

6RL Series



Regenerative DC Loads



DC Power

6RL Series
3.1kW to 1920kW
Energy Recycling
Up to 2000Vdc, 1000A
4U Rack Height @ 30kW

KEY BENEFITS OF 6RL REGENERATIVE DC LOADS

- Three phase 208~480Vac universal input voltage
- Energy recovery of the supplied DC energy into the local grid reduces utility bills and air conditioning costs
- Galvanically isolated DC input
- Input power ratings: up to 15 kW per unit for 208V grid models and up to 30 kW per unit for 480V grid models
- Parallel operation up to 1920 kW
- Input voltages: up to 2000 V
- Input currents: up to 1000 A per unit
- FPGA based digital control
- Large color TFT touch panel display
- User profiles, true function generator
- Galvanically isolated analog and USB interface
- USB port on the front for USB memory stick
- USB interface standard, LAN I/F standard on 30kW models
- Optional, digital, plug & play interfaces
- SCPI command set and ModBus support

Regenerative DC Loads like the 6RL Series are excellent for the environment as they produce little or no heat. They also save money by sending the energy sent into the load back on the AC power grid. For many test requirements like full load burn-in, this can save a significant amount in terms of reduced utility bills, often resulting in quick financial payback of the capital invested in the electronic loads. It also reduces HVAC cost as no cooling of the test room is required.

With a wide range of available power levels and input voltage ranges, the 6RL Series of regenerative DC Loads are an excellent choice for many DC test applications. Single chassis power up to 30kW and 2000V input.

Master/ Slave mode for series or parallel operation available for higher voltage and or power requirements.



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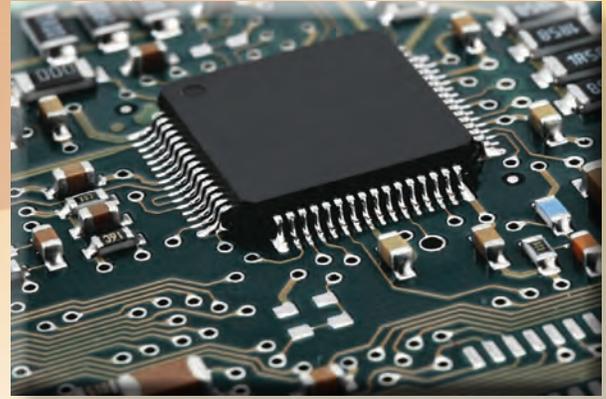
LAN



VALUE & PERFORMANCE BY LEVERAGING MODERN TECHNOLOGY

The 6RL Series of regenerative DC Electronic Loads uses state of the art field programmable logic array (FPGA) technology to implement a digital power conversion topology that combines high efficiency with a rich feature set and excellent specifications. This results in 16-bit resolution precision for both set points and measurements throughout.

Packaged in a compact, standard 19" rack mount chassis, these powerful functions are easily accessible through an easy to use, color touch screen based user interface from the front panel or by sending commands over one of several available digital control interfaces.



BROAD RANGE OF APPLICATIONS

The energy efficient operation of the 6RL loads makes them suitable for a broad range of DC power applications where loading of power supplies or discharging of bat-

teries involves high amounts of energy. This is typically the case in Power Supply test and Electric Vehicles power conversion and battery test applications.



Power Supply Test & Burn-in

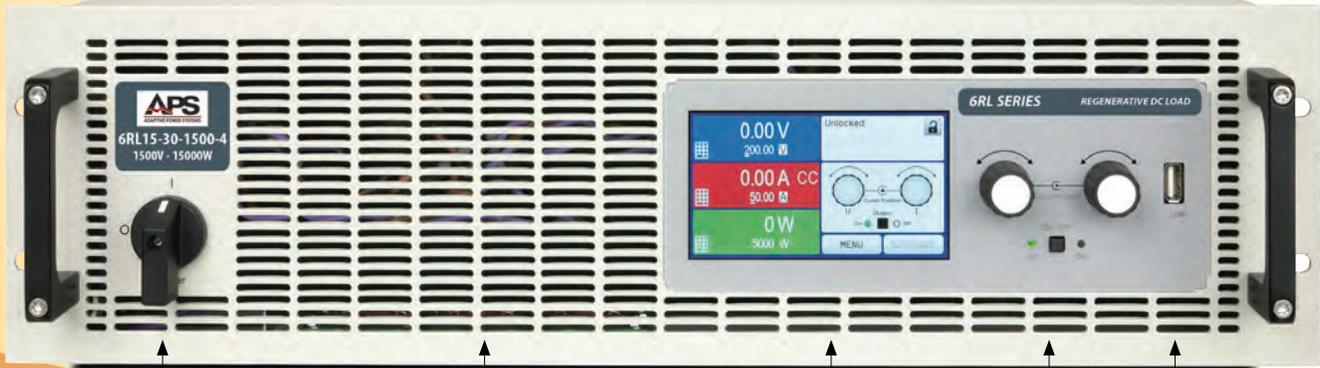


Electric Vehicle Component Test



Research & Development

MODERN COLOR TOUCH USER INTERFACE FOR EASE OF OPERATION



Power On/Off

Air Intake



Color LCD Touch Display

Dual Shuttles Load On/Off

USB Port

All 6RL Series models share an intuitive user interface using a combination of a large color LCD touch screen and two rotary shuttle knobs. This results in an easy to use electronic load for novice and experienced users alike.

The large color LCD allows visualization of output set-

tings and configurations as well as a wide assortment of precision DC measurements.

Changing parameters such as voltage or current can be done using the touch screen or the shuttle.

VALUE PROPOSITION

General

The 6LR Series of electronic DC loads offer all the features and function of a conventional DC load but rather than dissipating the absorbed energy as heat, it recovers 95% of this energy back to the mains instead.

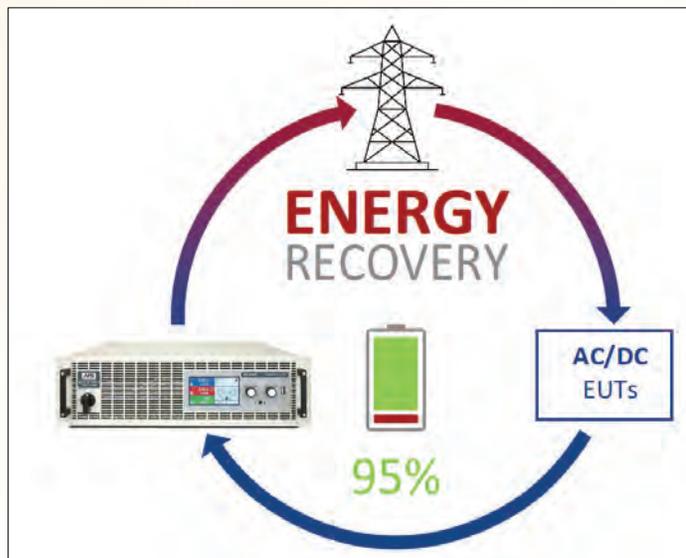
The energy recovery function converts the supplied DC energy into a synchronous sine current and feeds it back into the local grid, eliminating the usual heat dissipation to a minimum and saving energy costs at the same time. The large color TFT touch panel offers a different and intuitive kind of manual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

Power ratings, voltages, currents

The available input voltage ranges from models with 0~80 V DC input up to 0~2000 V DC. Input currents up to 1000 A are available on two models. The series offers several power classes of 3.1kW, 5kW, 6.2kW, 9.3kW, 10kW or 15kW in only 3U rack space or 30kW in 4U rack space. Higher power requirements can be met using parallelizing multiple loads up to 960kW in cabinets for a significantly high total current.

Grid Connection

All models require a 3-phase Delta mains supply connection (no Neutral conductor). The loads are available for either a 208 Vac Grid or a 380~480 Vac connections.

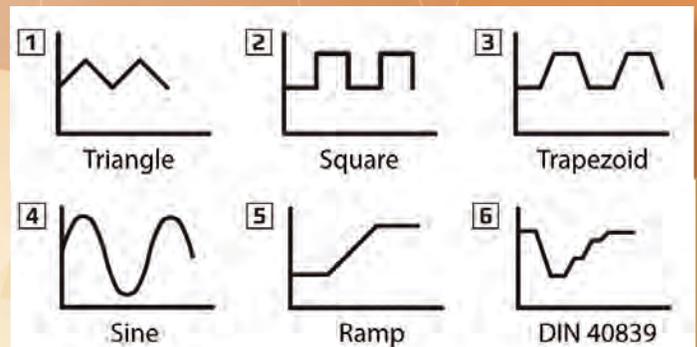


Energy recovery

A key feature of these electronic loads is the use of the AC input grid connection for recovery of the received DC energy from the unit under test. It is converted with an efficiency of up to 95%. Recycling energy recovery helps to lower energy costs and avoids expensive cooling systems as required for conventional electronic or resistive loads which convert the DC input energy into heat.

Function generator

A built-in digital function and arbitrary waveform generator allows for the control and execution of user-programmable load profiles and can generate sine, square, saw tooth and ramp functions in an arbitrary order.



With a programmable value table of 3276 points, the load can simulate non-linear internal resistances, such as those of batteries or LED strings.

Battery test

Battery test modes for various battery types, such as constant current or constant resistance discharging are supported. This mode displays values for elapsed testing time and consumed capacity (Ah). Adjustable under voltage threshold and maximum test period settings are supported to prevent over-discharge.

Master-slave Configurations

All models feature a digital master-slave bus. It can be used to connect up to 32 identical models in parallel operation to a bigger system. The configuration of the master-slave system is done from the control panels of the units or by remote control. System control is accomplished by manual or remote control. As an alternative to the standard models, there are specific slave models available.

Share Bus

The Share Bus is an analog connection used to balance current across multiple similar loads in a parallel connection. It can also be used to create a two-quadrant system with DCS Series power supplies. Such a system supports source-sink capability for battery cycling.

Power Grid Monitoring

6RL loads feature a switch-off function in case of an interruption of the grid connection. The load constantly monitors its AC input voltage and frequency and will automatically switch off the power stages in case upper or lower limits are exceeded.

TECHNICAL SPECIFICATIONS 5KW (3KW) Models

MODEL	6RL170-80HP ³	6RL70-200HP	6RL40-360HP	6RL30-500HP	6RL20-750HP
Voltage Range	0~80 V	0~200 V	0~360 V	0~500 V	0~750 V
Current Range	0...170 A	0...70 A	0...40 A	0...30 A	0...20 A
CP V-I Range	29.4V@170A ~ 80V@62.5A	71.4V@70A ~ 200V@25A	125V@40A ~ 360V@13.9A	166.7V@30A ~ 500V@10A	250V@20A ~ 750V@6.7A
Voltage Ripple	<100 mVpp <10 mVrms	<300 mVpp <40 mVrms	<320mVpp <55mVrms	<350mVpp <70mVrms	<800mVpp <200mVrms
U _{Min} for I _{Max} (Sink)	< 0.5 V	< 2.0 V	< 2.0 V	< 2.2 V	< 2.2 V
Insulation -DC to PE	±600 Vdc	±1000 Vdc	±1000 Vdc	±1500 Vdc	±1500 Vdc
Insulation +DC to PE	+600 Vdc	+1000 Vdc	+1000 Vdc	+2000 Vdc	+2000 Vdc
Power Range ⁴	0~5000 W / 0~3000 W	0~5000 W / 0~3000 W	0~5000 W / 0~3000 W	0~5000 W / 0~3000 W	0~5000 W / 0~3000 W
Resistance Range	0.016~26 Ω	0.1~160 Ω	0.3~520 Ω	0.6~1000 Ω	1.2~2200 Ω
Output Capacitance	7790 μF	2520 μF	393 μF	180 μF	180 μF
Efficiency	94.5%	94.5%	95.5%	95.5%	95.5%
Weight	18kg/39.7lbs	18kg/39.7lbs	18kg/39.7lbs	18kg/39.7lbs	18kg/39.7lbs

TECHNICAL SPECIFICATIONS 10KW (6KW) Models

MODEL	6RL340-80HP ³	6RL140-200HP	6RL80-360HP	6RL60-500HP	6RL40-750HP	6RL30-1000HP	6RL20-1500HP
Voltage Range	0~80 V	0~200 V	0~360 V	0~500 V	0~750 V	0~1000 V	0~1500 V
Current Range	0...340 A	0...140 A	0~80 A	0~60 A	0~40 A	0~30 A	0~20 A
CP V-I Range	29.4V@340A ~ 80V@125A	71.4V@140A ~ 200V@50A	125V@80A ~ 360V@27.8A	166.7V@60A ~ 500V@20A	250V@40A ~ 750V@13.3A	333.3V@30A ~ 1000V@10A	500V@20A ~ 1500V@6.7A
Voltage Ripple	<100mVpp <10mVrms	<300mVpp <40mVrms	<320mVpp <55mVrms	<350mVpp <70mVrms	<800mVpp <200mVrms	<1000mVpp <200mVrms	<2000mVpp <400mVrms
U _{Min} for I _{Max} (Sink)	< 0.5 V	< 2.0 V	< 2.0 V	< 2.2 V	< 2.2 V	< 4.0 V	< 4.0 V
Insulation -DC to PE	±600 Vdc	±1000 Vdc	±1000 Vdc	±1500 Vdc	±1500 Vdc	±1500 Vdc	±1500 Vdc
Insulation +DC to PE	+600 Vdc	+1000 Vdc	+1000 Vdc	+2000 Vdc	+2000 Vdc	+2000 Vdc	+2000 Vdc
Power Range ⁴	0~10000 W / 0~6000 W	0~10000 W / 0~6000 W	0~10000 W / 0~6000 W	0~10000 W / 0~6000 W	0~10000 W / 0~6000 W	0~10000 W / 0~6000 W	0~10000 W / 0~6000 W
Resistance Range	0.008~13 Ω	0.05~80 Ω	0.15~260 Ω	0.3~500 Ω	0.6~1100 Ω	1.2~2200 Ω	2.6~4500 Ω
Output Capacitance	15980 μF	5040 μF	786 μF	360 μF	360 μF	90 μF	90 μF
Efficiency	94.5%	94.5%	95.5%	95.5%	95.5%	95.5%	95.5%
Weight	25kg/55.1lbs	25kg/55.1lbs	25kg/55.1lbs	25kg/55.1lbs	25kg/55.1lbs	25kg/55.1lbs	25kg/55.1lbs

TECHNICAL SPECIFICATIONS 15KW (9KW) Models

MODEL	6RL510-80HP ³	6RL210-200HP	6RL120-360HP	6RL90-500HP	6RL60-750HP	6RL40-1000HP	6RL30-1500HP	6RL20-2000HP
Voltage Range	0~80 V	0~200 V	0~360 V	0~500 V	0~750 V	0~1000 V	0~1500 V	0~2000 V
Current Range	0~510 A	0~210 A	0~120 A	0~90 A	0~60 A	0~40 A	0~30 A	0~20 A
CP V-I Range	29.4V@510A ~ 80V@187.5A	71.4V@210A ~ 200V@75A	125V@120A ~ 360V@41.7A	166.7V@90A ~ 500V@30A	250V@60A ~ 750V@20A	375V@40A ~ 1000V@15A	500V@30A ~ 1500V@10A	500V@30A ~ 1500V@10A
Voltage Ripple	<100mVpp <10mVrms	<300mVpp <40mVrms	<320mVpp <55mVrms	<350mVpp <70mVrms	<800mVpp <200mVrms	<1600mVpp <300mVrms	<2400mVpp <400mVrms	<2400mVpp <400mVrms
U _{Min} for I _{Max} (Sink)	< 0.5 V	< 2.0 V	< 2.0 V	< 2.2 V	< 2.2 V	< 5.2 V	< 5.2 V	< 5.2 V
Insulation -DC to PE	±600 Vdc	±1000 Vdc	±1000 Vdc	±1500 Vdc	±1500 Vdc	±1500 Vdc	±1500 Vdc	±1500 Vdc
Insulation +DC to PE	+600 Vdc	+1000 Vdc	+1000 Vdc	+2000 Vdc	+2000 Vdc	+2000 Vdc	+2000 Vdc	+2000 Vdc
Power Range ⁴	0~15000 W / 0~9000 W	0~15000 W / 0~9000 W	0~15000 W / 0~9000 W	0~15000 W / 0~9000 W	0~15000 W / 0~9000 W	0~15000 W / 0~9000 W	0~15000 W / 0~9000 W	0~15000 W / 0~9000 W
Resistance Range	0.02~25 Ω	0.033~50 Ω	0.1~180 Ω	0.16~340 Ω	0.4~740 Ω	0.8~1300 Ω	2.5~3000 Ω	3.5~5300 Ω
Output Capacitance	23970 μF	7560 μF	1179 μF	540 μF	540 μF	131 μF	60 μF	60 μF
Efficiency	94.5%	94.5%	95.5%	95.5%	95.5%	95.5%	95.5%	95.5%
Weight	31kg/68.3lbs	31kg/68.3lbs	30kg/66.1lbs	31kg/68.3lbs	31kg/68.3lbs	31kg/68.3lbs	31kg/68.3lbs	31kg/68.3lbs

Note 1: Ripple RMS value is measured at LF with BWL 300 kHz, Ripple PP value is measured at HF with BWL 20MHz

Note 2: Weight of the base version, models with option(s) may vary

Note 3: A 60V model 6RL60-xxxHP is available as well with same max current rating. All other specs same as 6RL80-xxxHP 80V model

Note 4: Power rating shown applies with 380Vac ~ 480Vac Input Voltage applied. For 208Vac input, max. power is 60% of rated power.

TECHNICAL SPECIFICATIONS 30KW Models

MODEL	6RL1000-80HP ³	6RL420-200HP	6RL240-360HP	6RL180-500HP
Voltage Range	0~80 V	0~200 V	0~360 V	0~500 V
Current Range	0~1000 A	0~420 A	0~240 A	0~180 A
CP V-I Range	30V@1000A ~ 80V@375A	71.4V@420A ~ 200V@150A	125V@240A ~ 360V@83.3A	166.7V@180A ~ 500V@60A
Voltage Ripple ¹	<480mVpp <37mVrms	<450mVpp <60mVrms	<480mVpp <83mVrms	<525mVpp <105mVrms
Insulation -DC to PE	±500 Vdc	±800 Vdc	±1500 Vdc	±1500 Vdc
Insulation +DC to PE	+600 Vdc	+1000 Vdc	+2000 Vdc	+2000 Vdc
Power Range ⁴	0~30000 W (0~18000 W)	0~30000 W (0~18000 W)	0~30000 W (0~18000 W)	0~30000 W (0~18000 W)
Efficiency	94.0%	94.2%	94.6%	95.3%
Weight ²	50kg/110lbs	50kg/110lbs	50kg/110lbs	50kg/110lbs

TECHNICAL SPECIFICATIONS 30KW Models continued

MODEL	6RL120-750HP	6RL80-1000HP	6RL60-1500HP	6RL40-2000HP
Voltage Range	0~750 V	0~1000 V	0~1500 V	0~2000 V
Current Range	0~120 A	0~80 A	0~60 A	0~40 A
CP V-I Range	250V@120A ~ 750V@40A	375V@80A ~ 1000V@30A	500V@60A ~ 1500V@20A	750V@40A ~ 2000V@15A
Voltage Ripple ¹	<1200mVpp <300mVrms	<2400mVpp <450mVrms	<3600mVpp <600mVrms	<3600mVpp <600mVrms
Insulation -DC to PE	±1500 Vdc	±1500 Vdc	±1500 Vdc	±1500 Vdc
Insulation +DC to PE	+2000 Vdc	+2000 Vdc	+2000 Vdc	+2000 Vdc
Power Range ⁴	0~30000 W (0~18000 W)			
Efficiency	95.5%	94.6%	95.3%	95.5%
Weight ²	50kg/110lbs	50kg/110lbs	50kg/110lbs	50kg/110lbs

Note 1: Ripple RMS value is measured at LF with BWL 300 kHz, Ripple PP value is measured at HF with BWL 20MHz

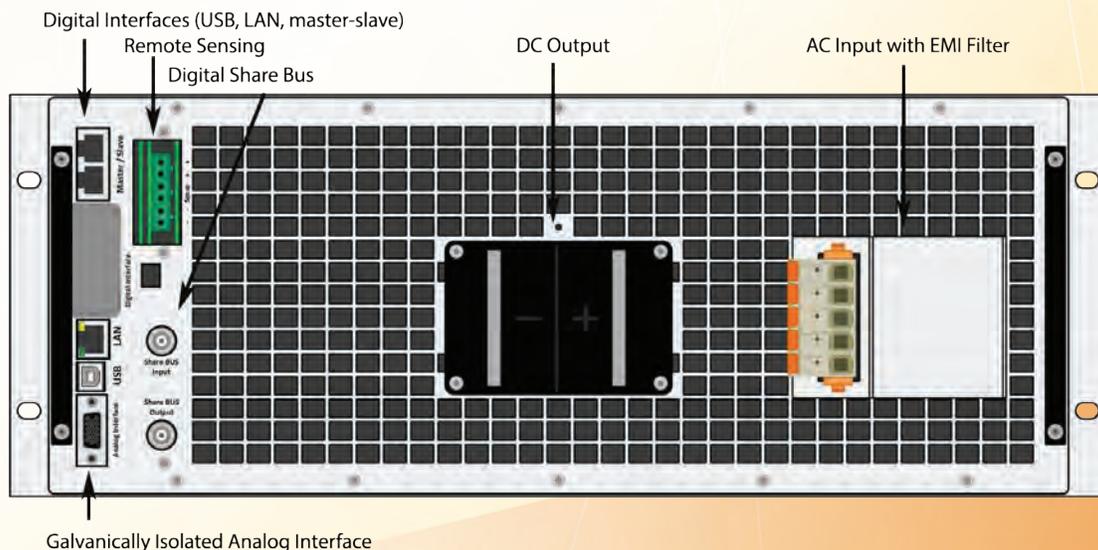
Note 2: Weight of the base version, models with option(s) may vary

Note 3: A 60V model 6RL60-1000HP is available as well with same max current of 360A. All other specs same as 6RL80-1000HP 80V model

Note 4: Power rating shown applies with 380Vac ~ 480Vac Input Voltage applied. No 208Vac input version for 30kW models are available.

REAR PANEL CONNECTIONS 4U MODELS

All power input and output connectors as well as interfaces are located on the rear panel of the power supply. This supports rack mounting of the power supplies in ATE systems as all internal cabinet wiring routes to the back of the unit and leaves the front panel display and controls accessible from the front. The illustration below shows the various connector locations on the rear panel.



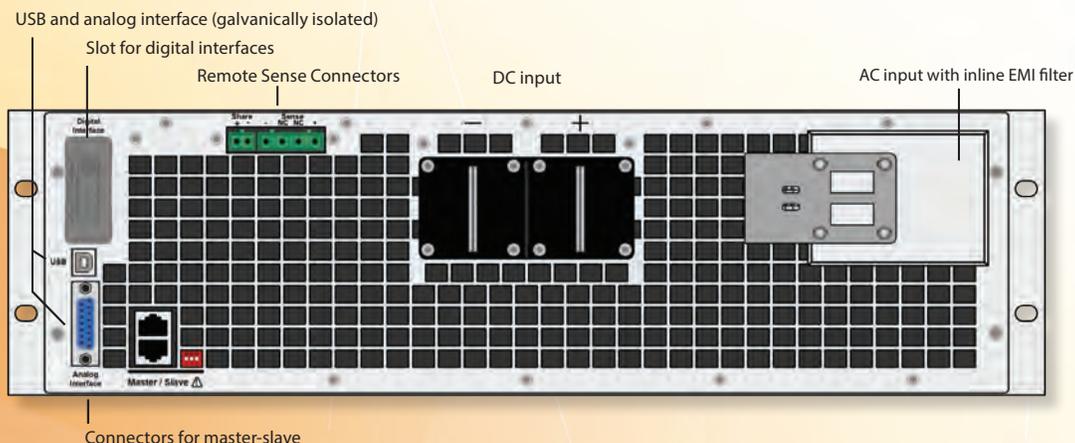
TECHNICAL SPECIFICATIONS

MODEL	All Models
AC Input	
3U Models	208V _{LL} ~ 480V _{LL} ±10%, 3ph
4U Models	380V _{LL} ~ 480V _{LL} ±10%, 3ph
Frequency	45~66 Hz
DC Voltage Mode	
Accuracy	3U Models: < 0.3% F.S. 4U Models: < 0.05% F.S.
Load regulation CV	3U Models: < 0.15% F.S. 4U Models: < 0.05% F.S.
Line regulation CV & CC ±10% line change	3U Models: < 0.05% F.S. 4U Models: < 0.01% F.S.
Stability CV	< 30 ppm / °C (after 30 mins warm-up)
DC Current Mode	
Accuracy	3U Models: < 0.4% F.S. 4U Models: < 0.1% F.S.
Load regulation 0-100% ΔVdc	3U Models: < 0.15% F.S. 4U Models: < 0.05% F.S.
Slew Rate 10~90%	< 300 μsec
DC Power Mode	
Accuracy	3U Models: < 1.5% of F.S. 4U Models: < 0.3% of F.S.
Resistance Mode	
Accuracy	3U Models: ≤ 1% of max. resistance + 0.3% of rated current 4U Models: ≤ 0.3% of max. resistance + 0.1% of rated current
Protection	OT, OVP, OCP, OPP, PF
Parallel Operation	Master-slave, up to 32 units
Regulatory Standards 3U Models	EN 60950:2006 + A11:2009 + A1:2010 + A12:2011 + AC:2011 + A2:2013 EN 61000-6-3:2011-09, EN 61000-6-4:2011-09 Radiation Class B EN 50160:2011-02 Grid Class 2
Regulatory Standards 4U Models	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
Dimensions (W x H x D)	
480Vac Input 3U Models	19" x 5.25" x 669 x 26.4" 483 x 133 x 670 mm
4U Models	19" x 7" x 669 x 26.4" 483 x 178 x 670 mm

MODEL	All Models
Environmental	
Pollution Degree	2
Protection Class	1
Cooling	Forced air, temperature controlled fans
Temperature	Operating: 0~50 °C / 32~122 °F Storage: -20~70 °C / -4~158 °F
Relative humidity	<80%, non-condensing
Altitude	Operating: <2000 m (1.242 mi)
Front Panel	
Display	Color Touch Screen Graphics LCD
Controls	Dual Rotary Digital Encoders
Output on/off	Push Button
Digital Interfaces	
Standard - Front Panel	1x USB type A
3U Models Std, Rear Panel	1x USB type B for communication
4U Models Std - Rear Panel	1x USB type B, 1x Ethernet for communication
Interface Slot	1x for retrofittable plug-in modules
Master / Slave Bus (Rear Panel)	2x RJ45
Share Bus (Rear Panel)	3U Models: Terminals 4U Models: 2x BNC
Analog Interfaces	
Internal	Built-in, 15 pole D-Sub (female), galvanically isolated
Signal range	0~5 V or 0~10 V (selectable)
Inputs	V, I, P, R, remote control on-off, DC input on-off, resistance mode on-off
Outputs	V, I, overvoltage, alarms, reference voltage
Accuracy V / I / P / R	0~10 V: < 0.2% 0~5 V: < 0.4%

REAR PANEL CONNECTIONS 3U MODELS

All grid power input and DC Load input connectors as well as interfaces are located on the rear panel of the load. This supports rack mounting of the unit in ATE systems as all internal cabinet wiring routes to the back of the unit and leaves the front panel display and controls accessible from the front. The illustration below shows the various connector locations on the rear panel.



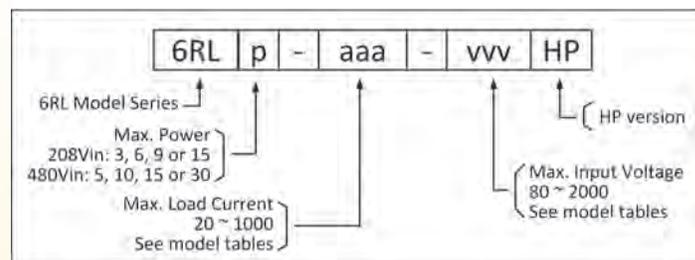
ORDERING INFORMATION

208~480Vac 3 PHASE GRID CONNECTION MODELS

5KW MODELS	DESCRIPTION	208~480V AC 3 ϕ INPUT	RACK HEIGHT
6RL5-170-80HP	DC Regenerative Load, 5000W, 0-80V, 0-170A	Power derating @ 208Vac input	3U
6RL5-70-200HP	DC Regenerative Load, 5000W, 0-200V, 0-70A		
6RL5-40-360HP	DC Regenerative Load, 5000W, 0-360V, 0-40A		
6RL5-30-500HP	DC Regenerative Load, 5000W, 0-500V, 0-30A		
6RL5-20-750HP	DC Regenerative Load, 5000W, 0-750V, 0-20A		
10KW MODELS	DESCRIPTION	208~480V AC 3 ϕ INPUT	RACK HEIGHT
6RL10-340-80HP	DC Regenerative Load, 10000W, 0-80V, 0-340A	Power derating @ 208Vac input	3U
6RL10-140-200HP	DC Regenerative Load, 10000W, 0-200V, 0-140A		
6RL10-80-360HP	DC Regenerative Load, 10000W, 0-360V, 0-80A		
6RL10-60-500HP	DC Regenerative Load, 10000W, 0-500V, 0-60A		
6RL10-40-750HP	DC Regenerative Load, 10000W, 0-750V, 0-40A		
6RL10-40-1000HP	DC Regenerative Load, 10000W, 0-1000V, 0-30A		
6RL10-40-1500HP	DC Regenerative Load, 10000W, 0-1500V, 0-20A		
15KW MODELS	DESCRIPTION	208~480V AC 3 ϕ INPUT	RACK HEIGHT
6RL15-510-80HP	DC Regenerative Load, 15000W, 0-80V, 0-510A	Power derating @ 208Vac input	3U
6RL15-210-200HP	DC Regenerative Load, 15000W, 0-200V, 0-210A		
6RL15-120-360HP	DC Regenerative Load, 15000W, 0-360V, 0-120A		
6RL15-90-500HP	DC Regenerative Load, 15000W, 0-500V, 0-90A		
6RL15-60-750HP	DC Regenerative Load, 15000W, 0-750V, 0-60A		
6RL15-40-1000HP	DC Regenerative Load, 15000W, 0-1000V, 0-40A		
6RL15-30-1500HP	DC Regenerative Load, 15000W, 0-1500V, 0-30A		
6RL15-20-2000HP	DC Regenerative Load, 15000W, 0-2000V, 0-20A		
30KW MODELS	DESCRIPTION	208~480V AC 3 ϕ INPUT	RACK HEIGHT
6RL30-1000-80HP	DC Regenerative Load, 30000W, 0-80V, 0-1000A	Power derating @ 208Vac input	4U
6RL30-420-200HP	DC Regenerative Load, 30000W, 0-200V, 0-420A		
6RL30-240-360HP	DC Regenerative Load, 30000W, 0-360V, 0-240A		
6RL30-180-500HP	DC Regenerative Load, 30000W, 0-500V, 0-180A		
6RL30-120-750HP	DC Regenerative Load, 30000W, 0-750V, 0-120A		
6RL30-80-1000HP	DC Regenerative Load, 30000W, 0-1000V, 0-80A		
6RL30-60-1500HP	DC Regenerative Load, 30000W, 0-1500V, 0-60A		
6RL30-40-2000HP	DC Regenerative Load, 30000W, 0-2000V, 0-40A		

Model Number Encoder

Use the encoder shown below to configure the correct regenerative DC load model.



OPTIONS

OPTIONS	DESCRIPTION	OPTIONS	DESCRIPTION
OPT-232	RS232 Serial Interface	OPT-ETH2P	Ethernet/IP 2 Port Interface
OPT-PBUS	Profibus DPV1- Interface	OPT-PNET1P	Profinet-IO 1 Port Interface
OPT-CANO	CANopen Interface	OPT-PNET2P	Profinet-IO 2 Port Interface
OPT-DNET	DeviceNet Interface	OPT-CAN	CAN Interface
OPT-MBUS1P	Modbus-TCP 1 Port Interface	OPT-ECT	EhterCAT Interface
OPT-MBUS2P	Modbus-TCP 2 Port Interface	Opt-RCT	Redundant Contactors
OPT-ETH1P	Ethernet/IP 1 Port Interface (Standard on 4U, 30kW Models)		





30000 W Models, 2000V Max.



3100 W Models, 750V Max.



6200 W Models, 1000V Max.



9300 W Models, 1500V Max.



5000 W Models, 750V Max.



10000 W Models, 750V Max.



15000 W Models 2000V Max.

Service and Support

Adaptive Power Systems' customer support is second to none. Our Customer Support Program provides the training, repair, calibration, and technical support services that our customers value. So, in addition to receiving the right test equipment, our customers can also count on excellent support before, during and after the sale. With company owned support and service centers around the world, support is never far away.

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