- Operation modes constant voltage-, current-, power, adjustable 0…100% via digital encoders
- Adjustable output impedance, for simulation of sources such as PV panels, alternators, batteries, fuel cells, cable inductances.
- Flexible auto-ranging output with auto-cross-over between CV, CC, CP, CR
- Fast-discharge of output capacitance (DC OFF) to IEC1010 (<10 sec for <60V)
- Insulated analogue interface 0-5V/0-10V and USB on board
- True master-slave bus with summary function for parallel operation of up to 14 units
- Share-bus to form a source-sink system with e-load series EL9000B & ELR 9000
- Protections: OTP, DC OVP, short-circuit, overload
- Plug'n play slot for optional digital interfaces RS232, CAN, Ethernet, Profibus, Profinet, Ethercat, Devicenet, Modbus (refer to EA-IF AB options)
- Software "ea-power-control" free-ware version and professional version
- TFT touch display 64,000 colours (up to 5-digit) for highly intuitive operation
- Housings 19" rack 3U, 675 mm depth
- Option HS "high-speed" allowing up to 5 times faster up and down ramping



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EA-PSI 9000 2U (intelligent)

FPGA controler
(Field Programmable Gate Array)

Typical Usage:

- R&D laboratories of universities and in industrial environment
- Automated test benches of medium power size (640W – 3.0kW)

Typical applications

- Development and testing of active and passive components, digital and analogue circuits, electrical and electronic appliances and devices in industrial sectors such as automotive, regenerative energy (solar/wind/water) communication (data com) and aeronautical market.
- Replacing the battery source in laboratory environment by simulating its various voltage/energy conditions. In automotive environment e.g. powering all electronic devices such as fuel injection pump, break assistant, audio and video devices (HiFi, GPS, mobile phone), headlamps, illumination, windscreen wipers etc.
- Ageing and functional test of halogenuous bulbs and LEDs and submitting these to under- and over-voltage conditions
- Under- and over-voltage testing of transmitters and base stations or related devices in telecom and data communication environment with e.g. -48V or 60V.
- Testing of under- and over voltage conditions on DC/AC inverters used in automotive and emergency power (UPS) installations, simulation of a PV (photovoltaic) solar panel for MPPT (maximum-power-point tracking) validation and run-in test of solar (PV) inverters.

EA-PSI 9000 2U (intelligent)

FPGA controller
(Field Programmable Gate Array)

Specific advantages of series EA-PSI 9000 2U

- The analogue interface is fully insulated and thus not sensitive to e.g. ground loops or mains potential variations.
- Fast reaction time of the output upon a manual setting, external trigger or command (fast stimulus-response) owing to a high-performance FPGA (16 bit) controller
- High insulation of human-machine interface (HMI), communication unit, micro-controller and power boards towards mains potential, for enhanced operator safety and high operational reliability
- Larger choice of digital plug'n play interfaces for the remote control, bringing about a wider scope of usage in digital control environment
- The user may vary the output impedance of the unit according to what he wishes to simulate, e.g. a PV source, a battery, a capacitor, or a large cable inductance
- The integrated programmable sequencer (I/U, U/I) with default wave forms such as sinus, square, triangle, trapezoidal, arbitrary, ramping, allowing generating a wide scope of output signals.
- The touch panel's logic menu enables the user to control the units in a most intuitive manner without necessarily reading the manual for executing basic to extended functions
- Calibration function; within 1% of nominal, the user is enabled to calibrate the unit himself.

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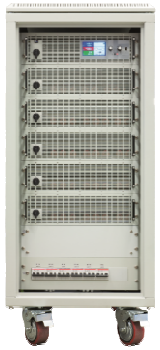
EA-PSI 9000 3U (intelligent)

FPGA controller
(Field Programmable Gate Array)

5-15 kW

Example 60 kW - 12U

15U



24U

34U

42U

Elektro-Automatik

EA-PSI 9000 3U (intelligent)

FPGA controller
(Field Programmable Gate Array)

High-end heavy-duty DC laboratory power-supplies featuring:

- 5kW, 10kW, 15kW (all auto-ranging), expandable up to 150 kW and more
- 0-40V, up to 0-1500V
- 0-30A up to 0-510A
- Highly isolated built-up of HMI, power boards, µ-controller and communication unit, eliminating major potential problems such as ground loops
- Controller (16 bit) unit based upon FPGA with integrated sequencer, arbitrary and with default wave forms, extremely fast stimulus-response for programming and performing of settings
- Operation modes constant voltage-, power-, current, resistance, adjustable 0…100% via digital encoders.
- Adjustable output impedance for simulation of sources such as PV panels, alternators, batteries, fuel cells, cable inductances.
- Flexible auto-ranging output with auto-cross-over between CV, CC, CP, CR
- Fast-discharge of output capacitance (DC OFF) to IEC1010 (<10 sec for <60V)
- Insulated analogue interface 0-5V/0-10V and USB on board
- True master-slave bus with summary function for parallel operation of up to 16 units
- Share-bus to form a source-sink system with e-load series EL9000B & ELR 9000
- Protections: OTP, DC OVP, short-circuit, overload
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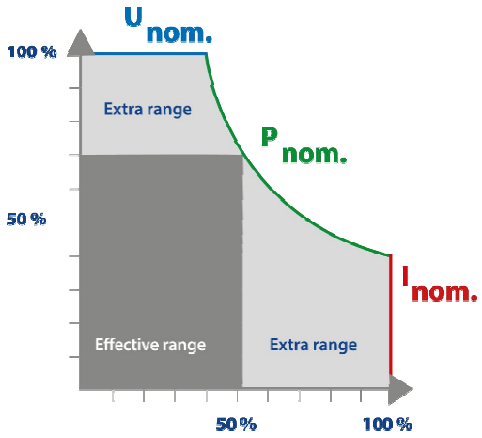
- Software "ea-power-control" free-ware version and professional version
- TFT touch display 64,000 colours (up to 5-digit) for highly intuitive operation
- Housings 19" rack 3U, 675 mm depth
- Option HS "high-speed" allowing 5 times faster up and down ramping



Elektro-Automatik

EA-PSI 9000 3U (intelligent)

FPGA controller
(Field Programmable Gate Array)

Typical Usage:

- Advanced heavy-duty applications (5kW - 150kW and more) in the industrial sector, were “pure” DC laboratory power quality (mV regulation and mV ripple) is indispensable.
- Sophisticated and highly-sensitive automated testing in end-of-line and burn-in facilities

Typical Applications:

- Charging of Li-Ion power-packs and high-power ultra-caps.
- Endurance testing of heavy-duty components such as DC rectifier bridges, FET (field effect transistor packs), IGBT (bipolar transistor), halogen and LED high-power bundles.
- Development and testing of large inductive and capacitive loads and appliances such as DC electric motors, electronic ballasts, magnetics, DC/AC inverters (in Telecom, automotive, industrial and photovoltaic environment), UPS and PFC DC indirect circuits, wafer heating, low-voltage plasma.
- True simulation of the varying inner resistance of a battery source or a fuel cell as required in automotive, military and aeronautical environment i.e. for a full performance and a close-to-reality testing on all sensitive heavy-duty DC electronic devices contained therein (control electronic, hydraulic, breaking systems, illumination, DC electric motors, satellite on-board devices etc.)

Elektro-Automatik

EA-PSI 9000 3U (intelligent)

FPGA controller
(Field Programmable Gate Array)

Typical Applications:

- Development and sequence-testing of high-power consuming sensitive active and passive components, digital and analogue circuits, electrical and electronic appliances and devices in industrial, automotive, military, aeronautical, telecom and solar environment with the possibility to use the integrated sequencer (arbitrary generator and default wave forms) allowing generating highly dynamic profiles. The sequencer allows 4096 freely programmable points and includes default profiles such as sinus, square, triangle and arbitrary function. These functions can be stored and recalled by the user respectively.

- True simulation of an electro-chemical storage source (battery) i.e. reproducing the varying voltages and capacities with the varying inner resistance states that a battery in the field may adopt (batteries used in automotive-, telecom-, UPS-, military-, aeronautic/aerospace environment). Different types of batteries such as lead, lead-acid, lead-fleece, Ni-Cd, Ni-MH or Lithium, but also the characteristic of a fuel cell may be truly simulated. This permits a most effective inspection of functionality and performance of many battery-operated consumer- or industrial product and devices used in e.g. cars and trucks, aeroplanes, rockets and satellites, power tools, illumination (LED, halogenous) just to mention a few.

- Furthermore, different types of PV (photovoltaic) panels such as mono-crystalline, poly-crystalline and thin-film panels in arrays up to 1500VDC may be truly simulated, as well as their variating output characteristic under varying temperature conditions.

- Owing to the ability of an output impedance modification by the user, it is possible to simulate a large inductance connected to the output terminals of the source such as extremely long power wires as the are typically installed in large aeroplanes, rockets and boats.

Elektro-Automatik

EA-PSI 9000 3U (intelligent)

FPGA controller
(Field Programmable Gate Array)

Specific advantages of series EA-PSI 9000 3U

- The analogue interface is fully insulated and thus not sensitive to e.g. ground loops or mains potential variations.
- Fast reaction time of the output upon a manual setting, external trigger or command (fast stimulus-response) owing to a high-performance FPGA controller (up to 16 bit)
- High insulation of human-machine interface (HMI), communication unit, micro-controller and power boards towards mains potential, for enhanced operator safety and high operational reliability
- Larger choice of digital plug'n play interfaces for the remote control, bringing about a wider scope of usage in digital control environment
- The user may vary the output impedance of the unit according to what he wishes to simulate, e.g. a PV source, a battery, a capacitor or a large cable inductances
- The integrated programmable sequencer (arbitrary, I/U, U/I) with default wave forms such as sinus, square, triangle, trapezoidal, ramp, allowing generating a wide scope of output signals.
- The touch panel's logic menu enables the user to control the units in a most intuitive manner without necessarily reading the manual before executing basic to extended functions
- Calibration function; Within 1% of nominal, the user is enabled to calibrate the unit himself.

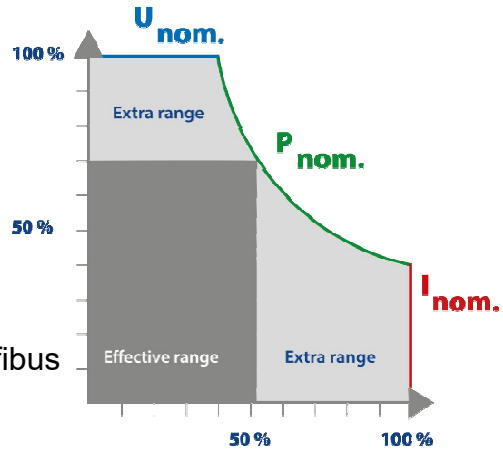
Elektro-Automatik

EA-PSI 9000 15U and 24U

(rack systems)
FPGA controller
(Field Programmable Gate Array)

High-end heavy-duty DC laboratory power-supply racks, featuring:

- 30kW up to 90kW (all auto-ranging)
- 0-80V up to 0-1500V (all flexible)
- 0-60A up to 0-3060A
- Highly isolated built-up of HMI, power boards and communication unit, eliminating major potential problems such as ground loops
- Controller (16 bit) unit based upon FPGA with integrated sequencer, freely programmable and with default wave forms, extremely fast stimulus-response for programming and performing of settings
- Operation modes constant voltage-, power-, current, resistance, adjustable 0…100% via digital encoders.
- Adjustable output impedance for simulation of sources such as PV panels, alternators, batteries, fuel cells, cable inductances.
- Flexible auto-ranging output with auto-cross-over CV, CC, CP, CR
- Fast-discharge of output capacitance (DC OFF) to IEC1010 (<10 sec for <60V)
- Insulated analogue interface 0-5V/0-10V and USB on board
- Share-bus to form a source-sink system with e-load series EL 9000 B /ELR 9000
- Protections: OTP, DC OVP, short-circuit, overload
- Plug'n play slot for optional digital interfaces RS232, CAN, CANopen, Ethernet, Profibus Profinet, Modbus TCP, EtherCAT (refer to EA-IF AB options)
- Software "EA Power Control" free-ware version and professional version
- TFT touch display 64,000 colours (up to 5-digit) for highly intuitive operation
- 19"-cabinets on wheels 15U (30-45kW) and 24U (60-90kW)
- Comply with EN 60950 (safety for IT installations)

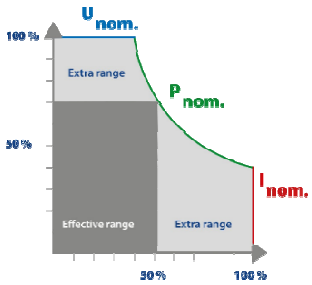


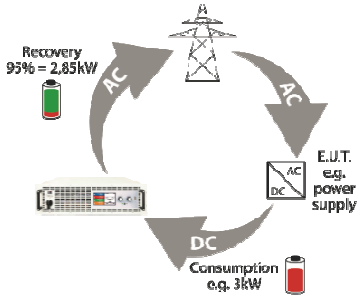
Elektro-Automatik

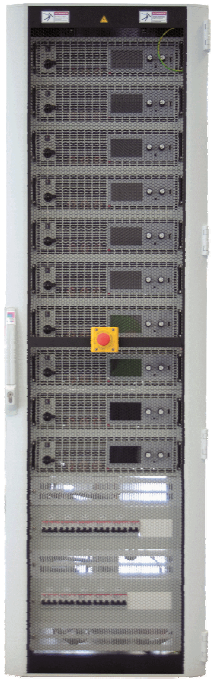
EA-Power Racks up to 1MW

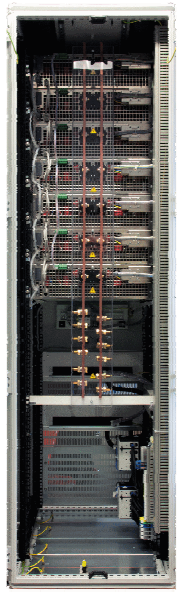
As DC Power Supplies,
As DC Electronic Loads (conventional and regenerative)
or combined as DC Source-Sink System and/or Bi-directional

- Flexibly configurable power rack as DC supply or DC load or combined or bi-directional
- Powers from 30kW up to 240 kW in a single rack
- Voltages from 0-40 V up to 0-2000 VDC
- Currents from 0-60 A up to 0-5000A
- Remotely programmable via analogue and digital interfaces
- Factory-installed interfaces and „plug n play“ slot
- State-of-the-art µ- processor controller (FPGA)
- Highly isolated modular architecture
- PV (solar) array simulation
- Battery and fuel-cell simulation
- Function generator, sine, square, trapezoidal, ramp, arbitrary
- Alarm Management, user profiles
- Battery and fuel-cell simulation
- Function generator, sine, square, trapezoidal, ramp, arbitrary
- 19" Cabinets 15U, 24U, 38U, 42U and 47U
- Safety: EN 60950 (IT Systems) or EN 60204-1 (Machines)
- Analogue, Ethernet, USB, CAN, Profibus, GPIB and many more
- User software „EA Power Control“ (optional: Multicontrol „app“)









Elektro-Automatik

Conventional DC Electronic Loads

EA-EL 3000 B

Elektro-Automatik

EA-EL 3000 B

Electronic Load (conventional) with versatile multi-function controller

This adjustable and programmable bench top series of conventional electronic loads is equipped with a highly performing FPGA (Field Programmable Gate Array) controller with 16-bit resolution. It features a highly flexible DC input range for a usage at either high voltage or high current as required, within the nominal power rating. It is equipped with a comfortable colour display integrating multiple functions such as a function generator with default wave forms (e.g. square, rectangle trapezoidal, ramp), memory, alarm manager and user profiles. It displays U/I/R/P values with 4 digit resolution. The DC input has and active suppression to impede oscillations, an input filter protection against excessive HF AC content, a sophisticated thermal management for a gradual automatic derating against excessive load/temperature conditions, is highly stable owing to a measurement-band of 1Mhz for U/I/P and allows 0...100% adjustable parameters. It is extremely dynamic (50µs current pulses) and generates no ripple (FET linear technology). For external automated control, this series is supplied with on-board isolated 0-5V/0-10V analogue, USB and Ethernet (LAN) interface. This series is an ideal tool for all kind of demanding load testing in R&D where reproducible test data is essential and is suitable for automated test-system integration.

- Powers 0-400W
- Voltages 0-80V up to 0-500V DC
- Currents 0-10A up to 0-60A
- FPGA-based controller, programmable
- Isolated analogue 0-5V/0-10V, USB and Ethernet (LAN) interface on board (optional)
- Operation modes CV, CC, CP, CR, battery discharge mode, enhanced filters and protective functions
- Integrated function generator with default waveforms, arbitrary, memory, alarm manager, user profiles
- Colour display for values, status and notifications
- Control software “ea-power-control”, available as basic free-ware and licensed professional software
- Attractive bench-top housing with carrying/standing handle

Elektro-Automatik

EA-EL 3000 B

Meters	U/I/P/R, Multilingual colour display
Input voltage	90-264V~ 45-66Hz
Bench housing	WxHxD 308 x 103 x 325 mm

Typical usage:

- For bench top R&D, for sensitive low-noise and/or highly dynamic applications

Typical applications:

- Programmed/sequenced dynamic load testing and aging simulation of DC sources of any kind such as battery chargers, telecom/industrial/open-frame/built-in and/or laboratory power supplies etc.
- Programmed/sequenced load testing of DC sources such as PV modules (small solar arrays)
- Discharging of all types of energy storage devices such as batteries (Li, Pb, Ni-Cad, Ni-MH) capacitors and fuel cells.
- Programmed/sequenced testing of semiconductors, passive and active electronic components such us rectifiers, fuses, transistors (IGBT,FET), contacts, diodes, circuit breakers etc.

Elektro-Automatik

Conventional DC Electronic Loads
EA-EL 9000 T

Elektro-Automatik

EA-EL 9000 T

Electronic Load (conventional) with versatile multi-function controller

This adjustable and programmable bench top series of conventional electronic loads is equipped with a highly performing FPGA (Field Programmable Gate Array) controller with 16-bit resolution. It features a highly flexible DC input range for a usage at either high voltage or high current as required, within the nominal power rating. It is equipped with a comfortable TFT touch panel (easy-to-operate intuitive menu structure) integrating multiple functions such as a function generator with default wave forms (e.g. sinus, square, trapezoidal, ramp, arbitrary), memory, alarm manager and user profiles. It displays U/I/R/P values with 4 digit resolution. The DC input has and active suppression to impede oscillations, an input filter protection against excessive HF AC content, a sophisticated thermal management for a gradual automatic derating against excessive load/temperature conditions, is highly stable owing to a measurement-band of 1Mhz for U/I/P and allows 0...100% adjustable parameters. It is extremely dynamic (50µs current pulses) and generates no ripple (FET linear technology). For external automated control, this series is supplied with on-board isolated 0-5V/0-10V analogue, USB and Ethernet (LAN) interface. This series is an ideal tool for all kind of demanding load testing in R&D where reproducible test data is essential and is suitable for automated test-system integration.

- Powers 300W up to 1.2kW
- Voltages 0-80V up to 0-750V DC
- Current 0-5A up to 0-60A
- FPGA-based controller, programmable
- Isolated analogue 0-5V/0-10V, USB and Ethernet (LAN) interface on board
- Operation modes CV, CC, CP, CR, battery discharge mode, enhanced filters and protective functions
- Integrated function generator with default waveforms, arbitrary, memory, alarm manager, user profiles
- TFT touch panel (64,000 colours) and setting encoders (intuitive easy-to-operate HMI)
- Control software “ea-power-control”, available as basic free-ware and licensed professional software
- Attractive bench-top housing with carrying/standing handle

Elektro-Automatik

EA-EL 9000 T

Meters	U/I/P/R, TFT touch Display, 4-digit
Input voltage	100-240V~ 50/60Hz
Bench housing	WxHxD 276 x 103 x 355 mm (1.0 & 1.5kW: 415 mm depth)

Typical usage:

- For bench top R&D, for sensitive low-noise and/or highly dynamic applications

Typical applications:

- Programmed/sequenced dynamic load testing and aging simulation of DC sources of any kind such as battery chargers, telecom/industrial/open-frame/built-in and/or laboratory power supplies etc.
- Programmed/sequenced load testing of DC sources such as PV modules (small solar arrays)
- Discharging of all types of energy storage devices such as batteries (Li, Pb, Ni-Cad, Ni-MH) capacitors and fuel cells.
- Programmed/sequenced testing of semiconductors, passive and active electronic components such us rectifiers, fuses, transistors (IGBT,FET), contacts, diodes, circuit breakers etc.

Elektro-Automatik

Conventional DC Electronic Loads

EA-EL 9000 DT

Elektro-Automatik

EA-EL 9000 DT

Electronic Load (conventional) with versatile multi-function controller

This adjustable and programmable bench top series of conventional electronic loads is equipped with a highly performing FPGA (Field Programmable Gate Array) controller with 16-bit resolution. It features a highly flexible DC input range for a usage at either high voltage or high current as required, within the nominal power rating. It is equipped with a comfortable TFT touch panel (easy-to-operate intuitive menu structure) integrating multiple functions such as a function generator with default wave forms (e.g. sinus, square, trapezoidal, ramp, arbitrary), memory, alarm manager and user profiles. It displays U/I/R/P values with 4 digit resolution. The DC input has and active suppression to impede oscillations, an input filter protection against excessive HF AC content, a sophisticated thermal management for a gradual automatic derating against excessive load/temperature conditions, is highly stable owing to a measurement-band of 1Mhz for U/I/P and allows 0...100% adjustable parameters. It is extremely dynamic (50µs current pulses) and generates no ripple (FET linear technology). For external automated control, this series is supplied with on-board isolated 0-5V/0-10V analogue, USB and Ethernet (LAN) interface. This series is an ideal tool for all kind of demanding load testing in R&D where reproducible test data is essential and is suitable for automated test-system integration.

- Powers 300W up to 1.2kW
- Voltages 0-80V up to 0-750V DC
- Current 0-5A up to 0-60A
- FPGA-based controller, programmable
- Isolated analogue 0-5V/0-10V, USB and Ethernet (LAN) interface on board
- Operation modes CV, CC, CP, CR, battery discharge mode, enhanced filters and protective functions
- Integrated function generator with default waveforms, arbitrary, memory, alarm manager, user profiles
- TFT touch panel (64,000 colours) and setting encoders (intuitive easy-to-operate HMI)
- Control software “ea-power-control”, available as basic free-ware and licensed professional software
- Attractive bench-top housing with carrying/standing handle

Elektro-Automatik

EA-EL 9000 DT

Meters	U/I/P/R, TFT touch Display, 4-digit
Input voltage	100-240V~ 50/60Hz
Bench housing	WxHxD 276 x 103 x 355 mm (1.0 & 1.5kW: 415 mm depth)

Typical usage:

- For bench top R&D, for sensitive low-noise and/or highly dynamic applications

Typical applications:

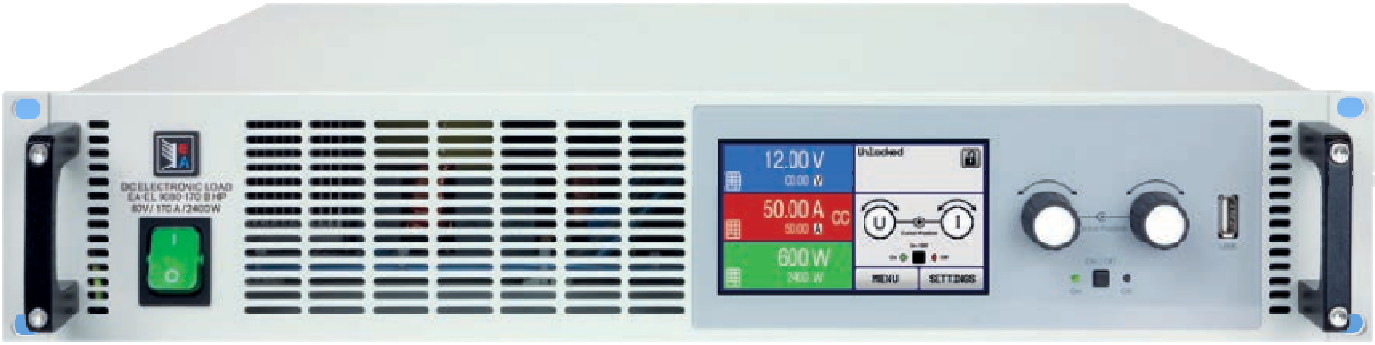
- Programmed/sequenced dynamic load testing and aging simulation of DC sources of any kind such as battery chargers, telecom/industrial/open-frame/built-in and/or laboratory power supplies etc.
- Programmed/sequenced load testing of DC sources such as PV modules (small solar arrays)
- Discharging of all types of energy storage devices such as batteries (Li, Pb, Ni-Cad, Ni-MH) capacitors and fuel cells.
- Programmed/sequenced testing of semiconductors, passive and active electronic components such us rectifiers, fuses, transistors (IGBT,FET), contacts, diodes, circuit breakers etc.

Elektro-Automatik

Conventional Electronic Loads

EA-EL 9000 B HP 2U

FPGA controller
(Field Programmable Gate Array)



Elektro-Automatik

EA-EL 9000 B HP 2U

FPGA controller
(Field Programmable Gate Array)

Electronic Load (conventional) with versatile multi-function controller

This adjustable and programmable 19” 2U conventional electronic load series is equipped with a highly performing FPGA (Field Programmable Gate Array) controller with 16-bit resolution. It features a highly flexible DC input range for a usage at either high voltage or high current as required, within the nominal power rating. It is equipped with a comfortable TFT touch panel (easy-to-operate intuitive menu structure) integrating multiple functions such as a function generator with default wave forms (e.g. sinus, square, trapezoidal, ramp, arbitrary), memory, alarm manager and user profiles. It displays U/I/R/P values with 4 digit resolution. The DC input has and active suppression to impede oscillations, an input filter protection against excessive HF AC content, a sophisticated thermal management for a gradual automatic derating against excessive load/temperature conditions, is highly stable owing to a measurement-band of 1Mhz for U/I/P and allows 0...100% adjustable parameters. It is extremely dynamic (50µs current pulses) and generates no ripple (FET linear technology). For external automated control, this series is supplied with on-board isolated 0-5V/0-10V (isolated) analogue and USB interface. An intelligent plug’n play slot allows retrofitting a multiple choice of optionally available interface modules such as CAN, Ethernet, Profibus, Modbus and others. This series is an ideal tool for all kind of demanding load testing to provide for reproducible test data and is suitable for automated system integration to form heavy-duty load banks.

- 600W to 2.4kW
- 0-80V up to 0-750V DC
- 0-10A up to 0-170A depending on model
- Provide rated steady power at a higher ambient temperature of 30°C
- FPGA controlled and programmable
- Isolated analogue 0-5V/0-10V & USB interface on board
- Operation modes CV, CC, CP, CR, battery discharge mode, enhanced filters and protective functions
- Integrated sequencer with default waveforms, memory, alarm manager, user profiles
- TFT touch panel (64,000 colours) and setting encoders (intuitive easy-to-operate HMI)
- Plug’n play digital interface slot (many optional interfaces e.g. Ethernet, CANopen, Profibus etc.)
- Control software “ea-power-control“ for automated testing & data logging
- Housing 19” 2U for all power ratings up to 2.4kW
- True master-slave parallel operation with summary function, stackable to create heavy duty load racks

Elektro-Automatik

EA-EL 9000 B HP 2U

FPGA controller
(Field Programmable Gate Array)

Meters	U/I/P/R, TFT touch Display, 4-digit
Input voltage	90-264V / 45-66Hz
Housing WxHxD	19” rack 2U, 498 mm deep incl. terminals (485 x 88 x 498 mm)

Typical Usage:

- For laboratory usage in R&D and industry , for low noise and highly dynamic applications
- Automated load test benches and burn-in rooms

Typical Applications:

- Programmed/sequenced dynamic load testing and aging simulation of DC sources of any kind such as battery chargers, telecom power-supplies, industrial and laboratory power supplies, open-frame/built-in power supplies etc.
- Programmed/sequenced load testing of DC sources such as PV modules (solar arrays), car and truck alternators, electric vehicle motors (operating in generator mode).
- Discharging of all types of energy storage devices such as batteries (Li, Pb, Ni-Cad, Ni-MH) capacitors and fuel cells.
- Programmed/sequenced testing of semiconductors, passive and active electronic components such us rectifiers, fuses, transistors (IGBT,FET), contacts, diodes, circuit breakers etc.

Elektro-Automatik

Conventional Electronic Loads

EA-EL 9000 B HP 2Q

FPGA controller
(Field Programmable Gate Array)

Elektro-Automatik

EA-EL 9000 B HP 2Q

FPGA controller
(Field Programmable Gate Array)

Electronic Load (conventional) with versatile multi-function controller

This adjustable and programmable 19” 2U conventional electronic load series is equipped with a highly performing FPGA (Field Programmable Gate Array) controller with 16-bit resolution. It features a highly flexible DC input range for a usage at either high voltage or high current as required, within the nominal power rating. It is equipped with USB port for PC remote control for basic V/I/P/R setting and optional functions such as a function generator with default wave forms (e.g. sinus, square, trapezoidal, ramp, arbitrary), memory, alarm manager and user profiles. The DC input has and active suppression to impede oscillations, an input filter protection against excessive HF AC content, a sophisticated thermal management for a gradual automatic derating against excessive load/temperature conditions, is highly stable owing to a measurement-band of 1Mhz for U/I/P and allows 0...100% adjustable parameters. It is extremely dynamic (50µs current pulses) and generates no ripple (FET linear technology). For external automated control, this series is supplied with on-board isolated 0-5V/0-10V (isolated) analogue and USB interface. An intelligent plug’n play slot allows retrofitting a multiple choice of optionally available interface modules such as CAN, Ethernet, Profibus, Modbus and others. This series is an ideal tool for all kind of demanding load testing to provide for reproducible test data and is suitable for automated system integration to form heavy-duty load banks.

- 600W to 2.4kW
- 0-80V up to 0-750V DC
- 0-10A up to 0-170A depending on model
- Achieve very short voltage fall times when running the loads in parallel to a power supply
- FPGA controlled and programmable
- Isolated analogue 0-5V/0-10V & USB interface on board
- Operation modes CV, CC, CP, CR, battery discharge mode, enhanced filters and protective functions
- Integrated sequencer with default waveforms, memory, alarm manager, user profiles
- TFT touch panel (64,000 colours) and setting encoders (intuitive easy-to-operate HMI)
- Plug’n play digital interface slot (many optional interfaces e.g. Ethernet, CANopen, Profibus etc.)
- Control software “ea-power-control“ for automated testing & data logging
- Housing 19” 2U for all power ratings up to 2.4kW
- Stackable to create heavy duty load racks

Elektro-Automatik

EA-EL 9000 B HP 2Q

FPGA controller
(Field Programmable Gate Array)

Meters	U/I/P/R, TFT touch Display, 4-digit
Input voltage	90-264V / 45-66Hz
Housing WxHxD	19” rack 2U, 498 mm deep incl. terminals (485 x 88 x 498 mm)

Typical Usage:

- Works with power supplies e.g., PSI 9000 2U/3U for two-quadrants operation (2Q). For instance, the regenerated energy of decelerating motor could be consumed; or discharge the battery using two-quadrants operation (2Q)
- Automated load test benches and burn-in rooms

Typical Applications:

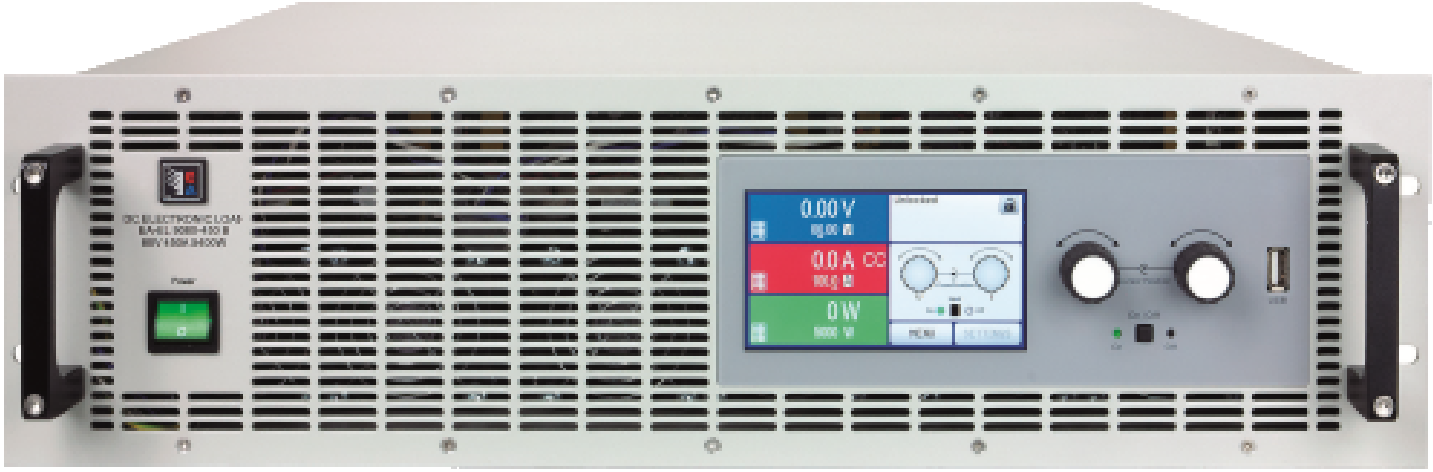
- Programmed/sequenced dynamic load testing and aging simulation of DC sources of any kind such as battery chargers, telecom power-supplies, industrial and laboratory power supplies, open-frame/built-in power supplies etc.
- Programmed/sequenced load testing of DC sources such as PV modules (solar arrays), car and truck alternators, electric vehicle motors (operating in generator mode).
- Discharging of all types of energy storage devices such as batteries (Li, Pb, Ni-Cad, Ni-MH) capacitors and fuel cells.
- Programmed/sequenced testing of semiconductors, passive and active electronic components such us rectifiers, fuses, transistors (IGBT,FET), contacts, diodes, circuit breakers etc.

Elektro-Automatik

Conventional Electronic Loads

EA-EL 9000 B 3U, 6U

FPGA controller
(Field Programmable Gate Array)



Elektro-Automatik

EA-EL 9000 B 3U, 6U

FPGA controller
(Field Programmable Gate Array)

Electronic Load (conventional) with versatile multi-function controller

This adjustable and programmable 19” 3U/6U conventional electronic load series is equipped with a highly performing FPGA (Field Programmable Gate Array) controller with 16-bit resolution. It features a highly flexible DC input range for a usage at either high voltage or high current as required, within the nominal power rating. It is equipped with a comfortable TFT touch panel (easy-to-operate intuitive menu structure) integrating multiple functions such as a function generator with default wave forms (e.g. sinus, square, trapezoidal, ramp, arbitrary), memory, alarm manager and user profiles. It displays U/I/R/P values with 4 digit resolution. The DC input has and active suppression to impede oscillations, an input filter protection against excessive HF AC content, a sophisticated thermal management for a gradual automatic derating against excessive load/temperature conditions, is highly stable owing to a measurement-band of 1Mhz for U/I/P and allows 0...100% adjustable parameters. It is extremely dynamic (50µs current pulses) and generates no ripple (FET linear technology). For external automated control, this series is supplied with on-board isolated 0-5V/0-10V (isolated) analogue and USB interface. An intelligent plug’n play slot allows retrofitting a multiple choice of optionally available interface modules such as CAN, Ethernet, Profibus, Modbus and others. This series is an ideal tool for all kind of demanding load testing to provide for reproducible test data and is suitable for automated system integration to form heavy-duty load banks.

- 1.5kW to 14.4kW
- 0-80Vup to 0-750V DC
- 0-20A up to 0-1020A depending on model
- FPGA controlled and programmable
- Isolated analogue 0-5V/0-10V & USB interface on board
- Operation modes CV, CC, CP, CR, battery discharge mode, enhanced filters and protective functions
- Integrated sequencer with default waveforms, memory, alarm manager, user profiles
- TFT touch panel (64,000 colours) and setting encoders (intuitive easy-to-operate HMI)
- Plug’n play digital interface slot (many optional interfaces e.g. Ethernet, CANopen, Profibus etc.)
- Control software “ea-power-control“ for automated testing & data logging
- Housing 19” 3U for all power ratings up to 7.2kW
- True master-slave parallel operation with summary function, stackable to create heavy duty load racks

Elektro-Automatik

EA-EL 9000 B 3U, 6U

FPGA controller
(Field Programmable Gate Array)

Meters	U/I/P/R, TFT touch Display, 4-digit
Input voltage	115/230V~ 50/60Hz
Housing WxHxD	19” rack 3U, 510 mm deep incl. terminals (485 x 133 x 510 mm)

Typical Usage:

- For laboratory usage in R&D and industry , for low noise and highly dynamic applications
- Automated load test benches and burn-in rooms

Typical Applications:

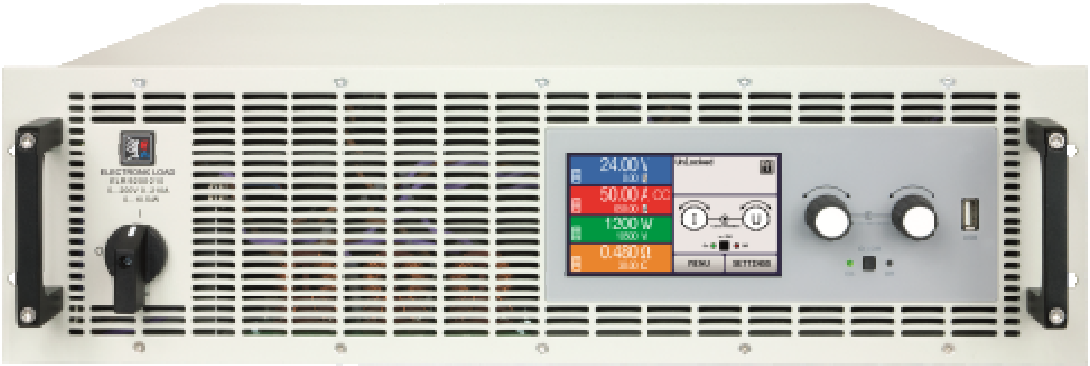
- Programmed/sequenced dynamic load testing and aging simulation of DC sources of any kind such as battery chargers, telecom power-supplies, industrial and laboratory power supplies, open-frame/built-in power supplies etc.
- Programmed/sequenced load testing of DC sources such as PV modules (solar arrays), car and truck alternators, electric vehicle motors (operating in generator mode).
- Discharging of all types of energy storage devices such as batteries (Li, Pb, Ni-Cad, Ni-MH) capacitors and fuel cells.
- Programmed/sequenced testing of semiconductors, passive and active electronic components such us rectifiers, fuses, transistors (IGBT,FET), contacts, diodes, circuit breakers etc.

Elektro-Automatik

DC electronic loads with energy recovery

EA-ELR 9000 3U

FPGA controller
(Field Programmable Gate Array)



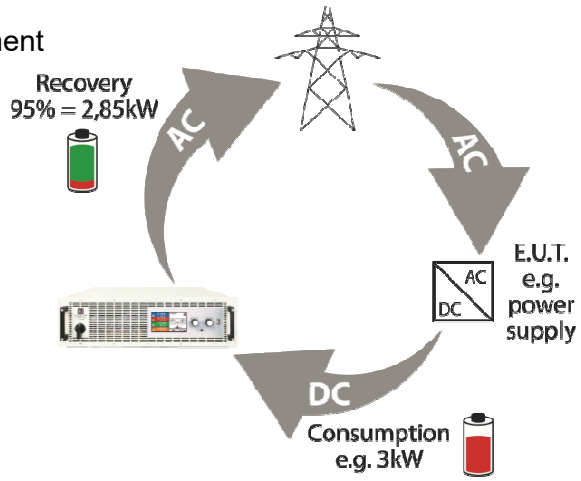
Elektro-Automatik

EA-ELR 9000 3U

FPGA controller
(Field Programmable Gate Array)

High-End DC Electronic Loads with Energy Recovery into the Local Grid.

Most electricity & cost saving, these electronics loads do not dissipate the extracted energy from a DC source into the ambient, but recover up to 95% of the energy into the local grid. This reduces the electricity bill and eases the heat management within a burn-in installation by reducing the investment for heavy temperature cooling devices which are also heavy electricity consumers.



- 3.5kW, 7.0kW, 10.5kW
- 0-80V up to 0-1500V
- 0-22A up to 0-510A
- DC-to-AC mains-synchronised inverter function with energy recovery into the local grid (electricity and cost saving, fast amortisation/ROI)
- Highly isolated built-up of HMI, power boards and communication unit, eliminating major potential problems such as ground loops
- FPGA based controller with integrated sequencer, freely programmable with default wave forms, fast stimulus response / programming and performing of settings, up to 16 bit resolution
- Insulated analogue interface 0-5V/0-10V and USB “on board”
- Operation modes CV, CC, CP, CR
- TFT touch display, 64,000 colours, up to 5-digit for a highly intuitive operation
- Plug’n play slot for optional digital interfaces RS232, CAN, Ethernet, Profibus, Profinet, Devicenet, Modbus ans more (refer to EA-IF AB-XX options)
- Freeware and professional control software “ea-power-control”
- Housings 19” rack 3U, 714 mm depth for all power ratings (3.5kW to 10.5kW)
- True master-slave bus with summary function for parallel operation, share-bus to form a sink-source system
- Protections: OTP, short-circuit, overload
- Optional ENS (AC grid monitor) for safe disconnection (mandatory when testing autarkic sources)

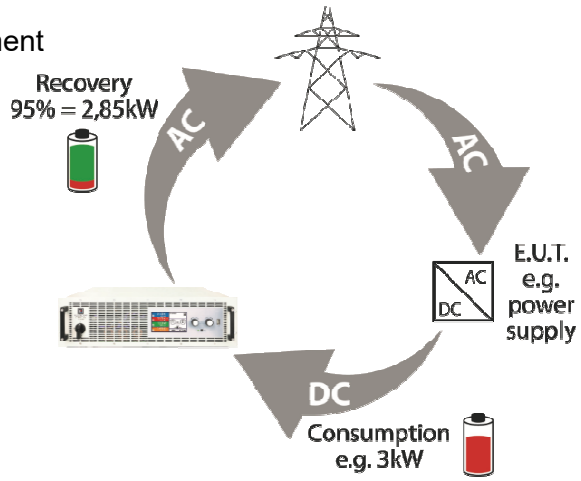
Elektro-Automatik

EA-ELR 9000 3U HP

FPGA controller
(Field Programmable Gate Array)

High-End DC Electronic Loads with Energy Recovery into the Local Grid.

Most electricity & cost saving, these electronics loads do not dissipate the extracted energy from a DC source into the ambient, but recover up to 95% of the energy into the local grid. This reduces the electricity bill and eases the heat management within a burn-in installation by reducing the investment for heavy temperature cooling devices which are also heavy electricity consumers.



- 5kW, 10kW, 15kW
- 0-80V up to 0-1500V
- 0-22A up to 0-510A
- AC wide range input 360-528V, for 400V and 480V grids
- DC-to-AC mains-synchronised inverter function with energy recovery into the local grid (electricity and cost saving, fast amortisation/ROI)
- Highly isolated built-up of HMI, power boards and communication unit, eliminating major potential problems such as ground loops
- FPGA based controller with integrated sequencer, freely programmable with default wave forms, fast stimulus response / programming and performing of settings, up to 16 bit resolution
- Insulated analogue interface 0-5V/0-10V and USB “on board”
- Operation modes CV, CC, CP, CR
- TFT touch display, 64,000 colours, up to 5-digit for a highly intuitive operation
- Plug’n play slot for optional digital interfaces RS232, CAN, Ethernet, Profibus, Profinet, Devicenet, Modbus ans more (refer to EA-IF AB-XX options)
- Freeware and professional control software “ea-power-control”
- Housings 19” rack 3U, 714 mm depth for all power ratings (5kW to 15kW)
- True master-slave bus with summary function for parallel operation, share-bus to form a sink-source system
- Protections: OTP, short-circuit, overload
- Optional ENS (AC grid monitor) for safe disconnection (mandatory when testing autarkic sources)

Elektro-Automatik

EA-ELR 9000 3U and ELR 9000 3U HP

FPGA controller
(Field Programmable Gate Array)

Typical usage:

- For laboratory usage in R&D and industry , where low-noise and low-heat dissipation is crucial
- Automated load test benches and burn-in rooms with critical temperature conditions

Typical Applications:

- Programmable and sequenced burn-in testing and ageing simulation of DC sources (power supplies) such as battery chargers, telecom power-supplies, industrial and laboratory power supplies, open-frame/built-in power supplies.
- Partial-, nominal- and overload testing of DC sources such as PV modules (solar arrays), car and truck alternators, electric vehicle motors (operating in generator mode)
- Discharging of all types of electro-chemical storage sources (batteries) such as Lithium, lead, Ni-Cd, Ni-MH as well as fuel cells, with optional ENS/BISI (AC grid monitor device, mandatory when testing autarkic sources)
- Sequenced testing of semiconductors, passive and active electronic components such as rectifiers, fuses, circuit breakers, contactors, IGBT, transistors, connectors, diodes
- All of the above combined with the exceptional feature of converting the extracted DC power into mains synchronised AC power and returning it onto the mains/grid with a an efficiency of >90%.

Note:

- EA-Elektro-Automatik's recovery load series ELR 9000 3U is intended for general industrial use and laboratory operation and therefore does not fall under the regulations of Electric Power Generation and Distribution as stated in e.g. VDE-AR-N 4105
- Nevertheless, the units are equipped with a grid monitor system, monitoring phase voltage and frequency. In the event of a mains power failure or substantial deviation to the default limits, the recovery load will stop operating to safeguard any electricians working on the grid not expecting voltage on the phases. Subject to local power utilities standards, an external country-specific grid monitor box may be required (see under options: EA-ENS N/A)

Elektro-Automatik

EA-ELR 9000 3U & ELR 9000 3U HP

FPGA controller
(Field Programmable Gate Array)

Example on how an electronic „recovery" load saves money:

The electronic loads of series ELR 9000 lead to substantial cost reduction. Up to 95% of the power required for testing is converted by an inverter with PFC to sine wave and re-directed back to the grid, thus generating only little losses. Expensive air-conditioning installation is no longer required and high energy costs are eliminated. Environmental balance is improved and costs reduced.

This can be shown in a typical application. For a burn-in test, a -48V DC power supply of a telecom transmitter system is to be tested. The 3kW supply unit with a 56V output voltage is tested for 2 hours at 53.5A. During an 8-hour shift, the daily energy consumption is 24 kW/h (3kW x 8h, costing € 0.25 per kW/h) and will be repeated during 220 working days per year.

Using an electronic load with recovery function, at least 90% of this power will be recovered:

Test costs with a conventional load 24 kWh x € 0.25 = € 6.00 / day = € 1,320.00 / year

Test costs with a recovery load 2.4 kWh* x € 0.25 = € 0.60 / day = € 132.00 / year
* (2.4 kW resulting from a 90% recovery into the grid)

Annual saving € 1,320.00 less € 132.00 = € 1,188.00

Owing to the high efficiency and subsequently a high saving rate, a fast pay back of the price difference between a recovery load and a conventional load is achieved. The above calculation even does not take into account further savings resulting out of the omission of an air conditioning equipment, usually required in burn-in installations equipped with conventional loads. Subject to a long-term testing with recovery loads, these may even pay back in full within only a few years.

Example ELR 9080-170 (3.5kW) list price € 6,880.00 divided by € 1,1880 annual saving = 5.8 year for a full amortisation (ROI).

A comparable ROI calculation using a higher-power recovery load (e.g. EL 9080-510 10.5kW, list price Eur 12,040.00) at 10KW load x 8 h/day x 0.25 €/kWh x 220 working days bring about an anual saving of € 3,960.00 net and thus a full ROI within 3 years (!)

And the environment will be most grateful about is as well!

Elektro-Automatik

Electronic Loads (Multichannel) with Energy Recovery

EA-ELR 5000 6U

Cortex M3 µ-processor

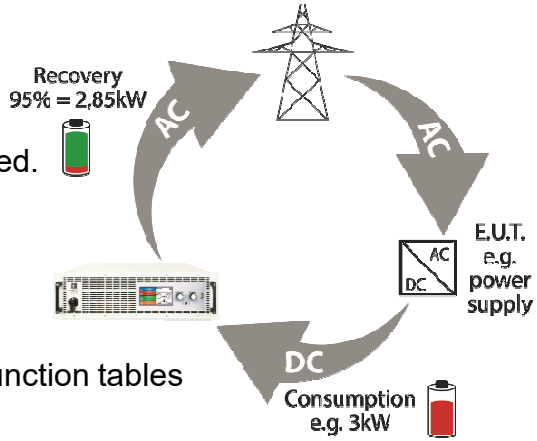
Elektro-Automatik

EA-ELR 5000 6U

Cortex M3 µ-processor

Multi-Channel DC Electronic Load with Energy-Recovery Function

High-performing, micro-processor controlled "**multi-channel"** electronic recovery load series consisting of a 19" 6U hosting cabinet for 19" rack integration
Hosting up to 10 electronic-load modules (ELM 5080-25 or 5200-12) each rated 320W.
EA-ELR 5000 series features a unique state-of-the-art inverter function with energy recovery. The energy extracted from the DC source under testing is inverted and mains-synchronized to 220-240V~ 50/60Hz and fed back into the local power grid, With an inverter efficiency of up to 92%, the enormous heat dissipation of 100% typically found at conventional electronics loads is therefore almost entirely eliminated.



- Micro-processor controlled (Cortex M3), programmable
- For laboratory, R&D, industry, automated test benches, burn-in facilities
- DC-to-AC Inverter function with energy recovery into the local mains
- "plug-in" load modules, 0-80V or 0-200V @ 320W
- On-board Ethernet interface for full remote control, front end USB port to insert function tables by memory stick and for firmware update
- Operation modes CV, CC, CP
- TFT 64,000 colour touch display and encoder (intuitive easy-to-use HMI)
- Freeware and professional control software "ea power control" for automated testing & data logging
- Housing 19" rack 6U to host up to 10 load modules each 320W
- IEC 320 AC input receptacle, DC via front-end screw terminals with safety cover
- Full amortization (ROI) by saving electricity after approx. 9 years (example with 3.2kW load x 8 h/day x 220 working days and 0.25 Eur per kW/h (in Germany) 3.2kW x 8 x 220 = 5,632kW/h x €0.25=Eur 1,408 x 0.92 eff.= € 1,295,36 of saving
  List price Eur 11,739.00 net / € 1,214.40 saving = ROI after 9.0 Years

Elektro-Automatik

EA-ELR 5000 6U

Cortex M3 µ-processor

Meters (HMI) TFT touch display, 320 x 240 pixel, W x H 38 x 50 mm, 65,000 colours
Mains voltage 195-255V ~ @ 50/60 Hz (Europe 220/230/240V, US/Taiwan 208/220V)
Housing WxHxD 19” 6U, depth 515 mm (320W Module: WxHxD 81 x 132.5 x 315 mm)

Accessories incl.: Manual DE / ENG / CN, mains power cord Europe/UK/CH

Typical usage:

- For laboratory usage in R&D and industry , where low-noise and low-heat dissipation is crucial
- Automated load test benches and burn-in rooms with critical temperature conditions

Elektro-Automatik

EA-ELR 5000 6U

Cortex M3 µ-processor

Typical applications:

- Programmable and sequenced burn-in testing and ageing simulation of low-power DC sources (power supplies) such as battery chargers, built-in industrial & DIN-rail power supplies, small laboratory power supplies, computer power supplies (desktop/ATX) etc.
- Discharging of all types of electro-chemical storage sources (batteries) such as single cell Lithium or small power packs, lead, Ni-Cd or Ni-MH batteries,
- Optional: ENS/BISI (AC grid monitor, mandatory for testing autarkic sources such as batteries)
- Sequenced testing of semiconductors, passive and active electronic components such as rectifiers, fuses, circuit breakers, contactors, IGBT, transistors, connectors, diodes etc.
- All of the above combined with the exceptional feature of converting the extracted DC power into mains- synchronised AC power and to feed back this energy into the local grid with a an efficiency of up to 90%.

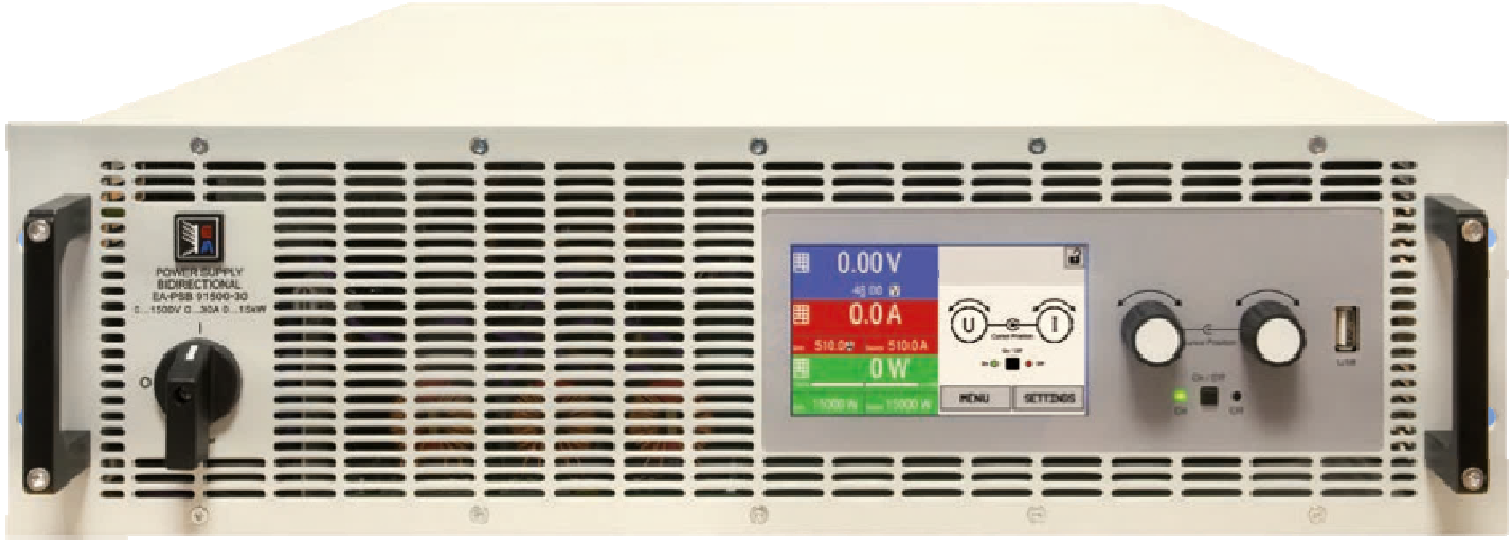
EA-Elektro-Automatik's recovery load series ELR 5000 3U is intended for general industrial use and laboratory
operation and therefore does not fall under the regulations of Electric Power Generation and Distribution as stated in e.g. VDE-AR-N 4105 Nevertheless, the units are equipped with a grid monitor system, monitoring phase voltage and frequency. In the event of a mains power failure or substantial deviation to the default limits, the recovery load will stop operating to safeguard any electricians working on the grid not expecting voltage on the phases. Subject to local power utilities standards, an external country-specific grid monitor box may be installed (see under options: EA-ENS N/A)

Elektro-Automatik

Programmable Bi-Directional Power Supplies

EA-PSB 9000 3U

FPGA controller
(Field Programmable Gate Array)



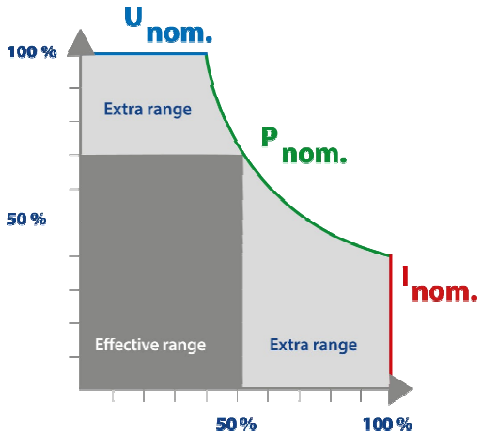
Elektro-Automatik

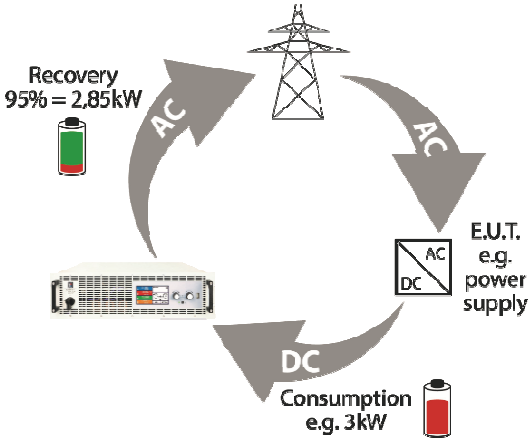
EA-PSB 9000 3U

FPGA controller
(Field Programmable Gate Array)

Highly dynamic, high efficiency and compact true bi-directional power supplies

- AC wide range input 360V-528V, for operation on 400V and 480V grids
- Bi-directional - power supply and load in one
- Energy recovery with high efficiency
- Power ratings: 5kW, 10kW or 15kW, expandable up to 480kW
- Voltage ratings: 60V up to 1500V
- Current ratings: 30A up to 360A
- Flexible, power regulated DC <-> AC stage
- Various protection circuits (OVP, OCP, OPP and OTP)
- Intuitive TFT touch panel with display for values status and notifications
- Remote sensing with automatic detection
- Galvanically isolated, analog interface
- Integrated function generator
- Battery test, MPP tracking simulation
- USB port integrated
- Optional, digital interface modules
- SCPI and ModBus RTU
- LabView support by VI package





Elektro-Automatik

EA-PSB 9000 3U

FPGA controller
(Field Programmable Gate Array)

Meters	U/I/P/R, TFT touch Display, 4-digit
Input voltage	360-528V~ 45/66Hz
Housing WxHxD	19” rack 3U, 735 mm deep incl. terminals (485 x 133 x 735 mm)

Typical Usage:

- Two-Quadrants operation in compact size, 3U Height offer max. 15kW source and load (regenerative) function with over 90% efficiency
- For laboratory usage in R&D and industry , for low noise and highly dynamic applications
- Automated load test benches and burn-in rooms
- Advanced heavy-duty applications (5kW - 150kW and more) in the industrial sector, were “pure” DC laboratory power quality (mV regulation and mV ripple) is indispensable.

Typical Applications:

- Charging and discharging of Li-Ion power-packs and high-power ultra-caps.
- Automotive DC-DC bi-directional converter / EV Electric motor functionality testing
- Automotive standard LV 123 (DC Voltage Dynamic Test)
- Battery emulation in energy storage system. True simulation of battery charging and discharging by varying the voltage.
- A full bi-directional AC-DC converter in DC-Micro Grid simulation application.
  It could be act as Solar panel simulator and battery in the DC-Micro Grid network

Elektro-Automatik

EA-IF AB

IF-AB-RS232	IF-AB-ETH1P	IF-AB-MBUS1P	IF-AB-CANO or IF-AB CAN	IF-AB-ECAT	IF-AB-PNET	IF-AB PBUS
RS232	Ethernet	Modbus TCP	CANopen or CAN hardware	EtherCAT	Profinet-IO Port	Profibus DPV1

Elektro-Automatik

EA-IF AB

General

The new EA IF AB interfaces are plug-in digital interface modules for power supply series
EA-PSI 9000 2U/3U, for electronic load series ELR 9000 as well as for future series of EA programmable power supplies and electronic loads.

- Supports LabView and several programming languages
  For RS232 and Ethernet interfaces, we provide ready-to-use LabView VIs. The communication protocol is open and includes full documentation, thus easing the full integration in virtually any programming language.

- Software and drivers
  All interface cards are supplied with a tool CD containing documentation and software.

Elektro-Automatik

EA-IF AB

Specific features:

► **RS232**
- Transfer speed: max. 115200 Bd
- D-sub, male, 9-pole for null modem cable

► **CANopen**
- Transfer speed: max. 1MBit/s
- Full CANopen slave
- Auto-baud
- Max. 32 TPDO and 32 RPDO
- EDS (Electronic Data Sheet) included
- 1x D-Sub socket, male, 9-pole

► **Profibus**
- Transfer speed: max. 12MBit/s
- Full DPV1 slave
- GSD (Generic Station Device) file included
- 1x D-Sub socket, female, 9-pole

► **ProfiNet 1P**
- Transfer speed: 100MBit/s, full duplex
- PROFINET IO communication
- Up to two APIs (incl. API0)
- Up to 32767 ADIs
- Up to 256 Bytes realtime I/O
- 1x RJ45 socket, 8-pole

► **ProfiNet 2P**
- Transfer speed: 100MBit/s, full duplex
- PROFINET IO communication
- Up to two APIs (incl. API0)
- Up to 32767 ADIs
- Up to 256 Bytes realtime I/O
- 2x RJ45 socket 8-pole, with switch

► **Ethernet 1P**
- Transfer speed: 10/100MBit/s
- Transparent socket
- 1x RJ45 socket, 8-pole

► **Ethernet 2P**
- Transfer speed: 10/100MBit/s
- Transparent socket
- 2x RJ45 socket 8-pole, with switch
- DLR (Device Level Ring)

► **Modbus-TCP 1P**
- Transfer speed: 10/100MBit/s
- Full ModBus TCP server (slave)
- 256 Bytes in/out
- 1x RJ45-Buchse, 8polig

► **Modbus-TCP 2P**
- Transfer speed: 10/100MBit/s
- Full ModBus TCP server (slave)
- 256 Bytes in/out
- 2x RJ45-Buchse 8polig
- Integrated switch for string bus topology

► DeviceNet
- Transfer speed: 125kBd - 500kBd
- 256 Bytes in/out
- DeviceNET function: adapter (slave)
- Implicit & Explicit Messaging, UCMM
- 1x 5pole WAGO plug

► CAN
- Transfer speed: max. 1MBit/s
- CAN standard 2.0 A and 2.0 B compatible
- 1x D-Sub socket, male, 9-pole

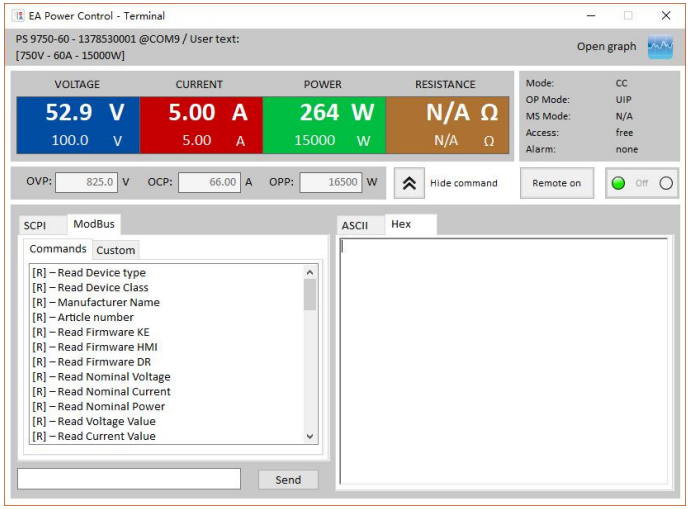
Elektro-Automatik

EA-IF AB

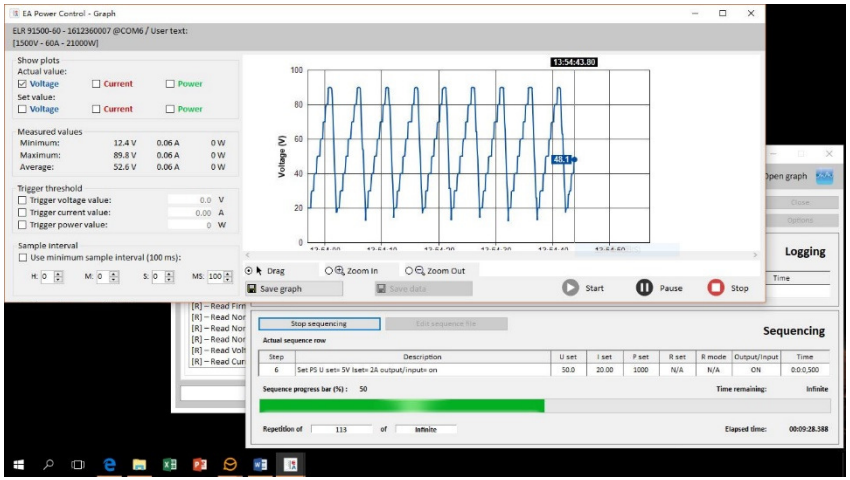
Type	Description
EA-IF-AB-RS232	RS232 Interface
EA-IF-AB-PBUS	Profibus DPV1-Interface
EA-IF-AB-CANO	CANopen-Interface
EA-IF-AB-DNET	DeviceNet Interface
EA-IF-AB-MBUS1P	Modbus-TCP 1 Port Interface
EA-IF-AB-MBUS2P	Modbus-TCP 2 Port Interface
EA-IF-AB-ETH1P	Ethernet/IP 1 Port-Interface
EA-IF-AB-ETH2P	Ethernet/IP 2 Port-Interface
EA-IF-AB-PNET1P	Profinet-IO 1 Port-Interface
EA-IF-AB-PNET2P	Profinet-IO 2 Port-Interface
EA-IF-AB-CAN	CAN hardware-Interface

Elektro-Automatik

EA POWER CONTROL



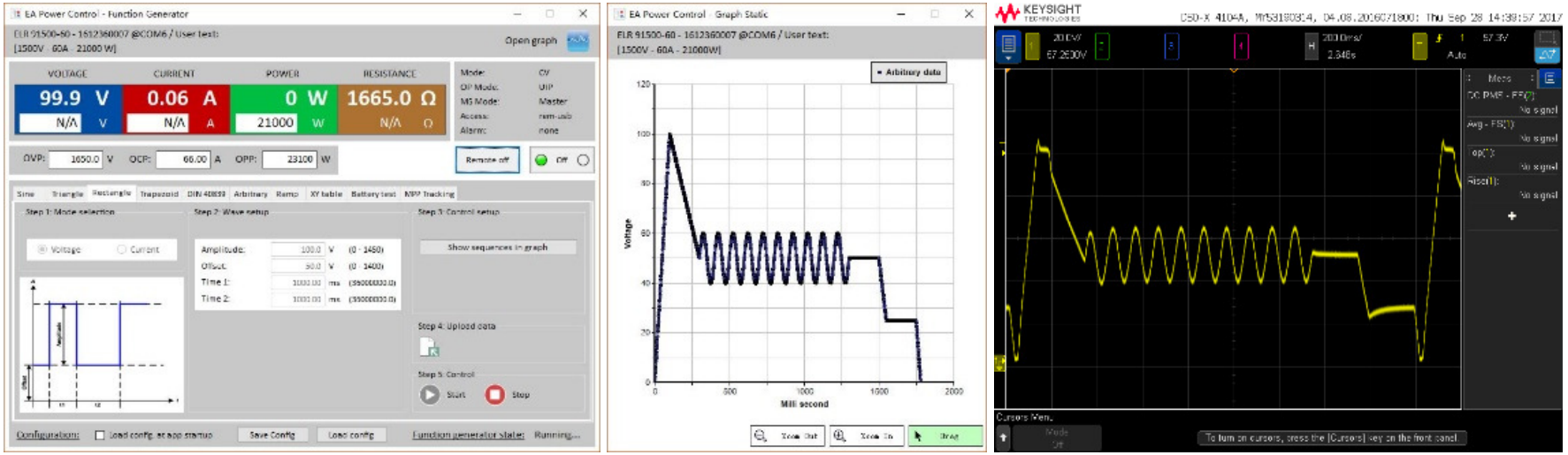
Main control window and Command window for programming reference



Sequencing and Logging functions for script-based programming by PC (waveform monitoring is licensed feature)

Elektro-Automatik

EA POWER CONTROL



Function Generator Editing Mode (Main User Interface, Waveform Preview, Actual Output from Oscilloscope)

Support PV Inverter Efficiency Test – EN 50530

Elektro-Automatik

EA POWER CONTROL

Support Models

- EL 3000 B, EL 9000 T, EL 9000 DT, EL 9000 B / EL 9000 B HP / EL 9000 B 2Q, ELR 5000, ELR 9000, PS 9000 T, PSI 9000 T, PSI 9000 DT, PSI 9000 2U - 24U, PS 9000 1U / 2U / 3U, PSE 9000, PS 5000, PSI 5000

Standard Features

- Remote control of up to 6 device at once, even of different type
- Display of all actual values (U, I, P, R)
- Input of set values (U, I, P, R) and alarm thresholds (OVP, OCP, OPP)
- Setting remote control on/off, setting DC input/output on/off
- Provide command window to send and retrieve commands by SCPI or ModBus protocol, which helps engineers to develop their own integrated system more easily.
- Sequencing & Logging (semi-automatic table control and data acquisition) – User can program the unit by PC in script-mode and record the U/I/P information automatically.
- Multi Control (purchasable extra feature, see below for details)

Licensed Features

- Visualisation of actual and set values on a graphical plot area, with data save features as picture or CSV (purchasable extra feature)
- Configure and use the function generator
- Multi Control - Control and monitor up to 20 devices of any model from the supported series in one window

Elektro-Automatik

EA POWER CONTROL

Licensed Features

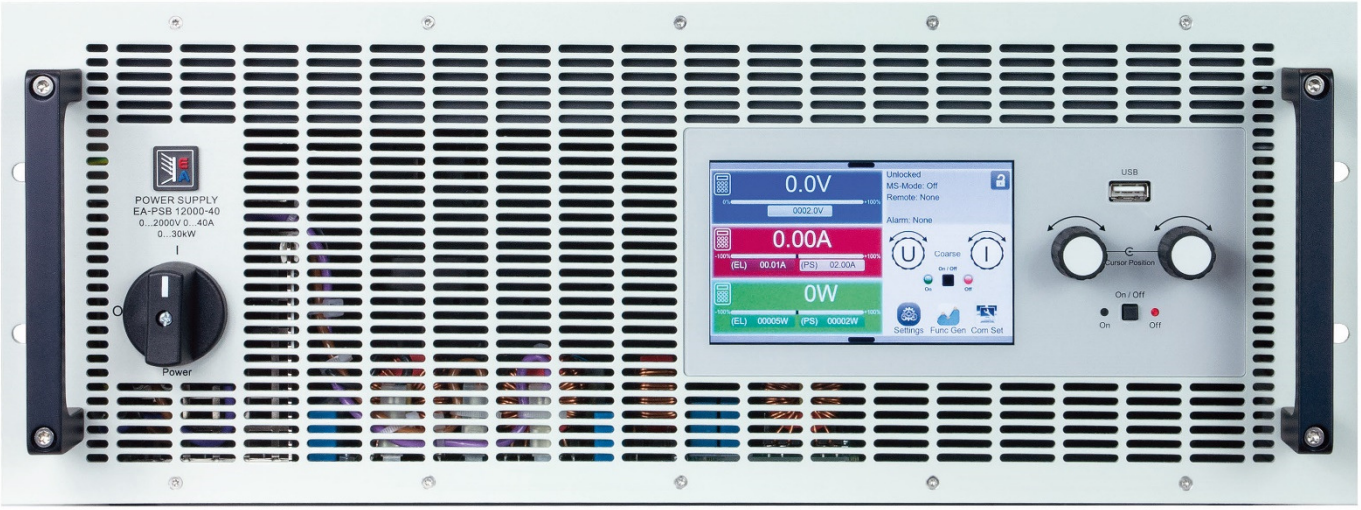
- **Visualisation of actual and set values on a graphical plot area, with data save features as picture or CSV (purchasable extra feature)**
- **Configure and use the function generator**
- **Multi Control - Control and monitor up to 20 devices of any model from the supported series in one window**

Elektro-Automatik

Programmable Bi-Directional Power Supplies

EA-PSI 10000 4U (Intelligent)

FPGA controller
(Field Programmable Gate Array)



Elektro-Automatik

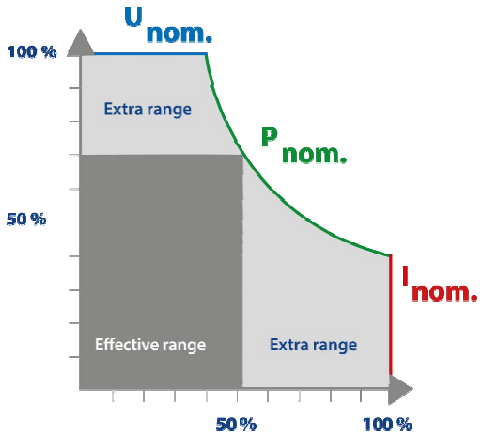
Programmable Bi-Directional Power Supplies

EA-PSI 10000 4U (Intelligent)

FPGA controller
(Field Programmable Gate Array)

High-end heavy-duty DC laboratory power-supplies featuring:

- 30kW (all auto-ranging), expandable up to 1MW and more
- 0-60V up to 0-2000V
- 0-40A up to 0-1000A
- TFT Touch display and encoder
- Operation modes CV, CC, CP, CR
- Controls identic to PSI 9000 3U
- New GUI (graphic user interface)
- New Share-Bus, galvanically isolated
- Master/Slave-Bus up to 32 devices
- Function generator
- Anybus plug-in interface modules
- LAN / USB / Analogue interface
- Digital regulation, U / I / P / R
- Available in Q2 2019

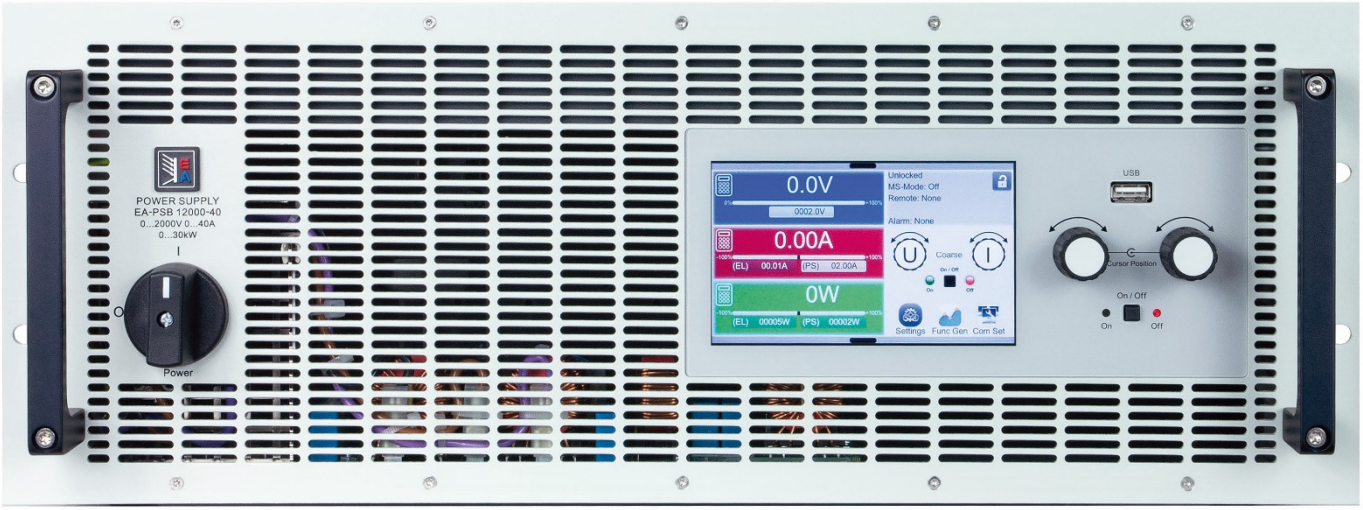


Elektro-Automatik

DC electronic loads with energy recovery

EA-ELR 10000 4U

FPGA controller
(Field Programmable Gate Array)



Elektro-Automatik

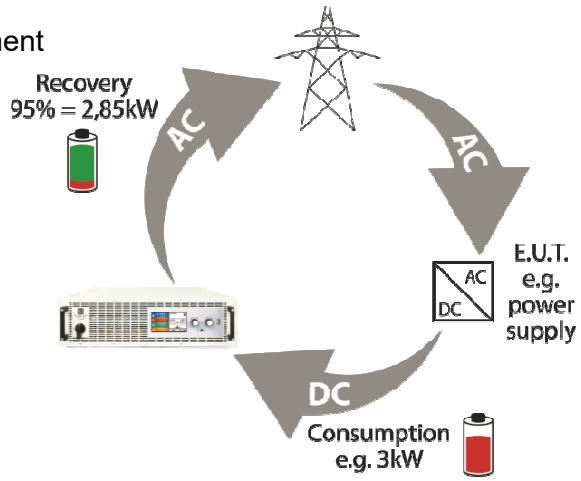
DC electronic loads with energy recovery

EA-ELR 10000 4U

FPGA controller
(Field Programmable Gate Array)

High-End DC Electronic Loads with Energy Recovery into the Local Grid.

Most electricity & cost saving, these electronics loads do not dissipate the extracted energy from a DC source into the ambient, but recover up to 95% of the energy into the local grid. This reduces the electricity bill and eases the heat management within a burn-in installation by reducing the investment for heavy temperature cooling devices which are also heavy electricity consumers.



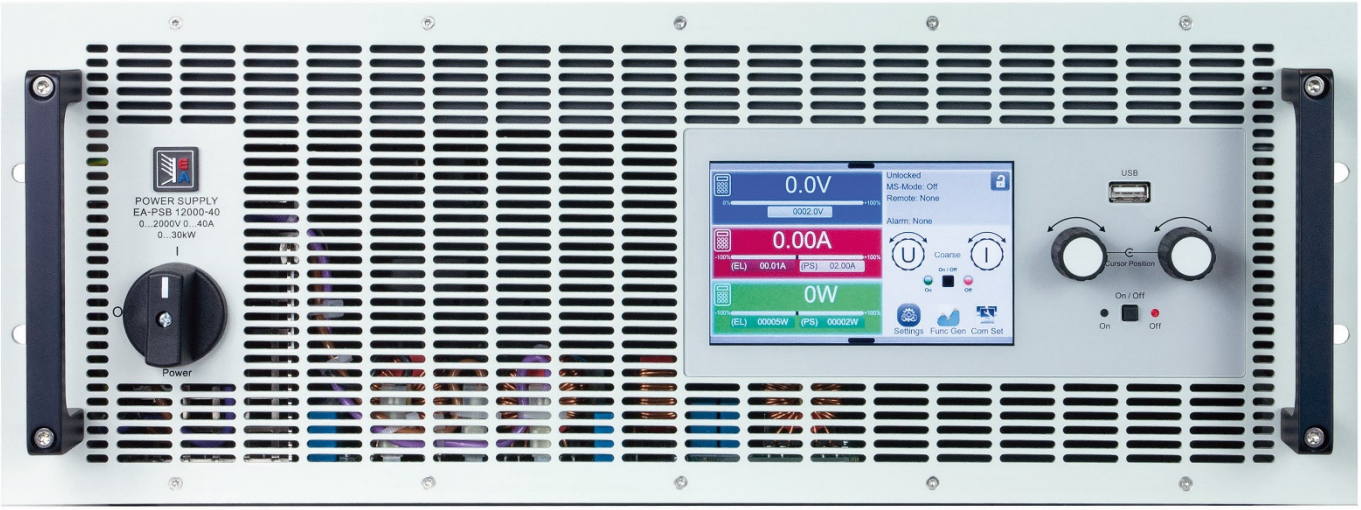
- 30kW (all auto-ranging), expandable up to 1MW and more
- 0-60V up to 0-2000V
- 0-40A up to 0-1000A
- TFT Touch display and encoder
- Operation modes CV, CC, CP, CR
- Controls identic to ELR 9000 3U
- New GUI (graphic user interface)
- New Share-Bus, galvanically isolated
- Master/Slave-Bus up to 32 devices
- Function generator
- Anybus plug-in interface modules
- LAN / USB / Analogue interface
- Digital regulation, U / I / P / R
- Available in Q2 2019

Elektro-Automatik

Programmable Bi-Directional Power Supplies

EA-PSB 10000 4U

FPGA controller
(Field Programmable Gate Array)



Elektro-Automatik

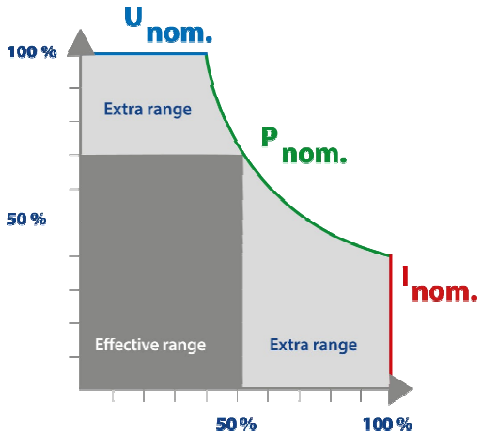
Programmable Bi-Directional Power Supplies

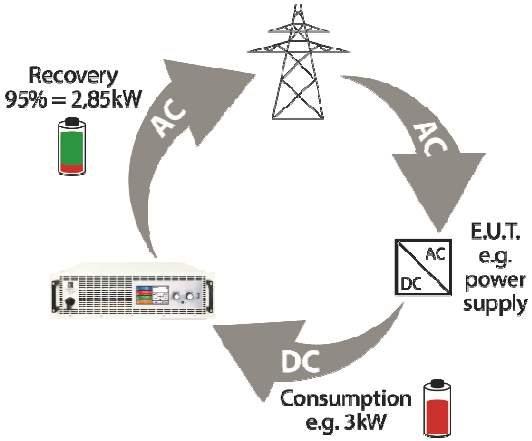
EA-PSB 10000 4U

FPGA controller
(Field Programmable Gate Array)

Highly dynamic, high efficiency and compact true bi-directional power supplies

- 30kW (all auto-ranging), expandable up to 1MW and more
- 0-60V up to 0-2000V
- 0-40A up to 0-1000A
- TFT Touch display and encoder
- Operation modes CV, CC, CP, CR
- Controls identic to PSB 9000 3U
- New GUI (graphic user interface)
- New Share-Bus, galvanically isolated
- Master/Slave-Bus up to 32 devices
- Function generator
- Anybus plug-in interface modules
- LAN / USB / Analogue interface
- Digital regulation, U / I / P / R
- Available in Q2 2019





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EA Battery Simulator - Introduction

- Basic functions and areas of application:
  - Battery simulation and emulation (via PC-Software)
  - Simulation of the connectivity behaviour of real batteries in HiL (hardware-in-the-Loop) test systems
  - Suitable for the usage with bi-directional power supply series EA-PSB 9000
  - For fast, economic and reproducible hardware tests
  - Outstanding advantages for the usage in E-mobility (EV) environment (simulation of any battery condition within the shortest time-> R & D optimisation)
- Further important basic functions:
  - Easy to scale
  - High flexibility
  - Contains profound knowledge and documentation on internal „real-life“ battery conditions
  - Simulation of Worst-Case-Scenarios

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EA Battery Simulator - Functions

- (Fast) Configuration of Temperatur, battery State of Charge (SOC), battery status of health (SOH) and many more
- Simulation of Aging Processes
- Simulate thermical interdependences inside the Battery Pack
- Enables to illustrate a large variety of battery geometries and cell arrangements
- HiL-Interfaces: EtherCat, CAN, RS232, Ethernet
- Compatible to MATLAB / SIMULINK
- Suitable for an integration into Real-time modules
- Simulation of following battery types:
  - Lead-Acid Batteries
  - Lithium-Ion Batteries
  - Lithium-Sulfate Batteries
  - Solid-state body battery
  - Redox-Flow Batteries (and other battery types upon request)

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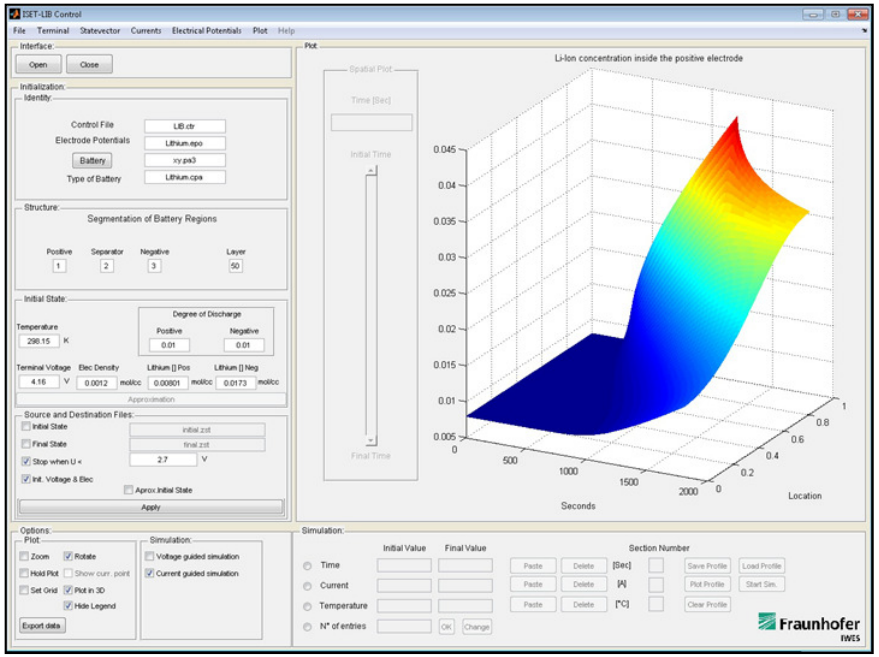
EA Battery Simulator – View into Design



- Features:
  - Transparent licensing system (Sublicensing under EA brand)
  - Specific Installation Software with License Dongle
  - Individual Adaptation to EA PSB 9000 units
  - New feature under preparation:
  - Change of specific basic parameters of a battery

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