



EL+ Series

Regenerative AC/DC Electronic Loads

CINERGIA's Electronic Loads are programmable current sources designed to emulate the electrical behaviour of passive and active devices connected to the grid. The uniqueness of these Regenerative systems, lies in its ability to emulate loads, generators and energy storage systems whilst saving Energy and Power.

Key features

- Bidirectional and Regenerative
- Clean grid current: THDi < 3% and PF > 0.98
- 13 models from 6.75kW to 160kW
- Parallelization of units to increase the power
- 5 versions:
 - AC only: the essential unit for AC applications
 - DC only: (see B2C+ datasheet)
 - AC/DC: the most flexible, AC and DC in one unit
 - AC/DC Lite: for Power HIL applications
 - HF: for avionics 360-900Hz
- Emulation of grid-connected devices:
 - Loads absorbing energy from the grid,
 - Generators injecting energy to the grid,
 - Programmable Active/Reactive consumption
 - Non-linear currents up to CF of 3
- Independent phase configuration of:
 - rms current, phase angle, harmonics, interharmonics,
 - generation of fast transients ("Current Dips")
- Intuitive User Interface
- Modbus/Ethernet Open protocol, Labview drivers



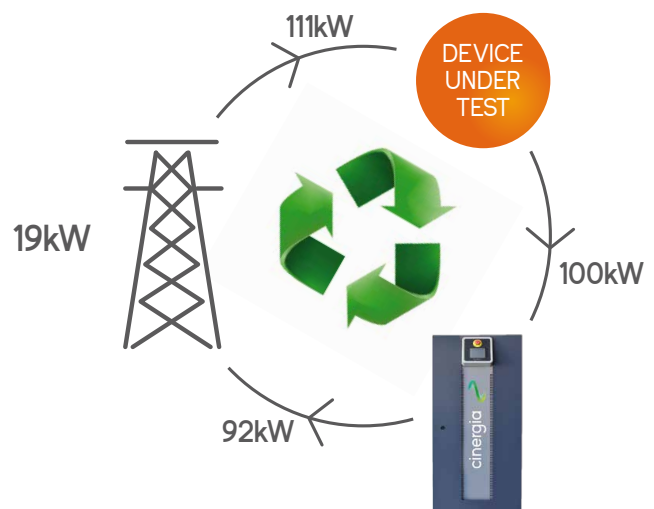
Highlights

Save Energy, Power and Time

Our regenerative Electronic Load Plus efficiently controls the output current and, thanks to its bidirectional power platform, the energy used during the test is fed back into the grid. This produces net energy savings and decreases utility power, ultimately resulting in a significant reduction of amortization time.

Smartgrids and Electrical Vehicles

Are key fields of application. EL+ can be used to emulate electrical appliances, house or office consumptions as well as emulating Distributed Energy Resources and Energy Storage Systems connected to the grid. In the Electrical Vehicles field, the EL+ will be used to test EV devices, EVSE infrastructures and Vehicle to Grid applications.



Range and specifications

Input side (GRID side)

AC Voltage

Rated: 3x400Vrms + Neutral + Earth

Range: +15% / -20%

Rated AC Current

Depends on model (see Wiring Manual)

Frequency

48-62Hz

Current Harmonic Distortion

THDi < 3% at rated power

Current Power factor

PF > 0.98 at rated power

Efficiency

≥ 89% (7.5&10), ≥ 91% (15 to 30), ≥ 92% (40 to 200)

Output side (EUT side in AC mode^(#))

Terminals

Number: 4 (3 phases + 1 neutral)

Configuration

Independent: 4Q, independent setpoints per phase

Parallel: 4Q, independent setpoints for all phases

Multichannel: 4Q, independent start/stop, alarm status and setpoints per phase (note: multichannel is an option for ≥ 80kVA)

Admissible Voltage

Connection: 1-phase or 3-phase (neutral is mandatory)

Maximum: ± 400V phase-neutral

Range: 10-100Hz

20^(l) to 277Vrms phase-neutral (295Vrms with HV option)

20^(l) to 480Vrms phase-phase (510Vrms with HV option)

> 100Hz: maximum rms voltage follows $V_f < 46000$

Frequency: 10 to 400Hz (versions AC, AC/DC and AC/DC HIL)

360 to 900Hz (version HF)

Current mode (CC)

Range: from 0 to ± 200%⁽¹⁰⁾ of Irated (see models table)

Setpoint Resolution: 10mA

Effective Resolution⁽²⁾: < 0.05% of FS⁽³⁾ (< 0.1% models 7.5&10)

Setpoint Accuracy⁽⁴⁾: < +/- 0.2% of FS⁽³⁾

Transient Time⁽⁵⁾: < 1ms (10% to 90% at a step transient)

Ripple⁽⁶⁾ (peak-peak): < 0.7% of FS⁽³⁾

Phase Angle

Range: -90 to 90° in Sink / Source

Resolution: 0.01°

Harmonics

Range: up to 50th

15 independent harmonics per phase:

14 fixed frequency multiple of f_0 : 2,3,4,5,6,7,8,9,10,11,12,13,14,15

1 free programmable frequency from 0.1 to 50 times f_0

Small Signal Bandwidth: up to 5000Hz

Setpoint Accuracy⁽⁴⁾: same as current accuracy

Transient Time⁽⁵⁾: < 2ms (10% to 90% at a step change)

All specifications are subject to change without notice.

(#) Refer to B2C+ datasheet for the specifications in DC mode for versions AC/DC Full and Lite

(1) The EL+ needs a minimum voltage to synchronise. Consult us for requirements < 20Vrms

(2) Effective resolution measured with a 400ms window

(3) FS Range of voltage is 800V

FS Range of current is 2|3 · Irated| (see models table)

FS Range of power is 2|200% · Prated| (see models table)

Power mode (CP, CS)

Range: from 0 to ± 200%⁽⁹⁾ of Prated (see models table)

Derived current setpoint: calculated from |S| and $\Phi(S)$

Setpoint Resolution: 1W, 1VA

Effective Resolution⁽²⁾: < 0.1% of FS⁽³⁾ (< 0.25% models 7.5&10)

Setpoint Accuracy⁽⁴⁾: +/- 0.4% of FS⁽³⁾

Transient Time⁽⁵⁾: < 2.5ms (10% to 90% at a step to Prated)

Impedance Mode (CZ)

Range: from 0.8 to 1000ohm, 0.1 to 2000mH, 0 to 3.7mF

Derived current/phase setpoint: calculated from |Z| and $\Phi(Z)$

Setpoint Resolution: 0.01 ohm/mH/mF

Setpoint Accuracy⁽⁴⁾: see current accuracy

Transient Time⁽⁵⁾: < 2.5ms (10% to 90% at a step to Rrated)

Protections

Overvoltage (peak, rms), Overcurrent^(10,11) (peak, rms), Overload⁽⁹⁾

Shortcircuit, Emergency Stop, Watchdog, Heart

Beat, Output Contactor

Alarms and Limits are user configurable and can be saved in a password protected EEPROM

Measurements⁽⁷⁾

Grid Voltage (rms), Current (rms), Power (P,Q) and Frequency

Output Voltage (rms), Current (rms), Power (P,Q) and Frequency

Heatsink Temperatures (x2) and DC Link Voltage

Datalogging available through FTP connection

User Interface

Local Control (4.3" Touchscreen panel)

Isolated Digital IO port: 6 inputs, 4 outputs

Isolated Analogue IO port: 6 inputs, 6 outputs

Interlock IO port: 1 input, 1 output

Emergency Stop pushbutton

Remote Control port:

LAN Ethernet with Open Modbus-TCP protocol

RS485, RS232, CANbus (optionals)

Software:

Battery Test / Cycler

Graphical User Interface for Windows 7/10

LabView drivers and basic Labview interface example

Ambient

Operating temperature⁽⁸⁾: 5-40°C

Relative Humidity: up to 95%, non-condensing

Cooling: Forced air

Acoustic noise at 1m: < 52dB(A) (7.5 to 60), < 65dB(A) (80 to 120),

< 70dB(A) (160 and 200)

Standards

CE Marking

Operation: EN-50178

Safety: EN-60950-1, EN-62040-1-2

EMC: EN-62040-2

(4) Accuracies are valid for settings above 10% of FS

(5) Measured with the rated resistive load and high-dynamics controllers configuration

(6) Consult us for lower voltage/current ripple requirements

(7) Accuracy of measurements is ±0.1% of FS for rms voltage, ±0.2% of FS for rms current, ±0.4% of FS for active power (valid only above 10% of FS)

(8) Rated power figures are given at 20°C. See (9) for admissible Overloads

Models

EL+ AC only version

Model	Version	AC Power Rated ⁽⁹⁾	DC Power Rated ⁽⁹⁾	AC Current Rated ⁽¹⁰⁾ RMS Per phase / Parallel	DC Current Rated ⁽¹¹⁾ DC Per phase / Parallel	Operation Modes All models
EL+7.5	vAC	7.5 kW	-	11A / 33A	-	Programmable Current (CC) Programmable Power (CP / CS) Programmable Impedance (CZ) Automatic Sequence (csv file) Disturbance Generator
EL+10	vAC	10 kW	-	15A / 45A	-	
EL+15	vAC	15 kW	-	22A / 66A	-	
EL+20	vAC	20 kW	-	29A / 87A	-	
EL+30	vAC	27 kW	-	40A / 120A	-	
EL+40	vAC	40 kW	-	58A / 174A	-	
EL+50	vAC	50 kW	-	73A / 219A	-	
EL+60	vAC	54 kW	-	80A / 240A	-	
EL+80	vAC	80 kW	-	116A / 348A	-	
EL+100	vAC	100 kW	-	145A / 435A	-	
EL+120	vAC	108 kW	-	157A / 471A	-	
EL+160	vAC	145 kW	-	211A / 633A	-	
EL+200	vAC	160 kW	-	232A / 696A	-	

All specifications are subject to change without notice.

EL+ HF version (360-900Hz for avionics)

Model	Version	AC Power Rated ⁽⁹⁾	DC Power Rated ⁽⁹⁾	AC Current Rated ⁽¹⁰⁾ RMS Per phase / Parallel	DC Current Rated ⁽¹¹⁾ DC Per phase / Parallel	Operation Modes All models
EL+15	vHF	15 kW	-	20A / 60A	-	Programmable Current (CC) Programmable Power (CP / CS) Programmable Impedance (CZ) Automatic Sequence (csv file)
EL+20	vHF	20 kW	-	26A / 78A	-	
EL+30	vHF	27 kW	-	40A / 120A	-	
EL+40	vHF	40 kW	-	52A / 156A	-	
EL+50	vHF	50 kW	-	65A / 195A	-	

All specifications are subject to change without notice.

EL+ AC/DC Full version

Model	Version	AC Power Rated ⁽⁹⁾	DC Power Rated ⁽⁹⁾	AC Current Rated ⁽¹⁰⁾ RMS Per phase / Parallel	DC Current Rated ⁽¹¹⁾ DC Per phase / Parallel	Operation Modes All models
EL+7.5	vAC/DC	7.5 kW	7.5 kW	11A / 33A	±10A / ±30A	AC Modes: Programmable Current (CC) Programmable Power (CP / CS) Programmable Impedance (CZ) Power Amplifier (for Power HIL) Automatic Sequence (csv file) Disturbance Generator DC Modes: Programmable Voltage (CV) Programmable Current (CC) Programmable Power (CP) Programmable Resistance (CR) Power Amplifier (for Power HIL) Automatic Sequence (csv file) Optional (software): Battery Test / Cycler Battery Emulation PV Panel Emulation
EL+10	vAC/DC	10 kW	10 kW	15A / 45A	±15A / ±45A	
EL+15	vAC/DC	15 kW	15 kW	22A / 66A	±20A / ±60A	
EL+20	vAC/DC	20 kW	20 kW	29A / 87A	±25A / ±75A	
EL+30	vAC/DC	27 kW	27 kW	40A / 120A	±30A / ±90A	
EL+40	vAC/DC	40 kW	40 kW	58A / 174A	±40A / ±120A	
EL+50	vAC/DC	50 kW	50 kW	73A / 219A	±50A / ±150A	
EL+60	vAC/DC	54 kW	54 kW	80A / 240A	±57A / ±171A	
EL+80	vAC/DC	80 kW	80 kW	116A / 348A	±105A / ±315A	
EL+100	vAC/DC	100 kW	100 kW	145A / 435A	±130A / ±390A	
EL+120	vAC/DC	108 kW	108 kW	157A / 471A	±130A / ±390A	
EL+160	vAC/DC	145 kW	145 kW	211A / 633A	±155A / ±465A	
EL+200	vAC/DC	160 kW	160 kW	232A / 696A	±185A / ±555A	

All specifications are subject to change without notice.

(9) Admissible overloads are the following: 125% of rated value during 10 minutes, 150% of rated value during 1 minute, 200% of rated value during 2s
 Overload levels can be configured by the user (to values below the factory ones) and saved in a EEPROM (password protected)
 The user can configure different admissible overload levels for power sourcing and power absorbing

(10) Admissible AC Overcurrents: 125% during 10 minutes, 150% during 1 minute, 200% during 2s
 Admissible Peak Overcurrent is 3 times the rated current (to allow a crest factor of 3)
 Overload levels can be configured by the user (to values below the factory ones) and saved in a EEPROM (password protected)

(11) Admissible DC Overcurrent is the following: 110% during 1 minute

Models

EL+ AC/DC Lite version (Power Hardware In the Loop)

Model	Version	AC Power Rated ⁶⁾	DC Power Rated ⁶⁾	AC Current Rated ⁽¹⁰⁾ RMS Per phase / Parallel	DC Current Rated ⁽¹¹⁾ DC Per phase / Parallel	Operation Modes All models
EL+7.5	vHIL	7.5 kW	3.75 kW	11A / 33A	5A / 15A	AC Modes: Programmable Current (CC) Programmable Power (CP / CS) Programmable Impedance (CZ) Power Amplifier (for Power HIL) Automatic Sequence (csv file) Disturbance Generator DC Modes: Programmable Current (CC) Power Amplifier (for Power HIL) Automatic Sequence (csv file) Optional (software): Programmable Voltage (CV) Programmable Power (CP) Programmable Resistance (CR) Battery Test / Cyclor Battery Emulation PV Panel Emulation
EL+10	vHIL	10 kW	5 kW	15A / 45A	7.5A / 22.5A	
EL+15	vHIL	15 kW	7.5 kW	22A / 66A	10A / 30A	
EL+20	vHIL	20 kW	10 kW	29A / 87A	12.5A / 37.5A	
EL+30	vHIL	27 kW	13.5 kW	40A / 120A	15A / 45A	
EL+40	vHIL	40 kW	20 kW	58A / 174A	20A / 60A	
EL+50	vHIL	50 kW	25 kW	73A / 219A	25A / 75A	
EL+60	vHIL	54 kW	27 kW	80A / 240A	28.5A / 85.5A	
EL+80	vHIL	80 kW	40 kW	116A / 348A	52.5A / 157.5A	
EL+100	vHIL	100 kW	50 kW	145A / 435A	65A / 195A	
EL+120	vHIL	108 kW	54 kW	157A / 471A	65A / 195A	
EL+160	vHIL	145 kW	72.5 kW	211A / 633A	77.5A / 232.5	
EL+200	vHIL	160 kW	80 kW	232A / 696A	92.5A / 277.5A	

All specifications are subject to change without notice.

Mechanical

Model	WEIGHT kg	DIMENSIONS DxWxH (mm)
EL+7.5	155 kg	770x450x1100 mm
EL+10	155 kg	770x450x1100 mm
EL+15	155 kg	770x450x1100 mm
EL+20	155 kg	770x450x1100 mm
EL+30	155 kg	770x450x1100 mm
EL+40	190 kg	770x450x1100 mm
EL+50	190 kg	770x450x1100 mm
EL+60	190 kg	770x450x1100 mm
EL+80	270 kg	880x590x1320 mm
EL+100	295 kg	880x590x1320 mm
EL+120	295 kg	880x590x1320 mm
EL+160	545 kg	850x900x2000 mm
EL+200	555 kg	850x900x2000 mm

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Galvanic Isolation (optional)

Model	Circuit Breaker Recommended	WEIGHT kg	DIMENSIONS DxWxH (mm)
IT7.5i	Type C - 25A	145 kg	Inside the cabinet
IT10i	Type C - 25A	145 kg	Inside the cabinet
IT15i	Type C - 32A	145 kg	Inside the cabinet
IT20i	Type C - 40A	145 kg	Inside the cabinet
IT30i	Type C - 50A	195 kg	Inside the cabinet
IT30e	Type D - 80A	174 kg	595x415x708
IT40e	Type D - 100A	217 kg	789x490x865
IT50e	Type D - 125A	280 kg	789x490x865
IT60e	Type D - 160A	381 kg	789x490x865
IT80e	Type D - 200A	435 kg	964x684x1252
IT100e	Type D - 250A	458 kg	964x684x1252
IT120e	Type D - 315A	514 kg	964x684x1252
IT160e	Type D - 400A	612 kg	964x684x1252
IT200e	Type D - 500A	753 kg	1192x744x1430

Note: 'i' stands for internal transformer, 'e' stands for external transformer (delivered in a stand-alone cabinet IP23)

All specifications are subject to change without notice.

Options

Galvanic Isolation: recommended for EV and EVSE test platforms, provides isolated output via low frequency transformer

Multichannel: allows separated on/off/alarm status and a different operation mode for each channel. It is an option for units ≥ 80 kW (included in all models from 7.5 to 60)

30kHz Switching Frequency: only available for models EL+15, 20 and 30. Power is derated to 7.5kW, 7.5kW and 10kW respectively.

Low Ripple Inductance: reduce the current ripple (included in all models ≤ 54 kW, optional for models ≥ 80 kW)

Dual Sensing Range: increase the accuracy and resolution for low current applications

Isolation monitor / Anti-islanding monitor: commercial isolation and/or anti-islanding relays can be installed for safety

High Voltage (HV): the high voltage option allows a maximum voltage of 295Vrms p-n

Communications: RS485, RS232, CAN



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