

EA-ELR 10000 30 kW



Programmable electronic DC loads with energy recovery



EA-ELR 10750-120



- Wide range 342...528 V AC supply for operation on 380 V, 400 V or 480 V grids
- US 208 V models available
- Energy recovery with high efficiency
- DC input galvanically isolated from AC
- Input power rating: 30 kW (15 kW*) per unit, expandable to 1920 kW
- Input voltages: 60 V up to 2000 V
- Input currents: 40 A up to 1000 A per unit
- FPGA based digital control circuit
- Multilingual 5" TFT touch panel
- User profiles, function generator
- Galvanically isolated interfaces (USB, Ethernet, analog) built in
- Master-slave bus for parallel connection
- Extra front USB port for autonomous data recording to USB sticks
- Optional, digital, plug & play interfaces
- SCPI and ModBus RTU/TCP command set
- LabView VIs and remote control software (Windows)

General

This 2019 released series of electronic DC loads with energy recovery, called EA-ELR 10000, is an advancement of the series EA-ELR 9000 HP. It offers 30 kW of continuous power in an enclosure of only 4 height units. Compared to a 30 kW system built from EA-ELR 9000 HP 15 kW models, the devices of this new series save a space of 2U or one third.

The extended master-slave bus allows for a connection of up to 64 units in parallel, making it possible to build system with a total power of up to **1920 kilowatts**.

The energy recovery function converts the supplied DC energy into a synchronous sine current and feeds it back into the local grid, eliminating the usual heat dissipation to a minimum and saving energy costs at the same time. The large color TFT touch panel offers a different and intuitive kind of manual operation, compared to electronic load series of other manufacturers.

* US 208 V models

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Power ratings, voltages, currents

The available voltage range portfolio goes from models with 0...60 V DC up to models with 0...**2000 V** DC. Input currents up to **1000 A** with only one unit are available. The series offers one power classes with 0...30 kW (standard models) or 0...15 kW (US 208 V models) in only 4U for single devices, which can be extended up to 1080 kW in rack systems for a significantly higher total current.

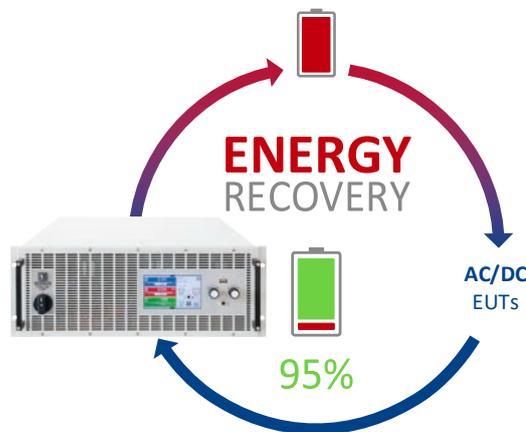
Supply

All models require a 3-phase mains supply without N conductor, as typical in the industrial grids. The devices offer a wide range AC input with 342 - 528 V AC, covering common international grid ratings between 380 V and 480 V.

Energy recovery

The most important feature of these electronic loads is that the AC input, i.e. grid connection, is also used as output for the recovery of the supplied DC energy, which will be converted with an efficiency of up to 95.5%. This way of energy recovery helps to lower energy costs and avoids expensive cooling systems, such as they are required for conventional electronic loads which convert the DC input energy into heat.

Principle view:



Operation of these recovering loads in terms of power generation is not intended. Grid protection devices, which could supervise the feedback of energy into the public grid, are available on the market for optional installation and are intended to achieve additional safety of persons and equipment, especially when running the so-called isolated operation.

Independently if there is a grid protection and supervision device installed, series EA-ELR 10000 device feature a simple and non-redundant shut-off function that covers situations when the grid voltage, frequency or phase angle may shift or when a blackout occurs where the device is supposed to stop pushing energy into the grid.

Operation (HMI)

Manual operation is done with a Gorilla glass touch panel, two rotary knobs and a pushbutton. The large color display shows all relevant set values and actual values at a glance. The whole setup is also done with the human-machine interface, as well the configuration of functions (square, triangle, sine) etc.

The display is multilingual (German, English, Russian, Chinese).



Battery test

For purposes of testing all kinds of batteries, such as for example constant current or constant resistance discharging, the devices offer a battery test mode. This show extra values for elapsed testing time and consumed capacity (Ah).

Data recorded by the PC during tests with, for example, EA Power Control can be exported as Excel table in CSV format and analyzed later in MS Excel or similar tools and even visualized as a discharge diagram.

For more detailed setup, there is also an adjustable threshold to stop the battery test on low battery voltage, as well an adjustable maximum test period.



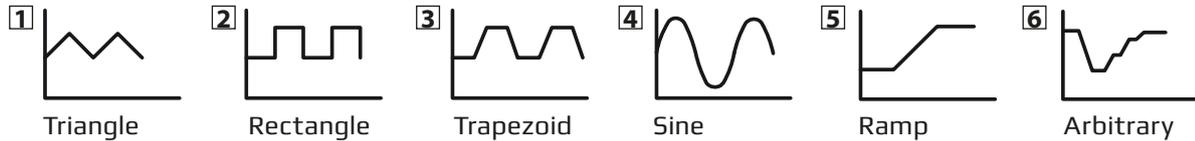
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Function generator and table control

A special feature is the comfortable, FPGA based, digital function and arbitrary generator. It enables to control and run user-customizable load profiles and can generate sine, square, saw tooth and ramp functions in arbitrary order.

With a freely programmable, digital value table of 3276 points, which is embedded in the control circuit, the devices can reproduce non-linear internal resistances, such as those of batteries or LED chains. For purposes of testing all kinds of batteries, such as for example constant current or constant resistance discharging, the devices offer a battery test mode.



Additionally to the standard functions, which are all based upon a so-called arbitrary generator, this base generator is accessible for the creation and execution of complex sets of functions, separated into up to 99 sequences. Those can be used for testing purposes in development and production. The sequences can be loaded from and saved to a standard USB stick via the USB port on the front panel, making it easy to change between different test sequences.

There is furthermore an XY generator, which is used to generate other functions such as IU, being defined by the user in form of tables (CSV file) and then loaded from USB stick.

Master-slave

All models feature a digital master-slave bus by default. It can be used to connect up to 64 units of identical models in parallel operation to a bigger system with totals formation of the actual value of voltage, current and power. The configuration of the master-slave system is either completely done on the control panels of the units or by remote control via any of digital communication interfaces. Handling of the master unit is possibly by manual or remote control (any interface). See page 33.

Share bus, series and parallel connection

The new **digital** and **galvanically isolated** „Share bus“ is introduced with this series. It's is used to balance current across multiple identical units in parallel and even series connection (models rated 360 V or higher).

Remote control & connectivity

For remote control, there are by default three interface ports (1x Ethernet, 1x USB, 1x analog) available on the rear of the devices, which can also be extended by optional, pluggable and retrofittable, digital interface modules (dedicated slot).

For the implementation into the LabView IDE the devices come with ready-to-use components (VIs) to be used with the interface types USB, RS232, GPIB or Ethernet. Other IDEs and interfaces are supported by documentation about the communication protocol.



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Control software

Included with the devices is a control software for Windows PCs, which allows for the remote control of multiple identical or even different types of devices. It has a clear interface for all set and actual values, a direct input mode for SCPI and ModBus RTU commands, a firmware update feature and the semi-automatic table control named "Sequencing". Also see page 146. Further features which can be unlocked by a purchasable license:

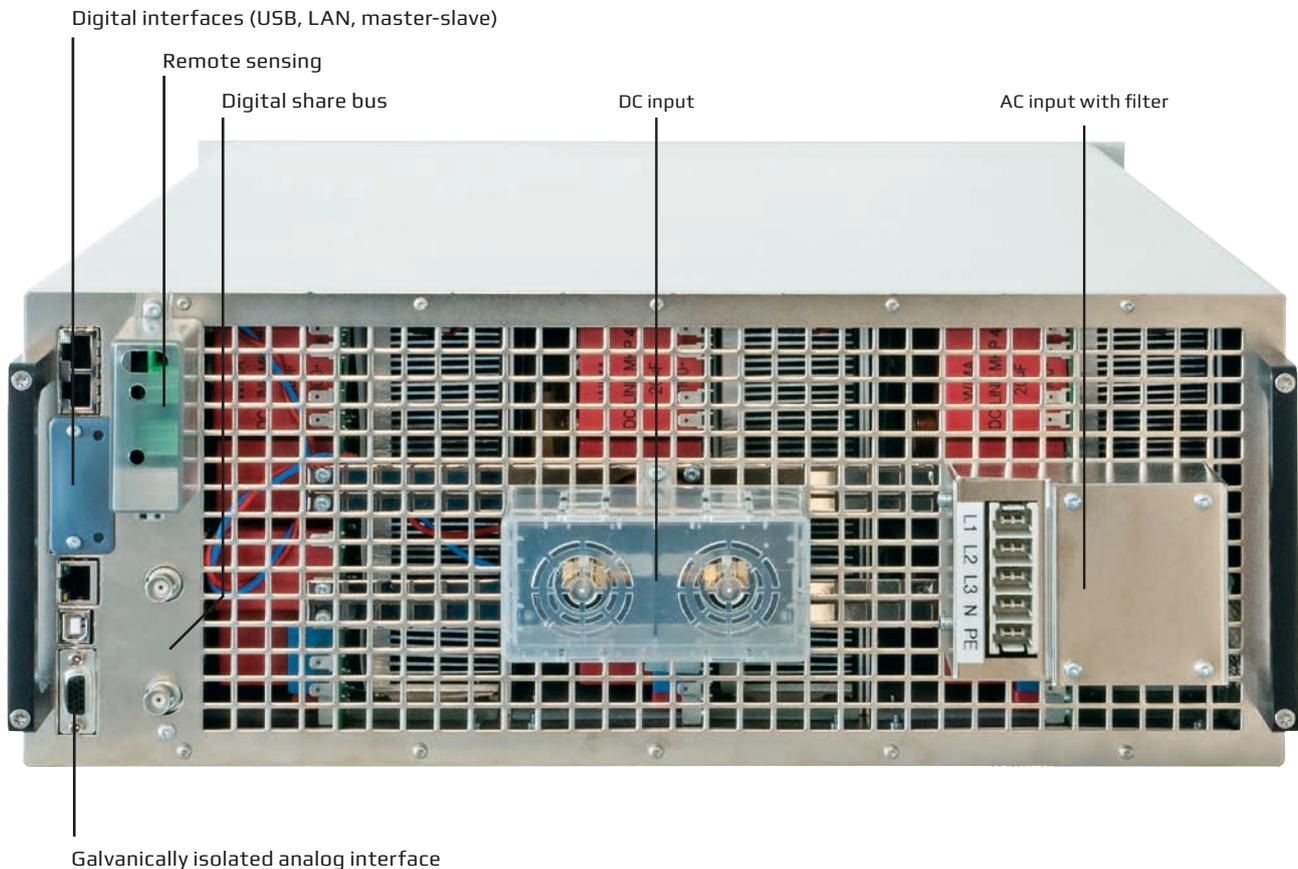
- Graphical visualization of the actual values
- **Multi Control** - an app to control up to 20 units at once, including Sequencing and Function Generator
- Full function generator configuration and control, including functions like **Battery test** and **MPP tracking**

Water-cooling

While standard water-cooling systems use an air flow-through engaged by fans in order to cool internal electronic components like an auxiliary power supply, this series premieres a new water-cooling system where no additional heat is exhausted anymore. All internal heat is dissipated into the water. This can help to cut down on additional, expensive exhaust systems for cabinets or rooms. Furthermore, this option will be available for all voltage classes.

Options

- Pluggable and retrofittable, digital interface modules for CAN, CANopen, Profibus, ProfiNet, RS232, EtherCAT or ModBus TCP (see page 144)
- Water-cooling (see page 150)
- Grid protection & supervision module EA-ENS2 (only for 400 V supply, see page 151)



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| Technical Data | Series EA-ELR 10000 4U | |
|--|---|-----------------------|
| AC: Supply | | |
| - Voltage / Phases | Standard models: 380 / 400 / 480 V, $\pm 10\%$, 3ph US 208 V models: 208 V, $\pm 10\%$, 3ph | |
| - Frequency | 45...66 Hz | |
| DC: Voltage | | |
| - Accuracy | $\leq 0.05\%$ of rated value | |
| DC: Current | | |
| - Accuracy | $\leq 0.1\%$ of rated value | |
| - Load regulation 1-100% ΔU_{DC} | $\leq 0.15\%$ of rated value | |
| - Slew rate 10-90% | $\leq 300 \mu s$ | |
| DC: Power | | |
| - Accuracy | $\leq 0.3\%$ of rated value | |
| DC: Resistance | | |
| - Accuracy | $\leq 0.3\%$ of max. resistance + 0.1% of rated current | |
| Display / control panel | Graphics display with touch panel | |
| Protection | OT, OVP, OCP, OPP, PF ⁽¹⁾ | |
| Degree of pollution | 2 | |
| Protection class | 1 | |
| Digital interfaces | | |
| - Built-in | 1x USB and 1x Ethernet for communication, galvanically isolated 1x USB type A for data recording etc. | |
| - Slot | 1x for retrofittable plug-in modules (standard models only) | |
| Analog interface | Built-in, galvanically isolated | |
| - Signal range | 0...5 V or 0...10 V (switchable) | |
| - Inputs | U, I, P, R, remote control on-off, DC input on-off, resistance mode on-off | |
| - Output | U, I, overvoltage, alarms, reference voltage | |
| - Accuracy U / I / P / R | 0...10 V: $\leq 0.2\%$ | 0...5 V: $\leq 0.4\%$ |
| Parallel operation | Yes, via master-slave bus and Share bus, up to 36 units | |
| Standards | EN 61010-1:2011-07 EN 61000-6-3:2011-09, EN 61000-6-2:2016-05 Radiation Class B EN 50160:2011-02 Grid Class 2 | |
| Cooling | Air (temperature-controlled fans), optional: water | |
| Ambient temperature | 0...50 °C (32...133 °F) | |
| Storage temperature | -20...70 °C (-4...158 °F) | |
| Terminals on rear | | |
| - DC input | Screw terminal | |
| - Share Bus & Sense | Share bus: 2x BNS, Sense: Phoenix, 4 pole | |

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| Technical Data | ELR 10060-1000 4U | ELR 10080-1000 4U | ELR 10200-420 4U |
|--|---------------------------------------|---------------------------------------|---------------------------------------|
| Rated voltage & range | 0...60 V | 0...80 V | 0...200 V |
| Insulation | | | |
| - Negative DC <-> PE | ±500 V DC | ±500 V DC | ±725 V DC |
| - Positive DC <-> PE | +600 V DC | +600 V DC | +1000 V DC |
| Rated current & range | 0...1000 A | 0...1000 A | 0...420 A |
| Rated power | 0...30 kW (0...15 kW ⁽³⁾) | 0...30 kW (0...15 kW ⁽³⁾) | 0...30 kW (0...15 kW ⁽³⁾) |
| Rated resistance | 0.003...5 Ω | 0.003...5 Ω | 0.0165...25 Ω |
| Efficiency | Up to 94% | Up to 94% | Up to 94.2% |
| Weight ⁽¹⁾ | ≈ 50 kg (110 lb) | ≈ 50 kg (110 lb) | ≈ 50 kg (110 lb) |
| Ordering number (standard) | 33200800 | 33200801 | 33200802 |
| Ordering number (WC) ⁽²⁾ | 33250800 | 33250801 | 33250802 |
| Ordering number (US208V) | 33208800 | 33208801 | 33208802 |
| Ordering number (US208V+WC) ⁽³⁾ | 33258800 | 33258801 | 33258802 |

| Technical Data | ELR 10360-240 4U | ELR 10500-180 4U | ELR 10750-120 4U |
|--|---------------------------------------|---------------------------------------|---------------------------------------|
| Rated voltage & range | 0...360 V | 0...500 V | 0...750 V |
| Insulation | | | |
| - Negative DC <-> PE | ±1500 V DC | ±1500 V DC | ±1500 V DC |
| - Positive DC <-> PE | +2000 V DC | +2000 V DC | +2000 V DC |
| Rated current & range | 0...240 A | 0...180 A | 0...120 A |
| Rated power | 0...30 kW (0...15 kW ⁽³⁾) | 0...30 kW (0...15 kW ⁽³⁾) | 0...30 kW (0...15 kW ⁽³⁾) |
| Rated resistance | 0.05...90 Ω | 0.08...170 Ω | 0.2...370 Ω |
| Efficiency | Up to 94.6% | Up to 95.3% | Up to 95.5% |
| Weight ⁽¹⁾ | ≈ 50 kg (110 lb) | ≈ 50 kg (110 lb) | ≈ 50 kg (110 lb) |
| Ordering number (standard) | 33200803 | 33200804 | 33200805 |
| Ordering number (WC) ⁽²⁾ | 33250803 | 33250804 | 33250805 |
| Ordering number (US208V) | 33208803 | 33208804 | 33208805 |
| Ordering number (US208V+WC) ⁽³⁾ | 33258803 | 33258804 | 33258805 |

| Technical Data | PSB 11000-80 4U | PSB 11500-60 4U | PSB 12000-40 4U |
|---|---------------------------------------|---------------------------------------|---------------------------------------|
| Rated voltage & range | 0...1000 V | 0...1500 V | 0...2000 V |
| Insulation | | | |
| - Negative DC <-> PE | ±1500 V DC | ±1500 V DC | ±1500 V DC |
| - Positive DC <-> PE | +2000 V DC | +2000 V DC | +2000 V DC |
| Rated current & range | 0...80 A | 0...60 A | 0...40 A |
| Rated power | 0...30 kW (0...15 kW ⁽³⁾) | 0...30 kW (0...15 kW ⁽³⁾) | 0...30 kW (0...15 kW ⁽³⁾) |
| Rated resistance | 0.4...650 Ω | 0.8...1500 Ω | 1.7...2700 Ω |
| Efficiency | Up to 94.6% | Up to 95.3% | Up to 95.5% |
| Weight ⁽¹⁾ | ≈ 50 kg (110 lb) | ≈ 50 kg (110 lb) | ≈ 50 kg (110 lb) |
| Ordering number (standard) | 33200806 | 33200807 | 33200808 |
| Ordering number (WC) ⁽²⁾ | 33250806 | 33250807 | 33250808 |
| Ordering number (US208V) ⁽³⁾ | 33208806 | 33208807 | 33208808 |
| Ordering number (US208V+WC) | 33258806 | 33258807 | 33258808 |

⁽¹⁾ Weight of the standard version, models with option(s) may vary

⁽²⁾ WC = water-cooling

⁽³⁾ 208 V models for US and Japan market

