



REGENERATIVE GRID SIMULATOR MODEL 61809/61812/61815

Chroma 61800 3U high series of regenerative grid simulators include three models with power ratings of 9kVA, 12kVA, and 15kVA and include single phase and 3-phase operation. With output voltage ranges up to 350VLN and 606VLL, each model can achieve 700VLN by a single phase 3-wire setup. Users are able to increase output power by configuring up to three units in parallel.

Chroma 61809/61812/61815 models are regenerative providing a complete energy-saving solution. The power generated by the DUT during the test can be easily fed back to the grid, rather than dissipated as heat, which protects the environment and lowers the cost of operation. With this capability, these models can be applied to applications in green energy products, such as PV inverters, energy storage systems (ESS), power conditioning systems (PCS), micro grids, power hardware-in-the-loop (PHIL), electric vehicle power supply equipment (EVSE), on-board charger (OBC) and bidirectional on-board charger (BOBC), etc.

For regulatory testing, 61809/61812/61815 models can be applied to IEC 61000-3-2/-3-3/-3-11/-3-12 (international regulations for AC voltage testing), IEEE 1547/IEC 62116 (international regulations related to green power generation), electric vehicle to grid (V2G) testing, electric vehicle to load (V2L) testing, electric vehicle to home (V2H) testing, energy storage system (ESS) testing.

By using full digital control technology, these models provide a maximum 350VLN output voltage and 30Hz to 100Hz output frequency. The total harmonic distortion rate is less than 0.5% at full load and 50Hz/60Hz output frequency. In addition to AC output, a DC output mode and AC plus DC output mode is included which can be expanded to DC test and AC test with DC bias voltage. The current output capability can provide 3 times the RMS peak current, which is suitable for a DUT input inrush current test.

These models are also able to provide precision measurements such as RMS voltage, RMS current, true power, power factor, current crest factor and many others. By applying advanced DSP technology, they can easily simulate power line disturbance (PLD) using LIST, PULSE and STEP modes. Additional features such as the waveform synthesis function allows users to program various distorted harmonic waveforms required by some regulatory standards.

With the intuitive 5" LCD touch screen interface, users can quickly get familiar with the instrument's operation. Remote interfaces include standard USB, LAN, and optional GPIB, CAN interface. Instruments can be controlled by computer and Chroma Softpanel software for fast digital operation. In addition, Chroma also provides control drivers where users can use LabVIEW software to program integration applications of the control system.

MODEL 61809/61812/61815

KEY FEATURES

- Output Power
 - 61809: 9kVA
 - 61812: 12kVA
 - 61815: 15kVA
- Output voltage: 0~350V
- Output frequency: 30Hz~100Hz/DC
- High Power Density 15kVA in 3UH
- Intuitive Touch Panel Interface
- User selectable single phase or three phase output
- Full 4 quadrant, fully regenerative up to 100% of output current rating
- Specifically designed for EV, PV inverter and Smart Grid related test applications
- Programmable slew rate settings for voltage and frequency
- Programmable voltage and current limits
- Turn on, turn off phase angle control
- Synchronize TTL signal of voltage changing
- LIST, PULSE, STEP mode functions for testing Power Line Disturbance (PLD) simulation
- Harmonics, inter-harmonics waveform synthesizer
- Comprehensive measurement capability, including current harmonics
- Universal AC Input Range
- Standard USB, LAN Interface
- Optional CAN, GPIB Interface
- Parallel output for higher power applications (Three phase only)
- Regenerative AC Load (option)

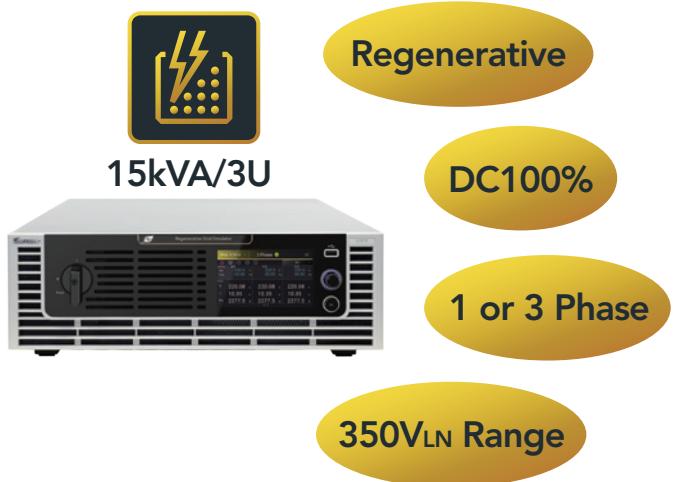


Chroma

HIGH POWER DENSITY

An advanced digital control system and cooling technology allows for a form factor at 3U height as well as achieving outstanding hardware capabilities like 15kVA output power, 350V_{LN} wide output voltage range, 1-phase / 3-phase output mode, 100% DC output, and regenerative function. Chroma has also improved transient capabilities, like rising / falling slew rate of output voltage, providing even a better power test solution for users.

For system applications, the 3U height form factor of the 61809/61812/61815 occupies less space in the system cabinet, which can provide more space and flexibility for users. In addition, they also can be placed on a lab bench which is a source of convenience for the user.



INTUITIVE TOUCH SCREEN

Chroma 61809/61812/61815 models are equipped with a 5" LCD touch screen interface providing users with an intuitive UI interface to quickly perform multiple settings and operations. The rotary knob can enlarge the display for the setting parameters of operation for fine-tuning of parameters. The display mode can expand the measurement value to full screen, making it easy to observe.



- 1. Screen Lock
- 2. Display Mode
(Show Only Measurement)
- 3. Rotary Knob Input Mode
- 4. Function Menu
- 5. 3-Phase Unified setting
- 6. Total Output Power
- 7. Output Switch On
- 8. Advanced Setting Options
- 9. Output Mode Selection
- 10. Output Voltage & Frequency Setting
- 11. Measurement
- 12. More Measurement
(Right/Left Swipe)

Rotary Knob Input Mode		
	Ø1	Ø2
Vac	220.0 v	220.0 v
Freq.	60.00 Hz	60.00 Hz
Meas.		
V	220.08 v	220.08 v
I	10.35 A	10.35 A
Po	2277.5 w	2277.5 w

Rotary Knob Input Mode

Display Mode		
	Ø1	Ø2
V	220.8 v	220.8 v
I	10.35 A	10.84 A
Po	2277.5 w	2385.4 w
V12	381.19 v	381.21 v
V23	381.21 v	PoTotal 6887.2 w
S		
VA		

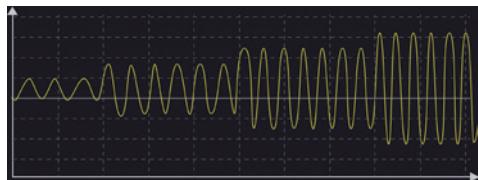
Display Mode

Universal AC Input Voltage Range

The 61809/61812/61815 support wide AC input voltage range and is capable of supporting three phase input voltage ranging from 200VLL to 480VLL ± 10%. Applicable for most of the three phase 200VLL, 380VLL, 400VLL, 480VLL systems implemented around the world.

POWER LINE DISTURBANCE (PLD) FUNCTIONS

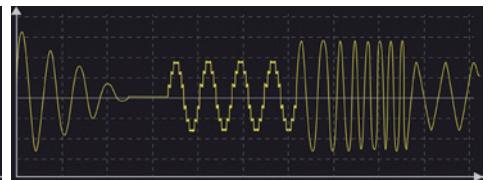
Chroma 61809/61812/61815 models include Power Line Disturbance (PLD) advanced programming functions and are capable of simulating various types of distorted voltage waveforms and transient conditions required by product validation testing. PLD functions include STEP, PULSE, LIST mode, and SYNTHESIS, Inter-harmonic, and Harmonic Measurement. The STEP and PULSE functions allow users to perform single or continuous step changes of output voltage. The LIST mode is a more versatile function as it allows users to compose complex waveforms of up to 100 sequences. With these programming modes, voltage waveforms required by immunity specifications such as IEC 61000-4-11/-4-13/-4-14/-4-28 can be easily achieved.



STEP Mode



PULSE Mode



LIST Mode

In addition, these advanced programming modes are easily set using the touch screen interface. For example, in LIST mode, the editing page can directly take the settings of all sequences and the search function can help quickly find the sequence if an adjustment is needed. Moreover, users can get more intuitive and convenient smartphone like programming as well as copying and pasting functions.

Setting		Meas.		Trigger	
Vac	220.0 v	V	220.08 v	Freq.	60.00 Hz
		I	10.35 A		
		Po	2277.5 w		
			220.08 v		
			10.84 v		
			10.11 v		
			2385.4 w		
			2224.3 w		

Main Page of LIST Mode

Sequence Editing Page of LIST Mode							
SEQ No.	Vac (V) Start End	Vdc (V) Start End	F (Hz) Start End	Degree	Waveform	Time (ms)	SEQ No.
0	0.0 200.0	317.5 317.5	60.00 60.00	0.0	A	6.0	4
1	0.0 0.0	317.5 400.0	60.00 60.00	0.0	A	8.2	4
2	0.0 0.0	400.0 400.0	60.00 60.00	0.0	A	1.0	4
3	0.0 0.0	400.0 385.0	60.00 60.00	0.0	A	0.1	4

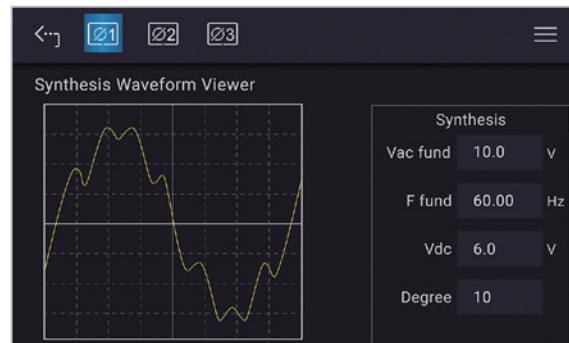
Sequence Editing Page of LIST Mode

The SYNTHESIS function allows users to create periodic harmonic voltage waveforms up to 50 orders based on a 50/60Hz fundamental frequency. The Inter-harmonic function allows users to perform frequency sweeps ranging from 0.01Hz to 2400Hz on top of the 50/60Hz fundamental frequency. This special function assists users in locating resonance points. The Harmonic Measurement function can measure 50th order harmonics of voltage or current and display values such as fundamental voltage, DC component, and total harmonic distortion.

N	%	θ	N	%	θ	N	%	θ
2	0.00	0.0	3	2.30	0.0	4	0.00	0.0
5	0.00	0.0	6	9.8	0.0	7	0.00	0.0
8	15.80	0.0	9	2.5	0.0	10	0.00	0.0
11	0.00	0.0	12	0.00	0.0	13	0.00	0.0
14	0.00	0.0	15	0.00	0.0	16	0.00	0.0

Synthesis
Vac fund: 100.0 V
F fund: 60.00 Hz
Vdc: 0.0 V
Degree: 0.0

SYNTHESIS Function



Waveform Viewer of SYNTHESIS Function

Inter-Harmonic Waveform Setting		
All		
Ø1	Ø2	Ø3
F Start: 0.0 Hz	0.0 Hz	0.0 Hz
F End: 0.0 Hz	0.0 Hz	0.0 Hz
Time: 0.0 Sec	0.0 Sec	0.0 Sec
Level: 0.0 %	0.0 %	0.0 %

Inter-harmonic Function

Harmonic Meas.					
Φ1	THD: 0.0 %	DC: 60.00 V	Fund.: 0.0 Hz		
2	0.00	3	0.03	4	2.53
5	0.00	6	1.94	7	0.00
8	2.61	9	0.03	10	0.00
11	0.01	12	0.00	13	0.00
14	0.00	15	0.00	16	0.00

Harmonic Measurement Function

MASTER-SLAVE PARALLEL OUTPUT FUNCTION

The 61809/61812/61815 provide master-slave parallel output functions, which can extend the output power when configuring up to 3 units in parallel. By connecting three 61815 regenerative grid simulators in a master-slave parallel setup, users can achieve a high power density configuration with a total output power of 45kVA at 9U height space.

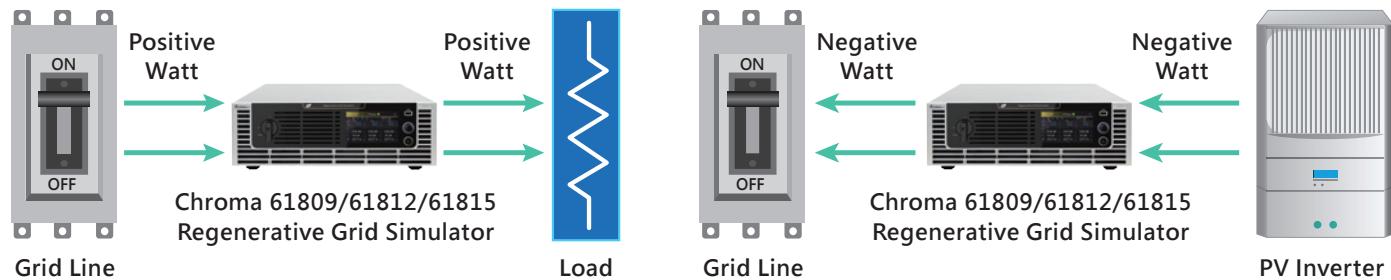


**45kVA
in 9UH**

KEY APPLICATIONS

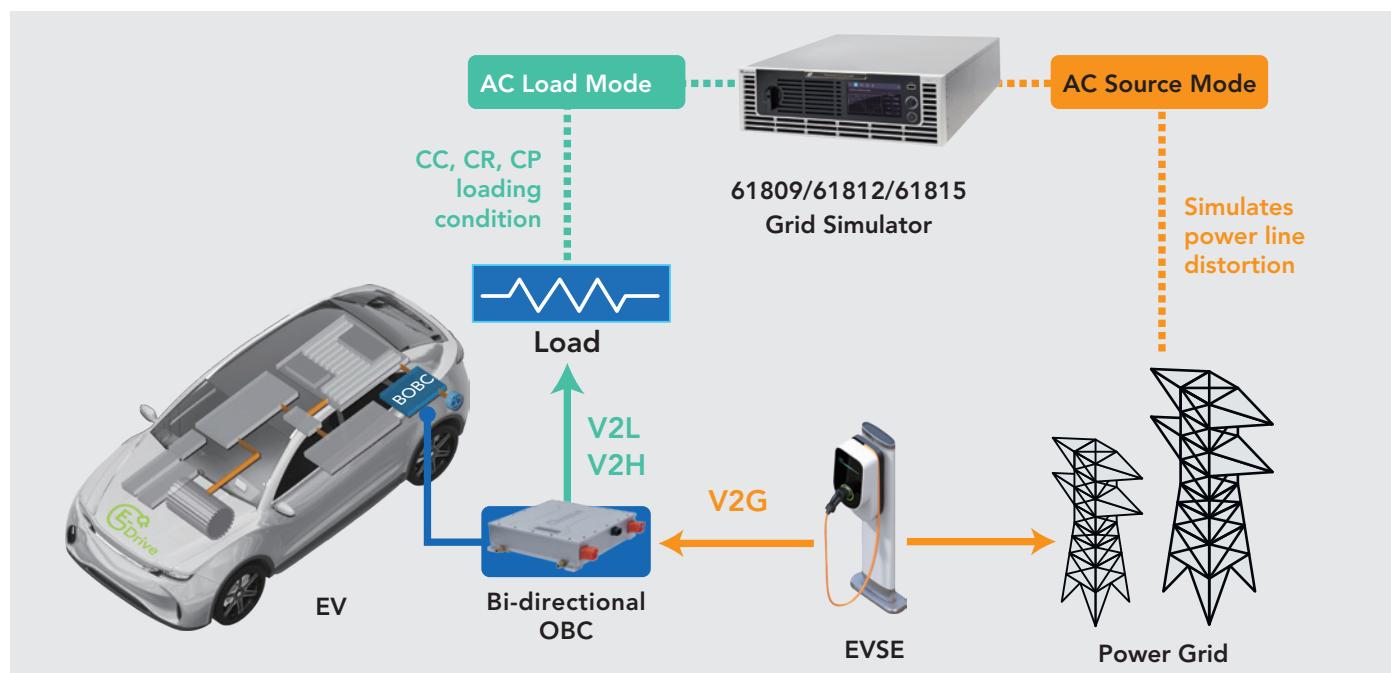
Common Power Test and Power Grid Related Test

The Grid Simulators are a full 4 quadrant, full regenerative, AC power sources designed for common electrical power testing such as home appliances and industrial electronics needing a programmable input source. In addition, they are designed to simulate grid characteristics for testing PV inverter and on-line UPSs. As shown below, power can be both sink and source from the DUT seamlessly to support many different applications. In cases where the DUT sources current a detection circuit will sense the excess power and recycle it back to the grid.



Electric Vehicle Related Test

Chroma 61809/61812/61815 models can provide complete power test solutions for electric vehicle industry related products such as electric vehicle supply equipment (EVSE), on board charger (OBC), and can also be compliant with EVSE test regulation SAE J1772 (AC Level 1, AC Level 2), China OBC test regulation QC / T 895. In addition, the development trend of OBC is moving towards bi-directional charge and discharge applications, such as V2G (Vehicle to Grid), V2L (Vehicle to Load) and V2H (Vehicle to Home) technologies. With the regenerative function, optional AC load function and advanced programming PLD function, these models can meet the requirements of test application related to this bi-directional on board charger (BOBC).



REGENERATIVE AC LOAD

Chroma 61809/61812/61815 models are available with an optional Regenerative AC Load function (B618007). This option allows for a single device to function as either an AC load or an AC source. Load and source modes are easily selected or switched through the user interface. It brings not only the four-quadrant regenerative function with energy savings, but is also single- or 3-phase selectable. In addition, it can support three units in parallel providing a 45kW AC load test solution.

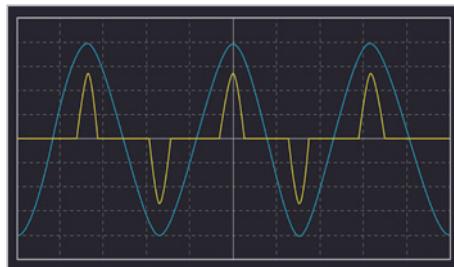


Regenerative AC Load in 3-Phase Mode

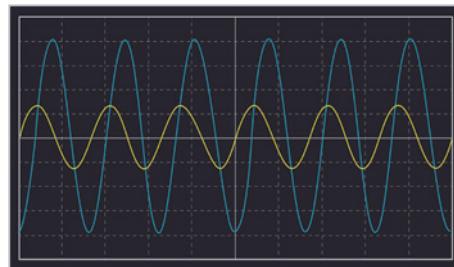


Regenerative AC Load in 1-Phase Mode

Chroma 61809/61812/61815 regenerative AC load function includes constant current, constant power, and constant impedance modes. An additional setting parameter is crest factor (CF) or voltage/current phase difference (θ) which includes Rectified Mode or Lead/Lag Mode respectively. Rectified Mode can simulate the characteristics of a rectified load by setting the CF from 1.414 to 3, providing a non-sinusoidal loading function. Lead/Lag Mode simulates capacitive or inductive load characteristics by setting phase leading or lagging $0^\circ \sim 90^\circ$ between voltage and current. These functions are intended but not limited to EVSE charging station, hybrid PV inverter, UPS and bi-directional on board charger(BOBC) related test applications.



Rectified Mode (CF=3)

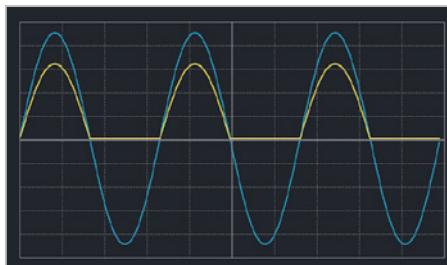


Lead/Lag Mode ($\theta = 90^\circ$)

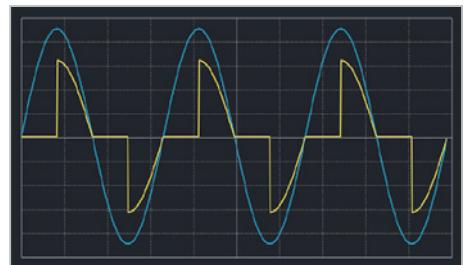
The regenerative AC load option provides a half-wave loading function via CC Rectified Mode. It can provide positive, negative half-wave loading, and 90° leading, trailing edge loading which simulates the characteristics of a SCR/TRIAC. The application include simulating the loading of temperature/light controlling household appliances, protection circuits, induction motors, and testing the output stability of the voltage source.



Half-Wave Function

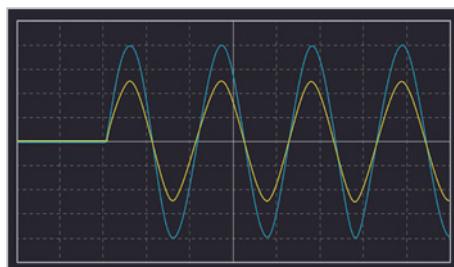


Positive Half-Wave Loading Review

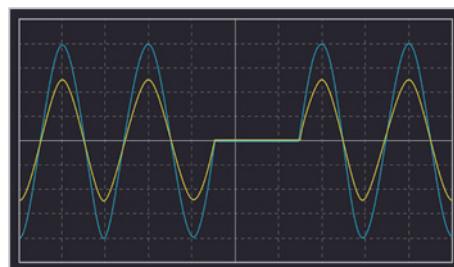


90° Leading Edge Loading Review

Chroma 61809/61812/61815 regenerative AC load provides a load on standby function when the voltage source is starting or is interrupted. It can be used to test the endurance and reliability of an inverter or UPS during power on with a load and various voltage dips, spikes, and other interruptions.



Load On Standby Function



Voltage Interruption Loading Function

SPECIFICATIONS

Model	61809	61812	61815
AC Output Rating			
Output Phase	1 or 3 selectable	1 or 3 selectable	1 or 3 selectable
Max. Power	9kVA	12kVA	15kVA
Per Phase	3kVA	4kVA	5kVA
Voltage			
Range	0~350V _{LN} / 0~606V _{LL}	0~350V _{LN} / 0~606V _{LL}	0~350V _{LN} / 0~606V _{LL}
Setting Accuracy	0.1%+0.2% F.S.	0.1%+0.2% F.S.	0.1%+0.2% F.S.
Resolution	0.1 V	0.1 V	0.1 V
Distortion	< 0.5% @ 50/60Hz < 0.8% @ 30Hz~100Hz	< 0.5% @ 50/60Hz < 0.8% @ 30Hz~100Hz	< 0.5% @ 50/60Hz < 0.8% @ 30Hz~100Hz
Line Regulation	0.10%	0.10%	0.10%
Load Regulation	0.20%	0.20%	0.20%
Maximum Current (1-phase mode)			
RMS	87A	96A	105A
Peak	261A	288A	315A
Maximum Current (each phase in 3-phase mode)			
RMS	29A	32A	35A
Peak	87A	96A	105A
Frequency			
Range	30Hz~100Hz	30Hz~100Hz	30Hz~100Hz
Accuracy	0.01%	0.01%	0.01%
DC Output (1-phase mode)			
Power	9kW	12kW	15kW
Voltage	495V	495V	495V
Maximum Current	65.25A	72A	78.75A
DC Output (each phase in 3-phase mode)			
Power	3kW	4kW	5kW
Voltage	495V	495V	495V
Maximum Current	21.75A	24A	26.25A
Harmonic Synthesis Function			
Harmonic Range	up to 50 Harmonic order @ 50/60Hz fundamental frequency		
Input Rating			
Voltage Operating Range	3Φ 200V~220V±10%V _{LL} /47~63Hz (100% output power) 3Φ 380V~480V±10%V _{LL} /47~63Hz (100% output power)		3Φ 200V~220V±10%V _{LL} /47~63Hz (80% output power) 3Φ 380V~480V±10%V _{LL} /47~63Hz (100% output power)
Current	39A Max./Phase (3Φ 200~240V±10%V _{LL}) Max. 21A/Phase (3Φ 380~480V±10%V _{LL})	51A Max./Phase (3Φ 200~240V±10%V _{LL}) Max. 27A/Phase (3Φ 380~480V±10%V _{LL})	51A Max./Phase (3Φ 200~240V±10%V _{LL}) Max. 34A/Phase (3Φ 380~480V±10%V _{LL})
Power Factor	0.98 (Typical)	0.98 (Typical)	0.98 (Typical)
Measurement			
Voltage			
Range	0~350V _{LN}	0~350V _{LN}	0~350V _{LN}
Accuracy	0.1%+0.2% F.S.	0.1%+0.2% F.S.	0.1%+0.2% F.S.
Current			
Range (Peak)	261A	288A	315A
Accuracy (RMS)	0.4%+0.3% F.S.	0.4%+0.3% F.S.	0.4%+0.3% F.S.
Accuracy (Peak)	0.4%+0.6% F.S.	0.4%+0.6% F.S.	0.4%+0.6% F.S.
Power			
Accuracy	0.4%+0.4% F.S.	0.4%+0.4% F.S.	0.4%+0.4% F.S.
Others			
Efficiency	87%(Typical)		
Protection	OVP, OCP, OPP, OTP, FAN		
Safety & EMC	CE (include EMC & LVD)		
Dimension (H x W x D)	132.8 x 428 x 700 mm/5.23 x 16.85 x 27.55 inch		
Weight	50 kg/99.21 lbs	50 kg/99.21 lbs	50 kg/99.21 lbs

* All specifications are subject to change without notice.

SPECIFICATIONS - Regenerative AC Load B618007

Optional AC Load Function	61809	61812	61815
Operating (each phase)			
Current (RMS)	29A	32A	35A
Current (Peak)	87A	96A	105A
Voltage Range	30~350V	30~350V	30~350V
Frequency Range	30~100Hz	30~100Hz	30~100Hz
CC Rectified Mode (each phase)			
Current Range	0~29A	0~32A	0~35A
Accuracy (A)	0.3%+0.5% F.S.	0.3%+0.5% F.S.	0.3%+0.5% F.S.
Resolution (A)	0.01A	0.01A	0.01A
Crest Factor Range	1.414~3.000	1.414~3.000	1.414~3.000
Resolution (CF)	0.001	0.001	0.001
CS Rectified Mode (each phase)			
Power Range	0~3kVA	0~4kVA	0~5kVA *1
Accuracy (VA)	0.3% + 0.3%F.S.	0.3% + 0.3%F.S.	0.3% + 0.3%F.S.
Resolution (VA)	1VA	1VA	1VA
Crest Factor Range	1.414~3.000	1.414~3.000	1.414~3.000
Resolution (CF)	0.001	0.001	0.001
CC Phase Lead/Lag Mode (each phase)			
Current Range	0~29A	0~32A	0~35A
Accuracy (A)	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.
Resolution (A)	0.01A	0.01A	0.01A
Phase (deg)	-90°~+90° (Current Source Mode: +90.01°~+180° & -90.01°~-180°)	-90°~+90° (Current Source Mode: +90.01°~+180° & -90.01°~-180°)	-90°~+90° (Current Source Mode: +90.01°~+180° & -90.01°~-180°)
Accuracy (deg)	1% F.S.	1% F.S.	1% F.S.
Resolution (deg)	0.01°	0.01°	0.01°
CS Phase Lead/Lag Mode (each phase)			
Power Range	0~3kVA	0~4kVA	0~5kVA *1
Accuracy (VA)	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.
Resolution (VA)	0.01A	0.01A	0.01A
Phase (deg)	-84.26°~ +84.26°	-84.26°~ +84.26°	-84.26°~ +84.26°
Accuracy (deg)	1% F.S.	1% F.S.	1% F.S.
Resolution (deg)	0.01°	0.01°	0.01°
PF	0.100~1.000 (lead or lag)	0.100~1.000 (lead or lag)	0.100~1.000 (lead or lag)
Accuracy	1% F.S.	1% F.S.	1% F.S.
Resolution	0.001	0.001	0.001
CR Mode (each phase)			
Resistance Range	1Ω~300Ω	1Ω~300Ω	1Ω~300Ω
Accuracy (Ω)	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.
Resolution (Ω)	0.001Ω	0.001Ω	0.001Ω
Measurement			
Voltage			
Voltage Range	0~350V	0~350V	0~350V
Accuracy (V)	0.1%+0.2%F.S.	0.1%+0.2%F.S.	0.1%+0.2%F.S.
Resolution (V)	0.01V	0.01V	0.01V
Current			
Current Range (RMS)	0~29A	0~32A	0~35A
Accuracy (RMS)	0.4%+0.3% F.S.	0.4%+0.3% F.S.	0.4%+0.3% F.S.
Resolution (RMS)	0.001A	0.001A	0.001A
Current Range (Peak)	0~87A	0~96A	0~105A
Accuracy (Peak)	0.4%+0.6% F.S.	0.4%+0.6% F.S.	0.4%+0.6% F.S.
Resolution (Peak)			
Active Power			
True Power Range	0~3kW	0~4kW	0~5kW
Accuracy (kW)	0.4%+0.8% F.S.	0.4%+0.8% F.S.	0.4%+0.8% F.S.
Reactive Power			
Reactive power Range	0~3kVAR	0~4kVAR	0~5kVAR
Accuracy (kVAR)	0.4%+0.8% F.S.	0.4%+0.8% F.S.	0.4%+0.8% F.S.
Apparent Power			
Apparent power Range	0~3kVA	0~4kVA	0~5kVA
Accuracy (kVA)	0.4%+0.8% F.S.	0.4%+0.8% F.S.	0.4%+0.8% F.S.
Frequency			
Frequency Range	30~100Hz	30~100Hz	30~100Hz
Accuracy (Hz)	0.1% F.S.	0.1% F.S.	0.1% F.S.
Resolution (Hz)	0.01Hz	0.01Hz	0.01Hz
Power Factor			
Power Factor Range	0.100~1.000	0.100~1.000	0.100~1.000
Accuracy	1% F.S.	1% F.S.	1% F.S.
Resolution	0.001	0.001	0.001
Crest Factor			
Crest Factor Range	1.414~3.000	1.414~3.000	1.414~3.000
Accuracy	3% F.S.	3% F.S.	3% F.S.
Resolution	0.001	0.001	0.001
Others			
Parallel Function *2	Max. 3 units in parallel	Max. 3 units in parallel	Max. 3 units in parallel

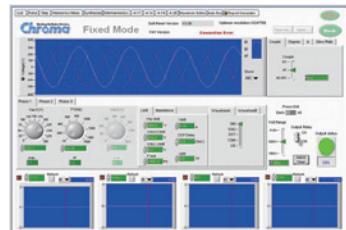
*1: The output power will be derated to 80% when using 3Φ 200Vac-220Vac as input voltage.

*2: Call for availability.

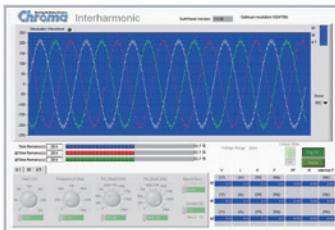
* All specifications are subject to change without notice.

SOFTPANEL

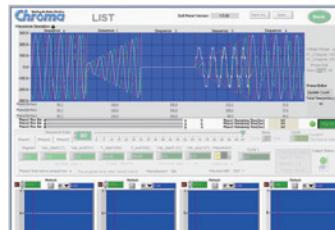
The 61800 series Softpanel is designed specifically for users to control the regenerative grid simulator with a user friendly interface in a graphical, instrument like setting. Users are able to perform online and offline waveform editing and the Softpanel can also provide a test environment configured specifically for conducting IEC regulation tests like IEC 61000-4-11, -4-13, -4-14, -4-28.



Main Operation Menu



Inter-harmonic Test



Transient Voltage Programming



Recording Function

PANEL DESCRIPTION



1. Power ON/OFF Switch
2. 5" LCD Touch Panel
Displays: measurements, setup, control, and status
3. USB HOST
Screenshot, save / recall the setting parameters
4. Pushable Rotary Knob
Rotate to edit screen and set values; push to change setting digits
5. Output ON/OFF Key
Press the ON key: light indicates Output ON, dark indicates Output OFF
6. Analogue Programming Interface (Ext. V Reference/TTL I/O Port)
External analog signal for voltage control and signal for system integration
7. GPIB/CAN Interfaces Shared Slot (alternative installation)
8. AC Output Terminal
9. Remote Sense Terminal
10. USB Interface (standard)
11. System Bus
For master-slave parallel output function
12. LAN Interface (standard)
13. AC Input Terminal

Ordering Information

61809: Regenerative Grid Simulator 9kVA

61812: Regenerative Grid Simulator 12kVA

61815: Regenerative Grid Simulator 15kVA

A618001: Softpanel for 61800 Series

A620039: GPIB remote interface (option)

A620045: CAN remote interface (option)

B618007: Regenerative AC Load (option)

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61815

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